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APPRAISAL STAGE

Report No.: AB4191

Project Name	GEF China Thermal Power Efficiency Project
Region	EAST ASIA AND PACIFIC
Sector	District heating and energy efficiency services (80%);Power (10%);Central government administration (10%)
Project ID	P098654
GEF Focal Area	Climate change
Borrower(s)	GOVERNMENT OF CHINA
Implementing Agency	
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A. Country and Sector Background

1. **Growing Energy Demand and GHG Emissions.** China is the world's second largest energy user. Since 1990 energy consumption has been increasing on average at 5.8% per year, growing from 987 million tons of coal equivalent (tce) in 1990 to about 2.46 billion tce in 2006[1]. China's greenhouse gas (GHG) emissions are now comparable to the United States. This is due mostly to the consumption of coal for electricity production. Carbon dioxide (CO_2) emissions in China are projected to double over the next decade and as a result China will experience the largest absolute growth in these emissions over this period. Therefore, efforts to curb CO_2 emissions resulting from the generation of electricity are of paramount importance to the Climate Change Agenda.

2. **Predominance of Coal in China's Energy Mix.** China's rising energy demand has been met largely by domestic coal. Coal consumption reached about 1.7 billion tce in 2006, accounting for 69% of the country's total energy consumption. Various projections show that coal will still constitute 60% or more of China's primary energy consumption by 2020[2].

[1] China Statistic Year Book 2007
[2] Sustainable Energy in China: The Closing Window of Opportunity, World Bank, 2007

3. Coal has also been the predominant source of electricity generation in China. Thermal power generation capacity reached 484 GW in 2006, amounting to about 78% of the 622 GW total installed capacity and generating 83% of the 2,834 TWh total electricity output in China. Of this thermal generation capacity, 422 GW was coal-fired, accounting for about half of the country's 2006 total coal consumption. The Government of China (GOC) is seeking to diversify generation resources, mainly through scaling-up renewable energy and nuclear power. However, even with this diversification policy, coal will remain the prevailing fuel source for the foreseeable future.

4. **Significant Environmental Consequences.** The rapid expansion of installed thermal power generation capacity and its primary reliance on coal has contributed significantly to adverse environmental impacts in China. Emissions of sulfur dioxide (SO_2), CO_2 and nitrogen oxides (NO_X) from burning bituminous coal cause serious atmospheric pollution and are partially responsible for ground level ozone (smog), acid rain, poor surface water quality and climate change.

5. **Low Efficiency of Coal-fired Power Generation.** China's coal-fired power plants consume considerably more coal per kWh of electricity supplied than the international average. In 2006 coal-fired generation in China consumed an average 366 gce/kWh compared to a 300 gce/kWh benchmark in Japan or Europe [3]. The main factors contributing to China's low power generation efficiency are:

(a) ***Large share of generation by inefficient small*** [4]***units.*** In 2006, coal-fired power generating units of 100 MW and below had a combined installed capacity of 115 GW. This was equal to more than 27% of the total coal-fired power generation capacity in China. With a typical heat-rate of between 400 and 800 gce/kWh, these small units significantly underperform in comparison to medium and large size coal-fired generation units. For example 200 MW units consume about 360 gce/kWh, while units 300 MW and larger consume between 325 and 335 gce/kWh[5]. Notwithstanding the much higher coal consumption, these inefficient small thermal units, under the existing generation dispatch practices, have similar utilization factors [6] to the larger, more efficient units.

(b) ***Generation dispatch not optimized for achieving maximum efficiency.*** Unlike most other electricity systems in the world, Chinese power generation dispatch practices do not favor more efficient or lower variable cost generation[7]. Instead, all thermal units are scheduled to operate for a similar number of hours per year, regardless of efficiency or fuel consumption cost. The underlying cause of this practice is the regulated energy-only generation prices[8] for electricity supplied to grid companies. The energy-only price for a coal-fired generation investment project is approved based on an annual operational hour

[3] With units of 6 MW and bigger
[4] Refers to units of 100 MW and smaller
[5] Conclusions of a sample survey carried out by Chinese government authorities in 2007
[6] Utilization factor = annual energy generated/(available capacity x number of hours in the year)
[7] International practice of merit order dispatch schedules available thermal generation units to minimize total generation variable costs (mainly fuel costs).
[8] The grid company pays a generator only for the energy (kWh) injected to the grid.

assumption, usually around 5000 hours. On a year-ahead basis, each generation unit is planned with a proportional allocation of the energy required to supply the demand forecast, leading to similar annual operational hours. Throughout the year, the dispatch center schedules generation in accordance with the operational hours target assigned to each unit. This causes significantly greater average coal consumption per MWh of electricity production than if the dispatch had prioritized the more efficient coal-fired generation units.

(c) ***Small combined heat and power units operating for power generation only.*** Small units for combined heat and power (CHP) supply operate at a higher overall efficiency when providing both power and heat. For this and other reasons, small CHP units supplying heat are exempt from government-mandated closure, if these units comply with a specified ratio of heat-to-power[9] generation over the course of a year. However, operation for power generation only must be restricted accordingly. The small CHP units that do not comply with the required annual ratio of heat-to-power are liable to be closed down. Nonetheless, despite government regulations, many small CHP units in China continue to operate solely for power generation even when more coal-efficient capacity is available for substitutive generation, since the regulatory entities and system dispatchers do not have effective measures to monitor the heat supply by the CHP units. An effective monitoring system of heat supply by the small CHP units would facilitate enforcement of government regulations and lead to improvements in the overall system efficiency in power generations.

(d) ***Old mid-sized coal-fired units operating at relatively high coal consumption rate.*** Mid-sized coal-fired generation units built in the 1990s are operating at coal consumption rates higher than the rates of units with newer technologies and have significant potential for efficiency improvement during their generation life expectancy through rehabilitation and retrofit. These potential gains could be achieved through: (i) rehabilitation and retrofit of more than 100 sets of 200 to 300 MW units built in the 1990s; (ii) conversion of more than 81 sets of 300 MW units in northern China from solely power generation into CHP operation[10]; and (iii) waste heat recovery from the cooling systems of condensing-type power generation units for district heating.

6. **Government Strategies.** Chinese authorities at the highest levels have recognized that a business-as-usual approach in the energy sector will lead to unacceptable environmental consequences and strain the coal supply chain on an unprecedented scale. The Government initiatives intended to improve efficiency and reduce coal consumption in China are contained in its 11th Five Year Plan (2006-2010), issued in early 2006 that calls for a 20% reduction of energy consumption per unit output of gross domestic product (GDP) by 2010; and in the Medium and Long Term Energy Conservation Plan issued in 2004 by the National Development and Reform

[9] State Council Document [2000]1268: Heat-to-Power Ratio over the year (GJ: kWh*(3600 GJ/kWh)) x 100% must be equal to or above 100% for units smaller than 50 MW and 50% for units between 50 to 200 MW

[10] A 2006 survey commissioned by NDRC and conducted by the China Electric Power Engineering Consultants Group Corporation identified 81 units of 300 MW power-only condensing turbine power plants that were within a 15 km of cities with substantial industrial and district heat demand.

Commission (NDRC), which targets a reduction of energy intensity from 2.68 tce per RMB 10,000 of GDP output in 2002 to 2.25 tce by 2010 and 1.54 tce by 2020.

7. Specific GOC strategies to improve coal-fired thermal power generation efficiency include: (i) closure of inefficient small coal-fired units and the addition of new high-efficiency large-sized thermal units[11]; (ii) introduction of efficient generation dispatch, known as the Efficient Fuel Saving Dispatch (ESD); (iii) adoption of new clean coal technologies such as integrated gasification combined cycle (IGCC); (iv) investment in energy efficient systems and the rehabilitation of existing generation units; and (v) scale-up of renewable power generation.

8. The GOC's strategy for reducing the capacity share of inefficient small coal-fired generation units seeks to close down 50 GW of these units by 2010. Plant closure goals for 2010 were negotiated in 2007 and NDRC signed agreements with 30 provincial governments and 7 major power companies for their closure goals. Early results have been favorable, with 14.38 GW of small units closed by the end of 2007, exceeding the national 2007 target of 10 GW. However, most of the units closed belonged to large power generation companies which have the financial, institutional and technical capacity to address the financial and social impact of such closures. Those units remaining to be closed in 2009 and 2010 are smaller and mostly owned by municipal and county level small power companies. These companies are less likely to be able to address the financial and social impact of closure in the allotted time without additional financial support.

9. Another element of the GOC's strategy for improving thermal power sector efficiency is the replacement of existing dispatch practices with the ESD[12]. This requires generation dispatch to follow a merit order of units, determined by their efficiency and emission levels. The ESD will commence with pilots in 5 selected provinces, with the intention later of being implemented nationally. The change in dispatch practice will significantly reduce coal consumption for power generation. However, this will also have a critical impact on the financial viability of less efficient units (due to the reduction in generation), rendering these units unable to recover fixed costs at current generation tariffs. Additionally, the ESD pilot requires new technical regulations on access, disclosure and verification of generation efficiency data that to date has not been available at dispatch centers or used for dispatch. Although the start up of the pilot was scheduled to commence by early 2008, it has been delayed until adequate regulation and financial compensation mechanisms are implemented to address the associated technical and financial barriers.

B. Objectives

10. The project development objective is to reduce coal consumption and GHG emission per unit of electricity production in Shanxi Province, Shandong Province and Guangdong Province in China, through (i) mitigating the financial barriers of closing inefficient small-sized coal-fired units; (ii) demonstrating the viability of investments in efficiency improvements in existing mid-

[11] Most of new units added in 2008 are 600 MW and larger, with super-critical and ultra-super-critical technologies.
[12] A simulation study conducted for one provincial power grid as part of the project preparation work shows that the ESD could reduce coal consumption by about 2.2 million tce per year in that province during the period 2007-2011.
[0]

sized thermal units; and (iii) developing effective regulations to implement the pilot ESD programs and conducting studies to support the transition to efficient generation dispatch. The project will support pilot programs and demonstration sub-projects in three provinces that have significant potential for power sector efficiency improvements – Shanxi, Shandong and Guangdong.

11. Key performance indicators include: (i) average efficiency of and GHG emission from coal-fired electricity generation in Shandong, Shanxi and Guangdong provinces; (ii) Cumulative capacity of small coal-fired power generation units closed in Shandong and Shanxi; (iii) thermal efficiency of and GHG emission reduction from the units #1-4 of Yangguang Thermal Power Plant in Shanxi; (iv) thermal efficiency of and GHG emission reduction from the units #7-8 at Huangtai Thermal Power Plant in Shandong; and (v) thermal efficiency of and GHG emission reduction from the units #5-6 at Jinan Beijiao Thermal Power Plant in Shandong.

12. **Consistent with the Bank's new Country Partnership Strategy.** The project will directly support Pillar 3 of the Bank's new Country Partnership Strategy (CPS) for China (2006–2010) by managing resource scarcity and addressing key resource and environmental constraints to China's future growth. Demonstrating more efficient ways of using coal, creating a more competitive electric power market and addressing climate change as the means to build a resource-efficient society, are explicitly stated objectives of the CPS. These objectives are also fully aligned with a major, and long-standing, GOC objective of reducing energy intensity and the resulting negative impact of coal use.

13. **Consistent with the Bank Climate Change Strategy.** The Bank is finalizing its *Strategic Framework on Climate Change and Development for the World Bank Group (SFCCD)*. Within the SFCCD, the Bank attaches great importance to partnerships and is taking specific steps to enhance coordination and/or collaboration among the United Nation agencies, GEF, multilateral development banks, bilateral donors, the private sector, research institutions and civil society groups. The Bank's operational response to climate change focuses on six key areas: (i) integrating climate actions in development strategy; (ii) mobilizing concessional and innovative finance; (iii) facilitating the development of innovative market mechanisms; (iv) leveraging private sector finance; (v) increasing support to technology acceleration; and (vi) stepping-up policy research, knowledge and capacity building. This project is consistent with the SFCCD, as it will integrate actions in both the reform and development of power sector policies. This includes the closure of inefficient small units, facilitating the pilot implementation and transition to efficient generation dispatch practices, supporting the development of power generation efficiency technology in China and enhancing energy efficiency policy research, best practices establishment, knowledge sharing and capacity building. This would be achieved through collaboration among government agencies, utilities, power companies, research institutions, GEF, international donors and the Bank.

14. **Consistent with the Bank's Strategy in Promoting Carbon Reduction.** The Bank, as the trustee of various Carbon Funds, is also a world leader in mitigating climate change. The Bank has achieved this by market-based GHG emission reduction purchase transactions through the Clean Development Mechanism under the Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC). Since ratifying the Kyoto Protocol,

China now has a strong interest in benefiting from the Bank and GEF support and from carbon finance. The Bank has already approved the Project Idea Note for one of the three sub-projects under the Component 2 of the project – *Waste Heat Recovery at Beijiao Thermal Power Plant in Shandong*. There are strong financial and technical barriers to investment in projects for the recovery of heat dispipated in plant cooling systems. The expected carbon finance from sales of carbon credits produced by emission reductions will help to off-set the cost of investment in these new improved technologies, and perhaps more importantly, will demonstrate their viability. A practical success story will help to encourage public/private enterprises to invest in heat recovery from similar plants for district heating in small and mid-sized municipalities in China.

15. **Consistent with the Strategic Objective of the GEF Interim Strategy** (*Summary of Negotiations on the Fourth Replenishment of the GEF Trust Fund, dated August 25, 2006)*. The project will support the retrofit of power plants, included under that strategy.

C. Rationale for Bank Involvement

16. Continued progress on improving coal-fired power generation efficiency is vital if the GOC's plan for a 20% reduction in GDP energy intensity by 2010 is to be realized. The success of the power sector efficiency strategy is closely linked to the removal of the key barriers identified above. Drawing from its international experience and knowledge of similar undertakings, the Bank is well positioned to assist in resolving the policy and technical issues associated with the GOC's sector strategy.

17. The Bank has assisted Russia and Poland in closing small mines. The experience acquired in addressing the social and financial barriers related to the mine closure could be applied in China. The Bank has also supported thermal power plant rehabilitation in many countries and has accumulated significant expertise in the planning and implementation of such projects. Project examples include: (i) the rehabilitation of the Elbistan thermal power plant in Turkey, consisting of four 320 MW units consuming local lignite; (ii) the Thermal Power Plant Rehabilitation Program in India, involving three power plants with a total of 640 MW capacity; and (iii) an Energy Sector Management Assistance Programme (ESMAP) study assessing the potential for rehabilitation or retirement of coal-fired power plants in Ukraine.

18. The proposed project continues and expands the Bank's support of the Government with its efforts to develop policies that will help achieve environmental sustainability of the energy sector. These efforts have included lending projects, analytical and advisory activities and economic and sector work (see Annex 2). More recently the Bank has been working with the Government on the development of a new investment framework which will promote clean energy and energy efficiency by combining carbon finance, Global Environment Facility (GEF) funds and the newly established Climate Investment Funds into lending operations. The GOC has requested this GEF project, and considers that it will provide a good opportunity to benefit from the Bank's experience in its efforts to improve the power sector efficiency in China.

D. Description

19. The project has five components: (i) mechanisms to support the closure of inefficient small coal-fired generation units; (ii) demonstration of power plant efficiency improvements; (iii) transition to efficient generation dispatch; (iv) technical assistance for project implementation; and (v) project management (see Annex 4).

20. **Component 1: Mechanisms to Support the Closure of Inefficient Small Coal-fired Generation Units** (GEF Grant US$ 9.50 million and counterpart funds US$ 26.92 million). This component will support the closure of inefficient small thermal units and GHG emission reduction in Shandong (4,300 MW) and Shanxi (2,870 MW), by 2010. Both provinces have adequate capacity reserve and committed investment in new generation capacities, which will ensure reliable power and heat supply along with the closure. The capacity of small units to be closed exceeds, by 300 MW and 200 MW respectively, the current provincial targets agreed with the NDRC. Out of the total target, the GEF Project is expected to support the closure of 2,910 MW in 2009 and 2010 (1583 MW in Shandong and 1327 MW in Shanxi). The component will support: (i) the establishment and pilot operation of a transparent and effective financial incentive mechanism for the closure of small units (MCSU). This will assist the small county and municipal power companies in Shanxi and Shandong to recover part of the costs of closure, mainly the cost of addressing the social impact of the closure; (ii) establishing CHP On-line Monitoring Systems to facilitate enforcement of government regulations for CHP unit operation; (iii) establishment of bulletin systems to enable the trading of emission allowances entitled by small units closed on schedule. These revenues can be complementary to the MCSU to partially offset closure costs; and (iv) monitoring and evaluation (M&E) and knowledge sharing to facilitate replication of successful experiences in other provinces of China.

21. **Component 2: Demonstration of Power Plant Efficiency Improvement** (GEF Grant US$ 3.51 million and counterpart funds US$ 52.77 million). This component will demonstrate plant efficiency improvement and GHG emission reduction through three different types of investment activities: (i) conversion of mid-sized power generation only units into CHP units, at Huangtai Thermal Power Plant in Shandong; (ii) waste heat recovery at thermal power units and utilization for district heating, at Jinan Beijiao Thermal Power Plant in Shandong; and (iii) improvement of power generation efficiency resulting from plant energy audit recommendations, at Yangguang Thermal Power Plant in Shanxi. Each project has been designed to improve the efficiency of power and heat supply during the remaining life expectancy of the generation units. The thermal efficiency baseline and target values of these demonstration projects are presented in Annexes 3 and 4. To ensure successful demonstration, sustainability and replication, support will also be provided for: (i) monitoring and assessment of the effectiveness of the three demonstrative projects, knowledge sharing and publications; and (ii) establishment of standard plant energy audit procedures and processes for identification and assessment of efficiency improvement investment activities and best practices of plant operation and maintenance (O&M).

22. **Component 3: Transition to Efficient Generation Dispatch** (GEF Grant US$ 4.07 million and counterpart funds US$ 3.23 million). This component will reduce system-wide coal consumption and GHG emission for power generation by supporting the transition from current system dispatch practices to an efficient generation dispatch that maximizes coal savings. Firstly, support will be provided for the pilot implementation of ESD in Guangdong Provincial

Grid, including: (i) development or improvement of the detailed regulations required to commence the piloting. This will cover; regulations for ESD financial compensation mechanisms, methodology and procedures for monitoring thermal efficiency and emission levels of units required to prepare the ESD merit order, and procedures for information disclosure to improve the ESD transparency and monitoring; and (ii) a simulation system to test improvements in the Guangdong Provincial Grid. Subsequently, the component will provide continued support for the improvement of the approach and regulations for generation dispatch and replication to other provinces. This will include: (i) a comprehensive assessment of the pilot ESD in all of the five pilot provinces after their first 12 months of operation, to identify recommendations on further improvement of the dispatch approach and regulations; (ii) key studies on generation pricing and tariff reform to phase out the ESD financial compensation mechanisms and to make the development of power markets compatible with the transition to efficient generation dispatch; and (iii) knowledge sharing and consensus building to support the improvement of the dispatch approach, regulations and replication.

23. **Component 4: Technical Assistance for Project Implementation** (GEF Grant US$ 1.27 million and counterpart funds US$ 0.59 million). This component will support the hiring of international and local consultants for operational management, technical advisory, procurement and financial management (FM) at various implementing agencies (IA) to support project implementation, M&E and replication of successful experience and practices (see Annex 4).

24. **Component 5: Project Management** (GEF Grant US$ 0.41 million and counterpart funds US$ 1.51 million). This component will provide budget support for the incremental operating costs of various IAs resulting from the project implementation (see Annex 4).

E. Financing

Source:	($m.)
BORROWER/RECIPIENT	15.5
Global Environment Facility (GEF)	19.7
Sub-borrower(s)	73.75
Total	108.95

F. Implementation

25. The GEF will finance about 18.1 % of the total project cost, estimated at US$ 108.95 million. The remaining 81.9 % will be co-financed by central government agencies including the Ministry of Finance (MOF), NDRC, State Electricity Regulation Commission (SERC) and Shandong and Shanxi Provincial Governments with budget allocations and in-kind contributions, Guangdong Provincial Grid Corporation (GDGC)[13] in Guangdong and three power plants in Shandong and Shanxi with loans from local banks (see Annex 5). USAID supported the energy audits of the three power plants under Component 2 during the project preparation and has agreed to continue its support for the introduction of international technologies and experience in

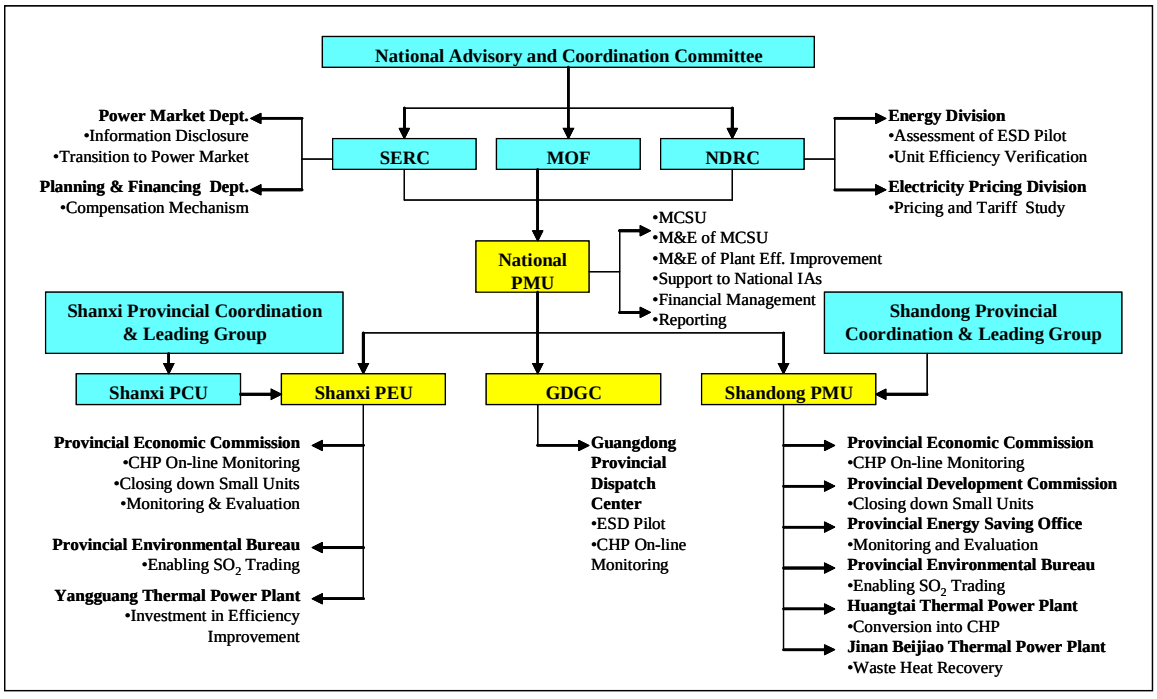
[13] A subsidiary of China Southern Grid Corporation.

plant efficiency improvement during the project implementation. The agency will finance international consulting services and workshops.

26. The project implementation will be carried out over four years by the central and provincial government agencies, GDGC in Guangdong and three power plants in Shandong and Shanxi. The institutional arrangements for project implementation have followed the normal functions of the government agencies and project entities (see Figure 1). Project management/coordination units have been created at both national and provincial levels so as to allow internal and external coordination, operational and logistical support to the project implementation, M&E and reporting, without major interruption to each IA's normal operating functions (see Annex 6).

27. According to the institutional and implementation arrangements illustrated in Figure 1 below, all IAs have comparative advantages and sufficient technical capacities to manage their respective project activities. However, the capacity assessments conducted by the Bank's Task Team indicated that the newly created project management/coordination units did not possess the capacity to provide the necessary operational support to the various IAs in procurement (see Annex 8), financial management (see Annex 7) and safeguard management (see Annex 10). See Section IV for the major conclusions of the capacity assessments and actions for capacity enhancement.

Figure 1: Institutional Arrangement for Project Implementation



G. Sustainability and replicability

28. **Sustainability.** The project activities have been designed to increase operational efficiency and thus reduce the operational cost of power generation, contributing to the sustainability of the power sector. There are clear indications of GOC ownership and commitment to closing down small units and implementing fuel efficient generation dispatch to reduce coal consumption in electricity production. The central government has issued several new sector regulations during the project preparation, signed agreements on closure targets with the provincial governments and major power companies and issued in 2007 the ESD principles and called for a ESD pilot in 5 selected provinces. The project-supported activities are complementary to the GOC's own initiatives.

29. The investment projects for plant efficiency improvement will lower operation costs and increase financial viability, consequently enhancing the financial sustainability of the thermal power plants. The project will also support the improvement of plant O&M practices which are critical to maintain the efficiency levels after the project completion.

30. **Replicability.** The GOC is strongly committed to scale up the impact of coal saving in the power sector. The GOC has adopted a phased approach to lower the energy intensity in power generation by issuing new sector policies and regulations on the closure of small units, issuing the ESD regulations to initiate the transition to efficient dispatch and piloting the ESD in selected provinces to test their effectiveness. The project will utilize international experience and contribute to the government's own initiatives, including technical assistance for assessment of the pilot programs and their replication.

31. The potential for replication of successful project experience is substantial. Many provinces are facing similar challenges in addressing the financial and social impacts of closing inefficient small units. The central government intends to continue the closure of the remaining less efficient small thermal units during 2010 to 2015. Replication of efficient generation dispatch practices to other provinces in China is part of the central government's current strategy and the provinces are expecting to benefit from the experience and lessons of the ESD pilot. The GOC and independent evaluations have confirmed that: (i) there are about 100 sets of 200-300 MW units, constructed in the 1990s, which could have their efficiency improved by up to 10% through dedicated investment activities; and (ii) there are over 81 sets of 300 MW units in northern China that have the potential to be transformed into CHP. When financially viable, waste heat recovery would be applicable to most of the coal-fired condensing type units in northern China where use of the recovered heat is needed locally.

32. The assessment of the MCSU and ESD pilot will lead to recommendations for improvements to central government policies and regulations to support replication. Assessment of plant efficiency improvement projects will demonstrate cases that are financially viable and also provide recommendations on standardized methodology and procedures for identification of the scope, implementation and M&E of efficiency improvement investments. This is vital to achieving effective replication of efficiency improvements to other power plants. Domestic commercial bank financial intermediaries, supported under the on-going China Energy Efficiency Financing Project, are keen to develop and sustain viable commercial energy conservation lending businesses. These would substantially increase investment in industrial energy conservation. In 2008, the MOF increased its current budget of US$ 3.2 billion to US$ 4.0 billion for energy saving and emission reduction investment project incentives. It is keen to

identify and promote appropriate energy efficient industrial technologies. At the request of MOF, the Bank is providing technical assistance on the use of this current budget for project identification and appraisal, determination of subsidy levels and evaluation of impacts on energy efficiency improvement and emission reduction.

H. Lessons Learned from Past Operations in the Country/Sector

33. Key lessons learned during Bank supported mine closure projects in Russia and Poland are relevant for this project and include: (i) financial resources must be available to address the social impact of closure; and (ii) financial aid must reach the target groups. These lessons have been incorporated in the design of the MCSU under Component 1, regarding the institutional arrangement for disbursement and monitoring of the MCSU. The Bank has supported several power sector reform projects in China. Key lessons learned are that the ownership and commitment of central government agencies and the major power companies, consensus building and a gradual approach are essential to the success of changes in power sector practices. Both Components 1 and 3 fully take these lessons into account. International experience and best practice for plant rehabilitation have been incorporated in the design of the investment projects for plant efficiency improvement under Component 2. An example of this is from Turkey where lignite power rehabilitation projects have been supported. The methodology of screening and determining the scope of rehabilitation through a standard energy audit has been introduced during the project preparation and the project design was based on audit recommendations. In India, similar ongoing rehabilitation projects supported by the GEF, IBRD, ESMAP and Policy and Human Resource Development Fund of Japan suggest the same experience. The Turkey and India projects prove that good O&M practice is cost effective in enhancing plant efficiency and has been incorporated into the project design.

I. Safeguard Policies (including public consultation)

34. The Bank's safeguard policies are not applicable for most of the project activities except for the plant efficiency improvement projects under the Component 2, for which the Bank's Safeguard Policies of Environment Assessment (OP/BP 4.01) and Involuntary Resettlement (OP/BP 4.12) are triggered.

Safeguard Policies Triggered	Yes	No
Environmental Assessment (OP/BP 4.01)	X	
Natural Habitats (OP/BP 4.04)		X
Forests (OP/BP 4.36)		X
Pest Management (OP 4.09)		X
Physical Cultural Resources (OP/BP 4.11)		X
Indigenous Peoples (OP/BP 4.10)		X
Involuntary Resettlement (OP/BP 4.12)	X	
Safety of Dams (OP/BP 4.37)		X
Projects on International Waterways (OP/BP 7.50)		X
Projects in Disputed Areas (OP/BP 7.60)		X

J. List of Factual Technical Documents

1. Report on Social Economic Survey for Closing Down Small Units in Shandong, Shanxi, Henan and Guangdong Province, November 2007.
2. Efficient Dispatch and Generation Trading to Reduce Coal Consumption in China – Final Report, Mercados - Energy Markets International, 25 June 2007
3. Simulation of Fuel-efficient Dispatch in Guangdong Provincial Power Grid and Estimate of Coal Savings
4. Feasibility and Detailed Design Report of CHP On-line Monitoring System in Shandong Province
5. Design Report for Rehabilitation of Shandong Huangtai Thermal Power Plant
6. Evaluation Report on Heat Supply Rehabilitation Program of Shandong Huangtai Power Plant, Xi'an Thermal Power Research Institute Co. Ltd., April 2008
7. Evaluation Report on Heat Supply Rehabilitation Program of Shandong Beijiao Plant, Xi'an Thermal Power Research Institute Co. Ltd., April 2008
8. Environmental Impact Assessment for Rehabilitation of Shandong Huangtai Thermal Power Plant, Shandong University, January 2008
9. Environmental Audit Report for Rehabilitation of Shandong Huangtai Thermal Power Plant, Shandong University, January 2008
10. Environmental Management Plan for Rehabilitation of Shandong Huangtai Thermal Power Plant, Shandong University, January 2008
11. Design report for Rehabilitation of Shandong Jinan Beijiao Thermal Power Plant
12. Environmental Impact Assessment for Rehabilitation of Shandong Beijiao Thermal Power Plant, Shandong Academy of Environmental Protection Science Research and Design and China Academy of Radiation Protection Research, January 2008
13. Environmental Management Plan for Rehabilitation of Shandong Beijiao Thermal Power Plant, Shandong Academy of Environmental Protection Science Research and Design and China Academy of Radiation Protection Research, January 2008

14. Resettlement Policy Framework for the Heat Supply Pipeline of Jinan Beijiao Thermal Power Plant
15. Resettlement Policy Framework for the Branch Heat Pipes of Huangtai Thermal Power Plant
16. Resettlement Plan for the Trunk Heat Pipes of Huangtai Thermal Power Plant.
17. Design Report for Rehabilitation of Shanxi Yangguang Thermal Power Plant
18. Environmental Impact Assessment for Rehabilitation of Shanxi Yangguang Thermal Power Plant
19. Financial Management Capacity Assessment Report, the World Bank, June 2008
20. Procurement Management Capacity Assessment Report, the World Bank, September 2008

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