Overview of current European geothermal research

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&

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General representation at EU level

- **EGEC** – European Geothermal Energy Council
  ”The voice of the Geothermal Sector in Europe”
- **IGA** – International Geothermal Association
  European Branch
- **TP RHC –** Technology Platform
  Renewable Heating and Cooling
- **IEA-GIA** – International Energy Agency
  Geothermal Implementing Agreement
- **ERA Net** – Geothermal Energy
- **EERA JPGE** – Joint Programme on
  Geothermal Energy in the
  European Energy Research Alliance

EERA – JPGE Participants

2010

Short Name	Country
BRGM	France
CEGL	Italy
CNR	Italy
CNRS	France
CRES	Greece
ETH Zürich	Switzerland
GFZ Potsdam	Germany
ISES	Netherlands
ISOR	Iceland
KIT	Germany
LIAG	Germany
TNO	Netherlands

12 participants
7 countries
~250 persons

2012

Short Name	Country
Uni Neuchâtel	Switzerland
ENEA	Italy
INGV	Italy
LNEG	Portugal
PT Milano	Italy
BGS	UK
RWTH Aachen	Germany
U Torino	Italy
VITO	Belgium
IFE	Norway
U Bari	Italy
U Trieste	Italy
TU Darmstadt	Germany

25 participants
11 countries
~350 persons

2013

Short Name	Country
TÜBITAK	Turkey
OGS	Italy
PT Torino	Italy
IRIS	Norway
GZ Bochum	Germany
Sintef	Norway
Uni Bergen	Norway
Uni Roma Tre	Italy
…	

Current status:
30+ participants
12 countries
~400 persons

EERA
European Energy Research Alliance
Joint Programme Geothermal Energy

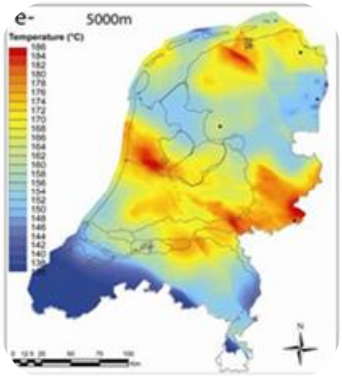
EERA-JPGE – Structure and Programme

SP5

SUSTAINABILITY, ENVIROMENT AND REGULATORY FRAMEWORK

SP1

RESOURCE ASSESSMENT

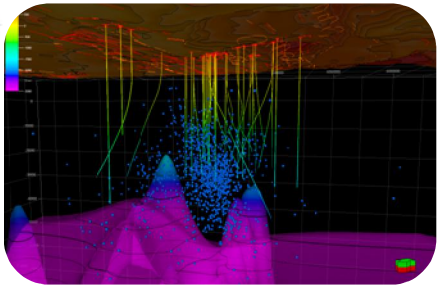


Overall goal

Development of new cost-effective technologies suitable for a sustainable growth of geothermal energy in Europe and worldwide

SP2

EXPLORATION



SP4

PROCESS ENGINEERING AND MANAGEMENT OF GEOTHERMAL SYSTEMS

SP 3

ACCESSING AND ENGINEERING A RESERVOIR

EERA
European Energy Research Alliance
Joint Programme Geothermal Energy

Research programmes of the EU
The Framework Programmes for RTD

- 7 Geothermal projects in FP6
- 4 Geothermal projects in FP7 (one ongoing)
- Current framework programme: Horizon 2020

SIXTH FRAMEWORK PROGRAMME

SEVENTH FRAMEWORK PROGRAMME

Recent and Ongoing Projects on Deep Geothermal Energy

- ***FP7:***
  - **GEISER** - **G**eothermal **E**ngineering **I**ntegrating Mitigation of **I**nduced **SE**ismicity in **R**eservoirs (finished 2013)
  - **IMAGE - I**ntegrated **M**ethods for **A**dvanced **G**eothermal **E**xploration (2013-2017)
- ***Horizon 2020:***
  - Call **LCE 2 – 2014** Development of new drilling technologies and concepts for geothermal energy (projects started)
  - Call **LCE 2 – 2015** Development of new technologies and concepts for geothermal energy (4 proposals in stage 2 evaluation)
  - Call **LCE 3 – 2015** Testing of enhanced geothermal systems in different geological environments (evaluation started)
- ***IEE:*** **GEOELEC** (2011-2013), **GEODH** (2012-2014)

GEISER

Geothermal Engineering Integrating Mitigation of Induced SEismicity in Reservoirs

Project Duration:	42 months
Start:	January 2010
Budget:	7 Mio € (5.3 Mio € contribution from EC)
Partners	13 partners (2 industry) from 7 countries
Co-ordinator	GFZ Potsdam

GEISER
Geothermal Engineering Integrating Mitigation of Induced Seismicity in Reservoirs

SEVENTH FRAMEWORK PROGRAMME

TNO innovation for life

GEISER Experience (2009-2013)

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News › World news › Switzerland

Swiss geothermal power plan abandoned after quakes hit Basel

Designer of 'hot rocks' scheme under city on a fault line could face jail over damage to property

understanding M_{max}

GFZ
BRGM
ETH
ISOR
TNO
KNMI

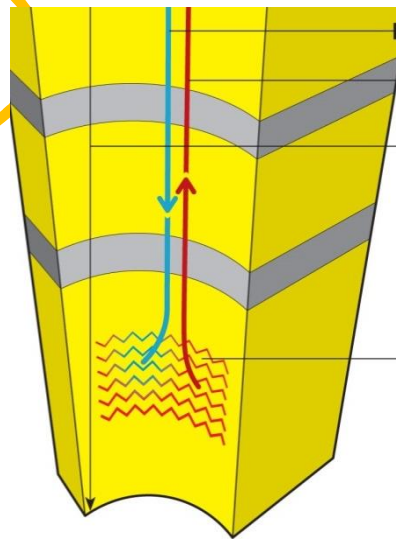
WP 3: Data Analysis

WP 4: Process Understanding (Geomechanics)

WP 5: Seismic Hazard Assessment (PSHA)

Key output:
- Indicator selection
- Thresholds
- Reaction plan

WP 6: Strategies (EGS operation & regulation)



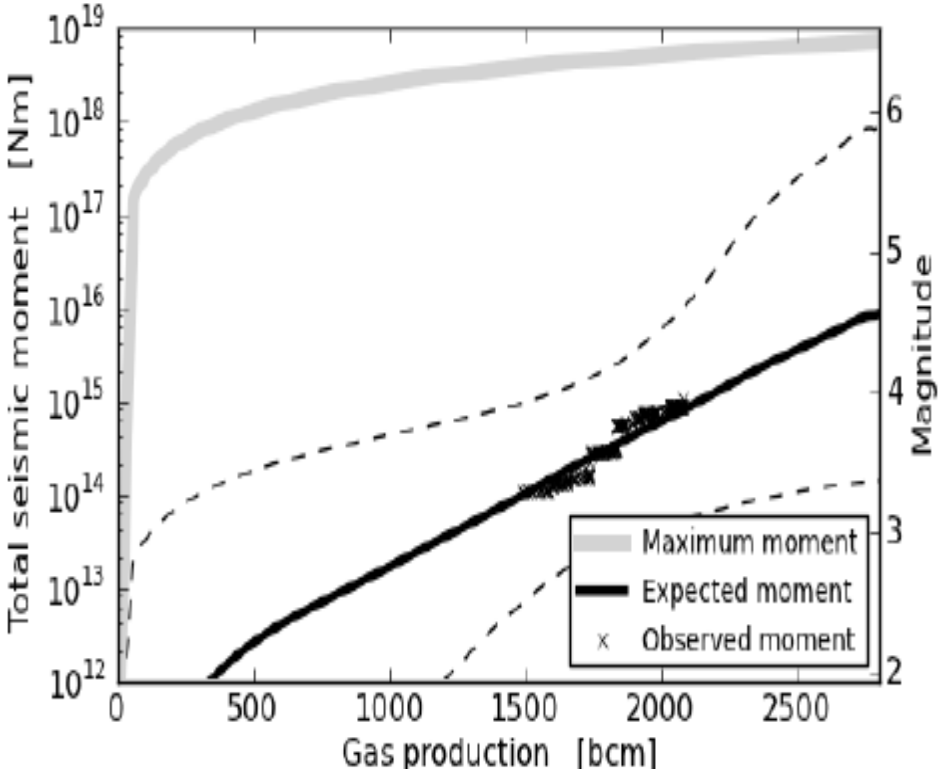
http://www.geiser-fp7.fr/ReferenceDocuments/Pages/ReferenceDocuments.aspx

GEISER - Project goals

- Understand processes and mechanics of induced seismicity in geothermal systems
- Develop mitigation strategies
- Provide legal and administrative guidelines for licensing of geothermal power generation

INDUCED SEISMICITY DUE TO GAS DEPLETION

STATUS 2014/2015



Versterking woningen gaswinningsgebied miljardenklus

Economie | Laatst gewijzigd:07-06-2014 11:54 | Martjan Kuit en Joost Zwaga |

1/1 Klik om de foto te vergroten

Assen - De Nederlandse bouwsector staat voor een opgave van ongekende omvang: 40.000 gebouwen in het Groningse gaswinningsgebied wachten komende jaren op schadeherstel of bouwkundige versterking.

Het gaat om een klus die in het uiterste geval kan oplopen tot maximaal 10 miljard euro. De Nederlandse Aardolie Maatschappij (NAM) maakte de getallen vandaag openbaar tijdens een druk bezochte consultatiedag in Assen, waar bouwers, ingenieursbureaus en andere marktpartijen warm werden gemaakt voor 'de Deltawerken 2.0', zoals het project binnen de NAM wordt genoemd. Alleen al tot 2020 wil de aardoliemaatschappij jaarlijks tussen de tweeduizend en vijfduizend gebouwen aanpakken.

Publicatie datum: 07-06-2014 11:54

Kamp beperkt gaswinning Groningen voorlopig en stelt definitieve besluit uit

NAM, technical addendum to production plan, 2014

IMAGE

Integrated Methods for Advanced Geothermal Exploration

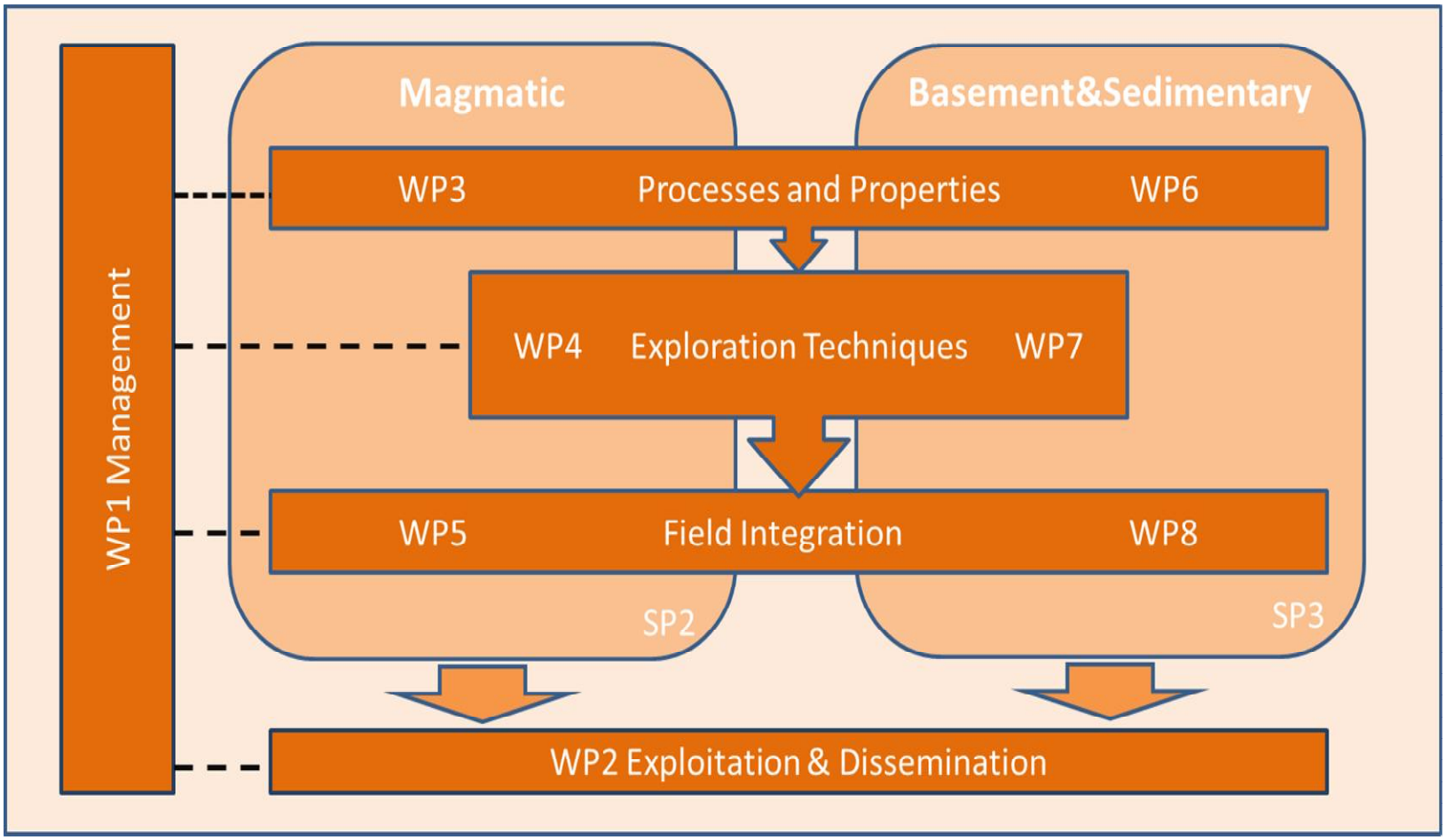
Project Duration:	48 months
Start:	November 2013
Budget:	13 Mio € (10.3 Mio € contribution from EC)
Partners	19 partners (4 industry) from 7 countries
Co-ordinator	TNO

IMAGE: Objectives

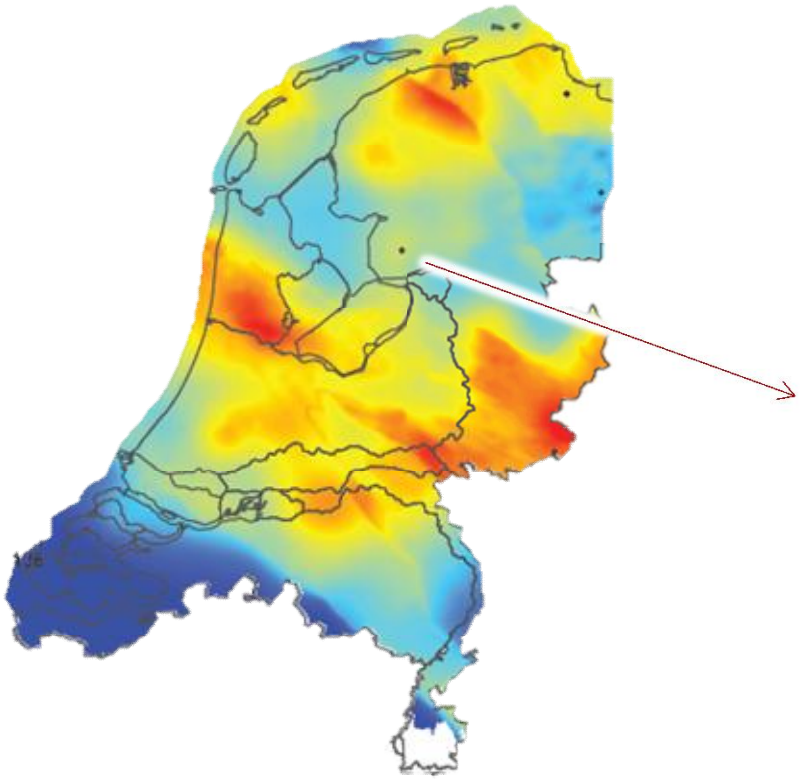
Develop reliable exploration methods for site characterization and well-siting

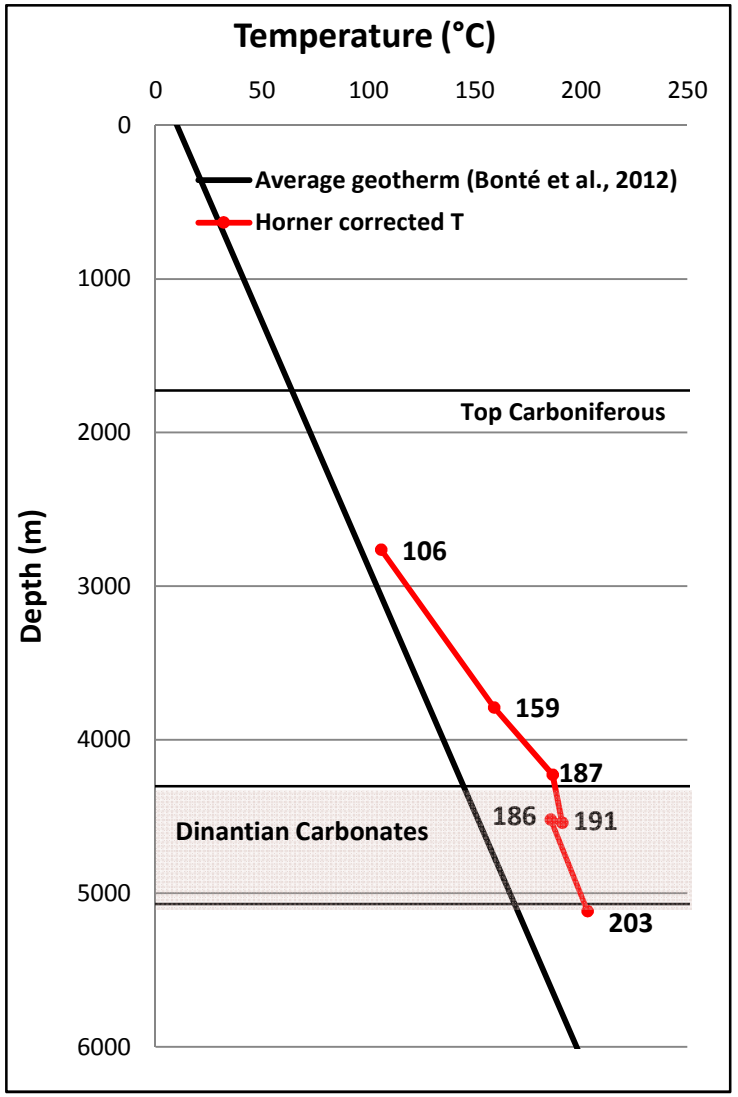
- **Understand processes and parameters** for prediction of the critical exploration parameters from continental to local scales
- **Develop exploration techniques** to improve assessment of critical exploration parameters by data-acquisition and processing in
  - Passive and active seismic
  - Electro-Magnetic methods
  - Temperature measurement, geothermometers and tracers
  - Fieldwork and stress measurement
  - To test the developed exploration techniques on selected sites of the industry partners
- **Develop and demonstrate integrated sound methods for site characterisation and well-siting in field integration**.

IMAGE: Project Matrix



Luttelgeest thermal anomaly





Temperature gradient – LTG-01	°C/km
Above Dinantian	54.3
Dinantian Carbonates	20.0
Complete dataset	39.0
Average Netherlands	31.1

Van Oversteeg et al., 2014. SGW proc

Why GeoElec?

- set geothermal on the energy agenda of EU Member States
- convince decision-makers about the potential of geothermal electricity in Europe
- stimulate banks and investors in financing geothermal power installations
- attract potential investors such as oil and gas companies and electrical utilities to invest in the geothermal power

Achievements in brief

- resource assessment for geothermal electricity in Europe (GeoElec Viewer)
- software to estimate financial viability of geothermal projects
- factsheets with newest numbers on markets, potential, finance, work, regulations, and public acceptance
- training courses for stakeholders from industry and R&D
- promotional workshop in Utrecht with 50 stakeholders

GEOELEC

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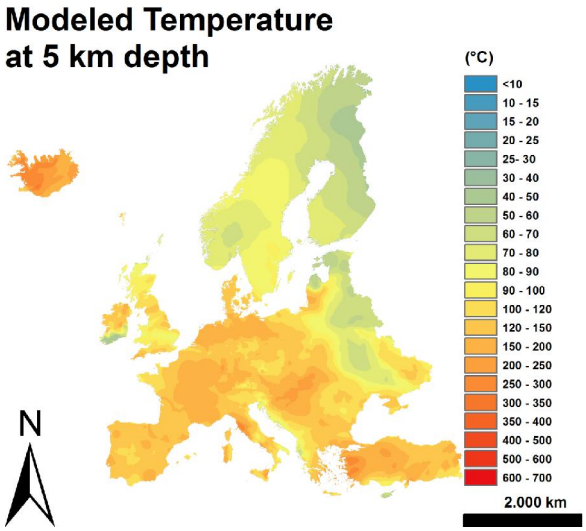
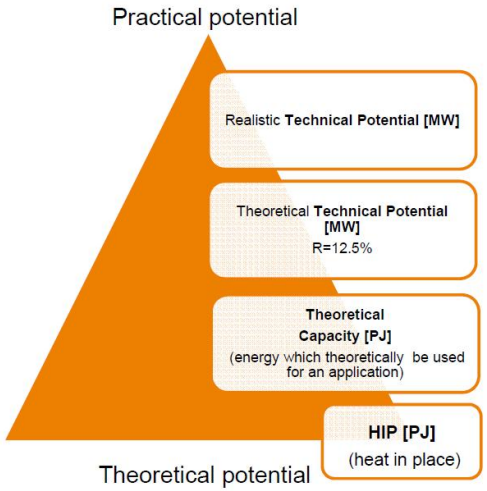
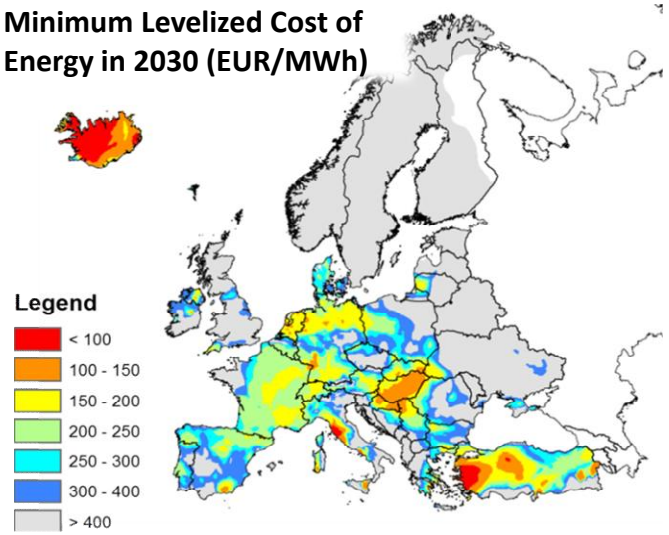
GeoElec Viewer (TNO product)

Geothermal Potential for Electricity Generation in the EU







The GeoElec Viewer presents for the first time a geothermal resource assessment from 1 to 5 km depth.

It enables users to assess estimated potential for geothermal electricity production in 2020, 2030, and 2050 in each of the EU-28 Member States plus Norway, Iceland, Switzerland, and Turkey.

GEOELEC

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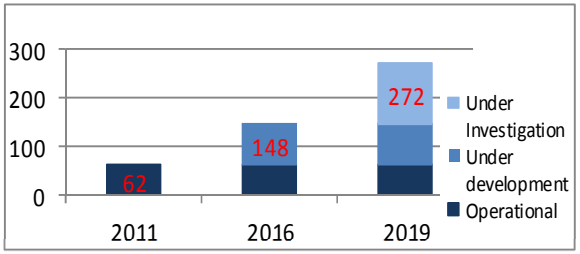
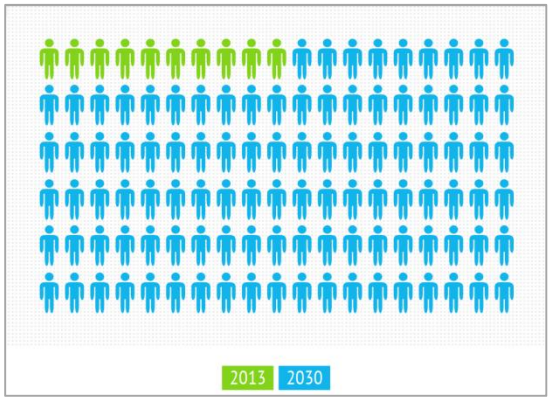
Growing business!

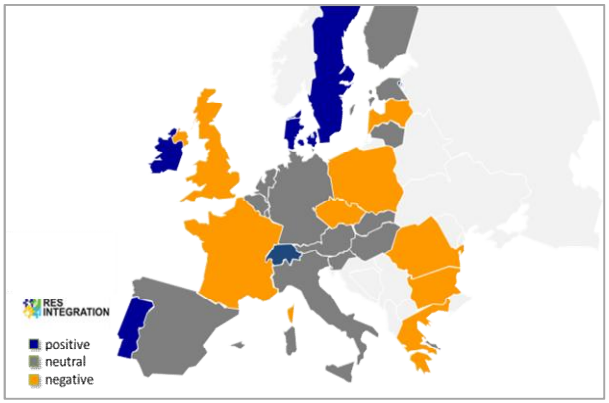
Geothermal will gain more significance in the coming decennia: markets, jobs, grid infrastructure



No. of geothermal power plants in Europe

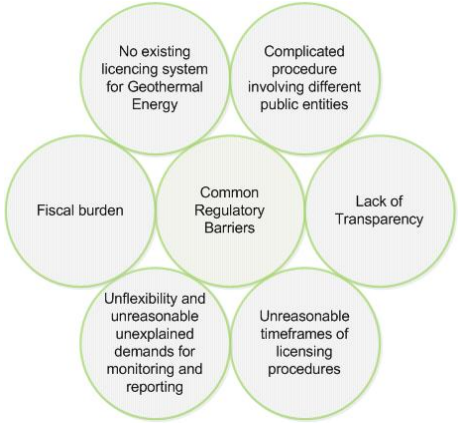


Jobs in the geothermal sector in Europe



Grid development process (Binda et al. 2012)

BUT: abolish barriers!



GEO-ELEC

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Dutch Geothermal challenges adressed in submitted (may 5th) H2020-2015 proposals

NAME	Topic	TUD/TNO [kEUR]	Dutch operators/companies [kEUR]
PRESCO	Corrosion&scaling	500	100
SURE	Radial drilling	600	100
POWER2USE	Heat storage	500	PM
DESTRESS	Soft stimulation demonstration	700	500
GEOWELL	Well completion and integrity	400	300

All numbers are crude estimates