CURRENT STATE OF THE MONGOLIAN POWER SYSTEMS

ENERGY GENERATION AND IMPORT, 2023 /million kWh/

- **Domestic Generation**: 8,529.6 million kWh
- **Power Import**: 2,446.5 million kWh
- **Total Electricity**: 10,976.1 million kWh

**SHARE OF IMPORTED ELECTRICITY**: 22.3%

- **80% of the regional energy demand is imported.**

**Altai-Ulstai ES**
- **Total Electricity**: 29.5 million kWh

**CES**
- **Electricity**: 8,198.7 million kWh
- **Import**: 731.9 million kWh
- **Total Electricity**: 8,930.6 million kWh

**SES**
- **Electricity**: 189.9 million kWh
- **Total Electricity**: 1434.7 million kWh

**Country Level**

- **Domestic Generation**: 248.8 million kWh
- **Import**: 0.24 million kWh
- **Total Electricity**: 249.1 million kWh

**EES**
- **Electricity**: 248.8 million kWh
- **Total Electricity**: 249.1 million kWh

Overhead Power Transmission Lines, current
- **220 kV OHTL**
- **110 kV OHTL**

Overhead Power Transmission Lines, planned
- **500 kV PTL**
- **220 kV PTL**

8.4% of total import
- **206.0 million kWh**

29.9% of total import
- **731.9 million kWh**

58.6% of total import
- **1434.7 million kWh**

1434.7 million kWh
The Gobitec, internationally known as the Asian Super Grid, this initiative first started in 2011 with the project name Gobitec.

The main goal of the Gobitec initiative is to build sustainable energy infrastructure based on renewable energy sources, wherein electricity produced from the vast potential of renewable energy in Gobi desert would be transmitted through HVDC Super grid to all countries of the Northeast Asia.

The Gobitec concept represents the idea of producing clean energy from renewable energy sources in the Gobi Desert and delivering the produced energy to high-demand regions.
Mongolia has 270-300 clear sunny days a year and solar radiation is 2250-3300 hours at average.

RENEWABLE ENERGY SOURCES

**Mongolia**
- **2200 GW** /installed capacity/
- **4800 TWh** /annual production/

**Installed capacity** of wind farms of 1100 GW can generate 2500 GWh power per year.

Interim results based on IRENA wind data. Update with new Vaisala wind data expected end of November 2017

Mongolia is abundant in wind resources, has potential to generate 7MW power from 1sq.meters site. Installed capacity of wind farms of 1100 GW can generate 2500 GWh power per year.

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**Optimization of PV panels tilt**

Based on Solargis solar data (Global Horizontal Irradiation -GHI), Optimization of PV panels tilt so as to increase performance: long term yearly average of daily totals of global irradiation at optimum tilt (GTI).
The findings the first stage research indicated that exploiting Mongolia’s abundant renewable energy resources and supplying power to regional countries by establishing a Northeast Asian Power System Interconnection is technically feasible and economically viable.

An ADB sponsored study for the Mongolian Ministry of Energy entitled Strategy for Northeast Asia Power System Interconnection (NAPSI) (“Strategy for NAPSI”) so called NAPSI stage 1 concluded that the economic relevance of regional interconnectivity is high. The study estimated that 200 GW of wind and 1200 GW of solar PV energy are immediately available in the suitable areas of Mongolia.

Project Initiation
The project was launched in 2017 at the request of the Mongolian government, with support from the ADB and various international funding sources.

Comprehensive studies were conducted by Électricité de France and local firm NovaTerra.

Ongoing Research
A second phase of the project (ADB TA-6845 MON) is currently underway, with Mercados-Aries Company conducting further research and analysis.
Mongolia has 200GW of wind energy capacity and 1,200GW of solar energy capacity for export.

Economic Benefits to Mongolia

<table>
<thead>
<tr>
<th>Investment (Billion USD)</th>
<th>GDP (Billion USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.6</td>
<td>20.84</td>
</tr>
<tr>
<td>4.2</td>
<td>40.29</td>
</tr>
<tr>
<td>57.3</td>
<td>83.76</td>
</tr>
</tbody>
</table>

NAPSI Economics WIN-WIN to all Countries

Profit and Loss result, 2036 Scenarios Segregated to Interconnected
Current NAPSI TA shall review the result considering the market realities (demand-supply balances, RE variability, infrastructure costs, electricity prices). These aspects are key for design options for commercially feasible cross-border trading.

- The results aims strengthening of the regional dialogue on electricity interconnection based on trading with renewable electricity supply from Mongolia, by creation of a strong base of projects at market, technical, financial, and institutional level.

No trade of these huge amount of RE energy is possible without institutional commitments.
GOVERNMENT OF MONGOLIA
MINISTRY OF ENERGY

DEVELOPMENT PLAN: SCENARIOS IMPLEMENTATION

Scenario 1
TARGETS:
- Timeline: 10-15 years
- Capacity: +5 GW
- Objective: Exportation to neighbouring countries.

Scenario 2
TARGETS:
- Timeline: mid term
- Capacity: +10 GW
- Objective: Exportation to neighbouring countries.

Scenario 3
TARGETS:
- Timeline: long term
- Capacity: +100 GW
- Objective: Exportation to neighbouring countries.

### Conceptual Design
### Cost Assessment
### Implementation Plan

<table>
<thead>
<tr>
<th>Exportation from Mongolia to NEA countries</th>
<th>Solar &amp; Wind investments in Mongolia</th>
<th>Grid investment in NEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 GW</td>
<td>$5.5bln</td>
<td>$3.3bln</td>
</tr>
<tr>
<td>10 GW</td>
<td>$10.0bln</td>
<td>$5.0bln</td>
</tr>
<tr>
<td>100 GW</td>
<td>$85.0bln</td>
<td>$60.0bln</td>
</tr>
</tbody>
</table>
The second phase of the project PROMOTION OF THE NORTHEAST ASIA POWER SYSTEM INTERCONNECTION was approved by the Government of Mongolia in December 2021, with research being conducted by Spain's company Mercados-Aries international.

The economic studies show that the cost of Solar and Wind energies produced Mongolia are the cheapest of the NEA region.

Because, the capacity factor are the best in the region, good factor of Solar power in Mongolia compared to the other NEA countries, and exceptional wind power factor roughly 12 point better the other NEA countries.

The average power factor of Mongolia’s wind power plants is 33-51 percent, which is a relatively high indicator, world average is 25-40 percent. Improvement in Solar and Wind technologies will help for higher power factor.

<table>
<thead>
<tr>
<th>PV factors</th>
<th>2020</th>
<th>2026</th>
<th>2036</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mongolia</td>
<td>18%</td>
<td>20%</td>
<td>23%</td>
</tr>
<tr>
<td>China East</td>
<td>16%</td>
<td>18%</td>
<td>21%</td>
</tr>
<tr>
<td>Japan</td>
<td>15%</td>
<td>17%</td>
<td>19%</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>16%</td>
<td>18%</td>
<td>21%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wind factors</th>
<th>2020</th>
<th>2026</th>
<th>2036</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mongolia</td>
<td>42%</td>
<td>44%</td>
<td>48%</td>
</tr>
<tr>
<td>China East</td>
<td>23%</td>
<td>26%</td>
<td>33%</td>
</tr>
<tr>
<td>Japan</td>
<td>26%</td>
<td>27%</td>
<td>30%</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>21%</td>
<td>22%</td>
<td>30%</td>
</tr>
</tbody>
</table>
Scenarios of availability of the resources

**WIND:**
- Wind speed > 8 m/s
- Capacity > 20 GW

**SOLAR PV:**
- GHI > 1700 kWh/m²
- Capacity > 480 GW

*Source: NAPSI*

**Source Solar Global Atlas**
**Source UL Windnavigator**
The Northeast Asian region is one of the most important prosperous economic region of the world. It shares about one-fourth of both the world wide GDP and population, accounting for 35 percent of global energy consumption, emits for almost 40 percent of global greenhouse gas emissions, which mostly stemmed from power generation, posing a considerable challenge.

Due to very high Economic growth in NEA, energy consumption has been growing rapidly and enormously year by year, the market is constantly lacking in energy however all NEA countries have ambitious development plans in Renewable Energy. These regional countries import most of energy raw materials from abroad, also joined to the Paris agreement commit to reducing GHG emissions. In that sense special attention is paid to the development of Renewable Energy.
• Economic benefits, Cost advantage due to cheap and clean Renewable based electricity.
• Job creation will be increased
• Diversification of local economy
• Enhance the sustainability and equity over the region
• Social benefits such as enhanced regional relationships.
• Increased energy, food and water security.
• Power systems that are well interconnected would improve system flexibility, electric power exchanges, and efficiency and allow system optimization, provide more reliable, affordable electricity to consumers.
• Reduction of CO2 emissions so economically it makes sense to invest in the NEA interconnection grid.

Benefits for Mongolia

• New industrial sector, improved infrastructures, If a large scale of solar and wind stations is built, contemporary high technologies of modern industry will come in Mongolia.
• New service sector: implementing solar and wind farms
• Increase of GDP
• Export surplus for a better Balance of Trade
• And last but not least … cheap Clean Energy for Mongolia.
The current Renewable energy law of Mongolia does not include any provisions on the exporting of Renewable energy. That is why, there is a need to reform current Renewable energy law or to introduce new legislation for the exporting of Renewable energy. Especially, it needs to be further developed for investment in Renewable energy generation dedicated to exports to NEA region.

The Mongolian Ministry of Energy has been actively engaged in all aspects of the project Northeast Asian Power System Interconnection, as it is extremely important for the development of Mongolia’s energy sector, as well as the economic and infrastructure cooperation between Mongolia and the NEA region.

The cheap Solar and Wind power from Mongolia will replace fossil-fuel in the NEA and helping for cutting NEA CO2 emission.

By fostering energy cooperation in Northeast Asia, Mongolia can become a key player in the regional energy market, enabling mutually beneficial and equitable cooperation with other countries in the energy sector.

NAPSI project will open up the new opportunities for cooperation in the region essentially to focus on developing robust business relationships in the energy market with other countries.
THANK YOU FOR ATTENTION!