

保加利亚省布尔干县县长办公室



为布尔干县中心地区家庭提供
5-20千瓦太阳能与风能互补可再生能源系统项目

GOVERNOR'S OFFICE OF BULGAN SOUM, BULGAN PROVINCE



PROJECT TO SUPPLY HOUSEHOLDS IN THE
CENTRAL AREA OF BULGAN SOUM WITH
5-20 kW HYBRID SOLAR AND WIND
RENEWABLE ENERGY SYSTEMS

摘要 EXECUTIVE SUMMARY

项目总体目标 GENERAL PROJECT OBJECTIVE

本项目旨在布尔干苏木家庭层面分阶段引入太阳能-风能-储能可再生能源综合系统，建立可靠、稳定、环境友好的能源供应体系，降低集中式电网负荷，提高家庭能源自给自足水平，进而支持当地绿色发展与经济可持续增长。 This project aims to introduce a phased solar-wind-battery hybrid renewable energy system at the household level in Bulgan soum, establishing reliable, stable, and environmentally friendly energy supply, reducing the load on the centralized power grid, increasing household energy independence, and thereby supporting local green development and sustainable economic growth.

本项目的核心内容是通过提供价格质量保证，为后续商务洽谈的推进创造条件。 The core content of this project offers a price-quality guarantee, enabling the continuation of subsequent business negotiations.

项目具体目标 Project Objectives

1. 通过太阳能-风能-储能综合系统满足布尔干苏木家庭一定比例的电力需求，在2026—2029年期间将可再生能源消费占比从15.9%提升至55.95% To cover a defined share of household electricity consumption in Bulgan soum through a solar-wind-battery hybrid system, increasing the renewable energy consumption ratio from 15.9% to 55.95% during the period 2026–2029
2. 在家庭层面分阶段安装5—20千瓦容量的太阳能-风能综合系统，逐年扩大安装总量，到2029年建立稳定运行的系统网络 To install 5–20 kW capacity solar-wind hybrid systems at the household level in phases, incrementally increasing total installations each year and establishing a stably operating network of systems by 2029
3. 为家庭层面生产的多余电力并入中央电网创造条件，提高当地能源供应的灵活性 To create the conditions for supplying surplus electricity generated at the household level to the central grid, thereby enhancing the flexibility of local energy supply

4. 为降低蓄电池及太阳能-风能设备的故障、老化和运营风险，在当地建立维护保养、备件储备及技术监控体系 To establish a local system of maintenance services, spare parts reserves, and technical supervision aimed at reducing the risks of battery and solar-wind equipment failure, aging, and operational disruption
5. 考虑家庭财务能力，引入优惠贷款、租赁、分期付款等灵活融资机制，提高项目的可及性 To introduce flexible financing mechanisms such as concessional loans, leasing, and installment payments in consideration of household financial capacity, thereby increasing project accessibility
6. 将建筑保温隔热、减少热量损失、太阳能热水器、热泵等解决方案与可再生能源系统协同实施，提高能源总体使用效率 To improve overall energy use efficiency by implementing building insulation, heat loss reduction, solar water heating, heat pump solutions in coordination with the renewable energy system
7. 培养当地技术人力资源，建立安装、运营、维护的可持续能力 To develop local technical human resources and build sustainable capacity in installation, operation, and maintenance
8. 为农牧业及小型加工业应用可再生能源创造条件，提升当地经济附加值 To create the conditions for utilizing renewable energy in agriculture and small-scale processing industries, thereby increasing local economic added value
9. 减少煤炭消耗及温室气体排放，为实现环境友好型可持续发展目标作出贡献 To contribute to achieving environmentally friendly and sustainable development goals by reducing coal consumption and greenhouse gas emissions
10. 将布尔干苏木发展成为家庭层面可再生能源的示范区，打造可在其他省份和苏木推广实施的样板项目 To develop Bulgan soum into a model zone for household-level renewable energy and to create a replicable model project that can be implemented in other provinces and soums

2026-2029 2026-2029年所需投资费用 / Required
Investment Costs for the Years 2026-2029

费用名称 / Cost Item	所需投资费用 / Required Investment Cost
薪酬费用 / Salary Cost	401,172,000₮
通信费用 / Communication Cost	9,450,298₮
反馈沟通及调研费用 / Return Communication and Research	4,217,935₮
管理费用 / Administrative Expenses	12,734,397₮
土地清场援助 / Land Clearing Assistance	9,089,920₮
运输费用 / Transportation Cost	44,700,008₮
营销费用 / Marketing Cost	51,648,000₮
安装（设备）费用 / Inventory / Installation Costs	9,768,187,361₮
总费用 / Total Cost	10,301,199,919₮

2026-2029 2026-2029年费用结构 / Cost Structure for the
Years 2026-2029

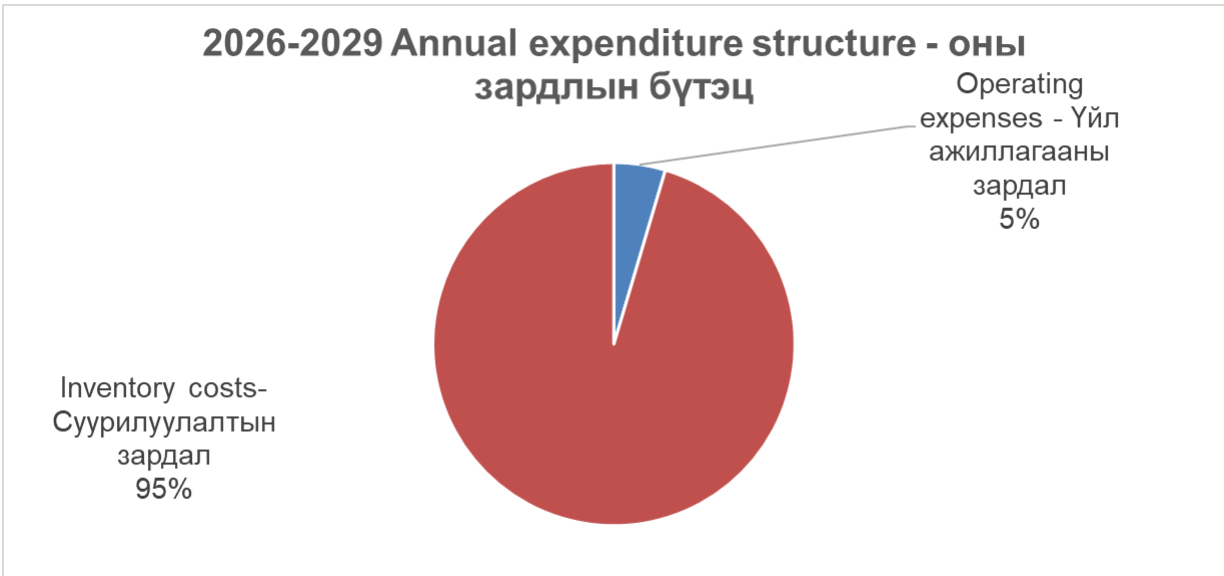
运营费用 / Operating Expenses	533,012,557₮
安装（设备）费用 / Inventory / Installation Costs	9,768,187,361₮
总费用 / Total Cost	10,301,199,919₮

项目2026—2029年总投资费用估算为10,301,199,919图格里克，其中绝大部分即9,768,187,361图格里克为安装及设备费用，体现了集中投入太阳能电池板、风力发电机、蓄电池、逆变器等核心系统的特征。 The total investment cost for the project during 2026–2029 is estimated at MNT 10,301,199,919, the majority of which — MNT 9,768,187,361 — comprises installation and

equipment costs, reflecting investment concentrated in core systems such as solar panels, wind turbines, battery storage, and inverters.

薪酬费用规划为401,172,000图格里克，用于保障项目管理、工程师及安装团队的运营需要。营销、运输、管理、通信及调研费用合计将支持项目实施的组织协调、信息传播及物流运营活动。 Salary costs are planned at MNT 401,172,000 to cover the operations of the project management, engineering, and installation teams. Marketing, transportation, administrative, communication, and research costs combined will support the organizational coordination, information dissemination, and logistics activities of project implementation.

在总费用结构中，运营费用为533,012,557图格里克，是保障项目稳定实施的基础成本。该费用结构以技术为核心、需要大量资本投入，但表明了项目在长期内具备创造能源节约效益、可靠性与环境效益的潜力。 Operating expenses of MNT 533,012,557 in the overall cost structure represent the baseline costs for ensuring stable project implementation. This cost structure, while technically focused and capital-intensive, demonstrates the potential to generate long-term energy savings, reliability, and environmental benefits.



项目立项依据 PROJECT RATIONALE

在布尔干苏木引入家庭层面太阳能-风能-储能可再生能源综合系统的项目立项依据，建立在能源领域持续增长的消费需求、当地自然资源与基础设施条件

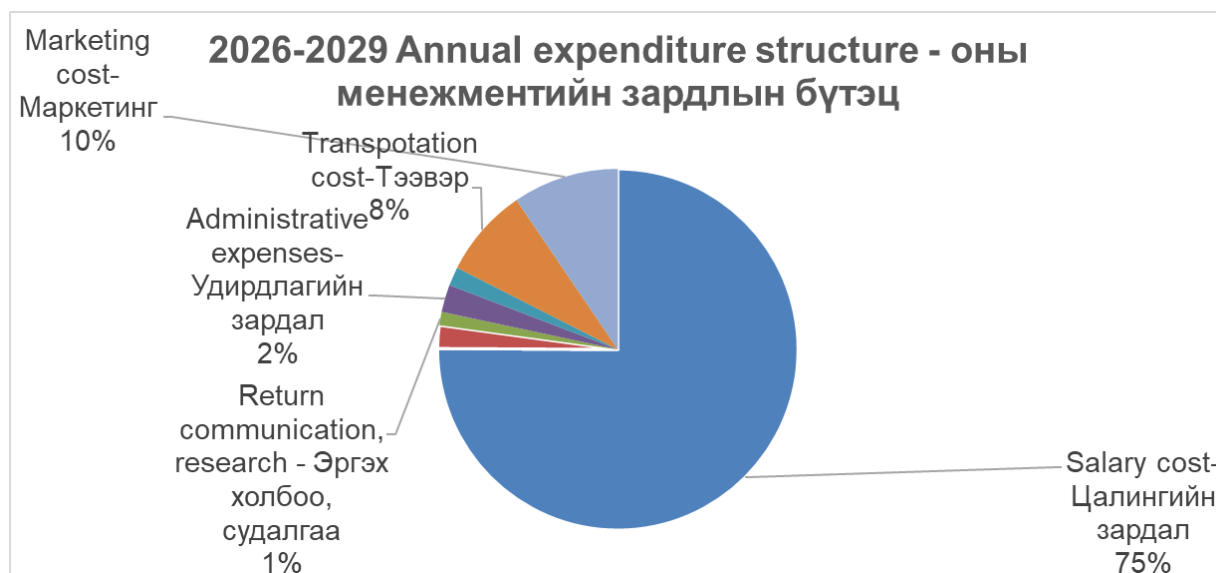
、供暖领域的迫切问题以及长期经济效益的基础之上。 The rationale for this project to introduce a household-level solar-wind-battery hybrid renewable energy system in Bulgan soum is defined on the basis of growing energy sector consumption, local natural resources, infrastructure opportunities, pressing heating supply challenges, and long-term economic benefits.

布尔干苏木的电力消费预计在2026—2029年间从17,411.5兆瓦增至25,072.6兆瓦，表明能源需求持续稳定增长。这一增长给集中式电力系统带来负荷压力，尤其在用电高峰期增大了断电和电压波动的风险。在此背景下，在家庭层面建立补充能源来源已成为保障电力系统可靠运行的战略需求。 Electricity consumption in Bulgan soum is projected to grow from 17,411.5 MW to 25,072.6 MW during 2026–2029, indicating a steady increase in energy demand. This growth places strain on the centralized power system, increasing the risk of outages and voltage fluctuations particularly during peak consumption periods. Under such conditions, establishing supplementary energy sources at the household level has become a strategic necessity to ensure reliable power system operation.

布尔干省是具有实际太阳能和风能资源的地区，太阳辐射强度及风能储量在技术层面完全具备引入家庭级综合系统的条件。将太阳能与风能来源相结合，可相互弥补季节性和昼夜波动，提高能源供应的稳定性。 Bulgan Province is a region with substantial solar and wind energy resources, with solar radiation density and wind resources being fully technically feasible for the introduction of a household-level hybrid system. Combining solar and wind energy sources mutually compensates for seasonal and diurnal fluctuations, increasing the stability of energy supply.

此外，布尔干苏木中心已全面接入电力网络，为本项目以并网（而非独立）模式实施创造了条件。通过将家庭层面生产的多余电力并入中央电网，可实现能源双向流动，提高系统灵活性。 Furthermore, the full connection of Bulgan soum center to the power grid creates the conditions for implementing this project in a grid-tied rather than standalone mode. By supplying surplus

electricity generated at the household level to the central grid, bidirectional energy flow can be achieved, increasing system flexibility.



项目的经济立项依据建立在总计10,301,199,919图格里克的投资结构之上。其中，安装及物料费用9,768,187,361图格里克占总费用的绝大部分，表明本项目以技术设备为核心。其余部分由薪酬费用401,172,000图格里克、营销费用51,648,000图格里克、运输费用44,700,008图格里克以及其他管理、调研、通信费用构成。 The economic rationale of the project is based on a total investment structure of MNT 10,301,199,919. Of this, installation and inventory costs of MNT 9,768,187,361 constitute the majority of total costs, indicating that this project is technically equipment-focused. The remainder consists of salary costs of MNT 401,172,000, marketing costs of MNT 51,648,000, transportation costs of MNT 44,700,008, and other management, research, and communication expenses.

这表明项目的主要成本由技术解决方案构成，即太阳能电池板、风力发电机、蓄电池、逆变器等设备。因此，设备质量、可靠性及使用寿命将成为直接影响项目成功的关键因素。 This demonstrates that the main project cost comprises technological solutions — namely equipment such as solar panels, wind turbines, battery storage, and inverters. Therefore, the quality, reliability, and service life of equipment will be critical factors directly influencing the success of the project.

此外，计划每年为140户家庭安装系统，在3年内推广共420套系统，为项目的分阶段实施提供了可行条件。相应地，安装费用逐年上升的趋势与通货膨胀及设备价格上涨有关。 Furthermore, the plan to install systems in 140 households annually and introduce a total of 420 systems over 3 years creates the conditions for phased project implementation. Accordingly, the tendency for installation costs to increase each year is related to inflation and rising equipment prices.

据测算，项目实施结果将使可再生能源消费从2,768兆瓦增至14,029.1兆瓦，占总消费比例从15.9%提升至55.95%，体现了项目的实质性影响。同时，预计将产生总计1,431,628,560图格里克的收入流，显示出项目一定程度的财务回报。

As a result of the project, renewable energy consumption is projected to grow from 2,768 MW to 14,029.1 MW, with its share of total consumption increasing from 15.9% to 55.95%, demonstrating the tangible impact of the project. Additionally, a total revenue stream of MNT 1,431,628,560 is projected, indicating a certain level of financial return from the project.

然而，本项目并非旨在短期内获取高额利润，而是具有长期能源节约、稳定性、环境效益及降低进口依赖的战略意义。 However, this project is not aimed at generating high profits in the short term but rather holds strategic significance in terms of long-term energy savings, stability, environmental benefits, and reduction of import dependency.

布尔干市供暖高度依赖煤炭，供暖季节漫长，建筑热量损失严重，反映出能源利用效率较低的现状。因此，需要采用综合性方法，将供热、热水、保温隔热、热泵等解决方案与发电相结合，而非单纯进行电力生产。 Bulgan city's heating supply is highly dependent on coal, with a long heating season and significant building heat loss, indicating low energy efficiency. Therefore, a comprehensive approach is required that combines heating, hot water, insulation, and heat pump solutions — not merely electricity generation.

此外，需要从国外、特别是中华人民共和国进口设备，这带来了供应延误、质量差异及备件保障方面的风险。尤其是蓄电池及太阳能-风能综合系统的故障

损坏将直接影响项目的可靠运行，因此必须建立维护保养体系。 Furthermore, the necessity to import equipment from abroad — particularly from the People's Republic of China — entails risks of supply delays, quality variations, and spare parts availability. In particular, failures of battery storage and solar-wind hybrid systems directly affect the reliable operation of the project, making the establishment of a maintenance and servicing system indispensable.

因此，在实施本项目时，正确选择技术方案、特别关注设备质量与可靠性、发展当地维修服务能力以及引入灵活的融资机制至关重要。 Therefore, in implementing this project, it is critical to select appropriate technical solutions, pay special attention to equipment quality and reliability, develop local maintenance and servicing capacity, and introduce flexible financing mechanisms.

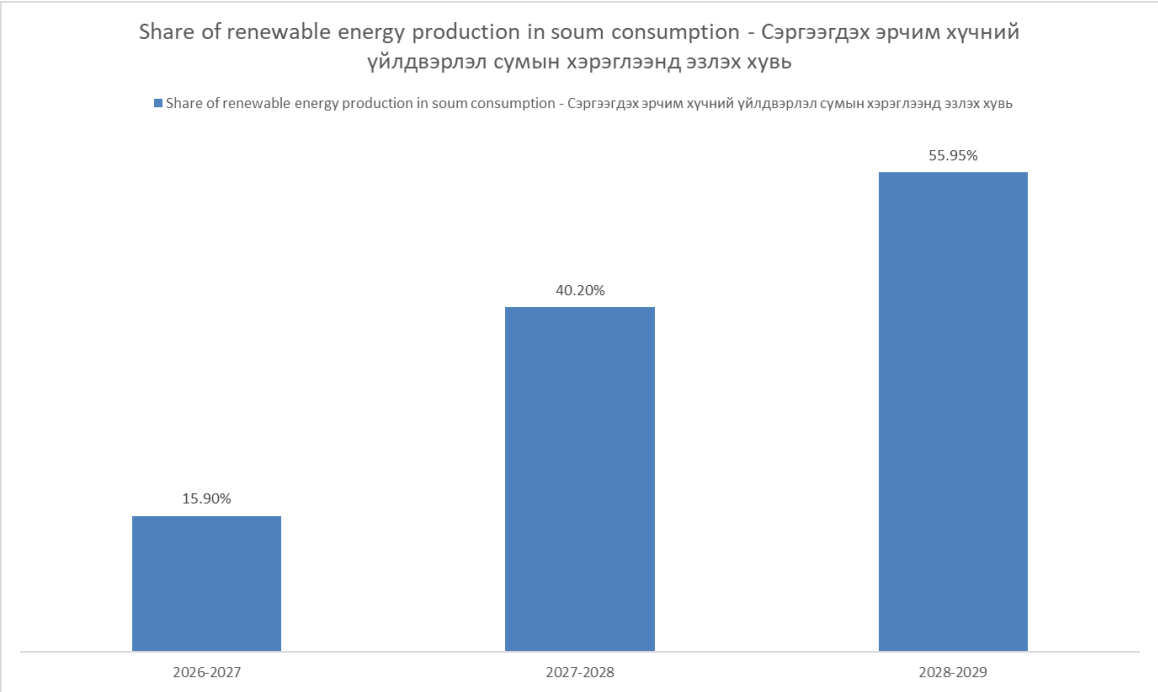
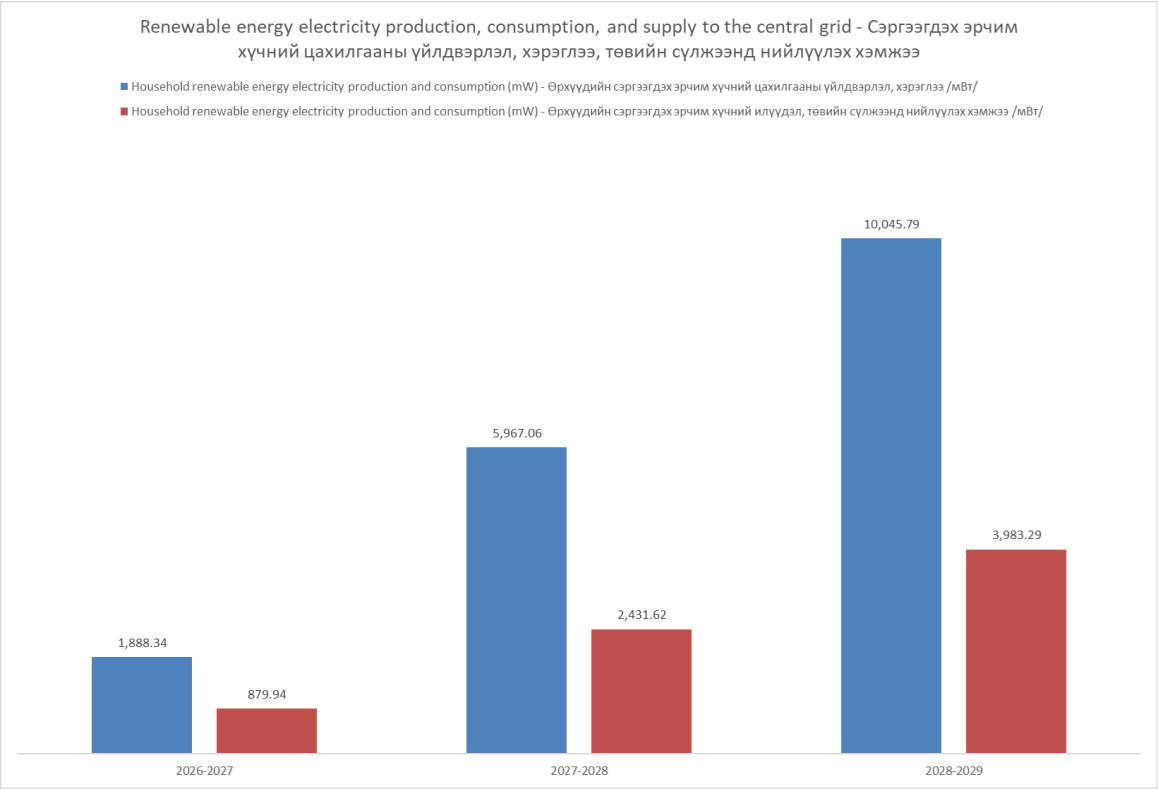
风险矩阵（热点图） RISK MATRIX (HEAT MAP)

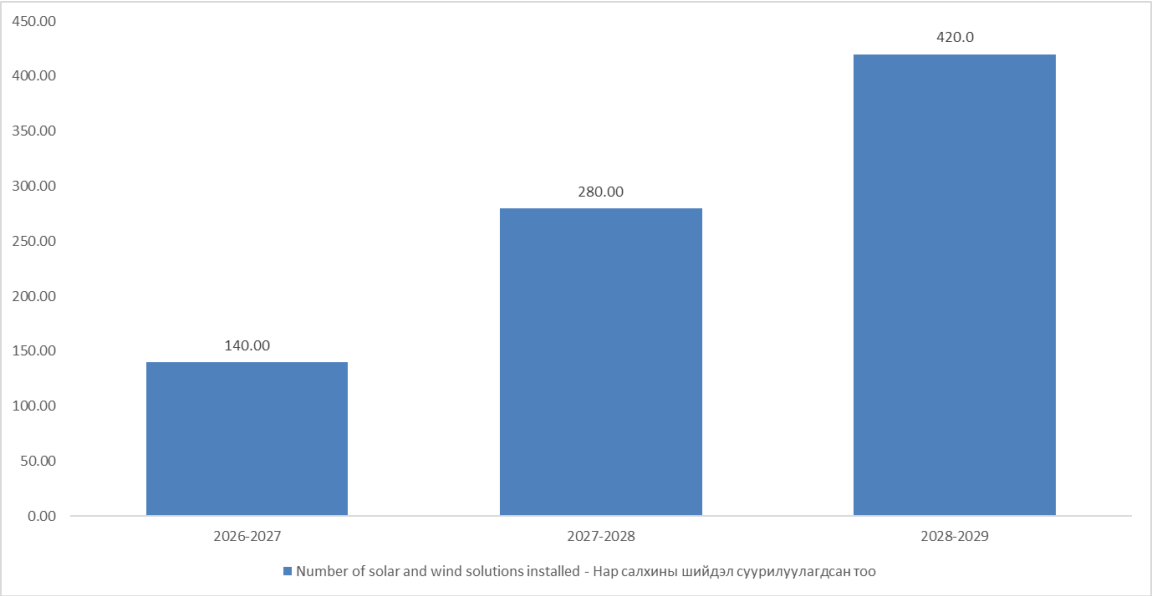
风险概率 \ 影响程度 / Risk Probability \ Impact	低 / Low	中 / Medium	高 / High
高 / High		设备供应延误 / Equipment Supply Delay	蓄电池故障、系统瘫痪 / Battery Failure, System Malfunction
中 / Medium	电价调整风险 / Tariff Change	汇率波动风险 / Exchange Rate Fluctuation	进口依赖风险 / Import Dependency
低 / Low	用户知识不足 / Insufficient Consumer Knowledge	维护保养滞后 / Maintenance Service Delay	气象波动风险 / Weather Fluctuation

财务摘要信息 FINANCIAL SUMMARY INFORMATION

2026-2029年可再生能源电力生产、消费及并入中央电网规模 / Renewable Energy Electricity Production, Consumption, and Supply to the Central Grid, 2026–2029

	2026- 2027	2027- 2028	2028- 2029	Total (合计)
布尔干苏木总电力消费量 (兆瓦) / Total Electricity Consumption of Bulgan Soum (MW)	17,411.50	20,893.8 0	25,072. 6	63,377.9
总安装额定容量 (兆瓦时) / Total Installed Nominal Capacity (MWh)	4,396.68	13,339.0 8	22,281. 5	40,017.2
家庭可再生能源总消费与生产量 (兆瓦) / Total Renewable Energy Consumption and Production by Households (MW)	2768	8399	14,029. 1	25,196.0
家庭可再生能源电力生产与消费量 (兆瓦) / Household Renewable Energy Electricity Production and Consumption (MW)	1,888.34	5,967.06	10,045. 8	17,901.2
家庭可再生能源电力剩余及并入中央电网量 (兆瓦) / Household Renewable Energy Surplus and Supply to Central Grid (MW)	879.94	2,431.62	3,983.3	7,294.8
太阳能及风能解决方案安装套数 / Number of Solar and Wind Solutions Installed	140.00	280.00	420.0	
可再生能源生产占苏木消费比例 / Share of Renewable Energy Production in Soum Consumption	15.90%	40.20%	55.95%	





2026-2029年可再生能源电力生产、消费及并入中央电网规模 / Renewable Energy Electricity Production, Consumption, and Supply to the Central Grid, 2026–2029

	2026-2027	2027-2028	2028-2029	合计 / Total
合计 / Total	179,074,320₮	477,209,520₮	775,344,720₮	1,431,628,560₮
白天用电 (06:00至17:00) / Daytime Use (06:00 to 17:00)	147,610,320₮	400,205,520₮	652,800,720₮	1,200,616,560₮
傍晚用电 (17:00至22:00) / Evening Use (17:00 to 22:00)	31,464,000₮	77,004,000₮	122,544,000₮	231,012,000₮
夜间用电 (22:00至06:00) / Night Use (22:00 to 06:00)	₮ 0	₮ 0	₮ 0	₮ 0