A CASE FOR ENERGY STORAGE IN KENYA
ROLE OF KPLC

- Purchasing bulk electricity supply (Single Buyer)
- Building and maintaining a robust power network
- System Operator, Dispatch function & Retailer of Electricity
- Customer Service
Key stakeholder in:
• Demand forecasting
• Generation planning
• Transmission planning
• Transmission planning

Procuring generation capacity:
• Negotiate PPAs
• Facilitate project development
• Facilitate operation of IPPs
Geothermal currently provides about 47% of energy requirements.

Over 75% of country’s energy is supplied from renewable energy sources.

The installed capacity and generation mix contribution from wind and solar expected to grow from ongoing and planned projects.

### Generation Capacity

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Installed MW</th>
<th>Effective MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro</td>
<td>826.23</td>
<td>805.02</td>
</tr>
<tr>
<td>Geothermal</td>
<td>652.00</td>
<td>644.00</td>
</tr>
<tr>
<td>Thermal (MSD)</td>
<td>746.93</td>
<td>710.81</td>
</tr>
<tr>
<td>Thermal (GT)</td>
<td>60.00</td>
<td>55.00</td>
</tr>
<tr>
<td>Wind</td>
<td>26.05</td>
<td>25.51</td>
</tr>
<tr>
<td>Biomass</td>
<td>28.00</td>
<td>23.50</td>
</tr>
<tr>
<td>Solar</td>
<td>0.69</td>
<td>0.62</td>
</tr>
<tr>
<td>Imports</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Total Capacity</strong></td>
<td><strong>2,340</strong></td>
<td><strong>2,264</strong></td>
</tr>
</tbody>
</table>

### Projected Installed Capacity Mix 2023

- Hydro: 16%
- Geothermal: 3%
- Wind: 8%
- Biomass: 19%
- Solar: 10%
- Thermal: 11%
- Imports: 3%

### Generation mix - April 2018

- Hydro: 35.41%
- Geothermal: 47.80%
- Diesel: 15.49%
- Biomass: 0.93%
- Wind: 0.36%
- Solar: 0.01%
- Imports: 0.00%
• Current Peak demand is 1,770MW recorded on 17th January, 2018

• Projected demand growth rate of between 6% and 10%

• Peak demand falls between 6.00pm and 10.00pm

• Off-peak period is between 12.00am to 05.00 am
ISSUES TO CONSIDER IN THE STUDY

- Situation analysis - circumstances
- Sizing of storage
- Cost of storage and benefits compared to other options
- Comparison with other technologies – GTs, pumped storage
- Location of storage in the network
- Functionality – primary or secondary reserves?
- Best practices
• Integration of intermittent renewable energy and characteristics- solar, wind

• LTWP requirements – single largest wind power plant

**Base load capacity**
- Low or no variable cost
- High capital/ fixed cost
- Geothermal, coal, hydro, non-conventional renewable energy plant - solar, wind, biogas etc.

**Regulation/ load following capacity**
- Flexible generation plant – storage capability
- Fast ramping capability
- Low capital cost – lower utilization requirements
- Hydro, Gas turbines

**Operating reserve capacity**
- Primary reserve
- Secondary reserve
- Tertiary reserve

**Peaking capacity**
- Fast start-up and shut down
- Low capital cost
- High variable cost
- Thermal (MSD), Gas turbines
• **Power system stability**
  - Frequency stability
  - Load / generation imbalance
  - Frequency variation

• **Transient stability**
  - Reduced system inertia (displacement of conventional plant)
  - RE plants affected by system disturbances (disconnect during faults and voltage dips)
  - Increased possibility of cascade of outages & loss of synchronism during system disturbances
EN ENERGY STORAGE PROJECT
GOALS

Provide Spinning Reserve to the system

Supply Power during Peak Load

To mitigate curtailment of RES production curtailments when production is high.

Reduce Transmission System Congestion where there are constraints

Stabilization of energy injection profiles i.e. wind gusts, for output stabilization.
SUCCESS INDICATORS FOR ENERGY STORAGE

- A more stable system which survives large disturbances (loss of generators and loads)
- Reduced load shedding – have sufficient capacity at peak
- Reduced fuel consumption - running less thermal power plants during peak
- Reduced load shedding – less transmission system constraints
- Reduced system losses
Thank you