DEVELOPMENT OF THE RENEWABLE ENERGY TO INCREASE ENERGY INDEPENDENCE AND RELIABILITY

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Government Objectives in the Energy Sector

1. Development of domestic renewable energy:
   - New HPPs at Meghri, Loriberd and Shnokh
   - New SHPPs
   - New WPPs
   - Investigate geothermal potential

2. Increased efficiency of existing resources:
   - New CCGTs at Yerevan TPP and Hrazdan TPP
   - Modernization of T&D networks
   - Rehabilitate Vorotan cascade
   - Investments in EE measures

3. Safe operation of ANPP & construction of a new NPP:
   - Complete ANPP safety enhancement and maintain safe operation
   - ANPP decommissioning plan
   - Feasibility study, design works and commissioning of new ANPP unit

4. Diversification of energy supply:
   - Diversify gas supply
   - Strengthen regional electricity transmission interconnections
   - Modernize and expand gas storage
Institutional Framework of the Power Sector

- Medzamor NPP
- Thermal Plants
- Hydro Plants
- High Voltage Grid
- Electricity Network of Armenia (ENA)
- Export/Import
- Customers

Flow of power/services
Flow of funds

Dispatching
Commercial Metering
Generation
Transmission
Distribution
End-Users

National Dispatch Center
Settlement Center

Regulation
Public Services Regulatory Commission (PSRC)

*Regulates Tariffs, Service Quality and Licensing

Customers
Public
Services
Regulatory
Commission
(PSRC)
Historical Energy Balance

Electricity Production by Generation Technology (GWh), 2012

- RE <10 MW, 513, 6%
- Hydro, 1,813, 23%
- Thermal, 3,399, 42%
- Nuclear, 2,311, 29%

Natural Gas Import Price and Domestic End-User Tariff, 2005-2013

- Import Price of Natural Gas
- End-user Natural Gas Tariff
Supply-Demand Gap

At least 170 MW of new capacity will be needed by 2018 to meet peak demand and maintain an adequate reserve margin. An additional 830 MW of new capacity will be needed starting from 2026 when the existing NPP is retired.

Forecast Gap between Installed Capacity and Winter Peak Demand

Source: World Bank and MENR Projections

Source: Public Services Regulatory Commission
## RE Resource Potential in Armenia

<table>
<thead>
<tr>
<th>Technology</th>
<th>Capacity (MW)</th>
<th>Generation (GWh/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>300</td>
<td>650</td>
</tr>
<tr>
<td>Utility scale solar PV</td>
<td>830 – 1,200(^a)</td>
<td>1,700 – 2,100(^a)</td>
</tr>
<tr>
<td>Concentrating solar power (CSP)</td>
<td>1,200</td>
<td>2,400</td>
</tr>
<tr>
<td>Distributed solar PV</td>
<td>1,300</td>
<td>1,800</td>
</tr>
<tr>
<td>Geothermal power(^b)</td>
<td>at least 150</td>
<td>at least 1,100</td>
</tr>
<tr>
<td>Landfill gas</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Small hydropower</td>
<td>100</td>
<td>340</td>
</tr>
<tr>
<td>Biogas</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>Biomass</td>
<td>30</td>
<td>230</td>
</tr>
<tr>
<td><strong>Total (electricity)</strong>(^c)</td>
<td><strong>3,800 – 4,300</strong></td>
<td><strong>7,400 – 8,700</strong></td>
</tr>
<tr>
<td>Solar thermal hot water</td>
<td>n/a</td>
<td>260</td>
</tr>
<tr>
<td>Geothermal heat pumps</td>
<td>n/a</td>
<td>4,430</td>
</tr>
<tr>
<td><strong>Total (heat)</strong></td>
<td></td>
<td><strong>4,690</strong></td>
</tr>
</tbody>
</table>

\(^a\) Resource potential depends on which solar PV technology is deployed.  
\(^b\) Assumes flash technology is used.  
\(^c\) Solar PV and CSP were evaluated as options for development in the same areas.
SREP Program

- Better security of supply and reliability
- The creation of a utility-scale solar sector and geothermal power sector attractive to private investors.
- Develop the first utility-scale solar PV projects, which through gradual tariff increases will eventually become commercially viable without SREP/MDB support.
- Contribution to reduction of impending supply gap to meet forecast demand
- Improvement to the enabling environment for RE technologies.
- Help customers realize the benefits of switching from electricity and natural gas to geothermal heat pumps and solar thermal heating technologies for heating and cooling.
- Creation of jobs related to the construction/installation, operation & maintenance of RE technologies
- Promotion of local R&D in a technology which has traditionally been a focus of researchers and academicians in Armenia
- Reduced greenhouse gas emissions as compared to the business-as-usual scenario, under which Armenia will likely continue to expand the use of natural gas
Priority Activities:
Geothermal Power Exploration and Development

The geothermal power project would include the following activities:

- **Exploratory Drilling at Karkar Geothermal Site** to determine whether or not power could be produced from the resource.

- **Feasibility Study for Karkar site**

- **Transaction Advisory Services**
  - Advisory services will be needed to help structure the PPP (BOT or BOO)

- **Development of Geothermal Power Plant**
  - It is expected that the private sector will make the capital investment required for generation of electricity (the power plant itself).
  - This investment plan assumes a plant with installed capacity of 28.5 MW, based on the average size of geothermal plants elsewhere. The actual size of the plant will depend on the resource potential identified in earlier activities.
Priority Activities:
Utility-Scale Solar PV Project Development

- Project preparation, feasibility studies, site measurement and monitoring
- Transaction advisory
- Investment in 40-50 MW projects
Priority Activities:
Development of Geothermal Heat Pump and Solar Thermal

- Integration into EBRD’s Caucasus Energy Efficiency Programme (CEEP)
- Can include geothermal heat pumps or solar thermal
- Programme also includes grant funding for help with energy audits, review investment proposals, support companies in securing funding from PBs and implementation support.
- US $3 million of SREP funds will help to increase the size of CEEP
THANK YOU

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