What is EAGER?

• **Funded by DFID**

• Regional Technical Assistance programme running for 3.5 years from May 2015

• GBP 6 million and covering 5 countries (Ethiopia, Kenya, Rwanda, Tanzania, Uganda)

• Seeks to cover gaps in Government role to support geothermal development by removing barriers and speeding progress
  
  ○ No duplication with other donors
Key Attributes of EAGER

• **Flexibility**
  - Looking at current issues not covered by others
  - Quick response, where possible

• **Large Pool of Expertise**
  - Able to draw on a wide range of expertise:
    - Geothermal technical; legal; regulatory; finance; business strategy; electricity markets and power planning; tariffs and PPAs
  - Focus on decision support and removing barriers to progress
  - Reports on international experience
People

• **DFID:** Gareth Martin (UK)

• **Programme Management:** Adam Smith International

• **Team Leader:** John Heath (UK)

• **Programme Managers:**
  - Laura Rizzotto (UK)
  - Matt Blythe (Nairobi)
1. Role of Geothermal in Electricity Markets:
   - Market Risks for Geothermal
   - Power Purchase Agreements and Negotiation

2. Geothermal Development – Business Models

3. Regulatory Mandates and Frameworks
To date the general assumption has been that there will always be demand for any additional power generation in East Africa.

But this is changing....

Over the period of a geothermal development starting today a number of countries may move to having a surplus in generation at some times or in some years.

There will be competition for baseload generation.

Large scale intermittent renewables change the marketplace.
Typical Daily Load Profile

Peaking

Load Following

Baseload
Competition for Baseload

- Geothermal
- Combined Cycle Gas Turbine
- Coal fired generation
- Intermittent renewables – seasonal or daily
  - Run of river hydro, wind
- Intermittent renewables displacing other baseload in the day because of “must run” priority:
  - Run of river hydro, wind, solar
- Exporters of baseload
What Will Happen as the Baseload Market Gets Crowded?

1. Economic despatch rules should apply, but:
   - May be overridden by PPA terms
   - Government policy decisions may allocate losses

2. “Take or pay” and “must run” IPPs will be paid to switch off:
   - Power purchase costs will exceed PPA prices
   - Who will carry the stranded costs?
This Raises Significant Questions for Geothermal Development Projects, Whether Public or Private Sector…

- Where will geothermal sit in economic despatch rules, compared with run-of-river hydro, wind, even solar?
- How will Government policy makers respond?
- Will competition for baseload squeeze prices down?
- How can geothermal developers influence the market?
- What will the market look like by the time a geothermal project reaches commissioning? Will demand rise to meet supply?
- Could this impact on off-taker viability?
- What sort of PPA will be best in the future?
Can Geothermal Operate as Load Following rather than Baseload?

- Longer term the load following market should become more valuable
- Flexible generation has to compensate for intermittent renewables
- Demand will always have uncertainty
Will Regional Markets Provide an Answer?

- Most countries seem to expect to sell rather than buy in the regional markets.
- Most seem to want to sell baseload apart from day ahead balancing trades.
- Buyers are more likely longer term to want peaking and load following power.
- The daily peak does vary in time across the region, but enough to cover baseload operation?
Geothermal Position – is this reflected in market prices?

- Despatchable
- Reliable
- Low operating costs
  - Competitive once capital recovered
- Insurance against drought risk
- Exploration cost and risk to cover
- High capex to cover

- Local community benefits
- Direct use options
- No energy price volatility
- Can offer ancillary services
- No emissions

- PPA structure may lead to non-despatch
  - e.g. steam supply treated as an avoidable energy charge
Power Purchase Risks and Negotiation

• Buyers will become more precise as to their needs:
  o Overall cost and risk will become more important than lowest price

• Flexibility will have a premium, and therefore the load following market will become attractive but also more competitive

• Ancillary services will have a clear value

• The optimal allocation of risks between buyers and sellers will change, but how?

• EAGER has prepared “Guidance for a Geothermal Specific PPA” which starts to cover some of these points (available upon request)
Geothermal Development – Business Models

• East Africa is seeing a continuing debate on geothermal development business models:
  o To go public sector or private sector?
  o At which stage in the development process?

• Why are different models chosen in different countries, at different times, and even for different fields?
Different Models at 5 Stages of the Process

Costs are indicative and cumulative for a 50MW plant
Which Models Have Been Used Historically?
World’s Largest Geothermal Fields (MW), 2016

Average Field = 100 MW
# Factors Impacting on Choice of Model

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited country resource</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Limited public funding</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited private capital</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Limited private appetite for risk</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Affordability</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Speed to production</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Limited public sector capability</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficult or restricted geography</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Country culture</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Implications

• There is no one right answer to the choice of model, and more than one model can apply in the same country

• Even the fully private sector models require Government involvement: enabling environment, regulation, control and monitoring

• The financial analysis is critical for the decision (note differences between volcanic and fault controlled fields):
  o Realistic and detailed
  o Scenarios to understand risks
Regulatory Mandates and Frameworks

• Starts from the questions:
  o Why regulate?
  o What are the issues of public interest that call for regulation?
  o How should the law and regulation interface?
  o Who should regulate?

• EAGER has reviewed international practice and produced a report
Public Interest Issues in Geothermal Development

- Resource Value
- Access to Electricity
- Affordability of Electricity
- Resource Exploitation (Construction and Operation)
- Environmental Protection
- Use of Land for Exploration and Access
- Labour
- Concession/Licensee Performance
- Community and Social Protection
Typically the Geothermal Developer Has to Deal with Each Agency Separately

And each agency will have its own interfaces with other agencies.
Single Point Regulator: Skills and Interface Issues

Ministry of Natural Resources
Geothermal Agency
Ministry of Energy etc.
Ministry of Justice
Environment Ministry/Agency
Water Rights Agency
Land Rights Agency
Ministry of Labour
Local Communities

Developers
Public Sector
JVs
Private Sector

EAGER
East Africa Geothermal Energy Facility
Key Points

• Is there a conflict of interest where the geothermal developer is also custodian of the resource and may award concessions?

• How can scarce skills and experience be best utilised?

• Single-point or multi-point regulation?

• What is the best balance between detailed laws or regulation and flexibility to encourage innovation?
Can EAGER Help You?

• We can do many things in geothermal...
• But only want to help with what Government and their agencies need...
• And what others are not doing...
• And what helps progress geothermal development
• Just contact us to discuss!!