Islamic Republic of Afghanistan

Afghanistan Energy Sector
Outline of Presentation

• Overview of Energy Sector Policy
• Energy Sector Structure
• Energy Status in Afghanistan
• Afghanistan Electricity Demand Forecast
• Afghanistan Energy Potential
• Projects in Pipeline
• Renewable Energy in Afghanistan
• Challenges and Way forward
Afghanistan’s Energy Sector Strategic goal is to provide sustainable power supply, at affordable prices, and in an environmentally sound manner, for economic growth, and to improve living standards

• Direct policies and regulations
• Make maximum use of domestic resources
• Initiate sector regulation
• Promote private sector participation and investment in the electricity sector
• Encourage the expansion of access to underserved and rural communities
• Stimulate the rational use of Renewable sources of energy
Project Work Flow

Policy
- Problem Assessment
- Strategy Definition

Programs
- Need Assessment
- Concept Development
- Project Initiation
- Survey and Feasibility Study
- Prioritization
- Budgeting and Approval
- Preparation of Tender Document (DB or DBB)

Procurement
- Tendering / Bidding
- Technical and Financial Evaluation (Committee)
- Negotiation and Contract Signing

Monitoring and Supervision
- Contract Management
- Monitoring and Supervision
- Project Closing
- Handover to Applicant

Operator
- Utilization
- Operation and Maintenance
Industry structure and institutional arrangements

• Currently, the power sector is governed by Ministry of Energy and Water (MEW) and operated by Da Afghanistan Breshna Sherkat (DABS), which controls & operates all the activities of power sector throughout the country.

• The Afghanistan power system is categorized into four different networks namely, North East Power System, South East Power System, Herat Zone System and Turkmenistan system which facilitates both internal and cross border interconnections with neighboring countries like Uzbekistan, Tajikistan, Iran and Turkmenistan.

  ✓ North East Power System; (NEPS) consisting of a grid linking 17 load centers (Kabul, Mazar-i-Shariff, Jalalabad, etc) with Uzbekistan and Tajikistan (HVTL 220kv, 110kv, 35kv)

  ✓ South East Power System (SEPS) consisting of Khandar, etc linking Kajaki (HVTL 110kv)

  ✓ Herat system linking the Herat Zone with Islamic Republic of Iran and Republic of Turkmenistan (HVTL 132kv, 110kv)

  ✓ Turkmenistan system linking Herat, Faryab, JawzJan, Sar-e-Pul and Andkhoy district. (HVTL 110kv)
Energy access is a key focus of national development programs

• **National Priority Programs (NPP)**
  – National Energy Supply Program (NESP) on Infrastructure Cluster

• **Power Sector Master Plan prepared**
  – 20 year grid expansion planning

• **Gas sector plan is under formulation stage**
  – Options to efficiently utilize country’s significant natural gas resources for electricity, transport, and heating/cooking

• **Development of coordination bodies**
  – Renewable Energy Coordination Committee
  – Inter-ministerial Commission for Energy
Afghanistan on Grid Generation / Transmission Profile

Transmission Lines Installed Capacity, Max in MW

- Republic of Uzbekistan: 326 MW
- Islamic Republic of Iran: 164 MW
- Republic of Tajikistan: 433 MW
- Republic of Turkmenistan: 77 MW
- Total: 1,000 MW

Afghanistan Core Generation, Installed Capacity in MW

- Hydro: 254 MW
- Thermal (Fuel Diesel/HFO): 200 MW
- Diesel Generator (Gen.Set): 65 MW
- Total: 519 MW
A demand forecast for 20 year horizon has been prepared based on commonly applied methodology. Inputs are key socio-economic variables, such as GDP growth, as well as standardization of the average tariff level for all category of consumers, as critical deciding factors. Starting with the forecasts for the various provinces, the anticipated total demand forecast for Afghanistan has been estimated. (Afghanistan Power Sector Master Plan)

For the whole of Afghanistan, gross demand, i.e. dispatched electrical energy, will increase in the base case scenario by 5.7% or 8.7% per annum on average from its current level to 18,400 GWh in 2032. Total peak demand in 2032 is expected to stand at around 3500 MW. In addition, high and low scenarios were developed which show a total gross demand of about 22,500 GWh and a peak of 4300 MW in 2032 in the high scenario and around 13,700 GWh gross demand and 2600 MW peak in the low scenario. (Afghanistan Power Sector Master Plan)
<table>
<thead>
<tr>
<th>No</th>
<th>Type</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydro Power</td>
<td>• 23,000MW of Energy&lt;br&gt;• 125 sites been identified for MHP, with potential of over 600MW of electricity</td>
</tr>
<tr>
<td>2</td>
<td>Wind Energy</td>
<td>• 158,500 MW installed capacity i.e. 5MW/km²&lt;br&gt;• 31,600km² windy land area i.e. 5% of Afg. total land area</td>
</tr>
<tr>
<td>3</td>
<td>Solar Energy</td>
<td>• 300 Sunny day in one year, i.e. 3,000 Hours of Sun&lt;br&gt;• 6.5 kWh/m² per day solar radiation average</td>
</tr>
<tr>
<td>4</td>
<td>Bio-Mass</td>
<td>• More than 85% of Afghanistan’s energy needs are met by traditional biomass, mainly wood and dung</td>
</tr>
<tr>
<td>5</td>
<td>Geo-Thermal Energy</td>
<td>• Prospects of low to medium temperature geothermal resources are widespread all over Afghanistan.&lt;br&gt;• Power plants to be built in Afghanistan could range from 5 to 20MW each</td>
</tr>
<tr>
<td>6</td>
<td>Gas and Coal</td>
<td>• 3000 MW*– 4000 MW*&lt;br&gt;• Prefeasibility Studies, Sites Identification of coal power plants&lt;br&gt;• 8 out of 12 gas wells been surveyed</td>
</tr>
</tbody>
</table>
To achieve the goal for providing power supply towards whole Afghanistan, a large investment plan is required for all the sub-areas like, Generation expansion, Transmission Network development and strengthen Distribution System. This will need a total investment of $10,096m, out of which, $7,330m for Generation sector development and network integration, $1,727m for major Transmission Projects and $1,040m for Transmission Network development within the provinces up to the year 2032. (Afghanistan Power Sector Master Plan)

The total investment for stage A is estimated at $1,214m. Stage B will require $1,464m while stage C and stage D will require about $1,409m and $6,010m. The high investment in Stage D is related to the hydropower plants. (Afghanistan Power Sector Master Plan)

<table>
<thead>
<tr>
<th>Overview on Investment type</th>
<th>Subtotal by project</th>
<th>Stage A</th>
<th>Stage B</th>
<th>Stage C</th>
<th>Stage D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation development</td>
<td>$7,329.50</td>
<td>$327.60</td>
<td>$348.50</td>
<td>$981.50</td>
<td>$5,671.90</td>
</tr>
<tr>
<td>Major transmission projects</td>
<td>$1,725.90</td>
<td>$595.00</td>
<td>$676.00</td>
<td>$212.90</td>
<td>$242.00</td>
</tr>
<tr>
<td>Transmission development within the provinces</td>
<td>$1,041.00</td>
<td>$291.10</td>
<td>$439.80</td>
<td>$215.10</td>
<td>$95.00</td>
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<tr>
<td>Total in Million USD</td>
<td>$10,096.40</td>
<td>$1,213.70</td>
<td>$1,464.30</td>
<td>$1,409.50</td>
<td>$6,008.90</td>
</tr>
</tbody>
</table>
Energy Projects in pipeline Status

• CASA 1000: 1000 MW from the Northern neighbors to Pakistan through Afghanistan - 300 MW will be used in the country
• Aynak copper mine: Chinese company (MCC) will exploit the coal mine in North Hindukush and build coal power plant - projected capacity is 400 MW
• Mazaar Gas Plant: 50 MW gas power plant supported by IFC/WB
• TAPI : Turkmenistan, Afghanistan, Pakistan and India Gas pipe line
• TUTAP : Turkmenistan, Uzbekistan, Tajikistan, Afghanistan and Pakistan – Interconnection
• TAP 500: Turkmenistan, Afghanistan and Pakistan 500 KV TL project
Legislation

General Works done and in Progress

### Regulatory + Policy + Strategy
- Electricity Services Law
- Renewable Energy Policy
- Rural Renewable Energy Policy - draft
- REN Strategy
- Energy Efficiency Standards for Buildings
- Wind & Solar Atlas and Investment Plan
- RED ToR and Five Year Action Plan
- REN Industry Study – Under process to be developed
- INDC

### Coordination
- Inter Ministerial Commissioning of Energy
- Renewable Energy Coordination of Energy
- REN Potential Maps
- REN Online Database
- REN Magazine
- REN Union of Private Companies
- Energy Working Groups – 5 Provinces
- Technical REN Working Groups

### Demonstration
- 50 MW REN projects – off grid
- Provincial Electrical Concepts
- REN Workshop and Exhibition or Road shows
- Regional REN workshops and seminars
- REN Park – To be constructed
- Solar and MHP Guidelines
- 100 MW REN Package for private investors
Electricity Regulator

• Historically electricity tariffs were fixed by Government.
• Constrained by political and administrative compulsions, over the years resulted in acute distortion of tariffs on a large scale.
• Thus arose the need for removing this responsibilities from Government and vesting them in independent electricity regulatory body.
• Independent regulatory mechanism for the Power sector is somewhat new to our country but it has been working successfully in many developed countries.
• In Afghanistan, the institution of electricity regulators has been introduced under USAID/GIZ assistance. Thereafter, this became an important item in the reform agenda for the Power sector and was ultimately included in the Afghanistan Electricity Law, 2015.
Renewable Energy Development Roadmap

Regulatory Framework
- Electricity Act
- REN Policy
- REN Strategy
- Tariff Act
- INDC

Institutional Framework
- Constituted Regulatory Body
- Constituted REN directorate in Ministry and Utility
- Established independent FI to finance REN projects

Capacity Development
- Establish REN Institute
- Arranging training at home and abrade
- Arranging seminar, symposium and workshop

Project Development
- Implementing REN Projects
- Identify REN Potentials
- Implementing REN project
- O&M – Sustainability of the projects
A renewable energy industry with private sector participation will require:

- **Assessments**
  - RE Resource
  - Market
  - Feasibility

- **Technology**
  - Research
  - Development
  - Demonstration
  - Standards

- **Commercials**
  - Access to capital
  - Business model innovation
  - Evidence of cost-recovery

- **People**
  - Awareness
  - Training
  - Certifications

Underpinned By:

- Political Will
- Regulatory Environment
- Investment
- Coordination (Govt / Devpt Partners / Private Sector)
## Renewable Energy Proposed 100 MW Projects

<table>
<thead>
<tr>
<th>No</th>
<th>Project Name</th>
<th>Province</th>
<th>Type of Energy</th>
<th>Capacity (kW)</th>
<th>Power Plant Est. Cost (Million USD)</th>
<th>No. of People Supplied</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Kandahar Solar - DG Hybrid Project</td>
<td>Kandahar</td>
<td>Solar</td>
<td>30000</td>
<td></td>
<td>90</td>
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<td>2</td>
<td>Kabul Solar - Hydro Hybrid Project</td>
<td>Kabul</td>
<td>Solar</td>
<td>10000</td>
<td></td>
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<td>3</td>
<td>Roof Top Solar Project</td>
<td>Kabul</td>
<td>Solar</td>
<td>5000</td>
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<td>15</td>
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<td>4</td>
<td>Kabul Waste to Energy Project</td>
<td>Kabul</td>
<td>Biomass</td>
<td>6000</td>
<td></td>
<td>23</td>
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<tr>
<td>5</td>
<td>Kabul Waste Water Treatment Project</td>
<td>Kabul</td>
<td>Biomass</td>
<td>1000</td>
<td></td>
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<td>6</td>
<td>Bini Hisar Biogas Digester Project</td>
<td>Kabul</td>
<td>Biomass</td>
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<td></td>
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<td>7</td>
<td>Pul Charkhi Biogas Project</td>
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<td>0.5</td>
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<td>8</td>
<td>Ghor Solar Project + Backup + Distribution Network</td>
<td>Ghor</td>
<td>Solar</td>
<td>5000</td>
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<td>Helmand Solar Project</td>
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<td>Herat Wind project</td>
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<td>11</td>
<td>Spogmee MHP Project</td>
<td>Badakhshan</td>
<td>MHP</td>
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<td>12</td>
<td>Kuran Wa Munjan MHP Project</td>
<td>Badakhshan</td>
<td>MHP</td>
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<td>13</td>
<td>Yangi Qala MHP Project</td>
<td>Takhar</td>
<td>MHP</td>
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<td>Farkhar MHP Project</td>
<td>Takhar</td>
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<td>Namak Ab MHP Project</td>
<td>Takhar</td>
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<td>Mazar Waste to Energy Project</td>
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<td>Biomass</td>
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<td>Zari MHP Project</td>
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<td>19</td>
<td>Kishindeh MHP Project</td>
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<td>MHP</td>
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<td>Urozgan Solar Project</td>
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<td>Solar</td>
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<td>21</td>
<td>Noristan Solar Project + Distribution Network</td>
<td>Noristan</td>
<td>Solar+MHP</td>
<td>1000</td>
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<td>22</td>
<td>Daikundi Solar Project</td>
<td>Daikundi</td>
<td>Solar</td>
<td>1000</td>
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<td>23</td>
<td>Badghis Solar Project</td>
<td>Badghis</td>
<td>Solar</td>
<td>1000</td>
<td></td>
<td>3</td>
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<td>24</td>
<td>Zabul Solar Project</td>
<td>Zabul</td>
<td>Solar</td>
<td>1000</td>
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</tr>
<tr>
<td>25</td>
<td>Paktia Solar Project</td>
<td>Paktia</td>
<td>Solar</td>
<td>1000</td>
<td></td>
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<td>26</td>
<td>Logar Solar Project</td>
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<tr>
<td>27</td>
<td>Khost Solar Project</td>
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<td>28</td>
<td>Ghazni Solar Project</td>
<td>Ghazni</td>
<td>Solar</td>
<td>1000</td>
<td></td>
<td>3</td>
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<tr>
<td>29</td>
<td>Paktika Solar Project + Distribution Network</td>
<td>Paktika</td>
<td>Solar</td>
<td>1000</td>
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<tr>
<td>30</td>
<td>Farah Solar Project</td>
<td>Farah</td>
<td>Solar</td>
<td>1000</td>
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</table>

**Total**: 1000000 (Million USD)
What we Offer for Investors

- Long Term Land Lease – Energy Farms
- 25% Subsidy
- Tax Incentives
- Security Assistance
- Long term PPA
- Right to Buy
- Attractive Tariff
Renewable Energy Maps

Afghanistan Solar Resource Potential Map

Afghanistan Direct Normal Solar Radiation Annual

Afghanistan solar resource per province

Afghanistan Solar Irradiance (Watt-Hours/m²)

Supported by Afghanistan Renewable Energy for Rural Areas (ERERA)
Renewable Energy Maps

Afghanistan Wind Resource Potential Map

Afghanistan's first ever power-generating wind farm was built in Farah in April 2006. It consists of 16 turbines, each with a rated capacity of 250 kW. The wind farm generates enough electricity to power the provincial government complex.

Afghanistan Wind Power Potential

Afghanistan Wind Resource per Province

This informational map is provided by the Renewable Energy Department of the Ministry of Energy and Water. The dataset and charts provide information on wind energy potential and installed generation capacity in Afghanistan.

Annual Max. and Min. Wind Speeds

Supported by Afghanistan Renewable Energy for Rural Areas (ARES) and the Renewable Energy Department (RED) of the Ministry of Energy and Water.
## Development of RE Sector

<table>
<thead>
<tr>
<th>No</th>
<th>What</th>
<th>How</th>
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<tbody>
<tr>
<td>1</td>
<td>Resource Assessments</td>
<td>• Site-specific resource assessments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Evaluation of grid-connectivity options</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Grid-tied / mini-grid / stand-alone balance assessment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Market (+tariff) assessments</td>
</tr>
<tr>
<td>2</td>
<td>Technology Development and Demonstration</td>
<td>• Pilot/demonstration programs (stand-alone / mini-grid / grid-tied)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Standards development</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• International technology transfer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• REN Parks</td>
</tr>
<tr>
<td>3</td>
<td>Commercials</td>
<td>• Business model innovation + demonstration</td>
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<tr>
<td></td>
<td></td>
<td>• Demonstrate cost-recovery by private sector</td>
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<tr>
<td></td>
<td></td>
<td>• Financial risk mitigation for PPPs</td>
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<tr>
<td></td>
<td></td>
<td>• Mechanisms to access capital</td>
</tr>
<tr>
<td>4</td>
<td>People</td>
<td>• Awareness programs</td>
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<tr>
<td></td>
<td></td>
<td>• Developing Curricula / certifications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Advertisements</td>
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## What Needs to be Done

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<th>No</th>
<th>What</th>
<th>How</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Political Will</td>
<td>• Awareness of RE benefits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coordination with government at different levels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Demonstration of benefit to constituents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Demonstration of economic benefit</td>
</tr>
<tr>
<td>6</td>
<td>Regulatory Environment</td>
<td>• Develop legal basis for private sector</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Transparent guidelines</td>
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<tr>
<td></td>
<td></td>
<td>• Technical standards</td>
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<tr>
<td></td>
<td></td>
<td>• Oversight/monitoring (especially O&amp;M)</td>
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<tr>
<td>7</td>
<td>Coordination</td>
<td>• ICE / RECC</td>
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<td>• IRENA</td>
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Thank You