Reflecting Supportive Mechanisms and Experience of Turkey

Zorlu Energy Case Study

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Topics

- Turkish Geothermal Growth
- Support Mechanisms
- Capacity Building & Lessons Learned
- Future Work
Turkish Geothermal Growth
From Past to Present in Turkey

• From humble 15 MW in 2008 to more than 1 GW today
• 500+ MW in development
• 1.3% of nation’s generation (2015 IEA)
• 60% fossil fuels
Kenyan Geothermal Growth

Installed Capacity (MW)

Capacity Additions (MW)

Data from IRENA
Support Mechanisms
Four Pillars of Support

Resource Data

Institutions

Supportive Policies

Access to Financing

Resource:
Energy Sector Management Assistance Program (ESMAP) Geothermal Handbook
Resource Data & Exploration

Resource Data

Institutions

Supportive Policies

Access to Financing

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Turkish Institutions

- Resource Data
- Institutions
- Supportive Policies
- Access to Financing
## Supportive Policies

### Resource Data

<table>
<thead>
<tr>
<th>Type of Energy Source</th>
<th>Price (USDcent/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro</td>
<td>7.3</td>
</tr>
<tr>
<td>Wind Farm</td>
<td>7.3</td>
</tr>
<tr>
<td>Geothermal</td>
<td>10.5</td>
</tr>
<tr>
<td>Biomass</td>
<td>13.3</td>
</tr>
<tr>
<td>Solar</td>
<td>13.3</td>
</tr>
</tbody>
</table>

### Institutions

- Turbine: 1.3
- Generator/Power Electronics: 0.7
- Steam Ejector/Vacuum Pump: 0.7

## Access to Financing
Supportive Policies

Resource Data

Institutions

Supportive Policies

Access to Financing
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Access to Financing
Capacity Building & Lessons Learned
Kızıldere-1 Power Plant

- 17.4 MW flash
- Operating since 1984

Lessons Learned:
- Scale prevention tactics
- Life extension
- “Training Ground” for operations staff
Kızıldere-II Power Plant

- 80 MW triple-flash combined cycle
- Commissioned 2013
- Additional resource studies

Lessons Learned:
- Cycle evaluations
- “Training Ground” for development and construction staff
 Alaşehir-1 Power Plant

- 45 MW double-flash combined cycle
- Commissioned 2015

Lessons Learned:
- “Proving Ground” for Development, Construction, and Operations staff
Kızıldere-3 Units 1 and 2

- 165 MW combined cycles
- Commissioned 2017-2018

Lessons Learned:
- Swift execution
- “PhD” of development
Human Capacity Growth

<table>
<thead>
<tr>
<th>PLANTS OPERATING</th>
<th>PROJECT END</th>
<th>DEVELOPMENT GROUP</th>
<th>CONSTRUCTION GROUP</th>
<th>OPERATIONS GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kızıldere-1</td>
<td>2008</td>
<td>5</td>
<td>N/A</td>
<td>14</td>
</tr>
<tr>
<td>Kızıldere-II</td>
<td>2013</td>
<td>16</td>
<td>45</td>
<td>42</td>
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<tr>
<td>Alaşehir</td>
<td>2015</td>
<td>21</td>
<td>62</td>
<td>46</td>
</tr>
<tr>
<td>Kızıldere-3U1</td>
<td>2017</td>
<td>38</td>
<td>64</td>
<td>82</td>
</tr>
<tr>
<td>Kızıldere-3U2</td>
<td>2018</td>
<td>40</td>
<td>67</td>
<td>84</td>
</tr>
</tbody>
</table>
Next Steps
What’s Next?

• Continue development

• Embrace R&D, new technologies

• Industry lobbying & policymaking

• Share expertise overseas
Thank you