TECHNICAL ASSISTANCE

TO THE

PEOPLE’S REPUBLIC OF CHINA

FOR

WASTE COAL UTILIZATION STUDY

September 2004
CURRENCY EQUIVALENTS
(as of 15 July 2004)

Currency Unit – yuan (CNY)
CNY1.00 = $0.1208
$1.00 = CNY8.2772

The exchange rate of the yuan is determined in relation to a weighted basket of currencies of the trading partners of the People’s Republic of China. In this report, a rate of $1.00 = CNY8.30 is used.

ABBREVIATIONS

ADB – Asian Development Bank
GSP – government of Shanxi Province
MW – megawatt
PRC – People’s Republic of China
TA – technical assistance

TA CLASSIFICATION

Poverty Classification – Other
Sector – Energy
Subsector – Energy sector development and reforms
Theme – Sustainable economic growth
Subtheme – Environmental sustainability

NOTE

In this report, “$” refers to US dollars.

This report was prepared by B. Q. Lin (team leader).
I. INTRODUCTION

1. During the 2004 Country Programming Mission, the Government of the People’s Republic of China (PRC) confirmed its request for technical assistance (TA) from the Asian Development Bank (ADB) to help the government of Shanxi Province (GSP) develop its waste coal utilization strategy, with a focus on specific investment planning.\(^1\) In July 2004, the Fact-Finding Mission was fielded to assess the results of available studies and determine the scope of the TA. The Mission held discussions with Government and GSP representatives. An understanding was reached on the TA goals, purpose, scope, cost estimates, financing and implementation arrangements, and consultants’ terms of reference. The TA framework is in Appendix 1.

II. ISSUES

2. The PRC is the world’s largest coal producer and consumer. In 2003 the PRC produced about 1,670 million tons (t) of raw coal, about 28% of the world’s total. Coal accounts for 95% of the nation’s primary fossil energy resources and provides more than 75% of the energy for power generation, 65% of chemical raw materials, and more than 50% of commercial and civilian energy. Coal will continue to be the country’s primary energy source. Shanxi accounts for about one third of the PRC’s coal production, or 480 million t in 2003. The cost of coal production is low, at about $12 to $13 equivalent per ton for large coal mines. However, coal is expensive to transport and is used inefficiently.

3. Waste coal is a solid produced during coal mining and preparation. Waste coal has a very low carbon content, which makes transporting it for use as fuel extremely inefficient. It usually accounts for 8–10% of total coal production. The PRC has about 1,500 waste coal heaps, with total waste coal amounting to about 3.6 billion t, occupying 15,000 hectares (ha), and increasing by 2,400 ha annually. Shanxi has about 300 waste coal heaps, with waste coal amounting to about 1 billion t, occupying 4,500 ha. In 2003, the PRC produced 167 million t of waste coal, 70 million t of it in Shanxi, where it is a major environmental problem.

4. The combustible matter in waste coal spontaneously combusts under certain conditions,\(^2\) emitting harmful elements such as sulfur dioxide, carbon dioxide, and discharge particulate matter (smoke and dust), and seriously affecting people’s health. After rainfall and water flushing, harmful elements of waste coal, especially heavy metal ions, are dissolved in water, leading to water pollution. Waste coal heaps could destroy the landscape and environment and cause water and soil degradation. The random piling of waste coal in rivers could hamper flood control and lead to disaster.

5. To ease the energy shortage, the Government has formulated a two-pronged strategy of accelerating the addition of new capacities and promoting energy conservation. Environmental protection is also receiving increased awareness and attention. The average heat value of waste coal is about 1,300 kilocalories per kilogram (kCal/kg), while the heat value of raw coal is about 5,000 kCal/kg. The storage of 3.60 billion t of waste coal, if fully used, will replace 0.94 billion t of coal, and, if utilized for electricity production, could generate about

\(^1\) The TA first appeared in *ADB Business Opportunities* (Internet edition) on 7 February 2004.
\(^2\) By the end of 1999, the PRC had 79 waste coal heaps undergoing spontaneous combustion, causing serious air pollution in mining areas.
2,100 terawatt-hours (TWh) of electricity, higher than the 2003 power generation of 1,898 TWh. Therefore, waste coal utilization is an important part of energy conservation.

6. Some waste coal utilization programs have been developed. Options include (i) low heating value fuel for power and heat generation through fluidized bed combustion, and briquette production with coal slime; (ii) raw material to produce cement, bricks and blocks, and light aggregate material; (iii) filling material for surface subsided areas and for the base of highways and railways; (iv) raw material to make chemical products; (v) secondary mineral resources; and (vi) producing composite fertilizer and providing trace elements for crops. Waste coal is mainly used for fuel, filling material, and building material.

7. The PRC has a series of policies and regulations to encourage waste coal utilization. These mainly promote the use of waste coal for power generation. By the end of 2003, Shanxi had established 37 waste coal power plants, with a total capacity of 427 megawatts (MW), consuming about 2 million t of waste coal. The capacity of single generating unit is small, and the largest one was 50 MW. The GSP has actively promoted the use of waste coal to generate power and plans to invest in waste coal power projects with a total capacity of 2,600 MW in the next 5 to 10 years. The environmental issues of waste coal power plants can be addressed by updated technology. Sulfur oxides emission can be lessened by circulated fluidized bed combustion, and a flue gas desulfurization system, if the sulfur content of the waste coal is greater than 2%. Dust emission can be reduced by multiple-tube cyclone dedusters and electrostatic precipitators. The fly ash and slag can be used to produce building material, or to reclaim land by filling the surface subsided area. The use of coal heaps as fuel will also eliminate spontaneous combustion and pollution.

8. About one third of waste coal is used to produce building material, such as cement, brick, and ceramic tile. Shanxi Lu'an Coal Group recently started a waste coal brick production line, the largest in the PRC, with a capacity of 130 million bricks annually, consuming 0.3 million t of waste coal. As the demand for ceramic tile increases by about 15%, the potential for using waste coal will be great.

9. Only in recent years has the PRC seriously started taking waste coal utilization into consideration in the development process. During 1997–2001, the PRC’s coal market was weak and coal mine companies suffered heavy losses, preventing them from investing in waste coal utilization. The main focus was to sell coal. The Government also heavily subsidized coalmine companies. With the improvement of the coal industry since 2002, coalmine companies have started waste coal utilization. The policy of restricting production of clay bricks has also promoted the use of waste coal as a building material. High coal prices and strong coal demand have increased investment in waste coal utilization projects. Coal companies now include waste coal utilization in their development plans. The Government also promotes waste coal utilization by increasing the environmental levy (such as reclamation fee and solid waste discharge fee).

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3 These regulations cover waste coal comprehensive use management methods, technical policy of waste coal comprehensive use, and management of resource comprehensive use power plant.
4 The implementation of the Shanxi Zhaocheng Waste Coal Power Plant started on 18 July 2003, with a capacity of 100 MW (2 x 50 MW).
5 Recently, new technology and equipment to produce hollow bricks from waste coal passed the appraisal of the State Development and Reform Commission. The technology is estimated to be able to use 16 million t of waste coal annually.
6 In January 2004, experts from the China University of Geosciences announced a new technology that can use waste coal to produce ceramic tile.
7 A 2003 Government regulation states that if waste coal is not properly treated, a discharge fee of waste coal will be collected at CNY5/t.
and has issued preferential policies to encourage the use of waste coal. The projects using waste coal enjoy tax benefits, including exemption of value-added tax and reduction of income tax.

10. Waste coal utilization projects are open to private investment. However, private sector involvement has been limited. Incentives are insufficient as (i) coalmine companies performed poorly before 2003 due to low coal prices; (ii) waste coal utilization is still in its infant stage, with perceived commercial risks; (iii) technical and institutional uncertainties exist; (iv) many waste coal utilization projects were funded by the Government’s preferential loans aimed at creating jobs for laid-off miners; and (v) power grid tariff for waste coal power plant was generally low, affecting profitability. To encourage private sector participation, an enabling environment needs to be created.

11. The GSP aims to contain worsening environmental pollution and ecosystem degradation to demonstrate that rapid economic growth and a clean environment are compatible. ADB’s PRC operational strategy aims to help the country achieve economic growth in an efficient, equitable, and sustainable manner. ADB’s PRC energy sector strategy includes (i) developing cleaner energy sources; (ii) renovating and retrofitting existing facilities to improve efficiency, and reduce emissions; (iii) promoting the corporatization and commercialization of energy utilities; and (iv) promoting pricing and tariff reforms. The energy sector strategy is complemented by ADB’s strategy for the environment sector, which supports the use of economic, supply-side, and other measures to ensure sustainable use of natural resources; promotes market-based pricing; and encourages cost recovery and environmental information disclosure. Shanxi suffers the most from waste coal and plans to improve its use by 2020. The TA is a major part of this effort. With the joint efforts of the GSP and ADB, Shanxi will try to obtain a special support policy from the Government to develop waste coal utilization and demonstration projects in promoting it. The TA, by developing a use strategy and active policy dialogue, is consistent with and supports the GSP’s development objectives, and is also consistent with ADB’s energy sector strategy. The largest coal supplier in the PRC, Shanxi will be the pilot province for advancing a national policy on coal waste use and for streamlining a series of administrative guidelines.

III. THE TECHNICAL ASSISTANCE

A. Purpose and Output

12. The TA’s objective is to help the GSP mitigate the environmental impact of waste coal and conserve energy by assessing waste coal utilization options and developing a waste coal utilization strategy and action plan. The TA will also develop a framework for medium- and long-term cooperation between the GSP and ADB for sustainable energy development.

13. The TA will (i) examine key issues related to waste coal utilization and propose measures to address them; (ii) assess impacts of waste coal utilization, including social and environmental aspects and sustainable economic development; (iii) identify and remove barriers to private sector participation in waste coal utilization, and develop a policy and regulatory framework to facilitate such participation; (iv) assess selected pilot waste coal utilization projects; (v) conduct an international seminar; (vi) carry out a field study; (vii) develop a waste coal utilization strategy and related investment programs; and (viii) conduct a consultation workshop with the main stakeholders.
B. Methodology and Key Activities

14. The TA will be implemented in close consultation with all stakeholders and interested parties, including targeted consumers and potential private sector investors. The TA will be carried out in three phases. In phase I, the consultants will do a detailed background study to thoroughly understand waste coal utilization issues. During phase II, the consultants will conduct an international seminar (para. 15) and identify the main issues to be addressed to (i) achieve the TA objectives, (ii) identify options for waste coal utilization, (iii) promote using waste coal for power generation and other commercial uses, (iv) introduce international best practices that are suitable for the PRC's power sector, and (v) implement reforms to solve these problems. Under phase III, based on the assessment of waste coal utilization options, the consultants will develop a strategy and action plan to support limited waste coal utilization. Based on the strategy, the TA will develop a framework for medium- and long-term cooperation between the GSP and ADB for sustainable energy development, and carry out a preliminary assessment for selected waste coal utilization pilot projects. The consultants will make assessments from technical, institutional, economic, social, financial, pricing, environmental, and poverty impact viewpoints. The consultants' recommendations will be discussed in a workshop with the main stakeholders. The consultants will organize a final workshop with the main stakeholders to disseminate the TA findings and recommendations. The consultants will also develop a public dissemination strategy for the TA findings. The outline terms of reference for consultants are in Appendix 2.

15. The consultants will organize an international seminar on waste coal utilization in phase II. The seminar will introduce and evaluate international experience and its relevance to the PRC and incorporate such experience into a waste coal utilization strategy. International and domestic experts will be invited to present papers and participate in the discussions. After the seminar, the consultants will prepare a report summarizing the discussions and identifying issues relevant to the PRC. The TA includes an international field study to expose selected PRC personnel to the latest trends and international best practices in waste coal utilization. Personnel from the GSP involved in policymaking and implementation of waste coal utilization will undertake the 10-day study. The consultants will consider the particular needs of the study participants and prepare a detailed proposal for ADB approval, specifying the (i) objectives of the field study, (ii) institutions to be visited, (iii) agenda for discussions and training, (iv) name and job description of each member nominated to participate in the field study, and (v) costs. Selection of participants for the international field study will be acceptable to ADB and consider economy and efficiency. At the end of the field study, the participants will submit to ADB a report summarizing the findings and recommendations.

16. The major assumptions for the TA's successful implementation include adequate counterpart support, adequate and timely provision of data, and submission of required studies. Major risks include delay in consultant selection and poor consultant performance. The Government’s continuing commitment to coal and power sector reforms, promotion of private sector participation, coal price and power tariff rationalization, and transparent regulation are also necessary for the TA's success. Efforts will be made to ensure that competent consultants will be recruited on time. The GSP is committed to reform and agreed to provide adequate counterpart support and data. Close coordination among the consultants, executing and implementing agencies, and ADB will further mitigate these risks.

C. Cost and Financing

17. The TA is estimated to cost $560,000 equivalent, with a foreign exchange cost of $259,750 and a local currency cost of $300,250 equivalent (Appendix 3). ADB will provide
$400,000 equivalent to finance $259,750 of the foreign exchange cost and $140,250 equivalent of the local currency cost. The TA will be financed on a grant basis by ADB’s TA funding program. The GSP will contribute $160,000 equivalent representing about 29% of the TA cost, to finance the remaining local currency cost.

D. Implementation Arrangements

18. The GSP will be the TA Executing Agency. ADB will engage the services of international and domestic consultants according to its Guidelines on the Use of Consultants and other arrangements satisfactory to ADB for the engagement of domestic consultants, and in consultation with the GSP. The international consultant will have expertise in (i) waste coal utilization, (ii) coal price and power tariff regulation, (iii) environmental assessment, (iv) economic and financial analysis, (v) institutional analysis, and (vii) poverty impact and social assessment. The domestic consultants will have similar expertise. An estimated total of 27 person-months of consulting services will be required: 7 for international and 20 for domestic services. A consulting firm will be selected following the submission of biodata proposals. The TA is expected to commence in December 2004 and be completed by December 2005.

19. The GSP will establish a counterpart team with representatives from the GSP and selected pilot projects. The counterpart team will closely interact with the consultants during TA implementation. The GSP will also establish a steering committee comprising senior GSP officials and representatives from other government organizations and agencies involved in formulating and implementing waste coal utilization policies. The steering committee will be the apex body, convey and interpret the Government’s views on policy issues, and generally oversee TA implementation. The counterpart team and steering committee members will interact with each other to clarify matters that fall outside the GSP’s purview. The GSP will provide interpreters, local transportation, and suitably equipped office space in Taiyuan. Some of the office equipment will be financed under the TA and will be procured by the international consultants in accordance with ADB’s Guidelines for Procurement. The consultants will establish an effective monitoring and evaluation system to monitor the impact of the TA, which will provide the basis for the GSP’s impact monitoring after the completion. The monitoring and evaluation system will include specific and measurable targets, and identify key risks and institutional arrangement for effective monitoring. The consultants will also provide the necessary trainings on monitoring. Within 3 to 5 years after the TA completion when development impacts should be evident, the GSP will carry out the impact assessment of the TA.

IV. THE PRESIDENT’S DECISION

20. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance not exceeding the equivalent of $400,000 on a grant basis to the Government of the People’s Republic of China for Waste Coal Utilization Study, and hereby reports this action to the Board.

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8 The pilot projects will be selected in phase I of the TA.
9 The GSP will appoint the counterpart team before TA negotiations.
## TECHNICAL ASSISTANCE FRAMEWORK

<table>
<thead>
<tr>
<th>Design Summary</th>
<th>Performance Indicators/Targets</th>
<th>Monitoring Mechanisms</th>
<th>Assumptions and Risks</th>
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</thead>
<tbody>
<tr>
<td><strong>Goal</strong></td>
<td>Improve Shanxi Province's environmental quality and conservation of energy</td>
<td>• Reduce waste coal storage by 30% by 2008&lt;br&gt;• Increase private sector investment in waste coal utilization by 20% by 2008</td>
<td>• Country economic and energy sector statistics&lt;br&gt;• Policy dialogue with the Government&lt;br&gt;• Implementation and impact monitoring by the government of Shanxi Province (GSP) and Asian Development Bank (ADB)</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>1. Promote waste coal utilization, including use options, financial and economic viability, environmental protection, and social development&lt;br&gt;2. Encourage private sector participation in waste coal utilization and create a policy and regulatory framework&lt;br&gt;3. Draw up a framework for medium- and long-term cooperation between the GSP and ADB to develop sustainable energy</td>
<td>• Comprehensive evaluation report by 2005&lt;br&gt;• Guidelines for promoting private sector participation in waste coal utilization by 2006&lt;br&gt;• A framework for medium- and long-term cooperation between the GSP and ADB by 2005</td>
<td>• Technical assistance (TA) final report and TA completion report&lt;br&gt;• Consultation workshop&lt;br&gt;• Review missions&lt;br&gt;• Implementation and impact monitoring by the GSP and ADB</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>1. A waste coal utilization strategy&lt;br&gt;2. An implementation plan&lt;br&gt;3. A framework for medium- and long-term cooperation between the GSP and ADB&lt;br&gt;4. Field study report</td>
<td>• Assessment of use options according to ADB guidelines&lt;br&gt;• Waste coal utilization strategy acceptable to the GSP and ADB&lt;br&gt;• Inception report&lt;br&gt;• International seminar report&lt;br&gt;• Field study report&lt;br&gt;• Draft final report</td>
<td>• Reform and development measures are relevant and sensitive to local issues.</td>
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</tr>
</thead>
</table>
| 5. International seminar report | • An implementable action plan  
  • Knowledge and experience of other countries  
  • Package of policies and regulations | • Final report  
  • Review mission  
  • Implementation and impact monitoring by the GSP and ADB | • Counterpart participation is active.  
  • The household survey is satisfactory. |
| 6. Consultation workshop report | | | |

**Activities**

1. Phase I: Preliminary analysis and data collection
   - Selected pilot projects acceptable to the GSP and ADB
   - Survey methodology acceptable to the GSP and ADB

2. Phase II: Review and analysis international experience
   - Sharing international experience relevant to the GSP
   - Key issues identified acceptable to the GSP and ADB

3. Phase III: Development of strategies and impact assessment
   - Waste coal utilization strategy accepted by all stakeholders
   - Effective implementation plan
   - Effective monitoring system and trainings on monitoring
   - Assessment of waste coal utilization pilot projects according to ADB guidelines
   - Meetings with consultants  
     - Review mission reports  
     - Draft final report
   - Consultation workshop report  
     - Final report  
     - TA implementation plan  
     - Implementation and impact monitoring by the GSP and ADB
   - Risks:  
     - Lack of counterpart support
     - Inadequate data  
     - Late consultant recruitment
   - Assumptions:  
     - Arrangements for international visits are satisfactory.
     - Consultants are selected on time, are suitably qualified, and perform well.
     - International and domestic speakers are qualified, and selected on schedule.
     - The household survey is satisfactory.
     - TA ownership by government of Shanxi Province is strong.

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## TECHNICAL ASSISTANCE FRAMEWORK—Continued

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<tbody>
<tr>
<td><strong>Inputs</strong></td>
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<tr>
<td>• International and domestic consulting services</td>
<td>• 7 person-months of international and 20 person-months of domestic consulting services</td>
<td>• Review mission reports</td>
<td>• International visits and seminars are arranged efficiently.</td>
</tr>
<tr>
<td>• Field study and training</td>
<td>• Field study for $20,000</td>
<td>• Consultation workshop report</td>
<td>• Cost estimates are accurate.</td>
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<tr>
<td>• International seminar and consultation workshop</td>
<td>• Surveys for $20,000</td>
<td>• Final report</td>
<td>• Counterpart support and office facilities are sufficient.</td>
</tr>
<tr>
<td>• Counterpart staff participation</td>
<td>• International seminar and consultation workshop for $42,500</td>
<td>• Field study report</td>
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<tr>
<td>• Computer and office facilities</td>
<td>• ADB financing of $400,000</td>
<td>• Implementation and impact monitoring by the GSP and ADB</td>
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<td></td>
<td>• GSP contribution of $160,000 equivalent</td>
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OUTLINE TERMS OF REFERENCE FOR CONSULTING SERVICES

1. The technical assistance (TA) will be carried out by a consulting firm with experience in waste coal utilization; institutional, economic, financial, environmental, and social analyses; impact assessment; and analysis of subsidies in the coal subsector. The team of international consultants will consist of a waste coal specialist, an energy economist, an environmental specialist, a social impact analyst, a financial analyst, and an institutional specialist. The study will require about 7 person-months of international and 20 person-months of domestic consulting services. To ensure effective assistance to the international consultants, the team of domestic consultants will have the same composition. The consultants will work in close collaboration with the government of Shanxi Province (GSP) and ensure effective know-how transfer. The international consultants will be recruited in accordance with Guidelines on the Use of Consultants of the Asian Development Bank (ADB).

2. When the TA starts, the consultants will do a detailed background study to thoroughly understand the issues related to waste coal utilization in the People’s Republic of China (PRC). The consultants will review the relevant reports and studies, including those of the GSP and international agencies, including ADB, the World Bank, and other aid agencies. The consultants will have discussions with members of the steering committee and counterpart team to understand the Government’s reform directions and establish a sound basis for the TA work. The consultants should evaluate international experience and its relevance to the PRC, and tailor their recommendations to ensure they can be effectively implemented. The recommendations should focus on how to progress to efficient waste coal utilization.

A. Terms of Reference

3. The terms of reference of the consulting services will include, but not be limited to, the following:

1. Phase I: Preliminary Analysis

4. The consultants will do the following:

(i) Trace the history of waste coal utilization in the PRC, and discuss the significant changes and their impact. Present a clear picture of waste coal utilization in the PRC, including (a) current waste coal utilization in different regions; (b) basis of waste coal utilization approval procedures; (c) relationships among the institutions involved; (d) roles and responsibilities of central and provincial governments in waste coal utilization; (e) subsidies and cross-subsidies; (f) financial position and financial governance of waste coal utilization utilities; (g) affordability by consumers; (h) objectives of waste coal utilization, including the overall objective and the objective in each development stage; and (i) past reform measures, including those for waste coal utilization in each development stage.

(ii) Organize and conduct a survey to identify the stakeholders and determine consumers’ willingness and ability to pay. The survey will provide a base for the impact assessment.

(iii) Evaluate in detail the quantity of waste coal in Shanxi to provide a sound basis for rational use and industry layout, including (a) quantity of waste coal heap,
main locations, status, and categories; (b) quality (contents and heating value) analysis of waste coal in the main production areas; and (c) analysis of waste coal production by category, and projection of its growth trend.

(iv) Identify the main issues of present waste coal utilization, including linkages to economic growth, social impact, and environmental improvement.

(v) Review issues of waste coal power plants. Investigate and analyze the situation of waste coal power plants, including investment modes, funding resources, power station types, installed capacity, contracted electricity generation, actual electricity generation, contracted generation tariffs, and actual average generation tariffs in the last 5 years.

(vi) Identify the barriers to waste coal utilization and measures to remove the barriers, including institutional, ownership, social, and financial constraints.

(vii) Describe waste coal utilization initiatives proposed by the Government, including objectives and the means to achieve these objectives. Determine if these reform measures are adequate to remove the constraints on waste coal utilization.

(viii) Review the potential for waste coal utilization in the PRC and discuss with concerned government agencies their plans and programs for promoting waste coal utilization.

(ix) Review the types of assistance for waste coal utilization being provided by other donor and funding agencies and discuss with them the options for promoting and implementing waste coal utilization.

(x) Review existing institutional and financing mechanisms to develop waste coal utilization projects and identify suitable general financing mechanisms to develop various types of waste coal utilization projects.

2. Phase II: Review and Analysis International Experience

5. During the second phase, the consultants will do the following:

(i) Introduce international experience in waste coal utilization and discuss its relevance to the PRC. Assess the use options for waste coal; develop waste coal utilization measures; and assess their adaptability to market modes in the PRC, including an integrated (hybrid) approach.

(ii) Review international methods of treating waste coal. According to the different use modes suggested by the GSP, recommend feasible options.

(iii) Based on international waste coal utilization regulation frameworks, experience, and lessons, and their relevance to the PRC, develop regulation principles, including cost compensation, reasonable rate of return, and equity principles.

(iv) Evaluate the possibility of private sector participation in waste coal utilization. Examine the program’s financial feasibility. Recommend measures to improve investments’ financial position. Such measures may include, but not be limited to,
better cost recovery mechanisms, cost control measures, adjustments to investment programs, and improvements in the performance of affiliated units.

(v) Assess the possibilities for private sector participation in waste coal utilization. Recommend effective policy dialogue to promote private sector participation in waste coal utilization by helping create a conductive environment.

(vi) Help the government of Shanxi Province identify possible waste coal utilization projects suitable for ADB financing, and the general organizational, financial, and technical support requirements to develop comprehensive proposals for development of such projects.

(vii) Discuss with concerned government officials and ADB staff members the proposed projects, and prioritize them by potential vis-à-vis required investments, project ownership by the proposed developer, and possible project implementation arrangements.

3. Phase III: Development of Strategies and Impact Assessment

6. During phase III, the consultants will do the following:

(i) Based on the waste coal resource evaluation and historical practices of waste coal utilization in Shanxi and international best practices, analyze and present the economic, environmental, and social benefits and costs of waste coal utilization to support large-scale use of waste coal. This analysis will support the selection of industry focus and main projects and will include the (a) role of waste coal utilization in energy conservation and sustainable development strategy of the Shanxi economy; (b) environmental benefit comparison of different use modes of waste coal, and the role of waste coal utilization in rebuilding the biological environment in coal-mine areas; (c) impact analysis of waste coal utilization on economic development in coal-mine areas, and promotion of economic structural adjustment; (d) impact analysis of waste coal utilization on the employment of laid-off workers in coal-mine areas and poverty reduction; (e) analysis of large-scale use options of waste coal that are most applicable in Shanxi; and (f) selection of development focus for waste coal utilization. In assessing cost recovery, financing mechanisms, affordability, subsidies, and other issues related to tariffs, the consultants should refer to ERD Technical Note #9: Setting User Charges for Public Services: Policies and Practices of the Asian Development Bank.

(ii) Develop a waste coal utilization plan up to 2020, including selection of development focus, scale, layout, implementation schedule, technical selection, investment, and promotion measures. The main focus of the planning will be (a) selection of applicable use options for different sources of waste coal; (b) setting up of the project database and implementation schedule of these projects; and (c) selection of projects for the first phase, and procedures to facilitate their approval by the related government agencies.

(iii) Carry out a technical and economic assessment of policies, including that requiring low heat value for waste coal power plants (limitation of 3,000 kilocalories per kilogram). Suggestions based on the assessment will help
the Government adjust these policies. The evaluation will be carried out for the combined combustion of waste coal with other low heat value fuels and will encourage the combined combustion of waste coal with other low heat value fuels for power generation, and accelerate policy formulation.

(iv) Evaluate the impact of waste coal utilization by analyzing survey data. Based on the recommendations regarding the subsidy program, determine the Government’s budgetary impacts.

(v) Assess the general financial, economic, and environmental benefits of the waste coal utilization projects selected for pilot studies. Recommend reform measures to remove the barriers to waste coal utilization. Identify critical issues that need to be addressed and steps that need to be taken by government agencies to develop the identified and prioritized waste coal utilization projects with assistance from ADB.

(vi) Propose waste coal utilization, taking into account the supply costs and consumers’ willingness and ability to pay. Where subsidies are suggested, they should be clearly identified and rationalized in accordance with the ADB policy on subsidies, taking into account relevant experience from developed and developing countries.

(vii) Propose technology, research, and development based on (a) introducing international waste coal utilization technologies; (b) introducing and promoting advanced applicable technologies, especially for large-scale circulated fluidized bed combustors; (c) cooperating with international research agencies to develop major applicable waste coal utilization technologies; (d) establishing a cooperation mechanism of scientific technology development and technical renovation, including (i) abrasion-resistant technology for circulated fluidized bed combustors; and (ii) low-cost furnace desulfurization technology, low-cost flue gas particulate removal equipment, water-saving generation technology, high-efficiency fly ash use technology for power plants, waste coal refill technology, and comprehensive evaluation methodology.

(viii) Propose personnel training in advanced technologies and improve personnel quality and management skills.

(ix) Identify assistance required to develop comprehensive project proposals for the waste coal utilization projects following discussions with government officials, and prepare the scope and terms of reference for the TA.

(x) Recommend a waste coal utilization strategy, mechanisms, and time-bound action plan. Identify different levels of responsible implementation agencies. Identify the legal and regulatory changes required to implement the waste coal utilization strategy. Discuss the relevance of the strategy in the context of energy conservation, environmental protection, and social economic conditions.

(xi) Develop a public dissemination strategy for the TA findings.

(xii) Assess resource requirement and institutional arrangement of monitoring the TA impact and identify data collection analysis and reporting skills, and management
information system skills required to implement the monitoring and evaluation system. The consultants will identify the training requirements and provide the necessary trainings on monitoring.

B. Field Study and International Seminar

7. The consultants will help organize an international seminar on waste coal utilization after the preliminary analysis in phase I. The seminar will introduce and evaluate the international experience in related areas and their relevance in the PRC context, to be incorporated into the strategy to develop waste coal utilization in phase II and III. International and domestic experts will be invited to present papers and participate in the discussions. After the seminar, the consultants will prepare a report summarizing the discussions and identifying reforms and development issues. The consultants will also help organize and conduct a field visit with the participation of key GSP staff involved in policymaking and implementation of waste coal utilization. The visits will be to selected countries to discuss with government officials and regulatory bodies the policy and implementation aspects of waste coal utilization. After the field visit, the consultants will prepare a report summarizing the main issues and findings of the participants.

C. Reports

8. The consultants will submit the following:

(i) **Inception report.** It will be submitted within 1 month after the TA starts, summarizing the initial findings and suggesting changes in the TA's approach, methodology, and time schedule. A report will be submitted on the international seminar, as well as one at the end of the international field visit, summarizing the main issues and findings.

(ii) **Draft final report and workshop.** The GSP and ADB will have 1 month to review the report. It will be discussed in a consultation workshop with main consumers, counterpart team, steering committee members, and key officials from other government agencies involved in waste coal utilization and implementation. ADB staff members will participate in the consultation workshop. The main objectives of the workshop are to (a) present the TA findings, and recommendations to the policymakers and stakeholders; (b) facilitate an exchange of ideas, and gather comments; (c) increase ownership of and commitment to the TA recommendations; and (d) allow the policymakers to discuss the stakeholders' feedback.

(iii) **Final report and final workshop.** One month after the consultation workshop, the consultants will submit the final report, taking into account the comments of the GSP and ADB on the draft final report, and the discussions held during the workshop. The consultants will write the final report and translate it into Chinese. The consultants will organize a final workshop with the participation of the main stakeholders to disseminate the TA findings and recommendations.
## COST ESTIMATES AND FINANCING PLAN

($) 

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<tr>
<th>Item</th>
<th>Foreign Exchange</th>
<th>Local Currency</th>
<th>Total Cost</th>
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### A. Asian Development Bank (ADB) Financing\(^{a}\)

1. **Consultants**
   a. Remuneration and Per Diem
      i. International Consultants 146,900 0 146,900
      ii. Domestic Consultants 0 88,000 88,000
   b. International and Local Travel 32,000 6,000 38,000
   c. Reports and Communications 5,800 10,000 15,800
2. **Equipments**\(^{b}\) 15,000 0 15,000
3. **Training, Seminars, and Conferences** 10,000 2,500 12,500
4. **Field Study** 20,000 0 20,000
5. **Surveys** 0 20,000 20,000
6. **Miscellaneous Administration and Support Costs** 2,100 1,000 3,100
7. **Representative for Contract Negotiations** 5,000 0 5,000
8. **Contingencies** 22,950 12,750 35,700

**Subtotal (A)** 259,750 140,250 400,000

### B. Government Financing

1. **Office Accommodation and Transport** 0 60,000 60,000
2. **Remuneration and Per Diem of Counterpart Staff** 0 42,000 42,000
3. **Training, Seminars, and Conferences** 0 30,000 30,000
4. **Others** 0 28,000 28,000

**Subtotal (B)** 0 160,000 160,000

**Total** 259,750 300,250 560,000

\(^{a}\) Financed by ADB’s technical assistance funding program.

\(^{b}\) Including three pentium computers, two photocopiers, a laser printer, a projector and a fax machine.

Source: ADB estimates.