As of 21 Nov 2017

Cover Page for Project/Program Approval Request

1. **Country/Region**:	*Mongolia*	2. **CIF Project ID#**:	(Trustee will assign ID)
3. **Source of Funding:**	☐ FIP	☐ PPCR	☒ SREP
4. **Project/Program Title:**	*Upscaling Renewable Energy Sector Project*		
5. **Type of CIF Investment:**	☒ *Public*	☐ Private	☐ Mixed
6. **Funding Request in million USD equivalent:**	*Grant: $14.6 million*	*Non-Grant:*	
7. **Implementing MDB(s):**	*Asian Development Bank*		
8. **National Implementing Agency:**	*Ministry of Energy*		
9. **MDB Focal Point and Project/Program Task Team Leader (TTL)**:	*Headquarters- Focal Point: Christian Ellermann (cellermann@adb.org)*	*TTL: Mr. Shigeru Yamamura (syamamura@adb.org)*	

10. **Project/Program Description** (including objectives and expected outcomes)**:**

The Mongolia Scaling Up Renewable Energy Program (SREP) Investment Plan (IP) was endorsed in November 2015 with a total indicative financing of $30 million. The SREP IP for Mongolia entails a two-track approach: (i) upscaling rural renewable energy in remote and less developed regions through developing distributed renewable energy systems, and (ii) strengthening renewable energy regulations to stimulate private-led renewable energy development.

Figure 1: Mongolia SREP Investment Plan Framework

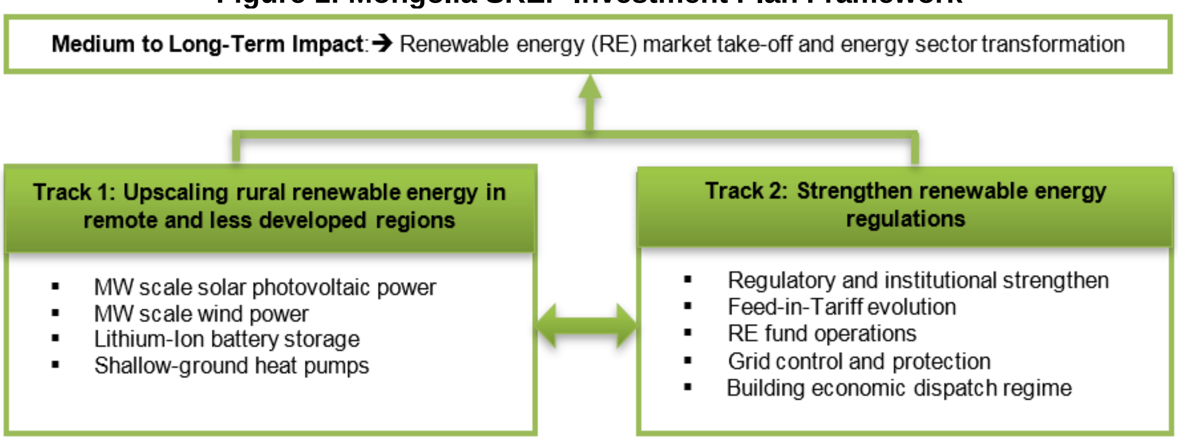


Table 1 presents the status of SREP IP for Mongolia.

Table 1: Mongolia SREP Investment Plan, 2015

MDB	Projects	SREP Fund ($ million)	SREP SC Approval
WB	Upscaling Rural Renewable Energy - Solar PV	12.4	February 2017
ADB	Upscaling Rural Renewable Energy	14.6	
WB	TA Strengthening Renewable Energy Regulations	1.2	August 2016

The proposed ***Upscaling Renewable Energy Sector Project ("Project")*** refers to the $14.6 million ADB allocation in the SREP IP. The Project aims to increase renewable energy supply in the country by providing renewable based distributed energy systems in remote and less developed regions of western Mongolia and strengthen sector's institutional and organizational capacity.

The Project has three components:

i. **Distributed renewable energy system development.** The subprojects comprise a total of 40.5 MW of solar PV and wind power in the Western and Altai-Uliastai regions. Advanced energy storage will be installed in selected subprojects for grid stability and time-shifting. These will be implemented in two stages:(i) first stage (2018-2021) with 25.5 MW capacity; and (ii) second stage (2021-2023) with 15 MW capacity.

   The first stage subprojects (2018-2021) will cover areas with higher energy demands in Umunogovi (Uvs province), Altai Soum (Govi-Altai province), Altai (Govi-Altai province). Second stage (2021-2023) covers Uliastai (Zavhan province), Telmen (Zavhan province), and Moron (Khovsgol province). Lessons from the implementation of the first batch will be considered as the project moves towards the implementation of the second batch.

ii. **Geothermal heat pump demonstration.** The subproject comprises installation of 500 kW thermal of geothermal source heat pump capacity in public buildings in five townships of the targeted region. It will be implemented in three batches. It starts 100 kW installation in Uvs aimag center, and is rolled out in two aimag centers in western region, and two aimag centers in Altai-Uliastai region.

iii. **Institutional strengthening and capacity enhancement.** The subproject will (i) enhance technical capacity of local utilities and the national dispatching center in renewable energy investment planning, transparent selection and bidding, renewable electricity dispatch, and grid control and protection; and (ii) support preparation of renewable energy investment plan 2023-2030 in targeted regions.

Table 2. List of Subprojects

Location/Province	Applied Renewable Energy Technology	Capacity (MW)	Construction Period
a. Distributed Renewable Energy System Development			
Umunogovi / Uvs	Wind Power	10.0	2018-2021
Altai / Govi-Altai	Solar PV	10.0	2018-2021
Altai Soum / Govi-Altai	Solar PV/Wind hybrid and battery storage	0.5	2018-2021
Uliastai / Zhavhan	Solar PV and battery storage	5.0	2018-2021
Telmen / Zhavhan	Wind Power	5.0	2021-2023
Moron / Khovsgol	Solar PV	10.0	2021-2023
Subtotal		**40.5**	
b. Geothermal Heat Pump Demonstration			
Hovd, the other Soums	Geothermal Heat Pump	0.5	2018-2023
Total		**41.0**	

MW = megawatt, PV = photovoltaic.

The Project's financing plan is presented below. A combination of loans and grants are proposed to be delivered via a public sector investment operation from ADB's East Asia Energy Division (EAEN).

Table 3: Financing Plan

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank		
Ordinary capital resources (loan)	40.00	60.51
Strategic Climate Fund (grant) [a]	14.60	22.09
Japan Fund for Joint Crediting Mechanism (grant) [b]	6.00	9.08
Government	5.50	8.32
Total	**66.10**	**100.00**

Notes: [a] Under the Scaling Up Renewable Energy Program in Low-Income Countries (SREP) financed by the Strategic Climate Fund. Administered by the Asian Development Bank.

[b] The Japan Fund for Joint Crediting Mechanism (JFJCM) is a single donor trust fund managed by ADB. It provides financial incentive to adoption of low carbon technologies in ADB financed projects. JFJCM will be co-financed with ADB loan for the subprojects in Altai-Soum and Uliastai to install the advanced battery storage.

The Project will utilize ADB's sector loan modality which enables time- and geographic-slicing for flexible project implementation. The time and geographic slicing approach is deemed suitable as (i) long term investment support will be ensured through batches of subprojects, (ii) subproject implementation complexity due to wide range of location-specific demand and grid conditions is minimized, and (iii) the capacity of local utilities in managing the grid system is appropriately enhanced through learning-by-doing practice.

The Ministry of Energy will be the executing agency. Altai-Uliastai Energy System (AuES) state owed joint stock company, National Renewable Energy Center (NREC), and Western Region Energy System (WRES) state owned joint stock company are the project implementing agencies who will be responsible for day-to-day project management for each subcomponent.

SREP Additionality. SREP will address capital cost barrier by providing concessional finance to ensure financial and economic sustainability of the Project in the short-term and lead to the further upscaling in remote and less developed regions by crowding in future private investments. It will help remove barriers via learning-by-doing, including: (i) demonstration of successful utility scale solar and wind projects, some of which will have integral energy storage; (ii) institutional capacity building to improve the enabling environment; (iii) elimination of perceived risks on the system performance including grid stability; and (iv) evolution of tariffs to facilitate future expansion of renewable energy.

The successful completion of the project will see the establishment of an institutional platform that encourages private sector investments in distributed renewable energy to sustainably expand clean and affordable electricity supply in these remote and less developed regions of the country. It will also support evolution of the FiT system to a more economically efficient tariff mechanism which reflects actual capital costs while assuring commercial financial viability sufficient to attract private investment in remote areas, at the same time providing affordable electricity and heating services.

The project is fully aligned with ADB's Country Partnership Strategy (CPS) 2017-2020 for Mongolia. The CPS overarching goal is to help Mongolia sustain inclusive growth in a period of economic difficulty through its three strategic pillars i) promoting economic and social stability; (ii) developing infrastructure for economic diversification; and (iii) strengthening environmental sustainability. The project is included in the Country Operations Business Plan (COBP) 2017-2019. The proposed Project will help Mongolia meet its Intended Nationally Determined Contributions (INDC) under the Paris climate accord, and consistent with the State Policy on Energy 2015–2030 which aims to achieve energy independence.

Country and Sector Context

Mongolia is a land-locked country with an estimated population of three million. It is the most sparsely populated country in the world with only 1.76 persons per square kilometer (km^2). Population and economic activities are concentrated in the capital, Ulaanbaatar, which accounts for 42% of the population and 49% of the country's gross domestic product. Ulaanbaatar is the largest energy demand center accounting for nearly half of the total energy needs in the country. Table 4 shows a comparison of per capita electricity consumption in Ulanbataar and selected aimags (provinces). Per capita consumption in aimags ranges from 274 to 508 kWh, a difference of +85%.

Table 4: Population and Electricity Consumption

	Total population (in thousand)	Household population (in thousand)	Total electricity consumption (in million kWh)	Household consumption (in million kWh)	kWh / per household	kWh / per person
Mongolia	3,064	870	5,446	1,321	6,261	1,778
Ulaanbaatar (capital)	1,381	381	2,121	811	5,570	1,536
Aimags in the Western Region						
Khuvsgul	129	38	35	17	932	274
Bayan-Ulgii	99	24	33	21	1,417	335
Govi-Altai	57	16	29	13	1,778	508
Zavkhan	71	21	23	13	1,096	326
UVs	81	22	32	17	1,498	396
Khovd	85	22	38	20	1,753	450

kWh = kilowatt-hour.

Mongolia is the world's fifth most carbon-intense economy. Coal is the dominant energy resource which accounts for 60% of primary energy and 95% of secondary energy, and has been the only energy resource available at affordable cost in the country. Coal resources are estimated at 179 billion tons which could potentially generate 285,741 terawatt-hour (TWh) of electricity, which is enough to meet total electricity demands in the People's Republic of China (PRC), Japan and the Republic of Korea for the next 20 years. There is no indigenous petroleum or natural gas production; all refined petroleum products are imported from PRC and Russia.

Due to the harsh winters, the country's electric power system is built around the heating system. The winter climate in Mongolia is extremely harsh with daytime temperatures ranging from -10 degree Celsius (°C) to -30°C, and can drop to as low as -40°C at night. The heating season is unusually long at eight months, and energy demand for heat load is over two times that for electricity. The coal-dominated heat and power system contributes more than 63% of carbon dioxide (CO_2) emission in the country.

The country's power system comprises four grid systems which provide electricity access to 97% of the population. The central energy system (CES) covers around 90% of power demand in the country. The other three grid systems are the Western Energy System (WES), the Altai-Uliastai Energy System (AuES), and the Eastern Energy System (EES) located in remote and less developed regions supplying power to only about 32% of the local population; these grids have witnessed more than 10% annual load growth for the last five years.

As of March 2017, Mongolia has a total installed capacity of 1,208 MW with renewable energy accounting for 11% or 137.17 MW (including hydropower plants) of the total capacity (see Table 5). CES has already attracted more than 400 MW of private sector-led utility scale renewable energy projects, of which 110 MW has been commissioned (i.e., 50 MW Salkhit wind farm, 50 MW Tessi wind farm, and 10 MW Darkhan solar plant). Outside CES, private investments in renewable energy development is limited mainly due to relatively small scale of power demand and high logistics costs.

Table 5: Installed Capacity of Renewable Energy Sources in Mongolia, 2017

Renewable energy source	Installed capacity (MW)
Hydro	25.84
Wind	100.00
Solar	11.33
Total	**137.17**

Source: Ministry of Energy (March 2017)

Coal-fired generation accounts for 95.7% of total electricity output. Generation from renewable energy sources is only 4.2% of total output (see Table 6).

Table 6: Electricity Production by Source, million kWh

	2011	2012	2013	2014	2015	2016	% 2016
Coal-fired CHPs (lignite)	4,450	4,775.5	5,014	5,191.3	5,415.6	5,551.6	95.7
Diesel	20.2	28.7	5.4	8.2	6.4	6.1	0.11
Hydro	52.6	52.1	59.9	66.3	59.3	84.7	1.46
Wind	0	0	52.9	125.4	152.5	157.5	2.72
Solar	0	0	0	0.6	0.6	0.6	0.010
Total production	**4,522.8**	**4,856.3**	**5,132.2**	**5,391.8**	**5,634.4**	**5,800.5**	**100.0**
Share of RE							**4.2**

CHP = combined heat and power, kWh = kilowatt-hour.
Source: Ministry of Energy (March 2017) as cited in GCF proposal of XacBank LLC

Mongolia is endowed with enormous renewable energy resources, primarily solar and wind, which are effectively infinite compared to energy demand: the technical potential is about 1,000 times the total electricity output in 2016. In addition to meeting domestic energy demand, this renewable potential is sufficient to cover more than 25% of energy demand in Japan, Korea, and PRC.

The country's current situation presents a unique opportunity for clean energy development to foster economic transformation and a sustainable future based on shared prosperity. The government recognizes the need to expand the energy sector and effectively develop and utilize the enormous renewable energy potential, and transition away from fossil fuels. This transition will not happen unless renewable energy systems are commercialized in areas outside the CES. Given the lack of private sector interest in the targeted regions, concessional funds are needed in the near term to address fiscal constraints and buy down the cost of capital so that development can be accelerated. The proposed Project addresses the energy trilemma head-on by delivering access to affordable and sustainable energy.

11. **Consistency with Investment Criteria:**

Increased RE capacity and increased access to energy via RE: The Project aims to upscale renewable distributed energy system in remote and less developed regions where private sector developers have been unwilling to invest. It is a first of its kind renewable energy system development with variety of renewable energy technologies ensuring grid stability and providing clean electricity and heat to the demand in geographically scattered load centers.

The Project will install an aggregate **RE capacity of 41 MW**,[1] consisting of 40.5 MW capacity from distributed renewable energy systems in Western and Altai-Uliastai regions and 0.5 kW of geothermal heat pumps in public buildings in selected five townships of the targeted region. The aggregate capacity is expected **to generate 98.77 gigawatt-hour (GWh) annually**.

The project will benefit about **71,828 households**[2] **or 258,314 individuals (139,489 male and 118,824 female population)**. This is approximately 50% of the local population in the targeted regions with access to clean energy (see Table 7).

Table 7: Subproject target capacity and beneficiaries

Subprojects	Capacity (MW)	Annual Power Generation (MWh)	Household beneficiaries	Individual beneficiaries
a. Distributed RE System Development				
1. Umunogovi Wind Power	10.0	34,038.1	21,557	83,859
2. Altai Solar PV	10.0	17,147.4	14,246	49,093
3. Altai Soum Solar PV/Wind hybrid and battery storage	0.5	1,148.5	246	28,702
4. Uliastai Solar PV and battery storage	5.0	10,025.2	8,329	48,022
5. Telmen Wind Power	5.0	16,773.4	13,935	46,573
6. Moron Solar PV	10.0	16,267.2	13,515	1,230
b. Geothermal Heat Pump	0.5	3,369.6		835
Total	**41.0**	**98,769.4**	**71,828**	**258,314**

MWh = megawatt-hour, PV = photovoltaic, RE = renewable energy.

The proposed investment will increase Mongolia's installed renewable energy capacity by more than 47% above 2017 levels. The Project is an important step in demonstrating the viability of solar, wind, energy storage, and geothermal heating in remote areas which are currently unattractive to private sector developers. It will provide a "blueprint" for commercial deployment of distributed renewable energy at MW scale in remote areas, where the bulk of Mongolia's renewable resources are located. The successful implementation of the Project will encourage more investments in RE projects, which will contribute to meeting Mongolia's growing energy demand. In addition, it will demonstrate performance of geothermal heat pump systems and increase experience in design, installation, operation and maintenance for future scaling-up. It is also expected to contribute to the knowledge and insight of the government to formulate appropriate policy incentives to ramp up new investments in clean energy.

Low-emissions development: The proposed Project is an important step to meet the Mongolia's targets under INDC which commits to enhance energy efficiency and increase renewable energy capacity to reduce greenhouse gas emission by 14% compared to the business-as-usual scenario by 2030. The Government of Mongolia plans to increase renewable energy to 20% of installed capacity by 2023 and 30% by 2030, versus 7.5% of total capacity in 2016. To meet these targets, renewable capacity needs to be expanded to 633 MW in 2023 and 1,085 MW in 2030 from 110 MW expected by year-end 2017 (see Table 8).

[1] The aggregate capacity is more than twice that envisioned for ADB's project concept in the SREP IP.
[2] Assumes average consumption of 1,579 kWh / household in WES and 1,204 kWh / household in AuES

Table 8: Medium and Long-Term Energy Sector Targets

Target Indicators	Base Year 2014	First Stage 2023	Second Stage 2030
1. Reserve capacity for electricity supply	-10.0%	10.0%	20.0%
2. Reserve capacity for heat supply	3.0%	10.0%	15.0%
3. Net profit margin of state-owned utilities	-16.2%	0.0%	5.0%
4. Power own use of CHPs	14.4%	11.2%	9.1%
5. Transmission and distribution loss	13.7%	10.8%	7.8%
6. Renewable energy share in total capacity	7.6%	20.0%	30.0%
7. Carbon dioxide emission per Gcal generation	0.52 ton	0.49 ton	0.47 ton
8. Reduction of building heat loss	0.0%	20.0%	40.0%

CHP = combined heat and power, Gcal = giga calorie.
Source: Ministry of Energy.

The Project will help decarbonize the country's energy sector by increasing the share of renewable energy in the energy mix. Coal-fired power accounts 91% of Mongolia's total generation capacity and 95% of total energy generation making the energy sector a major greenhouse gas emitter.

The implementation of the Project will reduce electricity imports from the Siberian Grid by 94.3 GWh per year; reduce petroleum consumption in electricity generation by 795,080 liters per year in the Altai Soum subproject area; and avoid 1,114 tons per year of coal use for space heating. This is equivalent to 56% GHG savings of current emissions in the regions targeted by the Project.

Using Siberian grid emission factor (0.893 tons CO_2e per MWh), diesel power emissions factor (0.72 tons CO_2e per MWh), and avoided coal fired from heat only boilers (HOB), 2.67 tons CO_2e per ton of coal), emission savings from the subprojects are estimated at **87,969 tCO2e per year or 2.2 million tCO2 over 25 years project lifetime** (see Table 9).

Table 9: Subprojects' greenhouse gas emission savings

Subprojects	Capacity (MW)	Annual Power Generation (MWh)	Annual GHG emission savings (tCO2e)	Lifetime GHG emission savings (tCO2e)
a. Distributed RE System				
1. Umunogovi Wind Power	10.0	34,038.1	30,396.0	759,900.2
2. Altai Solar PV	10.0	17,147.4	15,312.6	382,815.9
3. Altai Soum Solar PV/Wind hybrid and battery storage	0.55	1,148.5	826.9	20,672.1
4. Uliastai Solar PV and battery storage	5.0	10,025.2	8,952.5	223,812.6
5. Telmen Wind Power	5.0	16,773.4	14,978.6	374,466.2
6. Moron Solar PV	10.0	16,267.2	14,526.6	363,166.2
b. Geothermal Heat Pump	0.5	3,369.6	2,975.5	74,388.2
Total	**41.0**	**98,769.4**	**87,968.9**	**2,199,221.4**

MW = megawatt, MWh = megawatt-hour, PV = photovoltaic, RE = renewable energy, tCO2e = tons of carbon dioxide equivalent.
Note: GHG calculation does not consider additional savings from avoided transmission losses from electricity imported from the Siberian grid, hence represents a conservative calculation of the GHG mitigation benefits

Affordability and competitiveness of RE: To address the challenges in remote grid systems, the government has identified solar- and wind-based distributed energy systems as optimum energy service solutions. These systems are inherently modular and scalable, and deliver clean energy as close to load centers as possible, minimizing the need for imported electricity while reducing fossil fuel consumption and transmission losses.

The renewable energy potential (geothermal, hydro, solar, and wind) in Mongolia is estimated to be 2,600 gigawatts (GW); the solar potential alone is estimated at 1,500 GW, with potential energy output of 4,774,000 GW-hours per year (GWh/y). Assuming only 1% of solar – 15 GW – becomes economically viable, the scale-up and replication potential is 12.9 times existing total installed generation capacity, and 1,500 times currently installed utility-scale solar capacity. On an energy output basis, commercializing only 1% of solar potential – 47,740 GWh/y – the scale up and replication potential is 8.23 times 2016 total electricity output.

As the capital costs of solar and wind systems continue to decline, the economically viable resources in Mongolia will increase. As experience is gained and risk profiles for new projects are reduced, the off-take prices required for financial viability will decrease, resulting in a virtuous cycle of development which will accelerate renewable energy development. Based on global trends, off-take prices for utility-scale solar and wind in Mongolia can be expected to reach grid parity in the foreseeable future. Cost trends for energy storage are also declining rapidly, and within another five years the combined costs of solar, wind and batteries should result in dispatchable energy at grid parity.

However, renewable resources remain largely untapped in Mongolia, mainly because renewable energy system must compete with coal which has a levelized cost of around $0.07 per kilowatt-hour (kWh). This benchmark energy cost is being achieved on solar and wind power projects in other developing countries, but driving down the costs of solar, wind, and renewable energy based heating services in the country will require near-term concessional financing and evolution of energy policies and pricing frameworks to facilitate growth of renewable energy.

SREP will be instrumental in driving down the cost of electricity in the targeted regions and allowing the project to achieve grid parity. Establishing this levelized cost benchmark is needed to catalyze deployment of renewable energy in remote and less developed areas while also reducing the cost of energy services to end-user. SREP cofinancing will reduce the cost of electricity in the targeted regions from $0.07 / kWh to $0.05 / kWh.

The existing tariff system needs to evolve to better reflect best international practices while providing sufficient incentives to attract private investments in remote areas. The FiT established in 2007 is $0.15-0.18 / kWh for solar PV and $0.08-0.095 / kWh for wind power, which have successfully attracted private investors for more than 200 MW of solar and wind, all in the CES. However, these FiTs are well above current global benchmarks of US$0.06 – 0.08 per kWh. The project will help the government to design and implement a transparent and efficient incentive scheme, such as stepped FiT or competitive bidding (auctions) to incentivize private sector led renewable energy investment in remote regions, which would largely be based on experiences gained from the first batch of subprojects (2018-2020).

The implementation of the project is a first-of-its-kind distributed renewable energy application in the country, and entails perceived risks on the system performance, cost of energy and its impact upon end-user affordability, and grid stability.

Productive use of energy: The proposed investment will supply electricity directly to the grid which will reduce imports, and minimize transmission and distribution loses. New generation assets will be near the load centers: all subprojects locations are adjacent to substations and within 5-6 km of local load centers.

The inadequate investment in power generation capacity addition for remote grid systems has led to heavy dependence on imported electricity from neighboring countries to meet up to 70% of load demand in geographically scattered load centers, and transmission and distribution losses exhibiting up to 30% losses.

Table 10: Electricity Demand and Forecasts in the targeted regions

Item	Actual 2010	Actual 2015	Forecast 2025	Forecast 2030	Annual Growth
Western Region Energy System					
Power 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	-
Altai-Uliastai Energy System					
Power 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	-

GWh = gigawatt hour
Sources: Electric year book 2016, and ADB staff estimates

This proposed investment will improve the quality of electricity in the targeted regions providing more sustainable, reliable, and affordable electricity services to household and commercial consumers. The improved supply will encourage more business and microenterprise development in the project areas.

Economic, social, and environmental development impact: The proposed project will contribute to social and economic development in the regions as well as promote environmental sustainability. The project locations are in the remote and sparsely populated Western and Altai-Uliastai regions in the western part of Mongolia, composed of six aimags: Uvs, Hovd, Bayan-Olgii, Khovsgol, Zhavhan, and Govi- Altai. These aimags are the less developed with respect to educational attainment, life expectancy, and monetary income. Average Human Development Index (HDI) in these regions is around 0.657 versus HDIs in national average and in Ulaanbaatar are 0.735 and 0.812 respectively. The regional disparity in HDI is correlated strongly to electricity consumption per capita: 381 kWh per month of average electricity consumption per capita in these regions against 1,776 kWh in national average and 1,536 kWh in Ulaanbaatar.

Economic. The Project will bring economic benefits in terms of substituting imported electricity from Siberian grid in Russia; benefits are estimated at $7.5 million per year. In 2016, electricity imports into Mongolia represented 19.9% of total consumption. The foreign exchange savings from avoided electricity imports can be redirected to other economic and social development activities in these regions.

The Project is necessary to demonstrate the viability of utility-scale renewable energy systems in around outside of the CES to facilitate future economic growth and ensure shared prosperity.

Social. Clean and affordable electricity will benefit local population in terms of lower energy costs, public health benefits, and improved energy security. It will facilitate improved social service delivery, e.g., at public health facilities and schools. Improved quality of electricity will also facilitate access to modern appliances and communications.

Environment. The project will avoid air pollution associated with coal and diesel use for power generation and space heating. The geothermal heating component will supply air pollutant-free space heating for 10,000 square meter (m^2) of floor area in total. Due to harsh and long winters, space heating is one of the critical issues with direct influence on living standards. Decentralized, coal based individual heating system are common in the targeted regions while electric heating is also becoming popular. The subproject will demonstrate performance and enable to gain experience in design, installation, operation and maintenance of a geothermal heat pump systems for future scaling-up.

Economic and financial viability: The project will demonstrate technical and financial viability of the distributed renewable energy system in the targeted remote and less developed regions, and will provide valuable hands-on experience to mitigate the perceived technology risks associated with first-or-its kind project.

Financial analysis of the project indicates a financial internal rate of return (FIRR) of 7.99%, 7.69% for the distributed renewable energy system subcomponent, and 12.33% for the geothermal heat pump demonstration subcomponent, which are higher than the estimated weighted average cost of capital (WACC) of 3. 83%. Sensitivity analysis shows that the overall project and all subprojects are also financially viable at most adverse conditions.

The economic internal rate of return (EIRR) of the project without environmental benefits is 15.46% for the overall project, 15.69% for the distributed renewable energy system subcomponent, and 16.499% for the geothermal heat pump demonstration subcomponent. These EIRRs are above the 9.00% economic opportunity cost of capital. Sensitivity analysis shows that the project is likely to be sustainable with EIRRs above 9.00% under various adverse scenarios.

Leveraging of other financing: Total project cost is estimated at $66.1 million. ADB will co finance the project with $40 million loan (60.51%), Japan Fund for Joint Crediting Mechanism with $6.0 million grant (9.08%), $14.6 million (22.09%) from SREP, and $5.5 million (8.32%)as government counterpart. The direct leverage ratio (co-financing/SREP financing) of the project will be **1 : 3.53**.

The Project is also expected to mobilize private sector funding for additional investments through demonstrating the viability of distributed renewable energy system in remote regions. Considering the strong electricity demand growth in the project regions, around 60 MW of additional renewable energy capacity addition will be required by 2030.

Gender: please see item # 13

Co-benefits:

Energy security: The Project will help improve energy security and reduce dependence on imported electricity and fossil fuels by increasing the renewable energy share in Mongolia’s energy mix via delivery of renewable based distributed energy systems in remote and less developed regions.

Employment opportunities: The Project will create direct and indirect employment opportunities. It expected to generate 334 jobs (full time equivalent, FTE) of unskilled labor during construction and 30 jobs (FTE) during operational lifetime. The capacity development component will build technical skills by providing training for grid operators with hands-on experience and knowledge to manage renewable electricity in the grid.

Improved health: Access to clean energy and heating component will provide health benefits through avoided air pollutant emissions. It will provide proportional benefits to females.

12. **Stakeholder engagement:**
The proposed project was initially identified by the Ministry of Energy, and was conceptualized during preparation of the SREP IP. Stakeholder engagement has been ongoing since the preparation of the SREP IP and will continue during project implementation in accordance with relevant government and ADB policies and procedures. During the project design stage, the MOE and ADB carried out several consultations with National Dispatching Center, WRES State-Owned Joint Stock Company (SOJSC), AuES SOJSC, and local communities to firm up the subproject design and to carry out project feasibility studies. Additional consultations will be scheduled among key stakeholders particularly during site identification and project development. Other stakeholders include private sector, local residents (with focus on women and vulnerable groups), civil society organizations, schools, small business owners, local government officials and other public agencies.

13. **Gender considerations[3]:**
The proposed project will incorporate gender aspects during the development and implementation of subprojects. It will ensure women's participation in all technical and skills training, including employment opportunities during construction and operation stage; and women and disadvantaged groups' participation during project consultations activities. The project will apply a gender disaggregated monitoring and evaluation system to monitor implementation and ensure gender balance in all its activities.

14. Indicators and Targets (consistent with results framework):

Core Indicator	Overall Project Target	Project Target excluding JFJCM contribution
(a) Installed capacity from renewable energy, as a result of SREP interventions	41 MW solar and wind capacity, including geothermal heat pump	35.5 MW solar and wind capacity, including geothermal heat pump
(b) Annual electricity output from renewable energy as a result of SREP interventions (GWh/yr)	98.77 GWh / year	87.59 GWh / year
(c) Number of women and men, businesses and community services benefitting from improved access to electricity and fuels, as a result of SREP interventions	71,828 households or 258,314 individuals (139,489 male and 118,824 female)	63,253 households or 181,590 individuals (98,058 male and 83,531 female)
(d) GHG emissions avoided i. Annual ii. Lifetime (25 years)	 87,969 tCO_2e / year 2.2 million tCO_2e	 78,189 tCO_2e / year 1.9 million tCO_2e

[3] Ibid.

Development indicator(s): Job opportunities during construction works, and operation and maintenance

- 334 jobs (full time equivalent) of unskilled labor during construction and
- 30 jobs (full time equivalent) during operational lifetime

15. **Co-Financing:**

	Amount (in USD million):	*Type of contribution:*
• Government	5.5	Counterpart
• ADB	40.0	Loan
• Bilateral	6.0	Grant
Co-Financing Total:	**51.5**	

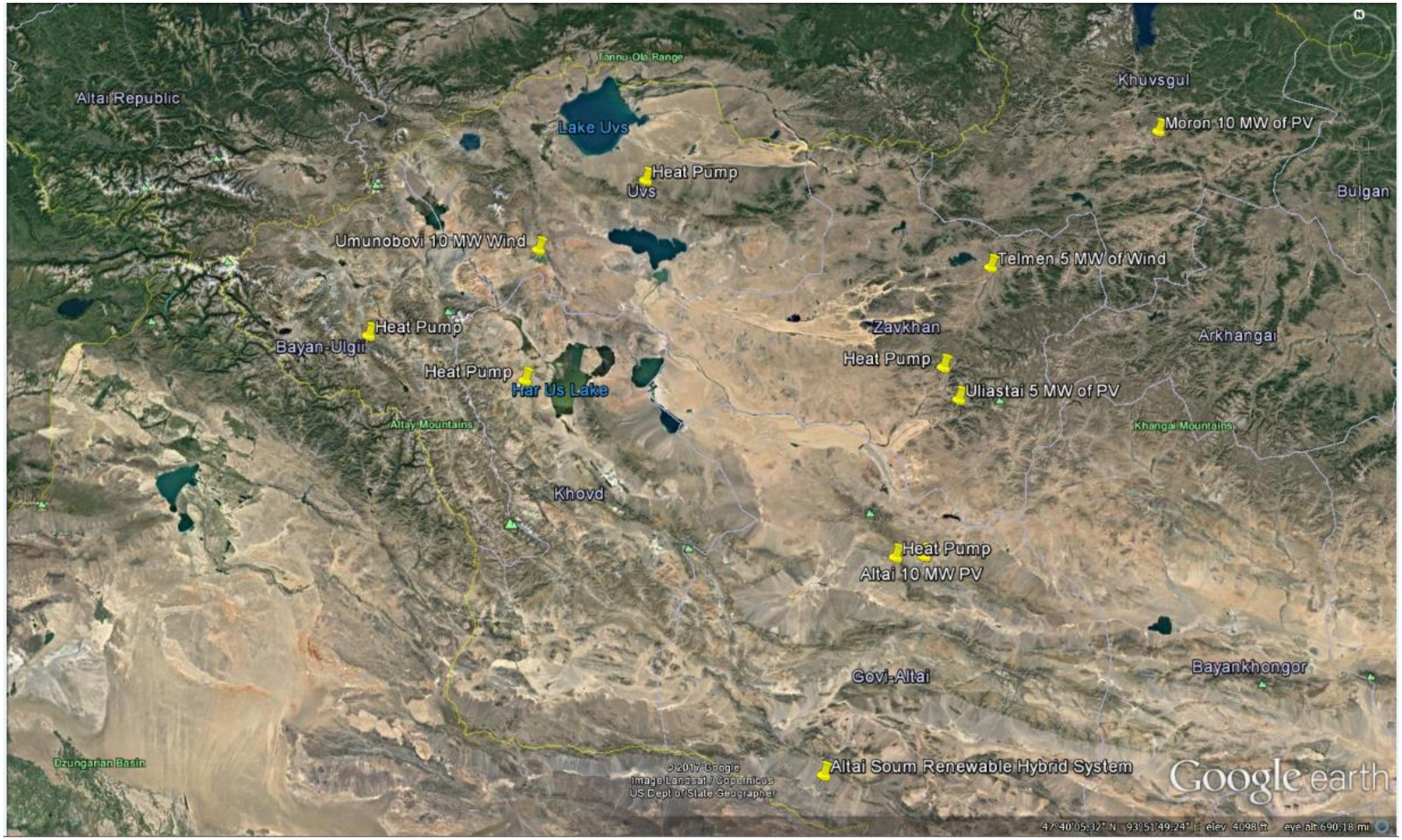
16. Expected Board/MDB Management[4] approval date:

Expected ADB board approval: August 2018

[4] In some cases activities will not require MDB Board approval.

As of 21 Nov 2017

Project Location Map


Altai Republic
Lake Uvs
Heat Pump
Uvs
Khuvsgul
Moron 10 MW of PV
Bulgan
Umunobovi 10 MW Wind
Telmen 5 MW of Wind
Heat Pump
Bayan-Ulgii
Zavkhan
Arkhangai
Heat Pump
Heat Pump
Har Us Lake
Uliastai 5 MW of PV
Altay Mountains
Khangai Mountains
Khovd
Heat Pump
Altai 10 MW PV
Govi-Altai
Bayankhongor
Dzungarian Basin
Altai Soum Renewable Hybrid System
Google earth