DESTRESS

Demonstration of soft stimulation treatments of geothermal reservoirs

Project Overview

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 691728

About DESTRESS

At a Glance

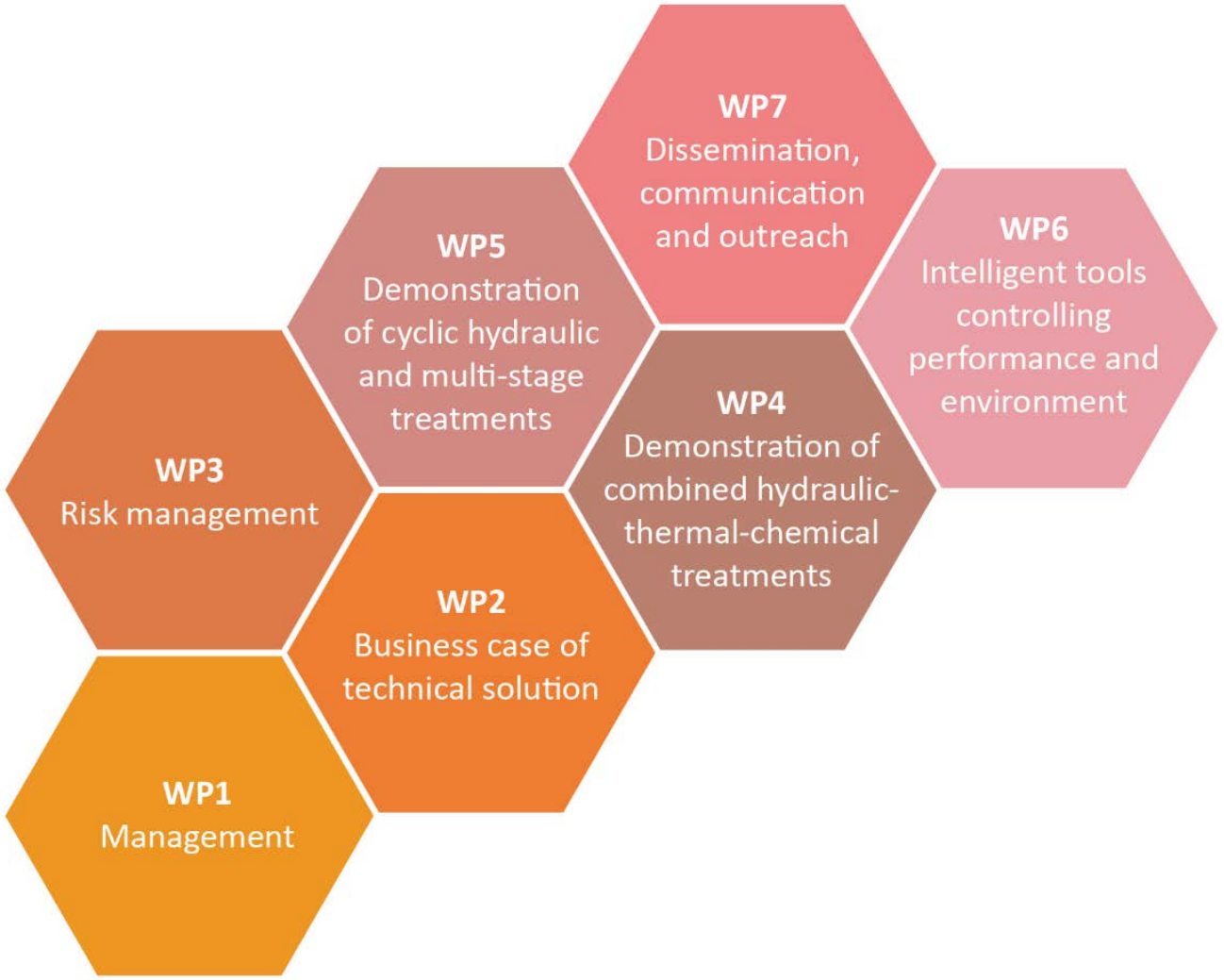
Title	Demonstration of soft stimulation treatments of geothermal reservoirs
Acronym	DESTRESS
Call	H2020-LCE-2015-2
Topic	Low Carbon Energy, LCE-03-2015: Demonstration of renewable electricity and heating/cooling technologies (IA)
Grant Agreement Number	691728
Duration	48 months, 01 March 2016 - 28 February 2020
Estimated Project Costs	€ 25 072 511.25
EU Contribution	€ 10 713 408.63
Project Lead	GFZ German Research Centre for Geosciences
Partners	16 European and East Asian research institutions, universities and industry representatives (large energy suppliers and SMEs)

In Brief

DESTRESS demonstrates methods of enhanced geothermal systems (EGS). The aim is to expand knowledge and to provide solutions for a more economical, sustainable and environmentally responsible exploitation of underground heat.

DESTRESS will improve the understanding of technological, business and societal opportunities and risks related to geothermal energy. Existing and new project sites have beer chosen to demonstrate the DESTRESS concept.

The demonstration sites are using **soft stimulation** treatments to minimise environmental hazards.

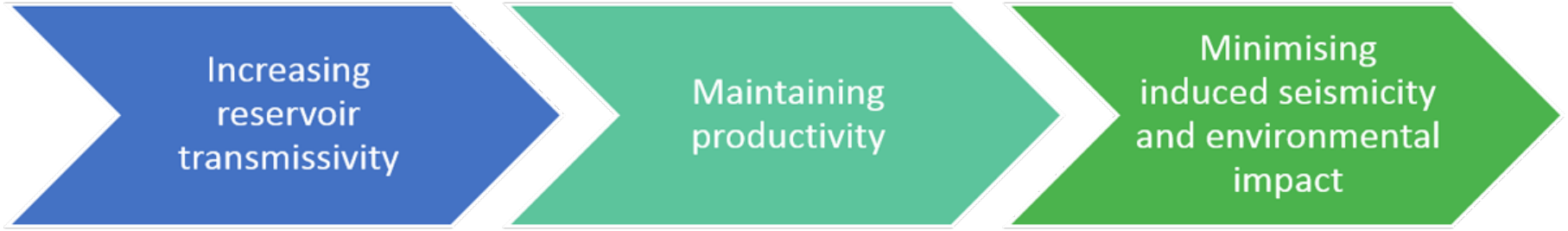


How Do We Define Soft Stimulation?

Soft stimulation is a collective term for geothermal reservoir stimulation techniques. It aims to achieve enhanced reservoir performance while minimizing environmental impacts including induced seismicity. Soft stimulation includes techniques such as cyclic / fatigue, multi-stage, chemical and thermal stimulation.

Objectives

The overall objective of DESTRESS is to develop good practices for creating reservoirs with increased transmissivity, sustainable productivity and a minimised level of induced seismicity.



The variety of the geological system (rocks, structures, tectonic situation, stress field) will be considered

- based on experience in previous projects, on developments in other fields, mainly the oil and gas sector, and on scientific progress in order to use a soft stimulation-approach;
- leading to business cases, including risk management designed to be transferrable to other sites (standardized procedure in the development of EGS projects).

Project Members

Academic Partners

GFZ Helmholtz-Zentrum Potsdam

University of Glasgow

TNO innovation for life

KICT Korea Institute of Civil Engineering and Building Technology

ETH zürich

Seoul National University

TU Delft Delft University of Technology

Ecole et Observatoire des Sciences de la Terre

Industrial Partners

EnBW

GEO ENERGIE SUISSE

TRIAS WESTLAND

ECW Netwerk

esg és géothermie

nexGeo NEXGEO Inc.

GEOTERMA

GTN

Funding Partners

European Union's Horizon 2020 research and innovation programme under grant agreement No. 691728 funds the DESTRESS project

Funding of KICT and NEXGEO

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

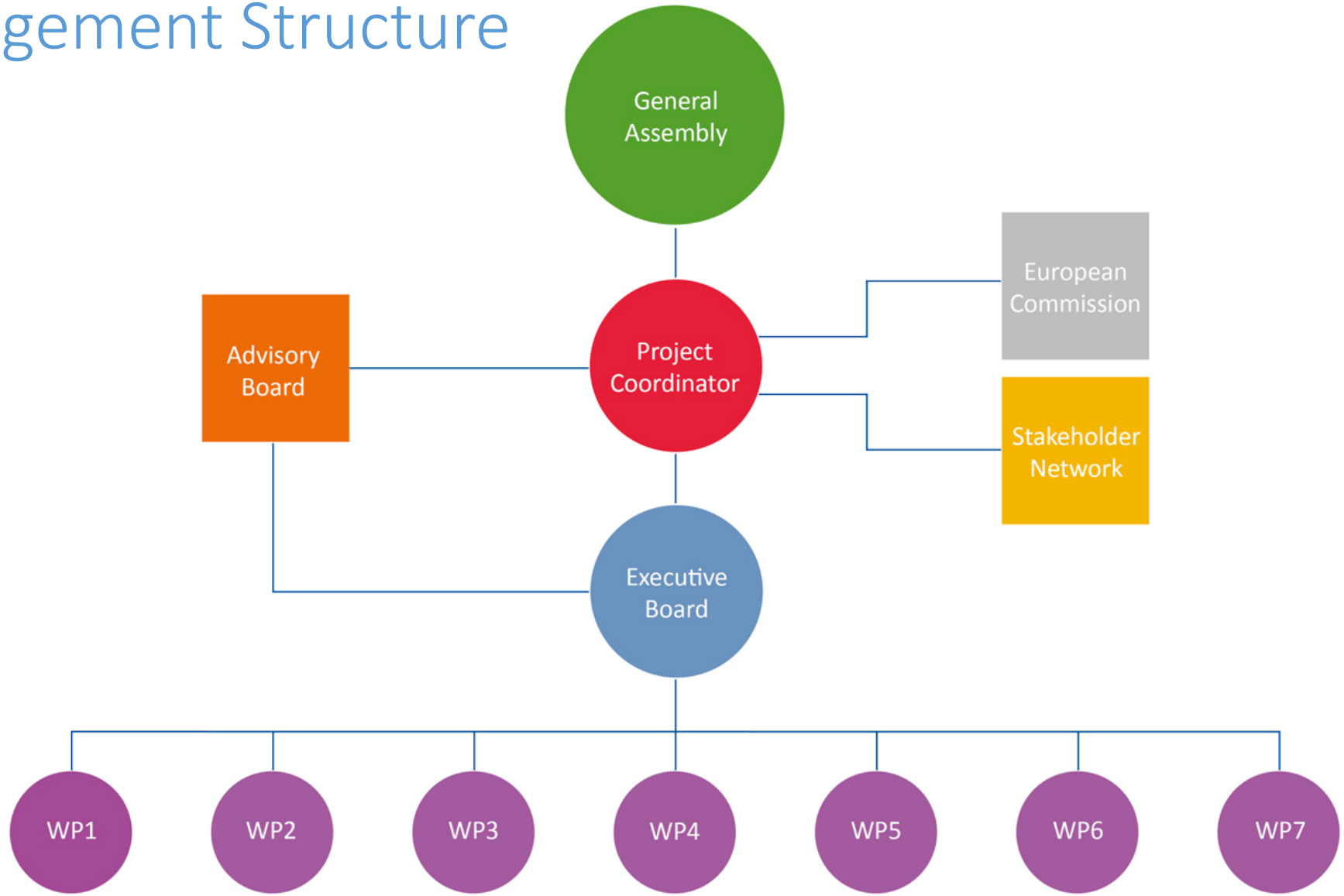
Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

Funding of ETH Zurich and Geo-Energie Suisse AG

National Research Foundation of Korea

Funding of Seoul National University

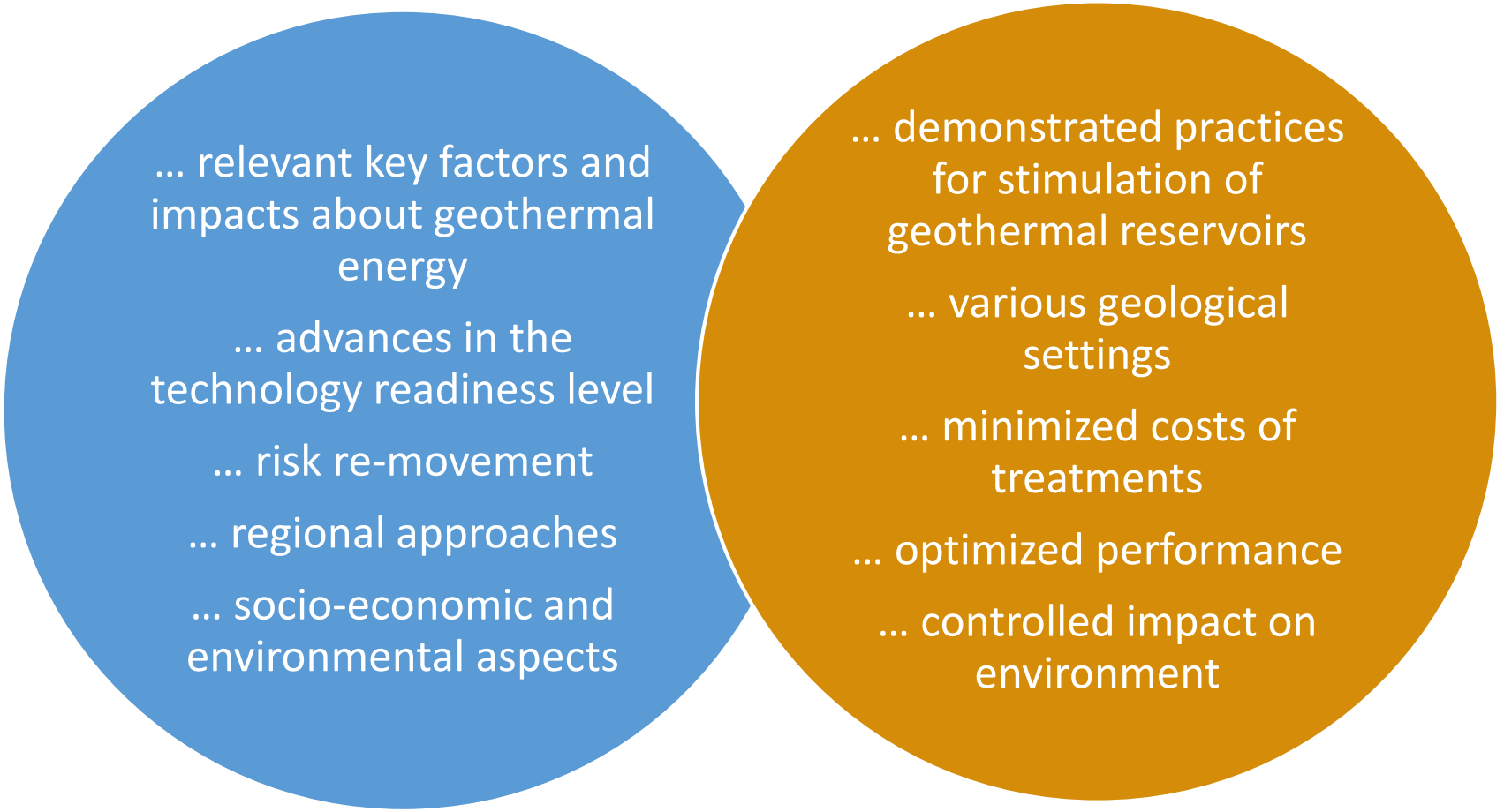
Management Structure



Input and Output

DESTRESS addresses...

DESTRESS expects results on...

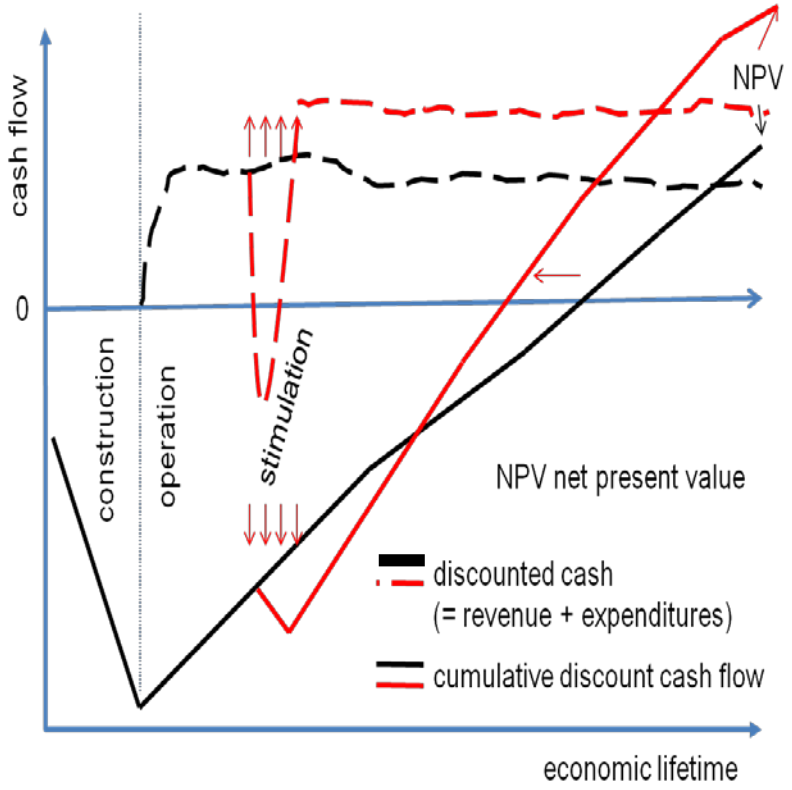


Business Case of Technical Solution

The stimulation leads to more thermal flow from the formation and higher cash flow; therefore investment in stimulation treatment of economically viable projects is needed.

To create efficient EGS, industrialization of geothermal energy needs a systematic and safe technique.

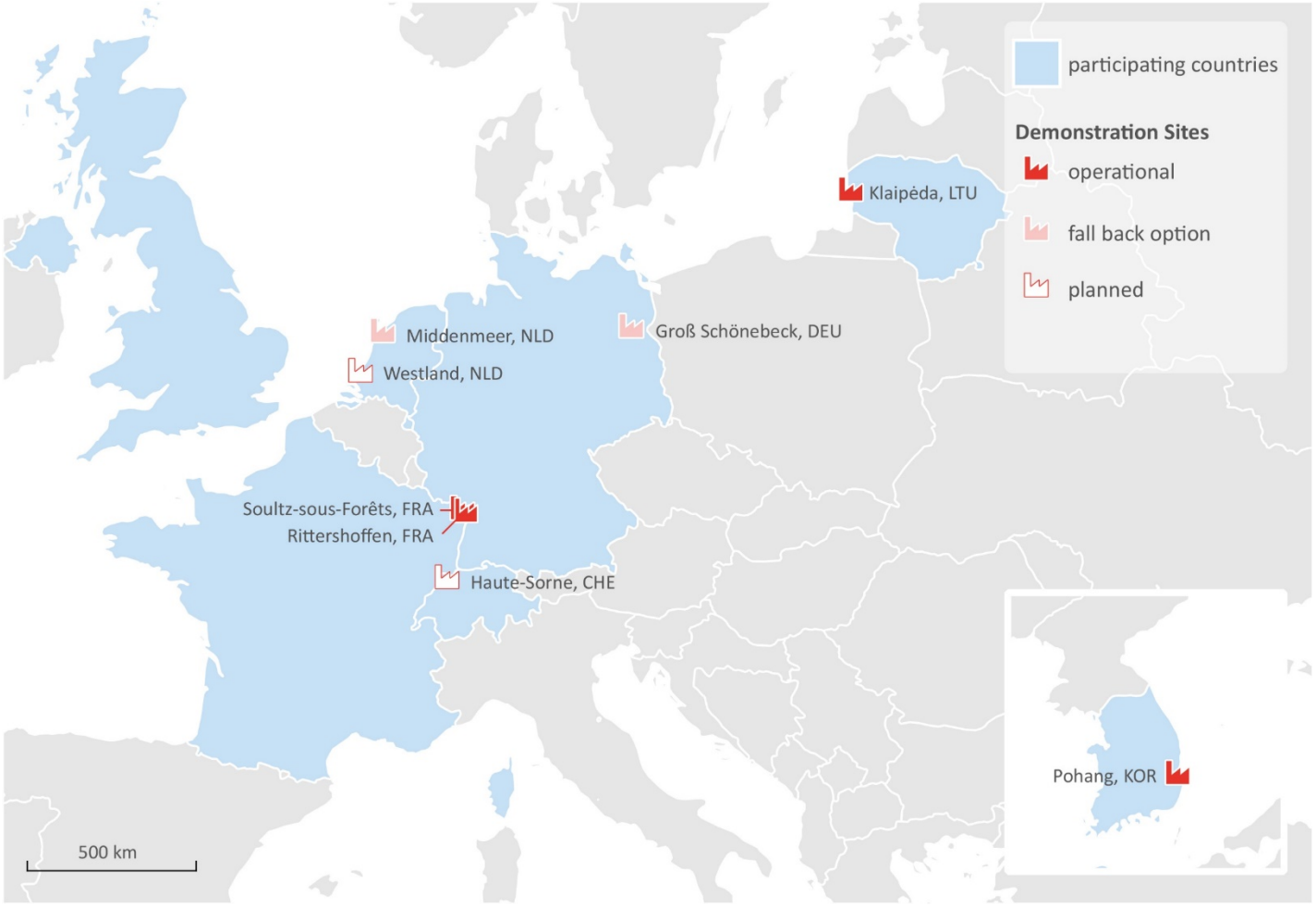
The issues of public acceptance and all market and regulatory barriers including financing and other supply-side issues of relevance are influencing the business.



Cash flow and net present value of a EGS project

How DESTRESS Tests Its Concept

Participating Countries and Demonstration Sites



Site Access Programme

The DESTRESS Access Programme invites you to visit its geothermal project sites for knowledge exchange and in-depth training. DESTRESS offers virtual (data) and physical access to its sites. The courses are taking place in the DESTRESS partnering countries.

WHO
Anyone with a strong interest in geothermal energy, including researchers, industry representatives, journalists and politicians is welcome to take part.

WHEN
Detailed information will be published on the DESTRESS website at least two months in advance and advertised in the DESTRESS newsletter.

More information on www.destress-h2020.eu/demonstration-sites/visit-demonstration-sites

Foreseen Stimulation Techniques

Borehole configuration

doublet | single well | sw with one fracture | sw with laterals | sw with multistage fractures

Treatments

hydraulic injections | chemical injections | thermal injections

Pumping

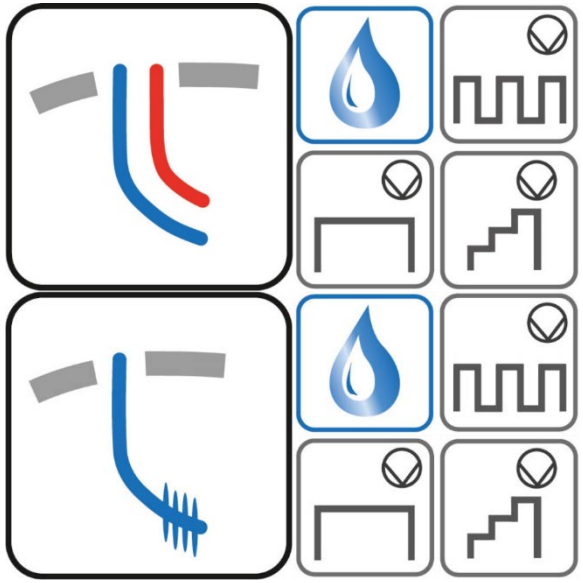
continuous | cyclic | stepwise increase

Haute-Sorne, Switzerland

Operator: Geo-Energie Suisse AG

WP No: 5

Status: Drilling starts in 2017



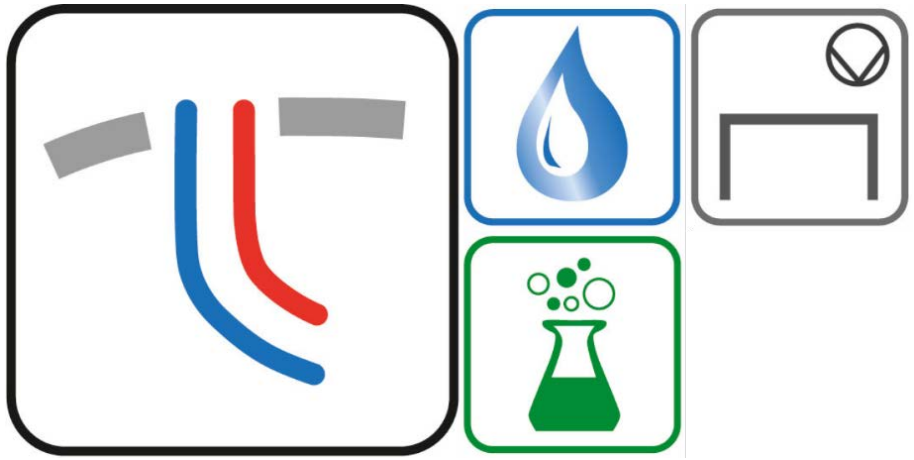
Foreseen Stimulation Techniques	Multi-stage shear stimulation
Type of Use	Provision of electricity
Soil Condition	Granite
Production Horizon	not known yet
Upper Depth (m)	5000
Thickness (m)	1700
T (C°)	170
Salinity (g/l)	no data available

Klaipėda, Lithuania

Operator: Geoterma

WP No: 4

Status: 4 wells since late 1990s



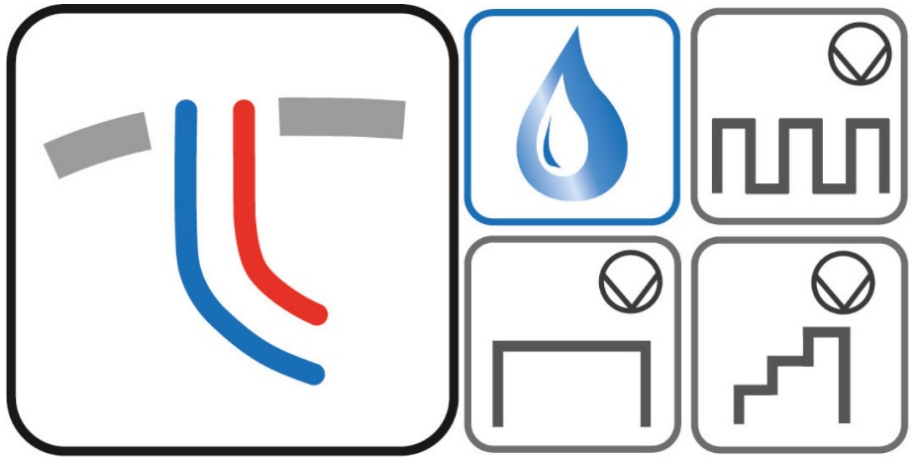
Foreseen Stimulation Techniques	Optional drilling radials, cleaning, cross flow, and stimulation techniques: Acid (HCL and/or HCL-HF)
Type of Use	District Heating system
Soil Condition	Clastic rocks (SS) of the low-enthalpy geothermal resources
Production Horizon	Lower Devonian (Viesvile formation)
Upper Depth (m)	990
Thickness (m)	128
T (C°)	38
Salinity (g/l)	108

Pohang, South Korea

Operator: NexGeo

WP No: 5

Status: 2 wells in 2016



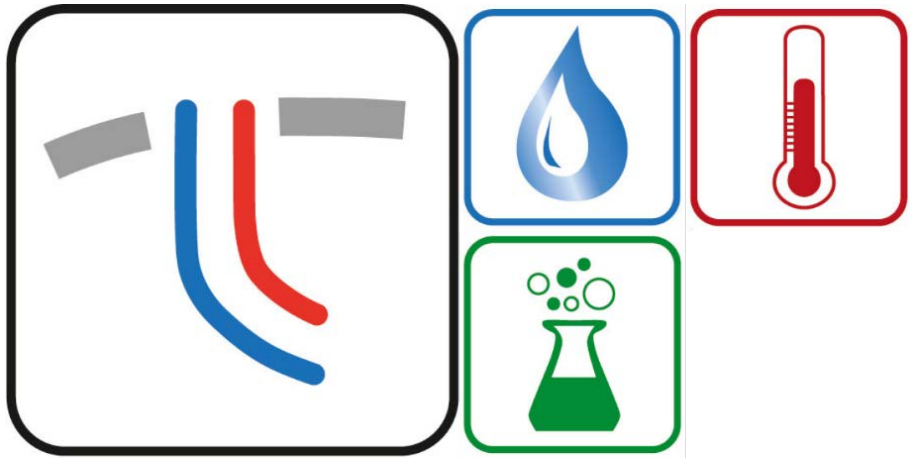
Foreseen Stimulation Techniques	Cyclic hydraulic stimulation (optional: multi-stage fracturing)
Type of Use	Provision of electricity
Soil Condition	Granodiorite formation
Production Horizon	Fractured granite/granodiorite
Upper Depth (m)	4248
Thickness (m)	>1000
T (C°)	140
Salinity (g/l)	<1

Rittershoffen, France

Operator: és Géothermie

WP No: 4

Status: 2 wells finished and stimulated in 2014



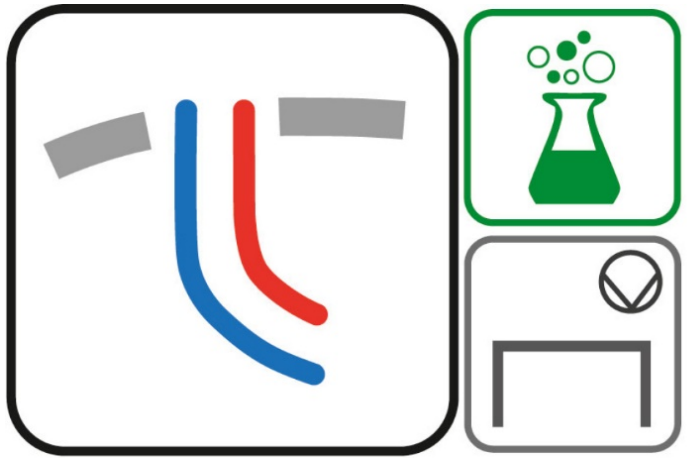
Foreseen Stimulation Techniques	THMC-Stimulation techniques performed 2013
Type of Use	Heat for (green) chemical industry
Soil Condition	Fractured clastic rocks (SS) and fractured granite with high temperature geothermal resources
Production Horizon	Fractured Triassic sandstone & carboniferous fractured granite
Upper Depth (m)	2600
Thickness (m)	680
T (C°)	>160
Salinity (g/l)	~100

Soultz-sous-Forêts, France

Operator: G.E.I.E. / EOST

WP No: 4

Status: 2008 (1st power plant) and 2016 (2nd power plant, currently in operation)



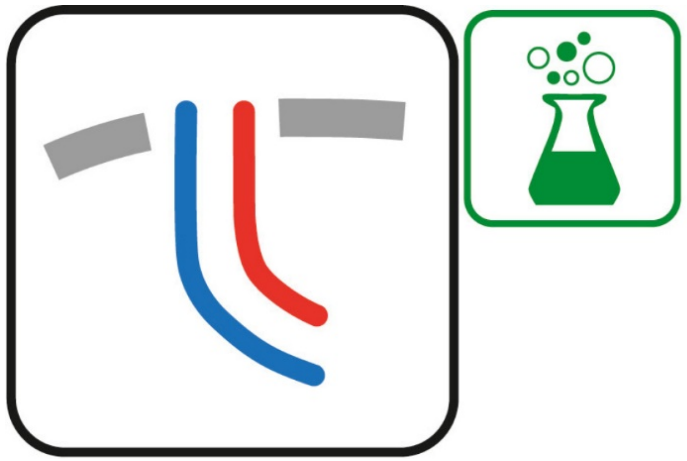
Foreseen Stimulation Techniques	Core treatment, injection tests in GPK4
Type of Use	ORC: 1.5 MWe gross power
Soil Condition	Fractured granite with high temperature geothermal resources
Production Horizon	Carboniferous fractured granite
Upper Depth (m)	5000
Thickness (m)	500
T (C°)	200
Salinity (g/l)	~100

Westland, Netherlands

Operator: Trias Westland

WP No: 4

Status: Drilling starts in 2017



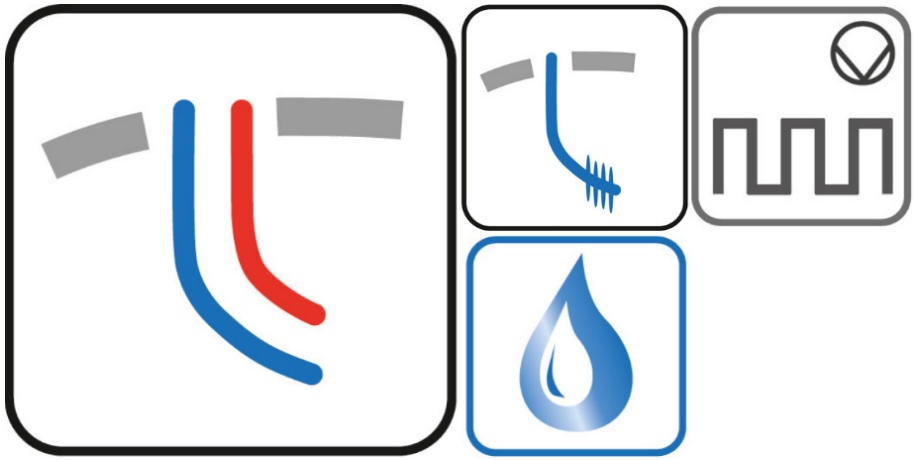
Foreseen Stimulation Techniques	Acid (HCL and/or) HCL-HF). Option: (tensile) fracturing or thermal stimulation
Type of Use	Heat for greenhouse
Soil Condition	Clastic (fractured) rocks (SS) with low-enthalpy geothermal resources (cores available)
Production Horizon	Triassic Sandstone
Upper Depth (m)	4000
Thickness (m)	175
T (C°)	140
Salinity (g/l)	~70

Groß Schönebeck, Germany (Fall Back Option)

Operator: GFZ

WP No: 5

Status: 3rd Well in 2018



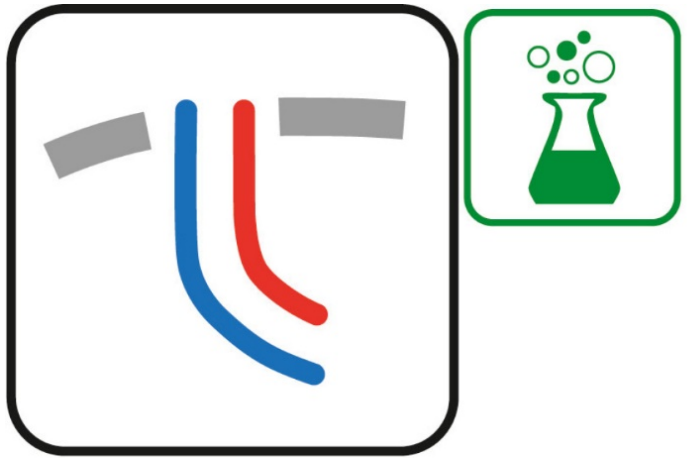
Foreseen Stimulation Techniques	Multistage (tensile and shear) fracturing
Type of Use	Geothermal Research Platform
Soil Condition	Tight sandstone and volcanic rocks
Production Horizon	Rotliegend
Upper Depth (m)	4200
Thickness (m)	200
T (C°)	150
Salinity (g/l)	250

Middenmeer (Fall Back Option)

Operator: ECW Netwerk

WP No: 4

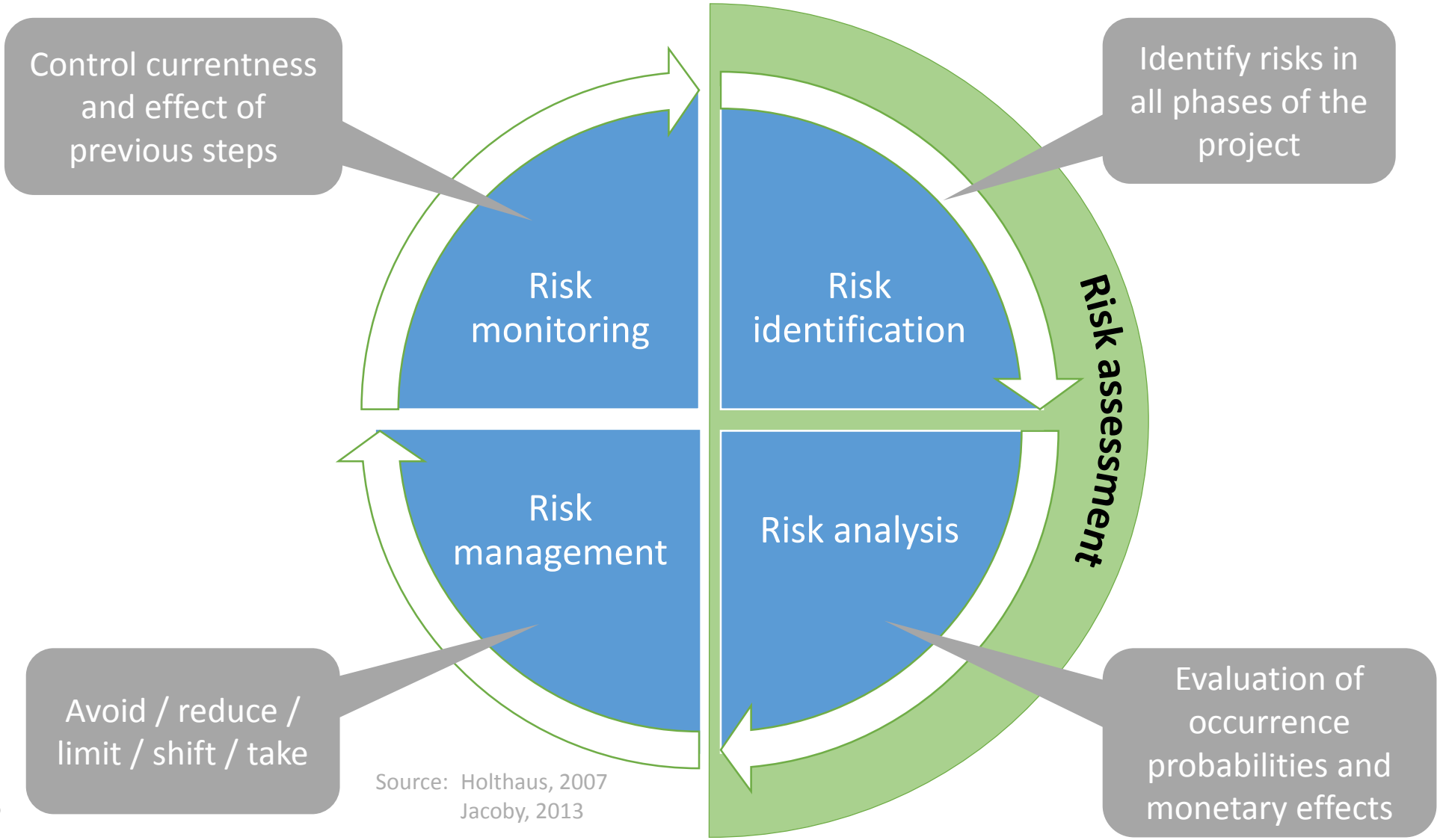
Status: 4 wells completed 2014



Foreseen Stimulation Techniques	Acid (HCL and/or HCL-HHF)
Type of Use	Heat for greenhouses
Soil Condition	Heterogeneous sandstone
Production Horizon	Rotliegend
Upper Depth (m)	2200
Thickness (m)	200
T (C°)	90
Salinity (g/l)	200

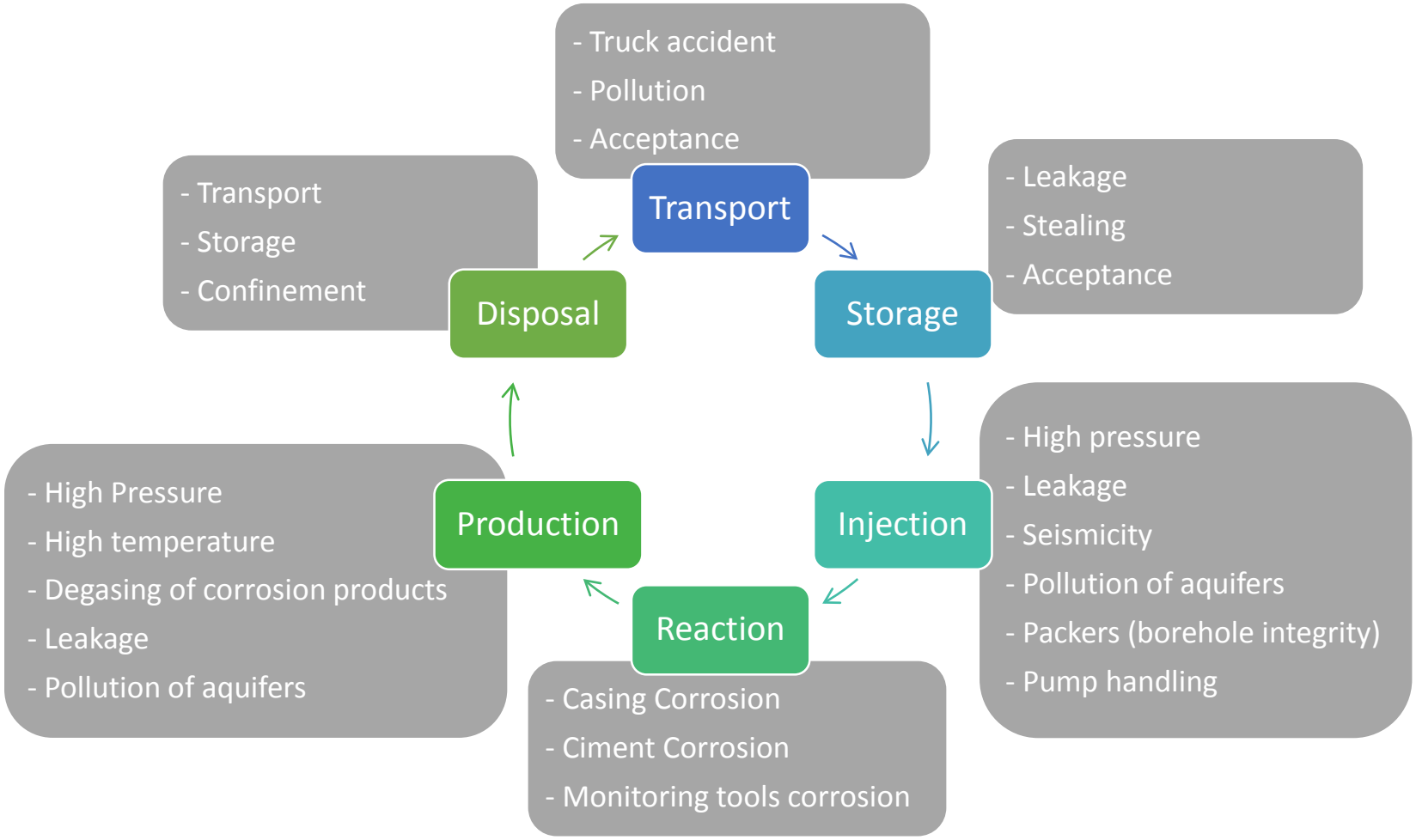
How DESTRESS Assesses Risk

Risk Management and Reduction Measures

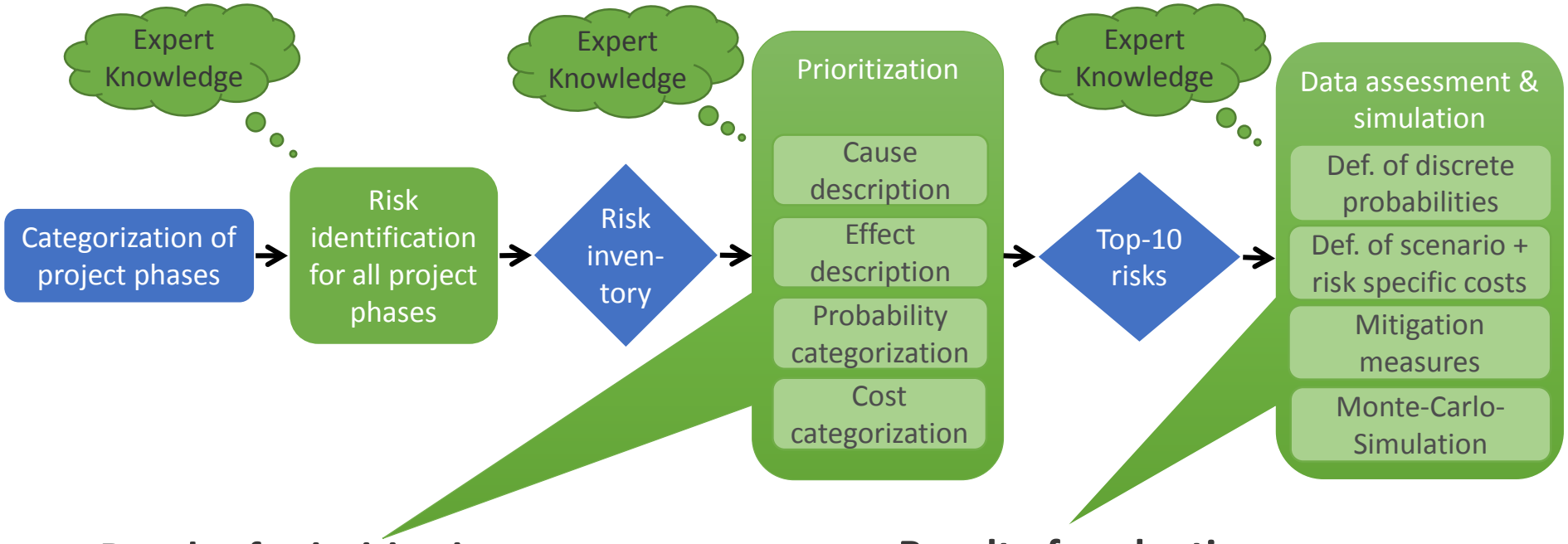


Source: Holthaus, 2007
Jacoby, 2013

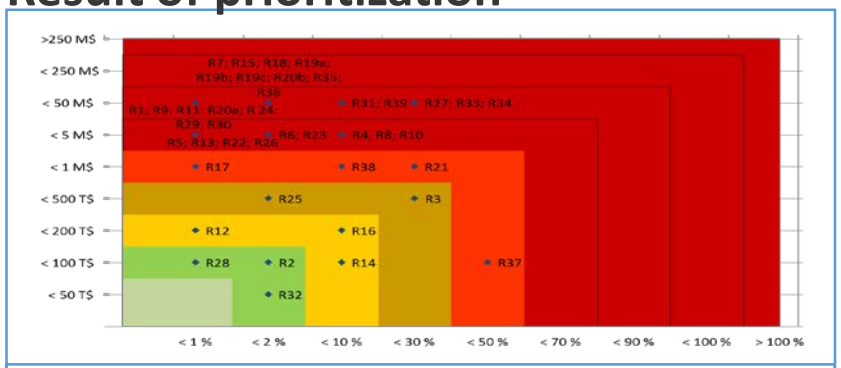
Risk Identification



Risk Analysis and Evaluation Process

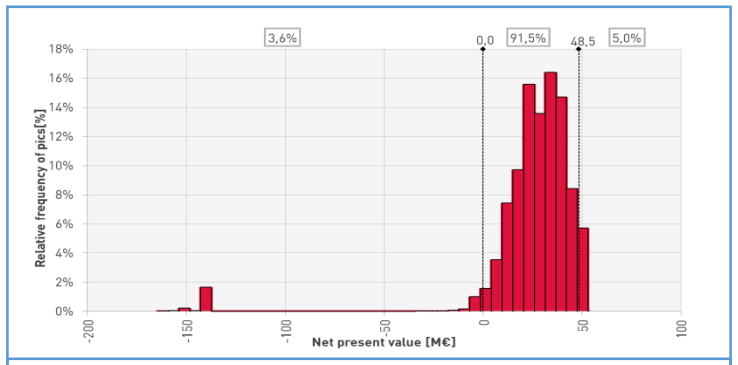


Result of prioritization



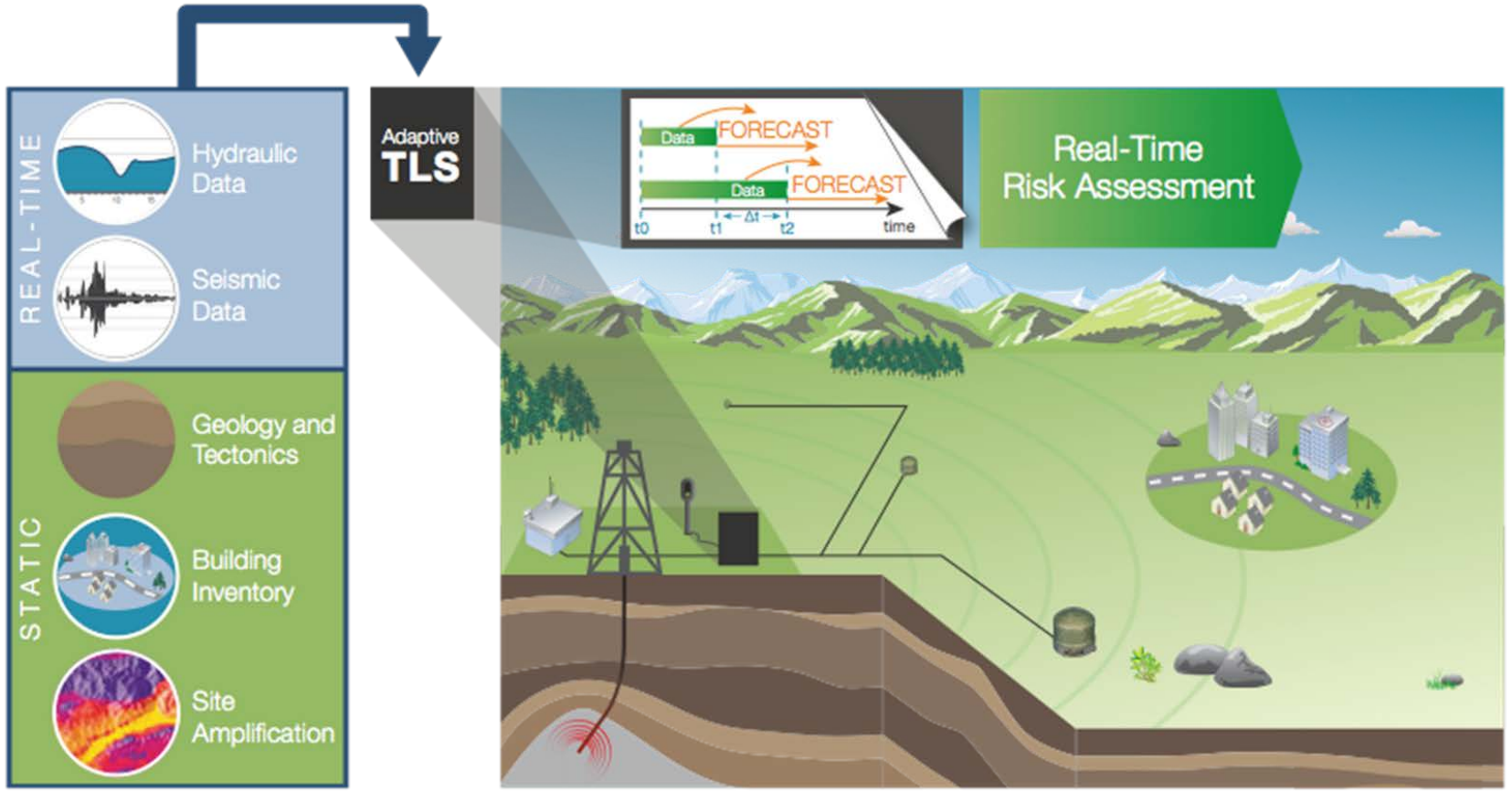
Results: Risk map

Result of evaluation



Results: E.g. distribution of NPV

Risk Monitoring



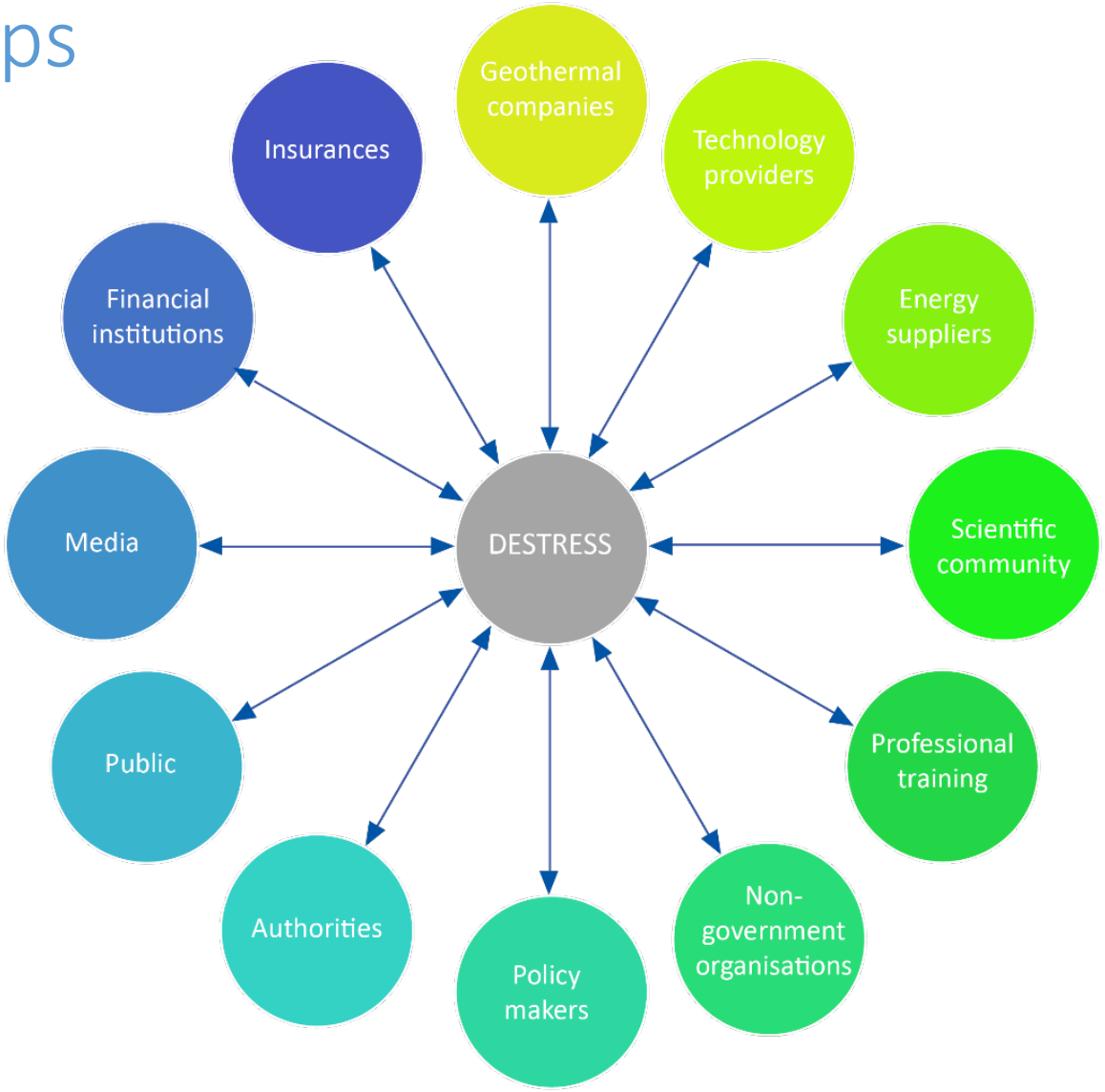
Stakeholder Network

Targeted Stakeholder Groups

The joint vision for the various stimulation treatments performed within DESTRESS is to ensure minimised environmental hazard, develop innovative approaches and risk management procedures and secure broad public acceptance. To share and spread the joint vision, DESTRESS is establishing a stakeholder network to facilitate the exchange of best practices. Become a part of it!

Learn more about the stakeholder network:

www.destress-h2020.eu/stakeholder



Your Interest and Our Offer

Your interest	Our offer
Familiarity or concern with geothermal energy issues in Europe	Involvement in knowledge, development and technology transfer
Link to research on geothermal energy	Exchange of good practices
Commitment to exploit DESTRESS results	Access to our demonstration sites and latest research
Willingness to support the vision of accelerated deployment of EGS	Invitations to attend internal conferences

Contact Details

Project Lead

Project lead
GFZ German Research Centre for Geosciences
Telegrafenberg, 14473 Potsdam (Germany)
www.gfz-potsdam.de/en/home

Project coordinator
Prof. Ernst Huenges
huenges@gfz-potsdam.de
+49 (0)331 288 1440

Project manager
Dr. Justyna Ellis
ellis@gfz-potsdam.de
+49 (0)331 288 1526