

FINANCIAL ANALYSIS

1. The financial analysis of the upscaling renewable energy sector project was undertaken in accordance with the Asian Development Bank (ADB) guidelines on Financial Management and Analysis of Projects.¹ The project is comprised of three subcomponents: (i) distributed renewable energy system development, (ii) shallow ground heat pump demonstration, and (iii) institutional strengthen and capacity enhancement. The executing agency is Ministry of Energy. Altai-Uliastai Energy System (AuES) state owned 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 responsible for day-to-day project management for each subcomponent. Cost estimates are based on the results of ADB's project preparatory technical assistance assessment done in October 2017.

2. The financial internal rate of return (FIRR) for each subcomponent (except institutional strengthen and capacity enhancement subcomponent) and for the whole project was derived using incremental annual cash flows over the 25-year economically useful life of the project. The FIRR was computed on an after-tax basis in real terms by converting nominal cost estimates and financial cash flows to real terms, and removing the impacts of inflation and potential currency fluctuation. The financial analysis model compared the project's FIRR with the weighted average cost of capital (WACC). Sensitivity analyses were conducted to assess the impact of various adverse conditions on the project's financial sustainability.

A. Key Assumptions

3. The whole project implementation period is 5 years. The project will be implemented with ADB's sector loan modality which enables time- and geographic-slicing for flexible project implementation. It 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. (Table 1).

Table 1. List of Subproject

Location/Province	Applied Renewable Energy Technology	Capacity (MW)	Construction Period
<i>Distributed Renewable Energy System Development</i>			
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
<i>Shallow Ground Heat Pump Demonstration</i>			
Hovd, the other Soums	Shallow Ground Heat Pump	0.5	2018-2023
Total		41.0	2018-2023

Source: The project Feasibility Study Report

4. The project will supply clean electricity in remote and less developed region. Upon successful completion of the project, it annually generates 98,769 megawatt hours of clean electricity, thereby avoiding 87,968 tons of annual carbon dioxide emission. The financial benefit of the project is a reduction of high cost electricity, thereby enhancing energy security and

¹ ADB. 2005. *Financial Management and Analysis of Projects*. Manila.

reducing cost of energy. It will primarily substitute high carbon imported electricity from Siberian grid in Russia and reduces cost of energy from \$0.07 per kilowatt hour (kWh) to \$0.05 per kWh.²

5. Capital costs are based on investment costs estimated in the feasibility study report of the project, including civil works, equipment and materials, installation, and other related expenses (e.g., design and technical services). Capital costs include (i) base cost, including investment cost of solar panel, wind turbine, and heat pumps, (ii) line and substation extension, (iii) installation of advanced secondary battery storage and energy management system, (iv) other associated costs including the consulting services and the project administration costs, (v) physical contingencies (5%), and (vi) value-added tax (10%) directly associated with the above purchased equipment and services. Operation and maintenance (O&M) costs include (i) treatment, maintenance, and repair costs to provide electricity and heat services and (ii) wages, benefits, and other sales and management expenses. Related taxes and charges are calculated separately based on valid tax and charge rates. Net income up to MNT3.00 billion is subject to corporate taxes of 10%, the excess is taxed at 25%.

6. The total estimated project cost of \$66.10 million were assumed to be financed by an ADB sovereign loan of \$40.0 million (60.63% of total project cost), Scaling-up Renewable Energy Program for low income countries (SREP) of \$14.6 million (22.09%), the Japan Fund for Joint Crediting Mechanism (JFJCM) grant of \$6.00 million (9.08%), and the Government of Mongolia's contribution of \$5.5 million (8.2%). The WACC was calculated after tax in real terms using the actual capital mix and costs of funds. The financing plan is detailed in Table 2.

Table 2: Detailed Financing Plan

Component	Subprojects	Total	SREP	ADB	JFJCM	Government
Component 1. Decentralized Renewable Energy System Development	10 MW Omunogovi Wind (The first stage)	13.70	8.22	5.45	0.00	0.00
	10 MW Altai Solar PV (The first stage)	9.71	5.38	4.33	0.00	0.00
	0.55 MW of Hybrid System (The first batch)	0.92	0.00	0.00	0.92	0.00
	5 MW of Uliatai Solar PV (The first stage)	7.95	0.00	2.87	5.08	0.00
	5MW of Telmen Wind (The second stage)	6.75	0.00	6.75	0.00	0.00
	10 MW of Moron Solar PV (The second stage)	10.20	0.00	10.20	0.00	0.00
Component 2. Shallow Ground Heat Pump Demonstratoion		1.00	1.00	0.00	0.00	0.00
Component 3. Institutional and Capacity Enhancement		1.00	0.00	1.00	0.00	0.00
Project Administration		2.00	0.00	2.00	0.00	0.00
Tax and Duties		5.42	0.00	0.00	0.00	5.42
Contingencies		5.66	0.00	5.62	0.00	0.00
Interest/commitment charge		1.78	0.00	1.78	0.00	0.00
Total project financing		66.10	14.60	40.00	6.00	5.42

Source: ADB staff estimates

² Present cost of electricity supply is \$0.0538 per kWh in Western Region, and \$0.07623 per kWh in Altai-Uliastai Region. The tariff for electricity and heat is set by the Energy Regulatory Commission. Tariffs are inflation indexed, but level of tariffs has not been determined following the cost-recovery approach and a reasonable profit margin so far. In July 2015, as part of the energy sector reform initiative, the Energy Regulatory Commission has commenced tariff reform which aims to gradually increase tariff on full cost recovery basis. In 2015, the government issued the State Policy on Energy 2015–2030, which targets to achieve 0% of net profit margin of state-owned utilities by 2023 and 5% in 2030.

7. The cost of the ADB loan is based on the current London-interbank offered rate (LIBOR) on a 10-year fixed-rate swap (2.33% per annum) plus the contractual ADB loan spread of 0.50% per annum, a maturity-based premium of 0.10% per annum and a commitment fee of 0.15%. The loan maturity period is assumed to be 25 years, including the grace period of 5 years and the repayment period of 20 years with equal principal payments. The real cost of funds contribution from the Government of Mongolia is assumed to be 13.00 % per annum, which is equivalent to the government domestic 3-year MNT denominated bond issued in October 2017. The real cost of SREP and JFJCM grant funding are assumed to be 5.63% per annum and is based on the yield-to-maturity of the US dollar denominated international 5-year bond issued by the government in October 2017. Since the financing structure defers according to the subproject, weighted average cost of capital (WACC) was separately calculated for each subprojects as is in table 3.

Table 3: Projected Weighted Average Cost of Capital

	Whole Project	Umunogovi Wind	Altai Solar PV	Altai Soum Hybrid	Uliastai Solar PV	Telmen Wind	Moron Solar PV	SGHP
WACC	3.83%	4.06%	4.06%	5.15%	3.66%	2.72%	2.72%	5.27%

SGHP=Shallow Ground Heat Pump, WACC=Weighted Average Cost of Capital

Source: ADB staff estimates

B. Financial Internal Rate of Return and Financial Net Present Value

8. The total project's FIRR is 7.99%, higher than the estimated whole project WACC of 3.83%. The financial net present value of the project was calculated using the estimated WACC as the discount rate, resulting in \$27,585,951. All subprojects are also financially viable at each subproject wise WACC (Table 4).

9. Sensitivity analyses were performed to test the FIRR's sensitivity to certain changes in parameters. The analyses showed that the project would remain financially viable with FIRRs exceeding the WACC for (i) an increase in project capital costs by 10%, (ii) an increase in operations and maintenance costs by 10%, (iii) a decrease in revenue by 10%, and (iv) all adverse event combined (i+ii+iii). Whole project and each subproject are also financially viable at most adverse conditions (Table 4).

Table 4: Financial Internal Rate of Return and Sensitivity Analysis

	WACC	Base Case	10% CAPEX increase (i)	10% OPEX Increase (ii)	10% Energy Yield decline (iii)	All combine (i-iii)
Whole	3.83%	7.99%	6.93%	7.80%	6.62%	5.44%
Umunogovi Wind Power	4.06%	8.36%	7.33%	8.31%	7.18%	6.16%
Altai Solar PV	4.06%	6.74%	5.76%	6.45%	5.36%	4.16%
Altai Soum Solar PV-Wind Hybrid	5.14%	6.48%	5.45%	5.94%	4.78%	3.29%
Uliastai Solar PV	3.66%	4.35%	3.47%	4.02%	3.02%	1.85%
Telmen Wind Power	2.72%	13.58%	12.18%	13.50%	11.97%	10.61%
Moron Solar PV	2.72%	6.62%	5.53%	6.32%	5.10%	3.78%
Shallow Ground Heat pumps	5.27%	12.33%	10.89%	11.99%	10.40%	8.78%

CAPEX=Capital Expenditure; OPEX=Operation and maintenance expenditure, PV=Photovoltaic, WACC=Weighted Average cost of capital

Source=ADB staff estimates.