Friday 24th October 2014, Copenhagen
GLOBAL GEOTHERMAL DEVELOPMENT PLAN – ROUND TABLE 2

EBRD's Geothermal Experience:
Combining financing with technical assistance and policy dialogue under the Sustainable Resource Initiative

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for Reconstruction and Development

EBRD experience in the Geothermal sector

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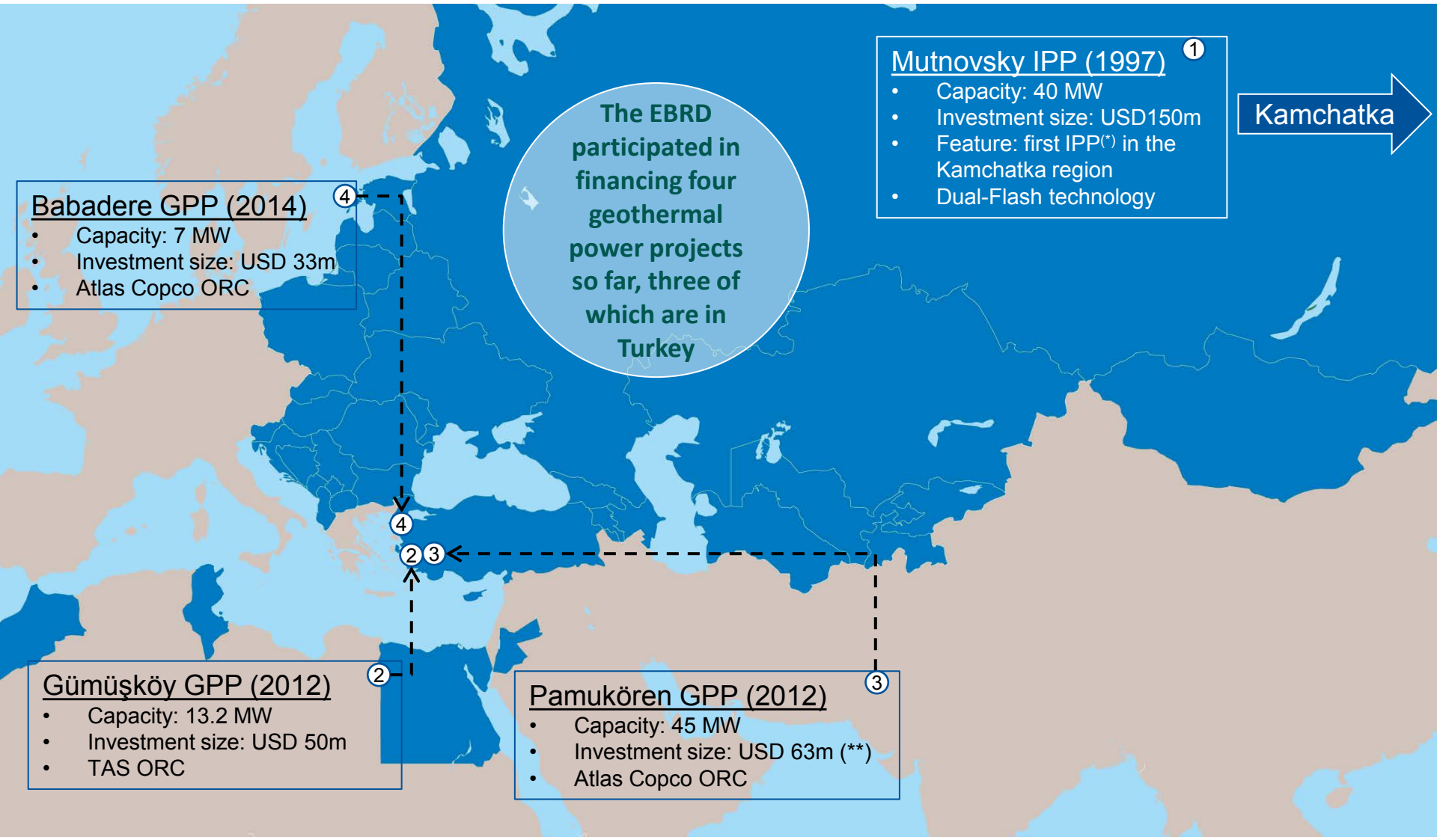

(*) IPP: Independent Power Plant
(**) Resource development costs were financed separately

Why geothermal, in Turkey & for the EBRD?

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Geothermal – global overview

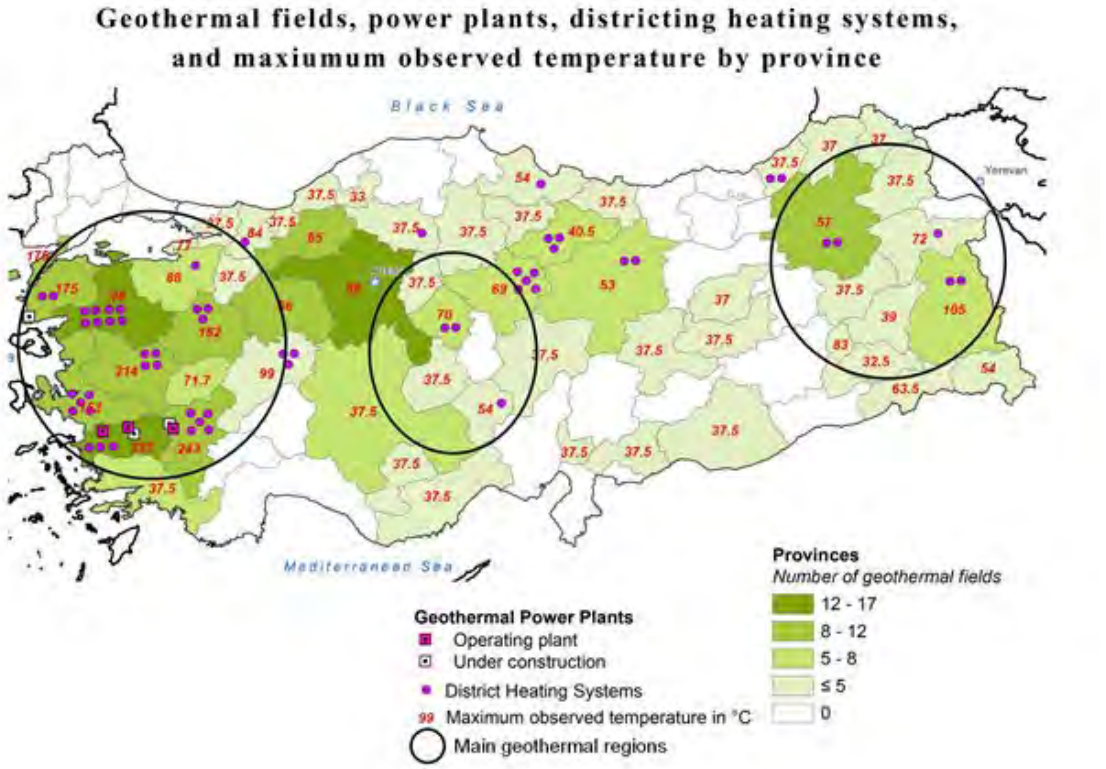
Global installed capacity is *circa* ***12 GW$_e$*** and expected to reach 19 GW$_e$ by 2016

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



(1) Geothermal Energy: an overview on resources and potential, Ruggero Bertani.

Sustainable Resource Initiative (SRI) – *business model for geothermal scale-up*

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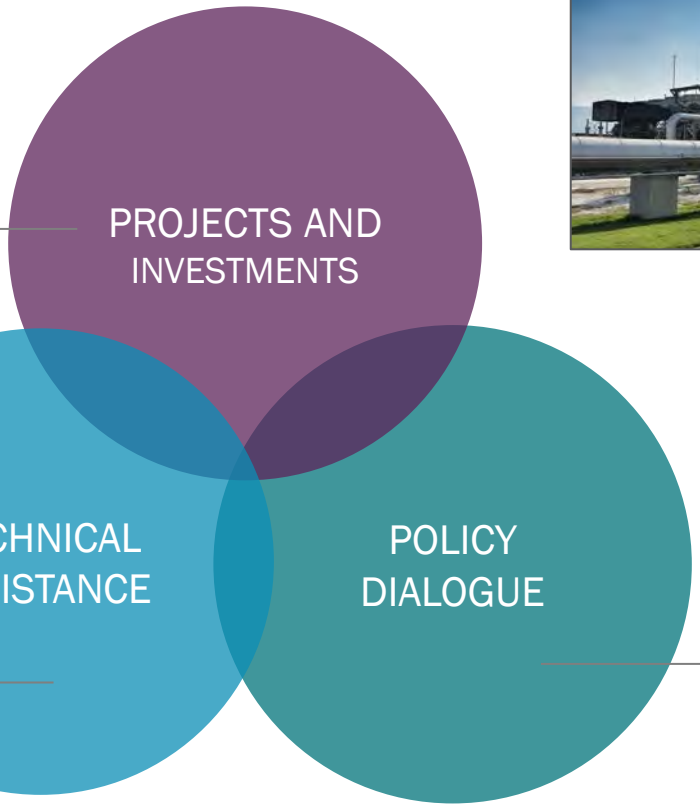
Various financing approaches that suit small and large projects alike

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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MIDSEFF

EUR 1 billion facility, commercially structured through DPR launched in 2011 for EUR 5 – 50 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

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Pamukören 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 Büyük Menderes Graben sites although levels seem to decrease over time (1.8% initially to 1.2-1.5% today)

GENERAL INFORMATION	
Project Location	Aydın 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

(*) provided that a solution to the NCG emission is found and successfully implemented.

Gümüşköy GPP – overview

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

GENERAL INFORMATION	
Project Location	Aydın 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

KEY DEVELOPMENTS

- Existing wells capable of supporting additional 6 MW
- Leader in carbon utilization, including sale of CO_2 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 farther increase installed capacity and plant efficiency

EBRD Support for Geothermal development

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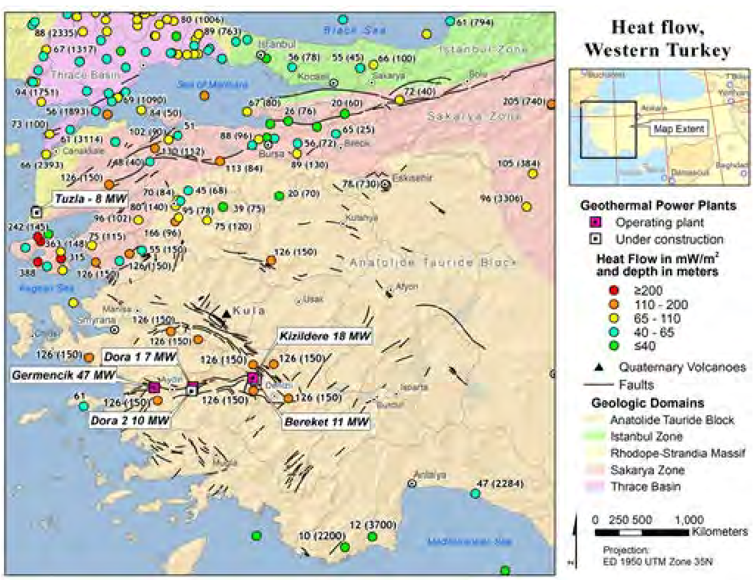
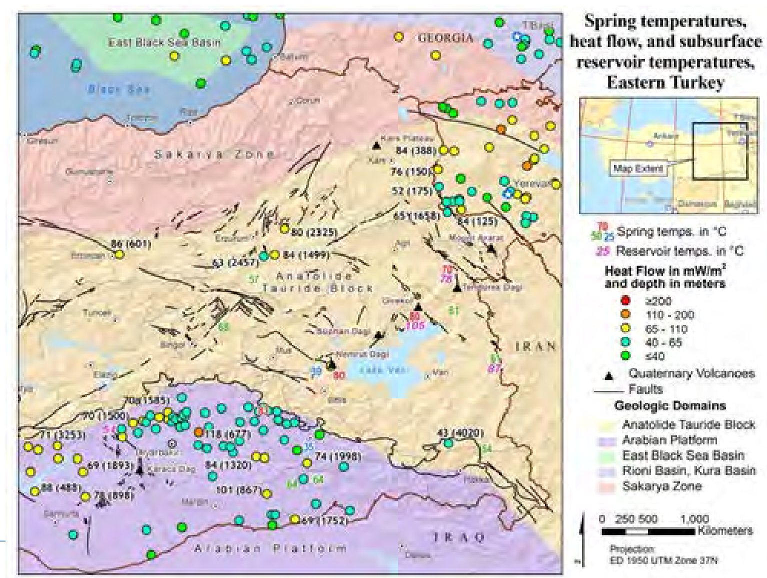
PROJECT FINANCE

- 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

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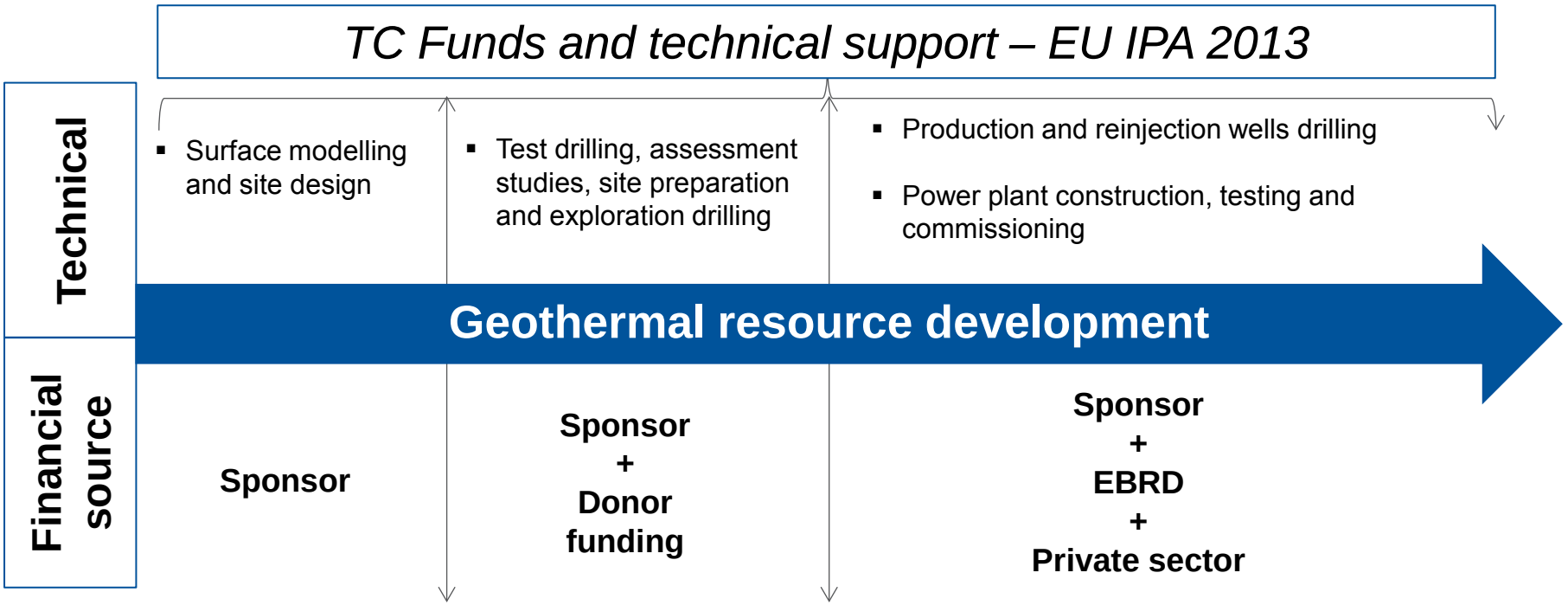
Currently developing a framework to ***support private sector early stage development***:

- 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: http://www.ebrd.com/pages/project/psd/2014/46809.shtml

For more information

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