



# Technical Assistance Report

---

Project Number: 43079-01  
Policy and Advisory Technical Assistance (PATA)  
October 2010

## Mongolia: Updating the Energy Sector Development Plan (Financed by the Japan Fund for Poverty Reduction)

Asian Development Bank

## CURRENCY EQUIVALENTS

(as of 5 October 2010)

Currency Unit	–	togrog (MNT)
MNT1.00	=	\$0.00075
\$1.00	=	MNT1,316

## ABBREVIATIONS

ADB	–	Asian Development Bank
CPS	–	country partnership strategy
COBP	–	country operations business plan
GW	–	gigawatt
MW	–	megawatt
TA	–	technical assistance

## TECHNICAL ASSISTANCE CLASSIFICATION

<b>Type</b>	–	Policy and advisory technical assistance (PATA)
<b>Targeting classification</b>	–	General intervention
<b>Sector (subsector)</b>	–	Energy (energy sector development)
<b>Theme (subthemes)</b>	–	<b>Economic growth</b> (widening access to markets and economic opportunities), environmental sustainability (eco-efficiency), regional cooperation and integration (cross-border infrastructure), capacity development (institutional development)
<b>Climate change</b>	–	climate change mitigation
<b>Location impact</b>	–	Rural (Low), urban (medium), national (high), regional (Low)

## NOTE

In this report, "\$" refers to US dollars.

<b>Vice-President</b>	C. Lawrence Greenwood, Jr., Operations 2
<b>Director General</b>	K. Gerhaeusser, East Asia Department (EARD)
<b>Director</b>	A. Bhargava, Energy Division, EARD
<b>Team leader</b>	S. Yamamura, Energy Specialist, EARD
<b>Team members</b>	T. Oi, Energy Specialist, EARD
	K. Ozoa, Administrative Assistant, EARD

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

## I. INTRODUCTION

1. During discussions for the country operations business plan (COBP) 2009–2012,<sup>1</sup> the Government of Mongolia sought Asian Development Bank (ADB) technical assistance (TA) to update the energy sector master plan. The TA is aligned with ADB's Energy Policy<sup>2</sup> in promoting energy sector reforms, capacity building, and governance. It will complement the energy sector road map by identifying priority lending and nonlending interventions to attain sector road map objectives in the COBP. The TA is included in ADB's COBP, 2009–2012 as nonlending assistance for 2010.<sup>3</sup> The design and monitoring framework is in Appendix 1.

## II. ISSUES

2. The current installed power capacity in Mongolia is 1,050 megawatts (MW),<sup>4</sup> but only 728 MW (69%) is available because of aging power plants.<sup>5</sup> The transmission and distribution network,<sup>6</sup> connecting around 70% of the population, has been less than reliable—causing frequent blackouts in major cities including Ulaanbaatar—mainly because of aging transmission lines and substation facilities. The obsolete power infrastructure has contributed to a total system loss of power supply exceeding 30%.<sup>7</sup> The government targets reducing the total system loss to less than 15% by 2010. This inefficient system is coming under tremendous pressure as the power demand led by the mining boom has risen consistently since 2003.<sup>8</sup> Investment in the power sector has traditionally been inadequate as a result of limited state finance, moderate demand growth, and uneconomical electricity tariffs inhibiting private investment.

3. The government has initiated various energy sector reforms and developments since 2001, including sector commercialization, energy efficiency, and renewable energy diffusion. Further to the Energy Law, 2001, which aimed to unbundle the energy sector<sup>9</sup> and establish a sector regulatory agency,<sup>10</sup> the government issued the Energy Sector Development Strategy with Short and Long-term Action Plans, 2002–2010 in 2002 focusing on (i) sector restructuring, (ii) energy conservation, (iii) planning and operational capacity enhancement, and (iv) energy access for all. The Renewable Energy Law, 2007 targets increasing the share of renewable energy in total primary energy sources up to 3%–5% by 2010 and 20%–25% by 2020. In 2008, the government issued the State Policy of Mongolia on Fuel and Energy, which identifies sector strategies, priorities, and actions from 2008 to 2015. The priorities include (i) enhancing energy security, (ii) improving the efficiency of the sector and creating favorable conditions for operation in the market environment, (iii) developing coal processing and clean coal technologies, and (iv) building energy exporting capacity.

---

<sup>1</sup> ADB. 2009. *Country Operations Business Plan: Mongolia, 2009–2012*. Manila.

<sup>2</sup> ADB. 2009. *Energy Policy*. Manila.

<sup>3</sup> The TA first appeared in the business opportunities section of ADB's website on 9 July 2010.

<sup>4</sup> The current energy mix is 89% coal-fired, 6.5% diesel, 3.8% hydropower, and 0.7% wind and solar power.

<sup>5</sup> All four major power plants operating in Mongolia have reached the end of their economic life and need urgent rehabilitation or replacement.

<sup>6</sup> The transmission and distribution network covers 21,542 kilometers of 35–220 kilovolt transmission lines and more than 20,000 km of 6–35 kilovolt overhead lines and underground cables.

<sup>7</sup> In 2009, generation loss was 16% and transmission and distribution losses were 18%. However, system loss (including generation, transmission, and distribution loss) improved from 43% in 2001 to 34% in 2009.

<sup>8</sup> Power demand since 2003 in industry, transportation, agriculture, and households have increased 31% (459.2 GWh), 30% (30.2 GWh), 22% (7 GWh), and 31% (174.7 GWh) respectively. The installed capacity growth has increased by 53.7 MW since 2003, a modest increase (6.8%).

<sup>9</sup> The single-buyer model was introduced in 2001. The monopolistic supply scheme was unbundled into seven generation companies, one transmission company, and nine distribution companies.

<sup>10</sup> The Energy Regulatory Authority authorizes tariff setting of heat and electricity and licensing of heat and electricity generation in Mongolia.

4. In spite of progress in policy reform and development, the state of the power sector is threatening to constrain economic growth<sup>11</sup> and may lead to serious failures with catastrophic consequences for the economy and social well-being.<sup>12</sup> While the mining boom is expected to provide much needed revenues to the government for undertaking urgent investments in the power sector, the private sector is expected to play a crucial role in sustaining these investments in the long term. There is an urgent need to take stock of the existing sector infrastructure, identify existing and projected critical capacity gaps over the short to medium term (2010–2020), and prepare a practical investment plan considering the available and anticipated public sector investment and potential private investment. In view of the above urgent needs, the power sector is being prioritized for ADB intervention in the proposed country partnership strategy (CPS), 2010–2015, which is being finalized.

5. The present energy sector master plan for Mongolia, 2000–2020 was prepared under two ADB-supported TA projects.<sup>13</sup> During the energy sector assessment in preparation of the CPS, many discrepancies were noted in the power demand forecast for 2000–2010, where actual demand grew much faster than projections. The mining boom has led to rapid economic growth—the gross domestic product of Mongolia has increased by 7%–10% per annum since 2003. This has spurred demand for electricity that is far beyond the high case growth assumption (4.5%–5.0% per annum) of the present energy sector master plan, 2000–2020. Rapid economic growth beyond forecasting has also caused a mismatch between forecast power demand growth (2.9% per annum) and actual demand growth (4.2% per annum on average). Because of this high demand pressure, the overall power plant reserve margin of the central energy system<sup>14</sup> has fallen below the required 20%. New large-scale mining development in the South Gobi is expected to cause significant power demand<sup>15</sup> pressure on the central energy system, worsening an already critical situation.

6. Coal mining development in the South Gobi could also provide an opportunity for Mongolia to add power supply capacity and enhance revenues through power export via cross-border power trade with the People's Republic of China.<sup>16</sup> In 2005, the government signed memorandums of understanding with the State Grid Corporation of the People's Republic of China, jointly developing (i) power plants (3,600 MW) in Siveovoo, South Gobi; and (ii) interconnected transmission line.

<sup>11</sup> From 2004 to 2007, the number of registered business entities in Ulaanbaatar nearly doubled. About 70% of the total registered business entities in Mongolia are in Ulaanbaatar, which accounts for 50% of the country's gross domestic product (GDP). Since 2009, approval of new business licenses has been suspended because of limited power supply capacity in Ulaanbaatar.

<sup>12</sup> Electricity and heating are essential during the harsh winter (about 7 months per year) when the temperature drops to –40°C or lower. About 69.1% of the population (56.7% of the poor) is connected to the grid system, and 23.8% of the population (9.0% of the poor) is covered under the central heating system network. Because of insufficient reserve margin in the power system, system failure could significantly affect industry and households.

<sup>13</sup> ADB. 1994. *Technical Assistance to Mongolia for the Power System Master Plan*. Manila (TA 2095-MON, approved on 6 June, \$595,000); ADB. 1999. *Technical Assistance to Mongolia for Capacity Building for Energy Planning*. Manila (TA 3299-MON, approved on 17 November, \$700,000).

<sup>14</sup> The central energy system, the largest grid system in Mongolia, covers 60% of the population and 60% of the country surface, with 840 MW installed capacity (80% of the total installed capacity) and 19,046 km of transmission lines (88% of total transmission lines).

<sup>15</sup> The South Gobi plans to be interconnected to the central energy system by 2012. Power demand in the South Gobi is expected to grow sharply (around 400 MW) by 2020 as a result of various mining developments including Oyu Tologoi gold and copper mine, Naryin Suhait and Ovoot Tologoi coal mines, and Tavan Tolgoi coal mine.

<sup>16</sup> Mongolia currently imports peaking power through an interconnected transmission line from the Russian Federation.

7. In addition to the urgent capacity addition and the opportunity for cross-border power trade, there is a strong need to align the sector strategies based on energy efficiency and the low-carbon development path. Mongolia is currently the world's fifth most carbon-intense economy (1,413 metric tons of carbon dioxide equivalents per \$1 million)<sup>17</sup> and the 10th most energy-intense (45,058 British thermal units per \$2,000 of gross domestic product).<sup>18</sup> As well as harnessing supply- and demand-side management for energy efficiency,<sup>19</sup> accelerating renewable energy diffusion is a challenge. Despite high renewable energy potential, including 175 gigawatt (GW) of solar power and 370 GW of wind power, the current installed capacity of renewable energy in the total primary energy mix is only 0.7% (3 MW)—far below the 25% target share of renewable energy in the mix by 2020.

8. The government target on energy access for all remains to be achieved. About 94% of the total population has access to either grid system or stand-alone electricity supply, but access to electricity is uneven among regions and households. About 13% of the rural population and 17% of the rural poor still do not have access to electricity, while only 0.5% of the urban population and 1.8% of the urban poor lack access to electricity.<sup>20</sup> Access to a reliable heating service is another issue. Around 1,200 coal-fired heat-only boilers have been in operation for heating supply in *aimag* (province) and *soum* (district) centers since the 1980s. The condition of heat-only boilers and piping systems for heating supply has deteriorated because of aging, and their combustion efficiency is only 40%.<sup>21</sup>

9. In view of these developments, it is urgent to analyze, refine, and update the existing energy sector master plan comprehensively for 2010–2020. This will complement the ADB sector strategies in the new CPS and the ongoing support for the sector reforms, especially seeking private sector investment. To build investor confidence and improve private sector investment in the energy sector, the government is developing a legal and institutional framework for public–private partnership and preparing an investment project, which is complemented by two ongoing ADB-financed TA projects.<sup>22</sup>

### III. THE TECHNICAL ASSISTANCE

10. The TA will support the government in (i) comprehensively assessing the sector to identify investment gaps and the urgent reforms needed to create an enabling environment for sustained sector development, (ii) formulating priority investments in power supply, and (iii) enhancing the government's capacity in sector assessment and investment needs analysis.

<sup>17</sup> World Resource Institute. 2009. *Climate Analysis Indicator Tool, Ver.7.0*, Washington, DC.

<sup>18</sup> United States Energy Information and Administration. 2009. *International Energy Statistics*, Washington, DC.

<sup>19</sup> ADB provided regional TA to develop a law on energy conservation and a medium- and long-term energy efficiency action plan. The output of the medium- and long-term energy efficiency action plan, which focuses on demand-side management, will be considered in formulating TA recommendations and plans. ADB. 2008. *Technical Assistance for Expanding the Implementation of the Energy Efficiency Initiative in Developing Member Countries*. Manila (TA 6501-REG).

<sup>20</sup> National Statistical Office. 2009. *Poverty Profile in Mongolia (Main Report of Household Socio-Economic Survey 2007–2008)*. Ulaanbaatar.

<sup>21</sup> The heat output of heat-only boilers is 0.8–2.1 MW. The combustion efficiency of similar-sized heat-only boilers in the People's Republic of China is around 60%.

<sup>22</sup> ADB. 2009. *Technical Assistance to Mongolia to Support Public–Private Partnerships*. Manila (TA 7291-MON, approved on 3 June, \$200,000); and ADB. 2010. *Technical Assistance to Mongolia for Ulaanbaatar Low Carbon Energy Supply Project Using a Public–Private Partnership Model*. Manila (TA 7502-MON, approved on 26 February, \$1,500,000).

## **A. Impact and Outcome**

11. The impact of the TA will be improved power supply in an environmentally sustainable manner. The outcome of the TA will be increased capacity in electricity and heating to meet additional demand.

## **B. Methodology and Key Activities**

12. The key outputs of the TA include the following:

- (i) A policy note with recommended policies and reforms to overcome the sector's investment constraints. The TA will conduct a comprehensive energy sector assessment that comprises (a) gap analysis between achievements and goals in the sector policy and strategy, (b) reform option analysis including tariff and sector deregulation, and (c) long-term energy demand–supply simulation and impact analysis under several energy demand–supply scenarios to identify the optimal investment scale in the energy sector together with feasible sector reform.
- (ii) A comprehensive sector investment plan, 2010–2020 to identify priority investment projects. The TA will (a) analyze the investment plan for electricity and heat generation, transmission, and distribution to identify the investment long list, and (b) develop selection indicators to identify a short list of potential investment to prepare a comprehensive sector investment plan.
- (iii) Capacity development training and seminars to strengthen capacity in sector assessment and investment needs analysis. The TA will (a) identify core capacity needs in energy sector analysis and planning, and (b) prepare a capacity enhancement module and conduct training and seminars.

13. The main assumptions relate to the continued economic growth led by the mining boom requiring sustained additional investment in the sector and the need to undertake urgent investment projects to meet rising demand. Another assumption relates to the strong buy-in from the government to address sector needs and undertake required reforms. The critical risks are frequent political changes that may threaten either the priority on the investment plan or the proposed reforms or both. The TA design has been extensively discussed with all relevant stakeholders to ensure their buy-in. The TA will be implemented in a participatory manner and the government will be extensively consulted in formulating the investment plan as well as reforms action plan so that the recommendations are practical and implementable.

## **C. Cost and Financing**

14. The TA is estimated to cost \$1,200,000 equivalent, of which \$1,000,000 will be financed on a grant basis by the Japan Fund for Poverty Reduction and administered by ADB. The Government of Mongolia will contribute \$200,000 to finance the cost of the project implementation unit. The proceeds of the TA will be disbursed in line with ADB's *Technical Assistance Disbursement Handbook* (2010, as amended from time to time). The detailed cost estimates and financing plan are in Appendix 2.

## **D. Implementation Arrangements**

15. The TA will be implemented over 15 months, from December 2010 to February 2012. The consultants will submit the following reports in English and Mongolian: (i) an inception report within 4 weeks after commencement of TA activities, (ii) a midterm report within 8 months

after the commencement, (iii) a draft final report within 13 months after the commencement, and (iv) a final report within 2 months after receipt of comments from ADB and the government.

16. The executing agency will be the Ministry of Mineral Resources and Energy. The implementing agency will be the Energy Authority. The Ministry of Mineral Resources and Energy and the Energy Authority will provide support to the consultants, including (i) adequately heated office space (with basic furniture, an international telephone line, and internet access); (ii) bilingual counterpart personnel available to work full time, if required; (iii) assistance with visas, accommodation, and other permits required by the consultants to enter and to work; and (iv) access to all data, including documents, reports, accounts, drawings and maps, and permission to enter offices, as appropriate and necessary, to undertake the work.

17. The TA will require international (25 person-months) and national (57 person-months) consulting services. International experts include (i) an energy specialist and team leader, (ii) an energy economist, (iii) a macro economist, (iv) a financial analyst, (v) a renewable energy specialist, and (vi) a power engineer. National experts include (i) an energy specialist and deputy team leader, (ii) a heating engineer, (iii) a transmission engineer, (iv) a power engineer, (v) a renewable energy specialist, (vi) a financial analyst, (vii) an energy economist, and (viii) a macro economist. The consulting firm (including international and local consultants) will be recruited by ADB in accordance with ADB's Guidelines on the Use of Consultants (2010, as amended from time to time) through the quality- and cost-based selection method (with a quality-cost ratio of 80:20), following submission of simplified technical proposals. ADB's Procurement Guidelines (2010, as amended time to time) will be followed and the shopping method will be used to procure equipment under the TA. Equipment used by consultants during TA implementation will be handed over to the executing agency upon completion of the TA. Appendix 3 provides the outline terms of reference.

18. The TA will be monitored based on (i) consultant progress reports, and (ii) ADB TA review missions. Quarterly consultation meetings will be organized for inception, interim, and draft final outputs inviting all concerned officials from the government and development partners to disseminate findings and receive comments.

#### **IV. THE PRESIDENT'S DECISION**

19. The President, acting under the authority delegated by the Board, has approved ADB administering technical assistance not exceeding the equivalent of \$1,000,000 to the Government of Mongolia to be financed on a grant basis by the Japan Fund for Poverty Reduction for Updating the Energy Sector Development Plan, and hereby reports this action to the Board.

## DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<b>Impact</b> Improved power supply in environmentally sustainable manner	Demand–supply gaps in electricity and heating fully met by 2015  Multiple PPP project launched by 2015  Reserve margin for generation improved to 20% by 2015  Transmission and distribution losses reduced to half from 2010 by 2015  Energy intensity reduced by 10% by 2015 compared to 2010	Government statistical data  ADB sector assessment report for the CPS in 2015  MMRE annual data on sector performance	<b>Assumptions</b> Government enabling policies are maintained in seeking private investment.  Tariffs are increased and maintained at a level that can attract private investment.  Subsidies are eliminated and sector operates on a cost recovery basis, ensuring quality operation and maintenance.  <b>Risk</b> Stagnated sector reforms inhibit investment and erode capacity.
<b>Outcome</b> Increased capacity in electricity and heating to meet additional demand	Priority investment project(s) start implementation by 2012 preferably through PPP  Recommendations and proposed reforms implemented by 2012	Government statistical data  MMRE annual data on electricity and heating tariff  ADB CPS midterm report	<b>Assumption</b> Government implements TA recommendations and private sector responds.  <b>Risks</b> Adequate government investment budget is not allocated.  Slow progress on sector reform undermines private investment in priority project.
<b>Outputs</b> 1. Policy note with recommended policies and reforms to overcome investment constraints  2. Comprehensive sector investment plan, 2010–2020 with identified priority investment projects  3. Capacity development training and seminars to strengthen capacity in sector assessment and investment needs analysis	Set of recommendations submitted to the MMRE, Energy Authority, and ADB in 2011  Report submitted to the MMRE, Energy Authority, and ADB in 2011  Various training activities held to train 25–30 staff from the MMRE and Energy Authority in all aspects of TA activities by 2011	Consultant reports  TA review mission	<b>Assumptions</b> Timely access to records, information, and personnel.  Mining boom continues to maintain sound macroeconomic conditions.  <b>Risk</b> Weak buy-in from the government on TA activities.



Activities with Milestones	Inputs
<p><b>A. Comprehensive energy sector assessment</b></p> <p>1.1 Review energy sector policies, strategies, laws, and regulations. Identify gaps between achievements and goals in the sector policy and strategy (by week 12).</p> <p>1.2 Review progress of single-buyer model development and sector privatization. Identify policy actions required for functioning single-buyer model and promoting sector privatization (by week 12).</p> <p>1.3 Prepare an inventory of electricity and heating systems, and assess the existing assets in terms of the operating life, available capacity, and loss (by week 12).</p> <p>1.4 Review the progress and the prospect of planned energy sector investment in the master plan of 2001. Identify gaps and issues to attain the target of the master plan (by week 12).</p> <p>1.5 Review the energy consumption trend. Identify factors of inefficient energy use and actions to improve energy efficiency. Propose several medium- and long-term energy intensity targets (by week 16).</p> <p>1.6 Review the wholesale and retail electricity and heating tariff level, tariff structure, and pricing methodologies (including impact analysis on poor households). Analyze options for the wholesale and retail tariff level and structure (by week 16).</p> <p>1.7 Conduct a managerial and financial capacity assessment of the licensed power enterprises. Develop performance benchmarks and identify measures to improve performance (by week 16).</p> <p>1.8 Review private and public investments of the energy sector. Identify several scenarios on the size of private and public investment for the energy sector up to 2020 (by week 12).</p> <p>1.9 Review the progress and achievement of renewable energy diffusion. Draw gaps and issues to attain the energy mix target in 2020 (by week 12).</p> <p>1.10 Develop long-term energy demand and supply model simulating several scenarios on power (electricity and heat) demand growth and optimal power supply for the planning period up to 2020 with 5-year interval (by week 20).</p> <p>1.11 Develop computer general equilibrium model, and assess impacts of power demand and supply scenarios on households (including the poor), industry, state budget, and macro economy (by week 28).</p> <p>1.12 Prepare policy note specifying priority agenda and actions for energy sector reform and the development and size of energy sector investment and its fund sources up to 2020 (by week 32).</p> <p><b>B. Prepare medium-term (5-year) and long-term (10-year) investment plan</b></p> <p>2.1 Prepare an investment plan for power generation capacity and loss reduction, including combined heat and power plants, renewable energy power plants, and other power plants for peak load (by week 40).</p> <p>2.2 Prepare an investment plan for electric transmission and distribution including loss reduction, which covers central, western, and eastern grid systems (by week 40).</p> <p>2.3 Prepare an investment plan for heat transmission and distribution including loss reduction, which covers centralized and independent, <i>aimag</i> (province) center, and <i>soum</i> (district) center heating systems in Ulaanbaatar (by week 40).</p> <p>2.4 Prepare an investment plan for electricity and heat supply for universal service access to remote areas, including standard stand-alone and micro grid project and program design (by week 40).</p> <p>2.5 Develop quantitative and qualitative indicators (including gender, social, and environmental impacts) for selecting candidate projects in the investment long list (by week 40).</p> <p>2.6 Develop standard methodologies of financial and economic analysis, indicators, and benchmarks for investment decision (by week 40).</p> <p>2.7 Identify a long list of candidate projects with consideration of gender, and social and environment safeguards, and prepare medium- and long-term energy sector investment plan (by week 52).</p>	<p>Japan Fund for Poverty Reduction: \$1,000,000 Government: \$200,000</p>

<b>C. Capacity development and knowledge dissemination</b> 3.1 Conduct capacity assessment of government ministries and agencies to identify core capacity needs in energy sector analysis and planning (by week 24). 3.2 Prepare capacity enhancement training module, and conduct capacity development training and seminars in energy sector analysis and planning (by week 56). 3.3 Hold quarterly consultation meetings to disseminate findings and receive comments on outputs (by weeks 4, 16, 28, 40, 52, and 60).	
---	--

ADB = Asian Development Bank, CPS = country partnership strategy, MMRE = Ministry of Mineral Resources and Energy, PPP = public-private partnership, TA = technical assistance.

Source: Asian Development Bank estimates.

**COST ESTIMATES AND FINANCING PLAN**

(\$'000)

<b>Item</b>	<b>Total Cost</b>
<b>A. Japan Fund for Poverty Reduction<sup>a</sup></b>	
1. Consultants	
a. Remuneration and per diem	
i. International consultants	517.00
ii. National consultants	173.00
b. International and local travel	139.00
c. Reports, translation, and communications	12.00
2. Equipment <sup>b</sup>	6.00
3. Training, <sup>c</sup> seminars, and conferences <sup>d</sup>	20.00
4. Surveys	30.00
5. Miscellaneous administration and support costs	8.00
6. Representative for contract negotiations	5.00
7. Contingencies	90.00
<b>Subtotal (A)</b>	<b>1,000.00</b>
<b>B. Government of Mongolia</b>	
1. Office accommodation and transport	100.00
2. Remuneration and per diem of counterpart staff	100.00
<b>Subtotal (B)</b>	<b>200.00</b>
<b>Total</b>	<b>1,200.00</b>

<sup>a</sup> Administered by the Asian Development Bank.

<sup>b</sup> Includes computers, printers, and energy demand and supply model software that will be used by consultants during the technical assistance and handed over to the executing agency upon completion.

<sup>c</sup> Details of training and seminars will be submitted to the Asian Development Bank for prior approval. The overseas training and study tour are not eligible for financing.

<sup>d</sup> At least six consultation sessions on interim and draft final outputs with the executing and implementing agencies, the other relevant ministries and agencies, and development partners.

Source: Asian Development Bank estimates.

## OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

1. A consulting firm will provide a team of international and national consultants. The terms of reference will include, but not be limited to, the following.

### A. International Consultants

2. **Energy specialist and team leader** (5.5 person-months). The expert should have a postgraduate degree in economics, engineering, or another relevant field, and at least 15 years of working experience in energy sector assessment and investment planning.

- (i) Review the Government of Mongolia's present and proposed energy sector policy, strategies, laws, regulations, and sector organizations. Identify gaps between achievements and goals in the sector policy and strategy.
- (ii) Review progress of single-buyer model development and sector privatization. Identify policy actions to be required for functioning single-buyer model and promoting sector privatization.
- (iii) Review the progress, achievement, and prospect of energy sector investment (including external assistance, ongoing projects, and proposed projects) planned in the energy sector master plan of 2001.
- (iv) Review the energy consumption (including power generation and loss performance), intensity, and elasticity trend. Identify factors of inefficient energy use and actions to improve energy efficiency. Propose several medium- and long-term energy intensity targets.
- (v) Review air pollution standard from coal-fired power plants by referring to outputs from Mitigation of Transboundary Air Pollution from Coal-Fired Power Plants in North-East Asia technical assistance (TA).<sup>1</sup>
- (vi) Prepare a policy note specifying gaps and issues in the energy sector, and priority agenda and actions for energy sector reform and development including performance benchmarks and the size of energy sector investment and its fund sources up to 2020.
- (vii) Develop quantitative and qualitative indicators in terms of energy security, air pollution control and greenhouse gas abatement, energy diversification, energy efficiency, improving access to electricity and heat, and social (including gender) and environment impact, for selecting candidate projects in investment long list.
- (viii) Identify a long list of candidate projects, with consideration of gender, and social and environment safeguards. Distinguish long-listed projects for public, public-private, and private initiatives; prioritize short-, medium-, and long-term candidate investment projects; and prepare the project summary.
- (ix) Conduct capacity assessment of government ministries and agencies in the analysis and planning of the energy sector to identify core capacity development needs.
- (x) Prepare capacity development module and conduct capacity development training and seminars in the analysis and planning of the energy sector.
- (xi) Assist the Ministry of Mineral Resources and Energy (MMRE) in development partner coordination for lending and nonlending interventions in the energy sector.
- (xii) Hold quarterly consultation meetings inviting all concerned officials from the government and development partners to disseminate findings and receive comments.

<sup>1</sup> ADB. 2007. *Technical Assistance on Mitigation of Transboundary Air Pollution from Coal-Fired Power Plants in North-East Asia*. Manila (TA 6371-REG, approved on 18 December 2006, \$900,000).

3. **Energy economist** (5 person-months). The expert should have a postgraduate degree in economics or another relevant field, and at least 10 years of working experience in economic analysis of the energy sector, preferably in constructing an energy demand and supply model.

- (i) Review and analyze options for wholesale and retail electricity and heating tariff level, tariff structure, and pricing methodologies in terms of full cost recovery and equity.
- (ii) Collect base data for energy demand and supply simulation. Identify deficiencies of database stock and recommend desirable database management for medium- and long-term energy demand and supply forecasting.
- (iii) Develop medium- and long-term energy demand and supply model. Simulate several power (electricity and heat) demand growth and optimal power supply scenarios in terms of stable power supply, universal access to electricity and heating services, improving energy efficiency, controlling air pollution, and greenhouse gas abatement, for the planning period up to 2020<sup>2</sup> with 5-year intervals.
- (iv) Assist team leader for preparing policy note specifying gaps and issues in the energy sector, priority agenda and actions for energy sector reform and development including performance benchmarks and the size of energy sector investment and its fund sources up to 2020.
- (v) Assist team leader for developing quantitative and qualitative indicators in terms of energy security, environment improvement (air pollution control and greenhouse gas abatement), energy diversification, energy efficiency, and improving access to electricity and heat, for selecting candidate projects in the investment long list.
- (vi) Assist team leader in conducting capacity assessment of government ministries and agencies in the analysis and planning of the energy sector to identify core capacity development needs.
- (vii) Assist team leader for preparing capacity development module and conduct capacity development training and seminars on energy sector analysis and planning.
- (viii) Assist team leader for holding quarterly consultation meetings inviting all concerned officials from the government and development partners to disseminate findings and receive comments.

4. **Macro economist** (3.5 person-months). The expert should have a postgraduate degree in economics, and at least 10 years of working experience preferably with experience in constructing computable general equilibrium model.

- (i) Collect relevant base data for construction and simulation of computable general equilibrium model. Closely coordinate the work progress with the energy economist.
- (ii) Review private and public investment in the energy sector in the past 5 years or more, analyze its trend, and identify several scenarios on the size of private and public investment for the energy sector up to 2020 with consideration of the country's borrowing capacity.
- (iii) Develop computable general equilibrium model, and assess impacts of power demand and supply scenarios on households (income and expenditure class), industry (firm scale and sector), state budget, and macro economy.
- (iv) Assist team leader in preparing policy note specifying gaps and issues in the energy sector, and priority agenda and actions for energy sector reform and development

---

<sup>2</sup> Parameters include (i) population trend; (ii) labor force trend; (iii) gross domestic product structure; (iv) industrial structure; (v) country's regional structure; (vi) change in oil, coal, and natural gas prices; (vii) size of state budget and borrowing capacity; and (viii) size of private flow.

including performance benchmarks and the size of energy sector investment and its fund sources up to 2020.

- (v) Assist team leader in conducting capacity assessment of government ministries and agencies in the analysis and planning of the energy sector to identify core capacity development needs.
- (vi) Assist team leader in preparing capacity development module and conduct capacity development training and seminars on energy sector analysis and planning.
- (vii) Assist team leader in holding quarterly consultation meetings inviting all concerned officials from the government and development partners to disseminate findings and receive comments.

5. **Financial analyst** (3.5 person-months). The expert should have a postgraduate degree in finance, accounting, or another relevant field, and at least 10 years of working experience in corporate financial and managerial analysis, preferably with experience in conducting financial and managerial capacity assessment of state-owned enterprises in the energy sector.

- (i) Collect and review balance sheet, profit and loss, and cash flow of the licensed power enterprises in the past 5 years or more.
- (ii) Conduct managerial and financial capacity assessment of the licensed power enterprises. Develop financial and managerial performance benchmarks ensuring financial self-sustainability and management improvement, and identify gaps with benchmarks, their causes, and measures to improve performance.
- (iii) Develop standard methodologies of financial and economic analysis, indicators, and benchmarks for investment decision in each power subsector for the use of executing and implementing agency officials.
- (iv) Assist team leader in preparing policy note specifying gaps and issues in the energy sector, and priority agenda and actions for energy sector reform and development including performance benchmarks and the size of energy sector investment and its fund sources up to 2020.
- (v) Assist team leader in identifying a long list of candidate projects. Distinguish long-listed projects for public, public-private, and private initiatives; prioritize short-, medium- and long-term candidate investment projects; and prepare the project summary.
- (vi) Assist team leader in preparing capacity development module, and conduct capacity development training and seminars on energy sector analysis and planning.
- (vii) Assist team leader in holding quarterly consultation meetings, inviting all concerned officials from the government and development partners to disseminate findings and receive comments.

6. **Renewable energy specialist** (2.5 person-months). The expert should have a postgraduate degree in engineering or another relevant field, and at least 10 years of working experience in renewable energy development.

- (i) Review the progress and achievement of renewable energy diffusion. Draw gaps and issues, including analysis on an enabling environment for diffusing renewable energy to attain the energy mix target in 2020.
- (ii) Assist team leader in preparing a policy note specifying gaps and issues in the energy sector, and priority agenda and actions for energy sector reform and development including performance benchmarks and the size of energy sector investment and its fund sources up to 2020.

- (iii) Conduct studies on investment options in renewable energy development and other potential sources development up to 2020. Studies will include, but not be limited to, (a) construction of renewable energy power plant development, and (b) other potential energy sources development (i.e., coal-bed methane). Identify candidate renewable energy and other potential source development projects up to 2020, including cost, impact and benefit, construction period, target year of operation, and fund source (public or private investment).
- (iv) Assist team leader in identifying a long list of candidate projects. Distinguish long-listed projects for public, public-private, and private initiatives; prioritize short-, medium-, and long-term candidate investment projects; and prepare the project summary.
- (v) Assist team leader in holding quarterly consultation meetings inviting all concerned officials from the government and development partners to disseminate findings and receive comments.

7. **Power engineer** (5 person-months). The expert should have a postgraduate degree in engineering or another relevant field, and at least 10 years of working experience in technical feasibility assessment of investment project and planning in the energy sector.

- (i) Conduct inventory survey for electricity and heating systems including the generation, transmission, and distribution network. Assess these existing assets in terms of the operating life, available capacity, and loss.
- (ii) Conduct studies on investment options in new power generation. Studies will include, but not be limited to, (a) construction of combined heat and power plant number 5, Shivee Ovoo power plant, and Tavantolgoi power plant; and (b) construction of power plants having power balancing and regulating functions and others. Identify candidate projects up to 2020.
- (iii) Conduct study on investment options in the rehabilitation and upgrading of power generation, including loss reduction. Studies will include, but not be limited to, (a) rehabilitation and upgrading of combined heat and power plants 2, 3, and 4; and (b) rehabilitation and upgrading of Choibalsan, Dalanzadgad, Darkhan, and Erdenet combined heat and power plants. Identify candidate projects up to 2020.
- (iv) Conduct study on investment options in electricity transmission and distribution, including expansion and loss reduction. Studies will include, but not be limited to, (a) the central grid system including Ulaanbaatar city, (b) the eastern and western region grid system including assessing the issues of interconnection of eastern and western grids to the central grid system, and (c) integration of the Gobi region and central grid system. Identify candidate projects up to 2020, including cost, impact and benefit, construction period, target year of operation, and fund source (public or private investment).
- (v) Conduct study on investment options in heat transmission and distribution, including expansion and loss reduction. Studies will include, but not be limited to, (a) analyzing the remaining transmission capacity of Ulaanbaatar district heating system for absorbing new additional connections, (b) expanding Ulaanbaatar centralized heating system (capacity of heat transmission pipeline and substations) and minimizing independent heating system, (c) restoring heating system in *aimag* (province) centers, and (d) restoring heating system in *soum* (district) centers. Identify candidate projects up to 2020, including cost, impact and benefit, construction period, target year of operation, and fund source (public or private investment).

- (vi) Conduct study on investment options in electricity supply for universal service access in remote areas. Studies will include, but not be limited to, (a) reviewing the performance of stand-alone and micro grid type electricity supply projects and programs, and drawing lessons learned; (b) analyzing international best practice but locally appropriate stand-alone and micro grid electricity supply design in remote areas; and (c) proposing standard stand-alone and micro grid project and program design including operation and maintenance structure for off-grid remote areas. Identify candidate projects up to 2020, including cost, impact and benefit, construction period, target year of operation, and fund source (public or private investment).
- (vii) Review medium- and long-term energy efficiency action plan to identify candidate projects for enhancing demand-side management up to 2020.<sup>3</sup>
- (viii) Assist team leader in identifying a long list of candidate projects. Distinguish long-listed projects for public, public-private, and private initiatives; prioritize short-, medium-, and long-term candidate investment projects; and prepare the project summary.
- (ix) Assist team leader in holding quarterly consultation meetings inviting all concerned officials from the government and development partners to disseminate findings and receive comments.

## B. National Consultants

8. The national consultants will comprise (i) a deputy team leader and energy specialist (9 person-months), (ii) a heating engineer (5 person-months), (iii) a transmission engineer (6 person-months), (iv) a power plant engineer (8 person-months), (v) a renewable energy specialist (6 person-months), (vi) a financial analyst (7 person-months), (vii) an energy economist (8 person-months), and (viii) a macro economist (8 person-months). They will generally work with the corresponding international consultants and provide assistance to support each international consultant. The heating engineer, transmission engineer, and power plant engineer will work with the power engineer (international).

## C. Reports

9. The consulting firm shall submit the following reports to ADB (in English) and the government (in Mongolian):

- (i) **Inception report** (within 4 weeks after commencement of services). The report will include a detailed work program.
- (ii) **Interim report** (within 8 months after commencement of services). The report will include an updated work program and any issues and concerns.
- (iii) **Draft final report** (within 13 months after commencement of services). Upon submission of the draft final report, a final consultation will be held, attended by relevant stakeholders, to receive feedback on the report.
- (iv) **Final report** (within 2 months after receipt of comments from ADB and the government on the draft final report). The final report shall take into consideration the comments of ADB and the government. A summary (maximum of 10 pages) should be included in the final report.

<sup>3</sup> The Mongolia medium- and long-term energy efficiency action plan is under preparation with the assistance of ADB. 2008. *Technical Assistance for Expanding the Implementation of the Energy Efficiency Initiative in Developing Member Countries*. Manila (TA 6501-REG).