

GEORISK Project

T 3.3 Transition of the Risk Mitigation Schemes

Ferid Seyidov, Dr. Horst Kreuter

6th November 2019

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [818232 — GEORISK]



GEORISK

Short Overview

- Risk Mitigation Scheme (RMS)
- Categories of Risk Mitigation Schemes
- Market Maturity
- Commercial Readiness Index (CRI) for Risk Mitigation Scheme
- A New Transition Framework
- Simulation

Risk Mitigation Scheme (RMS)

- Throughout the development of the projects there are number of risks to be faced.
- Major risk is exploration / reservoir risk
- RMS is a tool that facilitates either prevention of risk occurrence or minimization of the resulting damage.
- The market maturity significantly influences the characteristics of the RMS.
- Development of the market enables shift from the public support schemes to private ones – from high risk to low risk environment.
- The objective of this task is studying of this transition path and development of the framework that enables change from one tool to another.

Categories of the RMS

- I. Grants
- II. Convertible grants
- III. Repayable grants
- IV. Public insurance scheme
- V. Public-Private Partnership
- VI. Private risk Insurance
(Market has fully developed)

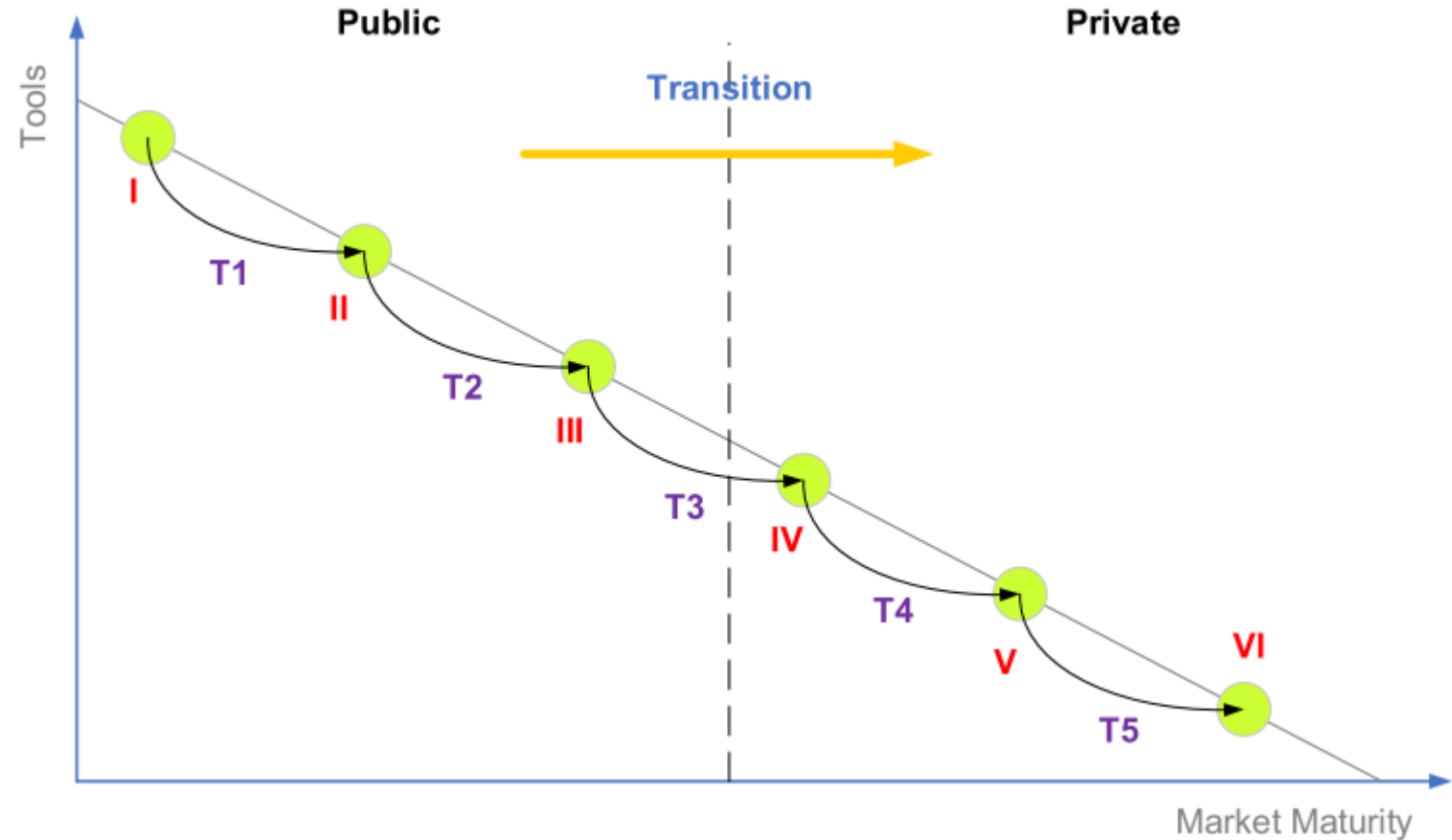


Figure 1: Transition between RMS depending on Market Maturity

Determination of Categories

- Category I – Grants: The money is not expected to be paid back
- Category II – Convertible Grants: The money can be repaid or returned in any other form
- Category III – Repayable Grants: The money will be repaid under certain conditions
- Category IV – Public Insurance: Insurance scheme that is sponsored by public entities, project must pay insurance premium.
- Category V – Public-Private Partnership: Support scheme that is sponsored by public-private partnership, project must pay support scheme fee.
- Category VI – Private Insurance Scheme: The insurance is covered completely by private entities.

Categories and structures are not fixed in respect of:

- Grant as a financial contribution by governments, states, institutions
- Maturity
- Private or Public engagement
- Grant to loan or loan to grant
- Revolving or non revolving
- Premium or fee or combination of both
- Risk categories
- Damage definition

Evaluation of Market Maturity

What is Market Maturity?

Market Maturity

The stage in product development where the product is qualitatively, cost-effectively and technologically advanced enough to meet the consumer's wishes in terms of design and therefore be launched on the market, having met the conditions for its production and distribution in a marketable manner.

Economic Lexicon

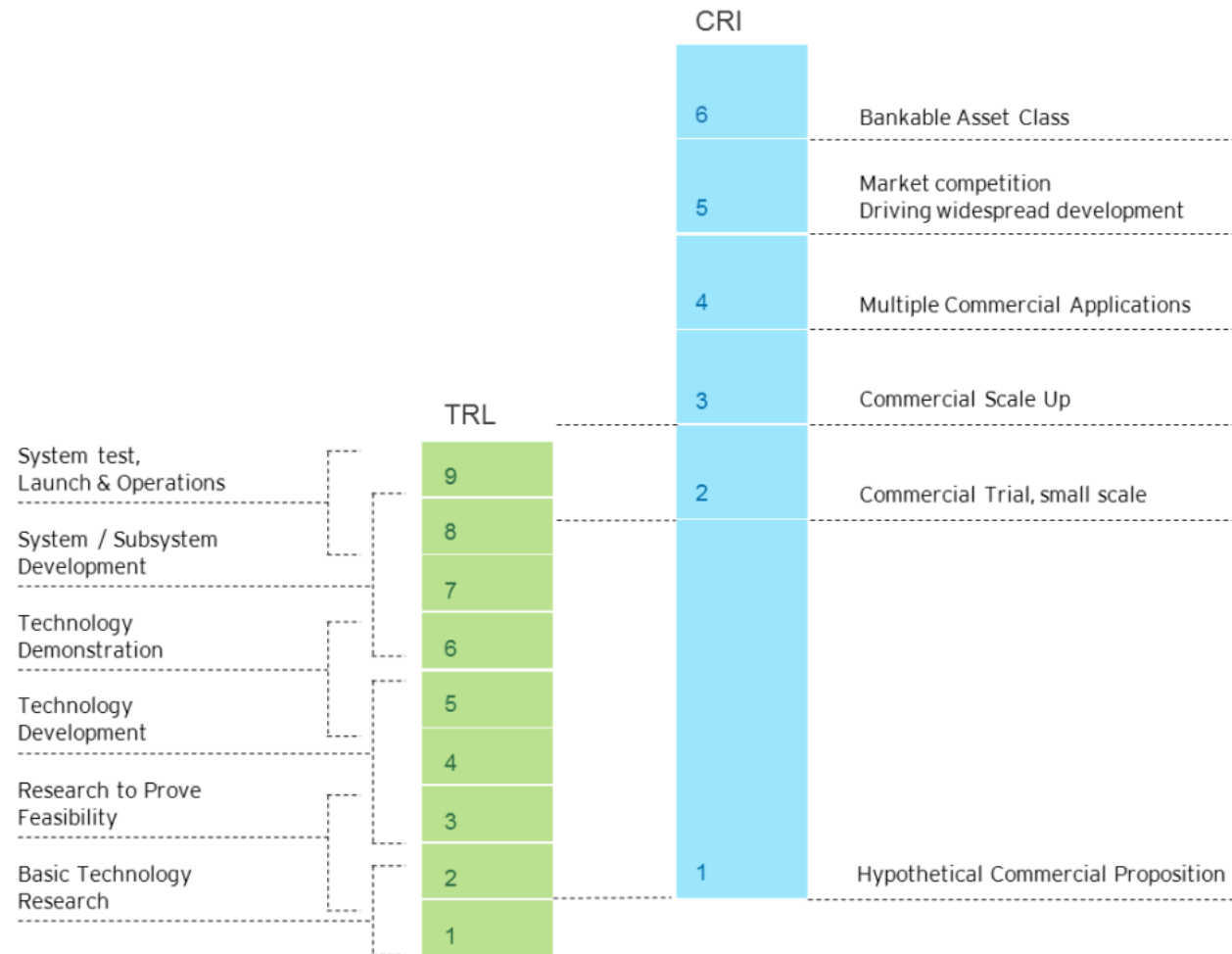
Commercial Readiness Index (CRI)

Renewable Energy Sector

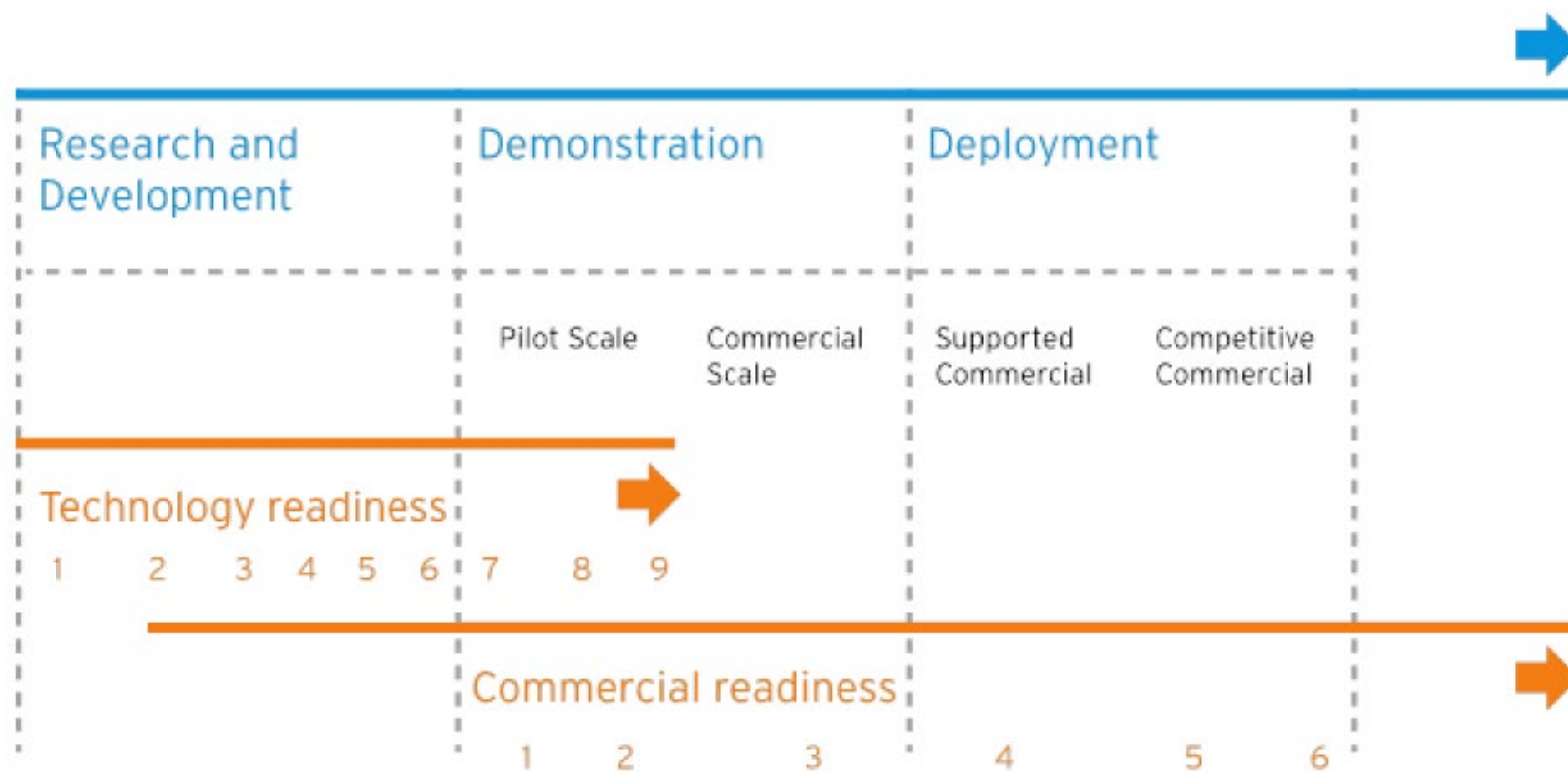
The CRI was initially developed by Australian Renewable Energy Agency (ARENA) in order to provide a tool for assessment of the „commercial readiness“ of constantly developing and improving renewable technologies.

It has been developed on top of the existing Technology Readiness Index (TRL) that is “a globally accepted benchmarking tools for tracking progress and supporting development of the technologies through the early stages of process chain.”

Originally, this measurement method was developed on the basis of evaluation of offshore wind generators in UK and solar power panels in Germany. However, within T3.3 we have tried to adopt this tool for the geothermal industry and market.



Source ARENA (2014); Correspondence of TRL and CRI



Source ARENA (2014); Correspondence of TRL and CRI

			Indicators							
			Regulatory Environment	Stakeholder Acceptance	Technical Performance	Financial Performance - Costs	Financial Proposition - Revenue	Industry Supply Chain & Skills	Market Opportunities	Company Maturity
Status Summary Level	'Bankable' Grade Asset Class									6
	Market competition driving widespread deployment									5
	Multiple commercial applications									4
	Commercial scale up									3
	Commercial trial									2
	Hypothetical commercial proposition									1

Source ARENA (2014); CRI Status Summary and Indicators

CRI Levels adaptation for Geothermal Market

1. **Hypothetical commercial proposition** – Presumption of the possibility to utilize Geothermal Energy in the region. Presumptions are made purely on theoretical data or with knowledge of regional geology. No test are preformed to support the claims.
2. **Commercial Trial** – Initiation of exploration and projects in order to test the theoretical presumption from level 1. Usually funded by governmental entities. Lead to development of commercial proposition based on the data from the trials.
3. **Commercial Scale-up** – The publicly available data and support programs (loans and grants) enable involvement of the private companies and stakeholders into the starting up geothermal market.
4. **Multiple commercial applications** – Presence of the geological and operational data proving technical performance and financial feasibility. Addressing regulatory challenges for smoothening and standardization of the licence acquisition processes. Despite rising interest from the private sector – public support is still needed.
5. **Market competition driving widespread deployment - & Bankable grade asset class**
The regulatory environment became completely standardized. Presence of competitive product and service providing entities across all the segments of the market. The public support becomes no longer essential for maintaining the development of the market.

Competition?

Licenses

Auctions

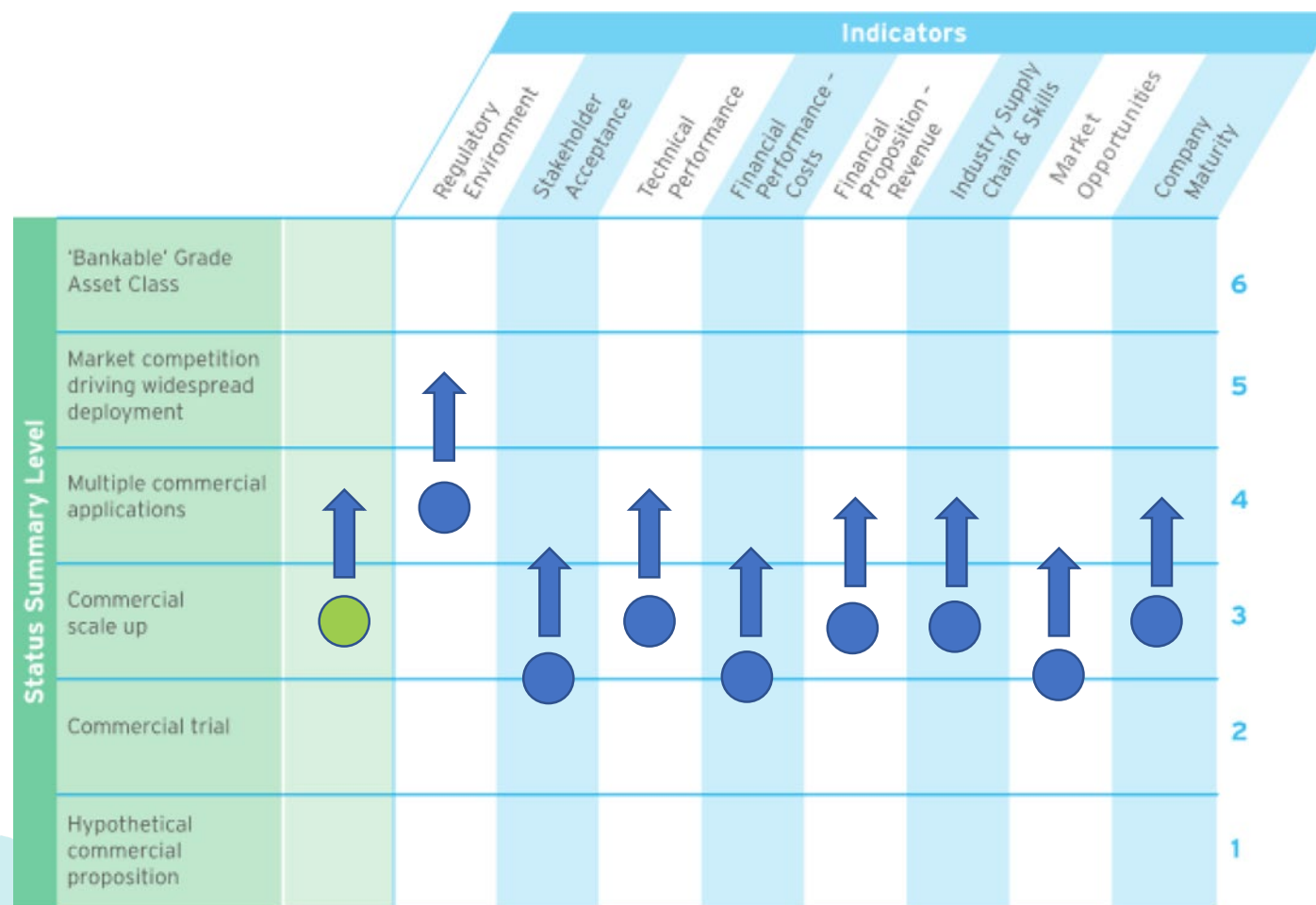
Qualified competitors

Government Development

Government as competitor

Indicator Description

- **Regulatory Environment** – Licence acquisition; Mining Ministry; Standardization of the acquisition processes
- **Stakeholder Acceptance** – Investors; Project Developers; Public opinion; Political Perception
- **Technical Performance** – Technical Standards; Predictability of the performance
- **Financial Performance Cost** – Level of predictability/calculability of the performance costs
- **Financial Performance Revenue** – Presence / availability of calculation process flows / standards
- **Industry Supply Chain** – Presence of competitive and efficient services and products supply chains
- **Market Opportunities** – Presence of hypothetical commercial plan to demonstrate viable market and sustainable business model
- **Company Maturity** – Presence of the companies with strong credit rating and established performance records.



Evaluation of the Geothermal Heating Market in the Germany

CRI Status Summary Level adaptation for RMS

It is clear that the indicators have different influence and contribution on the Risk Mitigation Schemes. Therefore, the calculation of the overall CRI/RMS level must consider indicators differently. After retrospection of the German geothermal market, we suggest following formula:

Indicator	Degree of contribution (%)
Regulator Environment (RE)	5
Stakeholder Acceptance (SA)	15
Technical Performance (TA)	20
Financial Performance Cost (FPC)	10
Financial Proposition Revenue (FPR)	5
Industry Supply Chain and Skills (ISC)	15
Market Opportunities (MO)	10
Company Maturity (CM) / Size	20

Conduction of the test Simulation

The transition from one financial instrument to another will be tested and its impacts would be evaluated based on the projects with the help of a financial simulation.

- Real Project partners for the simulation are sought.

For the interested parties, please contact me under

Email: Ferid.Seyidov@gec-co.de

Subject: GeoRisk T 3.3 Simulation



Geology			
Production Well		Reservoir	
Quantity	2	Flow Rate	384 (y)
Measured Depth (MD)	4,693 m	Temperature Well-head	113 °C
True Vertical Depth (TVD)	3,950 m	Temperature Inlet/line	50 °C
Injection Well		Productivity Index	0,00
Quantity	2	Injectivity Index	192,00
Measured Depth (MD)	4,555 m		
True Vertical Depth (TVD)	3,800 m		

■ A) Planning and Exploration
■ B) Drilling Site
■ C) Drilling Costs
■ D) Pumps
■ E) Road Connection / Connection- and Thermal Circuit
■ F) Plant
■ G) Heating Central

Capital Costs and Discount Rates

WACC for NPV	7.00%
WACC for actual Costs	3.00%
WACC for Terminal Value	7.00%

Dynamic Investment Cost

Drilling Costs per Meter
Costs per Meter

2,393.40 €	0.00%	1.50%	2.00%	1.00%	1.00%
30,000 €	0.00%	1.50%	2.00%	1.00%	1.00%
0,000 €	0.00%	1.50%	2.00%	1.00%	1.00%
25,000 €	0.00%	1.50%	2.00%	1.00%	1.00%
0,000 €	0.00%	1.50%	2.00%	1.00%	1.00%

Capital Costs and Discount Rates

WACC for NPV	7.00%
WACC for actual Costs	3.00%
WACC for Terminal Value	7.00%

Dynamic Investment Cost

Drilling Costs per Meter
Costs per Meter

2,393.40 €	0.00%	1.50%	2.00%	1.00%	1.00%
30,000 €	0.00%	1.50%	2.00%	1.00%	1.00%
0,000 €	0.00%	1.50%	2.00%	1.00%	1.00%
25,000 €	0.00%	1.50%	2.00%	1.00%	1.00%
0,000 €	0.00%	1.50%	2.00%	1.00%	1.00%

End of First Cash Flow to Project:		
RR of FCF to Project each Körpererschaftsteuer 15,825 % und GewSt 24 %		8,750%
End of First Cash Flow to Investor:		
RR of FCF to Investor nach Körpererschaftsteuer 15,825 % und GewSt 24 %		12,731%
Project sale alternatives for (B0) Calculations and Production Costs based on arithmetic median value:		
Company value after tax in Year 2041 @ 7%		120.044.005
Initial value in Year 2041:		85.021.293
Big value in Year 2041		0
Equity Based Profit:		
Equity Profit (after taxes)		35,61%
Overall Capital Profit:		
Overall Capital Profit (after taxes)		14,21%
Project Result / NPV		
Project Result after Taxes (nominal)		145.361.233
NPV after Taxes @ 7%		16.814.376
Amortisation Period:		
Amortisation Period after Taxes (aratic)		9 Jahre
Amortisation Period after Taxes (aratic) @ 7%		15 Jahre
Start-Up Costs and Losses:		
Accumulated Start-Up Losses (Equity Loss)		-13.710.000
Compensation of Start-Up Losses in Year		2023
Break-Even Point before Taxes in Year		2022

Produktion Graph 1

Jahr	MREZT (Einheiten)	Hochqualige Arbeit (Einheiten)	Stromproduktion Geothermie (Einheiten)
06	5200	4200	4000
07	4200	3500	4000
08	3500	3000	4000
09	3000	2500	4000
10	4000	3500	4000
11	4800	4200	4000
12	4200	3800	4000

Performance Indicators
Verbesserungsorientierter Stromertrag
Verbesserungsorientierter Stromertrag

	Operation starts in 2021	01 - 05 years	06 - 10 years	11 - 15 years	16 - 20 years	21 - 25 years	26 - 30 years
Accounting Indicators							
Ø Betriebsleistung p.a.	€	18.500.000	21.800.000	25.500.000	31.700.000		
Ø Verkaufing p.a.	€	15.400.000	20.100.000	19.900.000	25.700.000		
Ø EBITDA (Ergebnis vor Zins, St., MA) p.a.	€	13.500.000	17.800.000	17.500.000	17.100.000		
Ø EBIT (Betriebsergebnis) p.a.	€	9.200.000	13.500.000	13.100.000	12.700.000		
Ø EBT (Unternehmensergebnis) p.a.	€	7.000.000	11.500.000	11.600.000	11.700.000		
Ø Jahresüberschuss / Verlusttrag p.a.	€	4.800.000	8.100.000	8.100.000	8.100.000		
Ø Dividend p.a.	€	4.100.000	7.300.000	8.100.000	8.100.000		
Ø Payoff of available Liquidity	€	1.800.000	700.000	0	0		
Ø Dividend Profit	%	26,63%	41,53%	41,39%	43,34%		
Profitability Ratios							
Ø Gross Profit	%	83,13%	85,83%	84,52%	83,07%		
Ø Operational Income Profit	%	49,57%	52,64%	55,62%	54,87%		
Ø Profit before Tax	%	17,69%	29,08%	29,45%	29,18%		
Ø Turn-Over Profit	%	26,04%	34,76%	34,46%	34,41%		
Coverage Ratios							
Ø Debt Service Coverage Ratio	ratio						
Capital Structure							
Ø Equity Rate	%	23,58%	25,86%	32,88%	42,61%		
Ø Loan-Capital Ratio	%	77,42%	74,64%	67,12%	57,37%		
Ø Equity to Loan-Capital Ratio	ratio	3,43	2,94	2,04	1,25		
Ø Loan-Capital to Assets Ratio	ratio	0,77	0,75	0,67	0,57		
Ø Interest Coverage Ratio	ratio						
		Ende 5. Jahr	Ende 10. Jahr	Ende 15. Jahr	Ende 20. Jahr	Ende 25. Jahr	Ende 30. Jahr
Reserves for Work Filling / Demanding	€	63.743	263.634	315.050	539.206		
Reserves	€	829.354	829.354	829.354	829.354		



Crowdthermal

- H2020 project on alternative risk methods
- Crowdfunding
- Public engagement and acceptance (Social License to Operate SLO)
- Case Studies
 - Spain: Madrid Shallow Geothermal heating system
 - Iceland: Heating project for greenhouses
 - Hungary: Deep Geothermal district heating Szeged > 20 wells
- Risk mitigation in relation to alternative funding opportunities (synergies with Georisk)
- Demand analysis / unaddressed issues for risk mitigation
- Interested to cooperate: baisch@geo-t.de
- <http://www.crowdthermalproject.eu/>



GEORISK

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [818232 — GEORISK]

