Rödl & Partner

Globally active

GRMF – Geothermal Risk Mitigation Facility for Eastern Africa

Kai Imolauer | geo-T Expo Essen| 11.11.2014

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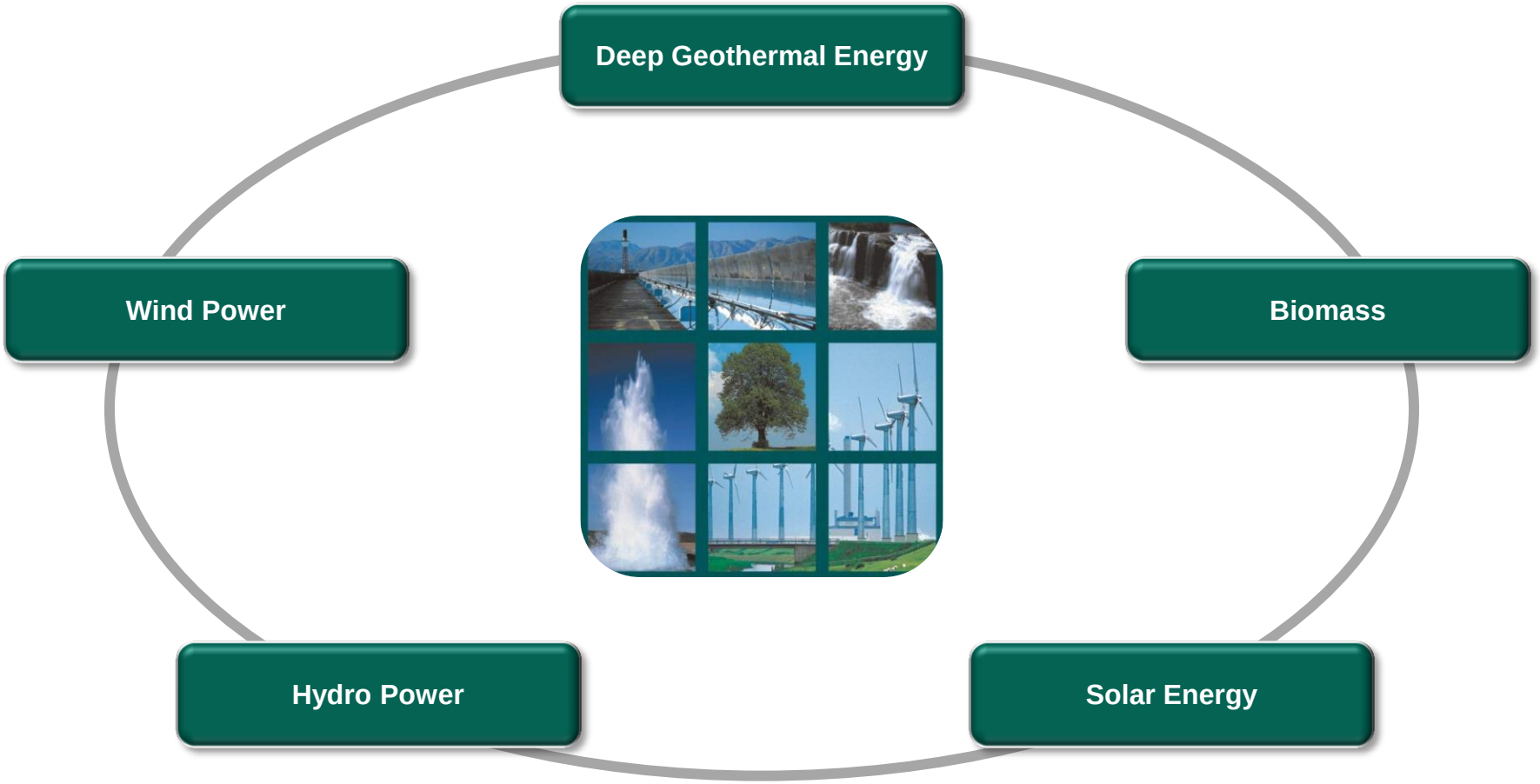
Rödl & Partner worldwide

Rödl & Partner
Interdisciplinary Services worldwide

Public Management Consulting
Our Sector-Expertise

The department PMC is advising cities and communities as well as public services companies for 18 years and implemented more then 1,000 projects successfully.

Energy Industries
Renewable Energies



Energy Industries
Consulting Services Renewable Energies

- Business Planning
- Strategic Consulting
- Due Diligence
- Fund Management
- District Heating Projects
- Project Assessment
- Contract Management
- PPP-Models

References national and international
Geothermal energy

Clients	Services
Geothermal Pilot Project Unterhaching	▪ Project management ▪ Acquisition of subsidies ▪ Development of the first insurance for drilling exploration risk worldwide
The World Bank	▪ Evaluation of two geothermal projects in Kamchatka, Russia: extension of the existing power plant; complete heat supply project of the city of Elizovo (40,000 inhabitants)
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and The World Bank	▪ Development of a countries benchmarking – study (pilot-project Hungary)
Corporación Andina de Fomento	▪ Development of a risk insurance model for discovery risk in Latin America

References national and international Geothermal energy

Clients	Services
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety	▪ Development of a concept to cover the exploration risk of geothermal deep drillings in Germany
KfW – German Development Bank	▪ Development of a risk insurance model for discovery risk in Indonesia
Private Investors	▪ Service related to the implementation of geothermal projects in Germany and Eastern Europe
International Financing Institute (confidential)	▪ Due Diligence of a geothermal project including all legal aspects and economic evaluation

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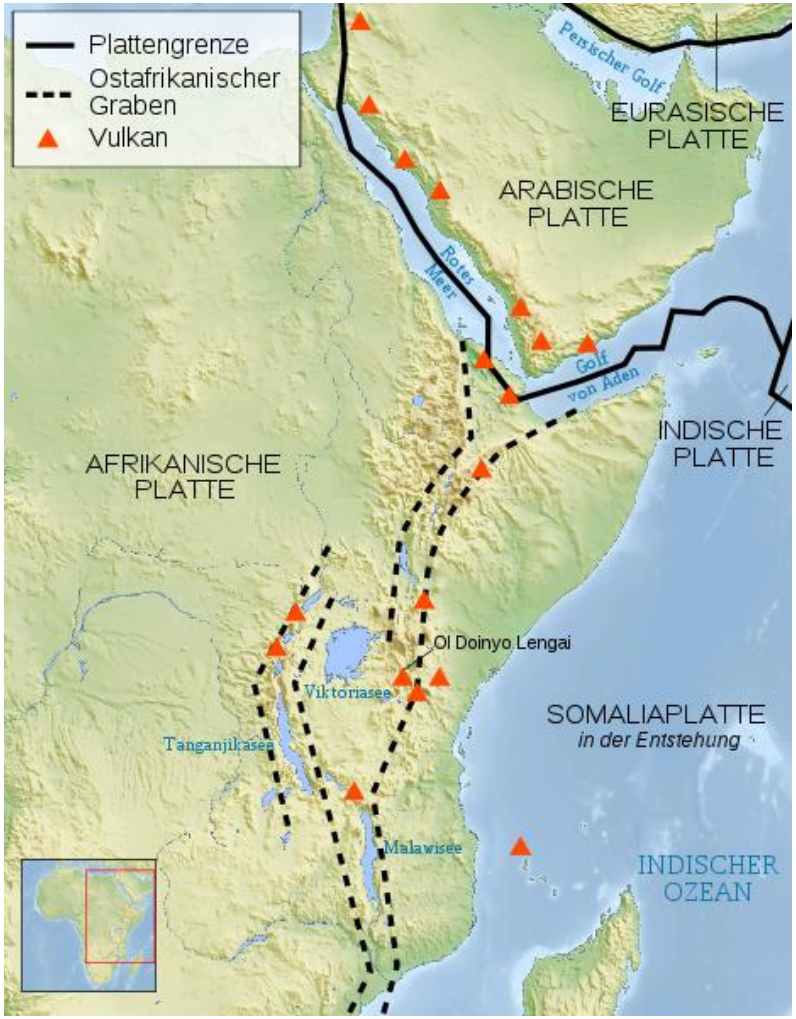
Geothermal Energy – East Africa

East Africa has with the special geological formation of the East African Rift a technical geothermal potential of 15,000 MW electric power to be generated from geothermal resources

The East African Rift has a length of approximately 6.000 km and its width varies from 30 km to 120 km.

The East African Rift transects through 9 countries with about 290 million people living along its outlines.



Sources: http://commons.wikimedia.org/wiki/File:Great_Rift_Valley_map-de.svg; travail personnel (own work); Image:EAfrica.jpg by Jide under licence Public Domain, itself from an USGS map; Image:Africa topography map.png by Bamse under licence GFDL.

Geothermal Energy – East Africa
Existing Projects

Name	Owner/ operator	Installed capacity (MWe)	Year commissioned	Plant type	Planned (MWe)	Total (MWe)
Olkaria I unit 1-3	KenGen	45	1981–1985	Condensing		45
Olkaria I unit 4 and 5	KenGen	140	2014	Condensing	70	210
Olkaria II units 1 and 2	KenGen	70	2004	Condensing		70
Olkaria II unit 3	KenGen	35	2010	Condensing		35
Olkaria III	Orpower	110	2000–2013	Binary	10	120
Olkaria IV	KenGen	140	2014	Condensing	140	280
Olkaria V	Kengen			Condensing	140	140
Olkaria wellhead	KenGen	25	2012-2014	Condensing	30	55
Oserian	ODCL	4	2004	Bin./Cond.		4
Eburru	KenGen	2,50	2012			2,50
Total	-	571,5	-	-	390	961,5

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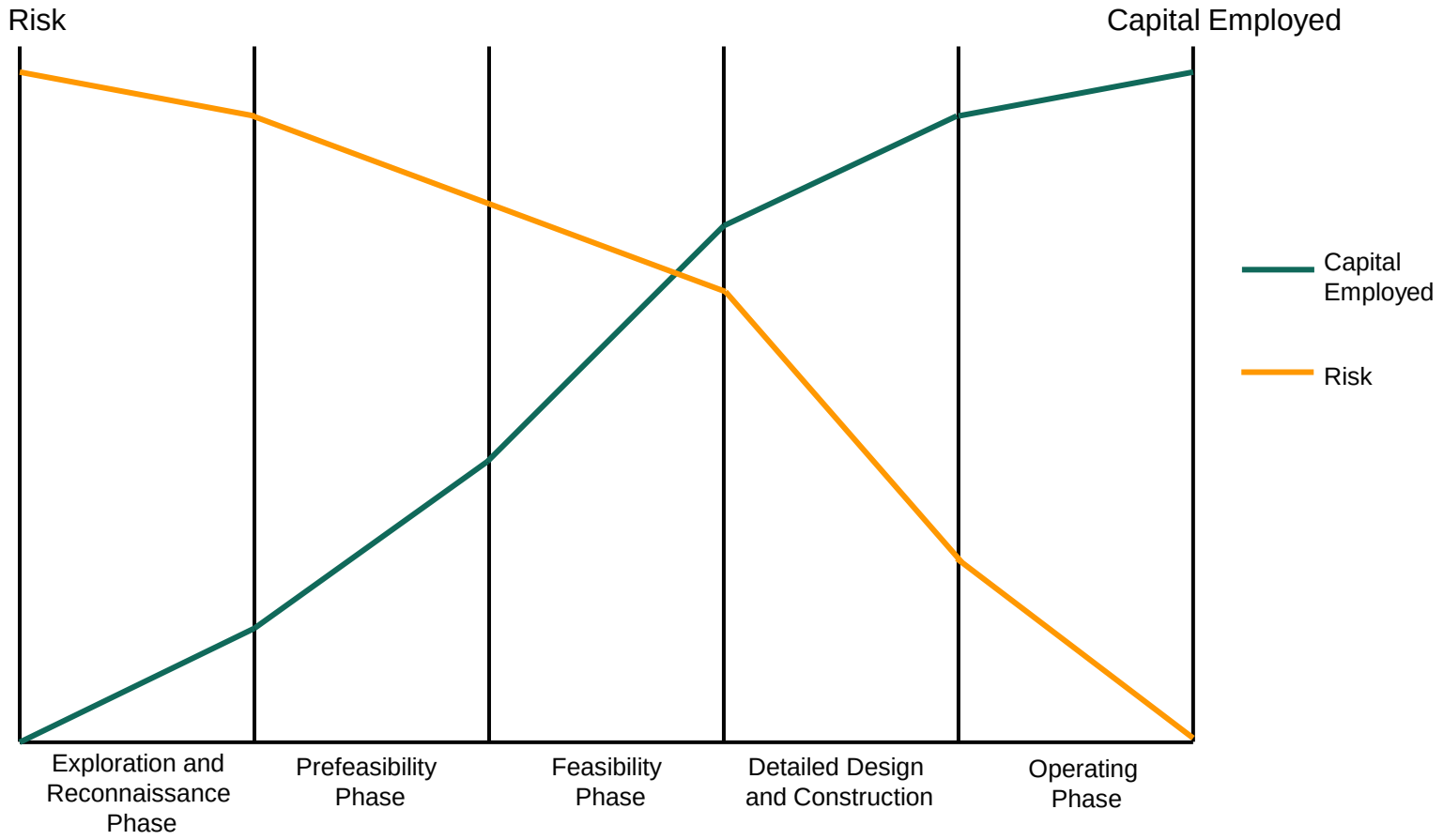
Geothermal Exploration Phases



Overview: Geothermal Project Development General Activities

Identification	Exploration	Drilling	Production
Locate and Assess a Prospect • Desktop Data Research and Analysis • Regional Reconnaissance • Geology and Geochemistry Resource Studies • Historical Drilling Data • Infrastructure Availability Assess Lease and Permits • Land Acquisition • Land Use Laws • Contact Federal Agencies • Water Rights • Mineral Rights • Environmental Review Establish Baseline Business Model • Physical and baseline economic viability testing and modeling • Resource expectations baselines • Project scale baselines • Electric market analysis • Land use costs • Land use limitations (conservation, PR, NIMBY, etc.) • Grid compatibility, interconnection costs	District Exploration: • Geochemical Analysis • Geophysical Survey Prospect Exploration: • Exploratory temperature gradient drilling • Resource measurement Permitting: • Permitting applications/procedures for exploration • Environmental Impact Statement for exploration Re-evaluate Business Model • Site, scale and technology choice • Generation potential revisions • Feasibility Analysis	Design and estimate cost of well • Design Characteristics • Geological Structure • Predicted Drilling Curve • Extent of Engineering Requirements Permits • Drilling Permits • Environmental Impact Statement for drilling • Water Reintroduction Assemble equipment and crew • Market Fluctuations with Oil and Gas • Crew availability • Rig Cost and Maintenance • Daily rate of other equipment (Compressors, Bits, Blowout Preventers, etc.) Drill, test and complete the well • Reservoir Management • Casing • Pumps	Obtain Financing • Complete Power Purchase Agreement • Bankable Geothermal Reservoir report • EPC Contract Preliminary Facility Design • Equity Constraints • Geophysical Constraints • Temperature and Salinity depreciations Permitting • NEPA, NPDS, CAA • USFWS, BLM, FERC EPC Manufacture EPC Construction

Source: Deloitte. (2008): Geothermal Risk Mitigation Strategies Report. Prepared for Department of Energy, Office of Energy Efficiency and Renewable Energy Geothermal Program.

Overview: Geothermal Project Development
Activities related to funding possibilities

Identification	Exploration	Drilling	Production
Locate and Assess a Prospect • Desktop Data Research and Analysis • Regional Reconnaissance • Geology and Geochemistry Resource Studies • Historical Drilling Data • Infrastructure Availability Assess Lease and Permits • Land Acquisition • Land Use Laws • Contact Federal Agencies • Water Rights • Mineral Rights • Environmental Review Establish Baseline Business Model • Physical and baseline economic viability testing and modeling • Resource expectations baselines • Project scale baselines • Electric market analysis • Land use costs • Land use limitations (conservation, PR, NIMBY, etc.) • Grid compatibility, interconnection costs	District Exploration: • Geochemical Analysis • Geophysical Survey Prospect Exploration: • Exploratory temperature gradient drilling • Resource measurement Permitting: • Permitting applications/procedures for exploration • Environmental Impact Statement for exploration Re-evaluate Business Model • Site, scale and technology choice • Generation potential revisions • Feasibility Analysis	Design and estimate cost of well • Design Characteristics • Geological Structure • Predicted Drilling Curve • Extent of Engineering Requirements Permits • Drilling Permits • Environmental Impact Statement for drilling • Water Reintroduction Assemble equipment and crew • Market Fluctuations with Oil and Gas • Crew availability • Rig Cost and Maintenance • Daily rate of other equipment (Compressors, Bits, Blowout Preventers, etc.) Drill, test and complete the well • Reservoir Management • Casing • Pumps	Obtain Financing • Complete Power Purchase Agreement • Bankable Geothermal Reservoir report • EPC Contract Preliminary Facility Design • Equity Constraints • Geophysical Constraints • Temperature and Salinity depreciations Permitting • NEPA, NPDS, CAA • USFWS, BLM, FERC EPC Manufacture EPC Construction

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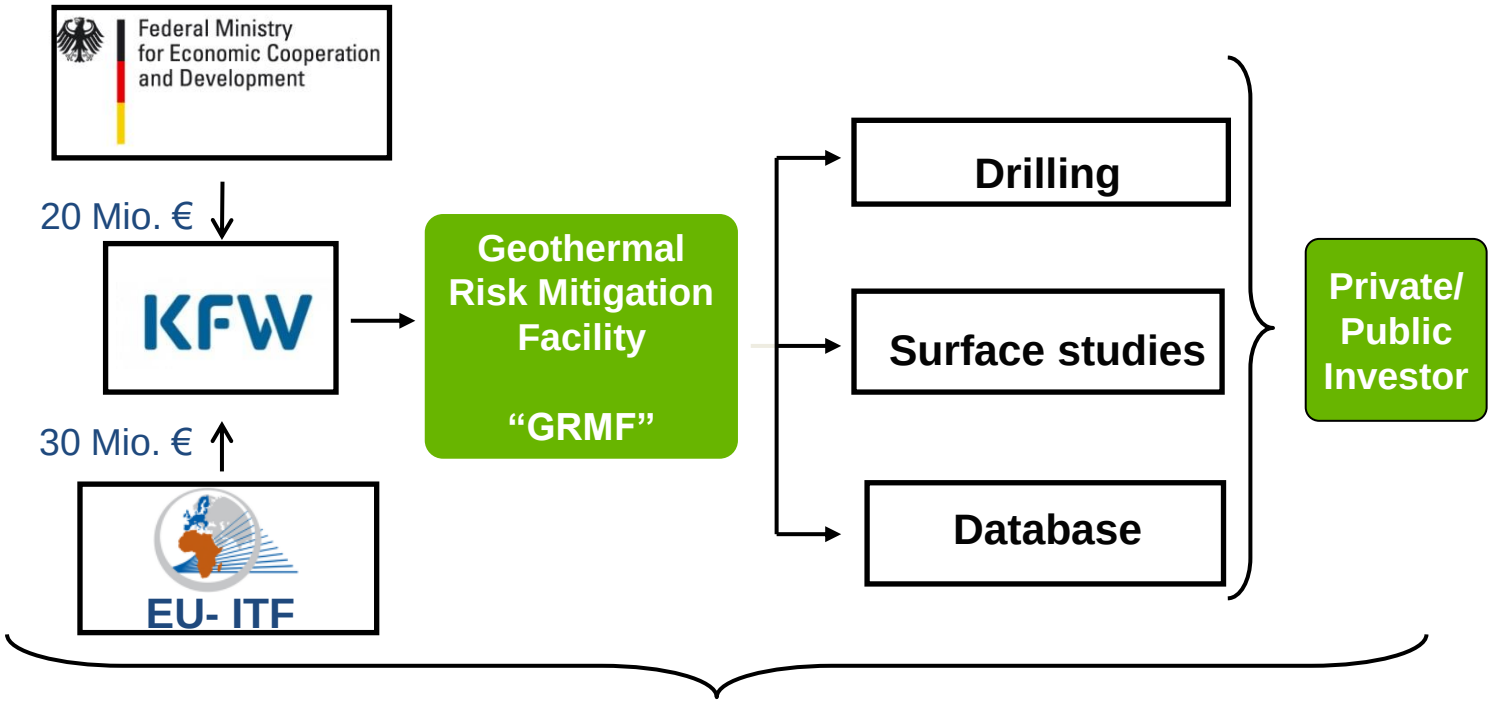
Project Structure



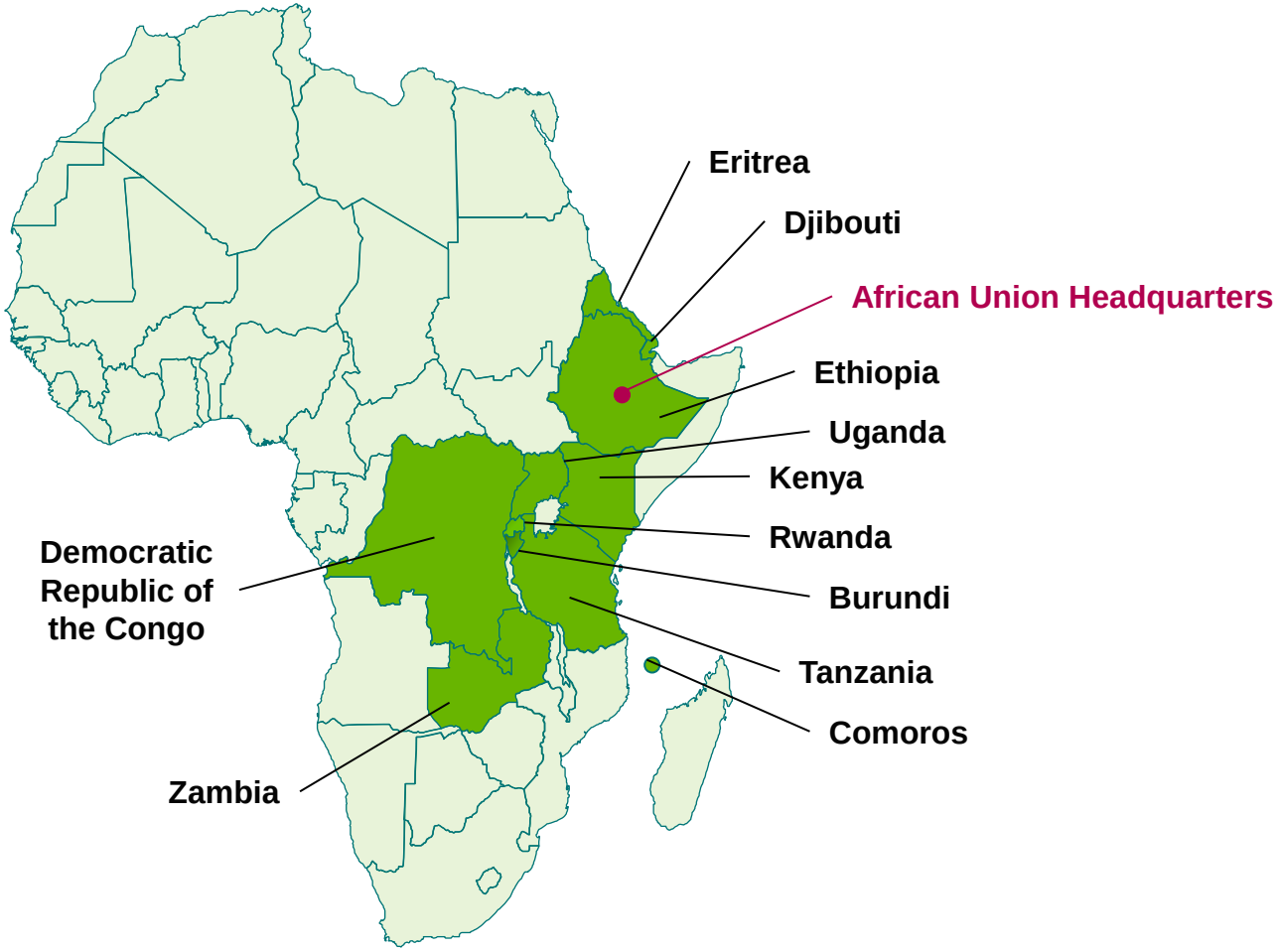
AUC Regional Geothermal Coordination Unit (RGCU)

- Information & Coordination of Countries, Developers, Donors etc.
- Valuation of Geothermal Projects for GRMF

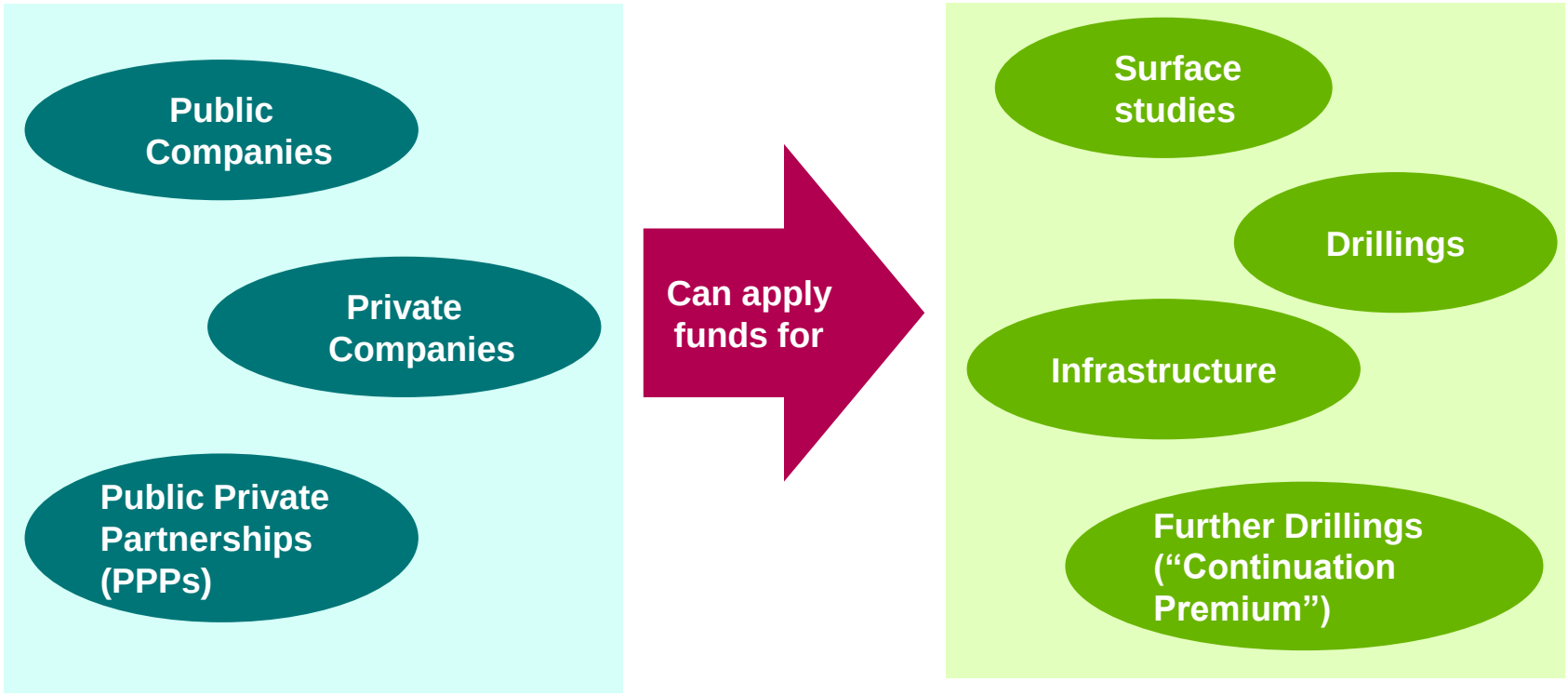
GRMF
Short Description

GRMF = Geothermal Risk Mitigation Facility for Eastern Africa	
Established by	the African Union Commission (AUC), the German Federal Ministry for Economic Cooperation and Development and the EU-Africa Infrastructure Trust Fund via KfW Entwicklungsbank (KfW)
Objective	encourage public and private investors as well as public private partnerships to develop geothermal prospects for power generation in Eastern Africa
Grants for two types of activity	• Surface studies • Drilling and testing of reservoir exploration wells at the most promising geothermal prospects • Drilling and testing of confirmation wells (continuation premium)
Start Date	03/2012
End Date	04/2018
Current Stage	1st Application Round: Grant awarded, 2nd Application Round: Applications received; grants to be awarded in January 3rd Application Round: started on 30th of October 2014
Facility Size	EUR 50 Mio.

GRMF
Support of Geothermal Activities in the Following Countries



GRMF
Possibilities and Eligibility for Funding



GRMF
Objectives and Funding

Objective:

To encourage **public & private investors** to mobilise financing for development of geothermal power plants in East Africa

Initial Countries: Ethiopia, Kenya, Rwanda, Tanzania, Uganda

New Countries (since 2013): Burundi, Comoros Islands, Djibouti, D.R. Congo, Eritrea, Zambia

Instruments

Drilling Project Support

- **40%** of **Exploration Drilling Costs**
- **20%** of **Infrastructure Costs** in connection with a drilling project
- **"Continuation Premium":**

30% of Exploration Drilling Costs as "Continuation Premium" if the Developer undertakes subsequent development steps

Exploration Drilling at geothermal prospects once the optimal locations for the drilling and testing of reservoir confirmation wells have been determined.

Surface Studies Support

- **80%** of **Surface studies Costs**
- **20%** of **Infrastructure Costs** in connection with a surface study

Surface Studies to determine the optimal location for reservoir confirmation wells at geothermal prospects that have previously been extensively studied are eligible for funding.

Regional geothermal database

Outcome of the 1st Application Round – Launched in October 2013

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List of projects awarded GRMF Grant

Awarded Grant Total: $22.718.212

Project	Applicant	Type of Project	Grant Status
Dofan (Ethiopia)	Geological Survey of Ethiopia (GSE)	Surface Study	Grant Signed on 3rd March 2014
Corbetti (Ethiopia)	Reykjavik Geothermal	Drilling	Grant signed 26 May 2014
Bogoria-Silali (Kenya)	Geothermal Development Company (GDC)	Drilling	Grant Signed on 3rd March 2014
Longonot (Kenya)	Africa Geothermal International Ltd. (Agil)	Drilling	Grant Signed on 27 November 2013
Suswa (Kenya)	WalAm Energy Inc.	Drilling	Cancelled

GRMF
Surface Studies

What is Funded

- 80% of approved allowable costs; should be directly associated with the Surface Studies (excluding infrastructure costs)
- Eligible costs comprise the following activities on the condition that they are directly associated with the surface studies:
  - Rental or provision of technical equipments (e.g. geophysical signal sources, geophysical sensors, recorders, receiver stations, GPS equipment)
  - Providers of specialist services (e.g. geological mapping, seismic surveys, electromagnetics, magnetotellurics, gravity, microseismics, lidar, chemical and petrological analyses, soil geochemistry)
  - Mandatory drilling insurances as specified in the Requests for Application
  - Project management costs
  - Personnel, on-site accommodation & transportation
  - Purchase of aerial photography, remote sensing data or equivalent
  - Documentation and reports
  - Consumables (e.g. fuel, chemicals used during sampling/measurement)
  - Environmental / social assessments, permits and licenses (for subsequent drilling)
  - Eligible, reasonable and agreed contingencies

GRMF
Drillings

What is Funded (1)

- 40% of approved allowable costs for the exploration drilling and testing program for reservoir confirmation wells (excluding infrastructure costs)
- Costs estimations are guided by the „Anticipated Well Cost“ (AWC), which specify cost structure for standard items
- Any cost exceeding the maximum allowable value needs justification.
- **Eligible costs** comprise the following activities on the condition that they are directly associated with the drilling and testing program:
  - Site preparation (well pads & sumps); mobilization and demobilization costs
  - Rental or provision of drilling rigs and associated equipment (e.g. pumps)
  - Mandatory drilling insurance as specified in the Request for Application
  - Providers of specialist services e.g. reservoir engineering stimulation, directional drilling, tubular inspections, mud logging, H2S monitoring, cementing, mud engineering, wireline services, geophysical logging, rig geology, petrology, chemical sampling and analysis coring, underbalanced drilling, environmentally acceptable disposal of waste including hazardous material according to applicable regulations
  - Rig-on, injection, production as well as interference testing and post drilling down-hole surveys
  - Cost of temporary abandonment so as to leave the well in an environmentally safe condition

GRMF
Drillings

What is Funded (2) – Eligible Costs

- Personnel, on-site accommodation and transport
- Purchase of aerial photography, remote sensing data or equivalent, mapping etc.
- Consumables (e.g. fuel, casing, wellheads, bits, cement, mud)
- Environmental / social assessments, permits and licenses (for subsequent construction of power plant)
- Documentation and reports
- Feasibility study with aim of securing finance for subsequent reservoir confirmation and/or well field development wells
- Contingencies

GRMF
Infrastructure

What is Funded

- 20% of approved allowable costs for infrastructure required for eligible surface studies or eligible reservoir confirmation wells

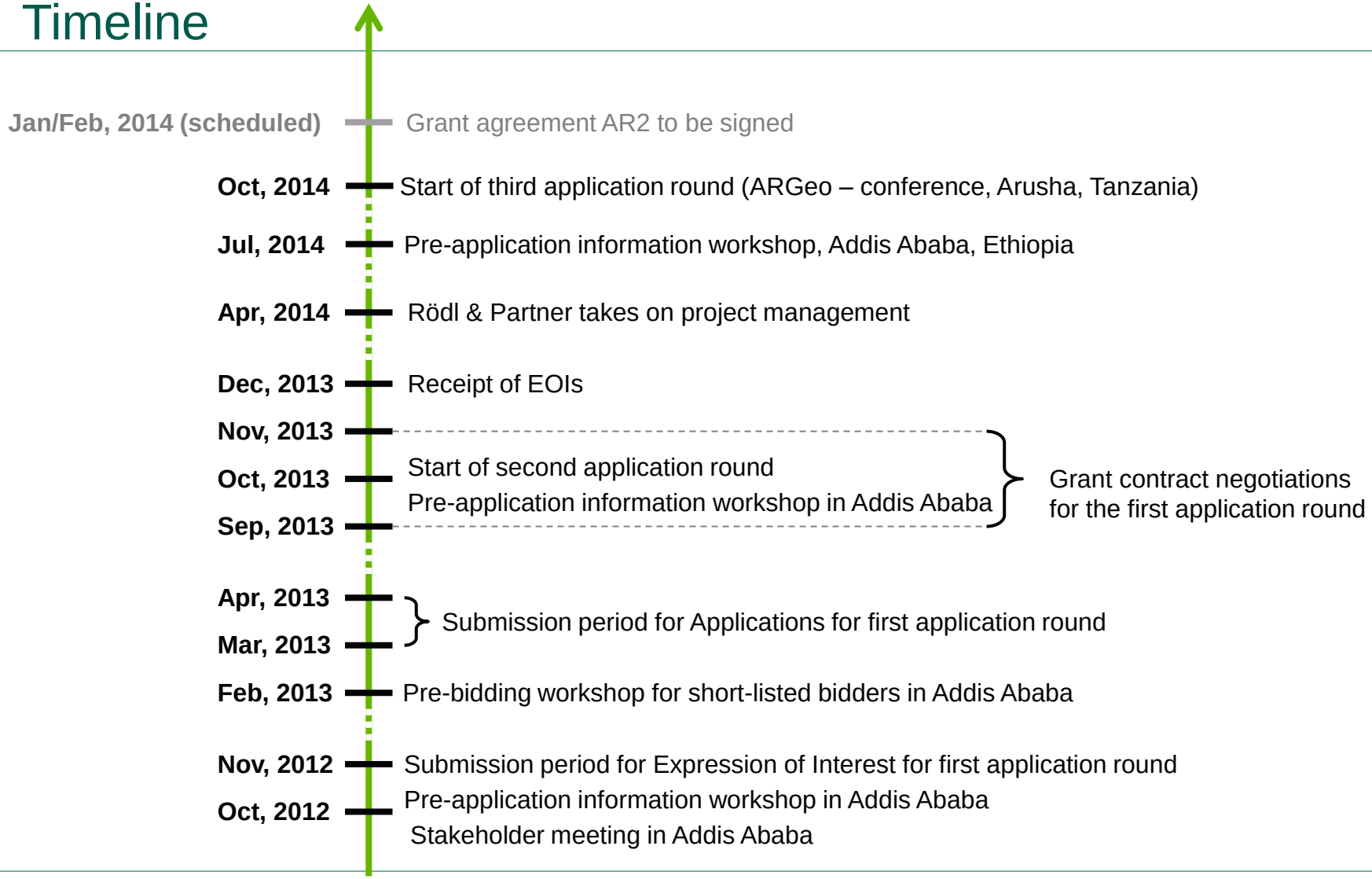
- Eligible costs for infrastructure comprise the following activities on the condition that they are directly associated with an eligible surface study or drilling program. Funds for infrastructure will only be granted in combination with a surface study or a drilling program.
  - Access roads and access road maintenance
  - If applicable: water supply infrastructure
  - If applicable: grid-connected power supply infrastructure
  - If applicable: transport and crew accommodation
  - Contingencies

GRMF
Continuation Premium

What is Funded

- 30% of developer‘s share of the approved allowable and expended costs for the drilling and testing program in case developers continue to develop their project within 6 months of the submission of the final drilling report.
- Eligible continuation activities comprise drilling of additional production or injection wells, reservoir engineering studies, development of a project financing package,engineering studies required for generation facility design etc.

GRMF Timeline



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Please see www.grmf-eastafrica.org for more information!!!

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„Each and every person counts“ – to the Castellers and to us.

Human towers symbolise in a unique way the Rödl & Partner corporate culture. They personify our philosophy of solidarity, balance, courage and team spirit. They stand for the growth that is based on own resources, the growth which has made Rödl & Partner the company we are today. „Força, Equilibri, Valor i Seny“ (strength, equilibrium, valour and common sense) is the Catalan motto of all Castellers, describing their fundamental values very accurately. It is to our liking and also reflects our mentality. Therefore Rödl & Partner embarked on a collaborative journey with the representatives of this long-standing tradition of human towers – Castellers de Barcelona – in May 2011. The association from Barcelona stands, among many other things, for this intangible cultural heritage.