

Friday 24th October 2014, Copenhagen

GLOBAL GEOTHERMAL DEVELOPMENT PLAN □ ROUND TABLE 2

EBRD □ Geothermal Experience:

Combining financing with technical assistance and policy dialogue under the Sustainable Resource Initiative

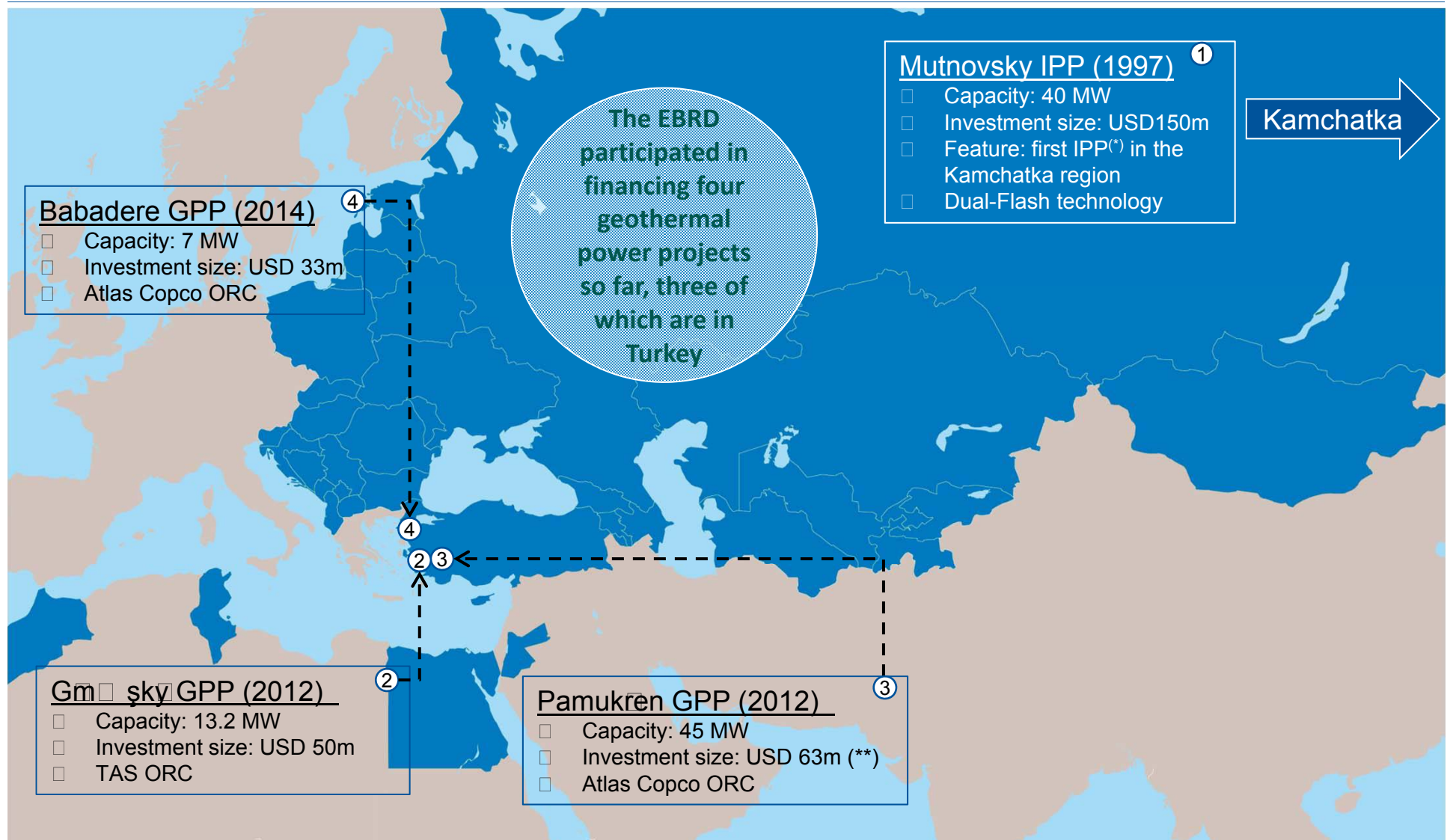
Adonai Herrera-Martínez

Energy Efficiency and Climate Change (E2C2)



European Bank
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EBRD experience in the Geothermal sector



Why geothermal, in Turkey & for the EBRD?



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Geothermal global overview

Global installed capacity is *circa* 12 GW_e and expected to reach 19 GW_e by 2016

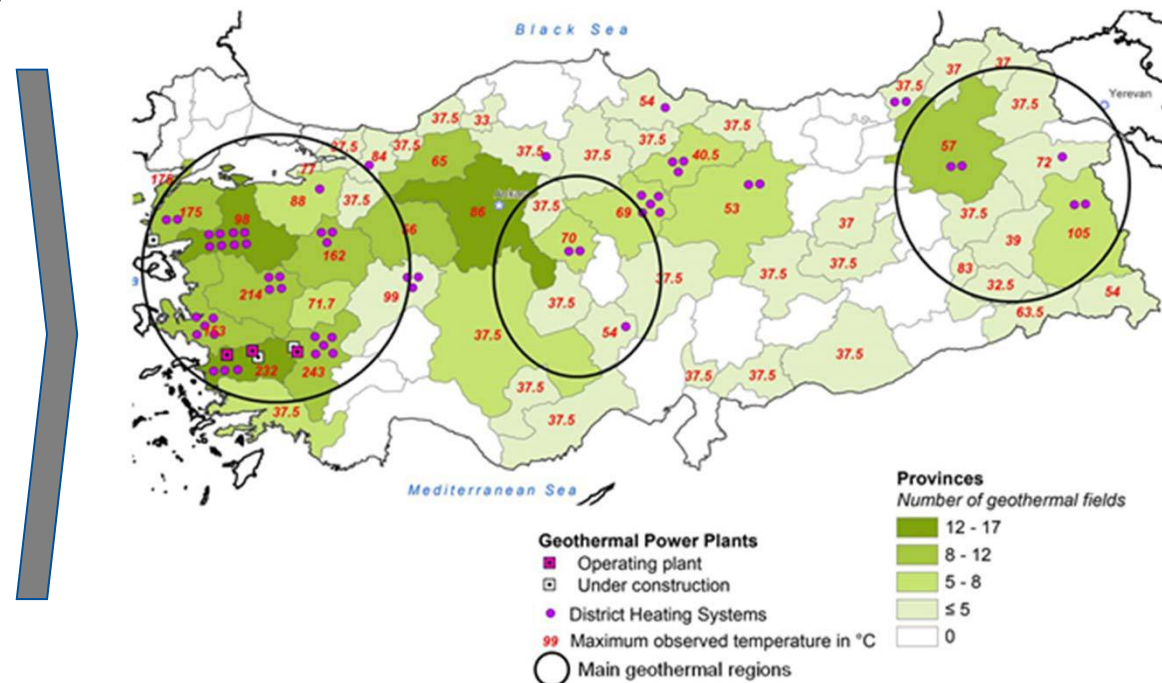
Estimated global potential 70 GW_e with present technology and up to 140 GW_e through the use of enhanced geothermal systems⁽¹⁾

Geothermal Turkey overview

Installed geothermal capacity: 310MW or 7% of the 4 GW_e estimated potential

Western Turkey currently holds the greatest potential for development of geothermal resources, with Central and Eastern Anatolia largely unexplored

Geothermal fields, power plants, districting heating systems, and maximum observed temperature by province



Sustainable Resource Initiative (SRI)

business model for geothermal scale-up



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Various financing approaches that suit small and large projects alike

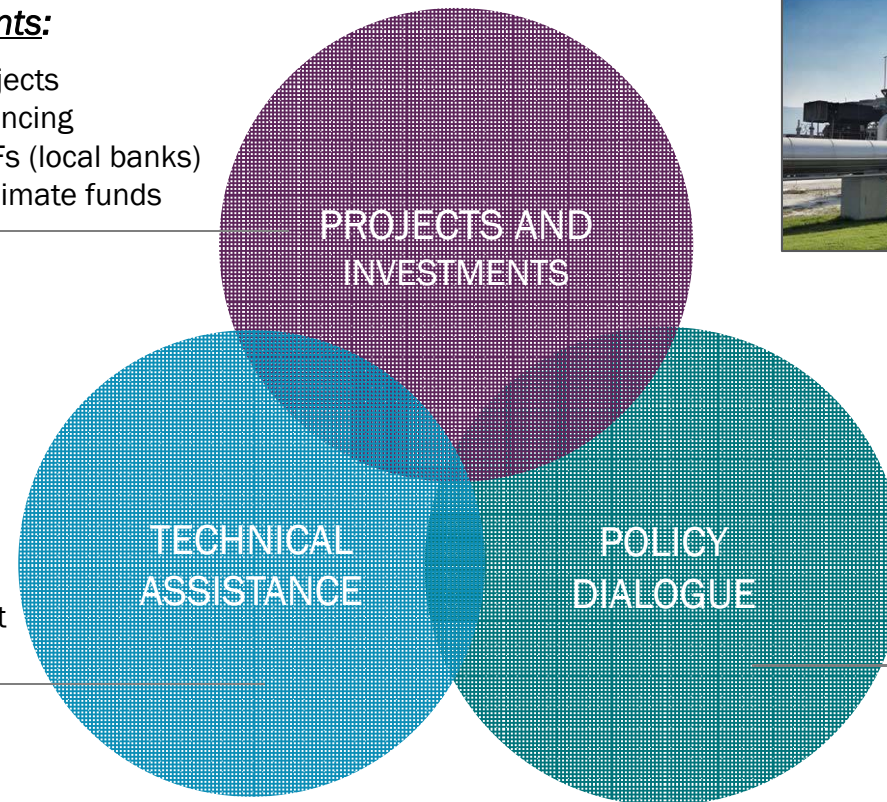
Tailored financial instruments:

- Direct-financing for large projects
- Syndicated loans and co-financing
- Small scale projects via SEFFs (local banks)
- Concessional finance from climate funds



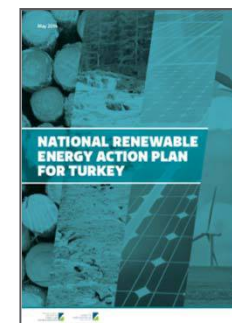
Industry best practices:

- Review of market potential
- Project development support
- Environmental assessment



Renewable Energy Action Plan:

Roadmap to achieving the 2023 600MW GPP target



MidSEFF: EUR 1 billion for Renewable Energy in Turkey



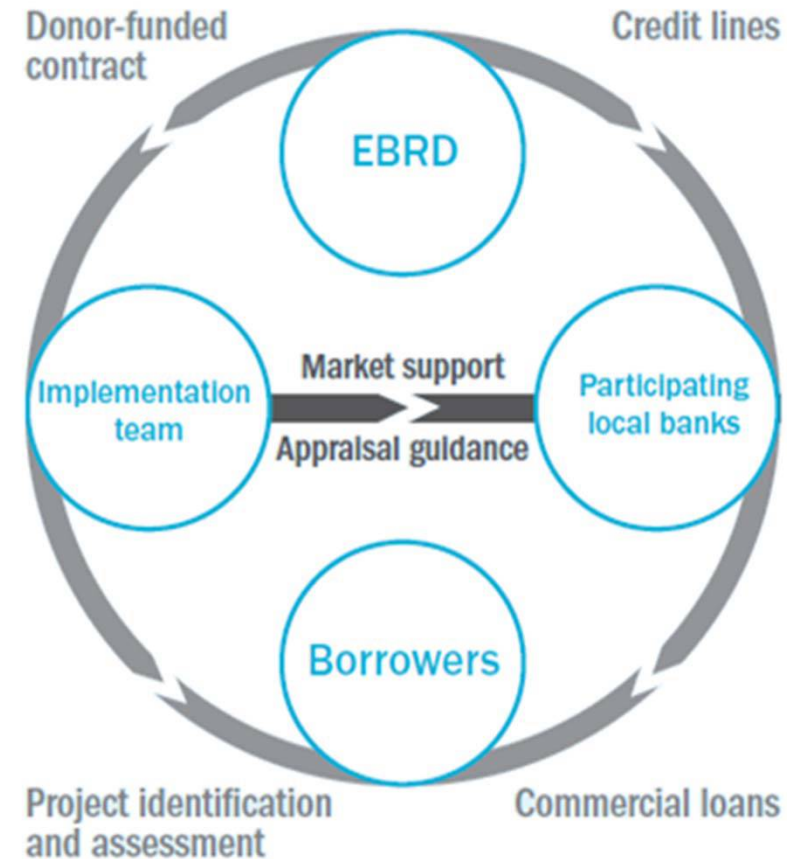
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EUR 1 billion facility, commercially structured through DPR launched in 2011 for EUR 500 million sub-investments in:

- Renewable Energy
- Energy Efficiency
- Waste-to-Energy

- + EU environmental & social standards
- + Support in Carbon Market development



<http://www.youtube.com/watch?v=KVh9eaVc-Js&feature=youtu.be>



Pamukren GPP Overview



PROJECT DESCRIPTION

- 2 x 22.5 MW units
- 15 feeding wells
- Binary system: Atlas Copco Organic Rankine Cycle (ORC)
- Expected electricity production 306 GWh/year equivalent to the demand for over 140,000 households

KEY DEVELOPMENTS

- The project initially relied on exploration work done by MTA, used by management for site development (45MW)
- Installed capacity expected to be extended to 68MW in a second stage and reach 112MW at a later stage
- Latest wells drilled have not been successful (drilling cost *circa* USD 1 mln/km) and delayed expansion plans
- New geological and seismic surveys required to establish resource location and site capacity
- High Non-Condensable Gas (NCG) concentration in all Byk|Menderes Graben sites although levels seem to decrease over time (1.8% initially to 1.2-1.5% today)

GENERAL INFORMATION	
Project Location	Aydin Province
Technology	Binary GPP
Plant Capacity	45 MW
Annual Energy Production	306 GWh/year
Annual CO2 Reduction	164,000 tCO ₂ /year ^(*)
TIME SCHEDULE	
Start of Construct.	March 2012
Commercial Operation	January 2013



PROJECT DESCRIPTION

- 2 x 6.6 MW units
- Fed by 5 production wells providing medium enthalpy resources + 2 re-injection wells
- Binary system: TAS Organic Rankine Cycle (ORC)
- Expected electricity production 85 GWh/year equivalent to the demand for over 38 thousand households

KEY DEVELOPMENTS

- Existing wells capable of supporting additional 6 MW
- Leader in carbon utilization, including sale of CO₂ for industrial uses and operation of a state-of-the art 5.0 Ha greenhouse
- Management is testing a Geothermal-CSP Hybrid Plant on site to further increase installed capacity and plant efficiency

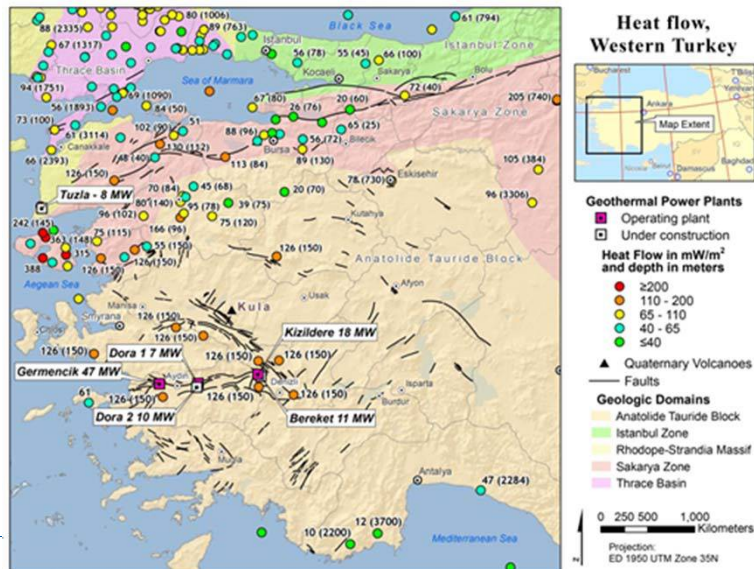
GENERAL INFORMATION	
Project Location	Aydin Province
Technology	Binary GPP
Plant Capacity	13.2 MW
Annual Energy Production	85 GWh/year
Annual CO₂ Reduction	47,000 tCO ₂ /year
TIME SCHEDULE	
Start of Construct.	April 2012
Commercial Operation	September 2013



EBRD Support for Geothermal development

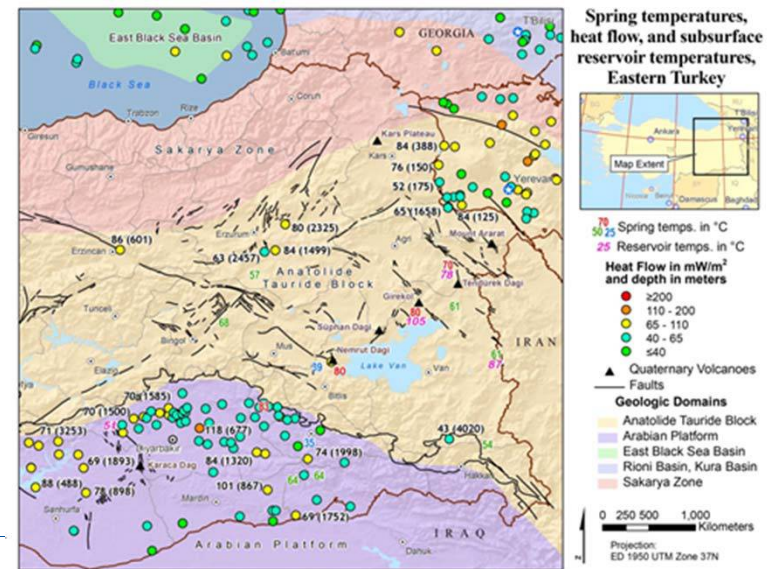
PROJECT FINANCE

- Direct project finance: 100 MW+ in the Aydin-Germencik province
- Financing existing projects through local banks
- Engaging blue-chip developers in Turkey to support future green field projects



POLICY DIALOGUE

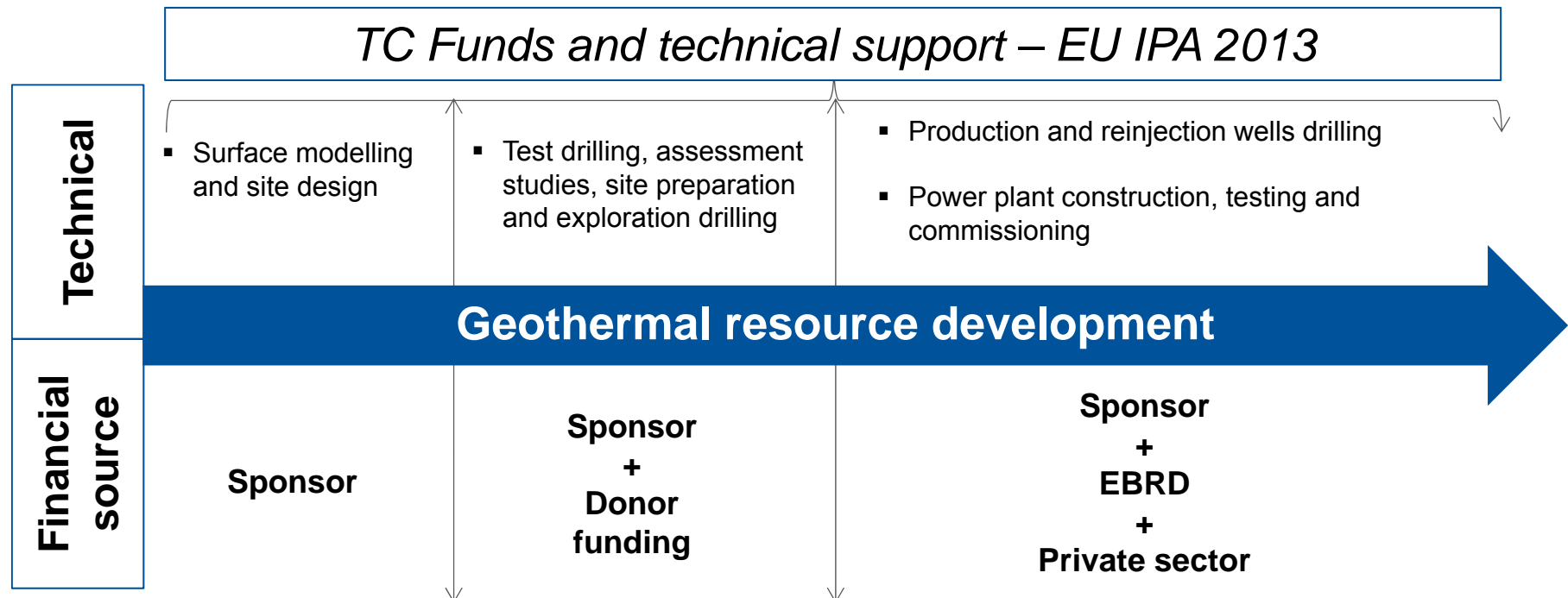
- Support the MoENR in further developing the legislative frameworks and licensing procedures
- Launching a market study and mapping key players, resources and market perspectives
- Defining centralized approach on key environmental issues such as NCG emissions



EBRD Early stage Geothermal framework

Currently developing a framework to *support private sector early stage development*:

- Deploying CTF concessional funds to partially mitigate early stage risk and unlock commercial direct financing
- Mobilizing own and private sector resources to finance site and plant development
- Engaging global experts as to implement best industry practices at all stages





For more information

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