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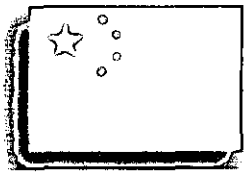

Energy Conservation and GHG Emissions Reduction in Chinese TVEs – Phase II – Project Impact Evaluation

(EG/CPR/99/G31)

Comprehensive Report

Review PIC and LPIC Mechanisms and Effectiveness and Evaluate the Project Impact on Policy Making, Market, Gender and Social Development

March 2007

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Contents

1、 Executive Summary

This report presents the findings of the independent evaluation for "Energy Conservation and GHG Emissions Reduction in Chinese Township and Village Enterprises – Phase II" project number CPR/99/G31 (the TVE project). This paper evaluates the PIC and LPIC Mechanisms and its effectiveness, as well as the project impacts on policy, market, gender and social development. This report was prepared with considerable input from the TVE Project Management Office, and with considerable guidance and feedback from UNDP China and UNIDO HQ, Vienna, but the responsibility for the conclusions reached are solely those of the evaluation team authors.

The (Phase II) TVE project arose out of the UNDP/GEF project entitled: "Energy Conservation and GHG Emissions Reduction in Chinese Township and Village Enterprises – Phase Ⅰ" implemented during 1998-1999. The Phase II TVE project was launched in February 2001 for a planned four-year implementation period, supported by a GEF grant of US$ 7.992 million and GOC co-financing (in-kind and in-cash) of US$ 10.55 million. UNDP is the International Implementing Agency, UNIDO is the International Executing Agency, and MOA on behalf of the GOC is the domestic Executing Agency.

The aim of the TVEs project is to reduce GHG emissions in China from the TVEs sector by increasing the utilization of energy efficient technologies and products in the brick, cement, metal casting and coking sectors. With the establishment of relevant policy support, technical and market service system and financing channel, the TVEs project will focus on supporting 9 demonstration enterprises of the above industries to carry out projects on energy saving and technological transformation. At the same time, it will eliminate relevant obstacles of the areas where these enterprises locate, enhance the capacity in promoting energy-saving and GHG reduction technology in market economy, widely extend energy efficient technology, improve produce quality, facilitate structural adjustment and gradually promote successful cases and experience across China.

Based on the findings of the project Phase Ⅰ ,there are market, policy, technological, and financial barriers to the production, marketing and utilization of energy efficient technologies and products in these industries. The general objectives of this evaluation are as follows: to evaluate the PIC and LPIC mechanisms and effectiveness; to evaluate the project impacts on policies, markets, social & gender issues at both project level and macro level; to identify

and analyze the best practices and lessons learned; and to determine the suggest areas for future adjustment and improvement, through comprehensive review and summarization of project activities, outputs, outcomes and impacts. The scope of the evaluation and assessment will cover 9 pilot TVEs and 118 replication TVEs, and will be based on the entire project period - from project design; inception, adjustment, and implementation to completion.

This evaluation adopts the Logical Framework of Approaches (LFA) as the fundamental framework. And at the meantime, this evaluation has designed following six evaluation criteria based on 5 GEF evaluation criteria: Effectiveness, Impacts, Efficiency, Linkage, Reaction Capability and Sustainability. In addition, based on the objectives of the evaluation, this evaluation has allocated four sub-reports to respectively review PIC and LPIC mechanisms and effectiveness and evaluate the project impact on policy, market, gender and social development. And base on the seven kinds of core indicators and the specific requirements of project document, respectively developed the sets of indicators and analysis frameworks for each sub-reports.

Moreover, the evaluation will pay attention to not only the measurement of changes (what) and its effectiveness, but also the analysis on their background, reasons (why) and mechanisms (how), and summarize best practices and lessons learned.

Through comprehensive review on the activities and outcomes of the project, reviewers believe that the project has achieved its set objectives and each main participant has gained a lot during project implementation.

The evaluation finds that the project has successfully met a series of challenges during the initial implementation stage. The project design, which is based on the dynamic socioeconomic development of China, is appropriate. The thinking of project implementation is mature and broad-minded and the project plan is realistic and practical. The management agency of the project works hard. All major participants of the project have close cooperation, which promotes and ensures successful implementation of the project.

The outputs of energy-saving and GHG reduction of the project exceed expectations in terms of both the development of demonstration enterprises and extension activities. After the GEF project experienced hard adjustment so that project design could go with the time with high starting point and more favorable environment for project implementation and final smooth implementation, major stakeholders of the project such as GEF, the international executive agency and

international implementation agency, Chinese government, township enterprises and financial institute have gained a lot from the project.

In addition, through good interaction, the project has further enhanced its influence on mechanism development, macro policies, market and the society.

Evaluation team suggests that the project should further expand its achievements taking the opportunity when China is building the socialist new countryside and combining urbanization process. Taking into account the support of GEF, domestic commercial fund and the application of Clean Development Mechanism (CDM), more funds should be channeled for extending the project outcome. At the same time, the team suggests each member of GEF working system further understand the basic principle of GEF on "State owned" and "State driven" during the implementation of the project.

2、 Project Background and Project Design Overview

2.1 Project Context

China's township and village enterprises (TVE) are rural, collective economic organizations established at the township or village level. They also include the city branches of township enterprises. TVEs were first promoted in the late 1950s. By 1980, TVEs had become a major component of the Chinese economy. By 2004, there were 22.13 million TVEs, who contributed 30.6% of the national GDP and created 138.66 million jobs in China. The development of TVEs effectively alleviates the employment pressure of redundant labor force of rural areas. And it has also played an important role in accelerating the process of industrialization and urbanization, as well as in promoting the development of rural areas.

Although the TVEs in China have gotten great development during the past 20 years, they also face some new problems and challenges, and environment protection is the most prominent one. Most TVEs are lack of capital, technology and corresponding policy support, so it is hard for them to adopt new energy-conservation technologies to improve energy efficiency. This greatly restricts the sustainable development of TVEs, and has also brought serious local and global environmental issues. In line with its overall policies to increase energy efficiency and reduce pollution, the GOC has made the drive towards energy conservation, technology innovation and quality awareness in the TVE sector a top priority. In 1994, MOA - in cooperation with UNDP and UNIDO - developed the "Energy Conservation and GHG Emissions Reduction in Chinese TVEs" project.

In early 1995, GEF approved this project。The aim of the project is to reduce GHG emissions in China from the TVE sector by increasing the utilization of energy efficient technologies and products in the brick, cement, metal casting and coking sectors. And its long-term goal is to promote TVEs to adopt advanced technologies to increase the energy efficiency through market mechanism, thus achieve the purpose to protect the local environment and reduce global emissions of greenhouse gas.

According to the suggestion of GEF, this project was implemented in two phases, and the total amount of grant is nearly nine million U.S. dollars. By the UNDP responsible for the implementation of foreign and supervision work of the United Nations Development Organization (UMIDO) and the Ministry of Agriculture jointly. For the project, UNDP is the International Implementing Agency, UNIDO is the International Executing Agency, and MOA on behalf of the GOC is the domestic Executing Agency.

Phase I was launched in late 1997, and its implementation period is 12 months. Phase I conducted an investigation in the above 4 heavy energy-consuming and high pollution industries, selected appropriate technologies and designed the project framework for the energy conservation pilot project of Phase II ,as well as analyzed the incremental cost of greenhouse gas emissions reduction. In addition, Phase I built capacities of rural energy and TVEs energy-conservation service agencies, and carried out a series activities including energy audit and training. Finally, it provides implementation plan and project summary document for the Phase II .

Based on the findings of the Phase I project, there are market, policy, technological and financial barriers to the production, marketing and utilization of energy efficient technologies and products in these industries.

(1) Policy barriers

In the past, the state often excluded the TVEs in making enterprises relevant policies. This led to a lack of clarity regarding application of policy, and restricted TVE participation in many activities. This barrier remains, despite the fact that recent legal initiatives (such as the TVE law, the energy conservation law and a number of pollution control laws) apply to TVEs.

When national laws and regulations clearly do apply to TVEs, enforcement of these regulations at the local (township and county) level is often weak. This is largely because the role of local government in energy conservation and

environmental protection is confused. On the one hand, local government is responsible for enforcing relevant laws, including shutting down obsolete plants and collecting pollution fees. On the other hand, given that they may have investments in or partly own, the TVEs, and given the need to maintain social stability and employment levels, local governments are keen to maximize TVE profitability.

This difficulty to translate national policy into local action also aggravates the rent-seeking behaviors of TVEs, and consumes the resources that otherwise would have allocated to business development.

(2) Technology barriers

TVEs generally lack access to the new technologies and market oriented technology transfer mechanisms. The opportunities to communicate with the technology suppliers are also very limited and sporadic. The result has been few efforts in these sectors by TVEs to upgrade.

A further barrier to technology upgrades is the low awareness of TVE managers, both of the benefits of increased energy efficiency, and of the alternative technologies available.

When TVEs do decide to upgrade technology, they are often unable to adequately take into account the existing conditions of production. This leads to the poor integration of system components and sub-standard performance. Moreover, TVE staffs are often not qualified to operate and maintain the new equipment properly, and the supply of spares is sub-standard.

(3) Market barriers

Market barriers are mainly embodied in the following four aspects:

① Rural consumers for building materials demonstrate no willingness to pay for products that exceed basic product characteristics, even though the use of such products offers significant savings and additional benefits.

② TVEs are lack of the initiatives in energy-conservation investment and production of energy-conservation products, lack of marketing skills and absence of distribution networks.

③ Local governments do not promote product quality, e.g. by enforcing minimum heat efficiency standards for buildings, construction guidelines or product quality specifications.

④ Markets are highly localized and non-competitive.

(4) Financial barriers

Should TVEs decide to upgrade their technology, they are faced with several barriers to accessing finance.

On one hand, it is hard for TVEs to get loans from commercial banks. Because TVE often do not have proper procedures for asset assessment, they do not control sufficient securities to meet formal loan eligibility requirements and banks have little experience lending to TVEs. On the other hand, TVEs managers are also reluctant to seek loans. This is in part because they have a shortage of resources to devote to investment planning and project monitoring. Also, TVE are reluctant to make investments which will not lead to immediate returns and/or expansion of jobs.

In addition, the Lack of financing channels in rural areas also reduces the demand for improved product quality. Private builders in rural China do not finance (mortgage) the construction of houses but rely on their savings and income. This severely limits their ability to purchase higher quality building materials for construction.

Based on the successful experiences of project Phase I ,in 1999, MOA - in cooperation with UNDP and UNIDO - developed the "Energy Conservation and GHG Emissions Reduction in Chinese TVEs" project –phase II and was approved in late 2000. Phase II was launched in February 2001, and is scheduled to last for 6 years after adjustment, aims to remove key market, policy, technological, and financial barriers to the production, marketing and utilization of energy efficient technologies and products in these industries.

2.2 Project aim and expected output

2.2.1 Project aim

The final objective of Project Phase II is to widely promote the application of energy high-efficiency technology in TVEs in order to meet the goal of environmental protection and GHG reduction. It is expected that with the project implementation, an operation mechanism or roadmap will be established to facilitate the long-term extension of energy-saving technology. During the implementation process, some new institutions for policy implementation, technical and market service as well as finance will be established and supported to ensure high-quality, comprehensive and effective services for TVEs and overcome the obstacles in policy, technology, market and finance. When the project finishes, these institutions will have the capacity in continuing the task promoting energy-saving and GHG reduction technology. Meanwhile, they will

transfer the experience of successful cases of the demonstration project into other enterprises of relevant industries.

2.2.2 Expected project output

Based on the findings of Phase I of the project, Phase II was designed to adopt a comprehensive, innovative and ambitious market transformation approach to promoting energy efficiency in the four TVE sectors. The two key elements of the strategy include building a sustainable barrier removal framework, and providing direct support to TVEs and local government.

The anticipated outputs of the project are as follows:

(1) To create an institutional mechanisms for barrier removal at the national, county, or enterprise level.

(2) To remove policy barriers in eight counties by establishing and implementing incentives and monitoring systems, and strengthening existing regulatory programs.

(3) To remove market and technology barriers in eight pilot counties.

(4) To remove financial barriers by creating access to commercial financing for TVE at 8 pilot sites in the four industries.

(5) To replicate the best practices for local regulatory reform to the national level, in part through the commercial financing of TVE energy conservation projects.

3、 Evaluation background and significance

3.1 Evaluation background

The six-year Phrase II Project of Energy Conservation and GHG Emission Reduction in TVEs is the first GEF project applied by China. The international implementation institute UNDP, executive institute UNIDO and the donor GEF attach great importance to this project and they will carry out final evaluation on the project in March of 2007. Therefore, the Project Office in the Ministry of Agriculture, which is the domestic implementation institute, carries out the self-evaluation on the outcome of the project before the final evaluation. It conducts comprehensive review and summary on the activities, output, achievements and implications of the project; summarize and analyze the experience and lessons and identify necessary adjustment and improvement in the future. The self-evaluation aims to provide direct support to the final evaluation.

This is the first time for the Chinese government to invite an independent third-party institute to carry out self-evaluation on the implementation of international project, which has great significance. The self evaluation will enrich project achievements, transfer valuable information in wider scope so as to improve the outcome and efficiency of future projects. At the same time, with GEF gradual developing into a financing mechanism with steady growth, this self evaluation has much significance to self evaluation of other GEF projects.

The specific objective and task of this evaluation are based on the requirements of project documents, mid-term evaluation suggestions, relevant policy and regulations of GEF and UNDP on monitoring and evaluation of project.

3.2 Evaluation Objectives

According to the Terms of Reference launched by UNIDO, the general objectives of this evaluation are as follows:

(1) To evaluate the PIC and LPIC mechanisms and effectiveness;

(2) To evaluate the project impacts on policies, markets, social & gender issues at both project level and macro level;

(3) To identify and analyze the best practices and lessons learned; and

(4) To determine the suggest areas for future adjustment and improvement, through comprehensive review and summarization of project activities, outputs, outcomes and impacts.

3.3 Scope

The scope of the evaluation and assessment will cover 9 pilot TVEs and 118 replication TVEs, and will be based on the entire project period - from project design; inception, adjustment, and implementation to completion. The evaluation will utilize the LFA as part of the evaluation methodology, and will pay attention to not only the measurement of changes (what) and its effectiveness, but also the analysis on their background, reasons (why) and mechanisms (how), and summarize best practices and lessons learned.

4、 Evaluation Criteria and Methodology

4.1 Evaluation Criteria

This evaluation has designed following evaluation criteria based on 5 GEF evaluation criteria:

Effectiveness: identify the actual and possible extent for achievement on project objectives;

Impacts: positive and negative, anticipated and unanticipated as well as changes and results has to be taken into account;

Efficiency: assessment on inputs-and-outputs correlations, costs, implementing progress and economic/financial outcomes;

Linkage: discussions on interlinks of project and global/country/local development and environmental priority, strategies;

Reaction Capability: assessment on project's reaction capability to the changed exterior policy environment and other suggestions?

Sustainability: discussions on extent of sustainability in terms of outcomes and profit achieved by the project.

During the whole process of evaluation implementation, feasible measures have been taken to ensure key stakeholders' active participation and information sharing.

4.2 Evaluation Methodology

4.2.1 The Logical Framework of Evaluation

In accordance with Global Environmental Facility Policies and Procedure for Monitoring and Evaluation, this evaluation adopts the Logical Framework of Approaches (LFA) as the fundamental framework.

Logical framework approach which is developed by US-AID is an effective tool for facilitating project design and evaluation. When being used properly, it will significantly in setting up linkage between objectives, activities and outputs. And it will also facilitate project activity design and implementation evaluation. (Table 4.1)

Table 4.1 Logical Framework of Evaluation

Framework levels	Objectives	Indicators and Monitoring		Assumptions and Risk
Macro objective: Avoided GHG emissions	Reduce CO_2 emissions from energy consumption and production.	CO_2 emission reduction, Energy production or savings and installed capacities	Establish baselines and initial scopes for national TVEs' energy consuming and CO_2 emission. Relate market trends to expected replication from program objectives. Collect evidence that project intervene is influencing market development trends and related activities. Measure trends and changes over time.	
Concrete objectives: Remove key market, policy, technological, and financial barriers to the production, marketing and utilization of energy efficient technologies and products in these industries.	1) To create an institutional mechanisms for barrier removal at the national, county, or enterprise level. 2) To remove policy barriers by establishing and implementing incentives and monitoring systems, and strengthening existing regulatory programs. 3) To remove market and technology barriers 4) To remove financial barriers by creating access to commercial financing for TVEs in the four industries. 5) To replicate the best practices for local regulatory reform to the national level, in part through the commercial financing of TVEs energy conservation projects.	Develop the set of indicators respectively to review PIC and LPIC mechanisms and effectiveness and evaluate the project Impact on policy making, market, gender and social Development, complying with the seven kinds of core indicators of UNDP.	Establish baselines and initial scopes for national TVEs' energy consuming and CO_2 emission. Relate market trends to expected replication from program objectives. Collect evidence that project intervene is influencing market development trends and related activities. Measure trends and changes over time.	Elimination of barriers will influence the use of energy-saving and energy renewable technologies, and influence the total amount of energy consuming and GHG emission. Relate market trends to expected replication from program objectives.
Project outcomes and outputs	Effectiveness; Impacts; Efficiency; Linkage; Reaction Capability Sustainability.	Develop indicators both at national level and project level, based on 5 GEF evaluation criteria. Project-level indicators include installed capacity, costs, skills, etc.	By the expert team as part of project preparation, implementation, and evaluation: Conduct project-level evaluations of direct project outputs. Conduct project performance. Scoring (if targets are set for new or ongoing projects). Conduct selective field inquiries to fill gaps.	Relevance: National market changes support the TVEs objectives. Project outputs are sufficient to market formulation and barriers elimination.

4.2.2 Set of indicators

Indicators are crucial tools to evaluate the project and reflect the value judgment of the project. These indicators provide the basis for before-and-after analyses and describe the effects (positive and negative) of project interventions, anticipated and unanticipated, intended and unintended.

According to the evaluation objectives, this evaluation has developed the set of indicators respectively to review PIC and LPIC mechanisms and effectiveness and evaluate the project Impact on policy making, market, gender and social development, based on the seven core indicators of UNDP and the requirement of project document.

（1）Indicators for evaluating the market impact of the project

UNDP and GEF generally base on following seven kinds of static core indicators to evaluate specific climate change projects: Energy production or savings and installed capacities, Technology cost trajectories, Business and supporting services development, Financing availability and mechanisms, Policy development, Awareness and understanding of technologies Energy consumption, fuel-use patterns, shares, and impacts on end users[①].

The evaluation identifies the four aspects of the project impact on market based on the seven kinds of core indicators and the specific requirements of project document:

① Users of products and technologies: customers performance change (awareness), emerging effective demand.

② Supply side: number of suppliers, competition situation/market structure, market share, cost change, environmental and energy efficiency performance, capacity building, links with market of capital and labor, etc.

③ Government intervention: introduction of environmental and energy codes and standards, ban and permits, tax and subsidies.

④ Market equilibrium.

（2）Indicators for evaluating the operation and efficiency of PIC and LPIC

With reference to relevant evaluation methods of UNDP and GEF and the focus of the assessment, the current evaluation adopts qualitative method for PIC evaluation and designs the organization structure and performance indicator system of PIC in view of the difficulty in quantifying PIC assessment. At the same time, it designs different indicator system for LPIC demonstration areas and LPIC in extension areas as the development of the two areas varies. The indicator system includes the followings:

① Establishment of institutions: it includes the stability of the organization the project depends on, development of "rules and regulations" and "Action Plan", formulation of

[①] Source: GEF M&E working paper 4.

the "volunteer agreement" and the level of LPIC.

② LPIC operation: it includes if LPIC information distribution and policy making mechanism have been built, if the mechanism for LPIC supervision and quality guarantee has been developed and the soundness of LPIC incentive mechanism.

③ LPIC operation result: it includes the degree of removing the obstacles for LPIC 的 policies, to what degree the demonstration enterprises meet energy conservation target, the efforts of the project in facilitating enterprises to apply and promote energy conservation technology and if the capacity of service oriented government has been strengthened.

④ LPIC sustainability: it includes to what degree LPIC integrates with the functions of local government, how relevant is the energy saving technology under extension to the top local development priorities.

Detailed indicators are seen in sub-report on evaluation of PIC and LPIC.

（3）Indicator system for evaluating the influence of macro policies

With reference to the indicator system of UNDP and GEF on policy evaluation, the current evaluation establishes a secondary indicator system (See Figure 4.1) to evaluate the influence of project policies based on the theory of policy life-cycle and real situation of the project. The indicator system is mainly composed of two qualitative indicators, i.e. the influence of the project on policy development and the influence of the project on the implementation of the policies. Among them, the former mainly includes the influence of the project on the development of national macro policies, formulation of relevant industrial policies and the establishment of relevant standards. The latter is expounded by assessing the influence of the implementation of exiting environment and energy policies (the implementation of preferential policies and bans) and the application and promotion of voluntary agreements.

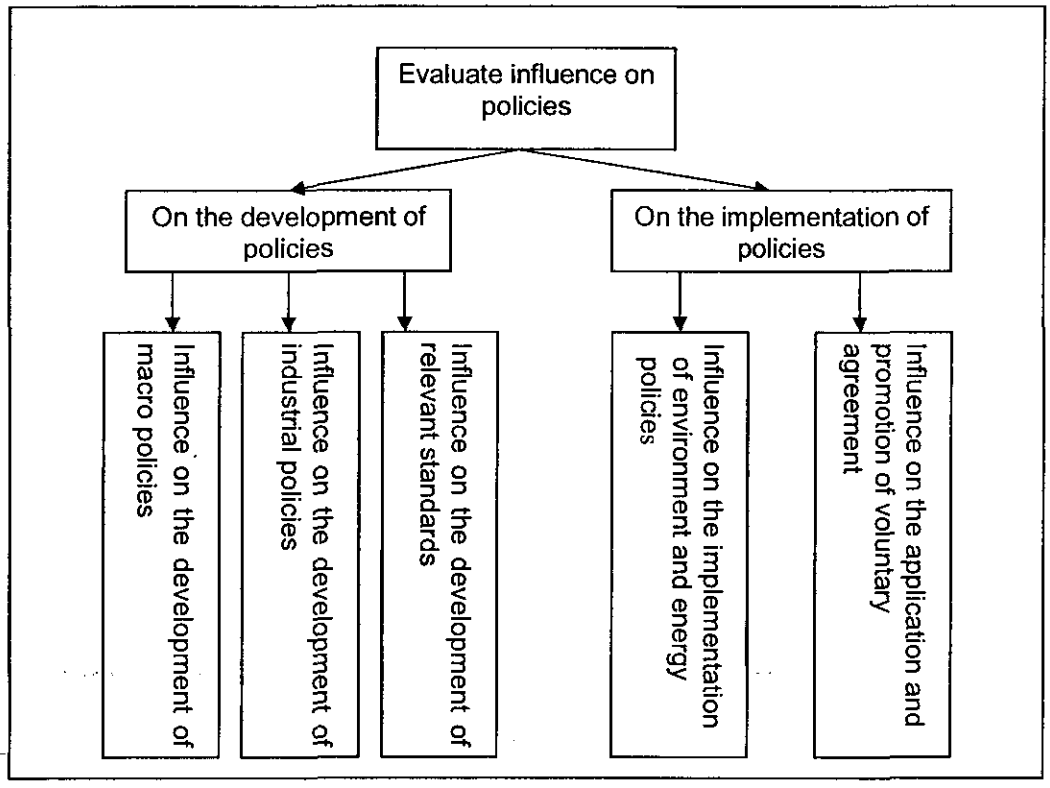

Figure 4.1 Indicator systems for evaluating the influence of the project on policies

（4）Indicator system for evaluating social influence

The current evaluation identifies the following major indicators for assessing social influence of the project:

① Public environmental awareness: referring to the awareness of workers and managers of enterprises in energy saving and environmental protection as well as its influence on everyday work and life;

② Employment: referring to exiting and potential job opportunities for excessive labors during project implementation. Income and poverty issue: referring to the influence of the project on the improvement of local income and poverty alleviation;

③ Worker's working environment: referring to the improvement of working conditions and influence on public health after the implementation of the project;

④ Public health and environment: referring to the improvement of public health and reduction of environmental pollution after the implementation of the project:

⑤ Land use: referring to the land area used for air-drying in brick making industry and the use change of the bricks after the implementation of the project;

⑥ Underprivileged group and social welfare guarantee: referring to the living conditions of underprivileged groups such as female or disabled workers and the development of social welfare after the implementation of the project.

4.2.3 Evaluation baseline

It will be a big challenge to evaluate a project like this, which refers to very broad issues, experiences a short time, is in its early stage of project cycles, and influenced by many overlapping factors. Another challenge is to separate the impacts of the project from the ones caused by other attributes. The impacts of different variables mix together. In order to deal with this situation, development of baselines becomes a core measures, although it is not easy to ensure this baseline convincible or not controversial.

The evaluators have established both stable baseline and dynamic baseline in assessing the project impacts: (Figure 4.2)

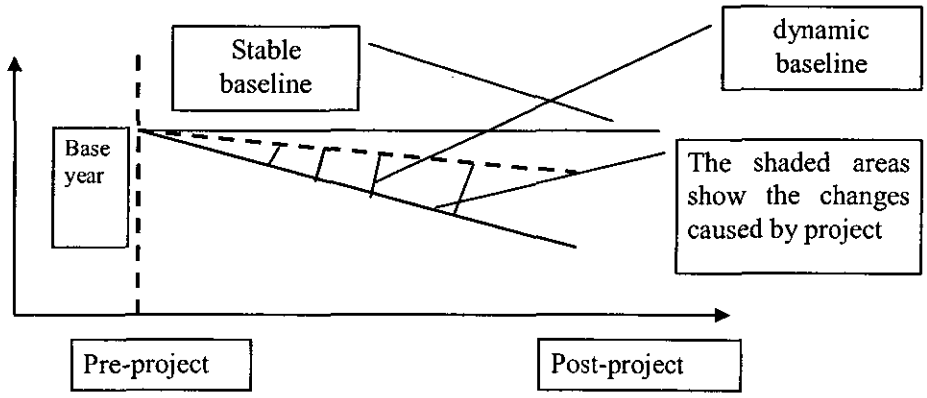

Figure 4.2 Set of baseline

Because the evaluation objectives and the situation of the four industries are different, the evaluators have respectively set various baselines to review PIC and LPIC mechanisms and effectiveness and evaluate the project Impact on policy making, market, gender and social development. The specific sets of baselines could be found in 4 sub-reports.

4.3 Information collection strategies

Table 4.2 presents the strategies and plan of the information collections.

Table 4.2 Information Collection Strategies and Plan

Working targets	Major information needs	Information sources	Communication tools
Evaluation of PIC and LPIC	Documents on PIC and LPIC operational rules, regulatory authorizations, and general introduction.	PMO, LPIC, PIC	Literature research; Workshop, meetings, and interviews.
	Organizational framework and functions	PMO, LPIC, PIC	Interview and desk work
	Records of its regular operations and main events	PMO, LPIC, PIC	Interview and desk work
	Communication performance info;	PMO, LPIC, PIC, enterprises, bank, other government officials;	Interviews, small meetings, questionnaires
	Guidance service and assistance in policies, information/knowledge, project development, training, networking, and other aspects	PMO, LPIC, PIC, enterprises, bank, other government officials;	Interviews, small meetings, questionnaires
	Satisfaction of enterprises	Case enterprises	Interviews, small meetings, questionnaires
Policy Impact	Literatures on the relevant policies, standards, regulations on macroeconomic management, energy, environment, and other such social issues on gender, rural employment, and poverty reduction.	Public dataset (internet-based) and publication	Literature research
	Policy making process and relevant stakeholder's behaviors, and position evolution; their interaction with the project stakeholders and project progresses.	Involved experts, officials, legislators, and representatives of enterprises	Interviews, informal meetings
Impact on market	Users of products and technologies: customers performance change (awareness), emerging effective demand.	Literature, enterprise, responsible authorities, professional institutes (construction materials, metallurgical and energy industrial association and research organizations)	Literature research, interviews, meetings, questionnaires (market survey)
	Supply side: number of suppliers, competition situation/market structure, market share, cost change, environmental and energy efficiency performance, links with market of capital and labor, etc.	Literature, enterprise, responsible authorities, professional institutes (construction materials, metallurgical and energy industrial association and research organizations)	Literature research, interviews, meetings, questionnaires (market survey)
	Market equilibrium: price change trends of product, input, and substitutes and complements	Literature, enterprise, responsible authorities, professional institutes (construction materials, metallurgical and energy industrial association and research organizations)	Literature research, interviews, meetings, questionnaires (market survey)
	Government intervention: introduction of environmental and energy codes and standards, ban and permits, tax and subsidies	PIC, LPIC, relevant authorities, experts, and case enterprises	Literature research, interviews, meetings, questionnaires
Impacts on social and gender issues	Creation of job opportunities by the case enterprises; distributional effects （income change and income gap, gender balance）; public health; working conditions and social security; poverty alleviation, training and education opportunities, knowledge and info dissemination, awareness improvement, and opportunities for public participation, etc.	PIC, LPIC, authorities responsible for rural management, TVEs; enterprises, experts, and NGOs.	Interviews, meetings, questionnaires

4.4 Implementation summary of Evaluation

4.4.1 Tasks

To achieve the objectives of the evaluation, several major tasks have been undertaken as follows:

(1) Do a literature research on the policies, rules and regulations of GEF, UNDP, UNIDO, and Chinese Government related to project evaluation and project background;

(2) Develop a set of indicators for evaluating the performance and effectiveness of the PIC and LPIC mechanisms based on guidance, handbook, and principles related to project evaluation made by UNDP, UNIDO, and GEF;

(3) Develop a set of indicators for evaluating the impact of the projects on policies of development, investment, taxation, finance, energy, and the environment, social security, employment, income, etc;

(4) Develop an analytical framework including basic concepts, evaluation criteria, rationales, and consideration of selected methodologies and analytical tools;

(5) Elaborate a detailed list of information and data needs based on the selected indicators and employed analytical tools;

(6) Develop communication strategies and plan for data and information collection with concrete identification of information sources, selection and design of such communication forms as meetings, interviews, and questionnaires;

(7) Establish a regular mechanism for communication with PMO, representatives from PIC, LPIC, case enterprises, and other stakeholders for the purpose of data and information collection, brain storming, and review of the project outputs with the guidance and assistance of PMO and in forms of formal and informal meetings, seminars, face-to-face or telephone interviews, as well as internet connection;

(8) Select target cases covering different typical regions, sectors, and levels with criteria serving for the evaluation;

(9) Conduct desk work to review documents related to the performance of PIC and LPIC and evaluate impacts of the projects;

(10) Conduct on-site work for interview, questionnaires, and meetings with relevant stakeholders in Beijing, and at least two other two places representing different environment, sectors, and performance of TVEs;

(11) Analyze the collected data and information and form a data set for this evaluation;

(12) Prepare inception report (mainly addressing working plan) and draft, draft final, and final report; and

(13) Organize several events for communication, discussion, and reporting the progresses and findings of the evaluation.

4.4.2 Evaluation Activities

Since the launch date of March 16, 2006, the evaluators have developed or participated in a lot of activities in order to ensure the relative stakeholders' active participation and information sharing, then to ensure the fairness of evaluation results. Specific project activities could be found in Annex 1.

4.4.3 The difficulties encountered and the responses

It will be a big challenge to evaluate a project like this, which refers to very broad issues, experiences a short time, is in its early stage of project cycles, and influenced by many overlapping factors. Another challenge is to separate the impacts of the project from the ones caused by other attributes. The impacts of different variables mix together. In order to deal with this situation, development of baselines becomes a core measures, although it is not easy to ensure this baseline convincible or not controversial. In this evaluation, the evaluators exactly apply the baseline approach to separate the impacts which are caused by the project.

However, along with the changes in the environment and implementation strategy of the project, huge adjustment has been made to the project. Consequently, the setting of a credible baseline, especially the dynamic baseline, emerged as another challenge in front of us. Since most of the impact of the demonstrational and promotional enterprises is felt at their localities and owning to the nature the TVEs, the statistical work of grassroots organizations are very incomplete and cannot yield very accurate data. In addition, the impact of the project, in most cases, is interwoven with other impacts and cannot be separated. Even though the separation is made, the reliability of the data concerning the project impact would be questionable. So in this evaluation, we have adopted a rather flexible approach to use the static baseline, namely the scenario of the actual implementation of the project, as a proxy in case it is hard to set dynamic baselines considering the fact that at lease a portion of the change taken place following the project can be attributed to the impact of the project.

Besides, due to the limit of both time and funds, we are unable to carry out on-the-site investigation of all the 9 demonstrational enterprises and 118 promotional enterprises one by one. In this connection, we conducted the evaluation of the market impact of the project by employing the comprehensive approach of carrying out on-the-site investigation of typical enterprises coupled with the execution document of the project.

5、 Implementation Effectiveness

5.1 The integral implementation effectiveness of Phase II

Since been launched in February 2001, the phase II project has done much effective work in such aspects as institution-building, selection and progress of pilot and replication TVEs, capacity building and so on. And the outputs have exceeded the anticipated ones in the original project design.

（1）Elimination of policy barrier

A. Mechanism construction

PMO and PIC were respectively established on March 2001. The members accepted the trainings in energy efficiency volunteer agreements and participated a study tour respectively n 2002 and 2003 to Europe and the United States. In 2002, county-level policy implementation committees were established. And in 2003, Local policy implementation committees were first established in eight pilot areas, and the intuitions for barrier removal created. Then the 11 LPICs of replication areas were selected and identified[②].

B. Pilot and replication TVEs

The VA mechanisms have been implemented. The Voluntary Agreements signed in nine pilot TVEs and related local governments, four replication areas and related TVEs, and also to be replicated in other seven replication areas and related TVEs.

C. Capacity building

Held 3 trainings about the development and capacity buildings of LPICs, and about 120 government officials and project participants attended the PIC annual meeting and other workshops and trainings, whose management capacity and policy guidance improved. The capacity building of LPICs has been carried out in

[②] The mechanism and its effectiveness of PIC and LPIC is mentioned in section 5.2

8 pilot areas (including the extending of the implementation plan, the sign of VA, and training activities). And based on this, similar activities could be taken in the left replication areas.

（2）Elimination of Technology and Market Barriers

A. Mechanism construction

In September 2001, PTPMC was established, and a commercially operated Hongyuan Company was established in July 2003 to play the role of, and to substitute for, the functions envisaged for PTPMC. The company intends to provide technology, financing and other services which are needed by the technological transformations in the four Industries, and aims to remove the technology and market barriers. A rotating fund business office was established in October 2001.

B. Pilot and replication TVEs

Taken comprehensive surveys of the four projected sectors; 9 pilot TVEs and 118 replication TVEs has carried out technical updating and the replication work in brick, casting, and some of the cement sectors has far exceeded the original requirement of projects. 7 pilot TVEs and 60 brick replication TVEs have finished their technical innovation work. Another 10 cement replication TVEs have accomplished feasibility studies and the construction funds have been guaranteed, will be completed in the near future. GEF has provided feasibility studies, engineering design and equipment purchases and other services; created a database including several design institutes, equipment manufacturers, service providers and individual experts. After training, the TVEs which are affected by the project have increased their demand for high energy-efficiency technologies, and the changes in pilot and replication TVEs have particularly noted; the measures in order to promote the demands of high energy efficiency products are still in discuss.

C. Capacity building

Carried out 13 energy-saving training activities, benefiting 670 enterprises, and 900 people have participated the trainings. Recycling 370 TVEs survey questionnaires selected and identified 118 replication TVEs. Till September 2005, more than 1,200 managers of TVEs, local officials and other stakeholders have accepted trainings about energy management and the professional technologies.

（3）Elimination of Finance Obstacle

A. Mechanism construction

In August 2003, UNDP, UNIDO, MOA and ABC signed a memorandum of understanding and approved the establishment of the revised RCF financing mechanism. The memorandum has determined the financing sources of RCF, and established a tripartite mechanism to address the finance barrier of TVEs: entrusted loan mechanism, commercial loan mechanism and capacity building mechanism.

B. Pilot and replication TVEs

9 pilot TVEs and 118 replication TVEs have composed, or are composing the proposals , feasibility studies and measures of technical innovation of energy-saving and technology upgrading projects; Most enterprises use their own assets or through other approaches to financing for technological transformation; since 2004, the RCF mechanism unchanged, but the pilot TVEs have relied on their own assets and commercial loans gradually to raising funds for technology innovation.

C. Capacity building

In August 2003, the represents from 9 pilot TVEs, the local affiliated agencies of ABC, PMO, Hongyuan Company and the secretariat of GEF China as well as the chief technical adviser attended the RCF training.

The subcontractor also held a RCF seminar during the training course. The representatives of some TVEs and ABC have discussed the operational structure as well as some specific issues with the subcontractor and the PMO, and they also put forward some good proposals. During the seminar, the subcontractors, the PMO and the Chief Technical Advisor also answered some of the questions raised by the representatives of the training program.

The headquarters of ABC also avail itself of this training course to organize the representatives from its local branches to discuss and study the Provisions on making Entrusted Loans on Energy Conservation for Township-village Enterprises.

（4）Global environmental benefit

Among the 9 pilot TVEs, the technology upgrading of 7 pilot TVEs has been finished, and highly reduced the energy consumption of per production. The Anticipated Energy Savings of 9 pilot TVEs is 120 thousand tce/a, and the CO_2 Emissions Reduction is 300 thousand tons/a. Till September 2005, accomplished energy savings 56 thousand tons/a, and accomplished 140 thousand tons/a, far exceeding the designed objectives in the project document-energy savings 32

thousand tons/a, and accomplished 280 thousand tons/a. The Anticipated CO_2 Emissions Reduction of 118 replication TVEs is 1603.7 thousand tce/a. The 45 brick replication TVEs in Xian, Xian yang and Shenyang whose construction were finished have accomplished CO_2 Emissions Reduction 85.8 thousand tons/a. The 20 cement replication TVEs, 10 of which has granted the construction funds and would be finished in late 2006, would accomplish CO_2 Emissions Reduction 341.3 thousand tons/a. Once the projects of power generation with waste heat in coke and cement replication TVEs were established, the installed capacities could be 177MW, which could meet the domestic electricity needs of a big city with a nine million population.

5.2 PIC and LPIC Mechanisms and its Effectiveness[③]

Based on the implementation results of Phase I of the project, we reach the conclusion that the major problems hindering TVEs in China from raising energy efficiency lie in the obstacles in the four aspects, i.e. policy, technology, market and financing. The project document has mapped out the framework system so as to eliminate the above obstacles, among which the mechanisms of PIC and LPIC are formulated to eliminate the policy obstacles, and their operation effects are closely connected with the effectiveness of the project in terms of removing policy obstacles.

Regarding the evaluation of PIC and LPIC, the evaluators design the evaluation indicator system for the two respectively by making reference of related evaluation methods of UNDP and taking account of the key points of this evaluation task to launch the evaluation from the perspectives of the establishment, operational mechanism and operational effect of both the PIC and LPIC as well as the sustainability of LPIC.

The Establishment of PIC and LPIC. The major obstacles faced by TVEs of China lie in the four sectors of policy, technology, market and financing. Aiming to clearing up all these obstacles, the related framework systems were drafted. In specific, the mechanisms of PIC and LPIC are set up to eliminate the policy obstacle. PIC is mainly composed of related representatives of MOA, MOF, National Development and Planning Commission (presently the NDRC), State Economic and Trade Commission, MOST and SEPA as well as experts from related enterprises and public institutions including the ABC. PIC is in nature a mechanism for project coordination and communication, which demands the

[③] Details are seen in sub-report on evaluation of PIC and LPIC.

coordination and communication among various departments in a more closely collaborative way. The content of LPIC can be divided into the following three major parts: the identification of the member organizations and supporting organizations, the drafting of related documents and training programs. By this, four effective feedback mechanisms and information communication mechanisms have been established among all the stakeholders concerning the establishment of LPIC, namely the feedback between LPIC and PIC; the feedback between LPIC subcontractors and LPIC member organizations; the feedback between LPIC subcontractors and PMO and CTA as well as the feedback between LPIC subcontractors and UNIDO. Governmental departments will still constitute the supporting organizations of LPIC. With the experience accumulation and the development of LPIC, it would be viable for science and technology research institutions and industrial associations to join in LPIC as member organizations. This will strengthen the technological supporting capacity of LPIC to enterprises and also serve as an effective means in guiding TVEs to initiate energy conservation technological transformation based on market mechanism. It is also an important method to expand the means for obtaining technical information for TVEs.

The Operation of the PIC and LPIC. The operational mechanism of PIC includes both the coordination mechanism and the supervision mechanism. The coordination work made by PIC concerning the project is mainly reflected in its arrangement of the PIC Annual Meeting and its participation in 3 project evaluations. Meanwhile, PIC is also responsible for related supervision over project execution, especially the supervision, guidance and stimulation of the enforcement of relevant laws and regulation in pilot counties, project implementation situation and the work of LPIC. The operation of LPIC includes its work format and content, its information transmission and decision-making mechanism, the supervision and guarantee mechanism and its incentive mechanism. During the operation process of LPIC, the information transmission and decision-making mechanism have been set up based on the pivot of the supporting organizations of LPIC. The supervision and guarantee mechanism for the operation of LPIC is quite commendable with detailed Series of Documents on the Evaluation System of LPIC securing the operation quality of LPIC. In contrast, the evaluators expressed their concerns over the incentive mechanism of LPIC since they found that the establishment of a sound LPIC incentive mechanism was far from being completed. They suggest that the close linkage between the interests of LPIC with the benefits originated from the energy conservation

technological transformation of enterprises be the only way out in securing the continuity of the cooperation between LPIC and enterprises.

The Operational Effect of PIC and LPIC. As one of the frameworks aiming to clearing out the policy obstacles, PIC has effectively removed the obstacles in the policy communication during the implementation process of the project, performed guidance and development of LPIC, conducted policy-compliance examination over the entrusted loans, instructed the construction and operation of Hongyuan Company with training courses to the stakeholders of the project. As a result, PIC operational pattern has been spread and promoted. The impact of the establishment of LPIC is mainly demonstrated in the management capacity, governance capacity and policy coordination capacity of local governments. As one of the frameworks aiming to removing the policy obstacles, LPIC has boasted its capacity in this aspect up to 85%, worth full commending. LPIC has effectively implemented the energy efficiency VA, all the demonstrational enterprises have over-fulfilled the energy conservation technological transformation targets, and the promotional enterprises have actively inked energy efficiency VA with their local governments. LPIC also made full use of relevant policy resources and policy channels in advancing the energy conservation technological transformation and demonstrational work in enterprises. In addition, LPIC has upgraded the capacity building towards a service-oriented government and fostered the service awareness of local government officials.

The sustainability of LPIC is reflected in the continuation of its work philosophy. Serving as the operational mechanism of the project, though LPIC will no long be in existence in its organizational format following the completion of the project, the work philosophy embodied in the operational mechanism of LPIC can remain. The designing concept of LPIC is in conformity with the energy conservation policies in China, and work considerations of some local departments are also similar to LPIC, thus enabling LPIC to fit into the work of local governmental departments well.

5.3 Conformity between the Actual Actions/Output of the Project and the Anticipated Goals

The project has resorted to a string of measures including the establishment of policy implementation committees both at the central and local level as well as the conclusion of the "voluntary agreement" between the policy implementation committees at all levels and enterprises to ensure and stimulate enterprises to

carry out energy conservation technological transformation and promote the successful experience to other enterprises in this sector. Meanwhile, it also intensified the enforcement efforts of existing laws and regulations on environmental protection and energy conservation through systematic training programs targeting local governmental officials in related departments in a bid to guarantee the accomplishment of the targets for eliminating policy obstacles in organizational capacity building.

The project also established an independent economic entity (namely the Hongyuan Company) that has sustained self-development capacity. The company aims to provide technical support as well as related information for energy conservation technological transformation of the pilot enterprises based on the identification of both domestic and overseas organizations and expert members. Besides, with its training courses on modern technology and management theories targeting the leaders and employees of those pilot enterprises, the company has also improved the capacity of TVEs in energy conservation and GHG reduction, raised public awareness in energy conservation and environmental protection and basically nurtured the self-development capacity in the field of energy conservation.

PIC has carried out its work starting from the promotion of industrial development and consolidating the capacity of TVEs in sustainable development and made huge efforts in realizing the goal of the project and ironing out the market obstacles. During the implementation process of the project, the methods of public bidding invitation and standard supervision have been adopted, thus effectively curbing local protectionism. Additionally, diversified services have been offered to enterprises for information provision and market planning so as to facilitate pilot enterprises in widening the sales channels even to international market.

The project has established the Revolving Capital Fund (the term "fund" is later changed into "mechanism" owning to the impact of related domestic policies) for letting out loans to the pilot enterprises on energy conservation technological transformation and then revolving the loan payment from these enterprises in reinvestment in more enterprises. Meanwhile, RCF has also built up the sustained and low-risk financing mechanism in facilitating TVEs in the implementation of energy conservation technological transformation by offering related training courses to the staff of financial institutions, employees of non-pilot enterprises and the people providing services to TVEs.

Generally speaking, the project has enhanced the adoption of advanced high-efficiency energy conservation technologies in TVEs in energy-intensive and heavy-polluting industries such as brick and tile, cement, casting and coking in China on a market-based mechanism, increased the energy efficiency and consequently met the target of reducing global GHG emissions. The project also supported and established some new organizations on policy execution, technological and market service and financing so as to ensure the provision of quality, sustainable and comprehensive services to the demonstrational enterprises and enable these newly-established organizations to further complete the task of popularizing energy conservation and GHG reduction technologies among Chinese TVEs and spreading the successful cases of the demonstrational enterprises of the project across all the enterprises in the same line following the completion of the project. Besides, the project has conducted the designing and specific implementation management as per the initial goal and made necessary adjustment to the project on the premise of keeping the original major goal and basic designing framework of the project during the whole process of the project implementation. Judged from the outcome and effect, the project has accomplished each anticipated target quite successfully.

6、 Policy, Market and Social Impacts of the Project[④]

This part is the key of the entire evaluation, and it aims to examine the policy, market and social impacts of the Project of Energy Conservation and GHG Emissions Reduction in Chinese TVEs – Phase II (Serial No. of the project: CPR/99/G31, shortened as the TVE Project) from the perspective of the project itself as well as from the macro-perspective. The specific evaluation results are gained based on the above-mentioned evaluation approaches and indicator system combined with the data and materials collected. The scope of the evaluation and assessment will cover 9 pilot TVEs and 118 replication TVEs, and will be based on the entire project period - from project design; inception, adjustment, and implementation to completion.

6.1 Macro-policy Impact of the Project

Objectively speaking, the initial design of the project does not require direct impact on macro-policy from the implementation of the project. However, the

④ Details are seen in sub-report on evaluation of policy impact, market impact and social impact,

evaluators are quite certain that the implementation of the project has exerted a subtle influence on the macro-policy to a certain level, which has more been felt from the positive impacts on macro-policies through the changes in the awareness or the decision-making behavior of various stakeholders (including local governmental officials, project execution organizations, etc.). All the participants of the project, both enterprises and governments at various levels, have truly understood the economic and environmental benefits of energy conservation. What's more, by conducting great amount of on-the-site investigation, the evaluators have proven that the influence exerted by the implementation of this project is much greater on local macro-policies than that on the national macro-policies.

Thanks to the activities of both PIC and LPIC and the adjustment of the demonstrational technologies and the success of the demonstrational project, the project has already enhanced the implementation of related energy conservation policies both at the national and local level and also positively stimulated the release of some national and local energy efficiency and environmental policies to a certain extend. The achievements of the project have promoted the enforcement of national and local macro-policies among local governmental officials. Apart from facilitating the materialization of the Energy Conservation Law of the People's Republic of China and the Law of the People's Republic of China on Promotion of Clean Production and the sound implementation of the Mid and Long-term Special Planning on Energy Conservation, the project also played an active role in the smooth attainment of the energy consumption reduction targets stipulated in the 11th "Five-Year" Plan. Meanwhile, the project takes the initiative of ushering in the mechanism of voluntary agreement on energy conservation in TVEs, transforming the passive energy conservation behavior of enterprises under governmental administration to spontaneous energy conservation out of the motivation of fulfilling its corporate social responsibilities. In this way, innovation has been made in the administration pattern of the government, the environmental protection awareness of enterprises has also been elevated and the enthusiasm of enterprises in energy conservation has been mobilized.

During the implementation process of the project, the following good instruments have been employed, having great significance of exemplification for future policymaking and enforcement:

(1) The demonstration and promotion of voluntary agreement on energy efficiency. By employing the mechanism of voluntary agreement on energy efficiency, the project has translated policy targets into the voluntary action of enterprises,

mobilized the enthusiasm of enterprises in energy conservation technological transformation and ensured the smooth implementation of TVE projects in various enterprises through governmental measures. This new type of interactive relationship between government and enterprise offers new ideas for drafting new energy efficiency policies in the future.

(2) Function change of local governments. Under the system of planned economy, the government is used to make too many decision-makings for enterprises and interfere in the normal operation of enterprises, which only leads to high administrative cost and low efficiency. However, under the system of market economy, the government only needs to handle the issue of incremental cost while mapping out policies, and enterprises can make self-adjustment in line with the law of market to fulfill profit-making and sustainable development.

(3) The introduction of industrial self-disciplined association in LPIC. Self-disciplined association is of great pragmatic significance as the bridge between the government and enterprises. The self-disciplined pact of the industrial self-disciplined association has crucial binding force to enterprises, and therefore is very conducive to the compliance of enterprises with industrial rules as well as the implementation of policies. From another perspective, the association represents the interests of enterprises and can bring about influence to the macro-policymaking process of the government. During an interview, the Secretary-general of Nanjing Casting Association, Mr. Meng Qinggui noted that the casting enterprises of Nanjing City are currently engaged in the move to raising the added-value of their products, lowering the waste ratio, recycling the wasted pig iron and scrap steel during the casting process and improving management efficiency through deep processing of their casts. According to statistics, the scrap rate of casting enterprises generally ranges between 10%~15% with great potential for improvement. Therefore, we must rely on science and technological advancement to improve the quality of their products and internal management. The casting enterprises should also spend efforts on adjusting the structure of the products for export and enlarge the export share of high added-value cast products in light of the fluctuation of international market and the production cost of the casts. The Nanjing Casting Association also promotes the development of related enterprises via diversified means such as holding regular exchange activities, providing information and subscribing professional magazines for enterprises.

(4) Vital support from technological organizations. Powerful technical support forms an indispensable part in the smooth implementation of a sound project. The

case of brick making industry in Xianyang of Xi'an City demonstrates that the Xi'an Research and Design Institute of Wall & Roof Materials plays a quite crucial role in the industry of building material within Shaanxi Province and even across the nation. The design and implementation of future projects should also bring the technological strength of scientific and technological research institutions and colleges and universities into full play, which should be the technical precondition in securing the fulfillment of the goal of the project.

(5) Maintaining the relevance of corresponding policies. Maintaining the relevance of corresponding policies is the important prerequisite for guaranteeing the smooth implementation and goal fulfillment of the project. During the implementation process of the project, the Chinese government ushered in the scientific development outlook and highlighted the construction of a harmonious society and taking the sustainable development path. To this end, this energy conservation and emission reduction project conforms to the development direction of China's macro-policy environment, and therefore has gained the support from various social sectors. This practice is of crucial reference significance to the selection and target setting for future projects.

At the same time, we also found that there are some places requiring improvement in existing laws and regulations with the following tentative expression:

(1) During the evaluation process of the energy conservation effect of this project, all the technical experts participating in the evaluation pointed out that there are three major defects in the current Energy Conservation Law of the People's Republic of China, namely the lacking of specific execution organization, the lacking of corresponding incentive and rewarding and punishment measures and the lack of practical and fair energy efficiency standards. These three defects should be underscored in the future drafting of the Law on Energy and Resources as well as the amendment of the Energy Conservation Law.

(2) The successful implementation of the project proves that SMEs are also capable of establishing modern corporate system, improving the quality of their products, performing standardized management and operation, employing new technologies on energy conservation and emission reduction and making vital contributions to the economic development and employment expansion in rural areas. In this connection, we should allow some flexibility to various SMEs across China though the central government has practiced the policy of closing down "fifteen types of small enterprises with heavy pollution" for many years. In stead, governments at all levels should support SMEs to change their extensive

production and management mode to pursue sustainable development through policy guidance while giving due regard to their specific local conditions at the same time.

(3) Prior to the implementation of this project, the four targeting industries and local governments have never thought about the issue of energy conservation and energy consumption reduction. What's more, most TVE operators either expand the production scale blindly during the rosy period of the market or recklessly withdraw when the market is sluggish. In other words, the entrepreneurs of TVEs are generally lacking the makings of entrepreneurship and are devoid of the development strategy for their enterprises. Consequently, they are reluctant to make long-term investment. Nevertheless, this project has mobilized the enthusiasm of enterprises in energy conservation and emission reduction, lowering cost and improving product quality. For instance, quite a number of brick making entrepreneurs expressed that they should run their brick making plant like a real enterprise and the long-term operational considerations for the enterprise can guarantee long-term investment in energy conservation and environmental betterment as well as investment in infrastructure and strategic investment. Therefore, the policy makers need to further change their mentality in formulating new energy efficiency policy and environmental policy in the future by offering comprehensive considerations to SMEs as major players in the market.

6.2 Market Impact of the Project

As shown by the survey results of Phase I of the project, the market obstacles facing TVEs in terms of energy conservation and emission reduction are mainly reflected in the following four aspects: first, consumers are unwilling to buy energy-conserving products with extraordinary performance even though such products are cost-effective or can bring other benefits to the buyer; second, TVEs themselves have no enthusiasm in investing in energy conservation and producing energy-conserving products, and they also lack relevant marketing strategies and sales network; third, local governments have no intention in taking measures to encourage improvement in product quality such as the possible formulation of the standard on the minimum heat dissipation value for buildings, drawing up related guidelines for construction or laying down quality criteria, etc.; fourth, the market lacks competitiveness and is dominated by local protectionism.

Based on the examination of the project activities and corresponding results in these four aspects, the evaluators indicated that up to now, the project has carried out lots of practical and detailed works in eliminating market obstacles and

promoting the development of TVEs led by the enhancement of the energy conservation and emission reduction work of TVEs in the four industries. Based on its beneficial and effective explorations, the project has gained remarkable achievements.

The project has mobilized the enthusiasm of consumers in buying energy-conserving products or the products made based on energy conservation technologies. Meanwhile, it has also driven the initiatives of enterprises in making investment in energy conservation technologies and producing quality energy-conserving products. During the evaluation process, the evaluators conducted a survey on energy conservation awareness among LPIC officials of the demonstrational and promotional zones, subcontractors of the promotional enterprises, local governmental officials, principals and employees of the enterprises participating in the project, people working in other related sectors and ordinary local people. The result indicates that the project has earnestly inspired the enthusiasm of all stakeholders in making investment in energy efficiency betterment projects and purchasing energy-conserving products, raised their awareness for energy conservation and deepened their understanding of energy conservation technologies, techniques and policies in this field. Besides, the project has enhanced the understanding of the project officials to the project itself and built up their management capacity in energy conservation and emission reduction projects by introducing related ideas of GEF regarding project management and emission reduction to China.

The project has yielded huge energy conservation and environmental benefits. With the improvement of production techniques and reduction in related input of enterprises, the production cost of enterprises has been effectively decreased.

The project has facilitated the demonstrational and promotional enterprises in resolving problems emerged during their development, which has brought about real benefits to these enterprises. While experiencing various benefits stemmed from energy conservation technological transformation, enterprises have boosted their consciousness and initiatives in energy conservation technological transformation in return. In addition, the achievements of these demonstrational and promotional enterprises have had a real demonstrational effect and exerted positive impact to their peer enterprises in this field. The project even disseminated its influence beyond the Chinese border to neighboring countries with over 10 foreign enterprises from India, Indonesia, Bangladesh and Vietnam paying visits to these demonstrational enterprises so far. According to statistics, the demonstrational enterprises have energetically unfolded spontaneous

promotion work through various means of visits, training, exchanges and consultation service provision, thus benefiting more than 400 enterprises.

The project has changed the profit-making mode and operational concept of the enterprises from the original extensive operation pattern of making small profits but quick turnover to sustainable operation pattern of making profit based on sound management and technological transformation to a certain extent. In this connection, it has pointed out a path of sustainable development for energy-intensive TVEs to a certain level and upgraded their comprehensive competitive force.

With the implementation of VA, the project has already drawn up and carried out related product standards. Meanwhile, it has also enhanced the understanding of local governments of the benefits of energy conservation and emission reduction and hence promoted the establishment of energy conservation policy, guidelines and standards as well as the enforcement of existing policies, guidelines and standards.

The project has consolidated the market competitiveness and propelled the industrial upgrade and restructuring of the four industries. Since its efforts accord with the national intervention efforts, it has broadened the market share and competitive edge of energy-conserving products and equipment, diminished the energy intensity of the four industries and their pollution of the environment and in a sense, provided guidance and model for national intervention in this regard.

It should be highlighted that the great amount of efforts of the project in eliminating market obstacles are not separate. Many such measures have produced remarkable effects in removing financial obstacles, policy obstacles and technical obstacles, which have further widened the achievements of the project.

On account of the fact that market regulation is often post-regulation, and the market impact itself is of the distinct character of time lag with the diffusion, duplication and visualization (such as the formation of price and the adjustment of price signals transmitted to the production of commodity) of the market impact being realized after a certain period of time. To this end, the results gained from the evaluation of the market impact of the project conducted prior to its completion will surely be inadequate, and some of the evaluation conclusion may not be well grounded on the support of facts. Nevertheless, since the main players of the market are fixed, the decision making of these players as well as the interaction among different players definitely follow certain rules under the presumption of the economic person. By this, the evaluators are reasonable to believe that the initial

evaluation results originated from the theoretical approach supposing the market impact does take place coupled with existing materials are generally reliable, and the preliminary analysis made in this report would also be of help to further understandings of this issue in the future.

6.3 Social Influence of the Project

The evaluation team found the project had influenced social development in the following aspects based on evaluation approach, indicator system and case study of on-site investigations.

(1) Improved public environmental awareness. Workers from the pilot and replication enterprises have participated in training programs offered through different channels in the process of technological reform. By learning the concepts of environmental protection and energy saving as well as related technologies, these workers have deepened understanding on and more awareness of environmental quality, hence building their environmental awareness and sense of responsibility. After training, both the management and workers start to pay attention to energy conservation in all links of production and conduct exchanges with peers in the line. In addition, Phoenix TV and other media featured the project and pilot enterprises, which has effectively expanded not only the publicity of the project, but also its influence on the general public.

(2) Increased job opportunities and more income for farmers. The evaluation team learned through interviews that with the expanded mechanization steps in corporate production, though the needed labor in single production line has reduced, companies still offered more job opportunities for farmers due to the scaling up of production and emergence of new types of work. Further more, as mechanized production has taken a larger share in the technological reform and companies reaped more profits, farmer workers in the pilot enterprises also earn more income on the average.

(3) Improved working environment for farmer workers. It was found that thanks to the project workers of the pilot enterprises polled were benefited from reduced labor intensity and largely improved working environment (especially soot and dust) as a result of updated equipment and technology.

(4) Bringing about enormous environmental benefits. The project helped the pilot enterprises to reduce pollution and alleviated pollution and destruction of local environment, which set a good example of getting rid of the shackle of environmental pollution and pursuing sustainable development for other TVEs in

the same industry.

(5) Better use of land resources. The hollow brick and artificial drying of bricks promoted by the project in brick manufacturing have effectively reduced land destruction and occupation by brickyard.

(6) Improved status of women and the well-being of vulnerable groups. In spite of the hard working conditions and intensive labor of the type of work in the pilot enterprises (brick manufacturing and casting, etc.) that place high requirements on workers' constitution, investigation indicates that women employees usually take up 20%-30% of the total employment in pilot enterprises, engaged in supportive work that is less intensive such as logistics, testing and computer control. The pilot brick manufacturers in Xi'an and Xianyang even have women workers accounting for 50%-60% of the employment. Leaders in the pilot enterprises investigated believe there will be more potential opportunities for women workers with higher mechanization level and better working environment.

(7) Promoting the establishment of social insurance system in rural areas. The evaluation team found some good changes in their investigation of pilot enterprises. Technology innovation, reduction of energy consumption and increase of output have driven enterprises to pay more attention to workers' well-being and insurance while seeking self-improvement. In East China, some enterprises have started to buy all kinds of insurance for employees in varying degrees. These exemplary behaviors will play an important role for the betterment of other enterprises in this aspect and for the building of social insurance system in rural China.

On the whole, the evaluation team maintains that the social impact the project has gone far beyond what they had expected in project design. The project provoked a more profound social impact and benefits. The remarkable implication of the project is mirrored not only in its role of promoting public environmental awareness, creating employment for surplus rural labor, increasing farmers' income, and improving the working environment, facilitating environmental protection and rational use of resources as well as upgrading women's status, but also in its far-reaching influence on maintaining social stability, promoting the establishment of social insurance system in rural areas and stimulating other TVEs to follow the path to sustainable development. The implementation of the project has offered a scientific approach for TVEs to enhance capacity building and pursue sustainable development, which will surely in turn play a major role in promoting urbanization of rural China in the future.

It is hoped that the follow-up projects will make full use of the interactive network developed in this phase, which links the government, associations and enterprises and spread it on a large scale for greater social benefits.

7、 Operating Efficiency of the Project

The project team has over fulfilled the targets without incurring more budgets. The performance alone displays its high efficiency.

A number of outcomes achieved out of limited input also reflected its operating efficiency.

With limited funds the project succeeded in attracting huge amount of investment in the reform of energy efficient technologies, thus diversifying financing channels for TVEs. The pilot enterprises are expected to make a total investment of USD51.45 million on efficiency improvement. Currently USD36 million investment has been put in place, of which direct investment only accounts for USD750, 000, or 1.5% of the total. Therefore, the project is a big success in opening up financial channels for enterprises. Loans exceeded USD20 million, making up nearly half of the total investment, of which loans offered by ABC alone reached USD17.46 million. The credit must go to Hongyuan Company who helped with going through the loan procedures with the guarantee of GEF funds. The total funds rose for project promotion (9 pilot enterprises and 118 replication enterprises) topped USD100 million. Meanwhile, the project also explored other financial channels. It teamed up with China Water Group Inc. to provide funds for capital of replication enterprises, removing the barriers of TVEs to apply for loans.

Moreover, the project also set up an important mechanism-RCF to help TVEs to overcome financing difficulties during the technology reform. Hongyuan Company was established to tackle the issue of marketing technologies and products involved in the reform. So far, two pilot enterprises have obtained USD200,000 RCF loans. More importantly, RCF has exerted great influence on small-to-medium sized enterprises in their financial policies, commercial banks and other financial institutions in their understanding towards TVEs' energy reform and on TVEs' will to invest in energy projects. On the other hand, Hongyuan Company assisted the project office in preparing and managing subcontracts of 36 projects, carrying out the mandatory loan mechanism for energy conservation projects and organizing 16 training courses on energy conservation technologies, which turned out over 900 technicians (person time) for 650 enterprises accumulatively. The company also worked with 4 TVEs to develop CDM projects

and provided paid service for technical consulting. The successful operation of these programs also contributed to higher efficiency of the project.

8、 Relevance of the Project to National or Regional Policies and Priorities for Energy and Economic Development

Macro economic policies are the foundation for the design and implementation of projects. Generally speaking, projects need to be in line with current policies, laws and regulations at all levels, which is the necessity of smooth operation and realization of project objectives. As policies are mandatory, if project design is not consistent with or runs counter to current policies, laws and regulations, the project will be subject to a lot of uncertainties or even turned into an impossible dream when it comes to project implementation and realization of the objectives.

China's energy production and consumption structure dominated by fossil fuels, especially the excessive dependence on coal, has made it to face more serious environmental problems. According to the relevant statistical information of IEA, the CO_2 emissions which are produced by the combustion of fossil fuel have increased from 1.48 billion tons in 1978 to 3.719 billion tons in 2003. And at present, China is also the world's second largest source of CO_2 emissions.

From the Outline of the National Program for Long- and Medium-Term Scientific and Technological Development issued by the State Council in Feb. 2006, we can see energy conservation, reduction of energy consumption and development of clean energy have become the focus of China's middle-to-long term energy polices. On March 14, 2006, the Outline for the Eleventh Five-Year Plan for National Economic and Social Development was adopted at the 4th Session of the 10th NPC, which specified that China would reduce its energy consumption per unit of GDP (an important indicator to measure the quality of economic growth) by 4% every year and the total reduction would be 20% in five years. This is the first time that China has incorporated energy consumption indicators into national development goals. Furthermore, the State Council issued the Decision on Enhancing Energy Saving on Aug. 31, 2006, a move to mobilize all social forces to strengthen energy saving.

The project of energy conservation and emission reduction for TVEs conforms to the trends of national macro policies and all the ideas the government has earnestly proposed for the advancement of sustained economic and social development, such as scientific outlook on development, circular economy, clean

production and the establishment of a resource efficient and environment-friendly society. Therefore, it is strongly backed up by the central government, governments at all levels and other pilot and replication enterprises, which secured the smooth operation of the project.

9、 Reaction Capacity of Project

9.1 Reaction Capability to the changes of exterior environment

During the implementation process of the project, the rapid national socio-economic development has led to the development of TVEs. The real situation that the project faces has changed a lot compared with the one faced during the original project design, and has affected the implementation of the project to a certain extent. The project document ever indicated "Given its innovative nature, the barrier removal framework will be subjected to constant monitoring and, if necessary, modification" for the original project design. Hence, the project has been made necessary adjustments while maintaining the objectives and the original designed basic framework unchanged.

9.1.1 Changes of exterior environment

（1）National socio-economic development

China has experienced rapid and steady overall socio-economic development since the late 1970s. With China's rapid economic development, energy demand and energy consumption keeps increasing. Now China has become the world's second largest energy consumer, and its total energy consumption accounted for about 11% of total global energy consumption. China's primary energy consumption has increased from 5.2 billion tons of standard coal in 1978 to 22.2 million tons in 2005, with an average annual growth rate 5.4%. China's energy production and consumption structure dominated by fossil fuels, especially the excessive dependence on coal, has made it to face more serious environmental problems. According to the relevant statistical information of IEA, the CO_2 emissions which are produced by the combustion of fossil fuel have increased from 1.48 billion tons in 1978 to 3.719 billion tons in 2003. And at present, China is also the world's second largest source of CO_2 emissions.

The GOC has realized that present high increase of GDP has been primarily driven by high inputs and high consumption of energy and of other resources, and has come at the cost of high and widespread environmental pollution. This

traditional extensive economic develop mode would not be sustainable. In November 2002, the Report of 16th Party Congress presented the economic development goal——in 2020, the gross domestic product is four times of the GPD in 2000, the social development goal——building an all-round well-off society, and the human development goal——achieve sustainable development. These will raise further severe challenges to China's current more and more intensified energy supply security and the relatively more vulnerable ecological environment.

According to the concepts and ideas advocated during the recent years, such as sustainable development, scientific development, recycling economy, resource-saving and environmental friendly society, harmonious society and so on, it is not difficult to grasp the trend of the GOC's macro-policies, that is with the development of economy, pay equal attention on the resources development and saving, and put saving in the first place, trying to carry out the transformation of ways of economic growth and regarding the improvement of resources use efficiency as core.

To meet the high pressures of energy supply and consumption, China is both developing new resources and enhancing the conservation/efficiency of existing resources. Through adopting advanced techniques and industry structure improvements, the two approaches both decrease energy consumption and enhance the utilization of currently wasted energy streams in industrial production processes.

Alongside the strong enhanced energy supply and energy conservation focus, increasingly more strict environment standards at both national and local levels are also driving the increased emphasis on clean production in industries, and hence acting as a new driving force for enterprises to pursue low emissions and reuse currently wasted heat and materials in manufacturing processes.

Furthermore, the strong development of a market economy in China offers both enterprises opportunities and pressures for them to reduce the consumption of energy and other resources to reduce their costs and enhance their profits.

With China's ongoing socio-economic development, more and more Chinese people - not just decision makers, scientists and experts - but also entrepreneurs and the wider public, also have a growing awareness regarding environment issues, including climate change issues, and want is contribute individually to improved local and global environmental conditions.

(2) National industry development technical updating and structural improvement

policies

To improve wider industry development approaches and also industry technical capacities, as well as accelerating the transformation of ways of economic growth, China issues a wide range of national industry development policies on technical updating and structural improvement. In Dec. 2005, the State Council promulgated Interim Provisions on Promoting Industrial Structure Adjustment (No.40 [2005] of the State Council) (hereinafter referred to as the "Interim Provisions"), which identifies the objectives, principle and emphasis of industrial restructuring at present and in the near future. The Interim Provisions also spelled out the principles of classification and supportive measures and policies for the three categories of items to be encouraged, restricted and phased out as named in the Catalogue for the Guidance of Industrial Structure Adjustment (promulgated by NDRC in 2005). According to the Interim Provisions, some old decrees should be repealed simultaneously including Catalogue of Industries, Products and Technologies Emphatically Encouraged by the State to be Developed (Amended in 2000) issued by former State Planning Commission and the former State Economic & Trade Commission and Catalogue of Outdated Production Capacities, Techniques and Products to Be Eliminated (Batch I, Batch II and Batch III) and Catalogue of Projects Stopped from Redundant Construction in the Area of Industrial and Commercial Investment (Batch I) promulgated by the former State Economic & Trade Commission.

The principles followed in updating these catalogs included considerations such as: market conditions and potentials, improved technical levels and standards, improving product quality, recycling currently wasted energy and other resources, enhancing environmental protection, utilizing regional comparative advantages, improving safety in production processes, generating more employment, and so forth.

For the forbidden categories in the new catalogs, China strictly forbids any investment in any new proposed projects and takes firm measures to stop existing production in these forbidden categories. For proposed projects within the scope of such restrained categories, government at all levels must strictly implement approval procedures according to relevant investment regulations. For any project within the scope of restrained categories and without government approval, no investment from government, banks and other financing organizations is allowed, and no approvals for project construction are allowed to be issued by government sectors of city planning, environment protection, etc.

(3) Financial environment and development policies

In the early 1990s, a large number of stock investment funds were created in China. These funds experienced a bumpy development process from their often-irregular establishment and operations and their often-problematic property and other asset quality. In the late 1990s, China issued strict policies to regulate the development of such funds. The new policies strictly limited the establishment of not only new stock investment funds but also other new kinds of investment funds.

9.1.2 Project Adjustments

The project adjustment can be considered under five main headings, as follows:

(1) RCF

The tripartite annual meeting at the end of 2002 approved that the RCF be adjusted from a "fund" to a "mechanism". Such an adjustment was based on the current state policies of China on the establishment on new sector funds, as indicated in 4.1 (c) and on the fact that the amount of capital involved was small. In October 2003, UNDP, UNIDO, MOA and ABC signed a memorandum of understanding and approved the establishment of the revised RCF financing mechanism, which consisted of an entrusted loan (US$ 1 million from the project's GEF grant), a commercial loan (US$ 2 million from ABC) and a capacity building fund (US$ 1 million from MOA). The entrusted loan is under the management of Hongyuan Company and the subsequent commercial loans are being allocated through the relevant local branches of ABC.

Under the framework of the RCF financing mechanism, the capital amount of the entrusted loan cannot be enlarged, but TVEs can easily apply and receive separate commercial loans without limit from ABC and the wider banking system in China because the development of TVEs has ensured that TVEs can now increasingly successfully obtain commercial loans. The adjustment to the RCF mechanism was designed to bring about the necessary specific financing resource to support the pilot and replication energy conservation and emission reductions in the four industry sectors of the project.

(2) PTPMC

Due to the restriction from state policies and regulations on registering new non-government organizations, the originally designed PTPMC was replaced by a new design. A commercially operated Hongyuan Company was established in July 2003 to play the role of, and to substitute for, the functions envisaged for

PTPMC. To ensure that Hongyuan Company could develop itself in a learning-by-doing approach by establishing a commercial operation during the project operation period, UNIDO signed a contract with Hongyuan Company to authorize it to provide services related to the TVE Phase II project's implementation.

(3) Pilot project enterprises

During Phase I (1998-1999), the project screened eight enterprises for pilot energy efficiency opportunities to be undertaken in Phase II. Owing to various reasons such as poor financial conditions and backward techniques in some of the proposed pilot project sites, as well as China's state policies for updating industry development and for enhanced environment protection, five of the proposed pilot project sites turned out to be unable to meet the criteria for pilot project selection once the TVE Phase II project got underway. Only three of the eight originally screened enterprises were eventually utilized as project pilots. Since 2003, six new pilot enterprises were chosen through the screening procedure and substituted for the original five pilots that could not be used. Though those new pilot enterprises joined the TVE Phase II project activities at a late period, they have all worked effectively and have satisfied the project requirements.

(4) Pilot project technologies for the four industries

When Phase II was launched at the end of 2001, China had in the meantime upgraded the state industry policies, especially in the cement and coking industries. For example, "1989 Type" coking ovens and shaft cement kilns were now in the National Development and Reform Commission (NDRC) catalog as technologies to be phased out. Therefore, the originally selected technologies for these sectors had to be updated at this point. Through adjustment, residual heat power generation techniques based on "Clean Type" coking ovens and rotary cement kilns replaced the previously proposed and now superceded project technologies. Similar adjustments were required for all the pilot technologies involved in the TVE Phase II project. (Table 9.1)

Table 9.1 Adjustment of pilot technologies

Sub Sector	Original pilot technology	Technology after adjustment	Reasons and significance of adjustment
Coking	Power generation with waste heat from 89 Type coking oven	Power generation with waste heat from "Clean Type Coking Oven"	89 type Oven forbidden by GOC
Cement	Renovation for EE on 88,000 t/a. shaft cement kilns	Renovation for EE on 88,000 t/a. shaft cement kilns	Shaft kilns are still widely used in many regions, and will exist for a long time in the Midwest regions in China.
		Replacement of shaft kilns with rotary kilns	Provide technical demonstration to replace outdated process - shaft kiln.
		Power generation with waste heat from rotary kilns	Provide technical demonstrations of energy efficient technology on rotary kilns that have shown great market potential.

These adjustments mean that the project results cannot be directly compared against the originally envisaged technologies, but rather need to be compared against the technologies that represented current practice in the absence of the TVE Phase II project at the time the technical renovations were designed and the changes actually happened. So for example the heat recovery upgrade in the brick making pilots would probably not have happened without the project, whilst for cement and coking pilots the heat recovery may have happened without the project but even there a large component of the formal replications can be attributed to the project, as would some of the informal replication projects.

(5) Replication scheme

TVEs' rapid development and the favorable policy environment opened up new opportunities for the TVE Phase II project to utilize the active involvement of local governments and to enlarge the target replication areas. Therefore, the replication elements with regard to LPICs were adjusted. The new replication scheme utilizes 1) more supportive organizations from local governments and associations joining LPICs; 2) more replication areas utilized - from the original 20 county-level replication areas to 3 provincial-level, 5 prefecture-level (the administrative area of a region is smaller than that of a province and covers that of several counties) and 3 county-level areas. In this regard the project achieved greater results than originally envisaged.

9.2 Reaction Capability to the Proposals of Mid-term Evaluation

The experts for the mid-term evaluation fully recognized the achievements of the project, and put forward some proposals on the follow-up activities: (1) make in-depth analysis of the past experience, pay more attention to the documentation of pilot projects and follow up the implementation of replication projects. Pilot projects, formal and informal replication projects should be evaluated comprehensively for the potential achievements; (2) enhance capacity building of Hongyuan Company for sustainable development; (3) revise the RCF mechanism and put sustainable development plan of RCF into the agenda; (4) evaluate the impact of the project on gender and society; (5) keep a close contacts with other GEF projects and (6) postpone the project till the end of 2006.

The project made a quick response to the proposals of the evaluation experts. First, it accepted the proposal of project postponement and made a work plan for 2006. The team revised PIR after exchanging views with the Beijing Office of UNDP and UNIDO as well as regional coordinator of UNDP.

Second, the project office devised three outsourcing plans to evaluate the project's achievements, experience and efficiency in removing market, financial, policy and technical obstacles according to the mid-term evaluation proposals. Proposals should also be made on the sustainable development of the project, the feasibility of further adjustment and development of Hongyuan Company and RCF. This report is one of them.

Additionally, the project office also started to pay more attention to the recording and documentation of project information, step up publicity on project achievements and have intensive discussion on the sustainable development of Hongyuan Company and RCF mechanism.

(1) The project office outsourced capacity building program in support of the sustainable development of Hongyuan Company (provide support to project implementation), discussed the amendment of the company's business plan and identified its future position in the market. Currently the revenue from consulting service covers 60% of the company's operating cost. The capacity of sustainable business operation is taking shape.

(2) Preparation for the outsourcing of evaluation and revision of RCF framework

Furthermore, the project team also kept close contact with related GEF projects like EUEEP and the World Bank project promoting energy conservation.

10、 Sustainability of the Project

10.1 Sustainability of LPIC

As an operating mechanism of the project, LPIC will not exist after the completion of the project. However, the work approach or philosophy represented by LPIC will be still there. From Table 1 and Table 2 we can find that the functions of LPIC fit in well with some functions of local governments whether in the pilot area or the replication area. The pilot technologies promoted also met the priority needs of local area, which is why the working mode will persist. The multi-sector cooperation mechanism LPIC called for agrees with what China now advocates, service-driven administration. In local government departments such cooperation mechanism has been around. For example, the bureau for small-to-medium sized enterprise of Jiangning District, Nanjing established a "service center of Jiangning government", where all the government departments work in the center to serve enterprises. It was vividly called "government supermarket" by local enterprises. This government supermarket shares the same working approaches as LPIC. Specifically, LPIC of Jiangning District did work in the supermarket, which made the two a good match.

Therefore, the evaluation team believes, the sustainability of LPIC is revealed from the continuation of its working approaches. Though the organization will not be there when the project is finished, the ideas or philosophy it embodies will still sustain. The concepts instilled into the design of LPIC coincide with China's energy policy and are similar to the working approaches of some local departments, which readily bring the mechanism of LPIC into the work of local governments.

10.2 Voluntary Replication

As the project helped the pilot enterprises and replication enterprises to solve their problems arising from development and brought them substantial benefits, enterprises grew more motivated to carry out energy conservation and technology reform. Moreover, pilot enterprises and replication enterprises have exerted positive influence through their achievements, serving as models for others in the industry. According to statistics, pilot enterprises volunteered to promote new technologies by means of open visit, training and exchanges as well as consulting services, benefiting over 400 enterprises. Voluntary replication is rooted in the anticipated benefits corporations reaped from technology reform. So long as this

foundation remains unshakable, it is expected that more and more enterprises will take part in the voluntary efforts in the near future.

10.3 Sustainability of RCF Mechanism

An important characteristic of the design of TVE project is the RCF mechanism. In retrospect, RCF has played an important role in providing financial support for pilot enterprises, which is especially evident in the leverage of fund to attract large amount of funds and removing financial barriers to technology reform of pilot enterprises. Nevertheless, there are still some defects in the mechanism which fail to fit in with current public policies and financing environment even though they conform to the macro environment at that time. The evaluation team holds if the mechanism will continue to play its role after the project, it will be necessary to make some adjustments to it, particularly to the element of entrusted loans.

At present, entrusted loans are required to be granted with the commercial loans ABC offer as a complete set, so that entrusted loans are not available to those small TVEs incapable of furnishing surety, brick manufacturers in particular. Since the entrusted loans are valued at USD 1 million in total and can only grant USD200, 000 at most in separate lending, the amount is insignificant to those eligible cement and coking plants whose financial needs usually come to tens of millions. Thus, the evaluation team suggests if RCF is to be sustainable, efforts should focus on how to enhance the efficiency of post-project entrusted funds and make it a useful solution for small-to-medium TVEs in financial difficulty, as the mechanism of RCF intended.

Now Beijing Huiwenhua Investment & Consulting Co., Ltd. is in charge of the revision and evaluation of RCF mechanism. Suggestions are presented in relevant evaluation reports.

10.4 Sustainability of Hongyuan Company

The development of PTPMC is another important characteristic of the project design. PTPMC is an organization comprising of all related service providers. It charges fees for services provided. However, a range of regulations and policies indicate this business operation mode cannot work as expected under the framework of collective ownership. So after deep deliberation and as agreed by UNDP and UNIDO, the project team established a company to play the role of PTPMC. The company was registered in July 2003 as a business entity under the name of Beijing Hongyuan Huanneng Science & Technology Co., Ltd.

Hongyuan Company was invested by two institutions under the Ministry of Agriculture. It has made great contributions to the operation of energy conservation project and RCF mechanism during the project implementation period. Of course, it also received compensation from project funds and the Ministry of Agriculture.

As TVE Phase II is coming to the end, a problem to be considered is that if Hongyuan Company, the enforcer of PTPMC as designed in the project, is able to sustain itself as supposed under current business mode?

The revenue of Hongyuan Company during the project period mainly comes from project-related activities. When the project is over, it will have to seek other sources for financing or open up new business area in order to retain sustainable development. This requires Hongyuan Company to find out the exact area it excels in its future development.

It is believed that although there is broad market for energy efficiency service in China, more and more new comers, either in the form of companies or individuals, will easily enter the market in the future. So in the long run, Hongyuan Company lacks competitive force in terms of ownership, financing and specialty. Compared with other energy service providers, Hongyuan Company stands out as a pioneer. It has successfully managed a feasibility research, acquired essential expertise in the implementation of pilot projects and has experience in the development and delivery of new training courses. Hence, to achieve sustainable development, the Company must make full use of its pioneering advantage to build strong competence in energy efficiency and provide competitive service to public sectors or private firms. As for its ownership, the evaluation team considers merger and acquisition as a practical solution to its ownership reform.

Another advantage of Hongyuan Company comes from the support of the Ministry of Agriculture and international organizations. Therefore, the company should target public ownership enterprises with private firms as supplement. Hongyuan Company will continue to exist and its role in energy service will make the project a big success, particularly the manipulation of RCF mechanism. So it is feasible to support the company through the project. Revenues from private enterprises can be used mainly for running training courses, promoting products, sponsoring equipment providers, supporting enterprises after reviewing the achievements of technology reform, as well as energy efficiency projects carried out by local governments and enterprises and establishing data base and websites.

On the other hand, as current RCF mechanism does not provide necessary

incentives to stimulate Hongyuan Company, it should try to gain reasonable benefits for itself by making use of the adjustment of RCF mechanism. An attempt it can make is to incorporate the management of RCF or entrusted loans into one of its major profitable business and to bring the important role of RCF into full play, which serves as a supplementary mechanism to solve financial problems for TVEs. Once Hongyuan Company builds up the profile of a recognizable service provider, it will earn a profit from the operation of RCF.

11、 Conclusion

It is concluded from the review of the project's social impact that extensive work has been done to promote the development of mechanisms, policies, technologies, financing, marketing and the development of TVEs in brick, cement, coking and casting industries. The work group has conducted a profitable and fruitful exploration and spread the achievements on a large scale, which facilitated TVEs to conserve energy and reduce GHG emissions.

I. The project achieves its set target, and major stakeholders gain a lot during the implementation of this project

Findings of this evaluation: the project has successfully addressed a series of challenges arising in the first-phase of implementation. According to the developments of China's society and economy, the project has been adjusted in order that it has reasonable design, mature and broad concept for implementation, and realistic and feasible work plan. The managing body is diligent, all major stakeholders work closely, so as to promote and ensure the successful implementation of this project.

In terms of both the ongoing pilot enterprises and the replication activities, outputs generated out of the project's initiative to save energy and cut down emissions have exceeded the expected goal. If the outputs of independently expanded activities (not directly funded by the project but promoted by it) are included, the project has already met its intended target as early as in the mid-stage. Since it is a GEF program that is successfully carried out by making hard adjustments so that its design advances with the time and corresponds to higher starting point and more favorable environment provided by the social and economic development of the country, GEF, its international implementing agency and executing agency, Government of China, TVEs, financial institutions and other major stakeholders gain much from the project.

(1) GEF

GEF has attained more environmental benefits at the global level out of the energy-saving and emissions-reducing initiative than what is expected in the original plan. The continuity and extension of the project's findings will continue to enable considerable reduction in GHG emissions. Therefore, the project will become typical of using a few funds to promote enormous environmental benefits at the global level among GEF programs.

What is more important is that the achievement of the environmental benefits is based on activities to promote sustainable development in China. According to the UN Framework Convention on Climate Change, developed countries are obliged to provide capital and technology to help developing countries to achieve sustainable development, so as to address climate change. GEF and its subsided programs provide a platform for members with different statuses and roles in the international community, enabling them to conduct good cooperation.

(2) International implementing agency and executing agency

UNDP is the implementing agency of this project and UNIDO is the executing agency. As UN organs, they have the responsibility to fulfill their aid-development strategies in hosting countries of the project, promote sustainable development of those countries, and facilitate the achievement of MDGs. GEF program is one of the good channels for these organs to bring their strategy and goals into reality.

During the implementation of the project, UNDP and UNIDO have transferred their advanced experience in managing large-scale projects to China, introduced some of the latest concepts, and helped create the channels for international cooperation. The cooperation between UNDP, UNIDO and GOC, in particular the Ministry of Agriculture, is the important guarantee for the project to adjust its design successfully, for its smooth implementation, and for over fulfilling the expected target. Exactly for this reason, UNDP and UNIDO pay more attention to this project and increase their supports. In terms of carrying out their aid development strategies and promoting the achievement of MDGs, UNDP and UNIDO ought to gain much more from their efforts.

In addition, the two organs can also disseminate the experience generated from this project to other developing countries through their global branches, so as to enhance the organs' capacity in providing technical assistance.

(3) Central and local governments

Due to the development phase of the country, GOC investment in businesses is more directed at fixed-assets, so despite big investment volume the results are

not impressive. In this project, GEF integrates the action to mitigate climate change into local economic development process by paying incremental costs, and promotes such development. One of the inspirations the government has got from the successful implementation of this GEF project is that while ensuring necessary fixed-assets investment, the investment related to incremental costs should also be one of the options in the future. Thanks to the awareness of risk and risk control, commercial investors tend to hesitate and straddle at the early stage of investment. However, governmental investors, who are capable of bearing greater risks than their commercial counterparts, can pave the way for commercial investment, guide, demonstrate and finally promote it.

In the implementation process, the government translates the initiative of saving energy and decreasing energy consumption into a voluntary action of the business through the voluntrary agreement. The enterprises cut down the costs by improving energy efficiency and are offered with favorable policies and financial supports; through the agreement on improving energy effciency, the government fulfills its function of providing public goods, that is, the reduction of CO_2 emissions. Such a practice corresponds with the rule of the market mechanism and is of referencial significance to translating administrative goals into the voluntary action of enterprises and combining government behavior with market behavior.

As policy coordinating mechanisms of GEF programs, PIC and LPIC have not only enhanced the capacity of GOC in implementing projects, but also improved the governmental structure, and helped the governments to realize that PIC and LPIC may be established to remove policy obstacles. In the implementation process, many examples indicate that government at all levels are shaping the concept of providing services for business, that is, as a public sector, the government may create a suitable environment for enterprises by making up for the policy limitation and carrying out the existing policies, and clear up the policy obstacles in the implementation process.

In this project, the government and the business have found the key technologies for energy-saving technical reform in four major energy-consuming sectors, and provided mighty supports for government departments to develop energy-saving policies or standards.

(4) Township-Village Enterprises (TVEs)

In this project, the participating TVEs for domenstation and replication purposes have obtained high energy efficiency through the technical reform for saving

energy, and improved their economic benefits. At the same time, those enterprises have also upgraded their own managerial level and enhanced the capacity of sustainable development.

This project also inspired the TVEs in that as small and mid-sized enterprises, TVEs should seek for government approaches to address the following three problems whenever encountered in their own development course. First of all, when they run into policy obstacles in their legitimate development, TVEs may resort to the government for policy supports; however, when financial problems occur, they should seek for solutions through market approaches rather than governmental subsidies. Second, since small enterprises have poor judgments on technologies, they may seek for government supports in case they encounter technical risks during the technical reform, rely on government force to establish ties with scientific research institutes or technical experts, so as to resolve the technical difficulties. Third, TVEs may turn to governments for help when they need to distinguish true information from the false.

In addition, as a non-governmental organization voluntarily established by local TVEs, the Local Industrial Association for Self-Discipline has played a positive role in helping TVEs to address technical difficulties, regulating the production and distribution orders of that particular industry, and encouraging enterprises and governments to have good interactions with each other. This is the important experience provided by this project for the development of TVEs.

(5) Financial Institutions

Through the active engagement in this project, the participating financial institutions, that is, Agricultural Bank of China (ABC) and its local branches, which have begun the commercial operation, improved their capacity in the rising market of saving energy and reducing emissions.

Nine pilot enterprises, 118 replication enterprises and suppliers of facilities for the development of energy-saving technology are involved in this project. Most of those enterprises are TVEs and private enterprises. While offerring commercial capitals for private sectors of this project to take part in production and business activities that may generate environmental benefits at the global level, financial institutions has learned about the development of the emerging market for energy saving and emissions reduction, improved their own capacities, and accumulated precious experience in participating the development of the market.

II. The project has expaned its influence by interacting with the national socio-economic development

Since the policy of reform and opening up to the outside world, China has experienced rapid economic growth, people's living standards have been upgraded, and the order of market economy has basically set up. However, the energy shortage and environmental pollution that are caused by the extensive growth pattern have affected the quality of economic growth and the sustainability of eocnomic development. In recent years, the country has adjusted its development strategy, adhered to the scientific outlook on development, developed circular economy, tried to build a resource-saving and environment-friendly society, insisted on the commercialized reform, and taken a road towards sustainable development. All this indicates that GOC has constantly emphasized the need of insisting the policy of "paying equal attention to the development and conservation of resources, and giving the first priority to the conservation" in economic development, worked closely around the fundamental change of economic growth pattern, and focused on improving resource efficiency.

Under the macro context mentioned above, this project goes with the tide of national macro policy in terms of the target and implementation approach. Accordingly, this project has won recognition and supports from relevant agencies or departments and had favorable internal and external environment for its implementation.

The implementation of this project indicates that the project has interacted well with the establishment and implementation of national policy. On the one hand, the development of national policy has great influence on selecting pilot enterprises, pilot technologies, and the extension plan as well as establishing RCF and PTPMC. This effort has ensured the successful implementation of this project. On the other hand, as PIC and LPIC mechanisms are operated with success, the pilot technology is adjusted, and the pilot project succeeds, this project has promoted national and local authorities to support the establishment and implementation of energy-saving policies, and facilitated some of the national and local policies on energy efficiency and environment. The findings of this project make local government officials implement national and local macro policies faster, help carry out Law on Energy Conservation and Law on Clean Production, are conducive to implementing the Mid-and Long-Term Plan on Energy Conservation, and play a positive role in meeting the targets of reduction in energy consumption as set out in the Eleventh Five-Year Plan. The favorable economic returns and environmental benefits brought about by this project and the positive experience generated during the implementation can be used for

reference in developing relevant policies in the future. In addition, government officials, technical experts and entrepreneurs have found that current policies and regulations are insufficient in improving energy efficiency in business. This finding can also be used for reference by policy makers and participants at all levels to develop relevant policies.

As mentioned in section 2.4.1, this project has been adjusted according to the practical situation, and the adjustment itself signals that the project has interacted with the national socio-economic development. The principle of the adjustment is as follows: (1) ensure the sustainability of the project and its role as a model provided the overall objective of the project remain unchanged; (2) adapt to the changes in national industrial policy; (3) adapt to the constrantly intensified national requirements for energy conservation and environmental protection; (4) fit into the improvement of market economic mechanism.

The practice domenstrates that the adjustment to the project is of necessity and enables the acheivement of the target. The positive meaning of this adjustment is that (1) the integration of this project into the development course of national policy marks the well interaction between the progress of the project and the exterior policy environment, and the progress itself is the specific development and implementation of the policy; (2) the adjustment enables the project to implement policies at a higher level. This practice is in line with the basic consideration on the design of the project and increases the cost effectiveness, so that the input of the funds would yield reasonable output; (3) thanks to the adjustment, the project can be better replicated and sustained, ensuring the acheivemnet of the goal.

It may well be said that this adjustment signifies the interaction between external factors (i.e., the environment for implementation) and the internal factors (i.e., the contents and participants). Such an interaction also expands the benefits of this project, including social benefits.

Last but not least, the fact that this project has been adjusted as necessary indicates that the basic framework of a project's design should reserve room for necessary adjustments and avoid possible difficulties in this. In the implementation process, we should not be restricted by the established design and treat it with creativity, enabling it to be reflected in the whole implementation process. Both the design and the implementation of this project should be oriented to the final results. This practice is valuable to GEF for reference in the future design of projects.

Objectively speaking, due to the limiting factors such as adjustments to and the duration of this project, the current evauation is mainly targeted at pilot enterprises. We can only start in full scale the replication to other enterprises and meet the basic intended target before the project comes to an end, so by this evaluation we cannot learn about the influence of this project on replication enterprises deeply and thoroughly. However, based on the positive results brought about by this project in nine pilot enterprises, there is a reason to believe that the replication TVEs will influence more than pilot TVEs by participating in this project and carrying out the intended replication. Such influence will be demonstrated in the near future with positive and far-reaching significance to the development of TVEs.

12、 Recommendations

(1) Seize the opportunity of building new socialist countryside, further expand the findings of this project

In February 2006, the CPC Central Committee and the State Council issued Some Opinions of the CPC Central Committee and the State Council on Promoting the Establishment of New Socialist Countryside (hereinafter referred to as the Opinions). The Opinions indicates that the major historical tasks on building a new socialist countryside, which are proposed at the Fifth Plenary Session of the 16th CPC Central Committee, will get stronger policy supports in the next few years.

In the implementation of the project in the following days, we suggest seizing the good opportunity of building a new socialist countryside and popularizing the interactions among Government, industrial association and enterprises in the implementation process, so as to generate more economic, energy, environmental, and social benefits.

We recommend expanding the findings of this project especially in brick industry. With the accelerated pace to build a new socialist countryside, small towns and rural infrastructure will be further developed. Therefore, if the rural areas stop using solid clay bricks, and if we promote the use of hollow bricks in the countryside, there will be considerable rural market for hollow bricks. On the one hand, this will contribute to saving rural land resources and improving energy efficiency. On the other hand, this will cut down the emissions of GHG in the brick industry.

We recommend expanding the findings of this project especially in cement

industry. Since the reform and opening up to the outside world, along with the sustained development of the rural economy, rural housing and urban and rural infrastructure construction projects have been increasing on a yearly basis, and more cement has been consumed in rural areas. According to the statistics of relevant departments, rural areas use 40% of all the cement consumed by the whole country. During the Eleventh Five-Year Plan period, the State will resolve to correct the investment direction, shift the focus of investment from infrastructure construction to rural areas, build more roads for the countryside, spend ¥100 billion in building or rebuilding the road network in rural areas, and basically enable all the towns and villages to have access to paved roads or cement roads. If we take this opportunity to popularize high-grade cement in the countryside, we will promote the cement industry to adjust its structure. All this is good for saving energy and reducing emissions. Nevertheless, this task can not be restricted to TVEs, and we need to do more in a larger scope.

(2) All stakeholders, in particular governments at all levels, financial institutions and TVEs, actively explore, establish, and develop new financing channels in order to ensure the sustainability and dissemination of the project's findings.

First, seek for GEF supports on establishing follow-up projects. One of the findings of this project is to set a new jumping-off point for the development of the four sectors. However, for any one of them, to achieve further development needs to overcome new obstacles and do a lot of work. And some of the work has gone beyond the sustained and extended coverage of this project. Therefore, we suggest using the new GEF resources to back up the follow-up projects, work on the newly identified areas, promote the sustainable development of this country, reduce the GHG emissions and thus achieve the environmental benefits at the global level. One of the options that deserve consideration is to set up a new GEF project in the brick industry on the basis of the first-phase understandings gained by the evaluators.

Secondly, secure funds from domestic commercial sources to support the technical reform on energy saving in TVEs. First of all, we will improve the financing capacity of TVEs themselves. On the one hand, TVEs should upgrade their capital structures and improve the self-accumulation mechanism by taking full advantage of self-financing which distinguishes with low cost and little risk. On the other hand, TVEs should strengthen the concept of credibility, build a good image and have a sound credit standing, try to foster a win-win relation between banks and enterprises, and allocate the capitals and resources according to the best needs. After that, we should set up the intermediary service system that is

favorable to TVE financing and improve the system. One of the important reasons why TVEs are difficult in financing is the incomplete credit guarantee system. Apart from the credit guarantee systems that are established by the government at city-, provincial-and national levels, civilian-run enterprises may as well engage in mutual guarantee and commercial guarantee and establish ties with banks and other financial institutions with good credit. We will set up a re-guarantee system and a compensation mechanism for credit guarantee, perfect the insurance system for loans, decrease the risks of banks, and fill up the gaps of TVE finance. Another important reason for TVEs to secure bank loans is that it is very costly for banks to judge the risks of TVEs and collect information about their risk control, so the banks find it difficult to master the risks of the loans. Therefore, we should set up and perfect intermediary agencies for credit evaluation and project evaluation, provide intermediary services on risk investment, credit guarantee, education and trainings, management and consultation, marketing, technical development, and legal assistance, and cut down the cost of the banks in providing loans for TVEs. Finally, we need to open new financing channels for TVEs through innovations in financial sector, for example, the RCF financing mechanism used in this project.

Thirdly, raise money for the technical reform on energy saving in TVEs through the Clean Development Mechanism (CDM). CDM is a mechanism for countries listed in Appendix I (those with targets for GHG emission reductions) and countries listed in Appendix II (those without targets for GHG emission reductions) under the Kyoto Protocol to cooperate on reducing GHG emissions at project level, so that countries of the first group can accomplish the mandatory targets to reduce GHG at lower costs, and countries in the second list can introduce state-of-art technologies and new funds, complete technical reform, convert the energy to other purposes, and promote the economic development. This is a win-win strategy. All the four sectors covered by this project are energy devouring and the focus of CDM program. If we introduce CDM into this project, we will open new financial and technical channels for the development and technical reform of TVEs.

(3) Members of GEF system should understand GEF basic principle –the "state-owned" and "state-driven" principle better by getting to know the necessary adjustment of this project

It means a lot to members of GEF system, including the Secretariat, the implementing agency and executing agency to thoroughly learn about the necessary adjustment of this project. In particular, it promotes the deeper understandings of the GEF basic principle-"state-owned" and "state-driven"

principle.

The principle of "state-owned" and "state-driven" derives from the United Nations Framework Convention on Climate Change. According to the Convention, developed countries have the responsibility to provide capital and technology to finance developing countries to achieve sustainable development, so as to address climate change. The capital provided by developed countries in line with the Convention flows into developing countries through GEF program, and developed countries can promote the sustainable development in developing countries by covering extra costs. Development is a dynamic process, which changes the social and economic environment where the project's original plan fits. In this case, the targets of the extra costs that are covered by GEF programs should also change in order to ensure the cost-effectiveness of the project's funds. Therefore, to adjust the plan of the project properly and measurably along with the country's socio-economic development, and to achieve the project's targets at a higher level is one of the actions of GOC to implement the Convention and treat international cooperation responsibly. This project is one of such examples in this regard.

One of the outstanding contributions of this project is to ensure the achievement of the target, provided both the target and basic framework are unchanged, in accordance with the development of the society and economy, and by adjusting the project's plan according to the changed environment.

In this project, by the principle of "state-owned" and "state-driven" we think more than the facts that the financial resources provided by GEF for this project go to GOC, and that on behalf of GOC, Ministry of Agriculture plays an important role in implementing this project. What's more important is that by this principle we truly integrate the implementation of this project into the process of socio-economic development, and such development promotes the implementation and also paves the way for itself, achieving good interaction and reflecting the best cost-effectiveness. Had we not adjusted the project as recommended by Ministry of Agriculture but implemented the original plan without flexibility, the project would not have been in a good shape as today. By the same token, if Ministry of Agriculture and local governments at all levels had failed to take effective measures to ensure the adjustment, the project would not have had such eye-catching turnouts and findings. Under the guidance and promotion of Ministry of Agriculture, with the concerted efforts of PIC members, and thanks to the supports of all stakeholders of this project, involving government organs, TVEs, financial resources, and other resources are mobilized to serve for the project's

target. If GOC had not regarded the GEF-funded project as its own, other institutions would probably not be able to mobilize various resources in a large scale, and the situation described above would not have existed.

In addition, to understand and employ the "state-owned" and "state-driven" principle deeper is favorable to guaranteeing the project's plan and making the findings clearly targeted. To integrate the project with the national priorities is what the GEF projects uphold and emphasize, and must realize. The national priorities are certainly state-owned and state-driven, and so are GEF projects that are integrated into such priorities. Therefore, if we adhere to this principle, we can guarantee the achievement of the target, that is, to gain the expected outcome or more than what is expected.

In the evaluator's opinion, success of this project is valuable for members of GEF system to learn it deeper, draw experience from this, and use it in the design and implementation of other projects that are funded by GEF and implemented in China or other countries.

Annexes: Evaluation Activities

Annex 1. Documents reviewed

The Evaluation Team reviewed the following documents:

(1) Project level documents

- Project Document
- Minutes from the Tripartite Project Review Meeting, 2002, 2003, 2004, 2005
- Annual Project Report (APR). 2001, 2002, 2003, 2004, 2005
- PIC Annual Report. 2001, 2002, 2003, 2004, 2005

(2) RCF

- TOR of Design and Establishment of the Revolving Capital Fund
- Final Report on Design and Establishment of RCF
- Minute of Understandings of PTPMC, MOA and ABC on the Operation of TVE Entrustment Loan Facility
- TOR on Transfer and Management of the Entrustment Loan Facility
- ABC Regulations on TVE Entrustment Loan
- Procedure and Criteria of Evaluation on Allocating Entrustment Loan to TVEs
- Procedure of Allocating Entrustment Loan to TVEs
- 2004 Annual Report: Provision of services relating to the Transfer and Management of the Entrustment Loan Facility

(3) PTPMC – Hongyuan Company

- TOR on Support to Hongyuan Co. Ltd. (formerly PTPMC)) to Ensure Their Sustainability
- Business Plan of Hongyuan Energy and Environmental Protection Technology CO. Ltd.

(4) LPIC

- TORs on Establishment and capacity building of LPICs(Phase I-Phase III)
- The First Progress Report
- The Second Progress Report
- The Third Progress Report

(5) Pilot Demonstrations

- Survey Reports on Cement, Coking, Foundry and Brick Industries
- TORs on Pilot Demonstration Enterprises

- Feasibility Study Reports for Pilot Demonstration Enterprises
- Final Reports for Pilot Demonstration Enterprises

(6) Replication TVEs

- Feasibility Study Reports for Replication TVEs
- Final Reports for Replication TVEs

(7) Voluntary Agreements

- TOR for Developing Energy Efficiency Voluntary Agreement

(8) Mid-Term Evaluation

- Mid-Term Evaluation Report

(9) Other Documents read:

- China Mid- and Long-term Plan on Energy Conservation (NDRC Dec 2004)
- Interim Regulations of China on the Orientation of Industrial Structure Improvement
- The catalog for guiding China's improved industry structure
- Request for Proposal No.P.16001066 - EG/CPR/99/G31 - Energy Conservation and GHG Emissions Reduction in Chinese TVEs – Phase II - Project Impact Evaluation
- UNDP Handbook on Monitoring and Evaluating for Results
- RBM in UNDP: Selecting Indicators
- The Logical Framework Approach
- Monitoring and Evaluation Working Paper 4
- Monitoring and Evaluation: Policies and Procedures

Annex 2. Meetings held, people met and their affiliations

Time	Location	Focus	People met and their affiliations	
March 15-16,2006	Henan building, Beijing	Inception meeting	Wang Xiwu	PIC Senior Officer of TVE project
			Xuhao	ABC
			PMO staff	TVE project
			Wengang	GEF China Secretariat
			Sub-contractors of 4 industries	Sub-contractors
			Representatives of LPICs	LPICs
			Wanghai	Hongyuan Co
March 17, 2006	Renmin University	Divide responsibilities and discuss the specific work plan of phase I	Evaluation team	Ren-Min University
March 28, 2006	PMO office	Communication meeting	Wang Guiling	PMO staff
			Xu Litong	PMO staff
			Wang Xiwu	PIC Senior Officer of TVE project
			Evaluation team	Ren-Min University
			Wang Hai and Song Dongfeng	Hongyuan Co
April 5,2006	TVE Bureau of Nanjing, Jiangsu Province	Pilot demo and replication in Nanjing	LPIC officials	LPIC of Nanjing, Jiangsu Province
			Evaluation team	Ren-Min University
			PMO staff	TVE project
April 5,2006	Nanjing Triumph Cement Technology Engineering Co., Ltd.	Cement Sector Replication Project	Luo Libo and other staff	Nanjing Triumph Cement Technology Engineering Co., Ltd.
			Evaluation team	Ren-Min University
			PMO staff	TVE project
April 6, 2006	Zhejiang Shenhe Cement Company	Pilot demo and replication in Zhejiang Province	Shen Fuqiang and other staff	Zhejiang Shenhe Cement Company
			Shen Xinglong	LPIC of Zhejiang Province
			PMO staff	TVE project
April18, 2006	Conference room in Tanghua Hotel, Xi'an, Shanxi Province	Pilot demo and replication in Shanxi Province	Zhouxuan	Xi'an Research and Design Institute of Wall & Roof Materials
			LPIC officials	LPIC of Baqiao District, Xi'an
April 26, 2006	Renmin University	Discuss the BTO reports and the writing standard of draft evaluation report	Evaluation team	Ren-Min University

May 10, 2006	Yongxin Co., Xinjin County, Sichuan Province	Pilot demo in Brick Industry	Gong Muquan	Yongxin Shale Hollow-Brick Company
May 11, 2006	TVE Bureau of Xinjin County, Sichuan Province	Pilot demo and replication in Xinjin County	LPIC officials	TVE Bureau of Xinjin County
			Managers of replication TVEs	Replication TVEs
May 12, 2006	TVE Bureau of Shuangliu County, Sichuan Province	Replication in Shuangliu County	Chen Xiaoping (LPIC) and other staff	TVE Bureau of Shuangliu County
			Managers of 5 replication TVEs	Replication TVEs y
June 2, 2006	Renmin University	Discuss the situation of information collection and the composition of evaluation report	Evaluation team	Ren-Min University
August 5,2006	Renmin University	Discuss the revision of the draft report according to Wengang's comments	Evaluation team	Ren-Min University
September 21,26, 2006	PMO office	Discuss the draft evaluation report and the methodology	Wang Guiling	PMO staff
			Xu Litong	PMO staff
			Wang Xiwu	PIC Senior Officer of TVE project
			Evaluation team	Ren-Min University
			Wanghai and Song Dongfeng	Hongyuan Co
September 30,2006	Renmin University	Discuss the set of indicators	Evaluation team	Ren-Min University
October 10, 2006	Xinggao Coking Co.,Gaoping County, Shanxi Province	Pilot demo in Coking Industry and replication in Shanxi Province	Gao Zhicheng, Ho Kang	Xinggao Coking Group Co. Ltd.
			Zhao Zhijie, Hao Shuiming (provincial LPIC)	TVE Bureau of Shanxi Province
			LPIC officials	TVE Bureau of Gaoping County
November 3,2006	Renmin University	Discuss the newly revision of the evalution report	Evaluation team	Ren-Min University
November 28,2006	PMO	Discuss the newly revised evaluation report	Wang Guiling	PMO staff
			Xu Litong	PMO staff
			Wang Xiwu	PIC Senior Officer of TVE project
			Evaluation team	Ren-Min University
			Wanghai and Song Dongfeng	Hongyuan Co
December 6,2006	Renmin University	Discuss the final evalution report	Evaluation team	Ren-Min University

Annex 3. Site visits undertaken

Time	Enterprises visited	Location
April 4, 2006	Nanjing Moling Foundry	Nanjing, Jiangsu Province
April 4, 2006	Nanjing Jiali Foundry	Nanjing, Jiangsu Province
April 4, 2006	Nanjing Yuhua Foundry	Nanjing, Jiangsu Province
April 6, 2006	Zhejiang Shenhe Cement Company	Tongxiang, Zhejiang Province
April 17, 2006	Xi'an Liucun Hollow Brick Plant	Baqiao District, Xi'an, Shanxi Province
April 17, 2006	Shenwei Wall Materials Plant, Xi'an	Xi'an, Shanxi Province
April 17, 2006	Shijiadao Hollow Brick Plant, Baling Town, Baling District, Xi'an	Baqiao District, Xi'an, Shanxi Province
April 19, 2006	Zhou Ling Hollow Brick Plant	Xianyang, Shanxi Province
May 10, 2006	Yongxin Shale Hollow-Brick Co.	Xinjin County, Chengdu, Sichuan Province
May 11, 2006	Sichuan Qionglai Honglin Brick Plant	Xinjin County, Chengdu, Sichuan Province
May 11, 2006	Xinjin Huayuan Shale Hollow Brick Plant	Xinjin County, Chengdu, Sichuan Province
May 12, 2006	Sichuan Chengdu Sanli Shale Hollow Brick Ltd.	Shuangliu County, Chengdu, Sichuan Province
May 12, 2006	Shuangliu Changhong Shale Hollow Brick Plant	Shuangliu County, Chengdu, Sichuan Province
October10, 2006	Xinggao Coking Group Co. Ltd.	Gaoping County, Jincheng, Shanxi Province

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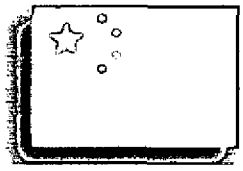

Energy Conservation and GHG Emissions Reduction in Chinese TVEs

– Phase II – Project Impact Evaluation

(EG/CPR/99/G31)

Sub-Report on Evaluation of PIC and LPIC

Review PIC and LPIC Mechanisms and Effectiveness

March 2007

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Contents

Figures and tables

Evaluation on PIC and LPIC

（I）Evaluation Methodology

With reference to relevant evaluation method documents of UNDP and the focus of the current evaluation task, the evaluation team has designed the following two sets of evaluation indicator systems (See Table 1, Table 2 and Table 3). Because the development of LPIC in demonstration areas is different from that of the replication areas, therefore, different evaluation systems apply to different situation.

Table 1 PIC Indicator System

Indicator		Indicator description
Composition of PIC		PIC is mainly composed of the officials of the government departments such as Ministry of Agriculture, Ministry of Finance, State Development and Plan Commission (now National Development and Reform Commission), National Economic and Trade Commission, Ministry of Science and Technology and SEPA and experts of relevant institutions including Agricultural Bank of China (ABC).
Outcome of PIC operation	If it guides the development of LPIC	Yes
	If it conducts policy review on entrusted loans	Yes
	If it guides the development and operation of Hongyuan Company	Yes
	If it conducts training to relevant project staff	Yes
	If PIC operation mode has been promoted	Yes

Table 2 Indicators of 8 pilot LPIC

Objective	Milestone	Indicators	Xinjin	Dalian	Huangshi	Jiangning	Tongxiang	Yingde	Baqiao	Shanxi
Evaluation of LPIC mechanism and effectiveness	Establishment	Stability of supporting units	Very stable	Stable	Very stable	Very stable	Very stable	Very stable	Very stable	Very stable
		Development of the Rules	Finished							
		Development of the Action Plan	Finished							
		Development of the Voluntary Agreement	Finished							
		LPIC level	County	City	County	County	County	County	County	County
	Operation	If LPIC information distribution and policy-making mechanism have been established	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
		If LPIC supervision and quality assurance mechanism has been established	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		Soundness of LPIC incentive mechanism	General	Not sound	General	General	General	General	General	General
	Outcome	Removal degree of the obstacles to LPIC policies	Obviously removed	Not removed	Obviously removed	Obviously removed	Obviously removed	No policy obstacle	Facilitate removal	Facilitate removal
		With the implementation of "Energy Efficiency Voluntary Agreement", to what degree the demonstration enterprises have finished recent energy conservation objectives	Exceed the target	Exceed the target	Exceed the target	Exceed the target	Exceed the target	Exceed the target	Exceed the target	Exceed the target
		Efforts in helping enterprises to carry out the demonstration and extension of energy saving technologies	Strong support	General support	Strong support	Strong support	Strong support	Strong support	Strong support	General support
		If it enhances the capacity building of service oriented government	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Sustainability	Integration with the functions of local governments	Full	No	General	Full	Full	General	General	General
		Relevance between the replicated energy saving technology and local development priorities	Very relevant	General	Very relevant	Very relevant	General	Very relevant	Very relevant	General

Table 3 Indicators of 11 Replication LPIC

Objective	Milestone	Indicators	Shuangliu	Liaoning	Xianyang	XiAn	Guang dong	Zhejiang	Nanjing	Jinzhong	Linfen	Tianjin	Jinzhou
Evaluation of LPIC mechanism and the effective-ness	Establishment	Stability of supporting units	Very stable										
		Development of the Rules	Finished										
		Development of the "Action Plan"											
		LPIC Level	City	Province	City	City	Province	Province	City	City	City	Province	City
	Operation	If LPIC information distribution and policy-making mechanism have been established	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		If LPIC supervision and quality assurance mechanism has been established	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		Soundness of LPIC incentive mechanism	General	General	General	General	General	General	General	General	General	General	General
	effectiveness	Removal degree of the obstacles to LPIC policies	Facilitate the removal										
		Amount of replication enterprises	5	16	14	15	3	6	6	5	5	7	8
		Amount of enterprises signing the Voluntary Agreement	6	6					6				3
		If it enhances the capacity building of service-oriented government	Yes										
	Sustainability	Integration with the functions of local governments	General	Full	Full	Full	General	General	General	General	General	General	General
		Relevance between the replicated energy saving technology and local priorities	Very relevant	Very relevant	Very relevant	Very relevant	Very relevant	General	Very relevant	General	General	Very relevant	Very

Table 4 Summary of Establishment of the 8 LPICs in pilot Regions

	Industry	pilotl areas	Time	Members	Supporting units	Pilot enterprises	Energy saving (tce)	AV Development and signing	Emission Reduction (t CO_2)
Phase I	Brick	Xinjin County of Sichuan Province	March 25, 2002	Government Office, Information Office, Medium & Small Sized Enterprises Bureau, Environmental Protection Bureau, Land and Resources Bureau, Construction and Planning Bureau of the County	TVE Bureau of Xinjin County	Xinjin County Yongxing Shale Hollow Brick Plant	1,476.00	Finished	3,681.00
	Cast-ing	Dalian of Liaoning Province	Sep. 8, 2003	TVE Bureau, Science & Technology Bureau, Environmental Protection Bureau and Finance Office of Dalian	TVE Bureau of Dalian	Jinmei Cast Pipe Co., Ltd of Lushunkou	152.00	Finished	381 .00
	Cement	Tieshan District, Huangshi City, Hubei Province	Sep.10, 2003	Government Office; Plan, Statistics & Price Bureau; Economic Development Bureau; Science & Technology Bureau; Environmental Protection Bureau; Financial Bureau; Agriculture, Forestry and Water Resources Bureau, Agriculture & Industry Relation Office of Tieshan District; Luzhangshan Subdistrict Office and Tieshan Division of Agriculture Bank of China	Government of Tieshan District	Lufeng Cement Co., Ltd.	9,375.00	Finished	23,373.00
	Cast-ing	Jiangning District, Nanjing, Jiangsu Province	Aug.22, 2002	Government Office, Financial Bureau, Science & Technology Bureau, Environmental Protection Bureau , Agriculture Bank, Economic Plan Bureau of Jiangning District, Moling Town Government and Moling General Casting Plant	TVE Bureau of Jiangning District	Nanjing Moling General Casting Plant	1,597.00	Finished	3,981. 00
Phase II	Cement	Tongxiang City, Zhejiang Province	Oct.8, 2004	Finance and Land Tax Bureau, Science & Technology Bureau, Environmental Protection Bureau, National Taxation Bureau of Tongxiang City; Tongxiang Branch of the People's Bank, Heshan Town Government and Shenhe Cement Co., Ltd.	Economic and Trade Bureau of Tongxiang	Zhejiang Shenhe Cement Co., Ltd.	8,119.00	Finished	20,242 .00
	Cement	Yingde City, Guangdong Province	Jan.13, 2005	Government Office, Economic and Trade Bureau, Science & Technology Bureau, Environmental Protection Bureau, Finance and Land Tax Bureau of Yingde City; Yingde Branch of Agriculture Bank of China	Economic and Trade Bureau of Yingde	Yingde Baojiang Cement Material Co., Ltd., Guangdong Province	24,265.00	Finished	60,493 .00
	Brick	XiAn Baqiao District of Shaanxi Province	June 14, 2004	Government Office, Economic and Trade Bureau, Science & Technology Bureau, Baqiao Branch of Environmental Protection Bureau, Construction Bureau, Land and Resource Bureau, Building Material Quality Inspection Station and Baqiao Branch of Agriculture Bank of China	TVE Bureau of Baqiao District	Baqiao Liucun Brick Manufacturer of XiAn	669.00	Finished	1,670.00
	Coking	Shanxi Province	Feb.28,2005	Medium & Small Sized Enterprises Bureau, Economic Commission, Science & Technology Bureau and Finance Bureau of Shanxi Province	TVE Bureau of Shanxi Province	Gangyuan Coking Company of Taiyuan	41,364.00	Finished	103,120 .00
						Xinggao Coking Company of Shanxi	45,960.00	Finished	114,578.00

Table 5 Summary of Establishment of the 11 LPICs in Replication Regions

	establishment of LPIC				Replication TVEs	
	Replication Areas	**Establishment Date**	**Member**	**Support unit**	**No. of Replication TVEs**	**Industry**
Phase III	**Jinnan District of Tianjin City**	May 23,2006	Office of District Government, Industrial Economic Commission, Development and Planning Committee, Environmental Protection Bureau and Science, Technology Committee of Jinnan District	Industrial Economic Commission	7	Foundry
	Jinzhou District of Dalian City	June 13, 2006	District Government, Economic Development Bureau, Environmental Protection Bureau, Science and Technology Bureau of Jinzhou District	Economic Development Bureau	8	Foundry
	Shuangliu County of Chengdu City	May 10, 2005	Office of County Government (County Office for Promotion), SME Bureau, Construction Bureau (Office of Wall Materials Reform), Land Resource Bureau, Science and Technology Bureau, Fiscal Bureau, Industrial and Business Bureau, Price Bureau, Environmental Protection Bureau, Power Supply Bureau, National Tax Bureau, Quality Supervision Bureau, Safety Supervision Bureau	Shuangliu SME Bureau	5	Brick Making
	Xi'an City of Shaanxi Province	August 17, 2006	Xi'an Wall Materials Research and Design Institute, Xi'an Economic Committee, Office of Leading Group for Energy Saving Construction and Wall Materials Reform in Xi'an (hereinafter referred to Office of Wall Materials Reform), Xi'an Technical Supervision Bureau, Xi'an Environmental Protection Bureau, Xi'an Quality Supervision and Test of Wall Materials Product Station	Xi'an Wall Materials Research and Design Institute	15	Brick Making
	Xianyang City of Shaanxi Province	March 15, 2006	Xianyang Leading Group of Rectification of Brick Production Order, comprised of twelve parties including Economic Committee, TVE Bureau, Technology Supervision Bureau, Land Resource Bureau Environmental Protection Bureau, Planning Bureau, Industry and Commerce Bureau, Agricultural Bureau, Power Supply Bureau, Police Station, Supervisory Bureau for Work Safety and Association of Wall Materials Industry	Xianyang Leading Group of Rectification of Brick Production Order	14	Brick Making
	Jinzhong City of Shanxi Province	April 26, 2005	LPIC of Shanxi Province is the guidance organization of Jinzhong LPIC; Office of Jinzhong Municipal Government is the coordinator of LPIC; Jinzhong Private Economic Development Bureau is the member of LPIC; Foundry industrial associations in the counties of Jinzhong are	Jinzhong SME Bureau	5	Foundry, coking

			executive of LPIC for detailed work.			
	Linfen City of Shanxi Province	May 8, 2005	Linfen SME Bureau, Financial Bureau, Environmental Protection Bureau, Foundry Industrial Association, Shanxi Institute of Technology, Shanxi Houma Tangrong Auto-parts Co. Ltd, Shanxi Huaxiang Tongchuang Foundry Co. Ltd	Linfen ME Bureau	5	Foundry, coking
	Nanjing City of Jiangsu Province	April 4, 2006	Nanjing Suburb SME Bureau, Nanjing Foundry Association, Jiangsu Metallurgy Design and Research Academy, Lishui County SME Bureau, Jiangning District SME Bureau, Liuhe District SME Bureau, Yuhuatai District Development and Reform Bureau	Nanjing Suburb SME Bureau	6	Foundry
	Liaoning Province	March 26, 2006	Liaoning Wall Materials Reform Office, Liaoning Provincial EPB, Liaoning Provincial Wall Materials Industrial Association, Shenyang Municipal Wall Materials Reform Office, Dalian Municipal Wall Materials Reform Office, Anshan Municipal Wall Materials Reform Office, Shenyang Municipal Wall Materials Reform Office, Fushun Municipal Wall Materials Reform Office, Benxi Municipal Wall Materials Reform Office, Dandong Municipal Wall Materials Reform Office, Jinzhou Municipal Wall Materials Reform Office, Yingkou Municipal Wall Materials Reform Office, Fuxin Municipal Wall Materials Reform Office, Liaoyang Municipal Wall Materials Reform Office, Tieling Municipal Wall Materials Reform Office, Chaoyang Municipal Wall Materials Reform Office, Panjin Municipal Wall Materials Reform Office, Huludao Municipal Wall Materials Reform Office	Liaoning Wall Materials Reform Office	16	Brick making
	Guangdong Province	June 23, 2006	Guangdong Cement Industrial Association, Resource Comprehensive Use Section of Provincial Economic and Trade Committee, Industry Section of Development and Reform Committee, Provincial Design Academy of Architectural Material, Environmental Protection Industrial Association, Material College of South China University of Technology, Guangdong Yuede Management Consulting Co. Ltd.	Liaoning Wall Materials Reform Office	3	Cement
	Zhejiang Province	Sep 18, 2006	Provincial SME Bureau, Provincial Science and Technology Department, Provincial environmental Protection Bureau, Provincial Financial Department, Provincial Economic and Trade Committee, Test Center of SME Bureau	Provincial SME Bureau	6	Cement

(II) Establishment of PIC and LPIC

The evaluation team has sorted out the development of PIC and the development of 19 LPICs (See Table 3 and Table 4). The followings are comprehensive evaluation on the background, aim, adjustment, contents and organization structure of PIC and LPIC respectively.

1. Aim of establishment of PIC and LPIC

Phase II of the Project "Energy Conservation and GHG Emissions Reduction in Chinese TVE" has carried out detailed analysis on existing obstacles of TVEs of China in raising energy efficiency. There are mainly the obstacles in the four aspects including policy, technology, market and financing. Policy obstacles are reflected in the following aspects:

1) In the past, all policies either standardizing or promoting the development of enterprises were targeting on state owned enterprises and were implemented by the ministries or commissions that administrate the focus industries. The same is true for energy conservation and environmental protection policies. This kind of practice, excluding TVEs in the administration, lacks transparency of policy application and restrains the participation of TVEs in many activities. Though newly promulgated laws such as the law on TVEs, Energy Conservation Law and the series of pollution control laws apply to TVEs, this kind of policy obstacles still exist.

2) When national laws and regulations clearly apply to TVEs, local (county, township and village) implementation lacks strength. On one hand, local governments take charge of the enforcement of relevant laws such as shutting down old or out-of-date productivities and collecting environmental protection fee. On the other hand, it is stipulated that local governments can invest TVEs or partly own TVEs and they must maintain social stability and certain employment level. Therefore, local governments are more enthusiastic about the economic benefits of TVEs.

3) The difficulties of local government in implementing the policies restrain the capacity of TVEs in adapting to the market. National policies aim to stimulate and standardize the market. In fact, to develop well, TVEs still need good relations with local government. TVEs have consumed large amount of resources to strive for government support.

2. Baseline of the establishment of PIC and LPIC

The following major policy obstacles exist during the process when TVEs raise their energy efficiency:

1) Policy bias obstacles. In the past, national energy saving and environmental protection policies were focusing on state-owned enterprises and neglected TVEs. Many promotion policies were targeted on state-owned enterprises, while constraint policies targeting on TVEs. 2) Self obstacles of the enterprises. The vague property rights weakens the motivation of TVEs in seeking for advanced technology and raising fund, which hinders the extension of energy conservation technologies; 3) Obstacles in law enforcement. Traditional work method and the bias towards TVEs lead to poor transparency in law enforcement. The authority lacks administrative staff who are familiar with environmental protection work. In addition, local authorities have "local protectionism" in law enforcement to maintain regional economic benefits.

The above obstacles affect energy conservation and reduction of GHG emission

of TVEs. To eliminate the above obstacles, strong policy pressure, high-efficient organization and coordination as well as effective information communications are particularly important. To implement the three functions, an institution must have the following capacity: familiar with TVE situation and having charisma; having relatively strong policy coordination capacity; realizing effective information exchanges and communications between enterprises and the government.

However, under existing administrative system in China, it is difficult for individual institution to have all the three functions. Under this circumstance, LPIC——a coordination mechanism involving many departments emerges as the times require.

3. Adjustment of LPIC

The establishment of 19 LPICs is divided into three phases. Four demonstration LPICs were established in Phase I, another 4 demonstration LPICs were set up in Phase II and 11 demonstration LPICs were established in Phase III (See Table 4 and Table 5). This development policy of "establishment in batches with gradual improvement" reflects the principle "Keeping up with the times" and illustrates the adjustment and development of LPIC.

During the establishment of LPIC, the adjustments are carried out in the following three aspects (See Table 6):

Table 6 Adjustment during the establishment of LPIC

Adjustment contents	Adjustment direction	Case	Adjustment time	Reason
Series documents Including the Rules, Energy Efficiency Voluntary Agreements and Action Plan	Improvement of the documents		Establishment of Phrase I LPIC	Strive for being scientific and rational and modulized of the series document
Supporting Units	Shift from government departments to industry association and research institutes	The supporting unit of LPIC replication areas in Guangdong is Guangdong Cement Association. The supporting unit of LPIC replication areas in XiAn is XiAn Institute on Wall Materials	Establishment of the Third Phase LPIC	Guide TVEs to carryout technical reform on energy conservation by market mechanism, natural relations between industrial association and enterprises as well as technical support of scientific institutes
Level	Upgraded from county to province	Shanxi set up LPIC at province level	Phase I	Wide distribution of coking industry in Shanxi facilitates technical extension.

4. Contents of LPIC

The evaluation team has found that the establishment of a demonstration site LPIC includes mainly three core components (Table 7): 1) institution composition, i.e. the identification of LPIC members and supporting units; 2) Drafting relevant documents. This includes the development of such documents as LPIC Rules, Action

Plan, Voluntary Agreement, Monitoring and Evaluation System for Action Plan and Monitoring and Evaluation System for Voluntary Agreement. One thing needs explanation is that establishment documents of LPIC in replication areas mainly include the Rules and Action Plan. It is up to the replication enterprises to decide if it would sign the Voluntary Agreement with the government. 3) Training. That is, carry out capacity building to LPIC and enterprises.

Table 7 Three Core Components of the Establishment of LPIC

Core Components of the Establishment of LPIC			
Component 1: Institution composition	Component 2: Document draft	Component 3: Training	
1. Identify member units 2. Identify supporting units	1. Rules 2. Action Plan 3. Energy Conservation Voluntary Agreement 4. Monitoring and evaluation system for Action Plan 5. Monitoring and evaluation system for Voluntary Agreement	1. Targets 1) Potential LPIC members 2) Head of the demonstration enterprises 3) Staff of other relevant enterprises	2. Training contents 1) Introduction of TVE Project 2) LPIC establishment method 3) Preparation of relevant document 4) National and international energy saving policies 5) Energy saving technology of each industry

The establishment of LPIC has generated large amount of documents. To effectively manage these document and record their change are of great importance to track the establishment process of LPIC. And they will be the first-hand information about the development and extension of LPIC mechanism. The evaluation team holds the view that LPIC subcontractors have set up detailed document file and developed a knowledge database, which is maintained by a special person in a special department. They have realized scientific management of the archives and ensured the continuity of the knowledge resources developed during the establishment of LPIC and avoided the phenomenon of loss of information due to post transfer of the staff.

The development of LPIC involves many stakeholders. To establish effective communication and feedback mechanism among them is the key to ensure the quality of LPIC.

The evaluation team believes that there are 4 major feedback routes (Figure 1) on the establishment of LPIC among important stakeholders. The first is the feedback between LPIC and PIC. The specific expression is: through PIC annual meeting on "LPIC Evaluation System Document", PIC guides and supervises the establishment of LPIC. The second is the feedback between LPIC subcontractors and LPIC members. This is reflected in industrial investigation process of early establishment of LPIC and the signing of LPIC Rules, Action Plan and "Energy Efficiency Voluntary Agreement". Apart from holding small meetings, LPIC subcontractor could communicate with the head of LPIC by filling out specific feedback form. The third route is the feedback of LPIC subcontractors, PMO and CTA. During the activities of LPIC on information collection, site investigation and industrial survey, PMO and CTA have presented important guidance and support. They even take part in key activities. The forth is the feedback between LPIC subcontractor and UNIDO. The evaluation team concluded that communications with UNIDO experts in time could accelerate the implementation of the project and ensure the quality of the project.

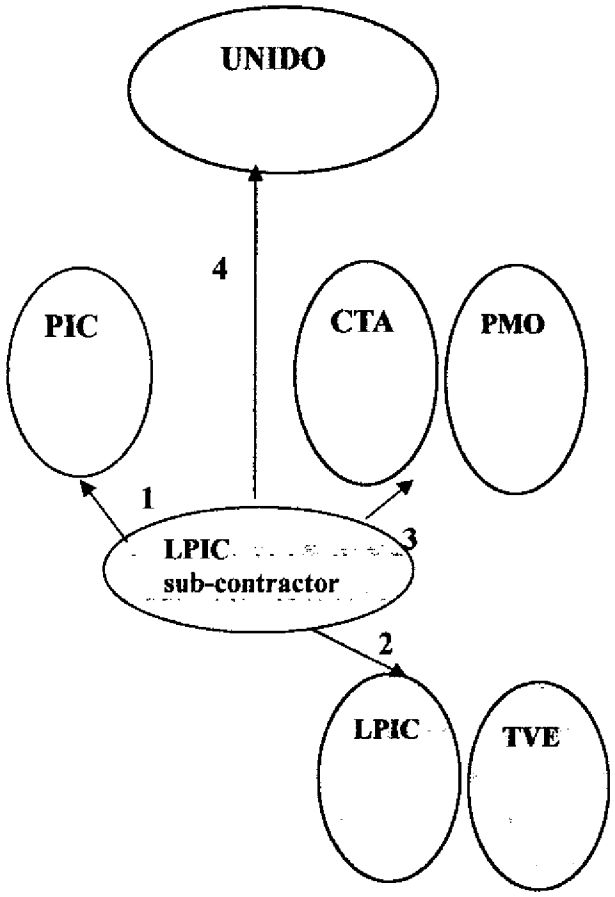

Figure 1 Feedback mechanism during LPIC establishment

5. Organization Structure of PIC and LPIC

The project Policy Instruction Committee (PIC) was officially set up in Feb. 2001. Following that, PIC Secretariat was soon established and PIC rules was discussed and approved in August of 2002. PIC Rules clearly states about the composition of PIC: PIC is mainly composed of representatives of government departments such as the Ministry of Agriculture, Ministry of Finance, National Development and Planning Commission (now National Development and Reform Commission), National Economic and Trade Commission, Ministry of Science and Technology, State Environmental Protection Administration as well as experts from relevant institutions including Agriculture Bank of China.

It can be seen from the above that PIC in its nature is a kind of project coordination and communication mechanism that requires close coordination and communications among many departments. With the implementation of the project, it opens a channel for inter-ministry communications and develops a coordination mechanism participated by many ministries and commissions under the State Council. In PIC and PMO, the Ministry of Agriculture plays more important role compared with other departments.

To establish LPIC, we must identify members and supporting units of LPIC and

identify their own responsibilities.

The evaluator analyzes the composition of 19 LPICs and finds out that members of a LPIC usually include the following stakeholders: relevant government departments, financial institutions, industrial associations, research institutions and demonstration enterprises. These stakeholders combine according to real situations and play their function advantages and remove relevant policy, technical and financial obstacles in the application and extension of the demonstrated technologies.

Next is the analysis on LPIC supporting units.

The supporting units of 19 LPIC involve local TVE bureaus, medium and small sized enterprise bureau, economic and trade bureaus, district government, wall reform offices and relevant associations. It can be seen from Figure 2 that, as LPIC supporting units, local TVE bureaus are in dominance. The reason is as the following: Ministry of Agriculture takes charge of the TVE project. TVE Bureau of Ministry of Agriculture is the national administrative organization of TVEs in China. There are TVE bureaus at province, (prefecture) city and county levels. In the initial project phase and exploration stage for the establishment of LPIC, it is convenient for management and coordination. This administrative relation determines that Ministry of Agriculture is bound to select its subordinate units as the organizations on which LPIC depends. At the same time, such organizations are diversified. This is because the institutional reform of the government of China. With the streamlining and merge of government departments, local TVE Bureaus are either integrated or merged into relevant bureau or departments.

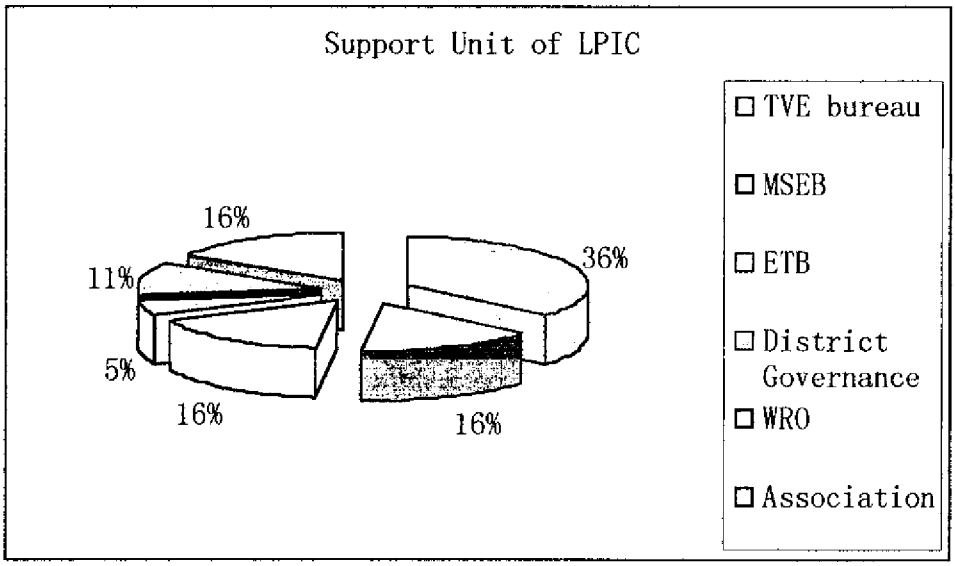

Figure 2 Support Unit of LPIC and their percentage

The evaluation team holds that though the LPIC supporting units vary, "government departments" are still the main supporting units for LPIC. The mark that truly reflects the change of LPIC supporting units is that research institutes and industrial associations become the supporting units of LPIC.

Compared with government departments, research institutes and industrial associations may provide more direct technical support to enterprises on energy saving technology, which includes technical service, technical consultation, technical transfer, technical information and professional talents information. This could greatly facilitate the reform and transformation of the technology on energy saving in TVEs and serves as an effective approach to guide TVEs adopting market mechanism to carry out technical reform on energy conservation.

However, as supporting units, research institutes and industrial associations may bring about the following problems. Though undertaking part government functions, industrial associations have poor capacity in policy coordination to TVEs in terms of technical reform on energy conservation. As result of institutional reform, most research institutes are bound to seek for maximum economic benefits as the entities assuming sole responsibility for its profits or losses. The competitive advantage of research institutes is their strong technical service. But they cannot have the core functions of LPIC——policy coordination and support. Therefore, the evaluation team considers that research institutes and industrial associations can be absorbed as LPIC members. However, LPIC supporting units may go beyond their function and weaken the role of LPIC.

This can be reflected by the change of the LPIC supporting units in Nanjing replication areas. In the past, LPIC of the Nanjing replication area originally depended on Nanjing Casting Association. However, it is difficult for industrial association to provide effective policy coordination and support service to technical reform on energy conservation of TVEs. So it had to be shifted to another supporting unit, which is Nanjing Medium and Small Sized Enterprises Bureau. And Nanjing Casting Association serves as a LPIC member.

With economic development and self improvement, industrial association has gradually played its role. However, the evaluation team considers there are some difficulties for industrial association alone as the unit on which LPIC depends. It is feasible that industrial association and government departments serve as the unit upon which LPIC depends.

(III) Operation of PIC and LPIC

1. PIC Coordination Mechanism

Coordinate and organize PIC Annual Meeting: PIC Secretariat held PIC Annual Meetings in 2003, 2004 and 2005 respectively. PIC Annual Meeting aims to inform each stakeholder the progress of the project including the implementation pf the decision made in the last PIC annual meeting, discuss and study some major issues occurred during project implementation and review the work plan of the next stage. 2003 PIC Annual Meeting discussed RCF development framework, screening and identification of second group demonstration enterprises and important issues occurred during the implementation of project strategy in coking industry. The meeting has reached common understanding. 2004 PIC Annual Meeting is the meeting with most participants. 2005 PIC Annual Meeting was held after the independent evaluation made by an expert group invited by UNDP. The Meeting mainly introduced three topics: project progress, the impacts of the project on macro policy and market development as well as project experience.

Take part in three project evaluation: PIC Secretariat helped the Project Office accompany with Ministry of Finance (July of 2004), UNIDO (September of 2004) and GEF Secretariat (October of 2005) to carry out three evaluations on the implementation and outputs of the project.

2. PIC Supervision Mechanism

PIC has the function on supervision and takes charge of the supervision on the implementation of the project, particularly project implementation and LPIC

activities.

To supervise LPIC work, PIC has developed a series of documents such as Action Plan, Voluntary Agreement and LPIC Evaluation Document Series. These documents are major components of LPIC supervision mechanism.

Because the real-time supervision of PIC on demonstration and replication enterprises is through the supervision on LPIC, this presents higher requirements for the capacity building and work coordination capacity of LPIC. Different LPICs have different capacity. Therefore, in area where LPIC has weak capacity, the capacity of LPIC in supervising the demonstration and replication enterprises will be weakened.

3. Work Method and Contents of LPIC

The Rules stipulate the work method of LPIC. LPIC is operated in the form of meetings and the meeting is held once every 6 months. The meeting is chaired by the Director or Vice Director in case of absence of the Director. It is regarded as a valid meeting with over 50% members participating. LPIC Director may call for tentative meeting at the request of National Policy Instruction Committee (PIC) and Project Office. LPICs will regularly submit meeting minutes and work reports to PIC.

The Action Plan specifies LPIC work contents. The evaluation team focuses the sorting out of the Action Plans developed by LPICs of 8 demonstration areas and considers the main work contents of LPIC are signing Voluntary Agreements with demonstration enterprises, replicating the Voluntary Agreements, putting place relevant favorable policies and facilitating their implementation, and training.

4. LPIC Information Conveying and Policy-Making Mechanism

LPIC information conveying and policy-making mechanism refers to the mechanism with which each stakeholder conveys the information and coordinates the tasks during the implementation of the project. The evaluation team finds that an information conveying and policy-making mechanism with the units on which LPIC depends serving as the pivot has been established during the LPIC operation. It is reflected by the fact that LPIC supporting units on behalf of enterprises carry out policy coordination to other relevant members; on behalf of local governments, LPIC communicates among the enterprises, PIC and PMO; the establishment of LPIC subcontractors is also through the communications between LPIC supporting units and local enterprises. The evaluation team finds that the capacity of LPIC supporting units in coordination is closely related with the role of "core person". "Core person" takes charge of the coordination of each work and takes part in the development of LPIC during the operation of LPIC. He must be in charge of many activities in many aspects such as coordination, training and drafting of documents. The enthusiasm and work capacity of the "core person" is the key factor determining the effects of LPIC operation. Mr. Wang Lizhi, the "core person" of the LPIC of Xinjin County of Sichuan Province actively facilitated the financing of the demonstration enterprises and raised necessary loan for enterprises to carry out technical reform on energy conservation. Because the job transition of LPIC head of Dalian, the progress of LPIC was affected. Other LPICs maintain their continuity of work due to the post stability of relevant staff.

5. Supervision and Quality Guarantee Mechanism of LPIC

During the operation of LPIC, it is very important to enhance the supervision and evaluation of LPIC activities. In doing so, the authority can understand the development of LPIC in each area in time, find out shortcomings or deficiency and correct them. The Action Plan is the specific program of LPIC on carrying out policy coordination and promoting technical reform on energy conservation. Apart from developing practical Action Plan, it is very important to strengthen the monitoring and evaluation of the implementation of the Action Plan.

The evaluation team finds that from the beginning, "the subcontractor of LIPC establishment and capacity building" has developed detailed LPIC Evaluation System Document Series. The evaluation system is composed of three series documents, which are LPIC Evaluation Procedures, LPIC Annual Work Report and Regulations on Evaluation of Annual Work of LPIC.

The evaluation team holds the view that the three series documents and the Action Plan constitute the quality ensuring system for the work of LPIC. Evaluation system document clearly identifies the flow chart on ensuring the work quality of LPIC and major evaluation contents. Matching the action plan and showing major functions of LPIC, this facilitates LPIC activities.

6. Incentive Mechanism of LPIC

Incentive mechanism of LPIC refers to the incentive and punishment mechanism, award and punishment are conducted to LPIC supporting units and major heads in the light of the above LPIC Evaluation System Document Series and based on the achievements and performance of LPIC. The incentive mechanism plays a very important role in enhancing policy support and coordination of local governments on the projects. With the incentive mechanism, the project could mobilize relevant LPIC heads and promote effective development of the project.

The evaluation team finds that in current documents, LPIC Evaluation System Document Series are the documents for LPIC to conduct supervision and evaluation, however, there are not any corresponding award and punishment documents. The defects of LPIC incentive mechanism weaken the service capacity and sustainability of LPIC to some degree. In order to maintain the sustainability of TVE Project and LPIC service mode. Only with close combination of LPIC's interests and the benefits of technical reform on energy conservation of enterprises can we ensure the continuity of the cooperation between the two.

(IV) Operation Result of PIC and LPIC

The evaluation of the operation outcome of PIC is mainly based on the evaluation of PIC functions in terms of the operation outcomes. It includes the following 6 aspects:

(1) Effect of PIC on removing policy obstacles

PIC is composed of the representatives and experts of several ministries and commissions and plays its role of consultation and coordination during the project implementation. In doing so, the policies developed by each ministry and commission in relation to the project could be promptly put in place during project implementation with the removal of the obstacles in policy communications. In addition, the establishment of LPIC has eliminated some policy obstacles (See the evaluation of LPIC). Both LPIC and PIC are established under the guidance of PMO. Therefore,

PIC plays some role in removing the policy obstacles.

(2) Guiding the establishment and development of LPIC

During project implementation, PIC has guided the establishment of the LPICs of 8 demonstration areas and 11 replication areas. The LPICs of the replication areas have expanded from the original 20 counties to 3 provincial level, 5 prefecture-level and 3 county-level replication areas. At the same time, LPIC supporting units are diversified. They have expanded from local TVE bureaus at each level in early stage to medium and small sized enterprise bureau, economic and trade bureau, district government, wall reform office and industrial associations. From this aspect, the achievements of the project are beyond the original targets.

(3) Policy review on entrusted loans

In practical implementation of the project, loan applications of 5 enterprises were received. However, only two enterprises have obtained financial support. On the one hand, China has not established complete credit system on medium and small sized enterprises. For a long time, medium and small sized enterprises in China have low credit in banks. Banks are not willing to present loans to medium and small sized enterprises. On the other hand, the review and approval procedures for RCF are relatively complex. The long time required for loan review and approval has weakened the initiatives of many medium and small sized enterprises in taking loans.

(4) Guide the development and operation of Hongyuan Company

The participation of the project has enhanced the project development capacity of Hongyuan Company, expanded market reputation, accumulated the experience and performance of energy-efficient service, which has developed potential client resources for future market of Hongyuan Company.

At present, Hongyuan Company has become an institution that meets the development requirements of medium and small sized enterprises of the four industries. Its commercial plan has been promoted in TVEs of China. Hongyuan Company has achieved sustainable development of the commercialization and met the expected design objectives.

(5) Organize training

In order to ensure smooth implementation of the project, PIC has carried out the training programs at three different levels to project participants, i.e. policy and management training; project management training; energy conservation technology and management training. Training targets include all people taking part in the project and the training achievements have exceeded the expected plan.

(6) Publicity

First, regular PIC Annual Meeting obtains extensive media publicity in TV stations. Second, the project has carried out special media publicity on PIC operation method. Finally, as the first GHG emission reduction project supported by GEF in China, the operation method of PIC plays a good demonstration role. All the following projects supported by GEF in China have established PIC mechanism.

The operation achievements of LPIC are shown in the following several aspects:

(1) Evident removal of policy obstacles

The evaluation team has focused on the sorting out of the removal of policy obstacles by LPIC in 8 demonstration areas (For detailed information please see Table 8. The capacity of 8 LPICs of demonstration areas in removing policy obstacles is worthy of affirmation.

LPICs of the replication areas also adopt active measures and promote the removal of policy obstacles (See Table 2).

Table 8 Removal of Policy Obstacles of LPIC in 8 Demonstration Areas

LPIC	Original main policy obstacles	Degree of policy removal	Corresponding measures to remove the obstacles
Xinjin County	Enterprises have no land use right, no asset mortgage. They have difficulty in financing.	Clearly removed	As a LPIC supporting unit, Xinjin County Medium and Small Sized Enterprises has obtained 1 million yuan for demonstration enterprises.
Dalian	Financing obstacles; enterprises are in chaos competition and lack self discipline on price	No obvious removal	There is some change in the units on which LPIC depends, which influences LPIC work.
Huangshi	The enjoyment of resource use tax is not in place	Clearly removed	
Jiangning District	System reform of the welfare enterprises in casting industry encounters tax obstacles	Clearly removed	LPIC helps the implementation of the policy
Tongxiang	The enjoyment of resource use tax is not in place Difficulty in approval of power generation using residual heat	Clearly removed	LPIC helps the implementation of the policy on resource utilization tax. It also helps the demonstration enterprises speed up the approval of residual-heat power generation project and on-grid of the power
Yingde	No obvious policy obstacle		
Baqiao	The ban on the utilization of clay solid brick lacks efforts in implementation and law enforcement	Facilitate removal	LPIC facilitates the establishment of self-discipline association
Shanxi Province	Uncertainty in policy on clean coke oven	Facilitate removal	The clean coke oven of demonstration enterprises has made explorations for the development of relevant policies

(2) Effectively implement Voluntary Agreement and finish energy conservation targets

It can be seen from Table 2 that under the policy guidance and coordination of the LPIC, 8 demonstration enterprises have finished the energy conservation objectives. With the implementation of the Voluntary Agreement, all relevant enterprises have finished the energy targets of the Action Plan ahead of time and reduced the emission of greenhouse gas emissions. This not only improves local atmosphere environment, but also makes active contributions to human beings.

Voluntary Agreement (VA) embodies the cooperation relations between public and private enterprises. Under the agreement which is within the energy saving plan of the government, enterprises voluntarily assume part task on the reduction of greenhouse gas (CO2). At the same time, enterprises will get the favorable government policies or the support and spiritual encourage to self economic activities. Voluntary Agreement is the policy tool to raise energy efficiency or reduce environmental pollution. The implementation of Voluntary Agreement facilitates technical advance, enhance the competitive power of the enterprises, raised energy efficiency and set the environmental image of the enterprises.

With the adoption of LPIC mechanism, the project has introduced this kind of advanced environmental management tools into the TVEs in the four industries, dramatically raised the environmental management level of such enterprises and improved environmental awareness of local government departments and employees of enterprises. At the same time, this would provide good foundation for the development of national energy conservation policies.

(3) Actively help enterprises to carry out the demonstration and replication of

technical reform of energy conservation.

Capital deficiency has always been major obstacles for enterprises to carry out technical reform on energy conservation. The caution of banks to provide loans to TVEs has strengthened this obstacle. There are many reasons that TVEs take loans, including lack of capital, no transparency in credit, narrow direct financing channels and poor social credit environment, etc.. The technical reform on energy conservation in TVEs required not only advanced energy efficiency technologies (or equipment) and environment-friendly technologies, but also adequate capital and corresponding policy support.

Targeting this, LPIC and PTPMC of each area has close cooperation. Based on technical reform measures on energy conservation, LPIC and PTPMC employ relevant policy resources and channels, actively apply supporting capital from local government and promote the technical reform on energy conservation. It is not an easy thing for medium and small sized enterprises to apply for government loans, especially those in brick making, casting, cement and coking industries. Among the four industries, it is most difficult for the enterprises of brick industry to obtain loans.

The evaluation team finds out that good LPIC operation has brought the capital for enterprises to carry out technical reform on energy conservation. For example, LPIC of Xinjin County, Sichuan Province recommends Xinjin County Yongxing Shale Brick Manufacturer as the financing demonstration enterprise to Chengdu Finance Bureau. The LPIC provided 500,000 yuan medium and small sized enterprises loan to Xinjin County Yongxing Shale Brick Manufacturer for technical reform on energy conservation. This loan not only provided the capital for technical reform of the enterprise, but also marks the beginning on financing medium and small sized enterprises and illustrates practical implementation of some national financing policies. In addition, the evaluation team finds that LPIC of Jiangning District of Nanjing, Jiangsu Province recommends Nanjing Moling General Casting Plant as the demonstration enterprise to Nanjing Science & Technology Bureau of Jiangsu Province and strived for 125,000 yuan as technical reform fund. The Science and Technology Bureau of Jiangning District provides 80,000 yuan supporting fund on technical reform to guide Nanjing Moling General Casting Plant building the aluminum alloy disappearing casting production line with the capacity of 1000 tonnes, raising the overall qualification rate of the casting products to 95% from 85%. In addition, the "pure low-temperature residual heat power generation project" of Zhejiang Shenhe Cement CO., Ltd. has obtained 100,000 yuan financial support from the Science & Technology Bureau of Tongxinag City

The LPIC of the demonstration area has actively helped the Project Office to choose the replication enterprises and facilitated the replication of energy-saving technology and Voluntary Agreement.

(4) Enhance capacity building of the service oriented government

To some extent, LPIC is an attempt to set up the micro type of the service oriented government. As shown in Table 1 and Table 2, the establishment of 19 LPIC has strengthened the capacity building of the service oriented government. In the wave of institutional reform of China, the function of government has gradually shifted from demand to service. LPIC has carried out meaningful explorations on how to effectively play the service function of the government under market economy conditions. The evaluation team finds that LPIC has cultivated the idea of local government officials for serving the enterprises. Director Shen Xinglong, Head of Tongxiang LPIC of Zhejiang Province said: "With this Project and the establishment of LPIC, we gradually understand that government should provide appropriate

services for enterprises." Gradually influence the awareness of government officials, LPIC has also provided a "practical chance" for them to offer service to relevant enterprises —— coordinate and help the demonstration enterprise remove various kinds of obstacles occurred during energy technical reform. To local government, this is a process for capacity building.

(V) Sustainability of LPIC

The philosophy of LPIC operation mechanism will still exist when the project finishes. It can be seen from Table 1 and Table 2 that the functions of the LPIC in both demonstration areas and replication areas have well combined with part of the functions of local governments. The replicated demonstration technologies basically meet the objectives of the priority areas. This is why the working philosophy of LPIC will last. The multi-department cooperation mechanism advocated by LPIC accords with the service oriented government. At the same time, similar cooperation mechanism exists among local government departments. For example, Jiangning District MSSE Bureau of Nanjing has set up "Jiangning District Government Administrative Service Center" in which all government divisions set up a joint office to provide service for enterprises. The enterprises of Jiangning District vividly call it a "Government supermarket". "Government supermarket" and LPIC has similar working philosophy. Moreover, the work of Jiangning District LPIC has been integrated into that of the "Government supermarket". This has combined the activities of LPIC with the work of local government.

(VI) PIC and LPIC Evaluation Conclusion and Recommendations

In conclusion, the current report carries out systematic evaluation on the establishment, operation, outcomes and sustainability of LPIC with specific conclusions and recommendations as the followings.

(1) Establishment of PIC and LPIC

PIC is mainly composed of the officials of the Ministry of Agriculture, Ministry of Finance, National Development and Planning Commission (now National Development and Reform Commission), National Economic and Trade Commission, Ministry of Science & Technology and State Environmental Protection Administration and experts of relevant institutions and enterprises including Agriculture Bank of China. Ministry of Agriculture plays more important role in PIC than other government departments.

The establishment of LPIC mainly includes the following three components: identification of members and supporting units; drafting relevant documents and training. Four effective feedback mechanisms and information communication mechanism have been set up among the stakeholders of LPIC.

"Government departments" are still the units on which LPIC mainly depends. With the development of the experience in setting up LPIC, it becomes feasible to gradually absorb research institutes and industrial associations as LPIC members. However, the evaluation team expresses its concern about the position of industrial association as the unit on which LPIC depends due to the limitations of industrial association.

(2) Operation of PIC and LPIC

The coordination mechanism of PIC plays a good role including the coordination and organization of PIC annual meeting and taking part three project evaluations, etc. The supervision of PIC on LPIC is good and effective. However, the supervision of LPIC on demonstration and replication enterprises depends on the capacity of individual LPIC. As a result, the monitoring and supervision of weak LPIC on the demonstration and replication enterprises is relatively weak, thus weakens the supervision of PIC on the demonstration and replication enterprises.

LPIC operation includes the work approach and contents, information transmission and policy making mechanism, supervision and ensuring mechanism as well as the incentive mechanism of LPIC.

During the operation process of LPIC, the information transmission and policy making mechanism with LPIC supporting units as the hub has been set up. The evaluation team affirms the LPIC supervision and ensuring mechanism, but expresses concern about LPIC incentive mechanism. The evaluation team suggests close combination between the interests of LPIC with the benefits resulting from energy technical reform. Only in this way can the sustainability of the cooperation between LPIC and enterprises be guaranteed.

(3) Outcomes of PIC and LPIC

Composed of the officials and experts of many ministries and commission under the State Council, PIC aims to remove the obstacles of policy communications in the project by means of consultation and coordination. In addition, the establishment of LPIC has eliminated some policy obstacles. Because LPIC is established under the guidance of PIC and PMO, PIC plays a certain role in removing policy obstacles.

The expected project objectives are that 8 enterprises get financial support from RCF. During the project implementation, 5 enterprises applied for loans and only 2 of them finally got it. On the one hand, medium and small sized enterprises (MSSE) have low credit in banks for a long time due to no sound MSSE credit system at present, so commercials banks are not willing to provide loans to MSSE. On the other hand, the complexity of review and approval procedures of RCF and long period required for loan approval abate the initiative of many MSSE for applying loans.

To ensure smooth implementation of the Project, PIC provides training courses to participants covering all people taking part in the Project. The training outcomes exceed the expected objectives.

By taking part in and implementing the project, the capacity in project development of Hongyuan Company has been improved with expanded reputation in the market which taps potential clients for the company in the future. At present, Hongyuan Company has become an institute meeting the development requirements of MSSE in the four industries. Its business plan has obtained publicity and replication among TVEs in China, which has achieved sustainable commercial development of the company and met the designed target of the Project.

The evaluation team finds that the capacity of LPIC in removing policy obstacles is worthy of affirmation. LPIC has helped TVEs obtain the necessary capital for technical reform on energy conservation. With close cooperation, LPIC and PTPMC in each place make use of relevant policy resources and channels and actively apply for supporting funds from local government departments in line with energy technical reform of the enterprises. This has facilitated technical reform and demonstration work on energy conservation.

LPIC mechanism has facilitated the implementation and extension of the

Voluntary Agreement. The demonstration enterprises have exceeded the designed target on energy technical reform. With LPIC mechanism, the Project has introduced the advanced environmental management tool into the four industries dominated by TVEs, dramatically improved environmental management level of the TVEs, raised environmental awareness of the people of local government departments and enterprises and laid a sound foundation for the development of national policy on energy conservation.

The evaluation team finds that LPIC has cultivated the idea of governmental officials on serving the enterprises. LPIC is an attempt to set up service oriented government at micro level. To local government, the establishment and operation of LPIC is a capacity building process, too.

(4) Sustainability of LPIC

The working philosophy of LPIC operation mechanism will last after the end of the project. The functions of the LPICs of both demonstration and replication areas have well been integrated into part of the functions of local government. The replicated demonstration technologies also confirm to the objectives of local priority areas. This is why the working philosophy of LPIC could last long. The idea of LPIC complies with energy saving policy of China. At the same time, the working philosophy of some local government departments is similar to that of LPIC. This makes it easy and effective for LPIC to integrate into the activities of local government departments.

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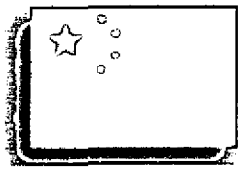

Energy Conservation and GHG Emissions Reduction in Chinese TVEs

– Phase II – Project Impact Evaluation

(EG/CPR/99/G31)

Sub-Report on Evaluation of Market Impact

Evaluate the Project Impact on Market

March 2007

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1、Executive Summary

This report presents the findings of the independent market impact evaluation for "Energy Conservation and GHG Emissions Reduction in Chinese Township and Village Enterprises – Phase II" project number CPR/99/G31 (the TVE project). This report was prepared with considerable input from the TVE Project Management Office, and with considerable guidance and feedback from UNDP China and UNIDO HQ, Vienna, but the responsibility for the conclusions reached are solely those of the evaluation team authors.

The (Phase II) TVE project arose out of the UNDP/GEF project entitled: "Energy Conservation and GHG Emissions Reduction in Chinese Township and Village Enterprises – Phase I " implemented during 1998-1999. The Phase II TVE project was launched in February 2001 for a planned four-year implementation period, supported by a GEF grant of US$ 7.992 million and GOC co-financing (in-kind and in-cash) of US$ 10.55 million. UNDP is the International Implementing Agency, UNIDO is the International Executing Agency, and MOA (Ministry of Agriculture) on behalf of the GOC (Government of China) is the domestic Executing Agency.

The aim of the TVEs project is to reduce GHG emissions in China from the TVEs sector by increasing the utilization of energy efficient technologies and products in the brick, cement, metal casting and coking sectors. With the establishment of relevant policy support, technical and market service system and financing channel, the TVEs project will focus on supporting 9 demonstration enterprises of the above industries to carry out projects on energy saving and technological transformation. At the same time, it will eliminate relevant obstacles of the areas where these enterprises locate, enhance the capacity in promoting energy-saving and GHG reduction technology in market economy, widely extend energy efficient technology, improve produce quality, facilitate structural adjustment and gradually promote successful cases and experience across China.

The general objectives of this evaluation are as follows: to evaluate the impacts on market of the phase II project at both project level and macro level; To identify and analyze the best practices and lessons learned in the project process of removing the market barriers; and to determine the suggest areas for future adjustment and improvement, through comprehensive review and summarization of project activities, outputs, outcomes and impacts. The scope of the evaluation

and assessment will cover 9 pilot TVEs and 118 replication TVEs, and will be based on the entire project period - from project design; inception, adjustment, and implementation to completion.

As shown by the survey results of Phase I of the project, the market obstacles facing TVEs in terms of energy conservation and emission reduction are mainly reflected in the following four aspects: first of all, consumers are unwilling to buy energy-conserving products with extraordinary performance even though such products are cost-effective or can bring other benefits to the buyer; secondly, TVEs themselves have no enthusiasm in investing in energy conservation and producing energy-conserving products, and they also lack relevant marketing strategies and sales network; thirdly, local governments have no intention in taking measures to encourage improvement in product quality such as the possible formulation of the standard on the minimum heat dissipation value for buildings, drawing up related guidelines for construction or laying down quality criteria, etc.; fourthly, the market lacks competitiveness and is dominated by local protectionism. Since been launched in February 2001, the project phase II has done much effective work in the following aspects in order to remove the market barriers:

1. Mechanism construction: In September 2001, PTPMC was established, and a commercially operated Hongyuan Company was established in July 2003 to play the role of, and to substitute for, the functions envisaged for PTPMC. The company intends to provide technology, financing and other services which are needed by the technological transformations in the four Industries, and aims to remove the technology and market barriers. A rotating fund business office was established in October 2001.

2. Pilot and replication TVEs: Taken comprehensive surveys of the four projected sectors; 9 pilot TVEs and 118 replication TVEs has carried out technical updating and the replication work in brick, foundry, and some of the cement sectors has far exceeded the original requirement of projects. 7 pilot TVEs and 60 brick replication TVEs have finished their technical innovation work. Another 10 cement replication TVEs have accomplished feasibility studies and the construction funds have been guaranteed, will be completed in the near future. GEF has provided feasibility studies, engineering design and equipment purchases and other services; created a database including several design institutes, equipment manufacturers, service providers and individual experts. After training, the TVEs which are affected by the project have increased their demand for high energy-efficiency technologies, and the changes in pilot and

replication TVEs have particularly noted.

3. Capacity building: Carried out 13 energy-saving training activities, benefiting 670 enterprises, and 900 people have participated the trainings. Recycling 370 TVEs survey questionnaires selected and identified 118 replication TVEs. Till September 2005, more than 1,200 managers of TVEs, local officials and other stakeholders have accepted trainings about energy management and the professional technologies.

Based on the examination of the project activities and corresponding results in these four aspects, the evaluators indicated that up to now, the project has carried out lots of practical and detailed works in eliminating market obstacles and promoting the development of TVEs led by the enhancement of the energy conservation and emission reduction work of TVEs in the four industries. Based on its beneficial and effective explorations, the project has gained remarkable achievements.

The project has mobilized the enthusiasm of consumers in buying energy conserving products or the products made based on energy conservation technologies. Meanwhile, it has also driven the initiatives of enterprises in making investment in energy conservation technologies and producing quality energy-conserving products.

The project has yielded huge energy conservation and environmental benefits. With the improvement of production techniques and reduction in related input of enterprises, the production cost of enterprises has been effectively decreased.

The project has facilitated the demonstrational and promotional enterprises in resolving problems emerged during their development, which has brought about real benefits to these enterprises.

The project has changed the profit-making mode and operational concept of the enterprises from the original extensive operation pattern of making small profits but quick turnover to sustainable operation pattern of making profit based on sound management and technological transformation to a certain extent. In this connection, it has pointed out a path of sustainable development for energy-intensive TVEs to a certain level and upgraded their comprehensive competitive force.

With the implementation of VA, the project has already drawn up and carried out related product standards. Meanwhile, it has also enhanced the understanding of local governments of the benefits of energy conservation and emission reduction and hence promoted the establishment of energy conservation policy, guidelines

and standards as well as the enforcement of existing policies, guidelines and standards.

The project has consolidated the market competitiveness and propelled the industrial upgrade and restructuring of the four industries. Since its efforts accord with the national intervention efforts, it has broadened the market share and competitive edge of energy-conserving products and equipment, diminished the energy intensity of the four industries and their pollution of the environment and in a sense, provided guidance and model for national intervention in this regard.

It should be highlighted that the great amount of efforts of the project in eliminating market obstacles are not separate. Many such measures have produced remarkable effects in removing financial obstacles, policy obstacles and technical obstacles, which have further widened the achievements of the project.

On account of the fact that market regulation is often post-regulation, and the market impact itself is of the distinct character of time lag with the diffusion, duplication and visualization (such as the formation of price and the adjustment of price signals transmitted to the production of commodity) of the market impact being realized after a certain period of time. To this end, the results gained from the evaluation of the market impact of the project conducted prior to its completion will surely be inadequate, and some of the evaluation conclusion may not be well grounded on the support of facts. Nevertheless, since the main players of the market are fixed, the decision making of these players as well as the interaction among different players definitely follow certain rules under the presumption of the economic person. By this, the evaluators are reasonable to believe that the initial evaluation results originated from the theoretical approach supposing the market impact does take place coupled with existing materials are generally reliable, and the preliminary analysis made in this report would also be of help to further understandings of this issue in the future.

2、Evaluation Methodology

2.1 Analytical Framework of Evaluation

Figure 2.1 presents the analytical framework to evaluate the impact of the project on market as follows:

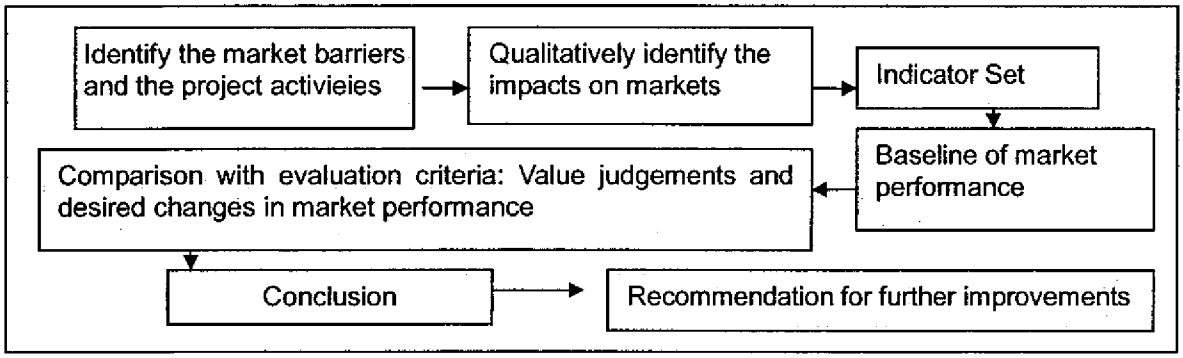

Figure 2.1 Analytical framework to evaluate the market impact

The above analytical framework has draw on the Logic Framework of the Climate Change Project Objectives[1] and the indicators for GEF Climate Change Energy Efficiency Projects[2] heavily with some adjustments based on considerations of local circumstances.

2.2 Identify the project impact on market

In this evaluation report, it is assumed that optimal allocation of resources is attained among the interaction of product and technology users, product suppliers and the government. Hence, the evaluation identifies the four aspects of the project impact on market:

(1) Users of products and technologies: customers performance change (awareness), emerging effective demand.

(2) Supply side: number of suppliers, competition situation/market structure, market share, cost change, environmental and energy efficiency performance, capacity building, links with market of capital and labor, etc.

(3) Government intervention: introduction of environmental and energy codes and standards, ban and permits, tax and subsidies.

(4) Market equilibrium: price and market share changes of energy efficient products and technologies.

[1] From GEF Climate Change Project E&M Working paper 4.
[2] From GEF E&M Working Paper 4

2.3 Set of indicators

UNDP and GEF generally base on following seven kinds of static core indicators to evaluate specific climate change projects: Energy production or savings and installed capacities, Technology cost trajectories, Business and supporting services development, Financing availability and mechanisms, Policy development, Awareness and understanding of technologies Energy consumption, fuel-use patterns, shares, and impacts on end users.

According to the four aspects of the project impacts on market, the evaluators set up the new set of indicators based on the seven kinds of core indicators and the specific requirements of project document: (Table 2.1)

Table 2.1 Indicators to evaluate the market impact					
4 aspects of the sets of indicators	Project Level	Project Level Examples (for Direct Project Results)	Relationship with the UNDP seven core kinds of indicators(according to the No. listed in Annex 2)		Programme/Macro Level (Country-Level)
1. Impacts on the users of products and technologies: customers performance change (awareness), emerging effective demand.	To evaluate the changes of awareness and performance	1) Awareness within TVE industry of the benefits of EE investments and level of awareness, understanding and invest interest of EE technologies.	Relevant to the original core indicators 6-Awareness and understanding of technologies. And 4) is the new indicator set by evaluators	6-1, 6-5, 6-3, 6-4	Briefly define the market scope for each specific EE production technology/equipment, production process, and/or engineering service in each sub-sector; as well as the relevance/meaning of the national markets Briefly establish national market baselines and relate trends to expected or targeted replication in project design.
		2) Awareness of potential contracting approaches with energy service companies or companies like the Hongyuan (i.e., performance contracting);		6-1	
		3) Awareness and capability of energy service companies or companies like the Hongyuan to make or facilitate profitable investments in TVE industry and sustain a profitable business		6-2	
		4) public awareness of environment protection and energy conservation		Set by evaluators	
2.Impacts on the supply side: number of suppliers, competition situation, market structure, market share, cost change, environmental and energy efficiency performance, capacity building, links with market of capital and labor, etc.	A. Impact on the environmental and energy benefits	1) Annual or cumulative energy savings (e.g., MWh, or tce) from energy efficiency investments in industry (TVE sectors), either by TVEs or by energy service companies	Relevant to the original core indicators 1-Energy production or savings and installed capacities.	1-1	
		2) Electric power capacity (MW) or energy consumption (e.g., coal or coke) reduced through energy efficiency investments		1-2	
		3) Amount of CO2 emission reduced, by enterprise, by sub-sector etc.		1-3	
		4) Reduced consumption of energy (electric power, coal, coke etc.) per unit of output product (i.e., energy efficiency gain in percentage)		1-4	
		5) Number of EE projects (pilot and replication etc.) implemented and evaluated		1-6	Check the existence, and to a less extent, the effectiveness of policies and institutional mechanisms that have a significant effect on the market penetration of targeted
	B. Impact on the Technologies and costs	1) Rates of return achieved from energy efficiency investments in industry	Relevant to the original core indicators 2-Technology cost trajectories And 3) is the new indicator set by evaluators	2-1	
		2) Costs of conserved energy (e.g., cents/kWh)		2-2	
		3) changes on the rate of spoiled products		Set by evaluators	

	C. Impact on the channels for corporate financing and fostered investment in energy conservation	1) Number and dollar volume of ongoing and completed EE sub-projects (total installed costs, broken out by sector)	Relevant to the original core indicators 4-.Financing availability and mechanisms	4-1,4-2	technologies/equipment, practices, services, or other EE measures. Collect evidence that direct project interventions are influencing policy and market development trends and related activities at the national level (replication). It should be noted that in UNDP China's Multi-Year Funding Framework (MYFF) 2004-2007, the relevant macro-level outcome, to which UNDP supported interventions are intended to make relevant contribution, is "National policies and frameworks for sustainable energy development strengthened". In this regard, the GEF and UNDP share the same development goals and interventions at the macro-level. It is not necessary to have separate sets of indicators, for GEF and UNDP respectively, concerning measurement of support to national policy development.
		2) Pipeline and amounts of financing of ongoing and completed EE sub-projects (broken out by sector)		4-5--4-10	
		3) Number of innovative financial and contracting mechanisms such as the RCF (packages) [broken out by sector]		4-3	
		4) Market acceptance of innovative financial and contracting mechanisms such as the RCF (packages) [broken out by sector]		4-4	
		5) The allocated entrusted loan Under the framework of the RCF financing mechanism		Set by evaluators	
		6) Fund structure of the RCF			
	D. Impact on the development of TVEs and the energy efficient technologies	1) Number of operating energy service companies or other similar companies like the Hongyuan Company offering efficiency improvement equipment or services in target market;	Relevant to the part of the original core indicators 3- Business and supporting services development (3-1——3-5)	3-1	
		2) Number of EE feasibility studies and EE proposals		3-2	
		3) Information network (clearinghouse; newsletters, Internet website, and conferences/workshops) developed		3-3	
		4) Number of pilot and replication TVEs		3-4.3-5	
		5) Number of spontaneous replication TVEs		Set by evaluators	
	E. Impact on the comprehensive competitive power of TVEs	1) Change in production scale of the enterprises which participated the energy conservation projects	Relevant to the part of the original core indicators 5- Policy development (5-6)	Set by evaluators	
		2) Changes in output and market share of the enterprises which participated the energy conservation projects			
		3) Whether has established the energy management system under help of the project or not			
		4) Whether has established an environmental management system or not			
		5) The overall level of local industries have increased or not			
		6) Number of training programmes for Government and TVE staff, experts, industry personnel, energy managers, and ESCOs		5-6	

3. Impacts on government intervention	Impact the environmental and energy codes and standards, ban and permits, tax and subsidies.	1) Existence and evolution of policies creating incentives for TVE industry to improve energy efficiency	Relevant to the part of the original core indicators 5- Policy development（5-1—5-5）	5-2
		2) Existence and evolution of regulatory/contracting frameworks that support energy conservation at enterprise level and support energy service companies (i.e., supporting policies in sub-sectors)		5-1
		3) Application of Voluntary Agreements		5-3
		4) Support offices created to coordinate and support institutional and capacity-building activities in EE and Offices established for identifying EE opportunities, such as PIC, LPIC, RCF, and Hongyuan Company.		5-4,5-5
		5) Legal, financial, institutional, and regulatory policies and PIC/LPIC action plans instituted to ensure large-scale, sustainable financing of EE investments in TVEs		5-10
4. Impacts on market equilibrium	Impact the price and market share changes of energy efficient products and technologies.	1) The costs of the factors (broken out by sector)	Relevant to the original core indicators 7- Energy consumption, fuel-use patterns and shares, and impacts on end users	Set by evaluators
		2) The market price of the traditional products(broken out by sector)		
		3) Changes in production scale, price and market share of the energy conservation products(broken out by sector)		
		4) Energy intensities of the four industrial sub-sectors, compared with past years and baseline projections		7-1
		5) Changes in output, price and market share of the energy conservation technologies(broken out by sector)		Set by evaluators
		6) Number (percent) of EE measures manufactured by in-country manufacturers		3-8

2.4 Evaluation baseline

The evaluation of TVE project has met with much challenge. Touching upon a wide range of issues, the project has just started to take hold even though the 6-year period of project phase II is coming to an end. The factors affecting the implementation of the project are multiple and overlapping, leading to mixed effect on the project. Therefore, to separate the impact of the project from the influence of other factors is yet another challenge. Under this circumstance, evaluation baseline becomes a core instrument though it is hard to ensure the baseline is convincible and undisputed. We resort to the baseline approach to separate the market effect of the project in the evaluation process.

The evaluators have established both stable baseline and dynamic baseline in assessing the project impacts: (Figure2.2)

- Stable baseline: Conditions before the project was started are taken as the baseline scenario.
- Dynamic baseline: From the trend of changes without the presence of the project we can extract the impact of the project.

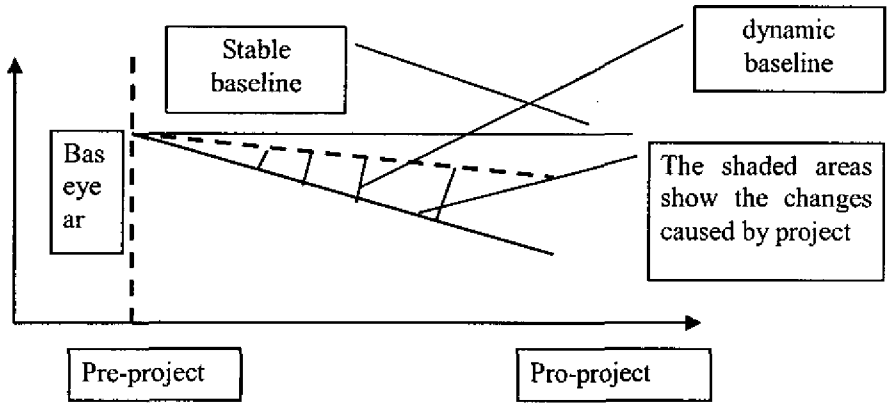

Figure2.2 Set of baseline

With the change of social environment and the implementation strategy during the implementation period, much adjustment has been made to the project. How to identify a convincible baseline constitutes another challenge for us, for the influence of pilot enterprises and replication enterprises is usually limited to local area, and the statistics of TVEs are far from complete. On many occasions accurate data are not available and the impacts of the project and influence of other factors are so interwoven that the single impacts of the project can not be perfectly disassociated. Even it is done, its reliability is questionable. Consequently, the evaluators adopt a flexible way: for situations hard to be measured by dynamic baseline, the evaluators use static one instead, i.e. the situation when the project was being carried out, for the changes taken place after the project can at least interpret some influence of

the project.

In addition, due to limited time and funds the evaluation team can not examine the 9 pilot (demonstration) enterprises and 118 replication enterprises one by one. So the evaluators use combined method of on-site investigation of typical enterprises and reference of project implementation documents to assess its impact on market. Specifically, when choosing typical enterprises, the evaluators fully consider the premise that different areas, departments and levels need to be covered.

3、Assessment and Analysis of the Market Impact of the Project

Energy conservation is achieved through different measures in pilot enterprises of various industries and the means and scope of impact on market of all the pilot enterprises also vary. As a result, the evaluators approach the evaluation in a breakdown of industries focusing on the four elements of product and technology users, product suppliers, government regulations and market equilibrium.

3.1 Impact on Product and Technology Users

The evaluators think the project has impacted the product and technology users from the following two avenues during the project phase I.

1. Influence on the price of energy saving products and relevant products in the industry

The project has enabled a cut in the production cost of energy saving products to some extent, so that these products are more competitive than others and the demand of product and technology users also increases.

Case 1: The price of hollow clay brick has declined somewhat compared with that of solid bricks after the project was implemented. In 2003, the 90 hollow bricks were sold at 0.16 yuan in Xi'an, while solid clay bricks were 0.08 yuan. However, in 2005, the price of hollow bricks remained at 0.16 yuan and the latter rose to 0.3 yuan[3]. The price of the 90 hollow bricks decreased from 2 fold to 1.85 fold of that of solid bricks, which changed the fact that houses built of hollow bricks cost more than those built of solid ones. Moreover, hollow bricks stood out for their improved quality. Their performance in heat preservation, earthquake resistance and sound proof was much better than the solid bricks. Hollow bricks were reusable if old buildings were demolished. Given all the pros and cons, the price advantage of hollow bricks was much clearer and people's demand for the products also rose.

2. Influence on the preference of product and technology users

When product and technology users have a growing preference for certain products, their demand for them will increase. During the evaluation process, we have conducted a survey on LPIC officials, outsourcing partners of replication enterprises, local government officials, principals and employees of participating enterprises, employees in other related industries as well as local residents in the pilot area and replication area. An examination of their energy conservation awareness indicates that the project has lifted the enthusiasm of stakeholders to invest in energy efficiency projects and purchase energy saving products. Stakeholders have not only got more aware of energy conservation but also deepened their understanding toward energy efficient technology, techniques and policies. The project management team has also heightened their cognition level and built up their management capability on energy conservation and emission reduction project through practice, which brought GEF's ideas on project management and emission reduction to China. (Table 3.1)

[3] Sources: Investigation Report on Establishing a Policy Implementation Committee for Energy Conservation and Emission Reduction of GHGs of TVEs of Baqiao Dist., Xi'an provided by PMO.

Table 3.1 Results of the Survey on Energy Conservation Awareness [4]

Intention of investing in energy efficiency projects or buying energy saving products		Contribution to lifting the enthusiasm for investment or purchasing	Elements luring investment or purchasing	Degree of enhanced understanding toward energy efficient technology, techniques and policies in this industry	Contribution to the improvement of energy conservation awareness
2000	2006				
2	9	7	1. Cost reduction; 2. Need for sustainable development; 3. Realize the importance of energy conservation and emission reduction; 4. Improvement of production techniques; 5. Establishment of an energy management system; 6. Ease China's energy tension; 7. For the benefit of social development; 8. Comply with national policy on energy conservation and emission reduction	8.5	9

Note: Scores in the table were given by interviewees on a scale from 0 to 10 to show people's response and the project's contribution

From the table above we can find that in 2000 when project phase II was approved people's intention of investing in energy efficiency projects or purchasing related products was low, but now they showed much interest in it. Apart from the influence of macro control of the state, the role of the project brooked no neglect. 70% of the changes were stimulated by the project. The project's contribution to enhanced awareness about energy conservation and deepened understanding toward such technology, technique and policies in the industry is estimated to be 90% and 85% respectively. Therefore, the project has played a leading role in raising people's awareness about energy conservation.

3.2 Influence on Product Suppliers

The evaluation revealed that the project made an impact on product suppliers from the following six aspects:

1. Remarkable environmental and energy benefits

Pilot enterprises have dramatically reduced their energy consumption per unit of output after taking technology reform. The 9 pilot enterprises are expected to save 120,000 ton- coal-equivalent and reduce 300,000 tons of CO_2 on an annual basis. The conserved energy and reduced emission each year are 56,000 ton-coal-equivalent and 140,000 tons of CO_2, outstripping much of what is designed in the project document- the target of 32,000

[4] refer to Annex I for the questionnaire

ton-coal-equivalent and 80,000 tons of CO_2 per year.

Table 3.2 Volume of energy conservation and emission reduction expected or realized by pilot enterprises [5]

Pilot TVEs	Baseline yesr	Energy savings/ Unit Product		Energy saving (tce)	CO2 Emissions Reduction (tCO2)
Zhejiang Shenhe Cement Company	2003	tce / t. clinker	0.009	8,020	19,994
Huangshi Lufeng Cement Co. Ltd.	2002		0.028	8,720	21,740
Baojiang Cement Material Co. Ltd	2003		0.015	11,865	29,580
Taiyuan Gangyuan Coke Company	2003	tce / t. coke	0.09	41,364	103,120
Xinggao Coking Group	2003		0.09	45,960	114,578
Nanjing Moling Foundry	2002	tce / t. casting	0.073	2,032	5,066
Dalian Jinmei Cast Pipe Co. Ltd	2002		0.034	152	381
Yongxing Shale Brick Company	2002	tce / 10000 regular brick	0.011	792	1,974
Xi'an Liucun Hollow Brick Plant	2003		0.026	1,298	3,236
Total				120,205	299,672

In addition to building pilot enterprises, the project team also selected replication area and enterprises to lead other businesses of the industry within the same area of jurisdiction to carry out energy saving programs. According to national industrial policies, characteristics of the industry and local government's efforts in energy conservation, the project finally decided on 118 replication enterprises, exceeding the set number of 100 in the project design. These pilot enterprises consisted of 20 cement plants, 60 brickyards, 7 coking plants and 31 foundries, which were distributed in 44 counties of 13 provinces. Based on the project design that feasibility studies should be made on the four industries, the project expanded the research scope of replication foundries and brickyards from project implementation to feasibility study and engineering construction. Currently, the project has completed feasibility study for 60 brickyards and technology reform of 45 brickyards. It has also conducted random on-site examination and research on 60 replication brickyards and finished draft feasibility study report on 20 cement plants.[5]。

[5]Sources: 2005 Annual Report on the Project of Energy Conservation and Emission Reduction Phase II of TVEs in China (from Aug. 2004 to Sep. 2005), provided by PMO.

Table 3.3 Expected CO2 emissions reduction of replication TVEs[6]

Sector	Number of TVEs	Expected CO2 emissions reduction (tCO2)	TVEs Location
Brick-making	60	117,276	Xi'an, Xianyang, Liaoning, Chengdu
Cement	20	714,590	Hebei, Jiangsu,Zhejiang, Jiangxi, Henan, Fujian, Guangdong, Chongqing
Foundry	31	15,500	JInnan District in Tianjin, Jinzhong, Linfen, Jinzhou District in Dalian,Nanjing
Coking	7	756,000	Shanxi
Total	118	1,603,366	

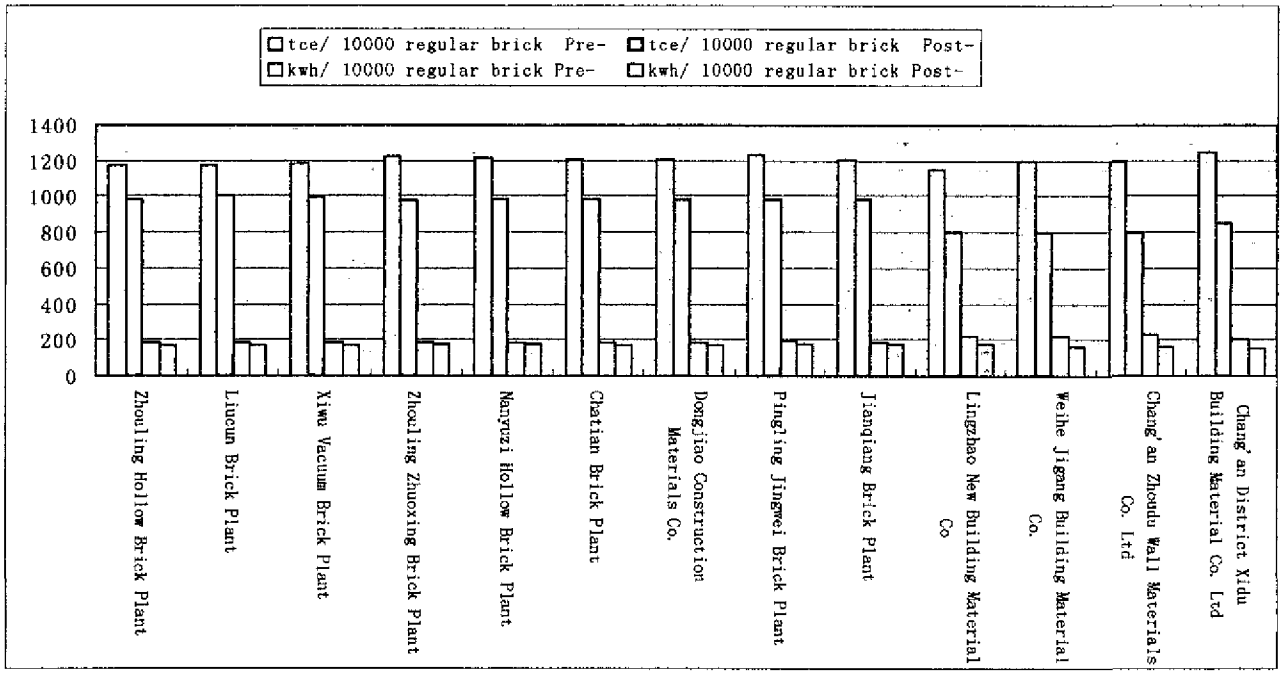

Figure 3.1 Changes of energy efficiency of replication brickyards in Xianyang [7]

Table 3.3 and Figure 3.1 show that the benefits of energy conservation and emission reduction in replication area are as prominent as in pilot area. Estimated CO2 emissions reduction in 118 replication projects is 1,603,366 ton/a. 45 completed brick replication projects have reached 85,780 ton/a CO2 emissions reduction. 20 cement replication projects, among which 10 have construction fund arrived, are going to be put into production by the end of 2006 and have 341,338 ton/a CO2 emissions reduction. Once the residual heat power generation project of replication coking and cement plants is completed, the installed capacity will reach 177MW, which can provide

[6] Sources: 2005 Annual Report on the Project of Energy Conservation and Emission Reduction Phase II of TVEs in China (from Aug. 2004 to Sep. 2005), provided by PMO.
[7] Sources: Final Report on the Technology Reform of Replication Enterprises in Xianyang, submitted by Xi'an Kai Sheng Building Materials Engineering Co., Ltd.

residential electricity for a big city with 9 million people.[8]。

2. Improved production technologies and reduced costs

(1) Foundry Industry

The project has made great contributions to trimming the energy-related costs for enterprises, which made businesses more competitive by offering them more room for profitability and price cut. Table 2.4 shows the change in production costs of Nanjing Moling Foundry (or casting plant) since it participated in the project. We can see a sharp decline of energy cost after the project was carried out.

Table 3.4 Change in Production Costs of Nanjing Moling Foundry [9]

Indicators	2002	2005
energy cost slashed by the energy conservation project	715.4RMB /t	597RMB/t
proportion of energy-related costs	18%	15%
rate of spoiled products	15%	5.2%

(2) Cement Industry

The production cost of cement consists of electricity, coal and limestone. Since 2004, the factory price of cement products have dropped while the purchasing price of raw materials, fuels and power have risen, leading to a dip in the profitability of cement industry. The project helped pilot enterprises to gain more profitability by largely reducing the production cost.

Case 2: The pilot enterprise, Zhejiang Shenhe Cement Co., Ltd. succeeded in its experiment of residual heat power generation in new dry cement line, which was the first five-stage cyclone preheater project in China. It not only solved electricity shortage for enterprises but also brought down production cost. The cost of residual heat power generation was 0.05 yuan per KWH of electricity. Taking depreciation into account, the total cost each KWH of electricity was 0.13 yuan, much lower than the industrial electricity cost of 0.59 yuan. Currently, one third of the electricity the company consumed came from this line. It saved the company over 1 million yuan each month and the cost of cement was reduced by 10 yuan per ton. Now the slack market has dragged the selling price of cement to about 200 yuan per ton, close to its production cost. A cost reduction of 10 yuan has promised a great opportunity for profit.

（3）Brick Industry

Both pilot enterprises and replication enterprises have seen a drop in energy-related costs through the technology reform on energy conservation. By increasing the void ratio of the hollow bricks and lowering the rate of rejects, enterprises have seen the benefit from improved product quality and plunging production cost.

[8] Sources: Annual Project Report (APR/PIR) for UNDP/GEF Projects 2005, provided by PMO.
[9] Sources: Investigation Report on Establishing LPIC in Jiangning Dist., Nanjing, Jiangsu Province, provided by PMO.

Case 3: Yongxing Shale Brickyard of Xinjin County, Sichuan, a pilot enterprise in the business, took the following energy efficient measures to reduce production cost: 1) reinforcing the tightness of kilns to reduce energy loss. 2) The plant reformed its flue, changing the gas supply route from underground to ground surface, so that the accumulated underground water would not cool the gas in the flue. This move alone would raise the gas temperature by dozens of degrees. 3) It used residual heat of the kilns for indoor man-made drying. 4) Retooled the fans by equipping very fan with transducers. In this way each fan might save over 600 KWH of electricity every month, which was half of the power consumption in the past. The saved electricity every year amounted to more than 100,000 yuan. 5) The company spent over 30,000 yuan adding capacitors to motors linking big machines for terminal compensation, but the saved electricity fees could cover the cost within one year. 6) Alterations were made to the brick making machines to increase the extruding pressure and the rate of bricks qualified. 7) Replacing all the incandescence bulbs with energy saving bulbs. 8) Since the reform, maintenance cost also plummeted.

（4）Coking Industry

Shanxi Gaoping Xinggao Coking Co., Ltd. adopted residual heat power generation technology by recovering clean heat into coking ovens. The solution not only satisfied its need for electricity consumption but also produced nearly 85% of excessive electricity for sales on grid. As a result, it both saved electricity cost and earned a handsome profit.

3. Expanded channels for corporate financing and fostered investment in energy conservation

The pilot enterprises are expected to make a total investment of USD51.45 million on efficiency improvement. Currently USD36 million has been put in place, of which direct investment only accounts for USD750, 000, or 1.5% of the total. Borrowed loans exceeded USD20 million. Loans offered by ABC alone reached USD17.46 million. Two pilot enterprises have got the entrusted loan in place. The total funds raised for project replication (118 replication enterprises) topped USD100 million. Meanwhile, the project has also explored other financial channels. It teamed up with China Water Group Inc. to provide funds for capital construction of replication enterprises. Therefore, the project is a big success in opening up financial channels for enterprises. From Figure 3.2 we can see funds provided through loans account for nearly half of the total investment. The credit must go to Hong Yuan Company who helped with going through the loan procedures with the guarantee of GEF funds, removing the barriers of TVEs to apply for loans.

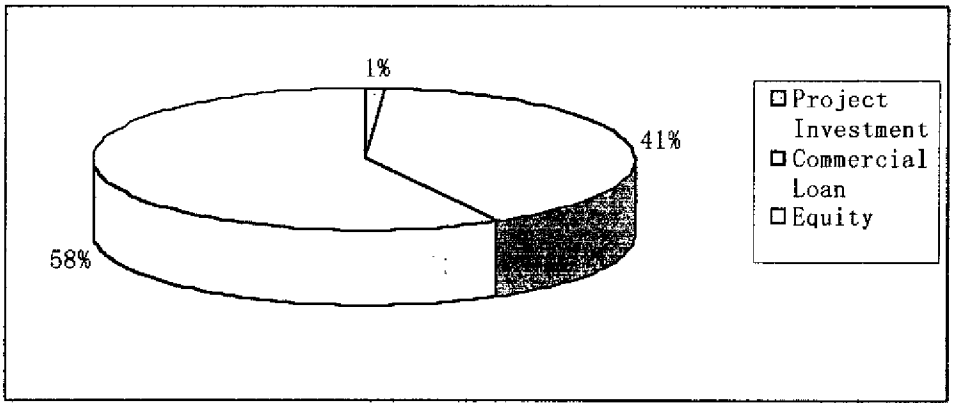

Figure 3.2 The investment structure of the pilot TVEs

The above shows that the RCF mechanism has produced good results. It not only offered entrusted loans of USD200, 000 for two pilot enterprises each, but also stimulated large amount of commercial lending and government investment.(Figure 3.3)

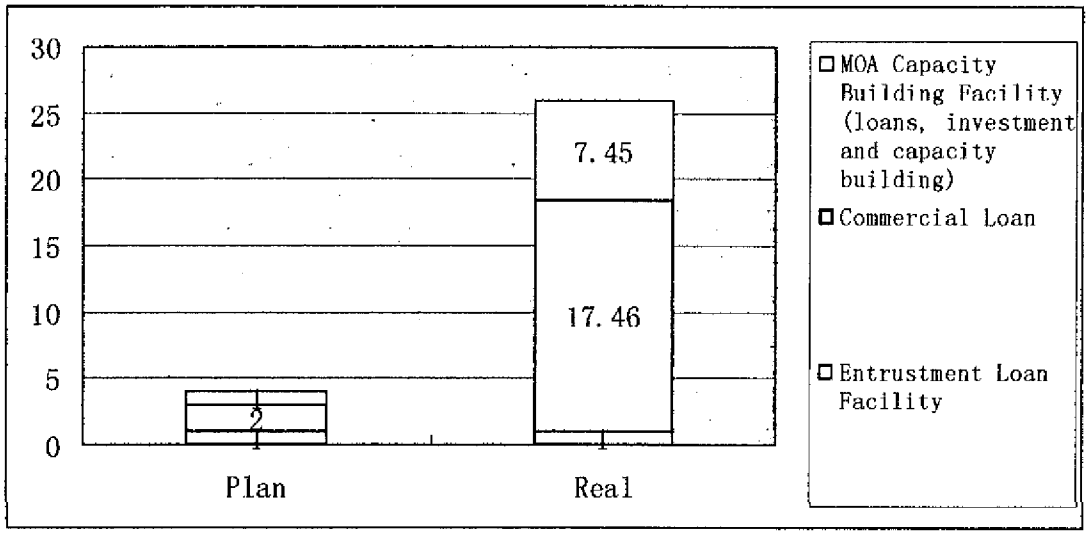

Figure 3.3 RCF structure（Unit: US$1 million）

It should be noted that by taking the characteristics of TVEs into consideration, the project has fully leveraged commercial banks, grass-roots braches of ABC in particular, to play their role of promoting investment in energy conservation.

In addition, the project has also developed new financial channels by coordinating with other projects, local governments, financial institutions and related investment companies, including 1)SME Security Fund; 2) ADB: Environment Fund, 2000; 3)Sino-Italian Cooperation Programme; 4) Developed cooperation with professional investment corporations. These financial channels solved some economic problems and secured the technology reform of TVEs.

Case 4: The project has sped up the building of credit guarantee system for medium-to-small enterprises. Governments would vouch for these enterprises when they asked for loans from banks. The pilot enterprise, Sichuan Yongxing Shale Brick Co., Ltd., is a case in point. It has obtained 1 million-yuan-loan from China Development Bank Sichuan Branch.

Case 5: With the coordination of the project office, China Water Group Investment Co. signed an exclusive agreement with Nanjing Triumph Cement Industry Design & Research Institute, one of the technical support units for the pilot enterprises. China Water Group Investment Co. would invest in the low temperature residual heat power generation projects and sell the electricity to enterprises at a price lower than market value, which removed the financial obstacles for enterprises to undertake such projects.

4. Motivating TVEs to participate in technology reform and promoting the development and spread of energy efficient technologies

As the project has helped the pilot (demonstration) enterprises and replication enterprises to solve their problems arising from development and brought them substantial benefits, enterprises have grown more motivated to carry out energy conservation and technology reform. Moreover, these enterprises have exerted positive influence through their achievements, serving as models for others in the business.

About 1200 people including representatives from PIC and LPIC, officials of various level of local governments, plant management, key technical staff of TVEs, Project staff, and EE product and technology providers have accepted the trainings provided by the project.

TVE Project has raised the interest of TVEs in energy technology reform, as is seen from the applications of 670 TVEs to Hongyuan Company for the candidacy of 118 replication enterprises.

At present, according with the success implementation of the project, Pilot TVEs have become bases for EE technology dissemination and for EE technology and products.

Case 6 Visitors from 45 cement plants visited Zhejiang Shenhe Cement Co. Ltd., received and helped 5 of them to review their feasibility study for introducing the pilot technology.

Case 7 Xinggao Coking Group received 40 coking plants visitors, and operators from 13 coking plants was trained in the company.

Case 8 Yongxing Shale Brick Company delivered three technical training sessions, and trained over 180 operators and technical persons from other brick making plants.

Case 9 Upon requirement to promote the use of rectangular-hole bricks in Xi'an, Xi'an Liucun Hollow Brick Plant voluntarily and successfully assisted the municipal government in a trial production of rectangular-hole bricks thereby, providing a good demonstration. In the meantime, the plant also provided valuable information to "Forbidding Solid-clay-brick Survey" conducted by four Chinese ministries concerning wall materials.

And the Project has also impacted the neighbor countries. Almost 10 enterprises from other countries such as India, Indonesia, Bangladesh and so

on have visited the pilot TVEs.

Case 10 Xinggao Coking Group received visitors from Indian and Vietnamese coking enterprises and provided technical training to operators from Indian coking companies.

Case 11 Xi'an Liucun Hollow Brick Plant introduced their pilot technology and, energy efficient Hoffman kiln, to a Bangladeshi delegation from a GEF brick making project, who consequently decided to introduce 50 sets of the EE Hoffman kiln in Bangladesh.

5. Enhanced comprehensive competitive power

Competitive power is a comparative capability of an enterprise when competing with other enterprises in a competitive market where enterprises allocate or create their resources for occupying market share, satisfying customers' needs, creating wealth and sustaining development. Competitive power can be viewed from several aspects, ranging from marketing ability, technology strength, management skills, innovative capability and corporate culture. This is how we evaluate the project's impact on corporate competence. The indicator system set out in table 1.1 is used for analysis.

1）Impact on marketing ability

A）The project has expanded corporate scale and improved their marketing ability

The evaluation team found that the participating enterprises have expanded their scale and market share through the project. Table 3.5 and Figure 3.4 below show all the three pilot enterprises and the replication brickyards in Xianyang have seen enlarged production scale of their companies, which is a function of technology reform and training.

Table 3.5 Change in production scale of pilot enterprises [10]

Pilot TVEs	Production scale before the project	Production scale after the project
Xi'an Liucun Hollow Brick Plant	3,187 10000 regular brick/year	5,000 10000 regular brick/year
Nanjing Moling Foundry	13,245 t casting/ year	28,000 t casting/ year
Baojiang Cement Material Co. Ltd	198,000 t. clinker/year	775,000 t. clinker/year

[10] Baseline data and achieved projected energy savings and GHG emissions reduction, 070130, by Tian Yishui.

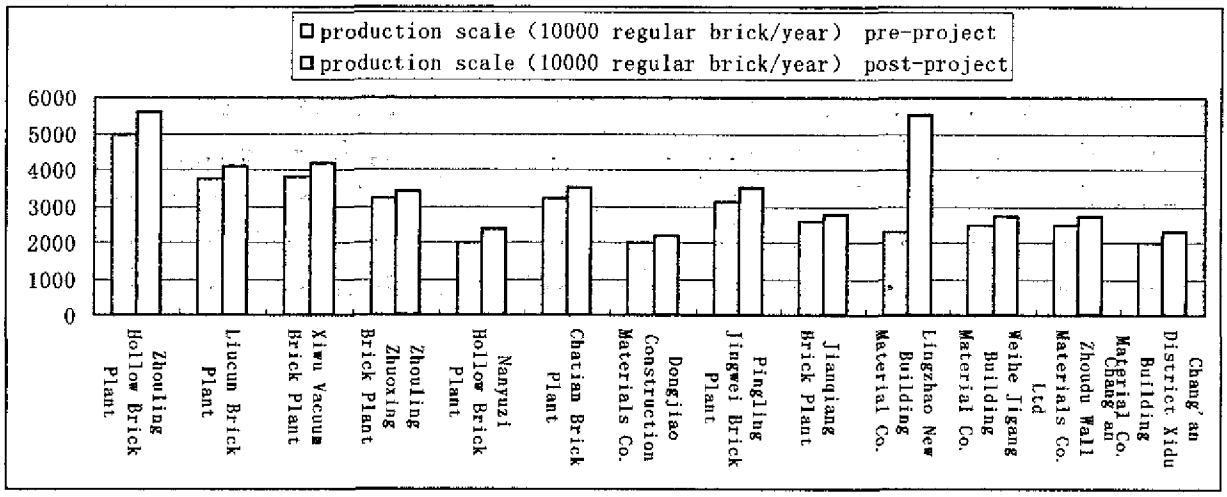

Figure 3.4 Change in production scale of Replication brickyards in Xianyang [11]

Case 12: Liucun Village Brickyard of Baqiao, Xi'an, a pilot enterprise, produced 32 million bricks annually before the project was commenced. The production rose to 40 million bricks per year in the initial stage of the project and now reached 50 million. The TVE project has facilitated the brickyard to expand into the largest one in local area with quality products. Now it could bypass the transport dealers and directly sign contract with construction companies, so that each brick could be sold at 0.33 yuan to construction companies rather than 0.30 yuan when the transport dealers kept their finger in it.

B) Improved technologies and quality and reduced costs

The project has offered the participating enterprises opportunities to be more competent by improving their techniques and product quality. Evident rise in the rate of bricks qualified is seen after the project was undertaken in the replication brickyard of Xianyang, as is showed in Figure 3.5. Costs and resources are saved by improving product quality and reducing the rejects.

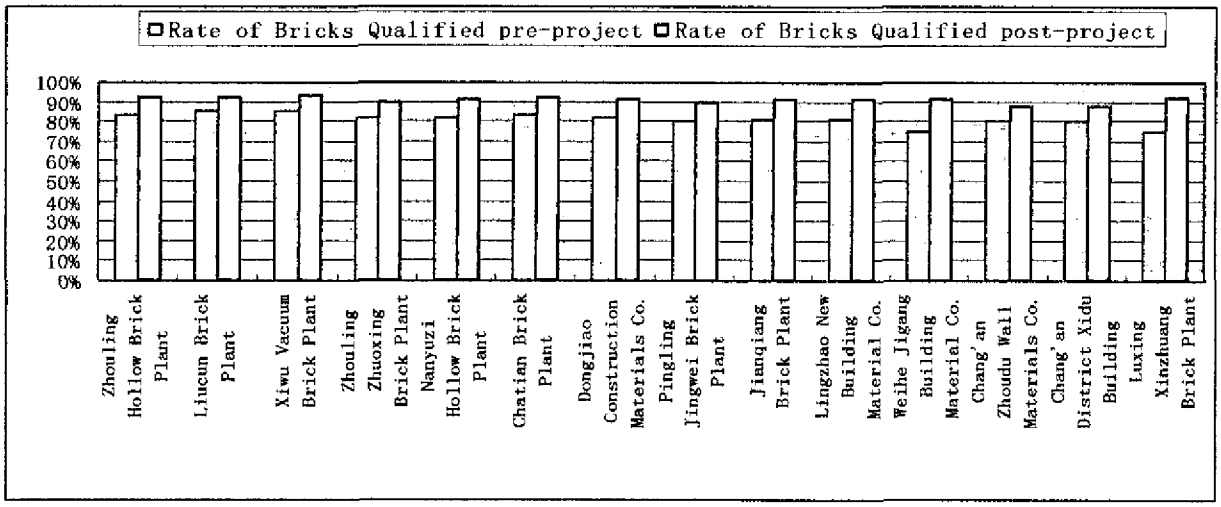

Figure 3.5 Change in the Rate of Bricks Qualified of Replication TVEs in Xianyang [11]

[11] Sources: Final Report on Technology Reform of Replication Enterprises in Xianyang, submitted by Xi'an Kai Sheng Building Materials Engineering Co., Ltd.

C) Fostering good corporate image

As an un-funded project, the TVE project enjoys brand-name effect in domestic market in the first place. And during the implementation of the project, the participating enterprises have bettered their social profile through improved environmental performance and management skills, which earn the recognition of their peers, government departments and public around.

2) Impact on corporate technical strength

Enterprises have established close connections and information sharing channels with leading research institutions in China through the project.

Case 13: The evaluation team found in the investigation that Xi'an Research & Design Institute of Wall and Roof Materials, the only A-level professional institute of the industry in China, served as the LPIC for replication area. It has provided technical support for the development of brick and tile enterprises. Visiting companies collect related information mainly from the institute.

The project promoted enterprises to upgrade their technology. These enterprises have built up their technical strength through energy efficient technology reform. Management and employees in the enterprises have also gained a deeper understanding of advanced technologies in the industry by taking part in various programs of training, study tour and visit.

3) Impact on corporate management

Weakness in management awareness and poor managing ability are universal problems with China's TVEs. The successful implementation of the project in pilot area and replication area have enhanced much of the management consciousness among corporate leaders and improved their management capability.

The project provided assistance to enterprises to pass ISO9000 quality management system certification and ISO14000 environmental management system certification.

In addition, with the help of the project enterprises have begun to realize the importance of energy management and established complete energy management systems for enhanced management in this respect.

Case 14: The person in charge of Xinjin Yongxin Shale Brick Plant of Chengdu, Sichuan, revealed during the on-site investigation that only comprehensive technology reform for energy conservation could make a difference due to acute competition in the brick market. In this sense, the management level of brickyards mattered. Excellent management would yield results. On the contrary, ignoring product quality and poor management would put enterprises into a corner. The principal of the brick plant has raised his management awareness while participating in the project. And the overall management of the plant has improved a lot as well.

4）Impact on corporate innovation

Once enterprises become aware of the benefits of innovation, they will be motivated to make profit through continued innovation. To some extent, the project has strengthened the innovative capability of enterprises. TVEs in particular, are facing shrinking market shares squeezed by intense competition. If they are able to create some new products superior to similar products, it will be a plus for them to sharpen their edge. In this way, the project has enabled enterprises to recognize the value of innovation and given impetus to their efforts.

5）Impact on corporate culture

It is a common problem with TVEs that the educational and technical level of their employees is inadequate. To tackle the problem, the project has provided training courses to managers and technical staff of the participating enterprises through various channels so that they would in turn give instructions to their employees as a whole. Such practice has promoted the overall improvement of technical skills and laid groundwork for the application of advanced technologies and upgrade of corporate management.

6. Establishing a service branch for energy conservation and emission reduction of TVEs

The project has established an independent corporate entity, Beijing Hong Yuan Company, which has the ability to sustain its development. Hong Yuan Company provides technical support and relevant information for pilot enterprises based on its network with institutions and experts home and abroad. It also offers training courses to managers and staff of pilot enterprises to learn modern technology and management skills, which has enhanced TVEs' capability of practicing energy conservation and emission reduction and promoted social awareness of environmental protection. Hong Yuan Company, on the other hand, has built up its ability of sustainable development in the area of energy conservation.

Additionally, the company has assisted the project office to prepare and manage outsourcing contracts of 36 projects, operated the entrusted loan mechanism and implemented 16 training programs on energy saving technologies, which turned out over 900 person-times for 650 enterprises. Hongyuan Company also facilitated 4 enterprises to carry out clean development mechanism and provided paid technical consulting service for 22 enterprises. The successful performance of the company helps improve the efficiency of the TVE project.

7. Promoting the development of local industries and the self-regulation

association of the industry

The project has promoted the establishment and development of local self-regulation associations for industry, which has strengthened the collective competence of all players in the industry.

Case 15: Xianyang City of Shaanxi Province, one of the replication areas of the project, has 1,195 enterprises engaged in the production of building materials. They contributed a total of 4.65 billion yuan to gross industrial output value every year and turned over 115.6 million yuan of profits and taxes to the state. The building material industry has grown into a mainstay of local economy. However, as most of the equipment was obsolete and the bricks of quite a few enterprises were not up to standard, adding that those profit-driven building companies only care about price rather than product quality, the brick market was turned into a mess. A vicious cycle of the market was stirred by the disordering competition among brick companies who were trapped in price squeeze and could not afford to take technology reform to upgrade their product. In order to maintain market order and eliminate vicious competition, the project facilitated the formation of Xianyang industrial association of wall & roof materials and measures and agreement on self-regulation of brick manufacturers were also devised. The founding of the association has unfolded a new stage for the wall & roof material industry of Xianyang. From then on, those wall material enterprises had their own organization, providing a strong base for common development. It also brought about significant impact on enterprises by upgrading the quality and technology content of their products, promoting frequent exchanges among enterprises and making them grow stronger. The association has played a constructive role in the reform of energy efficient wall materials. Now that a great majority of the enterprises have broadened their mind and enjoyed benefits since they joined in the association, more and more brickyards followed suit. Before long the implications of Xianyang's practice led to the establishment of another self-regulation association for the brick industry of Shuangliu County, Chengdu, a replication area as well. The person in charge of Chengdu Sanli Shale Hollow Brick Co., Ltd., one of the replication enterprises, was even made vice chairman of the association. Since the association was set up, it has played a positive role in limiting disordering competition and establishing links between enterprises and the government. As the association knows well of the national laws and policies, it will report illegal conduct to related department once found, which effectively curbs the abuse of land resources.

In summary, the impact of the project on both pilot enterprises and replication enterprises is embodied in the following aspects, which is felt by their peers not involved in the project and even other businesses in local area.

- In the face of increasingly stringent environmental laws and regulations, actions are needed as soon as possible. Voluntary efforts in technology reform to reduce emissions and pollutants will not only yield environmental benefits but also gain broader scope of development for enterprises.
- The project has helped enterprises to upgrade their production techniques while reduce production cost, presenting a larger profit margin.
- It is a profitable attempt in solving financial problems for small-to-medium enterprises through diversified channels for fund raising and commercial investment in energy conservation.

- Enterprises have showed more interest in the technology reform, which promoted the development, application and dissemination of energy efficient technologies.
- Enterprises have experienced a rise in their marketing ability, technical strength, management skills and innovative capability, which uplifted their comprehensive competence in the market.
- The position of government and enterprises are defined. Governments serve to remove policy barriers for enterprises.
- The project has promoted the development of local industries and the self-regulation associations for industries.

3.3 Impact on Government Regulation

Although the four industries involved in the project were market based, they still felt the strong influence of government regulation and policy. In a sense, the direction of government regulation determined part of the development of these industries. During the evaluation process, the team found that the project's influence on government regulation could make a difference to market, as shown in the following aspects:

3.3.1 Promoting the implementation and perfection of existing energy saving policies

The project efforts in the brick industry has pushed forward the campaign to prohibit the production and use of solid clay bricks and promoted the use of hollow bricks.

Case 16: The project has helped enterprises in Xi'an and Xianyang to tackle the technical problem of producing hollow bricks and abandoning solid bricks. It also provided some funds to support product transformation in local industry. The pilot enterprise, Liucun Village Brickyard of Baqiao, Xi'an now only produces circular pored hollow brick and has raised the void ratio from 25% to 33%. The brickyard did its bit for the promotion of rectangular pored bricks through its volunteer efforts to make experiment on it. Another replication enterprise, Shenwei Wall Material Plant, has also increased its void ratio from 22% to 25% since it participated in the project.

3.3.2 Response to government initiative on technology reform

The success in residual heat power generation has increased the benefit of dry-process rotary kiln technology, which lured companies to take the initiative in turning from shaft kiln to rotary kiln. The technology secured the efforts of Zhejiang Province to shut down all shaft kilns by the end of 2007.

3.3.3 Setting a good example for government regulation on industries

Zhejiang Shenhe Company's success in the first five-stage cyclone preheater project of residual heat power generation in new dry cement line has strengthened the resolve of Zhejiang Province to unveil the policy that prohibits

the approval of exhaust-heat power project. The triumph is taken as a model for other provinces and cities across the country to develop related policies.

The success of pilot project in coking industry has made clean coke oven technology a National Project of Two Highs and One New (high-level technology, high added-value and new materials). Shanxi Provincial Government (a key province producing coke) decided to encourage more coking enterprises to use such coke oven and adopt the residual heat power generation technology.

3.3.4 A change of government regulation on enterprises and market from mandatory planning to guidance

The local governments in the pilot areas have acquired deeper understanding of its role in market regulation. Their instruction on enterprises has gradually changed from mandate to guidance. Voluntary Agreement on energy efficiency is a typical example of government efforts in promoting enterprises to conserve energy on their initiative.

3.3.5 Changing the investment idea and behavior of government

The local governments have found out a viable channel to achieve their policy goals with limited investment through the successful implementation of the project. That is to follow the proven experience of the project. Instead of making direct investment in enterprises, government can invest in the incremental costs that enterprises are reluctant to cover in order to avoid risks. This little money will lure big investment to bolster the operation of many technology reforms. Local governments have started to try the investment practice. For example, Shenhe Cement Co. and Nanjing Moling Foundry have both gained special government fund for technical innovation.

3.3.6 Further the relationship between governments and enterprises

The project has furthered relationship between governments and enterprises. Local governments have provided a sound policy environment for the development of pilot enterprises and replication enterprises based on the mechanism of LPIC which serve as a platform to help enterprises overcome practical difficulties. The mechanism has further enhanced mutual trust between governments and enterprises. Placing much confidence in the government, enterprises are willing to take the initiative to cooperate with government in policy implementation and administration. On the other hand, governments come to know better how to play its role in real work, hence improving its service quality for enterprises.

3.4 Impact on Market Equilibrium

The impact of the project on both product and technology users and product

suppliers have changed the demand curve and supply curve, which have an influence on the market.

3.4.1 Promoting the adjustment of market structure

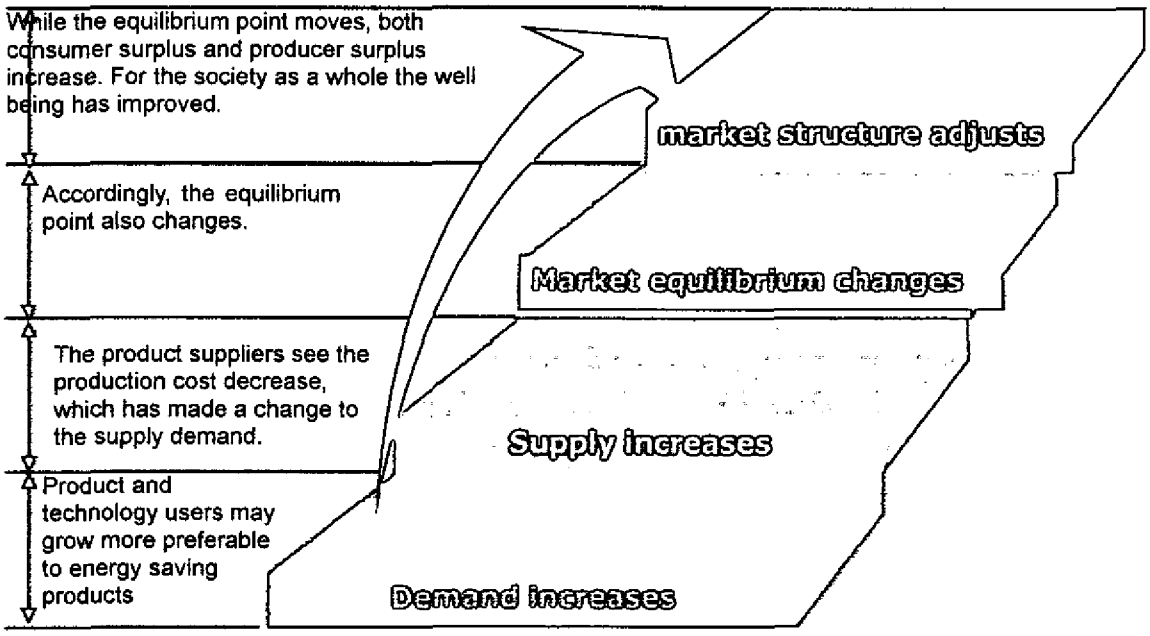

Figure 3.6 Impact on Market Equilibrium

As shown in Figure 3.6, product and technology users may grow more preferable to energy saving products either because of increased income or awareness of energy conservation, or other factors such as a drop in price compared with similar products. This will lead to a growing demand for energy saving products, technology and equipment.

In the meanwhile, the product suppliers see the production cost decrease as a result of their investment in energy efficiency projects, which has made a change to the supply demand.

Accordingly, the equilibrium point also changes. At the equilibrium point, the price of energy products is probably the same with the old one or even lower, but the output rises in the new market.

While the equilibrium point moves, the market structure is undergoing an adjustment. Both consumer surplus and producer surplus increase. For the society as a whole the well being has improved. This displacement represents Pareto improvement. That means, when suppliers have paid more attention to energy conservation, the overall social well-being increases. Under this scenario, the market share of energy saving products and equipment and those made with energy efficient techniques will expand.

The evaluation team believes the project has stimulated market demand for

energy saving products and equipment as well as products made with energy efficient techniques. Energy saving products will be more popular for they enjoy price advantage thanks to cost cutting. Now that energy conserving enterprises have fostered good image among consumers, the sales of their products go up, which will drive more enterprises to jump on the bandwagon. The sales of energy saving equipment also pick up. For example, by supporting the transfer from shaft kiln process to rotary kiln process and application of waste heat power generation technology[12], the market demand for low grade cement is decreasing and the project promoted technical upgrading in cement sub-sector and accelerated upgrade of cement product.

3.4.2 Facilitating a new market

What the project has achieved is reflected not only in the widespread application of energy conservation and emission reduction technologies in certain industry but also in the emergence and maturity of relevant market. For instance, the success of low temperature residual heat power generation project in the cement industry has fostered the commercialization process of domestic residual heat boilers.

4、Conclusion and further recommendations

4.1 Conclusion

The evaluation of the market impact of the project draws the following conclusion: aiming at promoting energy conservation and emission reduction among TVEs in four industries, the project team has done extensive work to remove market barriers and foster the development of TVEs. Their profitable exploration has produced fruitful results with large scale extension. Some useful adjustments are made combining recent economic development, making great contributions to the building of new socialist countryside.

(1) The project exceeds the set targets of energy conservation and emission reduction. This helps the participating enterprises to substantially improve their environmental performance and bring about prominent environmental benefits.

(2) The project has cleared market barriers to the development of TVEs, which enhances their competence and changed their profit-making modes and management concepts, and shifts the extensive operation mode featured by small profits but quick returns into the sustainable one that seeks the profits from good management and technological innovation. The project secures the smooth operation of the Eleventh Five-Year Plan claiming 20% cut of energy

[12] Shaft kiln normally produces P.325/425 cement, while rotary kiln can produces P. 435/535 cement or even higher grade products.

consumption and enriches the connotation of a new path to industrialization.

(3) The project has raised the environmental awareness of the vast majority of producers and consumers and facilitated the building of an environment-friendly and resource saving society.

(4) The project has boosted the maturity and development of advanced technologies in the four industries and promoted innovation of domestic technology patent, which laid a foundation for future development.

(5) The project is conducive to the upgrade and restructuring of the four industries and is consistent with national policy on intervention. It has set a good example for government intervention by expanding the market share and competitiveness of energy saving products and equipment, reducing energy consumption and alleviating their pollution to the environment.

4.2 Further recommendations

（1）Grasping the opportunity of building new socialist countryside and further promoting the achievements of the project

Although the market effect of the project has just shown up, a great deal remained to be done, for there is time lag for the effect to fully take hold and the promotion of project results is still in an early stage. The evaluation team suggests extending the implementation period to ensure the promotion of project results can be accomplished. Further more, given the great need for infrastructure construction and urbanization in the drive of building a new socialist countryside, it is proposed that the project be furthered based on present achievements. Efforts are needed in two areas, energy conservation in the production of building materials and the production of energy saving building materials. Support of state government and local governments is desired in the new socialist countryside drive. Efforts are needed to explore the possibility of extending the GEF project and establishing new GEF projects in related areas.

（2）It is suggested that the stakeholders of the project, especially governments at all levels, financial institutions and TVEs, should probe and develop new funding channels to sustain the project achievements.

On the one hand, we should review the project and communicate with quarters concerned in order to channel domestic funds to support TVEs' technology reform. Partnership with China Water Group Inc. reveals some professional investment institutions are quite interested in those energy efficient technologies not only generating good economic returns but also conforming to the direction of national policies. These technologies both solve practical problems for enterprises and promise great market potential. More attempts in

areas with common interest are needed.

On the other hand, CDM should be incorporated into the promotion of project achievements and more channels be explored to support enterprises financially and technologically. The four industries covered in the project are all energy intensive, which are possible areas for CDM investment. If CDM can be introduced, TVEs will be presented with more financial and technical support for further development and technology innovation.

Annexes

Annex I Questionnarie on the Awareness of Energy Conservation

This questionnaire aims to evaluate the impact of the TVE project on the awareness of energy conservation. The answers will be taken as the basis for overall assessment of the project. Please fill out faithfully. Your cooperation is very much appreciated!

1、 You are_____

A. LPIC officials B.Local government officials C.Managers of project participated enterprises D.Workers of project participated enterprises E. Worker of other relevant industries F.Other（please fill in_____）

2、 How long have you took part in the TVE project _____

A. less than 1 year B. 1-3 year C. 3-5year

D. 5-9year E. more than 9 year F. never

3、 Suppose you are a manager of a TVE. Will you invest in energy efficiency project? Please score your investment intention before and after the project was carried out. 0 means not interest at all and 10 means a strong interest in it.

Investment intention before 2000:

0 1 2 3 4 5 6 7 8 9 10

Current investment intention:

0 1 2 3 4 5 6 7 8 9 10

4、 If you scored above 5, what are the factors attract you? Please list the major factors.

5、 If you have more interest in the investment, how much do you think the project contributes to your enthusiasm for the energy efficiency project? Please score its contribution. 0 means that the project has no contribution and 10 means the contribution is great.

0 1 2 3 4 5 6 7 8 9 10

6、 How much do you think the project help you learn more about the energy efficient technologies, techniques and policies in the industry? Please score its contribution in this aspect. 0 means that the project has no contribution and 10 means the contribution is great.

0 1 2 3 4 5 6 7 8 9 10

7、 Do you think the project has raised your awareness in energy conservation? Please score its contribution to awareness improvement. 0 means that the project has no contribution and 10 means the contribution is great.

0 1 2 3 4 5 6 7 8 9 10

8、 Will you choose energy saving equipment and electric appliances voluntarily in the future?

A. Only when the benefit of energy saving exceeds cost
B. Will choose so long as the price is acceptable
C. Not care about energy saving in particular

Annex2 UNDP seven core kinds of indicators

Seven Core Indicators	Project Level	Project Level Examples (for Direct Project Results)
1. Energy production or savings and installed capacities	The electric capacity or capacity savings of the measures installed; the energy production or energy savings of measures installed; and/or the number of technologies/measures sold, financed, or directly installed through the project	1-1 Annual or cumulative energy savings (e.g., MWh, or tce) from energy efficiency investments in industry (TVE sectors), either by TVEs or by energy service companies 1-2 Electric power capacity (MW) or energy consumption (e.g., coal or coke) reduced through energy efficiency investments 1-3 Amount of CO_2 emission reduced, by enterprise, by sub-sector etc. 1-4 Reduced consumption of energy (electric power, coal, coke etc.) per unit of output product (i.e., energy efficiency gain in percentage); 1-5 Number (percent) of EE measures installed 1-6 Number of EE projects (pilot and replication etc.) implemented and evaluated
2.Technology cost trajectories	The costs of measures directly installed through the project	2-1 Rates of return achieved from energy efficiency investments in industry 2-2 Costs of conserved energy (e.g., cents/kWh, cents/tce)
3.Business and supporting services development	Number of businesses supported and number of personnel receiving training	3-1 Number of operating energy service companies or other similar companies like the Hongyuan Company offering efficiency improvement equipment or services in target market 3-2 Number of EE feasibility studies and EE proposals 3-3 Information network (clearinghouse; newsletters, Internet website, and conferences/workshops) developed 3-4 Dissemination of results of EE projects 3-5 Number of demonstration sub-projects of EE measures; [broken out by sector; includes monitoring and verification] 3-6 Number of energy audits (in particular facilities, or by sector) 3-7 Guidelines on identifying and developing EE projects 3-8 Number (percent) of EE measures manufactured by in-country manufacturers 3-9 Manufacturer investments in/production of EE equipment
4.Financing availability and mechanisms	Subproject financing committed or dispersed	4-1 Number and dollar volume of ongoing and completed EE sub-project transactions using financing (e.g., amounts borrowed, broken out by sector) 4-2 Number and dollar volume of ongoing and completed EE sub-projects (total installed costs, broken out by sector) 4-3 Number of innovative financial and contracting mechanisms such as the RCF (packages) [broken out by sector] 4-4 Market acceptance of innovative financial and contracting mechanisms such as the RCF (packages) [broken out by sector] 4-5 Number of commercial financial institutions participating in EE sub-projects 4-6 Pipeline of EE (portfolios of) sub-projects ready for implementation and financing by commercial parties 4-7 Revolving fund to support financing of incremental investment costs 4-8 Number and type of financial incentives offered [broken out by sector] 4-9 Amount of financing leveraged [broken out by sector] 4-10 Number of grants issued [broken out by sector]

5. Policy development	Agencies created or policies developed as a direct result of project activity	5-1 Existence and evolution of regulatory/contracting frameworks that support energy conservation at enterprise level and support energy service companies (i.e., supporting policies in sub-sectors) 5-2 Existence and evolution of policies creating incentives for TVE industry to improve energy efficiency 5-3 Application of Voluntary Agreements 5-4 Support offices, such as the PMO, PIC and LPICs, created to coordinate and support institutional and capacity-building activities in EE 5-5 Offices established for identifying EE opportunities in operations and developing and implementing programmes for EE 5-6 Number of training programmes for Government and TVE staff, experts, industry personnel, energy managers, and ESCOs 5-7 Strengthened institutional capabilities (including information management, evaluation, and dissemination) of organizations promoting EE 5-8 Energy auditing instituted as a regular activity 5-9 Model energy policy and guidelines 5-10 Legal, financial, institutional, and regulatory policies and PIC/LPIC action plans instituted to ensure large-scale, sustainable financing of EE investments in TVEs
6.Awareness and understanding of technologies	Number of participants with increased awareness and understanding, by type of participant, such as energy end users, energy-related businesses, and NGOs	6-1 Awareness within TVE industry of the benefits of EE investments and of potential contracting approaches with energy service companies or companies like the Hongyuan (i.e., performance contracting) 6-2 Awareness and capability of energy service companies or companies like the Hongyuan to make or facilitate profitable investments in TVE industry and sustain a profitable business 6-3 Level of awareness and understanding of EE technologies, processes, services, and/or actions [broken out by sector] 6-4 Awareness of business opportunities in EE field 6-5 Public acceptance of EE measures
7.Energy consumption, fuel-use patterns and shares, and impacts on end users	For directly supported project beneficiaries	7-1 Energy intensities of the four particular industrial sub-sectors, compared with past years and baseline projections

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(4 of 6)

Energy Conservation and GHG Emissions Reduction in Chinese TVEs – Phase II – Project Impact Evaluation

(EG/CPR/99/G31)

Sub-Report on Evaluation of the Impacts on Gender and Social Development

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Contents

1. Evaluation Methodologies

1.1 Evaluation Approaches

Due to the complexity of China's economic growth, the following principles and approaches are applied in evaluating the impacts of the project on social development:

(1) To integrate with the actual social and economic environment and economic growth periods of local areas;

(2) To combine qualitative analysis with quantitative analysis: on the one hand, to secure related qualitative information through discussions with experts and heads of enterprises and visits; on the other hand, to acquire basic data through questionnaire;

(3) To conduct moderate comparative studies, including horizontal comparison and vertical comparison.

1.2 Identification of Evaluation Indicators

Since it is the evaluation of a single project on the social development, and the final impacts on society after the project is completed is the concerted result of the project and the macro social environment, so the key point of the evaluation is to identify the social impacts that are imposed simply by this project.

On the other hand, social impact itself is reflected in qualitative aspects and subjective feelings, such as people's subjective consciousness, as well as their behaviors, living conditions, and working environment that are ruled by such consciousness. Therefore, only certain qualitative descriptions and much fewer data are available through questionnaire and interviews.

The following several indicators are mainly identified in the evaluation process:

(1) Public awareness on environmental protection, which refers to the awareness of workers and heads of enterprises on energy saving and environmental protection, as well as their influence in work and daily life.

(2) Employment, which means the surplus labor force already added while implementing the project as well as the adding possibility; income and poverty, i.e., to what extent the project has improved the workers' income and alleviated local poverty problem.

(3) Working environment, that is, how the project has improved the working conditions and how it influenced workers' health.

(4) Public health and the environment, which indicates that improvement of public health after the implementation of this project and the alleviation of environmental pollution.

(5) Use of land resources, which is targeted at the land used for brick industry to dry bricks in the sun as well as the changes in the use of bricks.

(6) Disadvantaged group, social welfare and social security, which refers to the situation of women workers and disabled workers, as well as the development of social welfare after the project is implemented.

Please refer to Table 1 for the indicators for and elaborations on the social impact evaluation.

Indicators			Linkage with the seven core indicators of UNDP	Particular Corresponding UNDP indicator (referring to the seven core indicators listed in sheet 2)
Public awareness on environmental protection		Awareness of local farmers on environmental protection before the project is implemented		
		Average education level of workers		
		Proportion of rural workers		
		Major training channels of the project		
		Influence of the training program		
		Coverage of the training program	The seven core indicators of UNDP are not clearly related to the evaluation of social impacts. On the basis of the six kinds of indicators used in TOR on evaluation of social development and gender, we have developed the indicators as described on the left column in this section: 1) number of affected persons (the gross number and the proportion of benefited group) 2) changes in the use of energy (such as reductions in the use of coal oil and timber) 3) Possible changes in livelihood and income, including other social parameters (such as the increase or reduction of household income, rise of job opportunities for women, etc.) 4) To what degree the persons directly benefited from this project and those indirectly affected by it accept or satisfy with those benefits 5) The relationship between this project and the national poverty relief program 6) Expected impacts on poor people (e.g., increasing the transfer payment of the society on medical services and education, and improving the infrastructure)	
Changes in ployment d income	Employment	Number of ordinary workers in enterprises		
		Actual number of workers in the added posts after the project is implemented		
	Income	Per capita monthly income of ordinary workers in the enterprises before the project is implemented (yuan)		
		Increase in the per capita annual income of ordinary workers in the enterprises after the project is implemented (yuan)		
		Per capita annual income of local areas before the project is implemented in 2000 (yuan)		
		Per capita annual income of local areas after the project is implemented in 2005 (yuan)		
. Public ealth and vironment	Working environment	Whether or not the working environment has changed since the technological reform for energy saving		
		Indications of changed working environment		
	Environment and public health	Whether or not public health has improved after the project is implemented		
		Types of pollutants with reduced emissions		
		Amount of pollutant emissions prior to the project (ton/year)		
		Amount of pollutant emissions after the project is implemented (ton/year)		
	Use of land resources	Area of the land used for drying the bricks before the project is implemented		
		Area of the land used for drying the bricks after the project is implemented		
		Output of bricks per cubic meter earth before the project is implemented		
		Output of bricks per cubic meter earth after the project is implemented		
. Women, social elfare and social security	Women	Whether or not there are women workers before the project is implemented		
		If there is any added post for women workers after the project is implemented		
		Major types of jobs for women workers		
		Types of jobs possibly added for women workers		
	Social welfare and social security	Whether or not it has increased the job opportunities of disabled persons		
		Popularization of the three kinds of insurances (endowment insurance, unemployment insurance and medical insurance) for enterprise workers		
		Popularization of the three kinds of insurances (endowment insurance,		

Table 1. Indicators for and Elaborations on Social Impact Evaluation

2. Analyzing the Evaluation of Impacts on Social Development

2.1 Public Awareness in Environmental Protection

As the rural areas are relatively underdeveloped, and rural residents enjoy lower education level, the awareness of environmental protection is yet to be disseminated in rural areas. Therefore, most of the people in areas where the surveyed enterprises are located have insufficient understandings about the significance of environmental protection before the project is carried out.

The proportion of farm workers is very large in surveyed pilot enterprises and replication enterprises, mostly above 80%, and those workers have received primary or secondary education on average. During the technological reform, not only managerial staff but also ordinary workers are trained in a variety of means and to varied degrees. In addition to the training programs and excursions that are organized under this project, there are TV programs on the exclusive interview of pilot enterprises. The TV programs are shown in Phoenix Satellite TV and other media, which has expanded the scope of publicity and the influence of this project. As shown in Table 2, part of the training programs are provided by Project Office and LPIC, and part of them are the initiatives of the enterprises when they look for referential information, consult the experts and exchange information with each other. The training programs include not only technical briefings and trainings, but also publicity of environmental protection and energy-saving concepts. This has increased the understandings and deepened the concerns of enterprise workers on environmental quality, and encouraged them to raise environmental awareness and sense of responsibility fpr environmental protection. Thanks to the training programs, managerial and ordinary staff in pilot and replication enterprises begins to save energy and reduce energy consumption in all production processes, employs energy efficient equipment, reduces waste of energy, and has exchanges with other enterprises in the same industry. We have learned from the interview that workers in Nanjing Moling Foundry enjoy seven trainings every year, and the training practice has become systematic. However, the comparison enterprise-Nanjing Yuhua Plant which is located in the same area but does not take part in the project, does not improve remarkably. By now, the Bureau of Medium and Small-sized Enterprises in Xinjin County, Sichuan Province has provided eight training programs for the replication enterprises, and 240 people from 15 enterprises have received the trainings. Xinjin Yongxing Shale Brick Plant of Sichuan Province has not only improved the production technology and increased the energy efficiency, but also changed incandescent

burners into energy efficient lights and cut down the energy consumption in the non-production sector. With frequent training programs and publicities in a large scope, workers will enhance their awareness of energy-saving and environmental protection, and improve their professional skills. The influence of this project has extended from the decision-making of the operators and the production of ordinary workers to their daily life. Such awareness will be spread to the trainees' relatives and friends, and all this will promote the development of the awareness of local residents on environmental protection and energy saving.

Table 2. Training Received by Workers in Surveyed Enterprises[1]

Sectors	Titles of the enterprises	Average education received by the staff	Proportion of farm workers among the workers with secondary-level titles	Whether or not there are training programs on technical reform while this project is carried out	Major training channels	Sphere of influence imposed by those trainings on respondents
Cement	Yingde Baojiang Cement Co. Ltd., Guangdong	Junior middle school	80%	Yes	Gathering information independently; other training programs	Leaders' decision-making and staff's work
	Shenhe Cement Co. Ltd.	Junior middle school	95%	Yes	Provided by LPIC; Gathering information independently; other training programs	Leaders' decision-making and staff's work
Coking	Gaoping Xinggao Coking Co. Ltd., Shanxi	Senior middle school	65%	Yes	Gathering information independently; other means of trainings	Leader's decision-making and the behaviors of the public
Metal casting	Nanjing Moling Foundry Factory	Junior middle school and primary education	95%	Yes	Provided by LPIC; trainings from Tsinghua University and Southeastern University; gathering	Leaders' decision-making, staff's work, and the behaviors of the public

[1] Unless otherwise indicated, all the data and conclusions derive from the surveys and interviews of local areas.

					information independently	
	Nanjing Jiali Metal Products Co., Ltd.	Junior middle school	80%	Yes	Project Office, Southeastern University, and exchanges through industrial associations	Leaders' decision-making and staff's work
	Nanjing Yuhua Plant (comparison enterprise)	Junior middle school	80%	/	/	/
Bricks	Liucun Village Hollow Brick Plant in Baqiao District, Xi'an City	Junior middle school	98%	Yes	Provided by LPIC; Gathering information independently; other training programs	Leaders' decision-making, the behaviors of the public and staff's work
	Zhouling New Building Materials Co. Ltd., Xianyang City	Junior middle school	100%	Yes	Provided by LPIC; other training programs	Leaders' decision-making, the behaviors of the public and staff's work

2.2 Impacts on Employment and Income

2.2.1 Expanding the Employment

China has 730 million workers, 480 million of whom are in rural areas, accounting for 66%[2]. Since the reform and opening up to the outside world, TVEs have experienced rapid development and contributed to allocating the surplus labor force in rural areas. By 2002, TVEs have absorbed 133 million such workers, which accounts for 27% of the rural labor force and 18% of all the labor force. With the development of TVEs, the ratio of labors in agricultural sector vs labors in non-agricultural sectors changes from 9.3:0.7 to 7.3:2.7. To develop TVEs is the effective approach to promote the transition of rural labor force from agricultural sector to non-agricultural sectors, from rural areas to cities, and from farmers to urban citizens.

We can see from Table 3 that the proportion of farmer workers among the employees of the pilot enterprises is big, and more than 80% or even 100% of the employees in

[2] Zong Jinyao, Chen Jianguang, and Zhang Guoliang, *Playing Important Role of TVEs in Employment, Economic Daily*, June 3, 2003

most of the pilot/replication enterprises are farmers. This vividly reflects the role of TVEs in transferring surplus labor force in rural areas. In the interviews, we have learned that with the technical reform and the increasing mechanization in the enterprises, workers needed in a single production line have dropped. However, due to the expanding production scales and the emergency of new jobs, there are more job opportunities available for farmers in all the enterprises. For example, Yingde Baojiang Cement Co. Ltd. of Guangdong Province has 108 more posts, half of the total staff. Nanjing Moling Foundry Factory added by 100 posts, taking up 16% of the total staff. However, the comparison enterprise-Nanjing Yuhua Plant has no changes in this regard. The project has greatly promoted the development of pilot enterprises themselves, and brought in more job opportunities for local farmers.

Table 3. Basic Information on the Employees of Surveyed Enterprises

Sectors	Titles of the Enterprises	Proportion of farmer workers among the employees	Number of ordinary workers	Number of added posts after the project is carried out
Cement	Yingde Baojiang Cement Co. Ltd., Guangdong Province	80%	260	108
	Shenhe Cement Co. Ltd.	95%	652	15
Coking	Gaoping Xinggao Coking Co. Ltd., Shanxi Province	65%	300	/
Metal casting	Nanjing Moling Foundry Factory	95%	680	100
	Nanjing Jiali Metal Products Co. Ltd	80%	400	/
	Nanjing Yuhua Plant (the Comparison Enterprise)	80%	95	/
Brick	Liucun Village Hollow Brick Plant of Baqiao District, Xi'an	98%	242	80
	Zhouling New Building Materials Co. Ltd, Xianyang City	100%	200	/

2.2.2 Increasing the Income of Rural Residents

Since the reform and opening up to the outside world, the growth in TVEs has contributed a lot to the increase of rural residents' income. In recent years, TVEs has slackened its development progress, restricting the growth in the income of rural residents. In this project, pilot enterprises has raised the income of workers while making technical reforms, developing and expanding itself, thus contributing to the improvement of local residents' livelihood.

Thanks to the increasingly mechanized production in the technical reform process, the

annual average income of farmer workers in pilot TVEs has somewhat increased. This is mainly attributable to the increase of the profits due to reduced costs and upgraded quality of the products. As shown in Table 4, after the project is carried out, the surveyed TVEs increase the income of farmer workers in a larger extent. For example, the ordinary farmer workers in Shenhe Cement Co. Ltd. of Zhejiang Province earn 13,000 yuan/year on average, equal to the annual average wages of all the employees across this province and with an annual increase at over 10%. Workers in Liucun Village Hollow Brick Plant of Xi'an City work for 10 hours per day. They are paid 1000-odd yuan/month by piece work. Since brick production is seasonal, the brick plant has to recruit new workers every year and rewards those who stay long enough. For example, a worker who has already earned 10,000 yuan will get another 1,000 for reward. The comparison between the per capita income of employees in surveyed TVEs and local farmers shows that before the project is introduced, the per capita income of workers in pilot TVEs is higher than that of local rural residents in the same period (see Table 5), and so is the income growth rate after the project is carried out.

Table 4. Income of the Employees in Surveyed Enterprises

Sectors	Titles of the Enterprises	Per capita monthly income of ordinary workers (yuan)	Increase in annual income after the project is carried out (yuan)
Cement	Yingde Baojiang Cement Co. Ltd., Guangdong Province	1200	2400
	Shenhe Cement Co. Ltd.	1100	1000
Coking	Gaoping Xinggao Coking Co. Ltd., Shanxi Province	1000	200
Metal casting	Nanjing Moling Foundry Factory	1000	600
	Nanjing Jiali Metal Products Co. Ltd	1000-1500	900
	Nanjing Yuhua Plant (the Comparison Enterprise)	1200	0
Brick	Liucun Village Hollow Brick Plant of Baqiao District, Xi'an	800-1300	700
	Zhouling New Building Materials Co. Ltd, Xianyang City	1000	800

Table 5. Per capita Income of Farmers in Areas of Surveyed Enterprises before and after the Project is carried out3

[3]Sources: *Statistic Bulletin on Economic and Social Development of Xi'an City, Statistic Bulletin on Economic and Social Development of Nanjing City, Statistic Bulletin on Economic and Social Development of Zhejiang Province,*

Local areas	Per capita net income of farmers in 2000 (yuan/person)	Per capita net income of farmers in 2000 (yuan/person)	Increase in net per capita income of farmers on an annual basis (yuan/person)
Xi'an City	2344	3460	223
Nanjing City	4062	6225	432
Zhejiang Province	4254	6660	481
Guangdong Province	3654	3931	55
Shanxi Province	1906	2891	197
Shaanxi Province	1444	2052	121

2.3 Environment and Use of Land Resources

2.3.1 Improving the Working Environment

Because of limited capital investment and backward managerial approaches and technical equipment, it is common for TVEs to have problems such as poor working environment and sanitary conditions, intensive work, insufficient health guarantee, and high incidence of occupational diseases.

Thanks to this project, in particular the updating of equipment and technical transformation, workers in the surveyed pilot TVEs and replication TVEs experience mitigated work intensity and improved working environment (in particular, reductions in soot and dust)(see Table 6). Take Nanjing Moling Foundry Plant as an example, workers of this plant used to wear face masks while in work, and poor sanitary conditions and fly ash damaged the workers' health greatly. After this project is introduced, the environment of the metal casting plant was improved, and there're no feelings of illness when people are in the workshop.

Table 6. Changes in the Working Environment of the Surveyed Enterprises

Sectors	Titles of the Enterprises	Changes in the working environment after	If any, reflected in which aspects

Statistic Bulletin on Economic and Social Development of Guangdong Province, Statistic Bulletin on Economic and Social Development of Shaanxi Province

		the technical reform on saving energy	
Cement	Yingde Baojiang Cement Co. Ltd., Guangdong Province	Big	Comfortable and clean working environment, less dust, and decreased work intensity
	Shenhe Cement Co. Ltd.	Big	Reduced dust and soot, and improved sanitary conditions
Coking	Gaoping Xinggao Coking Co. Ltd., Shanxi Province	Big	Reduced dust and soot, and improved sanitary conditions
Metal casting	Nanjing Moling Foundry Factory	Big	Reduced dust (including coal dust), improved sanitary conditions, and decreased work intensity
	Nanjing Jiali Metal Products Co. Ltd	Big	Reduction in dust in the air
	Nanjing Yuhua Plant (the Comparison Enterprise)	/	/
Brick	Liucun Village Brick Plant of Baqiao District, Xi'an City	Big	Less dust and soot
	Zhouling New Building Materials Co. Ltd, Xianyang City	Big	Decrease in black smoke

2.3.2 Environmental Protection

Bricks, cement, coking and metal casting are the four leading sectors among TVEs. Such sectors are characterized with high energy consumption and high pollution, and there is a sharp conflict between the development of the enterprises and the environment. Therefore, it is the first priority of TVEs to improve energy efficiency in these four sectors and reduce the emissions of pollutants in order to achieve sustainable development.

Since the implementation of the project, pilot TVEs have discharged much fewer pollutants while cutting down energy consumption and GHG emissions.

Gaoping Xinggao Coking Plant of Shanxi Province used to utilize modified mechanical coke oven. Since this coal-coking process can produce a large amount of toxic or hazardous substances like soot, Benzo(a)pyrene, Benzene-Soluble Organics(BSO), H_2S, and SO_2, and cost a lot for environmental treatment, the process is being phased out across the world. Due to severe air pollution around this plant, the incidence of respiratory diseases is very high among local residents, and for many years no one has passed the physical test for recruiting soldiers. As the leading local enterprise, Xinggao Coking Plant has undeniable liability for the environmental pollution in the local area because of its production activity and pollutant discharge.

After the project is introduced, this plant replaced modified coke oven with clean and heat-recovery coke oven. This has not only reduced energy consumption and CO_2 emissions, but also mitigated the emissions of air pollutants. According to the field testing conducted by Shanxi Province Environmental Monitoring Station, the concentrations of SO_2, fly ash, and Benzo(a)pyrene are 75.8%, 43.6%, and five-millionth[4] that of the current national standards[5]. By now since the project is introduced, respiratory diseases in the local area turned out to be better according to local residents.

Nanjing Moling Foundry Factory improved such processes like smelting, sand making, molding, core making, cleansing, thermal treatment and processing. As a result, SO_2 emissions fell by 9% than previously, fly ash was reduced by 8% and waste sand was down by 79% (see Figure 1). Prior to this project, soot emissions from cupola, drying oven, annealing oven, shakeout machine, and sand processing technology all failed to meet the standards. However, after the project is carried out with transformations of equipment, soot emissions come up to the national standards.

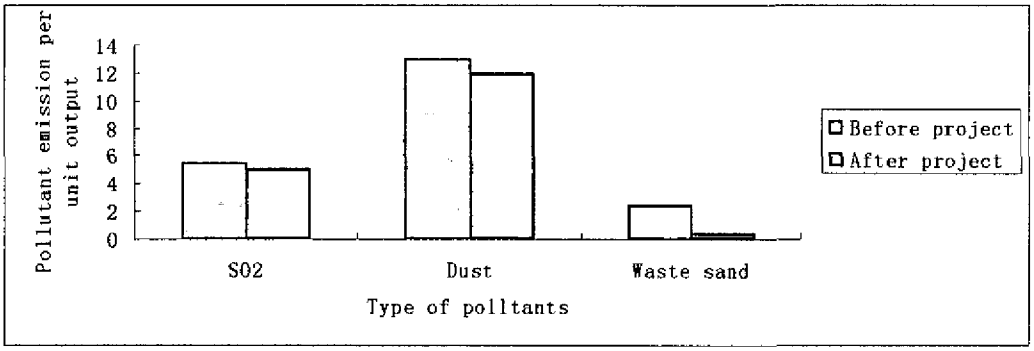

Figure 1. Pollutant Emissions of Nanjing Moling Foundry Plant before and after the Project is Introduced[6]

Liucun Village Brick Plant of Xi'an City, the pilot enterprise in brick industry, introduced technical reforms to the processing of raw materials, adobe making and baking processes. While increasing the energy efficiency of unit output and shrinking CO_2 emissions, the reform has also reduced the annual SO_2 emissions from 7,375 tons before the project was introduced to 59 tons after the project is carried out, a drop of 99.2% and a remarkable result in reducing SO_2 emissions.

The brick manufacturing enterprises in Xianyang City are mainly distributed in the outskirts, and they make the air pollutants in Xianyang City exceed the standards greatly. Xianyang is among the four cities publicized by State Environmental Protection Administration in 2003 as the cities with poorest air quality. In 2004, Xianyang city joined the project in the final phase and became one of the areas for

[4] Data sources: *Testing Report on Clean and Heat-Recovery Coke Oven*, Shanxi Province Environmental Monitoring Station, 2004.8

[5] *Standards on Air Pollutant Emissions from Coal-Coking Oven* (GB16171-1996), Grade II standards in Table 4

[6] In this figure, the unit for SO_2 and fly ash emissions is kg/t, and that for waste sand is ton/ton.

promoting technical reforms in brick industry with 14 enterprises involved. Since the project was introduced, air pollutants like SO_2 have fallen dramatically in Xianyang City, and the air quality has turned much better.

In 2004, Yingde Baojiang Cement Co. Ltd. established the new-type dry rotary kiln production line that mainly burned blind coal to replace the original two vertical kiln production lines. Since the new production line is operated, not only energy consumption and GHG emissions have dropped significantly, but also major pollutants have been emitted much fewer (see Figure 2). In particular, SO_2 emissions have fallen dramatically, only 40% of those prior to this project. The results of technical reform in Yingde Baojiang Cement Co. Ltd. can be used as a reference to reducing energy and pollutant emissions in similar SO_2 discharging enterprises of the two-controlled zones.

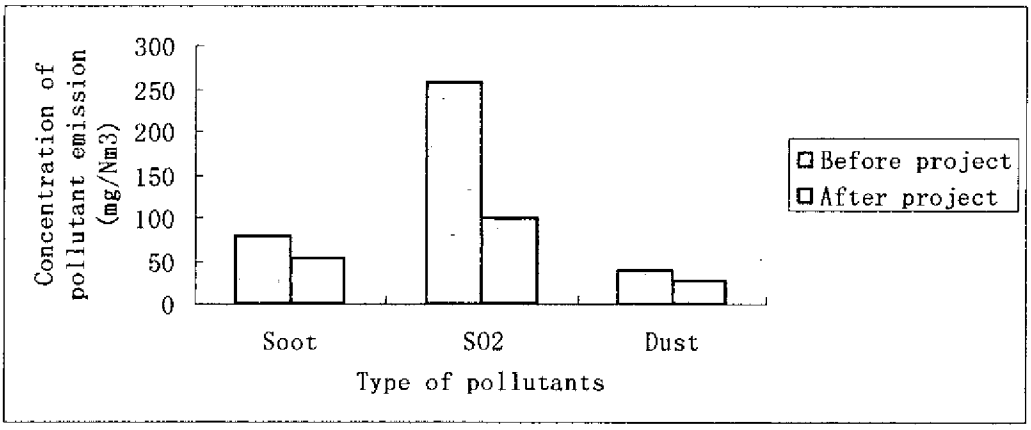

Figure 2. Pollutant Emissions of Yingde Baojiang Cement Co. Ltd. before and after the Project is Introduced

It is obvious that the project has enabled pollutant emissions from pilot enterprises much fewer, alleviated the environmental pollution and damages in local areas, and improved the environmental quality.

2.3.3 Use of Land Resources

There's a sharp conflict between a large population and fewer land resources. Nearly 10 million *mu* of arable land disappears every year because of soil and water erosion, and land used for construction and production purposes. However, up to 950,000 *mu* of arable land is used up by solid clay brick on a yearly basis. In recent years, the Administrative Office of the State Council, ministries, and local governments have repeated their orders to phase out solid clay brick.

The technology, which is promoted in brick industry to produce hollow bricks with alternative materials, cuts down the consumption of clay. Pilot TVEs in some of the local areas use an artificial approach to dry brick body. In this approach, the kilns are

more airproof, and the residue heat in them can be used to dry the brick. This practice has improved the energy efficiency, shortened the drying time, and also shrunk the area of land used to dry bricks.

In terms of raw materials, Yongxing Shale Hollow Brick Plant of Sichuan Province uses local shale that is less plastic, with low water content and large rigidity. Such shale can produce high-quality bricks with void space more than 50%, and thus directly control the damages to land resources from brick plants. Liucun Village of Baqiao District in Xi'an City and the replication enterprises for technical reform in the brick industry of Xianyang City use the raw materials mixed by industrial residues with clay to replace the former clay materials in making hollow bricks. This practice reduces the use of clay and also decreases the land used to stack industrial residues. The change from natural drying to artificial drying process also cuts down the area used for bricks in brick plants.

2.4 The Disadvantaged Group and Social Security System

2.4.1 Raise the social status of women, and improve the welfare of disadvantaged group

Women's social status is an indicator to assess the civilization of the social system. The emergence and expansion of TVEs may create more job opportunities for women to walk out of the family and get to work, so that women may have the chance to secure economic status on an equal footing. This plays a positive role in improving the social status of women in local areas. The evaluation reveals that working conditions are tough in pilot TVEs (such as in brick and metal casting sectors) with too much work, so the jobs have higher requirements for workers' physical conditions and are not suitable for women, however, according to the data (see Table 7), there're certain number of women working in pilot TVEs and they are engaged in technical and supporting jobs with little labor intensity, such as financing and accounting, logistics, testing, and computer control. Women workers accounts for 50%-60% in the pilot TVEs in brick sector of Xi'an and Xianyang City. When we came to visit the computer control room in Shenhe Cement Co. Ltd. of Zhejiang Province, we found four technicians, including one women technician who was supervising the operating conditions of cement equipment by the computer. With the development of the enterprises, women workers will have more possible job opportunities.

Table 7. Posts of Women Workers and Disabled Workers in Surveyed Enterprises

Sectors	Titles of the Enterprises	If there was any women worker	Main work	Whether or not women workers will increase after the project is carried out	If so, possible added posts	Whether or not posts for disabled persons will increase after the project is implemented
Cement	Yingde Baojiang Cement Co. Ltd., Guangdong Province	Yes, but few	Laboratory, logistics, and loadometer	Yes	Laboratory, logistics, loadometer, total step-down transformer station	No
	Shenhe Cement Co. Ltd.	Many	Logistics, testing	Yes	Control room, etc.	Possible
Coking	Gaoping Xinggao Coking Co. Ltd., Shanxi Province	Yes, but few	Financing	Yes	Cashiers, testing staff, technical staff in power plants	No
Metal casting	Nanjing Moling Foundry Factory	Yes, about 30%	Drivers	Yes	Mechanical operation, computer control room	Yes
	Nanjing Jiali Metal Products Co. Ltd	Yes, about 1/3	/	Possible	/	Possible
	Nanjing Yuhua Plant (the Comparison Enterprise)	/	/	/	/	/
Brick	Liucun Village Brick Plant of Baqiao District, Xi'an City	Many, about 50-60%	Semi-finished products, assistant work	Rarely	/	Possible
	Zhouling New Building Materials Co. Ltd, Xianyang City	Many	Semi-finished products	Rarely	/	Possible

With the deepening technical reform in enterprises, jobs are less intense and difficulty than before. At the same time, new jobs are created, which provides possible job opportunities for disables persons and plays a positive role in enabling the enterprises

to improve the social welfare of disadvantaged group and in safeguarding the social stability and unity. For example, Nanjing Moling Foundry Factory is a welfare enterprise which provides job opportunities for 196 disabled persons in rural areas.

2.4.2 Promote the establishment of rural social security system

The social security system in rural areas is in a first-phase stage, and most of the rural residents have no access to endowment insurance, medical insurance, or unemployment insurance. We have found from the surveyed pilot TVEs that some of the enterprises in East China begin to purchase insurances more or less for their employees. This can drive other enterprises to make progress in this regard, and play an important role in promoting the establishment of social security system in rural areas.

As shown in Table 8, the pilot TVEs in East China are better in providing social security for their employees. For example, workers in Shenhe Cement Co. Ltd. have endowment insurances, medical insurances, and unemployment insurances. Nanjing Moling Foundry Factory and Nanjing Jiali Metal Products Co. Ltd. have bought some insurance for their workers. However, Pilot TVEs in Western China need to improve the social security for their employees, because the employees there do not have any of the medical, endowment or unemployment insurance. Among others, Liucun Village Hollow Brick Factory of Xi'an only buys commercial insurance for workers who are engaged in dangerous jobs.

Table 8. Social Insurances of Employees in Surveyed Enterprises

Sectors	Titles of the Enterprises	Whether the employees have medical insurance or not	Whether the employees have endowment insurance or not	Whether the employees have unemployment insurance or not
Cement	Yingde Baojiang Cement Co. Ltd., Guangdong Province	Yes	Yes	No
	Shenhe Cement Co. Ltd.	Yes	Yes	Yes
Coking	Gaoping Xinggao Coking Co. Ltd., Shanxi Province	Yes	Yes	Yes
Metal casting	Nanjing Moling Foundry Factory	No	Yes	No
	Nanjing Jiali Metal Products Co. Ltd	No	Yes	Yes
	Nanjing Yuhua Plant (the Control Enterprise)	No	No	No
Brick	Liucun Village Brick Plant of Baqiao District, Xi'an City	No	No	No
	Zhouling New Building Materials Co. Ltd, Xianyang City	No	No	No

3. Conclusions and Recommendations

Pilot TVEs are all successful in carrying out the technical reforms for energy saving, and the social influence of the technical reforms far exceeds what is originally expected, resulting in far-reaching social impacts and more extensive social benefits.

1. Apart from fostering the concepts of workers in pilot and replication TVEs on environmental protection and energy saving, and improving relevant technical capacity, the training program provided by this project also imposes strong impacts on the establishment and development of the environmental awareness of the public in local areas.

2. The project helps the enterprises to find ways to save energy, reduce energy consumption, and improve the benefits. Besides, by promoting the development of pilot TVEs, the project also expands the employment of surplus labor force in local rural areas, increases the revenues of local rural residents, and enables the TVEs to play a more important role in the urbanization process of local areas.

3. While the technical reform is carried out, the project also helps improve the working conditions, promotes the improvement of local environmental quality and rational use of resources, helps pilot TVEs to release from the restraints of environmental protection, and has a far-reaching influence on pushing the TVEs to follow the path towards sustainable development.

4. While the project is implemented, surveyed enterprises create more jobs suitable for women and disabled people. This has a positive influence on raising women's the social status in local areas and is favorable for improving the welfare of disadvantaged groups and for safeguarding the stability and unity of local communities.

5. During their development process, pilot TVEs begin to pay attention to the welfare and social security of their employees, and some of the enterprises have popularized the three kinds of insurances (pension, medical and unemployment insurances). Such trends will gradually promote the establishment of social security system in rural areas.

All in all, this project has provided a scientific approach for TVEs to improve their self-development capacity and to follow the path towards sustainable development. It is hoped that follow-up projects can better utilize the established network for mutual contacts, further spread the means of interactions among government, industrial associations and enterprises as in this project, so as to bring about more social benefits.

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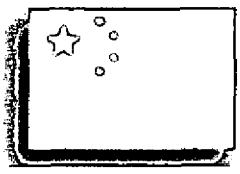

Energy Conservation and GHG Emissions Reduction in Chinese TVEs

– Phase II – Project Impact Evaluation

(EG/CPR/99/G31)

Sub-Report on the Evaluation of the Impact on Macro-Policy

March 2007

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CONTENTS

1. Background Information

The Energy Conservation and GHG Emissions Reduction in Chinese Township and Village Enterprises – Phase II project (the TVE project) is a cooperation project targeting the four energy-intensive and heavily-polluting sectors of brick-making, cement, metal casting and coking in the Chinese township and village enterprises (TVEs) under the joint efforts of Ministry of Agriculture (MOA), UNDP and GEF. With the practice of mechanism innovation and demonstrational programs, the aim of the TVE project is to promote the adoption of forefront and cost-effective energy conservation technologies in the above four sectors in a bid to reduce the energy consumption volume and reduce the GHG emissions of TVEs, eliminate the major market, policy, technology and financing obstacles in the production, sales and utilization of energy efficient technologies and products in these four industries and to enhance the county-level economic development and environmental betterment. The project is funded by GEF, organized and implemented by UNDP and executed by UNIDO and MOA. The implementation time period of the project is from June of 2001 till December of 2001.

This project is initiated against the backdrop that Chinese TVEs have contributed substantially to the fast economic growth and the elevation of social welfare of China during the past two decades or so, but their extensive production pattern and relatively backward production techniques have caused grave environmental problems to their localities and even the whole nation.

The Phase II of the TVE project is to be completed by the end of 2006, the Task Force from the School of Environment & Natural Resources of Renmin University is entrusted to make the evaluation of the implementation situation of the project. This sub-report is the independent evaluation of the impact on macro-policy during the entire implementation of the TVE project as well as the tentative and necessary directional proposal on possible follow-up projects of the same kind in the future.

2. Objective and Significance of the Evaluation

The Phase II of the TVE project stretches over 6 years, and the initial designing of the project doesn't expect its direct promotion of the progress of related polices. However, during the implementation process of the project, the macro-economic policy scenario of China has undertaken prominent change as the central and local governments began to actively advocate the notions of scientific development outlook, the practice of circular economy, establishing a resource-saving and environmentally-friendly society. China has speeded up the pace of technological advancement, intensified management over energy conservation, stimulated economic restructuring and

transformed the economic growth mode amid its efforts to fulfill the sustainable social and economic development. Against such a background, the evaluation of the impact of the design and implementation of the project on macro-policy as well as the evaluation of whether the project is conducive to getting over related policy obstacles can facilitate the thorough understanding o the significance of the project and the recognition of the achievements of the project in a right way, and is of great help for providing important experience to the design and implementation of future projects so as to guarantee clearer aims in the design of future projects.

3. Methodology of the Evaluation

With reference to the standard method of policy evaluation of UNDP and GEF, we first established the logic framework of the evaluation and then constructed the secondary index system suitable for the policy impact evaluation of the project. Finally, we made multiple case evaluation analysis by employing the method of case study coupled with a set index system based on the review of the evolvement of China's energy policies.

3.1 The Logic Framework of the Evaluation

This report first reviews the changing process of the energy conservation policies of China over times; second, it analyzes the impact of related macro-policies on the TVE project; third, it elaborates the impact of the project on macro-policy according to the designing and the entire implementation process of the project. After that, the evaluator expounds some of the enlightenment of the implementation of the project, namely the best practices during the implementation process of the project as well as the defects of existing policies, laws and regulations in increasing energy efficiency among enterprises. Finally, the report puts forward some tentative proposals and viewpoints on the designing of future follow-up projects.

The theoretical foundation of this evaluation report is the policy science theory. According to this theory, the period of policy is mainly divided into three stages of policy formulation, policy execution and policy feedback (see Figure 1). The policy maker defines the policy objectives based on the macro-situation and development targets and formulates the policy following the competition of various policy stakeholders. Then the policy executor executes the policy in line with the requirements of the policy as well as the actual local conditions. Finally, the evaluator incorporates the policy evaluation, policy monitoring and policy conclusion into the policy feedback stage. The effect of the implementation of the policy should be fed back to the policy formulator and policy executor as crucial bases for policy revision or laying down new policies as well as the improvement of policy execution pattern (e.g. the heightening of efforts in policy execution).

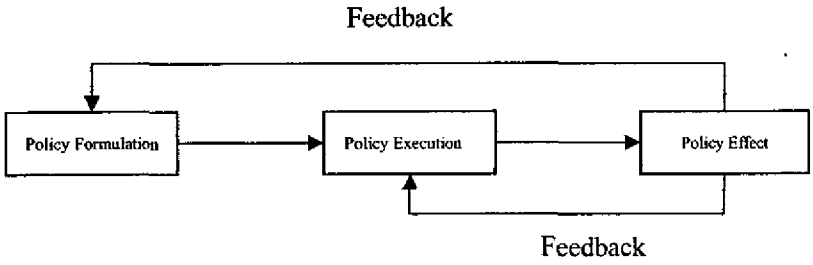

Figure 1. Diagram of the Policy Period

Here, the evaluator defines the impact of the project on macro-policy as well as its working mechanism from the establishment of the connection between micro projects and macro policies from the three aspects involved in the policy (namely the policy formulation, execution and feedback) based on the analysis of the impact on the stakeholders of the project (see Figure 2).

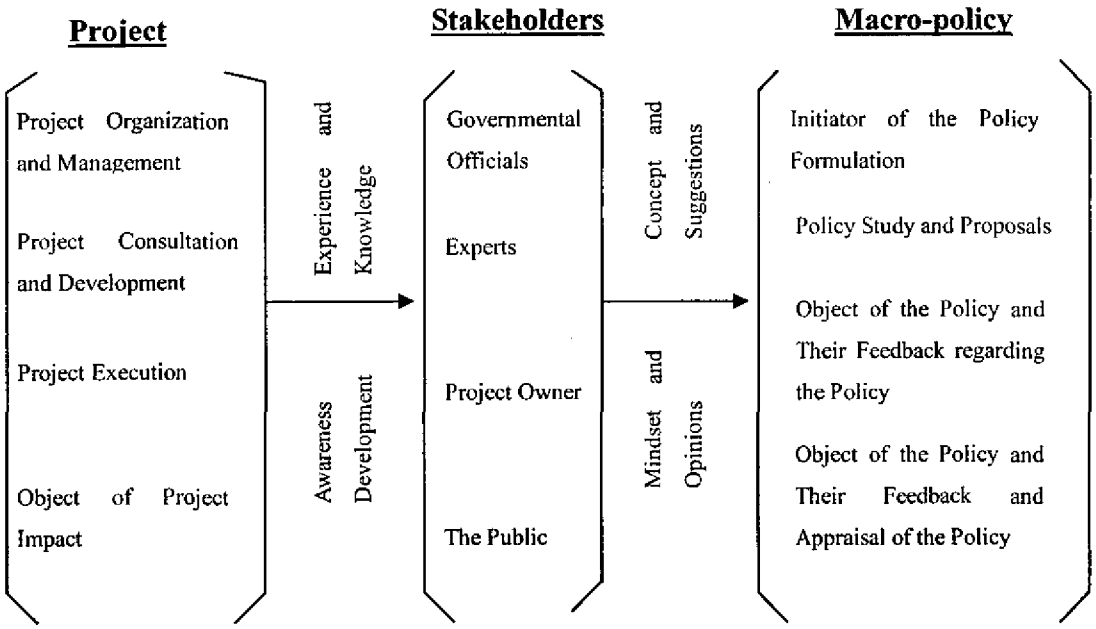

Figure 2 The Analysis Framework of the Project Impact on Macro-policy

3.2 The Index System of the Evaluation

With reference to the index system, policy life cycle theory applied in policy evaluation of UNDP and GEF combing the specific situation of this project, we have set up the two-layered index system for the impact evaluation of this project on macro-policy (see Figure 3). This index system is mainly composed of two qualitative indices, i.e. the impact of the project on policy formulation and on policy materialization. The former mainly includes the impact on the formulation of national macro-policy, the impact on the formulation of related industrial policies and related standards, while the latter is to respectively evaluate the project impact on the materialization of existing environmental and energy policies (such as the

enforcement of preferential policies and bans) and the application and promotion situation of Voluntary Agreement (VA).

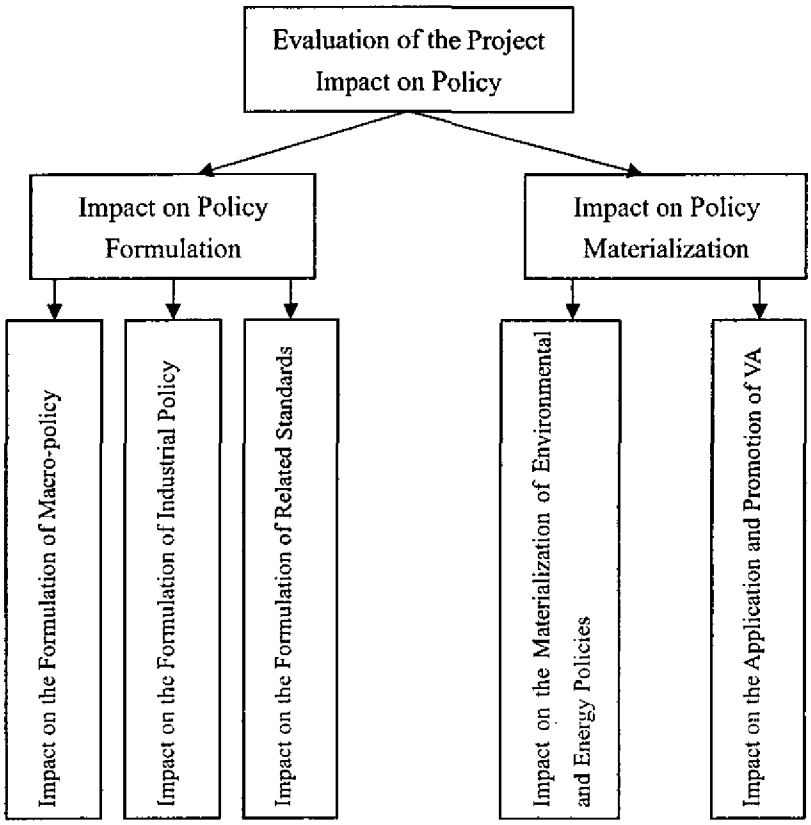

Figure 3 The Index System of the Evaluation of the Project Impact on Policy

3.3 Specific Approaches for the Evaluation

Regarding this specific project, the stakeholders relating to macro-policies can be classified as three types of governmental officials (including the members of PIC and LPIC), enterprises (demonstrational and promotional enterprises and enterprise associations) and experts from related science and technology research institutions. Based on the analysis and study of related literatures concerning this project combined with the four cases of the four sectors involved in the project as per their respective progress, we employ the approach of case study and the preset policy evaluation index system to conduct multiple case studies and explore the impact of the project on various stakeholders as well as the consequent impact on policy decision making, execution and feedback. Besides, in an effort to deepen the right understanding of this project and improve the objectiveness of the policy evaluation, we have launched on-the-site research of some demonstrational and promotional enterprises (including Nanjing Moling Foundry Corp., Zhejiang Shenhe Cement Co. Ltd, Shaanxi Xi'an Baqiaoqu Liucun Hollow Brick Plant and Sichuan Xinjing Yongxing Shale Hollow Brick Co. Ltd.) and held in-depth interviews with relevant stakeholders.

4. China's Macro-policies on Energy and the Environment

4.1 Background of the Macro-economy

Ever since late 1970's, the social and economic scenario of China has witnessed rapid and stable growth. During the period of 1978~2005, China's GDP grew at an average annual rate of 9.73%, while at the same time, the consumption volume of primary energy surged from 520 million tons of coal equivalent in 1978 to 2.22 billion tons of coal equivalent in 2005. Out of all the components of the primary energy consumption in China, coal has long been taking the predominant position. In 2005, coal takes up around 68.7% of the total consumption volume of primary energy while petroleum and gas combined account for 24%. Such a fossil fuel based energy consumption structure forces China to face ever-worsening environmental problems along with its continuous blistering economic growth. At present, China is the largest country in the world in terms of SO_2 emissions and the second largest of CO_2.

The Chinese government has already realized that the current high economic growth rate is achieved at the cost of high input and consumption of energy and other resources and large-scale and severe environmental pollution, and such an extensive development mode is rather unsustainable. The economic development target of "GDP of 2000 quadrupling that of 2020", the social development target of building a well-off society in an all-round way and the human development target of realizing sustainable development set down in the Report of the 16th National Congress of the Communist Party of China held in 2002 all pose grave challenges to the current ever-strained energy supply security and rather vulnerable ecological system in China.

Along with the successive advocating of sustainable development, scientific development outlook, circular economy, the construction of resource-saving and environmentally-friendly society and harmonious society, it's not so hard for us to grasp the development trend of macro-policies of the Chinese government, i.e. we should stick to the guideline of paying equal attention to resource development and conservation while giving top priority to conservation, focus our work around the center of the fundamental transformation of economic growth mode and make improvement in resource efficiency our key task.

4.2 Review of Energy Conservation Policies

China's energy conservation policies have experienced three major stages along with the ever-deepening economic and political structural reform during the 20-odd years ever since the practice of the reform and opening up policy:

During the first stage, the Chinese government under planned economy has the absolute domination of energy conservation management work through administrative orders possibly overstepping its authority. At the early period of the reform and opening up policy in 1980's, the State Council has defined the guideline of "paying equal attention to development and conservation and giving priority to conservation in the near future" for guiding the energy works of China. After that, the system of Energy Conservation Work Meeting of the State Council was established to incorporate energy conservation into national economic planning, special fund was appropriated for energy conservation, and a string of incentive policies were laid down on taxation preference and low-interest loans. During this stage, the energy conservation policies were mainly released in the form of administrative orders such as the five energy conservation orders issued by the State Council on reducing fuel oil, saving electricity, saving petroleum and saving coal during the period of 1980~1982.

During the second stage of the transitional period from planned economy to market economy, the government somewhat omitted or was devoid of its management authority over energy conservation. During this period, the Chinese government gradually stepped up the legislation on energy conservation policies as well as the formulation of energy conservation standards and energy conservation designing specifications. However, due to the cancellation of the then Ministry of Energy in 1992, China has so far been in lack of an independent central governmental department to take charge of energy policy and management affairs. In this connection, the role of the central government had been weakened in energy conservation management during this stage, and the immature market mechanism cannot well exert its function in this field where market mechanism has never worked well previously either.

During the third stage, the government is gradually restoring its just position with the initial establishment and gradual perfection of the market mechanism, and its predominant function in the energy conservation management system is progressively awakened. The government exerts little administrative interfefence in the specific ways and methods enterprises choose to launch their energy conservation promotion moves, while regarding related measures, it spontaneously advances the work from multiple layers of compulsory orders, incentive measures, consultation service provision and conclusion of agreements with enterprises. As for the contents of the management, the government focuses its attention mainly on the two "sources" of terminal energy-intensive equipment and designing specification and supports the implementation of energy conservation projects and the research, development and promotion and application of energy conservation related technologies through public budgeting. It also establishes the statistical index system, pays great attention to the collection and release of related data and information and properly handles the rudimental works on energy conservation.

To sum up, the existing system of policies and laws has already built up a solid

foundation for the energy conservation work in China to a certain extent. For instance, the *Energy Conservation Law of the People's Republic of China* having taken effect on January of 1998 has played a rather vital role in enhancing energy conservation across the whole society, improving energy efficiency and advancing economic development, while the *Law of the People's Republic of China on the Promotion of Clean Production* enacted in June of 2002 and taking effect in January of 2003 has offered a new mechanism for the work of energy conservation. By the end of 2002, China had already enacted 25 laws and regulations, 27 designing specifications and nearly 100 standards on energy conservation at the state level covering almost all social and economic activities including industries, agriculture, communications and transport and urban constructions, hence further offering real legal basis for the enforcement and materialization of various policies on energy conservation.

Meanwhile, the Chinese government also enacted a series of planning and related decisions in succession to support the implementation of the state-level resource policies and strategies and to vigorously enhance the energy conservation work and improve energy efficiency. In November of 2004, the National Development and Reform Commission (NDRC) released its first *Medium and Long-term Special Plan of Energy Conservation of China*. In the *Outline of National Plan for Medium to Long-term Scientific and Technological Development* released by the State Council in February of 2006, energy conservation and consumption reduction as well as clean energy sources have already become the key points in future energy policy development in the medium and long-term. According to the *Guidelines of the 11th Five-Year Plan for National Economic and Social Development of China* adopted at the beginning of 2006, the energy consumption per unit GDP of China is to be reduced around 20% in the next five years, the first time that the central government includes energy consumption index into national development targets. What's more, the State Council also issued the *Decision on Strengthening Energy Saving Tasks From the State Department* in August of 2006 as part of the efforts to mobilize all social sectors to take actions in strengthening energy conservation.

4.3 Comments on Energy Conservation Policies

After over 20 years' development progress, the energy conservation work of China has gained great achievements and contributed greatly to ensuring the continuous fast growth of national economy. The first achievement is the drastic drop in energy consumption volume per unit GDP, plummeting from 7.89 tons of coal equivalent/ten thousand yuan in 1980 to 2.86 tons of coal equivalent/ten thousand yuan in 2000. The second is the huge economic profits reaped in energy conservation. During the period of 1981~2000, an accumulated total amount of energy equaling 1.145 billion tons of coal equivalent had been conserved or spared, equaling 1.0825 trillion yuan (in the energy price of 1997). In addition, energy conservation has done very much good to the protection of eco-environment. In specific, the accumulated total amount of energy that had been saved or spared during the period of 1981~2000 equals to the

reduction of 722 million tons of carbon emissions.

At the same time, we found that there are quite a number of obstacles in the current energy conservation management system, which has hindered the effective implementation of many energy conservation policies and measures. These obstacles mainly find their expressions in the following aspects:

The first is the mindset of energy conservation. The concept of energy conservation in developed countries has already transformed from the practice of energy saving and reduction in early 1970's to cope with energy crisis to the targets of raising efficiency, decreasing pollution and improving living standards. However, in China, the concept of making ends meet and energy consumption reduction is still quite prevalent.

The second is concerning the government on energy conservation management. The role of energy conservation management organs has been apparently weakened in the reform of department restructuring within the Chinese government.

The third is regarding related policies, laws and regulations. For example, the *Energy Conservation Law of the People's Republic of China* is not well enforced, lacking practical and fair energy efficiency standards.

The fourth is supporting economic incentives. Ever since the fiscal system reform in 1994, the incentive measures such as tax reduction and exemption and preferential loans performed on energy conservation projects and products have been remarkably lessened and even cancelled.

The fifth is technological advancement. The input on the research and development of energy conservation technologies is far from enough, the quality of energy conservation equipment is very poor, and some key technologies and equipment rely heavily on import.

The sixth is concerning information services. There is large room of improvement in the work of public campaign activities and energy statistics in this regard.

In a word, the energy conservation work of China still has many weak links presently and awaits the forming of a sound management system. The Chinese government should beef up its leading position in energy conservation, build up the mechanism and management system securing the top priority on the conservation and highly-efficient utilization of energy, pinpoint the target of energy conservation policies, lay down special economic incentive policies on energy conservation in line with the market economic rules and upgrade the efforts in drafting energy efficiency standard, energy conservation certification and related labeling systems.

Under the current macro-economic background, this TVE project has tried its utmost

to remove various policy obstacles during its implementation process via mechanism innovation and technological demonstration to ensure its smooth completion. Actually, various local governments have also intensified their efforts in implementing national policies, laws and regulations through the practice of the project, thus advancing the formulation, enforcement and implementation of local policies and regulations in conformity with basic guidelines and principles of the central government.

5. Evaluation of Macro-policy Impact on the Project

The macro economic and policy environment is the basis for the design and execution of the project. Generally speaking, the project must comply with existing policies, laws and regulations of various levels, which serves as the prerequisite for the smooth implementation and objective fulfillment of the project. Should the design of a project be inadaptable to or run counter to current policies, laws, regulations and rules, the implementation and the targets realization of the project will be ridden by variables or even become impossible since related policies are compulsory. In other words, state-level and local macro policies can exert direct and evident impact on the project.

This TVE project on energy conservation and emission reduction conforms to the trend of national macro-policies and is in accordance with the package of notions including scientific development outlook, circular economy, clean production and the establishment of resource-saving and environmentally-friendly society presently being energetically advocated by the central government for the promotion of sustainable social and economic development, therefore, it has won the full support of both the central and local government as well as various demonstrational and promotional enterprises, which all guarantee the successful implementation of the project.

6. Analysis of the Project Impact on Macro-policy

Objectively speaking, the initial design of the project stipulates no requirements on the direct impact on macro-policy from the implementation of the project. However, we are quite certain that the implementation of the project has exerted a subtle influence on macro-policy to a certain level, which has more been felt from the positive impacts on macro-policies through the changes in the awareness or the decision-making behavior of various stakeholders. All the participants of the project, both enterprises and governments at various levels, have truly understood the economic and environmental benefits of energy conservation. What's more, by conducting great amount of on-the-site investigation, we have proven that the influence exerted by the implementation of this project is much greater on local macro-policies than that on the national macro-policies.

Since the visualization of the impact of project implementation on macro-policy is to be realized after a certain period of time, the results gained from the impact evaluation of the project on macro-policy conducted prior to the completion of the project will surely be inadequate. However, we still believe that the preliminary analysis made here would of help to further understand this issue in the future.

We first hammer out the mechanism through which this project is exerting impact on macro-policy, and then conduct induction and analysis of the project impact on macro-policy from the three stages (formulation, execution and feedback) of the policy period involved in the project impact on macro-policy.

One thing deserve our special attention is that the project impact on macro-policy is the outcome of the comprehensive operation of various impact mechanisms with quite a number of them being potential. To this end, it would be quite hard to say that the issuance of a certain policy or the intensified implementation of a certain policy is the result of the operation of a particular impact mechanism.

6.1 The Impact Mechanism

Judged from an objective perspective, the impact of a single project on macro-policy that can be observed within a rather short time period is very limited. Nevertheless, the stakeholders of this project that are also the subject of the project impact cover a wide range of social strata thanks to the designing of a sound implementation mechanism of this project, the establishment of the Policy Implementation Committee (PLC) both at the central and the local level, the diversification of the members of the PIC and the LPIC including both governmental officials and technical supporting organizations and industrial associations. In general, the stakeholders of the project found the connection point of their daily work and the project by participating in the implementation of the project and elevated their awareness of energy efficiency and environmental protection, thus enabling the project to play certain level of impact on macro-policy. In specific, the mechanism through which the project is exerting impact on macro-policy via its stakeholders is working through the following five aspects: policy reference, awareness improvement, interactive effect, brand effect and the change in administrative work pattern.

◆ **Policy reference**

The implementation of the project demonstrates to local governmental officials and entrepreneurs the interrelationship between the initiation of energy conservation and environmental protection activities as well as its considerable economic benefits in a direct way. Such a move has provided sound reference for local governmental officials in mapping out well-targeted energy efficiency improvement and environmental protection policies while accommodating for their specific local conditions.

Case 1. The Project Management Office (PMO) from MOA organized related personnel to initiate the first ever systematic nationwide survey over the energy consumption situation of TVEs since 1984 in the four sectors of cement, foundry, coking and brick making as the leadup for the launching of this TVE project. As a result, the survey has built up a solid foundation for drafting the *"Ten-Year" Plan on Energy Development of Township-Village Enterprises* by the MOA.

Case 2. The Xi'an Research and Design Institute of Wall & Roof Materials has already embarked on the formulation of the national energy efficiency standard for the brick making industry based on the substantial achievements made through the energy conservation technological transformation among the demonstrational and promotional enterprises in the brick making sector.

Case 3. As one of the demonstrational enterprises of the Nanjing Moling Foundry Corp. has reaped sound benefits in the area of energy conservation and environmental protection, it has already become a real example in the eyes of local decision makers. What's more, the threshold of whether other enterprises can pay the same attention on energy conservation and environmental protection as it has done has already become one of the unwritten criteria in deciding whether they can enter the development zone.

◆ **Awareness improvement**

The on-the-site survey has found that local policy makers and executors have undergone obvious change in their awareness with both recognizing the importance of energy conservation and environmental protection. This achievement should first be attributed to the central government's strong efforts in calling for the dissemination of such notions as scientific development outlook, circular economy and the establishment of a resource-saving and environmentally-friendly society. In particular, this project has translated all these notions into the real actions of energy conservation and emissions reduction against such a macro backdrop.

◆ **Interactive effect**

Through the establishment of LPIC, the project is implemented based on the full exchange and interaction between governmental officials and entrepreneurs, which guarantees not only the project accommodating to the local conditions but also the active cooperation of enterprises. More importantly, it heightens the mutual trust and understanding between enterprises and the government. Besides, the exchange between local and central governmental officials among the implementation process of the project is also conducive to the spread of local successful experience across the whole country. Based on this, the entrepreneurs are able to participate in the policy making process, while governmental officials are also able to take the development of enterprises into consideration in laying down related policies, and the policies, therefore, are more readily to win support of enterprises.

◆ **Brand effect**

Both the participating enterprises and governmental officials attach great importance to the project and think that the implementation of the project can facilitate the setup of sound environmental and social image of the enterprises and are also conducive to lift the image of their locality. Both the demonstrational and promotional enterprises highly value the badge issued by the PMO proving that the enterprise has participated in the GEP project executed by UNDP. Additionally, the participating enterprises of the project can always have priority in seeking support from related governmental departments and have the advantages of sound credit standing in the application for fund support from financial institutions.

Case 4. During the implementation period of the TVE project, the land-leasing contract of one of the demonstrational enterprise of Xi'an Baqiao District Liucun Hollow Brick Plant expired. Since this project is a GEF project executed by the UNDP, the Baqiao District Government of Xi'an paid great attention to this issue and has released a special document to support the renewal of the land-leasing contract of the brick making enterprise for another ten-year period.

◆ **Change in administrative work pattern**

During the implementation process of the project, various local governments have incorporated the work concerning this project into their daily administrative affairs and thus scaled up their governance capability. The project has also promoted local governments to focus their attention more on the provision of instruction on policy, laws and regulations during their work and worked hard to coordinate and tide over various obstacles encountered in policy execution and the development of enterprises based on the LPIC mechanism. With all these change in the administrative work pattern, the governance capability of local governments has been improved while the effect of administration has been noticeably perfected.

6.2 Project Impact on Policy Formulation

The successful implementation of the project has built up the foundation for the formulation and development of energy conservation regulations both at the national and local level and brought about positive promotion effect at the local level in particular. Combined with the related cases and evaluation index of the project, we have depicted the specific project impact on policy formulation as follows:

➢ **Impact on the formulation of macro-policy**

One of the demonstrational enterprises of the project, Zhejiang Shenhe Cement Co. Ltd. made the success of power generation from cement kiln waste gas heat by employing the new dry process production technology (5-level cyclonic pre-heater) of low temperature waste heat power generation in rotary kiln in March of 2005, marking the first of its kind within Zhejiang Province and even the whole country. By this, Zhejiang Economic and Trade Commission has included this technology into its *Guiding Catalogue of Electricity Conservation Technologies and Products for*

Promotion in Zhejiang Province (Group 1) (released in July of 2005). In the same year, the Zhejiang Economic and Trade Commission issued related promotional preferential policies concerning this demonstrational technology like the exemption of power grid access fee and streamlined examination and approval procedures. The *Medium and Long-term Special Plan of Energy Conservation of China* has also listed the low temperature waste heat power generation technology in its *Recommended Technologies for Adoption in Key Energy Conservation Projects*.

- **Impact on the formulation of industrial policy**

The technique of clean heat recovery coke oven & waste heat power generation adopted by one of the demonstrational enterprises of the Shanxi Gaoping Xinggao Coal and Coke Group has yielded sound social, economic and environmental benefits, which has attracted high attention of the central government and related departments of Shanxi Province. Presently, the technique has been included in the National Project of Two Highs and One New (high-level technology, high added-value and new materials) and also in the key technologies for promotion in the coke industry by the Shanxi Provincial Government.

- **Impact on the formulation of related energy efficiency standards**

Regarding the brick making industry, the successful application of the energy-saving three-centered arch kiln technology in the demonstrational and promotional enterprises has not only stimulated the development of energy-saving building materials in these regions and the prompt release of the policy regarding the ban over the use of solid brick, but also propelled the development of the *National Standard of Kiln for Firing Brick and Tile (JC982-2005)*.

6.3 Project Impact on Policy Execution

During the implementation of the project, LPIC has played an instructive and coordination role, thus ensuring the support of local government to the technological transformation of TVEs. This project has had the promotional effect on the implementation and enforcement of national and local macro-policies and boosted the initiatives of enterprises in energy conservation and energy consumption reduction as well as the materialization of environmental protection policies of local governments through the combination of energy conservation and environmental protection. Meanwhile, the project takes the initiative of ushering in the mechanism of VA on energy conservation in TVEs, transforming the passive energy conservation behavior of enterprises under governmental administration to spontaneous energy conservation moves out of the motivation of fulfilling their corporate social responsibilities. In this way, innovation has been made in the administration pattern of the government, the environmental protection awareness of enterprises has also been elevated and the enthusiasm of enterprises in energy conservation has been mobilized.

■ **Impact on the materialization of environmental and energy policies**

The cement industry: the demonstrational enterprises have augmented the economic turnover of the new dry process production based rotary kiln with the successful application of the technology of low temperature waste heat power generation. The move has ignited the interest of enterprises to transform from shaft kiln to rotary kiln, conducive to the realization of policy objective for the closedown of all shaft kilns by the end of 2007 within Zhejiang Province.

The brick making industry: the accomplishment of the energy conservation technological transformation at the two demonstrational enterprises of Sichuan Xinjing Yongxing Shale Hollow Brick Making Co. Ltd. and Xi'an Baqiaoqu Liucun Hollow Brick Plant in Shaanxi Province as well as other sixty promotional enterprises engaged in the brick making industry has effectively upgraded the competitive edge of local products of Hollow Bricks in the market and stimulated the materialization of national and local policies on the ban of solid clay brick and the active initiation of related energy conservation works in the building industry.

The foundry industry: the establishment of the Industrial Self-disciplined Association under the joint initiation of the demonstrational enterprise of Nanjing Moling Foundry Corp. and other local promotional enterprises has positively played an active role in coordinating the relationship between the industry and the government and materializing related national policies including the one of "collection first, abatement after" for the value-added tax on casting and forging products jointly issued by the Ministry of Finance and State Taxation Administration to a certain degree.

The coking industry: the project has advanced the materialization of the national policy on phasing out outdated coking techniques within the demonstrational and promotional areas.

■ **The application and spread of VA**

Presently, VA is internationally the most widely applied non-compulsory energy conservation and emission reduction measure, which can effectively complement the deficiencies of administrative approaches. By promoting the mechanism of VA on energy efficiency, the project has enabled local governments to translate policy targets into the self-initiated will and voluntary actions of enterprises, thus mobilizing their enthusiasm in energy conservation technological transformation and ensuring the smooth implementation of this project in various enterprises. This new type of interactive relationship between the government and enterprises facilitates the implementation of energy conservation and emission reduction policies and measures, but also greatly increases the economic profits, lowers the production cost and consolidates the competitive strength of enterprises. Meanwhile, it can also offer new ideas for drafting energy efficiency policies in the future.

This project has taken the lead in conducting the trial operation of VA on energy

efficiency among demonstrational enterprises with the first four performing the trial of Hubei Huangshi Tieshanqu Lufeng Cement Co. Ltd., Sichuan Xinjing Yongxing Shale Hollow Brick Co. Ltd., Jiangsu Jiangning Moling Casting Corp. and Liaoning Dalian Pipe Casting Co. Ltd. At present, the VA mechanism on energy efficiency has already been widely spread among the brick making enterprises within the demonstrational and promotional areas.

6.4 Brief Summary

The establishment of the sound interactive relationship between the project and national macro-policy is not only in conformity with the development tendency of the macro-policy in China, but also has produced favorable promotional effect to national policies on energy conservation and the environment. Therefore, during the six years of its implementation, the project has gained the support and recognition from various social sectors. At the same time, the project does bring about impact on macro-policy to a certain extent, which is more reflected in the positive influence to the change in the decision-making or the awareness of various stakeholders.

Thanks to the success of the activities of PIC and LPIC, the adjustment of the demonstration technologies and the demonstrational program, the project has enhanced the enforcement and implementation of energy conservation policies both at the national and local level to a certain degree and somewhat advanced the issuance of certain national and local policies on energy efficiency and environmental protection positively. The achievements of the project has deepened the understanding of local governmental officials on national macro-policies, which has not only facilitated the materialization of the *Energy Conservation Law of the People's Republic of China* and the *Law of the People's Republic of China on the Promotion of Clean Production* in TVEs, but also are conducive to the enforcement of the *Medium and Long-term Special Plan of Energy Conservation of China* and can also help the smooth obtainment of the energy consumption reduction targets set out in the 11th "Five-Year" Plan.

7. Great Enlightenment from Executing the Project

The implementation process of the project itself serves as a multi-perspective examination over the execution effect of existing national and local policies, laws and regulations on energy and the environment. On the one hand, the sound benefits reaped in the implementation of the project and the valuable experience gained during the process can provide reference for the defining of related policies in the future, while on the other hand, the defects of current policies and regulations in increasing energy efficiency among enterprises found by the stakeholders of the project during the implementation process can also serve as practical reference for policy makers and

person involved at various levels in laying down policies in the future.

During the implementation process of the project, the following sound instruments have been employed, having great significance of exemplification for future policymaking and enforcement:

(1) The demonstration and promotion of VA on energy efficiency. By employing this method, the project has translated policy targets into the voluntary action of enterprises, mobilized the enthusiasm of enterprises in energy conservation technological transformation. This new type of interactive relationship between government and enterprise offers new ideas for drafting new energy efficiency policies in the future.

(2) Function change of local governments. Under the system of planned economy, the government is used to interfere too much in the normal operation of enterprises, which only leads to high administrative cost and low efficiency. However, under the system of market economy, the government only needs to handle the issue of incremental cost in mapping out policies, and enterprises can make self-adjustment in line with the rule of market operation to fulfill profit-making and sustainable development.

(3) The introduction of industrial self-disciplined association in the LPIC. Self-disciplined association is of great pragmatic significance as the bridge between the government and enterprises. The self-disciplined pact of the industrial self-disciplined association has crucial binding force to enterprises, and therefore is very conducive for enterprises to comply with industrial rules and the implementation of policies. From another perspective, the association represents the interests of enterprises and can bring about influence to the macro-policymaking process of the government.

(4) Vital support from technological organizations. The case of brick making industry in Xianyang of Xi'an City demonstrates that the Xi'an Research and Design Institute of Wall & Roof Materials plays a quite crucial role in the industry of building material within Shaanxi Province and even across the nation. The design and implementation of future projects should also bring the technological strength of scientific and technological research institutions as well as colleges and universities into full play, thus forming the technical precondition in securing the fulfillment of the goal set out in the project.

(5) Maintaining the relevance of corresponding policies. This is the important prerequisite for guaranteeing the smooth implementation and goal fulfillment of the project. This project conforms to the development direction of China's macro-policy environment, and therefore has gained the support from various social sectors.

Besides, we also found that there are some places demanding improvement in existing laws and regulations with the following tentative expression:

(1) During the evaluation process of the energy conservation effect of this project, all the technical experts participating in the evaluation pointed out that there are three major defects in the current *Energy Conservation Law of the People's Republic of China*, namely the lacking of specific execution organization, the lacking of corresponding incentive and rewarding and punishment measures and the lack of practical and fair energy efficiency standards.

(2) We should allow some flexibility to various SMEs across China, and governments at all levels should support SMEs to change their extensive production and management mode to pursue sustainable development through policy guidance while giving due regard to their specific local conditions at the same time.

(3) Prior to the implementation of this project, the four targeting industries and relevant local governments have never thought about the issue of energy conservation and energy consumption reduction. However, this project has mobilized the enthusiasm of enterprises in energy conservation and emissions reduction, lowering cost and improving their product quality. Therefore, the policy makers need to further change their mentality in formulating new energy efficiency and environmental policies in the future by offering comprehensive considerations to SMEs as major players in the market.

8. Conclusions and Recommendations

8.1 Conclusions

The goal designed in this TVE project conforms to the development trend of national macro-policy of China, therefore, it has gained full support of departments of various levels, guaranteeing the successful implementation of the project.

The project has somewhat removed the obstacles in the field of the policy on energy conservation and emissions reduction. First, the introduction of the innovative mechanism of LPIC has not only incorporated the work concerning energy conservation and emissions reduction into the daily administrative affairs of local governments and raised the energy conservation and environmental protection awareness of local governmental officials, but also can advance the local governments to steering their work more on the provision of policy and regulation guidance and overcome multiple obstacles in the process of policy implementation and enterprise development through coordination. Second, the LPIC mechanism has given impetus to the release of related energy conservation policies, the drafting of industrial policies and the establishment of energy efficiency standards. Third, it can facilitate the materialization of the economic incentive policies and measures on energy

conservation and emissions reduction and has upgraded the efforts in the enforcement of existing policies on energy efficiency and environmental protection. Finally, it helps popularize technologies on energy conservation and emissions reduction and improve the awareness of enterprises and the general public in this regard.

In addition, we deem it quite necessary to further strengthen the leading position of the government in the energy conservation management system in the future. The government should guide and regulate the energy conservation market in the overall and long-term interests of the nation. Meanwhile, the work focus should be put on the two sources of standard labeling and designing specifications based on the formulation of energy conservation regulations and policies. The government should step up its efforts in law enforcement, lay down necessary industrial policies, promptly eliminate outdated technologies, techniques and products and release related special economic incentive measures on energy conservation in an effort to guide enterprises and the whole society to save energy.

8.2 Further Recommendations on the Project

According to the achievements of this project, we suggest to develop projects on the promotion of heat-preserving and energy-conserving Hollow Bricks in the building material market of rural areas to carry out the policy of building a new socialist countryside and implement related energy conservation policies in the construction sector as follow-up actions. The related move on the ban of solid bricks should also be expanded to the rural areas to help rural households to live an energy-conserving and environment-protecting life and to widen the range of subjects exercising energy conservation and emissions reduction. In addition, this move can explore new market for Hollow Brick-making enterprises undergoing the energy conservation technological transformation in this project, help them pursue new round of development, stimulate the economic development in rural areas and further resolve the employment and income increase problem and improve the living standard of rural residents.

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Energy Conservation and GHG Emissions Reduction in Chinese TVEs

– Phase II – Project Impact Evaluation

(EG/CPR/99/G31)

Sub-Report on Case Study

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Case Study

——The Implementation of TVE Project by Xinjin County Yongxing Shale Hollow Brick Plant in Sichuan Province

I. Introduction

Xinjin County Yongxing Shale Hollow Brick Co. Ltd. (Plant) in Sichuan Province is a key shale hollow brick manufacturer in Chengdu with annual capacity of 70 million standard bricks. The enterprise adheres to equal emphasis on economic benefits and social benefits and focuses on technological innovation and upgrading of its products. It began continuous technical reform on energy conservation since it was chosen as a demonstration enterprise in 1998 when TVE project was at Phrase I.

II. Technical Reform Measures and Energy Efficiency Management

Xinjin County Yongxing Shale Hollow Brick Co. Ltd. in Sichuan Province started the reform of its original production line during phrase II of the TVE Project. Namely, the semi-hard plastics shaping production line has been upgraded to present hard-plastics shaping production line with product porosity rate reaching 60% from 45%. It adopts broad tunnel kiln to bake and transforms the thermal insulation layer of the kiln, which reduces 15% heat loss. In addition, it has expanded the raw material warehouse. The plant attaches great importance to energy efficiency and won the award of Second Grade Energy Conservation Enterprise issued by the Ministry of Agriculture.

III. Project Achievements

a) Energy efficiency baseline and the achievement of energy conservation and reduction of GHG emissions

The plant took part in TVE project in 1998 when TVE Project was in phase I. It has carried out the following 6 comprehensive technical reforms on energy conservation and GHG reduction: 1) air-tight technology for kilns. This technology has raised the thermal insulation performance of the kiln. 2) fan transformation. This

technical reform has raised the kiln temperature by several dozen degrees with the utilization of residual heat to dry the adobe. 3) The adoption of frequency converter has saved large amount of electricity (double output with the same electricity consumption). 4) The adoption of terminal compensation (transformer) technology has lowered the idle energy and load. The electricity consumption per 10,000 bricks has decreased from 450 kW.h to 350 kW.h. 5) The adoption of hammer grinder has effectively saved energy. This technical reform has reduced the maintenance work (resulting longer safe operation hours of the machines). 6) The reform of brick making machine. The plant has transformed the original 50/45-20 Model vacuum brick machine into the 60/50-40 model with the motor power increasing from 160KW to 200KW, which lowers the reject rate.

With a series of technical reform on energy conservation, the comprehensive energy consumption of the plant has decreased from 1.3 t coal equivalent per 10,000 bricks in 2002 to current 1.03 ton coal equivalent per 10,000 bricks. It saves 1943 t coal equivalent each year and reduces the emission of 4844 t of CO2 per year, which are at the advanced level in the industry.

b) Economic benefits

With the implementation of the project, the demonstration enterprise has succeeded in technical reform. The kilns have raised their performance with 20% increase of their capacity. As a result, workers use 7 hours to finish the tasks that would have required 8-10 hours in the past. This has greatly saved electricity and labour. The comprehensive energy consumption per unit product of the plant has decreased from 1.3 t coal equivalent per 10,000 bricks to current 1.03 t coal equivalent per 10,000 bricks. The energy cost the product has been dramatically cut down.

At the same time, TVE Project has raised the qualified rate of the products. For example, with the transformation of adobe drying process, the waste product due to crack in drying occurred before the technical reform disappears (such waste products used to be 2%-3% of the total). The overall product acceptance rate is over 98%. This has to some degree lowered the production cost of unit acceptant product.

In addition, TVE Project has improved the product quality, enriched the product variety, raised comprehensive competitive power of the enterprise and laid a solid foundation for the enterprise to better meet market demand and obtain greater economic benefits.

1) Technical reform has made the particle size of raw materials become finer. Before technical reform, the post-grinding coarse particles with diameter bigger than 2mm account for 15%, and the fine particles with diameter less than 0.05mm only account for 50% of the total. After the technical reform, the percentage of coarse particles decreases to 5%. While the percentage of fine particles increases to 75%. This has provided the guarantee for the improvement of product quality and increase of product diversity.
2) Technical reform has raised the squeezing pressure of brick making machine and increased the compactness of adobe and bricks.
3) Technical reform has enriched the type of products. The main products of the enterprise have expanded from the original hollow brick to current porous bricks, hollow bricks and decoration bricks.
4) With professional training and site visit organized by the Project, the management and workers of the enterprise have improved their understanding on advanced technology in the industry.
5) TVE Project has helped the enterprise establish ISO9000 Quality Management System and ISO14000 Environmental Management System and facilitated the establishment of a sound energy management system. All these have raised the management capacity of the enterprise.

c) Reputation and social influence resulting from the technical reform

Xinjin County Yongxing Shale Hollow Brick Co. Ltd. is the Vice President Organization of China Brick and Tile Association. The social influence of its technical reform is mainly the conservation of land resources. In the selection of raw materials, because Sichuan Provincial Authority bans the use of clay as brick raw materials, Xinjin County Yongxing Shale Hollow Brick Co. Ltd. adopts local shale as the raw material. The shale has low plasticity and water content but high hardness. It is good for making bricks with over 50% porosity. The

adoption of shale as the raw material has directly controlled the damage to land resources imposed by brick manufacturers. In addition, the transformation from natural drying of adobes into artificial drying approach has also reduced land use area of the brick manufacturer. With the implementation of TVE Project, the enterprise utilizes the residual heat in the kilns to dry the adobes. It has changes the bottom blast in the drying chamber into surface blast with the temperature turning to 150 °C from the original 110°C, which cuts down the required drying time. The application of residual heat drying technology has not only saved lots of electricity, but also dramatically improved the adobe quality. After the technical reform, the drying reject rate has decreased from 2%~3% to 0. At the same time, it has eliminated the land occupying problem imposed by the reject piles.

d) Replication outcome and potential

The demonstration enterprise has received more than 150 visitors from brick making industry. A total of 1000 people from over 400 TVEs have received training since 1995 when the Project organized technical training courses on energy conservation.

The demonstration enterprise has developed the "China Sichuan Brick and Tile Technology Information Network", which focuses on technical innovation and provides an access for local enterprises to advanced technologies. Mr. Gong Muquan, General Manager of Xinjin County Yongxing Shale Hollow Brick Co. Ltd. is the leader of local brick industry and Vice President of China Brick and Tile Association.

With active participation of local Medium and Small Sized Enterprise Bureau and other government departments and the promotion of General Manager Gong Muquan, TVE Project has expanded to another 15 brick manufacturers in Chengdu Municipality. The comprehensive benefits of these enterprises obtained by successful technical reform are bound to raise the interest of other enterprises of the industry to carry out the technical reform on energy conservation. At present, over 80,000 brick manufacturers in China adopt Hoffmann Kiln with annual capacity of 480 billion bricks. There are over 600 brick manufacturers in Chengdu. Therefore, there is huge potential for the extension of the energy-saving technology adopted by the Project.

IV. Analysis on the Experience and Lessons

a) Selection of technology

The technical information of the brick and tile enterprises of Xinjin County mainly comes from Yongxing Hollow Brick Plant. There is hardly any information from technical market, network or patents. At the same time, these enterprises know little information about brick and tile research institutes across China and lack appropriate access to the information about advanced technology on energy conservation and GHG reduction.

In this connection, technical selection of Yongxing Hollow Brick Plant matters technical development of all brick and tile industry of Xinjin County and has strong technical demonstration effect. Experts have designed the production line of Yongxing Hollow Brick Plant with strict energy calculation. And the production lines of other such enterprises in the areas borrowed the design and idea of the demonstration enterprise. In 1991, Yongxing Hollow Brick Plant was identified as one of the first group of demonstration brick enterprises on the reduction of GHG emissions. Over the past 10 years, Yongxing Hollow Brick Plant, voluntarily centering on the requirements for energy conservation and reduction of GHG, has identified its technical reform plan and product development direction and invested over 2.5 million yuan in technical reform.

The technical reform program on energy conservation chosen by Yongxing Hollow Brick Plant is the outcome of continuous exploration and accumulation of the experience on the one hand, and the technical information introduced by TVE Project and relevant experts on the other. The Project has collected the knowledge and wisdom of Chinese and international experts in the field of brick and tile manufacturing, brought about rich human resources and injected strong driving force for Yongxing Hollow Brick Plant to carry out technical reform on energy conservation.

b) Policy driven incentive mechanism

The outcomes of TVE Project have facilitated the enforcement of national and

local policies and regulations by local governments and raised the initiatives of enterprises in energy conservation and GHG reduction and local governments in carrying out environmental protection policy. This helps the enforcement of Energy Conservation Law and Clean Production Law and is conducive to smooth implementation of the policies of building material industry on energy conservation and GHG emission reduction. At the same time, TVE Project is the first to introduce the Voluntary Agreement mechanism to TVEs. This is an innovation in government administration and mobilizes the initiatives of enterprises in saving energy and resources.

With smooth completion of the technical reform on energy conservation of Xinjin County Yongxing Shale Hollow Brick Co. Ltd., local government has accelerated the enforcement of national policy on "banning the use of clay resources and manufacturing of solid bricks" and "Provisional Measures of Chengdu on the Banning of Manufacturing and Utilization of Solid Clay Bricks (2003)". Local government has enhanced its efforts in shutting down the manufacturers of solid clay bricks within its jurisdiction and facilitated rehabilitation the occupied land to cropland. At the same time, it has raised the access to brick industry according to relevant national policy (which restricts the establishment of the enterprises with annual capacity less than 30 million standard solid bricks using gangue or shale as raw material).

c) Support from local government agencies — including LPIC

One characteristics of Xinjin LPIC is that it solves the financing problem for demonstration enterprises. At present, getting loans becomes a bottleneck for medium and small sized enterprises due to reluctant of banks to provide loans to them and poor financial status of such enterprises. Xinjin LPIC of Sichuan Province, which depends on TVE Bureau of Xinjin County, play sits role of service and coordination and has signed a cooperation agreement on lending 50 million yuan loans to medium and small enterprises with Sichuan Branch of National Development Bank. The LPIC recommended to Chengdu Finance Bureau the demonstration enterprise——Xinjin County Yongxing Shale Hollow Brick Co. Ltd. (Plant) as the financing trial organization, and provided 500,000 yuan loan for technical reform of the enterprise.

This loan not only is the fund for technical reform of medium and small sized enterprises (MSSE), but also marks the beginning for financing such enterprises, which illustrates the practical implementation of some national financing policies in enterprises. This has facilitated the development of MSSE credit system and become a model for the financing to local MSSE.

In addition, based on Xinjin County Yongxing Shale Hollow Brick Plant, Xinjin LPIC has held various lectures and technical exchanges activities and provided various policy consultation service to local enterprises.

MSSE like township and village brickyards are not big tax contributors and play a little role in driving local economic growth. Therefore, they had been not one of major concerns of local government for a long time. The evaluation team finds that local government begins paying attention to the development of such brickyards thanks to the TVE Project. This creates new opportunities for the development of such TVEs. Therefore, LPIC has provided a broader space for the development of the enterprises.

d) Financing

Financing obstacle is one of the four big obstacles for TVEs to carry out technical reform on energy conservation. The total investment of the demonstration enterprise is $320,000, $60,000 of which is the supporting fund of the Project and the remaining is raised by the enterprise. Though Project supporting fund accounts a small percentage in total investment, most such funds are utilized for the increment cost that TVEs most unwilling to pay, which includes $20,000 for feasibility study and $40,000 for the installation and testing of energy saving equipment and training activities. Project supporting fund plays an active role in stimulating the interest of TVEs in investing energy efficiency projects.

Moreover, TVE Project has facilitated local government in speeding up the development of MSSE credit guarantee system. Guided by the *Suggestions on Promoting the Financing Work for Medium and Small Sized Enterprises*, Xinjin MSSE Bureau actively carried out the *Circular on Printing and Distribution of the Five Supporting Documents on the Promotion of MSSE Financing Work* and provided

1 million yuan loan to the demonstration enterprise——Xinjin County Yongxing Shale Hollow Brick Plant for technical reform on energy conservation based on existing policy platform. Xinjin County MSSE Bureau assumed the risk for the enterprise, which makes the demonstration enterprise as the trial site for the financing of MSSE.

e) Market demand

The national ban on the production and utilization of solid clay bricks and increasingly stringent energy and environment policies and shortage of energy supply as well as the rise of energy price have further squeezed the survival space of brickyards using traditional technology and stimulated them to cut production cost and increase profits. The characteristics of energy-saving materials on further reduction of energy consumption during the application has increased the market demands for this new type of materials, thus stimulating the production interest of the enterprises.

Targeting this market situation, TVE Project has chosen profit-making technology to carry out technical reform on energy conservation in demonstration and replication enterprises with good economic benefits. The successful technical reform, project publicity and training have further facilitated the development of relevant technologies, raised public awareness in energy conservation and increased market demand for hollow brick products and corresponding energy saving technology.

f) Promotion and improvement of energy conservation awareness of the enterprises

Both the management and ordinary workers of the enterprise have received training at different degree during project implementation. In addition, a TV interview program on the demonstration project was broadcasted on Hong Kong Phoenix TV Station. This has expanded the publicity scope of the Project and enhanced its influence. Part of the training courses comes from the Project Office and LPIC. In addition, enterprise managers also take initiative to look up information, consult with experts and share their experience. Apart from energy saving technology, these training courses also focus on the idea and concepts on

environmental protection and energy conservation, which have effectively improved environmental awareness of the staff of the enterprises. Up to now, Xinjin County MSSE Bureau of Sichuan has conducted 8 training courses for the replication enterprises involving 240 person•times of 15 enterprises. With frequent and extensive training, workers of the enterprises have dramatically raised their awareness in energy conservation and environmental protection as well as operation skills. The influence of TVE Project ranges from the decision-making of business leaders, production work and everyday life of ordinary workers. It also facilitates the dissemination of the idea on energy conservation and environmental protection to the relatives and friends of the management and workers of relevant enterprises, which greatly promotes the development of awareness in energy conservation and environmental protection of local communities.

Case Study

—The Implementation of TVE Project by Shenyang Dongbei Red Brick Plant

I. Introduction

Established in 1993 and located at Huangtukan Village, Pingluo Town, Yuhong District, Shenyang, the Dongbei Red Brick Plant (hereafter the Plant) is a private owned shareholding company, and has fixed assets of US$969,000.

Main installations of the Plant include a 46-chamber Hoffmann kiln, a brick making line including a JZK45/50 Type extruder, a power transformers (with a capacity of 400 kVA) and its complementary low-voltage circuit and electric distribution system, an excavator, a fork-lift truck, a tractor, four transport vehicles and a deep-water well.

II. Technical Reform Measures and Energy Efficiency Management

Major energy saving measures of the plant is the construction of 16 artificial drying chambers that recycle and reuse the residual heat of the Hoffmann kiln. This technical reform has extended the annual effective operation period of the plant from 210 days to 260 days and annual capacity from 35.2 million standard bricks to 43.5 million standard bricks per year. In addition, the plant has established a sound energy-saving production management system.

III. Project Achievements

(1)Energy efficiency baseline and the achievement of energy conservation and reduction of GHG emissions

Under the support of TVE Project, Shenyang Dongbei Red Brick Plant constructed 16 new energy-saving artificial drying chambers with the dimension of 60300 mm × 1230mm ×1020 mm during March-August of 2005, which will recycle

and reuse the residual heat of Hoffmann kiln for drying adobes. This technical reform has obtained some outcome for energy conservation and reduction of GHG emissions and reduced the use of land resources (compared with natural drying method). According to estimate, the electricity consumption of unit product of the plant has decreased from 0.06 t coal equivalent per 10,000 bricks to 0.05 t coal equivalent per 10,000 bricks after the technical reform. There is no big change in coal consumption. The comprehensive product energy consumption has decreased from 1.37 t coal equivalent per 10,000 bricks to 1.36 t coal equivalent per 10,000 bricks. This technical reform has significantly raised energy efficiency of the plant with annual saving of about 1,406 t coal equivalent and reduction of 3506 t of CO_2 per year.

(2) Economic benefits

TVE Project has promoted technical upgrading of the enterprise and raised the capacity of the enterprise, from 35.20 million bricks per year to current 43.50 million bricks per year, up by 35%.

With the training of the management and professional of the replication enterprise and other enterprises showing interest, TVE Project has improved their understanding on energy-saving technology, policies and standard of the industry. It also helps relevant enterprises understand the importance of energy management and set up a sound energy management system.

TVE Project has enriched the product type of the enterprise. After the technical reform, the enterprise not only produces hollow bricks, but also porous bricks. In doing so, the enterprise has won the survival space through self technical reform facing the increasingly strict policies that ban the production and utilization of solid clay bricks.

(3) Reputation and social influence resulting from the technical reform

The social influences of the development and application of new type wall materials mainly include the following aspects. A) Saving of land resources. As a result of the production of new type of wall materials in 2004, a total of 14,415 mu (15 mu = 1 hectare) land were saved in Liaoning Province. B) Contribution to local environmental protection. In 2004, the development and application of new type wall

materials in Liaoning Province not only met the objective of energy saving and GHG emission reduction, but also contributed to reduction of SO2 emission by 13,000 t. C)Effective use of industrial solid waste. The development and application of new type wall materials in Liaoning Province in 2004 had consumed 9.5 million t of industrial solid waste including gangue. This reduced not only the pollution and disposal cost of such waste, but also required land resources for the stockpile of industrial wastes. D) Raised the income of local farmers. More than 90% workers of local brickyards including Dongbei Red Brick Plant are local farmers with the income far higher than the average income of local farmers. The continuously successful operation of the enterprises no doubt provides important and steady income for relevant farmers. In addition, there are some women workers in the brick plants, The continuously successful operation of the enterprises also plays an important role in raising social status of local women.

(4) Replication outcomes and potential

After comprehensive evaluation of the products, production scale and technology, management level and the initiatives in technical reform on energy saving, TVE Project has identified 16 enterprises in Liaoning Province to carry out replication work on energy-saving technology. After the implementation of the project, these 16 enterprises will have annual capacity of 621.50 million standard bricks, up by 51.30 million compared with that before the technical reform. In view of the fact that the scale of brick making industry in Liaoning Province is relatively small but with high consumption of energy, the technical reform on energy conservation in this industry will play an active role in improving local environmental quality and technical level of the industry. At the same time, TVE Project identifies the objectives in the Project Document: replicating the replication project to feasibility and construction stages of brick enterprises based on the feasibility study of the four industries dominated by TVE.

With the implementation of the project, replication enterprises have solved the problems during their development process and obtained benefits. This will generate active influence on other enterprises of the industry. It is expected that within the

foreseeable future, the amount of simultaneous replication enterprises will have a big increase.

6) Analysis on the Experience and Lessons

(1) Selection of technology

Brick-making enterprises in Liaoning Province have low mechanization level. Most such enterprises adopt natural drying process. Among all the employees of brick making industry of the province, only less than 2% have primary and intermediate professional titles. This reflects the fact that the education level of the workers of this industry is low and this is one of the main reasons why the technical level of the industry lags behind. The reject rate of these enterprises is relatively high due to small scale, low-level technology and variations of product quality. Energy saving technologies that Dongbei Red Brick Plant is going to adopt include thermal insulation and sealing in the drying chamber, idle compensation of electric motors, vacuum energy conservation, even supply of the mixed fuel, seal of the tunnel kiln door, and that shifts the production of solid brick into porous or hollow bricks. These technologies are promising ones in the industry, and they are suitable technologies for the development of TVEs. They could raise the economic benefits and at the same time meet the objective of reducing the emission of GHG.

In selecting appropriate technology, one must comply with relevant policy requirements of Liaoning Province and observe the market rules on the application of technologies.

(2) Policy driven incentive mechanism

The outcomes of TVE Project have facilitated the enforcement of national and local policies and regulations by local governments and raised the initiatives of enterprises in energy conservation and GHG reduction and local governments in carrying out environmental protection policy. This helps the enforcement of Energy Conservation Law and Clean Production Law and is conducive to smooth implementation of the policies of building material industry on energy conservation and GHG emission reduction. At the same time, TVE Project is the first to introduce

the Voluntary Agreement mechanism to TVEs. This is an innovation in government administration and mobilizes the initiatives of enterprises in saving energy and resources.

With smooth completion of the technical reform on energy conservation of Shenyang Dongbei Red Brick Plant, local government has accelerated the enforcement of national policy on "banning the use of clay resources and manufacturing of solid bricks" and "Regulations of Liaoning Province on the Development and Utilization of New Type Wall Materials (No.142 Order of Liaoning Provincial Government putting into effect as from May of 2002)". Local government has enhanced its efforts in shutting down the manufacturers of solid clay bricks within its jurisdiction and facilitated the rehabilitation of the occupied land to cropland.

With the promotion of TVE Project, the brick industry of Shenyang has made evident achievements in saving land and energy resources, recycling of solid waste and protecting the environment. It has made important contribution to the implementation of the outlook on scientific development, advancement of circular economy and acceleration of the extension of energy-saving building materials.

(3) Support from local government agencies — including LPIC

Depending upon Wall Material Reform Office of Liaoning, the LPIC in the replication areas of Liaoning Province not only has the advantage of implementing relevant policies and regulations based on the real situation of the industry, but also coordinate the support of relevant departments to guide and help relevant enterprises to carry out energy-saving and GHG reduction work with the help of the work network composed of wall material reform office of each county and city and Liaoning Wall Material Industry Association.

Compared with the LPIC of demonstration areas, LPIC of replication areas would be responsible for the technical reform of more enterprises. Therefore, it is very difficult for it to provide one-to-one service to certain enterprise as XiAn LPIC provides to Liucun Hollow Brick Plant. One characteristics of Liaoning LPIC is that it has developed a list on major new technologies that will be replicated in brick enterprises across Liaoning Province. On the basis of the development of the 11th

Five-Year Plan of Liaoning Province for Wall Material Industry, Liaoning LPIC has identified the list on major new technologies that the industry should replicate. This has laid a good foundation for the brick-making industry of Liaoning to adopt new technologies and raise the competitive power. At the same time, LPIC has developed the *Technical Specifications of Liaoning Province for the Manufacturing of Concrete Porous Bricks* and *Local Standard of Liaoning Province on Steam Pressure Fly-ash Bricks*. These standards have played an active role in facilitating the development, production and utilization of new type of light and strong wall materials that save land and energy resources and have good thermal insulation capacity.

(4) Financing

Total investment is 1.79 million yuan RMB. Among them, TVE Project provide supporting fund of $12600 for Feasibility Study of the project. Though Project supporting fund accounts a small percentage in total investment, most such funds are utilized for the increment cost that TVEs most unwilling to pay. Project supporting fund plays an active role in stimulating the interest of TVEs in investing energy efficiency projects.

(5)Market demand

The implementation of the project has helped brick-making TVEs address major problems during their development, released the pressure imposed by the national policy on "banning the production and utilization of solid clay bricks and created new space for the survival of such enterprises. With technical reform and comprehensive management, it has lowered the production cost, released energy pressure, raised product quality, added more product types and created new profit making areas. The replication of energy saving technology advocated by the project meets the requirements of TVEs and enhances the demands of such enterprises for corresponding energy-saving technologies.

In addition, the publicity of the Project and practical demonstration effects of replication enterprises have further expanded the replication scope of such technologies. At the same time, the Project has further increased market demands for energy-saving bricks (porous or hollow bricks, etc.) due to the improvement of public

awareness in energy conservation, the advantages of such bricks compared with traditional bricks and the encouragement of relevant national policy.

(6)Promotion and improvement of energy conservation awareness of the enterprises

Both the management and ordinary workers of the enterprise have received training at different degrees from different channels during project implementation and they have effectively raised their awareness in saving energy. Apart from training and site visits, a special interview program on the demonstration project was broadcasted on media including Hong Kong Phoenix TV Station. This has greatly expanded the publicity scope of the Project and enhanced its influence. Part of the enterprise training channels comes from the Project Office and LPIC. But a large proportion of such training activities come from the initiatives of enterprise managers to look up information, consult with experts and share their experience. Apart from energy saving technology, these training courses also focus on the idea and concepts on environmental protection and energy conservation, which have effectively enhanced the understanding of and concern about environmental quality by the staff of the enterprises and improved their environmental awareness and responsibilities. After the training courses, the managers and workers of the demonstration and replication enterprises begin paying attention to such issues as energy and resources saving in each production link, application of energy-saving equipment, reduction of energy waste and sharing of experience among the counterparts of the industry.

Frequent and extensive training and publicity activities have dramatically raised their awareness in energy conservation and environmental protection as well as operation skills. The influence of TVE Project ranges from the decision-making of business leaders, production work and everyday life of ordinary workers. It also facilitates the dissemination of the idea on energy conservation and environmental protection to the relatives and friends of trainees, which greatly promotes the development of the awareness in energy conservation and environmental protection of local communities.

Case Study

—The Implementation of TVE Project by Liucun Hollow Brick Plant of XiAn

I. Introduction

Situated in Baqiao District of XiAn, Liucun Hollow Brick Plant of XiAn has the annual capacity of 50 million standard bricks. In 2003 Liucun Hollow Brick Plant carried out technical reform on such processes as raw material treatment, adobe making and baking under the support of TVE Project. At the same time, it is the first in XiAn to successfully manufactured multi-rectangular-hole brick. This has laid technical foundation for the replication and application of rectangular-hole bricks in XiAn region and facilitated building energy-saving work of the region.

II. Technical Reform Measures and Energy Efficiency Management

Major technical reform measures adopted by XiAn Liucun Hollow Brick Plant include the followings: 6-month weathering treatment of clay to improve internal texture of the clay; adoption of high-efficient grinder to replace the old one; adding the blend process; application of 50 Model brick extruder to replace the original 40/45 Model; adoption of energy-saving kiln to replace the old Hoffmann kiln. In addition, the plant has established a complete system on energy-saving production management.

III. Project Achievements

1、Energy efficiency baseline and the achievement of energy conservation and reduction of GHG emissions

In 2003, Liucun Hollow Brick Plant carried out energy-saving technical reform on such processes as raw material treatment, adobe making and baking under the support of TVE Project. It has transformed the original cutter into a vertical cutter, which has raised the raw material efficiency from 88%—90% to over 98% and cut

down electricity consumption by over 8%. It has upgraded the machine opening mold and raised the porosity rate of multi-hole bricks to 33% from 26%. It has replaced the 40/45 Model extruder with the 50 Model that has raised product acceptance rate from 80% to 90%. The application of new ventilation device of the Hoffmann kiln has lowered ventilation power consumption by 8%. It has replaced the old Hoffmann kiln with the energy-saving three-centered arch kiln and added thermal insulation measure, which has reduced the heat consumption of baking by 15%.

With the above technical reform on energy conservation, the coal consumption of the plant has decreased from 1.25 t coal equivalent per 10,000 standard bricks in 2003 to 1 t coal equivalent per 10,000 standard bricks at present; power consumption has decreased from 0.063 t coal equivalent per 10,000 standard bricks to 0.056 t coal equivalent. The comprehensive energy consumption has dropped from 1.32 t coal equivalent per 10,000 standard bricks in 2003 to 1.06 t coal equivalent per 10,000 standard bricks at present. Now it saves an average of 1298 t coal equivalent per year with the reduction of CO2 emission of 3236 t.

2、Economic benefit

TVE Project has reduced the production cost. Before the implementation of the project, the demonstration enterprise had two 260 kW•h electric motors working 16 h every day. After technical reform on energy conservation, it needs only one 310 kW•h electric motor operating 8 hours per day. This has significantly saved power. In addition, with the replication of energy-saving kiln, the reject rate of the enterprise has decreased from 15% to 12% and energy consumption per 10,000 bricks has decreased to 1 t coal equivalent, thus reducing the production cost to a big margin.

TVE Project has improved the quality of the product. With the implementation of the project, the porosity of the hollow bricks of the demonstration enterprise has increased from 25% to 33%.

TVE Project has expanded the scale and operation capacity of the enterprise. Before the project, annual output of Liucun Brick Plant was 32 million standard bricks. Now it is 50 million per year, becoming No.1 brick manufacturer in the region. In addition, the project enables the enterprise to directly sign contracts with the

construction enterprises instead of transport suppliers, thus enjoying higher economic profits.

TVE Project has facilitated the understanding of enterprises on the importance of energy management and helped them set up sound energy management system.

In addition, with training TVE Project has improved technical level of relevant enterprises and the awareness of workers. It has helped the establishment of close relations between the enterprise and XiAn Wall Material Research and Design Institute, the only Grade A research institute of the industry in China, which has provided strong technical support to the development of the enterprises.

3、*Reputation and social influence resulting from the technical reform*

Liucun Hollow Brick Plant in Baqiao District of XiAn is the Vice President Organization of XiAn Wall Material Association and a member of China Brick and Tile Association. The social influences of the technical reform of the enterprise are mainly the following: A) Increased farmer's income. Workers of XiAn Liucun Hollow Brick Plant work about 10 hours per working day with average monthly income of over 1000 yuan. The production of bricks mainly takes place in late fall and winter, the plant recruits new workers each year. It gives bonus to the workers with experience. The income of workers is far higher than that of local farmers. B) Contribution to local environmental protection. With the technical reform on raw material treatment, adobe making and baking process, Liucun Hollow Brick Plant has reduced annual SO2 emission from 7375 t to current 59 t, down by 99.2%. C) Raised social status of women. Women workers of Liucun Hollow Brick Plant account for 50%-60% of the total. With the development of the enterprise, there will be more potential job opportunities for women.

4、*Replication outcome and potential*

TVE Project has promoted the establishment and development of local industrial self-discipline association that greatly facilitates the development of local brick making industry. With 2-year implementation of the project, many brick making TVEs have made great efforts in technical reform. In XiAn and Xianyang alone, there are 29 replication enterprises, producing huge economic and environmental benefits.

At the same time, Liucun Hollow Brick Plant has become a trial and dissemination base for new technology. To meet the requirement of XiAn for the extension of rectangular-hole bricks, Liucun Hollow Brick Plant carried out the pilot trial on the production of such brick free of charge and got successful result. It set an example in XiAn for the extension of rectangular-hole bricks. At the same time, it has provided relevant information for the "investigation on the banning of production and utilization of solid clay bricks" carried out by wall reform offices of four ministries and commissions under the State Council.

Moreover, Liucun Hollow Brick Plant has received many domestic and foreign visitors. The project outcomes have international implications. It showed the project demonstration technology ——energy-saving Hoffmann kiln to the "Bangladesh GEF Brick Making Technical Visiting Delegation". Bangladesh has decided to introduce 50 energy-saving Hoffmann kilns in the first round.

TVE Project has helped the demonstration and replication enterprises addressing the problems occurred during the development and brought about practical benefits to them. This has positive implications to other enterprises in the industry. The foundation of simultaneous replication lies in the expected economic benefits from technical reform on energy conservation. If this condition does not change, it can be expected that more enterprises will take part in simultaneous replication in the foreseeable future.

IV. Analysis on the Experience and Lessons

1、Selection of Technology

In the early stage of the establishment of LPIC of XiAn region, there were 52 brick & tile making enterprises in Baqiao District with a total of 58 production lines. Only one of them was designed by a professional design institute. The other 57 production lines were designed by the enterprises themselves. All of them adopt the technology of natural-drying Hoffmann kiln. 21 of the above enterprises manufacture hollow bricks and 31 manufacture solid clay bricks. The information of the brick &

tile enterprises of Baqiao District comes mainly from industrial association and government departments.

The focus of technical reform program of Liucun Hollow Brick Plant is energy-saving reform of Hoffmann kiln and upgrading energy-saving equipment. This conforms to either the interests of the enterprises or environmental requirements. The right selection of appropriate technology could facilitate harmonious development of economy and the environment.

Technical reform program on energy conservation of Liucun Hollow Brick Plant has obtained strong support from XiAn research institute. Technical and professional resources of research institutes have ensured smooth technical reform, contributed to the training of workers of the enterprises and their capacity building. Research institutes or professional technical service companies are important participants for the selection of appropriate technology.

2、 Policy driven incentive mechanism

The outcomes of TVE Project have facilitated the enforcement of national and local policies and regulations by local governments and raised the initiatives of enterprises in energy conservation and GHG reduction and local governments in carrying out environmental protection policy. This helps the enforcement of Energy Conservation Law and Clean Production Law and is conducive to smooth implementation of the policies of building material industry on energy conservation and GHG emission reduction. At the same time, TVE Project is the first to introduce the Voluntary Agreement mechanism to TVEs. This is an innovation in government administration and mobilizes the initiatives of enterprises in saving energy and resources.

The successful application of the three-center arch kiln technology by Liucun Hollow Brick Plant has vigorously facilitated the development of policies of XiAn and Shaanxi Province on the development and utilization of energy-saving new wall materials and promulgation of policies and regulations on the "banning of production and utilization of solid clay bricks". It has also facilitated the National Standard JC982-2005 "Brick and Tile Baking Kilns". With the promotion of TVE Project, the

brick enterprises of XiAn and Xianyang region have made evident achievements in saving land and energy resources, recycling of solid waste and protecting the environment. It has made important contribution to the implementation of the outlook on scientific development, advancement of circular economy and acceleration of the extension of energy-saving building materials.

3、Support from local government agencies — including LPIC

Baqiao District LPIC of XiAn, Shaanxi Province carried out the following policy coordination when helping the energy-saving technical reform of Liucun Hollow Brick Plant of Baqiao: land use issue of Liucun Hollow Brick Plant. It has facilitated the signing of another 10-year agreement on land use between Liucun Hollow Brick Plant and local government. During the expansion of plant areas, Liucun Hollow Brick Plant encounters the issue of removal of the graveyard. However, there is no relevant national policy on this issue. Baqiao District LPIC has properly solved this issue. Meanwhile, Baqiao District LPIC also helps to solve various small contradictions between the enterprises and local villagers.

It can be seen that the obstacles TVEs encounter during their development vary. Under current situation that the management of TVEs is not in place, this kind of policy blank is not uncommon. Baqiao District LPIC provides various services for TVEs. To some extent, it has enhanced the management on TVEs and facilitated the establishment and improvement TVE management system of China.

Baqiao District LPIC in XiAn on the one hand helps eliminate the specific obstacles during the development of TVEs. On the other hand, it has also actively strived for favorable macro policy environment for TVE development. Baqiao District LPIC has facilitated the development of *Self-discipline Agreement of XiAn Brick and Tile Industry*, which standardizes the market, stabilizes the price, curbs vicious competition and provides a good foundation for healthy development of local TVEs.

4、Financing

Total investment in the demonstration enterprise is 2.5 million yuan RMB, $60,000 of which are project supporting fund for the increment cost covering the feasibility study and energy-saving training, etc. Another $60,000 is commercial loan

coming from rural credit association. All the remaining capitals are self raised. In addition, TVE Project has improved the assistance of local government in financing energy technical reform projects. That is, XiAn Municipal Government would allocate 100,000 yuan to any brick-making enterprise with the investment of 1 million for technical reform.

Therefore, it can be said that TVE Project to some extent has alleviated the financing obstacle of TVEs. However, because the entrusted loan under RCF mechanism requires supporting commercial loan of ABC, this leads to the phenomenon that under current operational mechanism, the entrusted loan may not provide direct financial support to small TVEs that cannot provide guarantee, especially the brick-making TVEs. How to raise the efficiency of the entrusted loans and practically remove the financing obstacle for medium and small sized TVEs is the key issue for consideration during the adjustment of RCF mechanism.

5、Market demand

Though TVE Project has facilitated the development of "banning the production and utilization of solid clay bricks", the evaluation team finds during the investigations in Shaanxi Province that the amount of solid brickyards is still bigger than that of hollow brickyards in XiAn region. Most rural areas still use solid bricks in construction. In XiAn Baqiao District where the demonstration enterprise locates, there are 83 brick-making enterprises, those close to urban areas are dominated by hollow brick manufacturers. But most such TVEs far from cities are solid brickyards. Solid clay bricks still occupy 50% market in Baqiao District of XiAn.

Therefore, in post-project activities, the authority should make full use of replication enterprises, combine the project follow-up work with the development of socialist new countryside, facilitate the extension of hollow and porous bricks in rural areas and speed up the application in rural construction energy-saving market. In doing so, it will create larger market space for the development of hollow and porous bricks and raise the overall application level of the baked products.

6、Promotion and improvement of energy conservation awareness of the enterprise

Both the management and ordinary workers of the enterprise have received training at different degrees from different channels during project implementation and they have effectively raised their awareness in saving energy. Part of the enterprise training channels comes from the Project Office and LPIC. But the enterprises also take initiatives to look up information, consult with experts and share their experience. Apart from energy saving technology, these training courses also focus on the idea and concepts on environmental protection and energy conservation, which have effectively enhanced their environmental awareness and responsibilities. Frequent and extensive training and publicity activities have dramatically raised their awareness in energy conservation and environmental protection as well as operation skills. The influence of TVE Project ranges from the decision-making of business leaders, production work and everyday life of ordinary workers. It also facilitates the dissemination of the idea on energy conservation and environmental protection to the relatives and friends of trainees, which greatly promotes the development of the awareness in energy conservation and environmental protection of local communities.

Case Study

—The Implementation of TVE Project by Nanjing Moling General Casting Plant in Jiangning District

I. Introduction

Situated in Moling Town, Jiangning District of Nanjing, Nanjing Moling General Casting Plant in Jiangning District is the biggest TVE casting enterprise in Nanjing with annual output of over 10000 t casting products. Stimulated by the TVE Project, it has carried out continuous energy technical reform and capacity building in management with self-raised capital since it was identified as a demonstration enterprise at Phase I project in 1998.

II. Technical Reform Measures and Energy Efficiency Management

Nanjing Moling General Casting Plant has carried out continuous energy technical reform and capacity building in management since it was identified as a demonstration enterprise in 1998. It has carried out technical reforms in such production processes as smelting, sand making, moulding, core making, cleaning, and thermal treatment, which have raised energy efficiency and lowered the reject rate. In Phase II of the project, it mainly adopts 12V135 Model Engine to carry out technical reform on the casting production technology.

III. Project Achievements

1、 Energy efficiency baseline and the achievement of energy conservation and reduction of GHG emissions

Under the support of TVE Project in 2003 Nanjing Moling General Casting Plant has carried out a series of technical reforms in such production processes as smelting, sand making, moulding, core making, cleaning, and thermal machining treatment. The reformed sand treatment line has significantly raised the quality of sands and the

products. It has lowered the labor intensity at the same time. Using thermal cupola instead of cool cupola, the plant saves 15% coke. The reformed machining production line could raise the added value of the products and energy efficiency and at the same time reduce energy consumption per unit output.

After the above energy technical reforms, the consumption of coal, coke, electricity and oil per unit product has been reduced to different degrees. Product comprehensive energy consumption of the plant has decreased from 0.606 t coal equivalent per ton of casting product in 2002 to the current 0.374 t coal equivalent per ton of casting product. It now saves 3068.20 t coal equivalent each year and reduces the emission of CO2 by 7649.02 t per year. It is one of the top enterprises in the industry in terms of energy consumption.

2、 Economic benefits

TVE Project has improved the production technology, raised the output and reduced production cost of the plant. This enables the plant has bigger profit-making and price-cutting space in the market and stronger competition power. Table 2.4 shows the change of the production cost and scale of Nanjing Moling General Casting Plant before and after taking part in the TVE Project. It can be seen that there are big reduction of energy cost and great increase of output after the implementation of the Project.

Table 2.4 Change of the production cost and scale of Nanjing Moling General Casting Plant before and after taking part in the TVE Project[1]

	2002	2005
Energy cost	715.4yuan/t	597 yuan/t
Percentage of energy cost	18%	15%
Reject rate of major products	15%	5.2%
Output	13,245 t products/y	28,000 t products /y

[1] Source: Investigation Report on the Establishment of Jiangning District LPIC, Nanjing, Jiangsu Province

TVE Project has reduced the emission of pollutants of relevant enterprises and provided greater space for them to survive in the face of increasingly strict environmental laws and regulations.

In addition, with the help of TVE Project, relevant TVEs have more information access and chances for the exchange with experts, which improved the professional capacity.

3、Reputation and social influence resulting from the technical reform

Nanjing Moling General Casting Plant has been awarded as "Top 500 Public Welfare Enterprises in China" by Ministry of Civil Affairs and the "Star Enterprise" by Naning Municipal Government. Social influences of the technical reforms of the plant include the following aspects: A) Improvement of working conditions. The implementation of the TVE Project has significantly improved the working conditions of workers. Before the Project, dust pollution of Nanjing Moling General Casting Plant imposed big threat to the health of workers. The environment of the plant has enjoyed evident improvement after the implementation of the Project and workers no longer have any significant pollution problem in the workshop. B) Salient contributions to local environmental protection. Nanjing Moling General Casting Plant has carried out a series of technical reforms in such production processes as smelting, sand making, moulding, core making, cleaning, thermal treatment and machining. As a result, there is a 9% reduction in SO2 emission, 8% reduction in dust emission and 79% reduction of the discharge of waste sand. C) More job opportunities. During the implementation of the TVE Project, Nanjing Moling General Casting Plant has increased 100 jobs, accounting for 16% of the total. But there is no new job opportunity in the control enterprise ——Nanjing Yuhua Plant. D) Improvement of the welfare for the disadvantaged groups. With the implementation of TVE Project and technical reform of the plant, the labor intensity and difficulties of some original work categories have decreased. At the same time, some new work categories emerge, which provides job probabilities for disadvantaged groups including the disabled. When facilitating local economic growth, relevant enterprises

have played an active role in improving the welfare of the disadvantaged groups and maintaining social unity and stability.

4、 Replication outcome and potential

The demonstration enterprise plays a big demonstrating role in the region. It presents comprehensive demonstration including all aspects such as management mode, idea on energy saving, technology and construction. During the process, Mr. Liang, Party Secretary of Nanjing Moling General Casting Plant and Vice President of Nanjing Casting Association plays an ineffaceable role. During Phase II of the Project, Mr. Liang, replacing Jiangning District TVE Bureau, organized energy-saving training programs for all casting enterprises in Jiangning District.

At present, the carrying out of TVE Project in Nanjing region has extended to other 6 casting enterprises with total number of replication enterprises being 31. At the same time, TVE Project has identified the following objectives in Project Documents: it will expand the project implementation of casting TVEs into feasibility study and construction based on feasibility studies of TVEs of the four industries. The comprehensive benefits of these enterprises through effective technical reforms will certainly attract the interest of other enterprises of the same industry in energy technical reform. At present, energy consumption per ton of casting product in China is still relative high, about 2~3 times of that of developed countries[2]. Under the strategy of sustainable development, there is huge potential for energy conservation in this industry of China.

IV. Analysis on the Experience and Lessons

1、 Selection of Technology

In selecting the appropriate energy saving technology, TVE Project fully respects the selection of relevant enterprises. Based on the practical situation, it has guided and supported relevant TVEs to adopt the most required technologies, which has greatly mobilized the initiatives of enterprises in energy technical reform. Meanwhile, TVEs also voluntarily carry out the activities in saving energy and reducing the emission of

[2] Source: China Casting Yearbook 2005

GHG. Based on the requirements for self development, Nanjing Moling General Casting Plant has adjusted its energy technical reform program many times. TVE Project provided strong support to such adjustment and changed TOR. This fully demonstrates that TVE Project closely combines with the development direction of TVEs. TVE Project has facilitated the adoption and absorption of state-of-art technologies by relevant enterprises. Meanwhile, it has provided more reliable and richer sources of information. Investigations show that the production technology, education level and skills of workers and market conditions of the casting enterprises of Jiangning District make it difficult for carrying out energy saving activities. Fully understanding this situation, LPIC of Jiangning District helps TVEs get access to the required technical information by means visits, technical training and exchange meetings, which has laid a good foundation for such TVEs to adopt energy saving technologies.

2、 *Policy driven incentive mechanism*

The outcomes of TVE Project have facilitated the enforcement of national and local policies and regulations by local governments and raised the initiatives of enterprises in energy conservation and GHG reduction and local governments in carrying out environmental protection policy. This helps the enforcement of Energy Conservation Law and Clean Production Law and is conducive to smooth implementation of the policies of casting industry on energy conservation and GHG emission reduction. At the same time, TVE Project is the first to introduce the Voluntary Agreement mechanism to TVEs. This is an innovation in government administration and mobilizes the initiatives of enterprises in saving energy and resources.

With smooth implementation of energy technical reforms and its good economic, social and environmental benefits it has obtained resulting from energy saving and environmental protection, Nanjing Moling General Casting Plant has become a good example for local TVEs. It becomes an unofficial access standard for other enterprises to enter local development zones. That is, if other enterprises do not have same energy-saving and environmental protection performance, they will not be

permitted in the economic development zones. This illustrates that the successful implementation of TVE Project has facilitated active change of the attitude and awareness of local governments and other stakeholders. This has created a good atmosphere for the development and enforcement of local energy-saving and environmental protection policies.

3、Support from local government agencies — including LPIC

LPIC of Jiangning District has actively raised the capital for the energy technical reform program of Nanjing Moling General Casting Plant. The LPIC strived for 125,000 yuan from Nanjing Science & Technology Bureau as technical reform fund. At the same time, Science & Technology Bureau of Jiangning District presented 80,000 yuan supporting fund to guide the plant building the aluminum-alloy-disappearing mold casting production line with annual capacity of 1000 tons, this has raised the overall product acceptance rate to 95% from 85%.

At the same time, LPIC of Jiangning District has facilitated the implementation of relevant policies on welfare enterprises. Nanjing Moling General Casting Plant has become a private share-holding enterprise with the percentage of disabled workers enabling it enjoying favorable tax policy stipulated by the State. It still enjoys the favorable policy of first collection and then refund of value-added tax. This has removed the obstacle of "private welfare enterprise being not able to enjoy national favorable policy due to change of ownership". To some extent, this has improved relevant national policy.

In addition, taking the advantage of the contacts among different local governments, LPIC of Jiangning District organized the representatives of casting enterprises in the District to carry out technical visits to such cities as Dalian, Jinan, Suzhou and Shanghai in 2004, which has enhanced mutual exchanges.

Among the 19 LPIC, the establishment and work of Jiangning District LPIC have the unique good conditions. MSSE Bureau of Jiangning District has established the "Jiangning District Administrative Service Center", that is, each government department of the District sets up an office in the center to provide the service for the enterprises. Enterprises of Jiangning District call it as the "government supermarket".

As the unit on which LPIC of Jiangning District depends, MSSE Bureau of Jiangning District naturally integrates LPIC work into the "government supermarket", which effectively combines LPIC functions with that of local government and ensures sustainable development of the philosophy of LPIC.

4、Financing

Financing obstacle is one of the four big obstacles of TVEs carrying out energy technical reform. Total investment of the demonstration enterprise is 29.40 million yuan RMB, $100,000 of which is TVE Project supporting fund and the remaining parts are self raised. Though Project supporting fund accounts a small percentage in total investment, most such funds are utilized for the increment cost that TVEs most unwilling to pay, which includes the cost for feasibility study, the installation and testing of energy saving equipment and training activities. Project supporting fund plays an active role in stimulating the interest of TVEs in investing energy efficiency projects.

In addition, TVE Project has enhanced the efforts of local government in supporting energy reform projects. The demonstration project——Nanjing Moling General Casting Plant has, with the support of LPIC officials, obtained the financial support of such funds as Jiangsu Big Project Investment Fund, Jiangsu Province Clean Production Fund (one sum of 500,000 yuan in 2005) and Nanjing Technical Reform Fund.

5、Market demand

With price rise of energy and raw materials, the competition of international big companies in China and increasingly strict restrict of national energy and environment policies, TVEs in casting industry are facing increasingly grave market situation. Therefore, they have spontaneous technical reform requirements in casting TVEs for reducing the cost, lowering GHG emission, improving product quality and developing new products.

Meeting the market demand, TVE Project selects profit-making technologies to carry out energy technical reform in the demonstration and replication enterprises with good economic profits. Successful technical reform of these enterprise and the

publicity and training of the project have further promoted the improvement of relevant technology, raised public awareness in energy saving and enhanced market demands for energy-saving products and technologies.

Meanwhile, the investment in mould-disappearing process and resin sand processes of casting enterprises has increased the sales of relevant energy-saving equipment. As a result, TVEs in casting industry begin investing in such production processes.

6、*Promotion and improvement of energy conservation awareness of the enterprises*

Both the management and ordinary workers of the enterprise have received training at different degrees from different channels during project implementation and they have effectively raised their awareness in saving energy. Apart from energy saving technology, these training courses also focus on the idea and concepts on environmental protection and energy conservation, which have effectively enhanced the environmental awareness and responsibilities of the staff of the enterprises and improved their. After the training courses, the managers and workers of the demonstration and replication enterprises begin paying attention to such issues as energy and resources saving in each production link, application of energy-saving equipment, reduction of energy waste and sharing of experience among the counterparts of the industry.

The workers of Nanjing Moling Casting Plant have about 7 training courses each year and it has become a system. As a comparison, Nanjing Yuhua Plant, the control enterprise in the same region, has no evident change because it has not took part in the Project. High-frequency and extensive training and publicity have facilitated the dissemination of the idea on environmental protection and energy saving to the relatives and friends of the staff of the TVE and improved the awareness of local communities in environmental protection and energy saving.

Case Study

—The Implementation of TVE Project by Zhejiang Shenhe Cement Co., Ltd.

I. Introduction

Zhejiang Shenhe Cement Co., Ltd. has the only off-kiln-decomposition new dry rotary clinker production line with daily capacity of 2500 t in Jiaxing City, Zhejiang Province. It is originated from a small enterprise using shaft kiln with annual capacity of 200,000 t. With the adjustment of national macro industrial policies and increasing environmental protection awareness and social responsibility of the management of the enterprise, Zhejiang Shenhe Cement Co., Ltd. took the lead in cement TVEs in 2000 to upgrade its production line and has become a modern cement manufacturer.

II. Technical Reform Measures and Energy Efficiency Management

The energy technical reform of Zhejiang Shenhe Cement Co., Ltd. is the establishment of the first 5-grade pre-heat pure low-temperature residual heat generation demonstration project for new dry cement clinker production lines in China. With the innovative application of the pure low-temperature residual heat power generation technology, the project employs the residual heat of the cement kiln to generate electricity without any additional combustion measures and influence on normal operation of the cement production process, thus realizing terraced utilization of energy.

III. Project Achievement

1、Energy efficiency baseline and the achievement of energy conservation and reduction of GHG emissions

As the first 5-grade pre-hear pure low-temperature residual-heat power generation demonstration project for new dry cement clinker production lines in China, Zhejiang Shenhe Cement Co., Ltd. employs the residual heat of the cement kiln to generate

electricity without any additional combustion measures and influence on normal operation of the cement production process, thus realizing terraced utilization of energy.

The power generation facility has been in safe operation for 9360 hours since its on-grid power generation on March 26, 2005 with accumulated output of 25 million kW•h, creating economic benefits of 15 million yuan. At present, the installed capacity of the generation system is 3MW with annual power capacity of 20.94GWh.

At present, energy consumption per ton of clinker of Zhejiang Shenhe Cement Co., Ltd. is 0.096 t and comprehensive energy consumption is 0.106 t coal equivalent per ton of cement. With the application of pure low-temperature residual heat power generation technology, Zhejiang Shenhe Cement Co., Ltd. recycles the energy equivalent to about 8020 t coal equivalent and reduces 19994 t of CO2 emission each year. It has become one of the top enterprises in the industry in terms of low energy consumption per unit product.

2、Economic benefits

Production cost of cement is mainly composed of the costs of electricity, coal and limestone. Beginning from 2004, the profit making level of cement industry has a significant decrease due to the reduction of off-plant price and rise of the price of raw materials and fuel. The implementation of TVE Project has greatly lowered production cost of the demonstration enterprise and won big profit margin for it.

Zhejiang Shenhe Cement Co., Ltd.——the project demonstration enterprise has successfully developed the first 5-grade-cyclone-preheater new dry residual heat power generation project in China. This not only addresses the power issue of the enterprise, but also greatly reduced production cost. The cost of residual heat power generation is 0.05 yuan/kW•h, and 0.13 yuan/kW•h plus equipment depreciation. This is much lower than industrial price of power being 0.59 yuan/kW•h. At present, 1/3 power of the enterprise comes from this generation facility, which saves over 1 million yuan per month and 10 yuan reduction of the cost of each ton of cement. Right now, cement market is flat. The price of cement is about 200 yuan/t which is

pretty close to the cost. The 10 yuan cost reduction has won a good profit margin for the enterprise.

In addition, the success of the project has to some extent changed profit-making mode and operation concept of the enterprise, i.e. shifting from the extensive operation with small profit but larger sales into the sustainable operation mode characterized by seeking higher profits from better management and technical innovation, which has strengthened comprehensive competitive power of the enterprise.

3、Reputation and social influence resulting from the technical reform

Reputation and social influence resulting from the technical reform mainly are the followings: A) Increased farmer's income. The annual income of an ordinary worker of Zhejiang Shenhe Cement Co., Ltd. is 13000 yuan, similar to the average worker's income of Zhejiang Province. The workers of Zhejiang Shenhe Cement Co., Ltd. has over 10% growth year on year, this income level is far higher than that of local farmers. B) Raised social status of women. In every four technical workers of the computer control room of Zhejiang Shenhe Cement Co., Ltd., there is one woman worker there monitoring the operation of cement manufacturing equipment. With the development of the enterprise and high automation, more job opportunities will be available for women. C) Promoted the establishment of rural social security system. Zhejiang Shenhe Cement Co., Ltd. has offered the pension, medical insurance and unemployment insurance for its staff and been in top position in TVEs across China in terms of social security.

4、Replication outcome and potential

The success of the first 5-grade cyclone new dry residual heat power generation project in Zhejiang Shenhe Cement Co., Ltd. has evoked a big repercussion in the cement industry. Up to now, Zhejiang Shenhe Cement Co., Ltd. has received the representatives of 45 cement enterprises learning the demonstration technology and put forward comments and suggestions on the Feasibility Study of the demonstration technique of 5 cement enterprises. The amount of replication enterprises in cement

industry is 20. In addition, there are more than 50 such projects under way in Zhejiang Province.

At present, there are 83 new dry rotary kiln production lines in Zhejiang Province. If they all adopt this new technology, the electricity saved could be enough to supply domestic power for a small city with 1 million residents. This is very significant to alleviate power shortage of Zhejiang Province.

It is inevitable that the new technology would replace the shaft kiln in the future. The information from NDRC indicates that industrial restructuring is one of the key tasks for the development of cement industry in China during the 11th Five-Year Plan period. It is expected that the percentage of cement from the dry technology will go up from 40% to 70% in 2010[3], this has created a large room for the application of the new dry cement manufacturing technology to generate power with residual heat.

IV. Analysis on the Experience and Lessons

1、Selection of technology

The residual heat power generation facility of Zhejiang Shenhe Cement Co., Ltd. has been in safe operation for 9360 hours since its on-grid power generation on March 26, 2005 with accumulated output of 25 million kW•h and reduction of 25,000 t of CO2 emission. The cost of residual heat power generation is about 0.12 yuan/kW•h, leading to 15 yuan reduction of the cost of per ton clinker and 20 million yuan cost reduction each year.

The selection of residual heat power generation technology complies with the principle of marching with the times. When selecting the demonstration technology, it is found that the power generation technology using residual heat from cement rotary kiln conforms to national industrial development trend though not being listed as national key development program. This technology is conformity with the orientation of national industrial development policy with big potential in energy conservation and extension value. Therefore, TVE Project has adjusted the

[3] Source: Development Objective of Cement Industry in 2010, Feb. 23, 2006. Digital Cement Network

demonstration technology of cement industry in line with relevant national industrial policies.

This fully demonstrates that the selection of the demonstration technology must conforms to national and local development policies and the outlook on scientific development and be conducive to the development of a resource-saving and environment-friendly society. Meanwhile, the selection of the demonstration technology must also fully respect the will of the enterprise. As a private enterprise, Zhejiang Shenhe Cement Co., Ltd. has been determined to make progress and made technical innovations. It is the first in China to successfully develop the kiln residual heat power generation technology. This reflects the fact that private enterprises are gradually becoming an important force in technical innovation. This actually complies with the national macro policy on "self innovation".

2、Policy driven incentive mechanism

The successful implementation of the project has provided a good foundation for the establishment and development of national and local energy-saving policies and regulations, particularly at local level.

To some extent, it can be said that Zhejiang Shenhe Cement Co., Ltd. is a successful case where TVE project has direct influence on macro policy. This company succeeded in employing the residual heat of new dry (5-grade cyclone pre-heater) rotary kiln to generate electricity in March of 2005, the first in Zhejiang Province and even in China. As a result, Zhejiang Economic and Trade Commission has included this technology into the "Guiding List of Zhejiang Province on the Replication of Electricity-Saving Technologies and Products (Group I)"(issued in July of 2005). In the same year, it promulgated favorable policy on the extension of the demonstration technology of the project including the exemption of on-line charge and simple review and approval procedures. In addition, the "National Medium and Long Term Plan for Energy Conservation" issued by NDRC in December of 2004 also specifies the replication of the pure residual heat power generation technology in 30 cement enterprises each year, making it one of the technologies under national support. Moreover, the Central Government still provides national bond support to the

residual heat power generation technology in cement industry in the background that the State has reduced the loan to the industry.

3、Support from local government agencies — including LPIC

Tongxiang LPIC has given strong support to the carrying out of the demonstration project. During the review and acceptance of the residual heat power generation project, Tongxiang LPIC carried out relevant policy coordination work. According to Mr. Shen Xinglong, Director of Zhejiang TVE Bureau, pure residual heat power generation project of Zhejiang Shenhe Cement Co., Ltd. conforms to relevant national policies and local policies of Zhejiang. Therefore, there was no obstacle in review and approval of the project. The LPIC actively carried out policy coordination with relevant departments including Zhejiang Economic and Trade Commission and accelerated the approval process. Then, Tongxiang LPIC carried out key policy coordination work on power on-grid link. The policy of Tongxiang Power Grid Company stipulates that power generation and on the grid are not allowed without permission in order to avoid the threat to the overall power grid. Tongxiang LPIC had many communications with Tongxiang Power Grid Company and finally strived for favorable on-grid policy for Zhejiang Shenhe Cement Co., Ltd., which permits within 1 km on grid of the power generated by Zhejiang Shenhe Cement Co., Ltd. But the electricity should not be transmitted out, thus avoiding the threat to the whole network.

In addition, residual heat power generation project of Zhejiang Shenhe Cement Co., Ltd. has obtained 100,000 yuan financial support of Science & Technology Bureau of Tongxiang City.

4、Financing

Total project investment of Zhejiang Shenhe Cement Co., Ltd., is 17.76 million yuan, $100,000 of which is TVE Project supporting fund, $200,000 is the entrusted loan and the remaining is self raised capital. To some extent, the entrusted loan plays its role in removing the financial obstacle of Zhejiang Shenhe Cement Co., Ltd. However, the capacity of RCF mechanism is limited. Therefore, it is more important

for the mechanism to guide and lure more capitals from other channels to invest in technical reform on energy conservation.

The success of the project has changed the attitude of commercial banks towards energy technical reform of enterprises. In the past, commercial banks held bias view on technical reform on energy conservation of TVEs. They thought its main purpose is to meet the enhanced supervision requirements of the government and the nature is passive technical reform with major benefits being social rather than economic. The success of the technical reform project of Zhejiang Shenhe Cement Co., Ltd. has eliminated the worries of those banks to a large extent. As a result of the demonstration project, commercial banks have provided many loan supports to similar projects.

In addition, the huge economic benefits of the project have attracted professional investment companies. China Water Investment Corporation and one of the technical supporting units of the project——Nanjing Kaisheng Cement Design Institute has signed an exclusive agreement. According to the agreement, China Water Investment Corporation would invest in the pure residual heat power generation project and sell the electricity at lower-than-market-price to enterprises. This approach has removed the capital obstacle for relevant enterprises that want to adopt this technology.

5、Market demand

The overall profit level of cement industry has been under sharp decline since 2005 due to the reduction of off-plant price and the rise of energy price. Severe lack of power of Zhejiang Province in 2005 led to wide under capacity in cement industry and further reduction of profits. At the same time, cement industry in China is facing pressing restructuring and upgrading requirement in the beginning of the 21 century. The traditional shaft kilns will be banned in the near future. The new dry pure residual heat power generation technology advocated by the project has further enhanced the advantage of the new cement production process, lowered production cost, reduced environmental pressure and addressed power shortage issue. It is the energy-saving technology with economic profits and big market potentials. The large scale extension

of this new technology and the residual heat power generation projects have also brought huge benefits for energy conservation and environmental protection.

In addition, the transformation from shaft kiln to new dry production line and reuse of the residual heat of the kiln has facilitated technical improvement of the cement industry and led to gradual shrinkage of the application area of low-grade cement product4, thus facilitating the restructuring of cement market. Moreover TVE Project has increased the demands for energy-saving equipment.

6、Promotion and improvement of energy conservation awareness of the enterprises

Both the management and ordinary workers of the enterprise have received training at different degrees from different channels during project implementation and they have effectively raised their awareness in saving energy. Apart from training and site visits, a special interview program on the demonstration project was broadcasted on media including Hong Kong Phoenix TV Station. This has greatly expanded the publicity scope of the Project and enhanced its influence. Part of the enterprise training channels comes from the Project Office and LPIC. But a large proportion of such training activities come from the initiatives of enterprise managers to look up information, consult with experts and share their experience. Apart from energy saving technology, these training courses also focus on the idea and concepts on environmental protection and energy conservation, which have effectively enhanced the understanding of and concern about environmental quality by the staff of the enterprises and improved their environmental awareness and responsibilities. After the training courses, the managers and workers of the demonstration and replication enterprises begin paying attention to such issues as energy and resources saving in each production link, application of energy-saving equipment, reduction of energy waste and sharing of experience among the counterparts of the industry.

[4] Shaft kiln usually produces 325/425# cement, while rotary kiln could manufacture 435/535# grade cement or better.