Technical Assistance Report

Project Number: 46343
Project Preparatory Technical Assistance (PPTA)
April 2014

Mongolia: Preparing the Energy Efficiency and Urban Environment Improvement Project
(Financed by the Japan Fund for Poverty Reduction)

Asian Development Bank

CURRENCY EQUIVALENTS
(as of 3 March 2014)

Currency unit	–	togrog (MNT)
MNT1.00	=	$0.000571
$1.00	=	MNT1,751.50

ABBREVIATIONS

ADB	–	Asian Development Bank
CHP	–	combined heat and power
CRETC	–	Central Regional Electricity Transmission Company
EIA	–	environmental impact assessment
ERC	–	Energy Regulatory Commission
GWh	–	gigawatt-hour
PPP	–	public–private partnership
TA	–	technical assistance
UBEDC	–	Ulaanbaatar Electricity Distribution Network Company

TECHNICAL ASSISTANCE CLASSIFICATION

Type	**–**	Project preparatory technical assistance (PPTA)
Targeting classification	**–**	General intervention
Sector (subsector)	–	Energy (electricity transmission and distribution)
Theme (subtheme)	–	**Environmental sustainability** (urban environmental improvement)
Location (impact)	–	Urban (high), national (medium), regional (low)
Partnership	–	Japan Fund for Poverty Reduction

NOTE

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

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I. INTRODUCTION

1. The proposed technical assistance (TA) for preparing the Energy Efficiency and Urban Environment Improvement Project is included in the country partnership strategy, 2012–2016 for Mongolia. The proposed project will upgrade the electricity transmission and distribution networks in and around Ulaanbaatar, thereby improving energy efficiency, reducing transmission and distribution losses, and reducing emission of greenhouse gases and other air pollutants from existing power plants in Ulaanbaatar. The project will also facilitate financial closure of an ongoing combined heat and power (CHP) plant—plant number 5 (CHP 5)—through a public–private partnership (PPP) model that the Asian Development Bank (ADB) has been supporting.[1] The components of the project include (i) upgrading the electricity transmission and distribution networks; (ii) computerizing the system at load dispatch center, transmission, and distribution level; and (iii) capacity building.

2. ADB received a request on 23 April 2013 from the Government of Mongolia to provide the TA. During the fact-finding mission on 25 November 2013, an understanding was reached with the Ministry of Energy regarding the impact, outcome, outputs, implementation arrangements, cost, financing agreements, and outline terms of reference for the TA. The design and monitoring framework is in Appendix 1.[2]

II. ISSUES

3. In Mongolia, the energy sector has been unbundled into generation, load dispatch center, and transmission and distribution companies since 2001. Due to lack of available public funding, private investment in the sector is a key policy priority for the government. Existing facilities for providing heating and electricity (power plants and transmission and distribution lines) are energy-inefficient and vulnerable because they are old and outdated. Two of three coal-based CHP plants in Ulaanbaatar, CHPs 2 and 3, have operated for more than 40 years without proper emission control devices, and the largest plant, CHP 4, has operated for more than 25 years. Due to inadequate heat supply and coverage of central heating systems, residents in *ger* areas surrounding Ulaanbaatar (60% of residents in Ulaanbaatar) have to use coal-based household stoves and small, inefficient, heat-only boilers without proper emission control devices. Lack of investment in expanding the coverage of the electricity and heating network is the primary cause for continued use of inefficient and polluting heat systems. The result is serious urban air pollution during the winter season in Ulaanbaatar, which is widely regarded as among the most polluted cities in the Asia and Pacific region.[3] During winter months, particulate matter of less than 10 micrometers in diameter (PM10) in Ulaanbaatar's atmosphere routinely measures 279 micrograms per cubic meter of air, which is about five times higher than the World Health Organization's air quality guidelines of 50 micrograms/cubic meter.

4. Mongolia has experienced rapid economic growth (11.5% in 2013) led by mining development.[4] Electricity and heating demand has also been growing in Ulaanbaatar due to

[1] By strengthening associated transmission and distribution networks, the project will overcome a critical barrier to reliable evacuation of power from the CHP 5.

[2] The TA first appeared in the business opportunities section of ADB's website on 17 March 2014.

[3] The proposed project will complement and coordinate its activities, as necessary, with two ongoing urban development and urban transport projects administered by East Asia Urban and Social Sectors Division and East Asia Transport and Communications Division (ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Mongolia for the Ulaanbaatar Urban Services and Ger Areas Development Investment Program.* Manila; ADB. 2012. Report and Recommendation of the President to the Board of Directors: *Proposed Loan to Mongolia for the Urban Transport Development Investment Program.* Manila).

[4] The World Bank. 2013. *Mongolia Economic Update*. Washington, DC.

rapid urbanization and more economic and commercial activities.[5] But due to the unavailability of new power and heat plants, this demand is largely unmet and suppressed. As a result, electricity consumption in the central energy system, which covers Ulaanbaatar, other major cities, and mining development areas, grew modestly to 3,542 gigawatt-hours (GWh) in 2012, about 34% more than in 2003.[6] It is projected that electricity consumption in the central energy system will increase to 4,422 GWh in 2015 and by 2025 reach 8,189 GWh, more than double the 2012 rate.[7] The reserve margin of heat and power supply has become close to zero. To overcome the potential supply shortage, the government plans to build a new CHP 5 in Ulaanbaatar through a PPP model, and install additional capacity in the existing CHP 4.

5. The Government of Japan is supporting capacity expansion at the CHP 4 by 100 megawatts of electricity. ADB has been supporting construction of a new, energy-efficient CHP 5 (3 x 150 megawatts of electricity, using the circulating fluidized-bed boiler technique) through preparation of a feasibility study with safeguard documents and with advisory services to the government on PPP transactions. The international tender for the CHP 5 was successfully conducted and the government announced a preferred bidder on 26 August 2013.[8] ADB's Private Sector Operations Department is taking a lead role among the financiers, which include the European Bank for Reconstruction and Development, Japan Bank for International Cooperation, and private commercial banks. If the financial closure of the deal is successful, this will be the largest PPP transaction in the power sector of Mongolia.

6. In parallel to the construction of the new CHP 5 and the capacity expansion at the CHP 4, associated downstream facilities—e.g., power transmission and distribution networks managed by the Central Regional Electricity Transmission Company (CRETC) and Ulaanbaatar Electricity Distribution Network Company (UBEDC), and district heating networks managed by Ulaanbaatar District Heating Company—have to be strengthened and expanded to be able to supply reliable electricity and heat not only to existing customers but also to as-yet unserved communities and entities in Ulaanbaatar.[9] This will ensure that new investments in CHP plants will be optimally utilized. The existing power transmission and distribution infrastructure is inefficient and unreliable for lack of investment and maintenance, and is in urgent need of rehabilitation and upgrade. Electricity distribution losses totaled 19.6% in 2012, much higher than international best practice of about 5%. The average outage duration of the distribution network in Ulaanbaatar was 2,084.5 minutes per customer with more than 13 interruptions per customer in 2012, unacceptably high for any modern electricity distribution network. Improving transmission and distribution networks will reduce the power losses and thereby avoid additional consumption of coal and associated greenhouse gas emissions and pollutants; and improve the reliability and quality of electricity services to a population of 1.2 million, or 40% of the total population of Mongolia.

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[5] The population of Ulaanbaatar grew by 32.5% during 2003–2011 (1.2 million in 2011) and is expected to grow by about 26.9% during 2012–2020.

[6] Major mining activities are supported through captive power plants, which are not part of the central grid.

[7] ADB. 2010. *Technical Assistance to Mongolia for Updating the Energy Sector Development Plan*. Manila.

[8] The consortium of International Power–GDF Suez (France), Newcom (Mongolia), Posco Energy (the Republic of Korea), and Sojitz Corp (Japan).

[9] The lengths of electricity distribution lines are (i) 895.7 kilometers (km) of overhead 35 kilovolt (kV); (ii) 1,417.1 km of overhead 6 kV–10 kV; (iii) 754.7 km of underground cable; (iv) 1,716 km of overhead 0.4 kV; and (v) 492.1 km of underground cable 0.4 kV. The number of substations are (i) 40 of 35/6–10 kV; (ii) 6 of 35/0.4 kV; and (iii) 1,414 of 6–10/0.4 kV. The installed capacity of 6 kV–10 kV substations is 609.3 megavolt-ampere. Electricity demand from the Ulaanbaatar distribution network in 2011 was 1,849 terawatt-hours (TWh) and total sales were 1,472 TWh. The length of the electricity transmission lines in Ulaanbaatar is about 142 km of 220 kV and140 km of 110 kV.

7. In addition to the above investments, there is an urgent need to strengthen the capacity of the Energy Regulatory Commission (ERC), which is mandated to issue operational licenses to power plants, review and approve tariffs of licensees, and propose the end-user tariffs to the government. Since no new plants have been set up for a long time in Mongolia (para. 4), the ERC does not have hands-on experience in setting electricity and heating tariffs that would allow an adequate return on new investments and promote energy-efficient practices in the sector. This is a critical capacity gap that may undermine investments in new plants. With the large proposed investments in two CHP plants (para. 4), this need has become more urgent.

8. Through close donor coordination, the government requested ADB and the Japan International Cooperation Agency to focus on electricity transmission and distribution, whereas the World Bank was requested to focus on the district heating network. The proposed project is in line with (i) the country partnership strategy, 2012–2016 (and the new government confirmed its continued priority during the review of the strategy in November 2013); (ii) Mongolia's energy sector master plan; and (iii) ADB's Energy Policy, 2009.

9. The TA will (i) identify issues in electricity transmission and distribution networks; (ii) prepare feasibility studies based on these issues;[10] (iii) improve the capacity of implementing agencies to understand and apply ADB's procurement and disbursement procedures, and meet its environmental and social safeguard requirements; and (iv) develop the capacity of other public entities in the energy sector that are involved in the project.

III. THE PROPOSED TECHNICAL ASSISTANCE

A. Impact and Outcome

10. The impact will be improved energy services in Mongolia. The outcome will be improved efficiency of the power transmission and distribution systems in Ulaanbaatar.

B. Methodology and Key Activities

11. The TA outputs will be to rehabilitate and expand power transmission and distribution systems, and develop the institutional capacity of the ERC.

12. The TA will conduct due diligence for the proposed project, covering various aspects:

(i) **Technical.** Due diligence on technology selection will determine if the selected technology is appropriate for improving energy efficiency and reducing emissions.

(ii) **Economic and financial.** Economic and financial analyses of the project in accordance with ADB's financial management analysis[11] and economic analysis[12] guidelines will determine the economic and financial viability of the project. The TA will also assess financial management, design of funds flow, and disbursement arrangements.

[10] Contents of the feasibility study should include (i) project overview, (ii) analysis of system status, (iii) project rationale, (iv) technical design, (v) implementation schedule, (vi) energy saving analysis, (vii) cost estimates and financing plan, (viii) financial and economic analysis, (ix) social analysis, and (x) environmental impact assessment.

[11] The analysis will be guided by ADB's (i) Financial Management and Analysis of Projects (ADB. 2005. *Financial Management and Analysis of Projects.* Manila.), (ii) Financial Due Diligence Methodology Note (ADB. 2009 *Financial Due Diligence Methodology Note.* Manila.), (iii) Financial Management Assessment Questionnaire (http://www.adb.org/sites/default/files/financial-management-assessment-questionnaire.pdf), and (iv) latest ADB technical guidance for preparation and presentation of cost estimates.

[12] The analysis will follow ADB's Guidelines for the Economic Analysis of Projects (1997).

(iii) **Environment.** The TA will estimate to what extent a reduction of system losses will reduce emission of carbon dioxide and pollutants.

(iv) **Governance.** The TA will assess the sector-specific policy, legal, and institutional mechanisms and anticorruption measures, and assess the procurement capacity of the executing and implementing agencies (CRETC and UBEDC).

(v) **Procurement.** An indicative procurement plan, including details of procurement packages and their procurement mode, will be prepared. Due diligence will be conducted on new procurement laws, and the requirements of the general procurement agency for ADB-financed projects. Actions required to facilitate advanced contracting will be comprehensively examined during TA implementation to ensure that the project's readiness can be enhanced.

(vi) **Sector policy.** Due diligence will examine tariffs, and billing and collection policies.

(vii) **Social dimension.** A social and poverty analysis will be conducted for the preparation of the summary poverty reduction and social strategy, with focus on conducting analyses on gender, health impact, affordability, and potential job creation.

(viii) **Safeguards.** The environmental impact assessment report will be prepared by a locally certified agency and approved by both the Ministry of Environment and Green Development and ADB. The report shall be prepared to meet ADB's Safeguard Policy Statement (2009). If necessary, a resettlement plan will be prepared in accordance with the Safeguard Policy Statement.

13. Based on the lessons learned from previous interventions in similar projects, the main risk in attaining the project's output is a delay in project implementation. To mitigate that risk, the TA will provide project implementation training to the implementing agency, supported by ADB's resident mission in Ulaanbaatar. Training will include procurement procedures, disbursement procedures, and environmental and social safeguard requirements.

C. Cost and Financing

14. The TA is estimated to cost the equivalent of $2,200,000, of which $2,000,000 will be financed on a grant basis by the Japan Fund for Poverty Reduction, and administered by ADB. The government will provide counterpart support in the form of counterpart staff, office space, furniture, administrative support services, and local city transport and logistics costs. The government has been informed that approval of the TA does not commit ADB to finance any ensuing project. The cost estimates and financing plan are in Appendix 2.

D. Implementation Arrangements

15. The Ministry of Energy will be the executing agency, and CRETC and UBEDC will be the implementing agencies. A project steering committee will be established under the Ministry of Energy to oversee overall project implementation and coordinate with relevant government agencies and ADB.[13] A project management office will be established under CRETC and UBEDC to implement the project.

16. The TA will take a two-stage approach to use consulting services efficiently. Part 1 (data gathering and preliminary assessment) will require individual consultants (two international,

[13] The committee will comprise representatives from the Ministry of Energy, Ulaanbaatar Municipal Government, and the Ministry of Environment.

4 person-months; and two national, 4 person-months) while part 2 (preparation of feasibility studies, capacity building, and due diligence) will require a consulting firm (eight international consultants, 34 person-months; and 10 national consultants, 103 person-months). The required areas of expertise and the outline terms of reference for consultants are in Appendix 3. The consulting firm will be engaged using the quality- and cost-based selection method (with a quality–cost ratio of 90:10)[14] and a simplified technical proposal. The consultants for parts 1 and 2 will be recruited in accordance with ADB's Guidelines on the Use of Consultants (2013, as amended from time to time). The procurement of equipment under the TA will follow ADB's Procurement Guidelines (2013, as amended from time to time). Proceeds of the TA will be disbursed in line with ADB's *Technical Assistance Disbursement Handbook* (2010, as amended from time to time). Equipment procured under the TA will be turned over to the executing agency upon TA completion.

17. The TA will be implemented over 24 months. Part 1 is expected to start on 1 June 2014 and end on 31 July 2014, while part 2 is expected to start on 1 August 2014 and end on 31 May 2016.

18. Consultation workshops with stakeholders will be held during the TA and project processing stages to discuss the project design.[15]

IV. THE PRESIDENT'S RECOMMENDATION

19. The President recommends that the Board approve ADB administering technical assistance not exceeding the equivalent of $2,000,000 to Mongolia to be financed on a grant basis by the Japan Fund for Poverty Reduction for preparing the Energy Efficiency and Urban Environment Improvement Project.

[14] The 90:10 ratio is proposed because the high quality of technical input is essential.

[15] The potential stakeholders include the Ministry of Energy, Ministry of Economic Development, Ministry of Finance, Ulaanbaatar Municipal Government, Ministry of Environment and Green Development, Central Dispatching Center, Energy Regulatory Commission, CRETC, UBEDC, communities in Ulaanbaatar, the Embassy of Japan in Mongolia, and Japan International Cooperation Agency.

PRELIMINARY DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
Impact Improved energy services in Mongolia	By 2022, reserve margin will be 15% (baseline: 3.1% in 2010) By 2030, loss-of-load probability will be 1.37% (baseline: 2.3% in 2010) Additional 450 MWe of capacity added to the system	Data from the ERC	**Assumptions** Timely completion of CHP 5 and rehabilitation of CHP 4, and reliable operations by both Transparent and cost-recovering tariffs encourage private investments. **Risk** Failure to financially close the CHP 5 transaction inhibits further investments in the sector.
Outcome Improved efficiency of the power transmission and distribution systems in Ulaanbaatar	By 2020, distribution losses decreased to 10% (baseline: 19.6% in 2012) By 2020, annual coal consumption attributed to loss reduction will be reduced, resulting to lowered emission of CO_2, SO_2, PM10 and NO_2[a]	Data from the ERC Data from the National Electricity Transmission Grid Company and Ulaanbaatar Electricity Distribution Network Company	**Assumption** Other bilateral and international donors make timely investments in power transmission and distribution. **Risks** Delays in project implementation. Inappropriate tariff setting.
Outputs 1. Rehabilitate and expand power transmission and distribution systems 2. Develop institutional capacity of the ERC	By 2019, the system average interruption duration index and system average interruption frequency index improved (baseline in 2012: 2,084.5 minutes and 13.2 times) By 2019, staff from the implementing agencies and ERC are trained	Data from the National Dispatching Center Consultant's report	**Assumptions** Sufficient and timely counterpart funds available. Timely hiring of the procurement agent and project implementation consultant. **Risks** Inadequate capacity of project implementing agencies. Poor quality of consultants.

Activities with Milestones	Inputs
1. Rehabilitate and expand power transmission and distribution systems 1.1 Upgrade the capacity of 220/110 kV transformers from 125 MVA to 200 MVA 1.2 Upgrade the 110 kV transmission line to double-loop lines 1.3 Upgrade transformers for existing power plants and install transformers for newly constructed power plants 1.4 Upgrade 35/10 kV substations 1.5 Upgrade 10 kV distribution poles 1.6 Install SCADA system 1.7 Install 10 kV underground cable and optical fiber cables **2. Develop institutional capacity of the ERC** 2.1 Assist in the preparation of bidding documents 2.2 Conduct training on procurement and disbursement 2.3 Assist in the preparation of environmental and social impact monitoring 2.4 Conduct training on grid planning and tariff setting	Japan Fund for Poverty Reduction: $2,000,000 Note: The government will provide counterpart support in the form of counterpart staff, office accommodation, office supplies, and other in-kind contributions.

ADB = Asian Development Bank, CHP = combined heat and power (plant), CO_2 = carbon dioxide, ERC = Energy Regulatory Commission, kV = kilovolt, MVA = megavolt-ampere, MWe = megawatt of electricity, NO_x = nitrogen oxide, PM10 = particulate matter of less than 10 micrometers in diameter, SCADA = supervisory control and data acquisition, SO_2 = sulfur dioxide.

[a] Final figures will be determined during or after the implementation of the project preparatory TA

Source: Asian Development Bank.

COST ESTIMATES AND FINANCING PLAN
($'000)

Item	Amount
Japan Fund for Poverty Reduction[a]	
1. Consultants	
a. Remuneration and per diem	
i. International consultants	1,045.00
ii. National consultants	428.00
b. International and local travel	154.00
c. Reports, translations, and communications	10.00
2. Equipment (e.g., computers, printer)[b]	6.00
3. Workshops, training, seminars, and conferences[c]	100.00
4. Surveys	120.00
5. Representative for contract negotiations	4.00
6. Miscellaneous administration and support costs[d]	10.00
7. Contingencies	123.00
Total	**2,000.00**

Note: The technical assistance (TA) is estimated to cost $2,200,000, of which $2,000,000 will be financed on a grant basis by the Japan Fund for Poverty Reduction. The government will provide counterpart support in the form of counterpart staff, office accommodation, office supplies, and other in-kind contributions. The value of government contribution is estimated to account for 9% of the total TA cost.

[a] Administered by the Asian Development Bank.

[b] Equipment procured under the technical assistance will be turned over to the executing agency upon completion of the technical assistance, i.e., laptop computers (two), and other office equipment (three).

[c] Workshops, training, seminars, and conferences (to be administrated by consultants, all to be held in Ulaanbaatar). Includes inception workshop, midterm workshop, draft final workshop, final workshop, and four project implementation training.

[d] Includes media for public awareness campaign.

Source: Asian Development Bank estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

A. Consulting Requirements

1. Part 1: Data Gathering and Preliminary Assessment

1. **Power transmission and distribution planner** (international, 2 person-months, intermittent). The expert should have a postgraduate degree in electrical engineering or relevant field, and at least 15 years of work experience. The expert will undertake the following activities:

(i) identify issues in the central transmission system and Ulaanbaatar distribution system, including necessary infrastructure for power evacuation related to the proposed combined heat and power plant number 5 (CHP 5) project, and recommend action plans for improvement with ranking of priorities;
(ii) assess current technical standards in the distribution network (i.e., voltage level) in Ulaanbaatar and recommend measures to reduce technical losses in the distribution system; and
(iii) conduct due diligence on the feasibility study of transmission facilities related to CHP 5 financed by the Government of Mongolia.

2. **Substation design, costing, and communication engineer** (international, 2 person-months, intermittent). The expert should have a postgraduate degree in electrical engineering or relevant field, and at least 15 years of work experience. The expert will undertake the following activities:

(i) review the current substation technologies, and identify modern equivalent assets suitable for the purpose of replacement and/or refurbishment;
(ii) collect all the necessary local and international information related to the construction, operation, and maintenance of substation plants and equipment, such as labor cost, inland transportation cost, and taxes and duties;
(iii) estimate the total installed capital cost of substation primary plants and equipment, secondary and auxiliary plants and equipment, and associated facilities;
(iv) estimate the cost for labor, welfare, and any other allowance for staff and workers required to undertake civil works; and
(v) review the current communication, automated dispatching, and metering systems, and the design of at least two alternative-option systems, with corresponding technical and economic comparisons.

3. **Power transmission and distribution planner** (national, 2 person-months, intermittent) and **substation engineer** (national, 2 person-months, intermittent). The experts should have a postgraduate degree in electrical engineering or relevant field, and at least 10 years of work experience. The experts will assist the international expert in all tasks listed in paras. 1 and 2.

2. Part 2: Preparation of Feasibility Studies, Capacity Building, and Due Diligence

4. **Power transmission and distribution planner, and team leader** (international, 10 person-months, intermittent). The expert should have a postgraduate degree in electrical engineering or relevant field, and at least 15 years of work experience. The expert will undertake the following activities:

(i) be responsible for the overall management of the project and for liaison with the Asian Development Bank (ADB) and the executing agency during implementation of the technical assistance (TA);
(ii) based on the issues identified in Part 1 and in cooperation with other specialists and engineers from the implementing agencies, prepare a long list of rehabilitation and upgrade action plans, and bankable feasibility studies based on the recommended action plan (feasibility studies must be designed with a balanced approach, i.e., from both an economical and energy-saving viewpoint);
(iii) calculate the energy efficiency gains, avoided annual coal consumption, and avoided annual emission (of carbon dioxide and other air pollutants);
(iv) prepare a procurement plan, financing packages, and implementation plan for each feasibility study;
(v) with the procurement specialists, assist the implementing agencies in the preparation of bidding documents;
(vi) arrange training on grid planning for transmission and distribution companies, and on tariff setting and power purchase agreements for the Energy Regulatory Commission; and
(vii) identify the potential of solar rooftop installations that can provide additional power output during long sunlight periods in the summer months.

5. **Substation, costing, and communication engineer** (international, 6 person-months, intermittent). The expert should have a postgraduate degree in electrical engineering or relevant field, and at least 15 years of work experience. The expert will undertake the following activities:
(i) according to the recommended electrical, control, and communication plants and equipment of substations identified in Part 1, design standard substation electrical layout(s) with due regard to safe working conditions in operation and maintenance;
(ii) with the civil engineer, finalize the detailed cost estimates of proposed substations;
(iii) provide estimates for operation and maintenance costs, and other costs associated with the project, including contingency;
(iv) review the current communication, automated dispatching, and metering systems, and the design of at least two alternative-option systems, with corresponding technical and economic comparisons; and
(v) prepare independent cost estimates of the proposed communication and automated dispatching systems, and develop technical and economic comparisons.

6. **Civil engineer** (international, 3 person-months, intermittent). The expert should have a postgraduate degree in civil engineering or relevant field, and at least 10 years of work experience. The expert will undertake the following activities:
(i) design substation buildings, including size and structure, foundation drainage, heating, ventilation, air-conditioning, and fire detection and fire-fighting systems;
(ii) with the costing engineer, design substation switchyard foundations and support structures for outdoor plant and equipment, with due regard to substation earthing needs;
(iii) estimate the material quantities and prices, and provide a cost estimate for substation-specific civil works;
(iv) estimate the cost for labor, welfare, and any other allowance for staff and workers required to undertake civil works; and
(v) work with the substation design engineer to finalize the detailed cost estimates of

proposed substations.

7. **Environment safeguard specialist** (international, 5 person-months, intermittent). The expert should have a postgraduate degree in environment management or relevant field, and at least 10 years of work experience. The expert will undertake the following activities:

(i) prepare the domestic environmental impact assessment (EIA) reports in conjunction with a locally certified EIA institute;
(ii) evaluate environmental impacts of the project, and recommend environmentally friendly technologies for design and construction that emphasize (a) biodiversity conservation; (b) public health and safety; (c) physical cultural resources; (d) pollution prevention and abatement; and (e) climate change mitigation, including potential use of clean energy sources, and ensure that those aspects are documented and incorporated in the domestic EIA reports;
(iii) identify all the relevant environmental laws and regulations in Mongolia and other relevant environmental standards used by the World Bank and other well-known international organizations; and determine and apply the most suitable environmental standards and Environmental, Health, and Safety guidelines that are best applicable for various aspects of the project;
(iv) based on the domestic EIAs, assist the executing and implementing agencies in the preparation of the English version of the initial environmental examination report that consolidates subproject domestic EIAs according to the format required by ADB. Special attention has to be given to preparation of (a) public consultation; (b) due diligence of existing and associated facilities; (c) environment management plan, including costs; (d) a public grievance mechanism; and (e) quantification of environmental benefits such as energy efficiency improvements, emission reduction, and other associated environmental benefits; and
(v) organize training on environmental safeguard monitoring in conjunction with ADB's Mongolia Resident Mission.

8. **Social safeguard and analysis specialist** (international, 2 person-months, intermittent). The expert should have a postgraduate degree in social science or relevant field, and at least 10 years of work experience. The expert will undertake the following activities:

(i) conduct a stakeholder analysis and prepare a stakeholder participation and communication strategy;
(ii) conduct poverty and social analyses, including (a) gender analysis, (b) labor issues, (c) affordability issues for the poor and households headed by women, and (d) willingness to pay for electricity by consumers and gender groups;
(iii) visit project sites and (a) assess impact of involuntary resettlement and permanent and temporary land acquisition; (b) design the project in coordination with engineers to avoid involuntary resettlement; and (c) prepare the land acquisition plan, if required, in accordance with ADB's Safeguard Policy Statement (2009); and
(iv) conduct a social compliance audit of the existing facilities to determine any past or present involuntary resettlement issues, and recommend corrective actions where noncompliance is noted.

9. **Procurement specialist** (international, 3 person-months, intermittent). The expert should have a postgraduate degree in engineering, business administration or relevant field, and at least 5 years of work experience with strong familiarity with ADB's procurement and disbursement procedures. The expert will undertake the following activities:

(i) prepare an indicative procurement plan in coordination with the other team members;
(ii) conduct procurement capacity assessment of the executing agency and each implementing agency;
(iii) based on the result of the procurement capacity assessment and in conjunction with ADB's Mongolia Resident Mission, design and provide a series of training sessions to the implementing agencies and institutes that will prepare bidding documents on ADB's procurement and disbursement procedures and guidelines;
(iv) assess the application of new procurement laws, particularly by the general procurement agency, in implementing the project, and reflect the findings in the project implementation arrangements; and
(v) draft the bidding documents for the first-year procurement to meet ADB standards.

10. **Financial analyst** (international, 3 person-months, intermittent). The expert should have a postgraduate degree in finance or relevant field, a professional accountancy qualification such as certified accountant or certified public accountant, and at least 5 years of work experience. The expert will undertake the following activities:

(i) evaluate the organizational structures of the implementing agencies;
(ii) conduct a review of the audited and unaudited financial statements of the implementing agencies for the past 3 years to assess (a) historical financial performance; (b) heating tariffs; (c) capital structure; and (d) sufficient generation of internal funds to support sustainability of ongoing operations (i.e., the ability to service existing debt and to finance a reasonable proportion of capital expenditures);
(iii) carry out financial analysis of the project and prepare preliminary projected financial statements (balance sheet, income statement, and statement of cash flows) for the next 10 years;
(iv) assess the financial management capabilities and internal controls of the implementing agencies, and make recommendations for institutional strengthening and capacity building during the TA phase; and prepare a financial management assessment report on the executing agency and implementing agencies; and
(v) design the funds flow and disbursement arrangements, based on the financial management assessment of the executing and implementing agencies.

11. **Economist** (international, 2 person-months, intermittent). The expert should have a postgraduate degree in economics or relevant field, and at least 5 years of work experience. The expert will undertake the following activities:

(i) perform an economic analysis for the proposed project and subprojects, following ADB's Guidelines for the Economic Analysis of Projects (1997), specifically including (a) electricity demand analysis, (b) least-cost and equalizing discount rate analysis, (c) economic viability analysis, and (d) risk analysis;
(ii) discuss alternative methodologies for carrying out the economic analysis;
(iii) assess the willingness to pay for electricity by consumers in the project area in consultation with the social specialist, based on a sample survey of energy consumed, price paid by households, and household income;

(iv) incorporate into the economic analysis an economic quantification of environmental impacts following ADB's Economic Valuation of Environmental Impacts: A Workbook,[1] and Environmental Assessment Guidelines;[2] and
(v) provide quantitative and qualitative benefits of the proposed project and each of its components.

12. **Power transmission planner and deputy team leader** (national, 15 person-months, intermittent), **power distribution planner** (national, 20 person-months, intermittent), **substation engineer** (national, 20 person-months, intermittent), and **cost engineer** (national, 6 person-months, intermittent). The experts should have a postgraduate degree in electrical engineering or relevant field, and at least 10 years of work experience. The experts will assist the international experts in performing all tasks listed in paras. 4 and 5.

13. **System communication and automation specialist** (national, 8 person-months, intermittent), and **civil engineer** (national, 10 person-months, intermittent). The experts should have a postgraduate degree in engineering or relevant field, and at least 5 years of work experience. The experts will assist the international experts in performing all tasks listed in paras. 5 and 6.

14. **Environmental safeguard specialist** (national, 6 person-months, intermittent). The expert should have a postgraduate degree in environment management or relevant field, and at least 5 years of work experience. The expert will assist the international expert in performing all tasks listed in para. 7.

15. **Social safeguard and analysis specialist** (national, 4 person-months, intermittent). The expert should have a postgraduate degree in social science or relevant field, and at least 5 years of work experience. The expert will assist the international expert in performing all tasks listed in para. 8.

16. **Procurement specialist** (national, 6 person-months, intermittent). The expert should have a postgraduate degree in engineering, business administration or relevant field, and at least 5 years of work experience with strong familiarity in ADB's procurement and disbursement procedures. The expert will assist the international expert in performing all tasks listed in para. 9.

17. **Financial analyst** (national, 8 person-months, intermittent). The expert should have a postgraduate degree in finance or relevant field, and at least 5 years of work experience. The expert will assist the international expert in performing all tasks listed in para. 10.

B. Reports

18. The consultants for Part 1 will submit the preliminary assessment report upon completion of the assignment. The consultants for Part 2 will submit the following reports to ADB (in English) and to the government (in Mongolian): (i) inception report within 4 weeks of starting their services; (ii) interim report within 16 weeks of commencement of services; (iii) draft final report within 24 weeks of commencement of services; and (iv) final report within 18 weeks of receipt of comments from ADB and the government on the draft final report.

[1] ADB. 1996. *Economic Valuation of Environmental Impacts: A Workbook.* Manila.
[2] ADB. 2003. *Environmental Assessment Guidelines.* Manila.