POWERING AGRI-FOOD VALUE CHAINS WITH GEOTHERMAL HEAT

ENABLING FRAMEWORK CONDITIONS TO FOSTER INVESTMENT

CAPACITY BUILDING EVENT – GLOBAL WEBINAR

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The integration of geothermal energy within the agri-food sector requires supportive government policies and regulations to support a nascent industry.

Critical to attract developers and encourage private sector participation.

**Policy**
- Ministry of Agriculture
- Ministry of Industry/Trade
- Ministry of Rural Development
- Prioritize agri-food sector of the economy
- Remove market barriers through supportive fiscal/tax policies, subsidies and risk mitigation support

**Examples:**
- France
- Indonesia
- Netherlands

**Regulation**
- Concessions for exploration and development
- Simplified procedures to obtain licenses and permits
- Regulations governing surface rights
- Framework for socio-economic considerations

**Examples:**
- Ethiopia
- France
- Hungary
- Chile
Conduct studies to collect and analyse relevant information (resource parameters) to identify and prioritise project development and inform decision-making.

Set objectives/targets for the direct use geothermal heating sector.

Propose relevant technology solutions to achieve targets.

Align policies and regulations across different sectors of the economy (energy, agriculture, industry etc.).

Identify all stakeholders, secure their participation and build their capacity.

Provide incentives to foster industry/private sector participation.

Establish budgets, timelines and milestones to achieve sector targets.

Allocate appropriate human and financial resources to achieve targets (i.e., through fundraising, providing technical assistance etc.).
## Financing Options

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<th>Financing mechanism</th>
<th>Description</th>
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| **Pure grants**     | ✓ Funding for risky activities such as initial exploration and initial drilling  
                      ✓ Grantors are typically governments or international development organisations  
                      ✓ No strings attached if the work is performed as contemplated |
| **Contingent grants** | ✓ Typically provided during the exploration and initial drilling stage  
                                 • If drilling is unsuccessful, the grantee has no monetary obligations  
                                 • If the operation is successful, the grant converts into a loan that the grantee will repay over time  
                                 ✓ Can be recycled to provide support for more projects |
| **Risk mitigation** | ✓ Drilling phase:  
                                 • Insurance: The insured pays a one-time premium prior to the start of drilling  
                                 • Grants: Under this mechanism, the qualified applicants can obtain a grant covering the costs of the initial drilling and other related expenses |
| **Concessional loan** | ✓ Loan at below-market conditions: lower interest rate, longer maturity and no or very light securities and collaterals  
                                 ✓ Available at later stages of project development  
                                 ✓ Repaid from the profits of the operation |
| **Project financing** | ✓ Multilateral or regional development banks typically offer project debt (e.g., AfDB, IDB, World Bank/IFC, etc.)  
                                 ✓ Equity is usually provided by investors focused on emerging markets  
                                 ✓ Project financing allows the project assets to be the only collateral → time consuming and expensive |
Direct Use Project Ownership and Business Models

Project ownership models:

(i) Stand-alone direct use systems
(ii) Cascaded direct use systems
(iii) Integrated geothermal direct use and electricity generation systems

Business models:

✓ Ownership models impact the financing schemes → ownership of entire operation, partnership, heat purchase agreement (HPA)
✓ Powering agri-food value chains with geothermal heat → parallel approach – geothermal resource and processing plant
✓ Unique case: Existing power generation facility
✓ The challenge is the processing plant – design affected by technology, market, and supply chain considerations
Geothermal Heat Tariffs

Two approaches

- Cost-based approach
- Market-based approach

Capex elements for different direct use set-up options

Stand-alone and cascaded systems
- Geology, Geophysics, Geochemistry, and reservoir engineering
- Drilling and testing exploration wells
- Permits and other compliance regulations
- Infrastructure development such as roads, well pads and retention ponds
- Drilling and testing production and injection wells
- Design and construction of the brine delivery and re-injection system

Both set-ups
- Feasibility and other engineering studies of the opportunity
- Heat exchangers
- Pumps
- Electrical and controls
- Design and the construction of the hot water delivery and return water systems

Integrated with electricity generation
- Additional permitting for resource utilisation (if required)
- Design and construction of the brine bypass of the original injection system
Geothermal Heat Tariffs

Key components of a geothermal heat tariff

✓ Cost-plus approach

- Capital Costs (CAPEX)
  - Exploration studies
  - Feasibility studies
  - Permits
  - Drilling
  - Energy delivery systems and associated infrastructure

- Operating Costs (OPEX)
  - Salaries/wages
  - Electricity usage for operations
  - Equipment maintenance
  - Interest/bank fees
  - Depreciation of assets

- Shared Costs
  - Direct use project integrated with electricity generation

- Markup

✓ Market-based approach

CAPEX of energy supply from alternative sources is used as a benchmark for calculating the geothermal heat tariff

✓ Advantages and limitations of each approach
# Recommendations

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<th>Challenge/gap</th>
<th>Description</th>
<th>Recommendations/lessons learnt</th>
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| **Policy, legal and regulatory frameworks**       | Laws and regulations to support the development of geothermal projects may be inadequate or lacking. Policy instruments to support the integration of geothermal energy into agri-food systems may be inadequate or lacking. | • Establish adequate and simplified licencing procedures for geothermal direct-use projects and clearly defined regulations.  
• Develop and implement policy instruments to encourage the deployment of geothermal heat in the agri-food sector. |
| **Cross-sectoral alignment and multi-stakeholder engagement** | Policies of different sectors whose involvement is required to implement direct-use projects are usually non-aligned. Numerous stakeholders are involved in the development of direct-use projects. | • Develop cross-sectoral, integrated planning approaches to facilitate the adoption of geothermal energy into food systems and to align public and private sector priorities (e.g. with master plans or roadmaps for geothermal heat utilisation).  
• Identify the various stakeholders in direct-use project development and devise a strategy for their engagement as early as possible.  
• Establish risk mitigation schemes to minimise the exposure to losses by geothermal developers.  
• Develop laws and regulations that encourage the deployment of geothermal heating, including simplified licencing procedures for geothermal direct-use projects.  
• Develop direct-use projects alongside existing power projects to utilise excess heat through cascading systems or available heat from sub-commercial wells.  
• Assess the socio-economic benefits of deploying geothermal heat in agri-food projects to demonstrate the potential to improve the livelihoods of local communities.  
• Launch pilot projects to demonstrate the technical/financial viability of direct-use technologies and associated business models.  
• Partner with local banks and build their capacity to finance direct-use projects using local currency financing.  
• Leverage technical assistance and matchmaking platforms to connect investors/financiers with bankable projects. |
| **Access to financing**                           | Geothermal project development has high up-front costs and risks. Public financial resources are limited, especially in developing countries. Multilateral and international bank funding is mainly focused on geothermal electricity production projects. Demonstrable feasibility of direct-use projects is lacking in many developing countries. |    |
THANK YOU!