SECTOR ASSESSMENT (SUMMARY): ENERGY

A. Sector Performance, Problems, and Opportunities

1. **Climate change impact.** From 1940 to 2007, Mongolia's climate underwent significant change: (i) the annual mean temperature increased by about 2.1 degrees Celsius; (ii) the duration of heat waves increased by 8–18 days, depending on geography; and (iii) annual precipitation patterns changed, with some areas getting 5%–25% more rainfall, and others less. Climate change and global warming could have a significant impact on Mongolia's natural resources (such as water resources), rangelands, land use, snow cover, permafrost, and major economic activities (such as arable farming and livestock raising).

2. **High carbon dioxide emissions per capita.** Although Mongolia's contribution to global greenhouse gas (GHG) emissions, at 32.88 metric tons of carbon dioxide (CO_2) equivalent in 2012 (excluding land use and forestry), is only 0.07% of the world total, annual GHG emissions per capita, totaling 11.76 tons, are almost twice the world average.[1] The largest contributor to GHG emissions in the country is the energy sector (including the electricity and heating subsectors), which account for about two-thirds of the country's GHG emissions. Analysis of GHG emissions by fuel type for 1993–2020 indicates that coal will be the predominant source of CO_2 emissions, with CO_2 emissions from heat and electricity generation projected, on the basis of the business-as-usual scenario, to be 6.5 times the 1993 (base year) level by 2020.[2]

3. **Enormous renewable energy potential.** Renewable energy, especially wind and solar, holds tremendous potential for Mongolia. The 5,457 terawatt-hours of clean electricity per year that could be generated would meet about 30% of total annual electricity demand in Japan, the People's Republic of China, and the Republic of Korea, as well as Mongolia. However, this rich renewable energy resource has not been fully used. The government looks forward to increasing the share of renewable energy in total installed capacity from 11% in 2015 to 20% by 2023 and 30% by 2030. Renewable energy capacity must grow from 137 megawatts (MW) in 2017 to 274 MW by 2023 and 595 MW by 2030 to meet medium- and long-term targets.

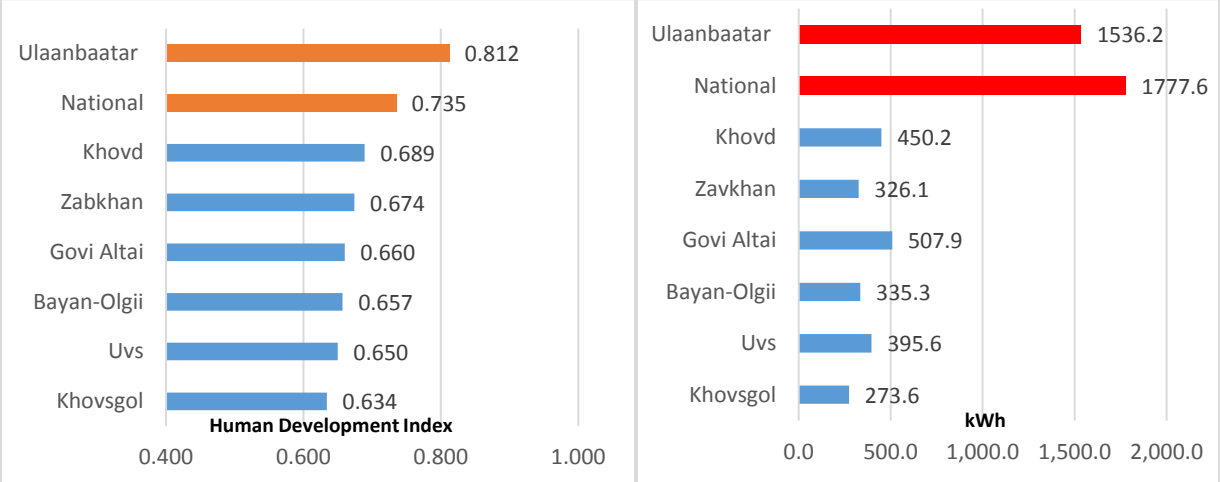
4. **Geographically uneven investment in renewable energy despite demand growth in grid systems.** The country's power system consists of four grid systems, which have successfully expanded electricity access to 97% of the population. The central energy system, covering around 90% of power demand in the country, has so far attracted private sector-led renewable energy projects totaling around 400 MW. At the same time, grid systems in the western Mongolia, which supply power to 25% of the population in the country and have witnessed annual demand growth of more than 10% between 2010 and 2015, have failed to attract private investment in renewable energy development mainly because of low power demand and high transportation cost. Inadequate investment in power generation capacity addition for remote grid systems has led to heavy dependence, for more than 70% of the country's power needs, on electricity imported from neighboring countries across long stretches of transmission lines, with transmission and distribution losses of around 30%. To address such unique challenges in remote grid systems, the government has sought to develop a first-of-its-kind distributed energy system using renewable energy potential. It comprises a

[1] http://cait.wri.org/profile/Mongolia
[2] http://www.4.unfccc.int/submissions/INDC/Published%20Documents/Mongolia/1/150924_INDCs%20%of%20Mongolia.pdf

smaller-scale and modular renewable energy system, which will produce reliable electricity and thermal energy locally for local use while minimizing transmission loss.

5. **Regions targeted under the project.** The western and Altai-Uliastai regions targeted under the project are among the country's less-developed regions. These remote and sparsely populated regions are composed of six *aimags* (provinces): Uvs, Hovd, Bayan-Olgii, Khovsgol, Zavkhan, and Govi-Altai. These *aimags* are less developed with regard to educational attainment, life expectancy, and monetary income. The average Human Development Index in these *aimags* is around 0.657, compared with 0.812 for Ulaanbaatar and 0.735 nationwide. Such regional disparity is also observed in electricity consumption per capita: 381 kilowatt-hours (kWh) per month of average electricity consumption per capita in these *aimags*, against 1,536 kWh in Ulaanbaatar and 1,776 kWh in nationwide (see figure below).

Human Development Index and Electricity Consumption



Sources: United Nations Development Programme. 2016. *Mongolia Human Development Report 2016. Building a Better Tomorrow: Including Youth in the Development of Mongolia*. Ulaanbaatar; and National Statistical Office of Mongolia. 2017. *Mongolia Statistical Yearbook 2016.* Ulaanbaatar.

6. **Energy system and generation technology options in the targeted regions.** Two grid systems supply electricity in the two regions. They are interconnected and there is a cross-border connection with the Siberian grid in the Russian Federation. As the electricity load demand centers are remote and scattered, bulk power is transported through the transmission network across more than 2,000 kilometers of transmission lines. The primary energy resource options for expanding the regions' electricity generation capacity are coal, hydropower, solar, and wind. The coal-based thermal power plant or combined heat and power option is hampered by low overall load demand in scattered load centers, and therefore higher power generation cost. The generation costs of hydropower projects have also increased as average annual precipitation and river flow have decreased since 1980, resulting in a lower capacity factor than the designed.

7. **Electricity demand growth in the targeted regions.** Electricity load demand growth in the western and Altai-Uliastai regions was very high during 2010–2015, averaging around 25% during this period, with growing industrial electricity demand in the mining sector (Table 1). Although demand leveled off in 2016, long-term regional economic growth is still positive and associated annual electricity load demand is forecast to reach 230 gigawatt-hours in the western region energy system (6.5% of compound annual growth rate), and 110 gigawatt-hours in the Altai–Uliastai energy system (4.6% of compound annual growth rate) by 2030. To meet long-term growth in electricity demand, 58 MW of generation capacity in the western region

energy system and 33 MW in the Altai–Uliastai energy system will be required (Table 1). But generation capacity in these regions relies mostly on 23 MW from two hydropower plants in Durgun and Taishir, which normally operate with only one turbine out of three because of diminished water flow from the rivers that feed the system.

Table 1: Long-Term Projections of Electricity Demand in the Targeted Regions

Item	Actual 2010	Actual 2015	Forecast 2025	Forecast 2030	Annual Growth (%)
Western Region Energy System					
Sent-out demand (GWh)	78.4	143.1	190.6	231.8	6.5
Transmission and distribution loss (%)	30.1	27.3	19.1	12.7	N.A.
Altai–Uliastai Energy System					
Sent-out demand (GWh)	18.6	63.3	231.9	285.1	4.6
Transmission and distribution loss (%)	25.1	23.5	17.5	11.2	N.A.

GWh = gigawatt-hour, N.A. = not applicable.
Source: Asian Development Bank.

8. **Distributed renewable energy system development.** The project will develop distributed renewable energy systems in the project areas, where the private sector has been unwilling to invest because of low demand and high transportation cost. It is a first-of-its-kind development, with a variety of renewable energy technologies to ensure grid stability and clean electricity and heat generation to meet the energy demand of 258,313 people (50% of the population in the selected regions) in geographically scattered load centers, by 2022. Because of the sharp decline in the overnight cost of solar photovoltaic and wind power since 2010, the project is also expected to reduce the cost of energy supply from $0.07 per kWh to $0.05 per kWh. The project is an ideal match for the country, given Mongolia's unique energy demand and system, as it will contribute to reducing high-carbon electricity imports from the Russian Federation, and supplying clean and affordable electricity in the targeted regions.

B. Government's Sector Strategy

9. **Medium- and long-term energy policy.** The policy framework for accelerating renewable energy deployment in the country is being developed. In 2015, the government, under its Intended Nationally Determined Contribution to the Paris climate accord (footnote 2), committed to a 14% reduction in its CO_2 emissions by 2030, compared with the business-as-usual scenario, through renewable energy capacity addition, transmission and distribution loss reduction, and improved energy efficiency. Also, in 2015, the Parliament approved the State Policy on Energy, 2015–2030[3] (Table 2).

Table 2: Medium- and Long-Term Energy Sector Targets

Target Indicator	Base Year 2014	First Stage 2023	Second Stage 2030
Reserve capacity for electricity supply (%)	(10.0)	10.0	20.00
Net profit margin of state-owned utilities (%)	(16.2)	0.0	5.00
Transmission and distribution losses (%)	13.7	10.8	7.80
Share of renewable energy in total capacity (%)	7.6	20.0	30.00

( )= negative.
Source: Ministry of Energy.

[3] Government of Mongolia. 2015. *State Policy on Energy, 2015-2030*, Ulaanbaatar.

10. **Law on Renewable Energy.** This law, aimed at increasing the use of renewable energy in Mongolia and regulating its generation and supply, was adopted by the Parliament in 2007. The law establishes the licensing procedures and defines the characteristics of power purchase agreements between producers and transmission companies. It also sets a United States dollar-denominated feed-in-tariff (FIT) to attract foreign investors. An amendment to the law, approved by the Parliament in June 2015, introduced a renewable energy surcharge on end user tariffs and established a payment fund for renewable energy generators.

11. **Renewable energy investment plan.** Together with a series of policies and laws being developed, the government prepared an investment plan for scaling up the development and use of renewable energy in the country in 2015.[4] The planning process involved a sector assessment, the formulation of the necessary regulatory reforms, and the preparation of the investment plan to guide renewable energy deployment toward medium- and long-term renewable energy targets by 2030. The renewable energy investment plan calls for a two-track approach: (i) scaling up rural renewable energy in remote and less-developed regions by developing distributed renewable energy systems; and (ii) strengthening renewable energy regulations to stimulate private sector-led renewable energy development in the central energy system, which has started attracting interest from private investors. In November 2015, the plan was endorsed by the Scaling-Up Renewable Energy Programme subcommittee.

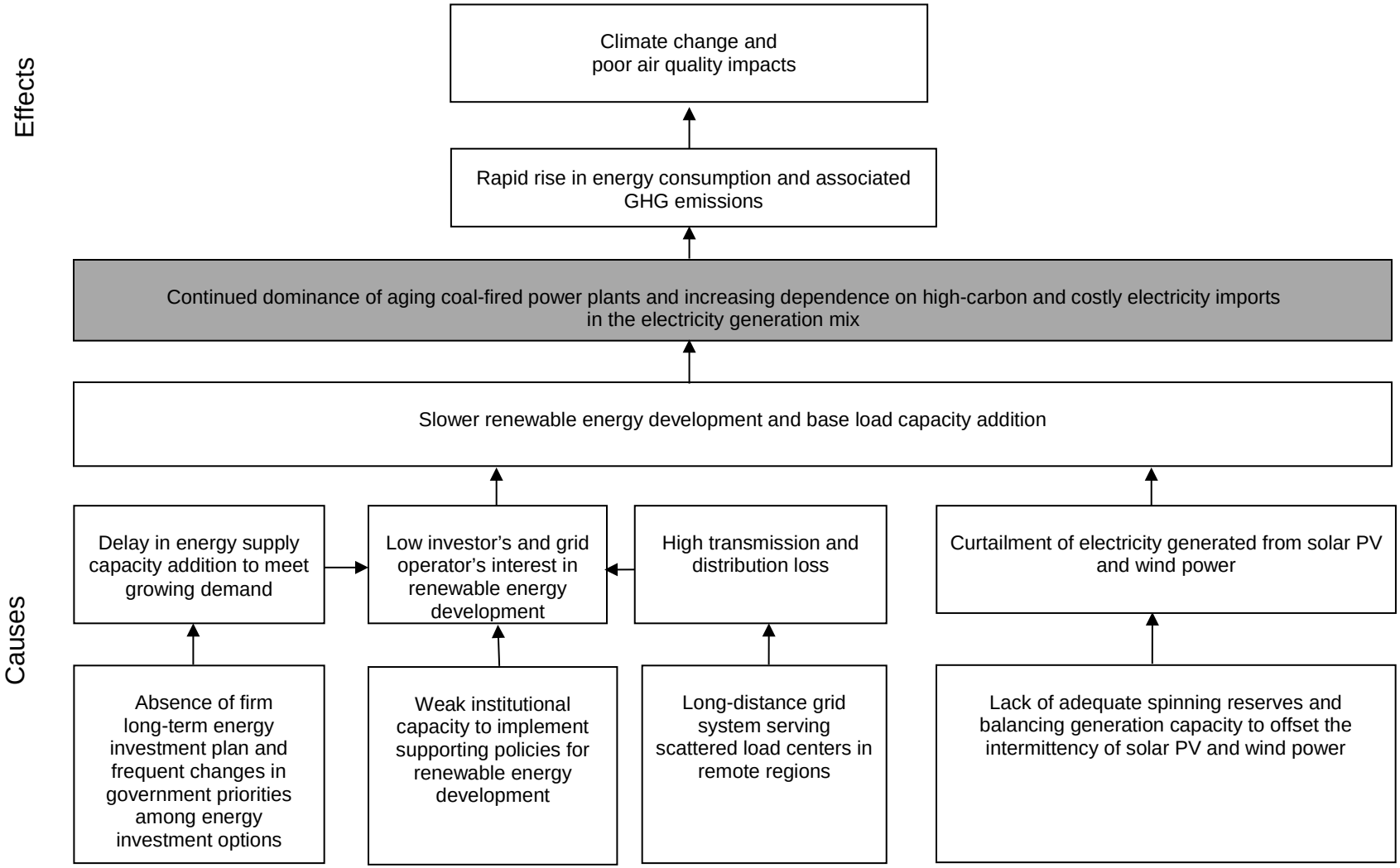
12. **Need for institutional and capacity strengthening.** The existing FIT must evolve to more closely reflect best international practices while providing enough incentives to attract private investments in remote areas. The FIT established in 2007 ($0.15 per kWh–$0.18 per kWh for solar photovoltaic and $0.08 per kWh–$0.095 per kWh for wind power) has successfully attracted private investors. But it is quite rigid and lacks a mechanism for tariff adjustment according to a decline in the renewable energy overnight cost. Immoderate incentives have led to the proliferation of licensed projects, far in excess of the absorption capacity of the central energy system grid. End users will be affected through a renewable energy surcharge. The project will help the government design and implement a transparent and efficient incentive scheme, such as a stepped FIT or competitive bidding (auctions), based largely on experience gained from the first batch of subprojects (2018–2021), to encourage private sector-led investment in renewable energy in remote regions.

C. Asian Development Bank Sector Experience and Assistance Program

13. The Asian Development Bank (ADB) has led other multilateral development banks in supporting the preparation of the renewable energy investment plan, endorsed by the Climate Investment Fund in 2015, with $30 million in indicative grant funding assistance. Together with the World Bank, ADB will support capacity development to strengthen renewable energy policy and regulations (including the licensing regime, the FIT adjustment mechanism, and grid curtailment controls), as well as the deployment of renewable energy systems in poor and remote regions. In addition, ADB will continue to support ongoing energy sector reform with a primary focus on the implementation of tariff reforms toward full cost recovery, the privatization of publicly owned utilities, and the development of institutional and regulatory capacity in demand-side energy efficiency, through technical assistance and policy dialogue, whenever appropriate.

[4] Government of Mongolia. 2015. *Scaling-Up Renewable Energy Programme: Investment Plan for Mongolia*. Ulaanbaatar.

Problem Tree for Energy



GHG = greenhouse gas, PV = photovoltaic.
Source: Asian Development Bank.