Financing Geothermal projects in Europe

Philippe DUMAS
Secretary General EGEC
WHAT ARE THE CURRENT FINANCING CHALLENGES?

1) Economical and Financial situation in Europe: what about investment in clean energy?

2) Why public funds should be used to support geothermal industry?

3) What are?
   - Geothermal technologies and costs in Europe
   - Financial barriers and needs
   - Innovative financial incentives
Financial crisis in the EU means...

- Renewable energy investment

- Financing geothermal has become more difficult both for capital investment and risk insurance
Financial crisis in the EU means…

European stock markets still uncertain
Banks look for zero risk, ECB intervention (by lending €530bn to 800 banks).

- Need non traditional investors:
  - Pension funds
  - Insurance companies
  - Sovereign funds

- Need innovative tools:
  - pool of developers, etc.

> Public Financing to Leverage Private Capital
> For helping market development
Why public funds should be used to support the geothermal industry and interfere with the market?

1) to compensate for market failures and unfair competition

2) to favour the deployment of a given technology

- support schemes should be phased out when technology reaches full competitiveness...
- in an open internal market where a level playing field is fully established!
Compensate for market failures and unfair competition

Regulated price and social tariffs distort the market (especially for gas in CEEs)

Price regulation fails to activate consumers and suppliers

Member States currently phasing out price regulations:
By 2013: Greece, Portugal & Lithuania
By 2017: Romania
Compensate for market failures and unfair competition

- EU ETS Sector (e.g. Power and Industry > 20 MW)
  - Problems: free allocation of permits; economic downturn
  - Result: price collapsed, system is failing (despite the adjustments, back-loading, etc.)

- Non-ETS sectors (e.g. Buildings and heating installations < 20 MW) - no carbon pricing (tax) in most EU countries

Consequences: No incentive in investing in long-term low-carbon technologies!
Geothermal technologies and costs in Europe

LCoE of Geothermal electricity

- R&D, Innovation
- Deployment
- Implement Research Agenda
Geothermal technologies and costs in Europe

LC of Geothermal heat
Drilling costs reduction

Project Expansion Unterföhring

Lessons learnt

Weitere Info in: BBR: Sonderheft Geothermie 2015
Geothermal technologies and costs in Europe

Source: Subsidies and costs of EU energy: Final report, p. X (Roman numeral)
Financial barriers & needs

• Project financing
• Risk Insurance
• Research & Development & Deployment
• Public financial incentive schemes
Project financing

Example: € million, based on a 20 MWe conventional high temperature plant

- Year 1: Site scouting and geophysical exploration
- Year 2: Exploratory drilling
- Year 3: Drilling
- Year 4: Field development
- Year 5: Power plant construction
- Year 6: Project financing

<table>
<thead>
<tr>
<th>Year</th>
<th>Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Seed capital (Venture capital) (+ R&amp;D)</td>
</tr>
<tr>
<td>2</td>
<td>Private equity</td>
</tr>
<tr>
<td>3</td>
<td>Mezzanine debt</td>
</tr>
<tr>
<td>4</td>
<td>Bridge debt</td>
</tr>
<tr>
<td>5-6</td>
<td>Construction</td>
</tr>
<tr>
<td>7</td>
<td>Project financing</td>
</tr>
</tbody>
</table>

Total expenses:
- Year 1: 1-2
- Year 2: 20-30
- Year 3: 30
- Year 4: 50-60
- Year 5-8: 30-60, 80-120

- Public funding: Grants, Risk insurance
- Private funding: Private equity, Mezzanine debt, Bridge debt, Construction
Cover the geological risk: Towards an European Geothermal Risk Insurance Fund (EGRIF)

- upfront costs for exploration: 1-2
- exposure to risk of failure: 20-30
- drilling: 30
- field development: 50-60
- power plant construction: 30-60, 80-120

Example: € million, based on a 20 MWe conventional high temperature plant.
Example: € million, based on a 5 MWe EGS plant

- upfront costs for exploration
- exposure to risk of failure

Cover the geological risk, reduce costs, deploy
Breakdown of the total EU Member State RD&D expenditure on energy supply side technologies (€2012 87 billion) in 1974-2007.

Source: Subsidies and costs of EU energy: Final report, p. 29.
Operational support to geothermal electricity

Feed-in tariff systems (€ct/kWh)

Feed-in premium systems (€ct/kWh)

Quota system:
- Romania (~ €ct 5.4/kWh + electricity price) and
- Belgium (min. €ct 9.5/kWh)
Operational support to geothermal electricity

NEW STATE AID GUIDELINES

Feed-in tariff systems (€ct/kWh)

- Feed-in tariff
  - Max. (€ct/kWh)
  - Min. (€ct/kWh)

- Feed-in premium systems (€ct/kWh)
  - Max.
  - Min.

+ electricity price

Quota system:
- Romania (~ €ct 5.4/kWh + electricity price)
- Belgium (min. €ct 9.5/kWh)
Geothermal technologies and costs in Europe

Support scheme levels shouldn’t be based only on LCoE:

\[ \text{LCoE} = \text{Investment costs} + \text{O&M} + \text{Commercial costs} \]

But

\[ \text{Full Production cost} = \text{LCoE} + \text{Systems costs} + \text{Externalities} \]

= Costs for the society!
Geothermal technologies and costs in Europe

Figure 4-2: Total interventions, external costs and costs of energy split by technology 2012 (in million €2012)

Note: In this figure, total interventions exclude those not allocated to technologies i.e., infrastructure, energy demand, energy saving and free allocation of EU ETS allowances. Direct historic support is shown as ranges at the top of the interventions bar (marked by a gap in the bar). External costs have a higher level of uncertainty than the other components.

Source: Subsidies and costs of EU energy: Final report, p. 52.
Recommendations for financing mechanisms for geothermal

• Towards an European Geothermal Risk Insurance Fund (EGRIF)

• Well designed support schemes

• Innovative support schemes for Deep Geothermal
Recommendations over support schemes

- Adapted to the technology profile and maturity of the RES; geothermal projects are very capital intensive, takes 5-7 years etc.

- **A balanced approach** among RES technologies;

- **Predictable in the long term to encourage investments** (No stop & go policy – see Moratorium in Spain);

- The base-load and flexibility characters of Geothermal power and its contribute to grid stability should be rewarded;

- Regional and local benefits should be taken into account;
# Innovative support schemes for Deep Geothermal

## Market Maturity

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Juvenile</th>
<th>Intermediate</th>
<th>Mature</th>
<th>Competitive: at the Horizon 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 deep geothermal wells are existing</td>
<td></td>
<td>6-60 deep geothermal wells exist</td>
<td>Both geoelec &amp; geoDH systems are developed all over the country</td>
<td>Costs reach grid parity with around 10 €ct/kWh</td>
</tr>
<tr>
<td>&lt; than 3 plants are operational</td>
<td></td>
<td>&lt; than 10 plants are operational</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Level of risk

<table>
<thead>
<tr>
<th>Costs: High temperature</th>
<th>Very high</th>
<th>high</th>
<th>medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EGS</td>
<td>na</td>
<td>7</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>16</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>12</td>
</tr>
</tbody>
</table>

## Support schemes

<table>
<thead>
<tr>
<th></th>
<th>Repayable</th>
<th>Feed-in Tariff</th>
<th>Feed-in Premium</th>
<th>Grid premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Risk insurance</td>
<td>(repayable) Grants for seismic exploration, slimholes, and the 1st well</td>
<td>Feed-in Tariff</td>
<td>Feed-in Premium</td>
<td>Grid premium</td>
</tr>
</tbody>
</table>

## Flanking measures

<table>
<thead>
<tr>
<th></th>
<th>Public Risk insurance</th>
<th>Public or Private Risk insurance</th>
<th>Public &amp; private Risk insurance</th>
<th>Private Risk insurance</th>
</tr>
</thead>
</table>
CONCLUSIONS

- Demand for comfort, energy / electricity will increase in Europe
- Costs of fossil fuel energy will rise
- Ensuring Access to Affordable Energy for All
- Climate dimension

> Geothermal electricity will be key
...and needs more support now!
Join us for the next edition of Europe’s largest geothermal event, where the industry, academic and public sectors meet.

19-24 September 2016

Strasbourg, France

The European Geothermal Congress