Geothermal ERA-NET

OpERA

Operational Issues of Geothermal Energy Installations in Europe

Expert Workshop
1 + 2 October 2015
Vaals (NL/D)

Hjalti Páll Ingólfsson
Project Manager

Geothermal ERA NET Coordination Office

The Geothermal ERA NET is supported by the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 291866

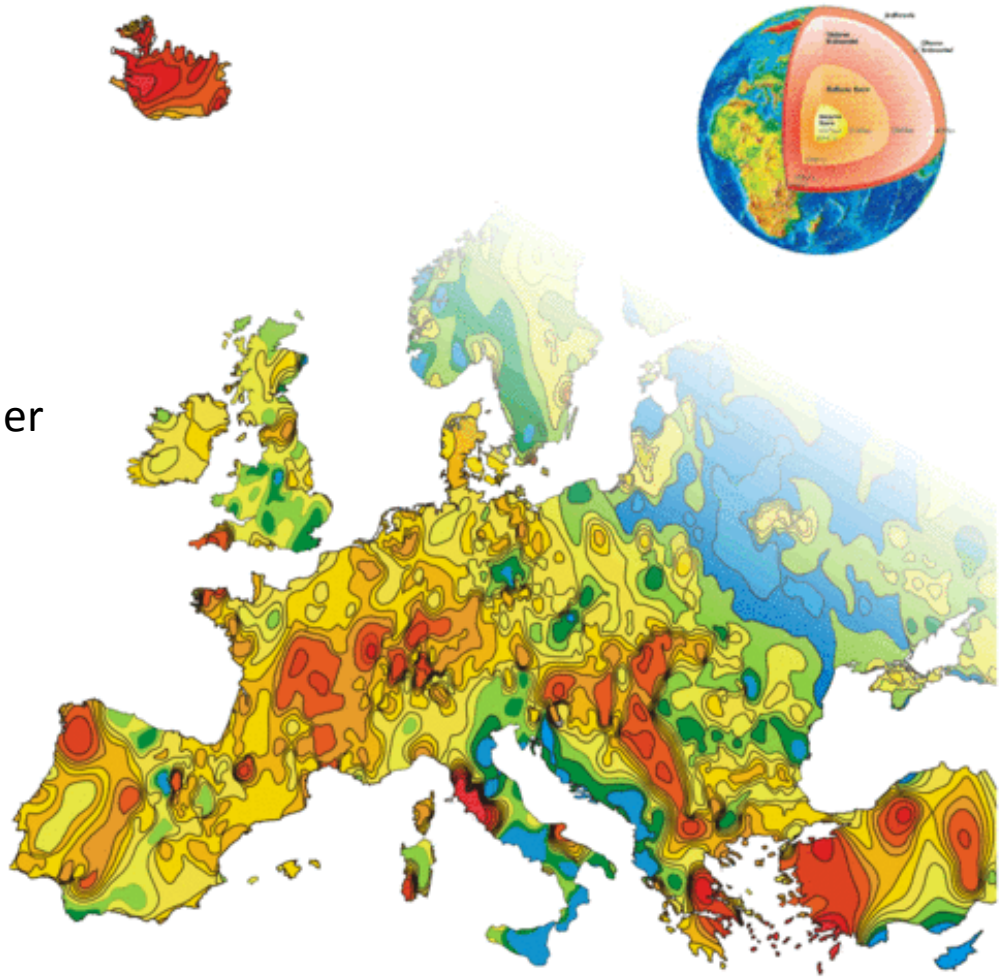
Geothermal energy contributes to the Energy Union

Geothermal energy is environmentally friendly.

It produces reliable baseload **power** and **heat** – all the more important to balance intermittent supplies from other renewable energy sources

Geothermal is a renewable energy source and independent of weather conditions.

Geothermal energy is indigenous and contributes to Europe's security of supply.



Geothermal ERA NET
Coordination Office
Orkustofnun, Iceland

The Geothermal ERA-NET Consortium

IS	Orkustofnun (National Energy Authority),
NL	Rijksdienst voor Ondernemend Nederland
CH	Swiss Federal Office of Energy (SFOE)
I	National Research Council of Italy (CNR)
D	Jülich (PTJ)
F	ADEME (BRGM as third party)
IS	Icelandic Centre for Research (RANNÍS)
TR	TÜBITAK (Scientific and Technological Research Council of Turkey)
SVK	Slovak Ministry of Education, Science, Research and Sport
MFIG	Hungarian Geological and Geophysical Institute
SED	Slovenian Energy Directorate
EAD	Electicidade dos Acores

Lead partner is Orkustofnun
operating the
Geothermal ERA NET Coordination Office

Started 2012 for 4 years
Budget 2 millj. €

Good geographical balance (North-West to South-East Europe) Partner countries chosen a.o. on basis of their 2020/2050 geothermal ambitions

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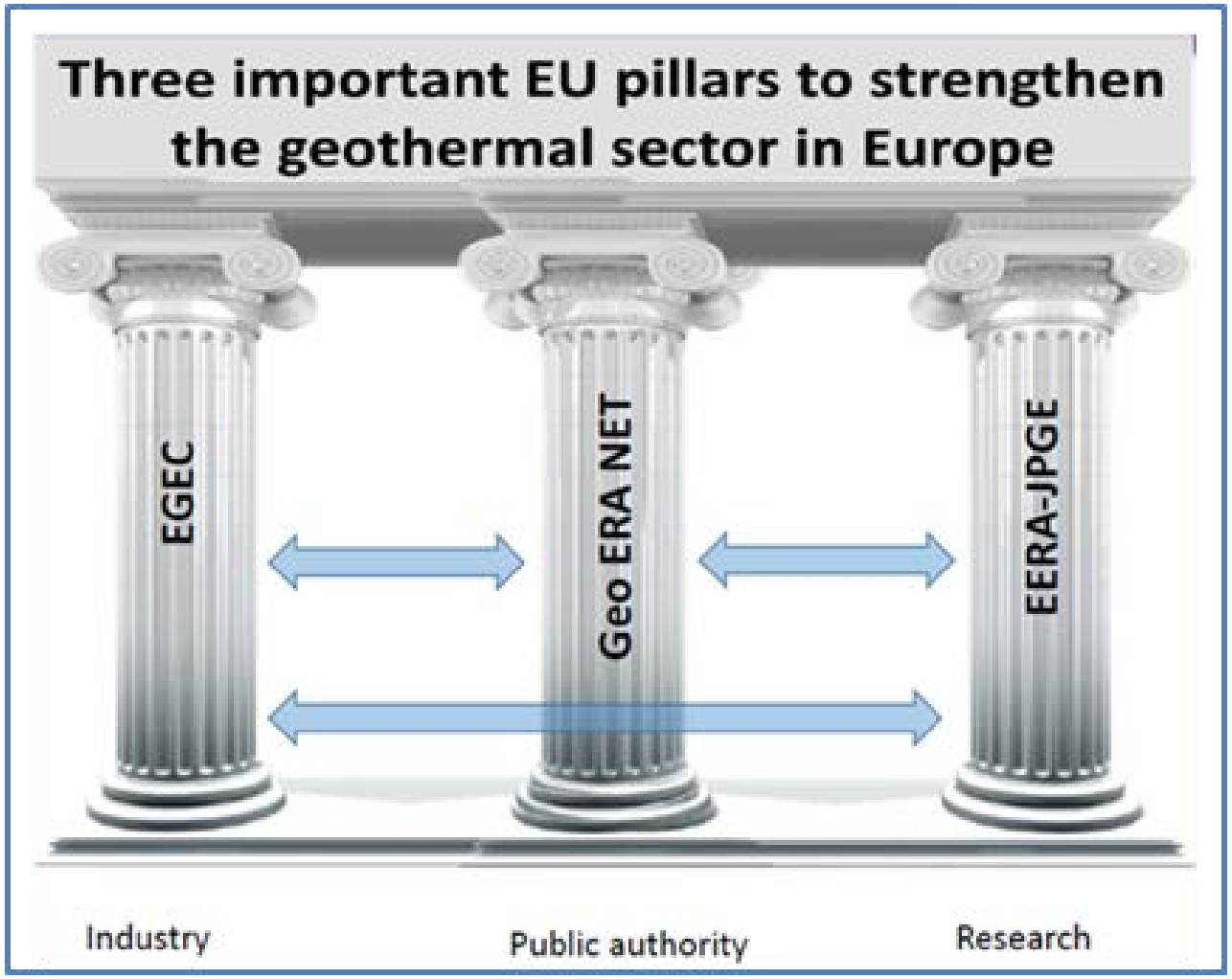
The three Pillars of the EU Geothermal Policy

ERA NET vision is to

- *minimize the fragmentation of geothermal research,*
- *build on European know-how and know-who to utilize geothermal energy*
- *structure large opportunities in the utilization of geothermal energy through **Joint Activities (JAs)**.*

One important element of the Geothermal ERA NET is to

- *link together the geothermal industry pillar, the research pillar and the policy pillar*
- *increasing cooperation and consultation between those pillars and stakeholders*
- *strengthen geothermal assessment and policy recommendation.*



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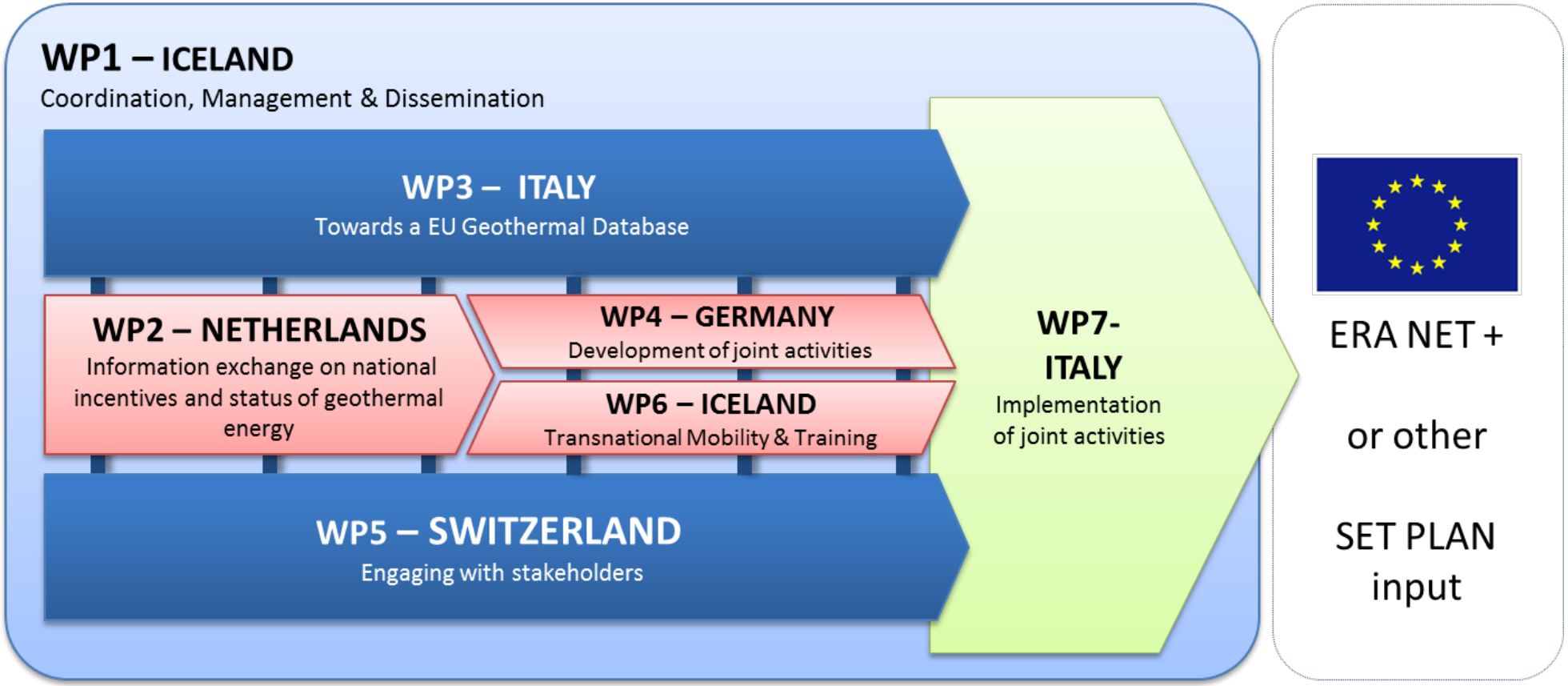
Organisational structure / work packages



Task 2.1 Initial Information Exchange

D2.1
December
2013
>ready

D2.2
October
2013
>ready

Technical & non-technical barriers & opportunities (task 2.2a

Shortlist of barriers and opportunities for geothermal development
Technical and non-technical issues

Country:

barriers

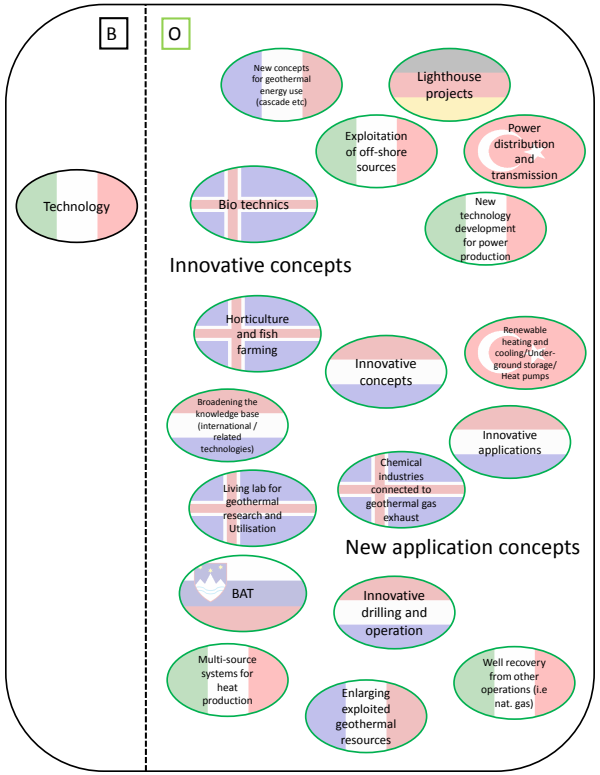
	Title	Short description	Category[1]	U[2]	I[3]	S[4]

opportunities

[1] Distinguish between (one or more of): technical (T); (geological) risk (R); environmental (E); legal/regulatory (L); financial (F); social (S), or other (O) (please specify).
[2] Urgency U. Distinguish between urgent (++) and mid/long term issue (+).
[3] Importance I. Distinguish between High importance (++), important (+) and less important (-). This column may be left blank. Default is + (important).
[4] Sector S - which sector(s) consider this a barrier/opportunity. Distinguish between Users/Developers/Investors of geothermal projects (U), Geothermal Industry (I), Research community (R), Government/Ministry (M), other...

10-bullet lists
(per country)

clustering
workshop



Report
(barriers &
opportunities)

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Technical/non-technical barriers & opportunities

7 B&O clusters

A1 Regulations	
A2 Economics & risk-mitigation	a investment
	b operational support
	c risk mitigation
A3 New/innovative concepts and applications	
A4 Operational issues	
A5 Sub-surface knowledge/data	
A6 Structuring the geothermal sector	
A7 Public and education	a public acceptance
	b visibility & dissemination
	c education and training

report
> ready
sep'14

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Future RD&D needs for geothermal development (task 2.2b PTJ/RvO)

Shortlist of RD&D needs for geothermal development

From first idea to field tests and demos; from subsurface to utilisation issues; supply and demand side; long and short term.

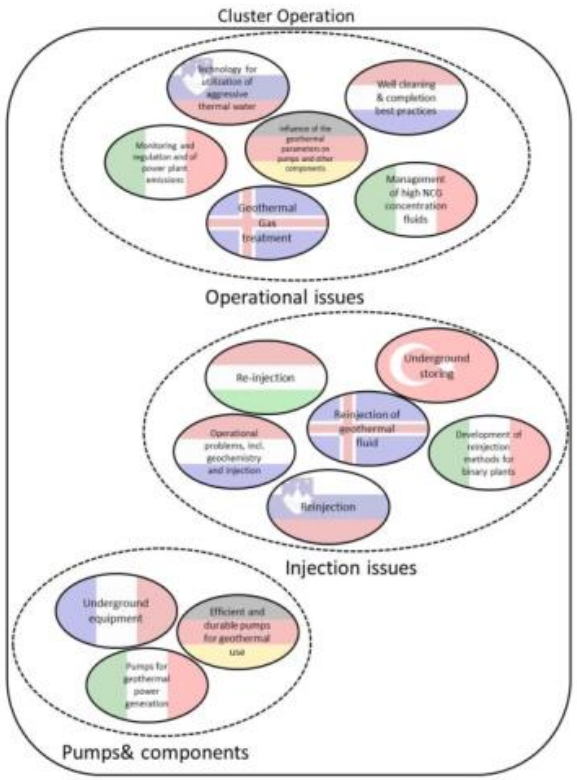
Country:

	Title	Short description	Keywords[1]	R&D or DM[2]	U[3]	I[4]	S[5]
6							
7							
8							
9							
10							

[1] Describe the RD&D needs with one or more keywords. Suggestions: Geology, Analysis/monitoring techniques, Drilling, Operation, Electricity, Direct use, ORC, new applications, EGS, well stimulation, induced seismicity, High enthalpy, new concepts, ... (your own characterisations)
[2] Distinguish between paper/lab-scale work (R&D); field tests and demonstration (DM); and other (O) (please specify)
[3] Urgency U. Distinguish between urgent (++) and mid/long term issue (+).
[4] Importance I. Distinguish between High importance (++), important (+) and less important (-). This column may be left blank. Default is + (important).
[5] Sector S – which sector(s) consider this an RD&D need. Distinguish between Users/Developers/Investors of geothermal projects (U), Geothermal Industry (I), Research community (R), Government/Ministry (M), other...

10-bullet lists
(per country)

clustering
workshop



report

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RD&D needs

RD&D clusters

B1 Reservoirs	A reservoirs (general)
	B reservoir modelling
	C reservoir exploration
B2 Operation	A operational issues
	B injection issues
	C pumps & components
B3 PR & data	A dissemination
	B acceptance
	C reporting code/statistics
B4 New concepts	A innovative concepts
	B heat
	C power cycle
B5 Anthropogenic influence	A reservoir creation
	B seismicity
B6 Drilling	

report
> ready
sep'14

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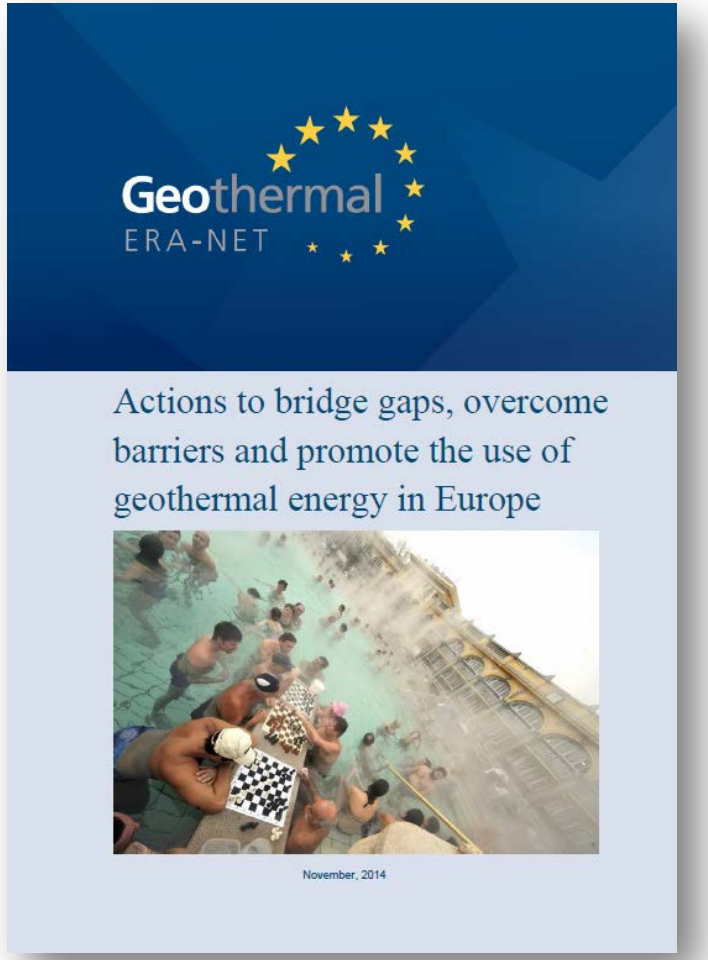
Orkustofnun, Iceland

Propose (joint) actions

> ready nov ’14

> basis for wp4:
development of joint activities

> All reports available on: www.geothermaleranet.eu



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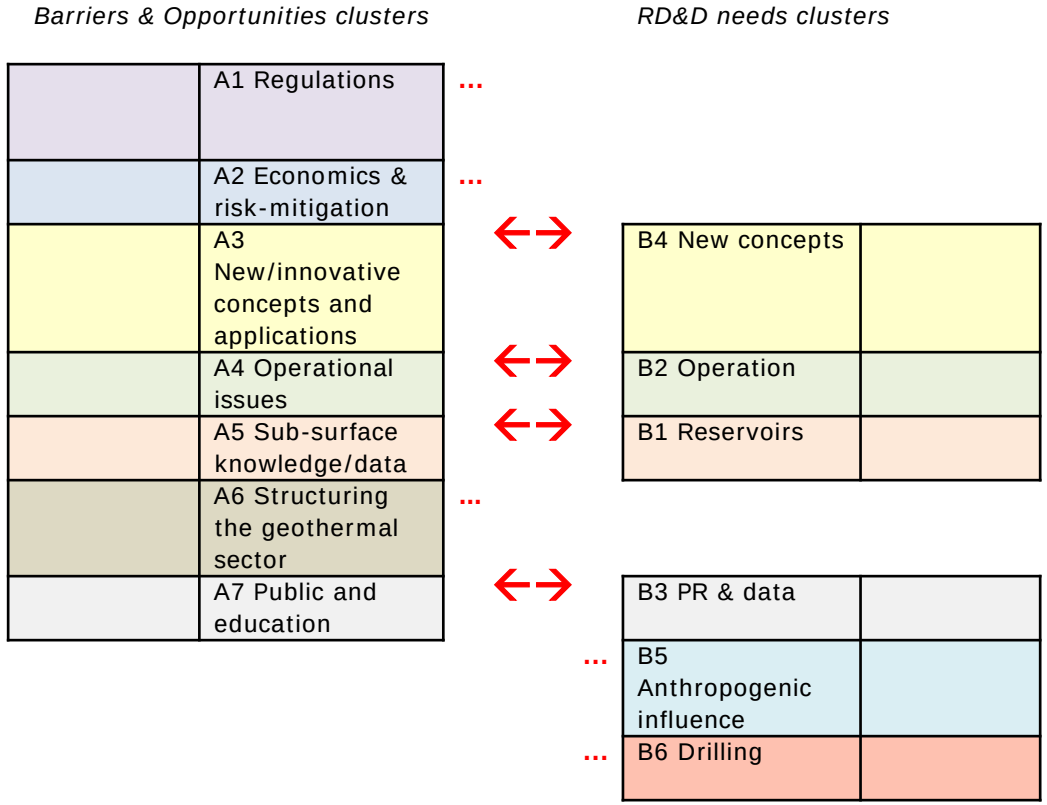
Common Challenges in Geothermal EraNet countries



9 clusters

1. Regulations (A1)
2. Economics & Risk-mitigation (A2)
3. New/innovative concepts & applications (A3/B4)
4. Operation (A4/B2)
5. Subsurface/reservoir knowledge (A5/B1)
6. Structuring the geothermal sector (A6)
7. Public & Education (A7/B3)
8. Anthropogenic Influence (B5)
9. Drilling (B6)

All clusters are relevant for the progression of geothermal energy in Europe

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Coordination Office
Orkustofnun, Iceland

How to collaborate?

JA1 Information exchange (groups)

regular meetings, workshops, visits, idea factories, etc.:

JA2 Joint work

Joint assignment: detailed study on specific issue

JA3 Joint call

Jointly developing new insights, new systems

- Appropriate (and feasible) JA-type should be chosen for a specific challenge
- JA's can evolve from JA1 > JA2 > JA3
- Effectiveness/Impact more important than amount of €'s

How to start/organise joint activities ?

- Bottom-up
- Bi- or multilateral
- Based on countries preferences (within the clusters)

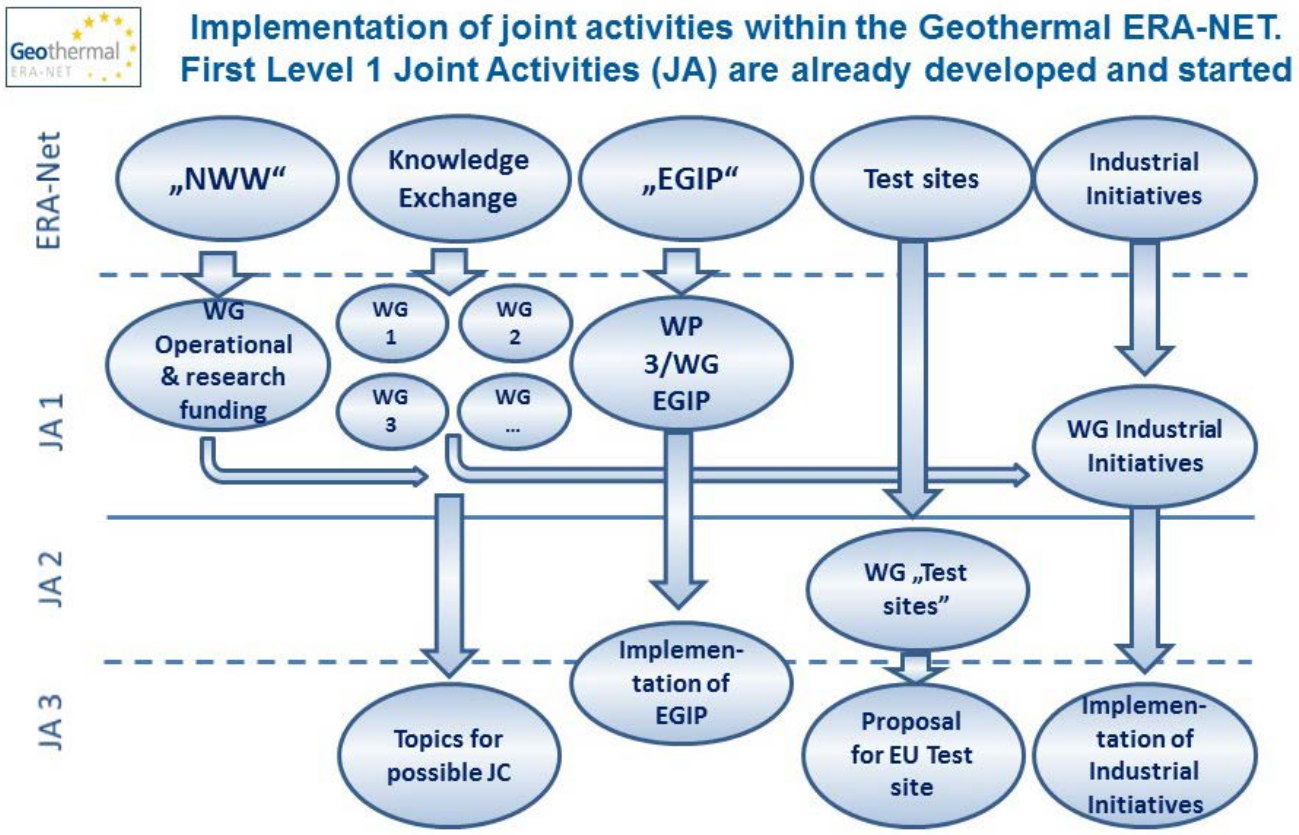
At least two countries to take the initiative

The Geothermal Era Network as a continuing vehicle to launch JA's !

Joint Activities

As a result 7 Joint Activities (JA) on different topics were proposed:

- **NWW** – New ways of working: Financial Instruments and Funding of RD&D and Geothermal Projects
- **OpERA** – RD&D Knowledge Exchange on operational issues of geothermal installations in Europe
- **PRGeo** - RD&D Knowledge Exchange on public relations for geothermal energy
- **New Concepts** for geothermal energy production and usage
- **ReSus** - RD&D Knowledge Exchange on reservoir sustainability
- **Tuning EGIP** (European Geothermal Information Platform) for target users
- **Geostat** - Towards Consistency of geothermal data



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Coordination Office
Orkustofnun, Iceland

Geothermal ERA NET Cofund Action – continued cooperation

creating a European research and innovation framework

- The objective is to organize and pool national financial and human resources as well as national research infrastructures, **to accelerate research and innovation**.
- Building on relationships with industry and researchers and bridge the gap between research and the market with **innovative solutions**.

- Focus on what is often called “deep” geothermal energy.
  - The scope includes the integration of geothermal reservoirs into novel energy system concepts (e.g. use of reservoirs for energy storage, CO2 storage, integration with near-surface geothermal applications).

Next steps towards the Geothermal ERA NET Cofund Action

Action	Finished by
Identification of relevant contacts in potentially participating countries	September 2015
Invitation letters to potential participants & flyer	September 2015
Distribute first draft proposal	September 2015
Preparatory meeting 1	November 2015
2nd draft proposal	December 2015
Deadline for letters of commitment	February 2016
Preparatory meetings 2, 3, teleconferences and subsequent drafts	First quarter 2016
Submission of the proposal	5 April 2016 (provisional)

www.geothermaleranet.eu

Netherlands Enterprise Agency

Geothermal ERA-NET

OpERA
an introduction

Paul Ramsak
Netherlands Enterprise Agency
Geothermal ERANet KnowlEx leader
OpERA steering committee

OpERA Expert workshop
Vaals (NL/D/B)
1+2 oct 2015

OpERA

Operational Issues
of
Geothermal Installations in Europe

Common Challenges in Geothermal EraNet countries

Barriers & Opportunities clusters | *RD&D needs clusters*

	A1 Regulations	...		
	A2 Economics & risk-mitigation	...		
	A3 New/innovative concepts and applications	↔	B4 New concepts	
	A4 Operational issues	↔	**B2 Operation**	
	A5 Sub-surface knowledge/data	↔	B1 Reservoirs	
	A6 Structuring the geothermal sector	...		
	A7 Public and education	↔	B3 PR & data	
		...	B5 Anthropogenic influence	
		...	B6 Drilling	

9 clusters

1. Regulations (A1)
2. Economics & Risk-mitigation (A2)
3. New/innovative concepts & applications (A3/B4)
4. **Operation** (A4/B2)
5. Subsurface/reservoir knowledge (A5/B1)
6. Structuring the geothermal sector (A6)
7. Public & Education (A7/B3)
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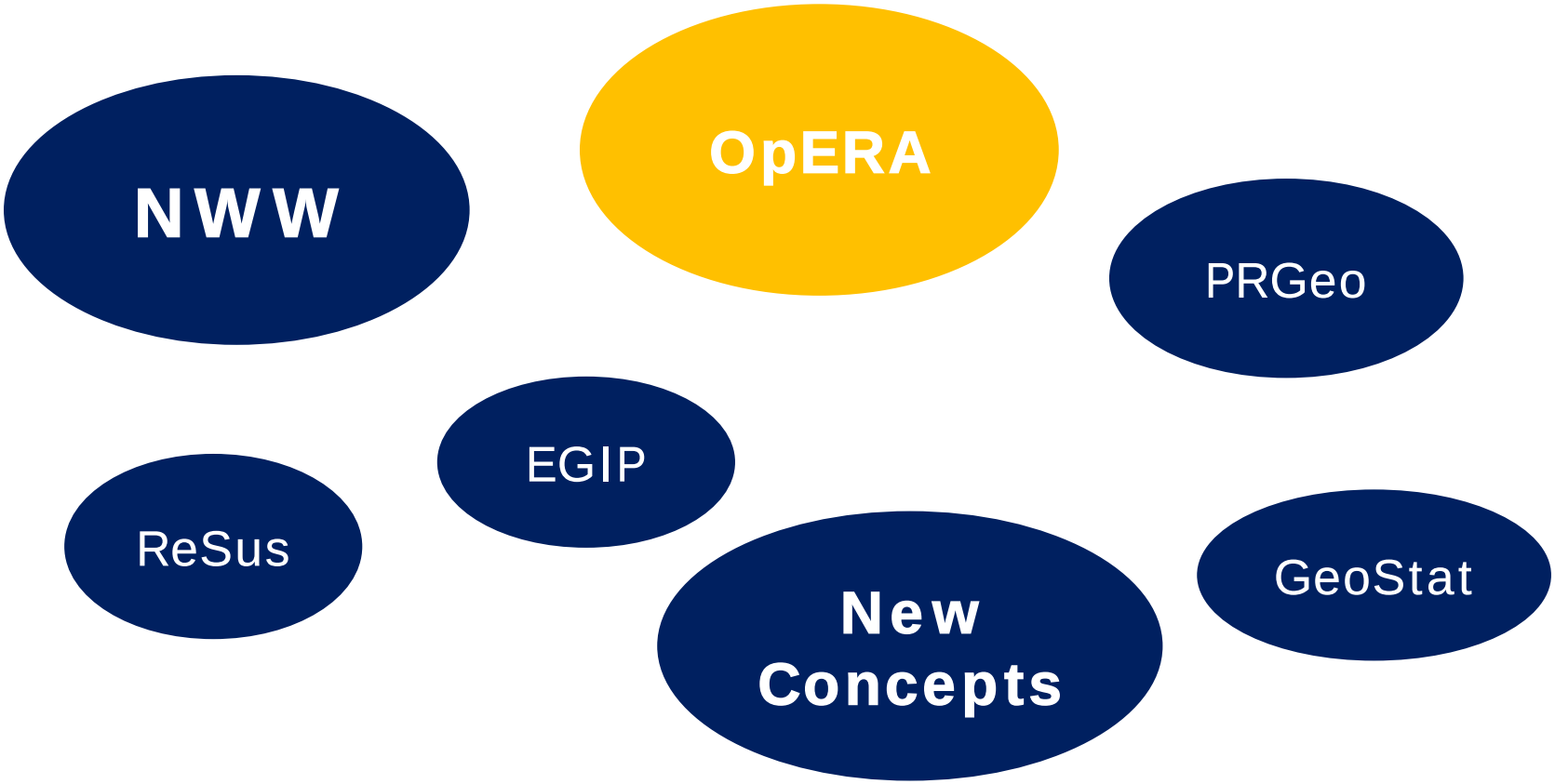
9. Drilling (B6)

All clusters are relevant for the progression of geothermal energy in Europe

7 Joint Activities



Why OpERA?

WP2 identified several barriers and RD&D-needs related to operation of geothermal installations

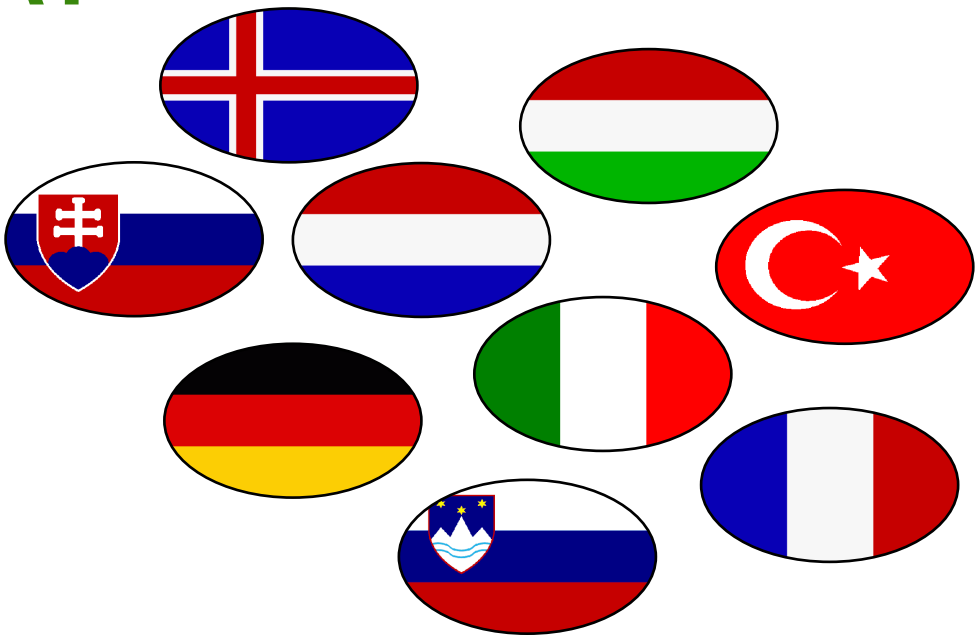
Crucial for LT performance of Geothermal Installations

- Barriers:
  - Resource exploitation
  - Operational issues
  - Environmental impact
  - Geochemistry & injectivity
  - Reinjection

- RD&D-Needs:
  - Operational Issues
    - Aggressive thermal water
    - Pumps & components
    - Well cleaning & completion
    - High NCG concentrations
    - Power plant Emmissions
    - Gas treatment
  - Injection Issues
    - Re-injection (mentioned 3x)
    - Underground storage
    - Re-injection methods (binary)
    - Geochemistry during re-injection
  - Pumps & Components
    - Underground equipment
    - Efficient & durable pumps
    - Pumps

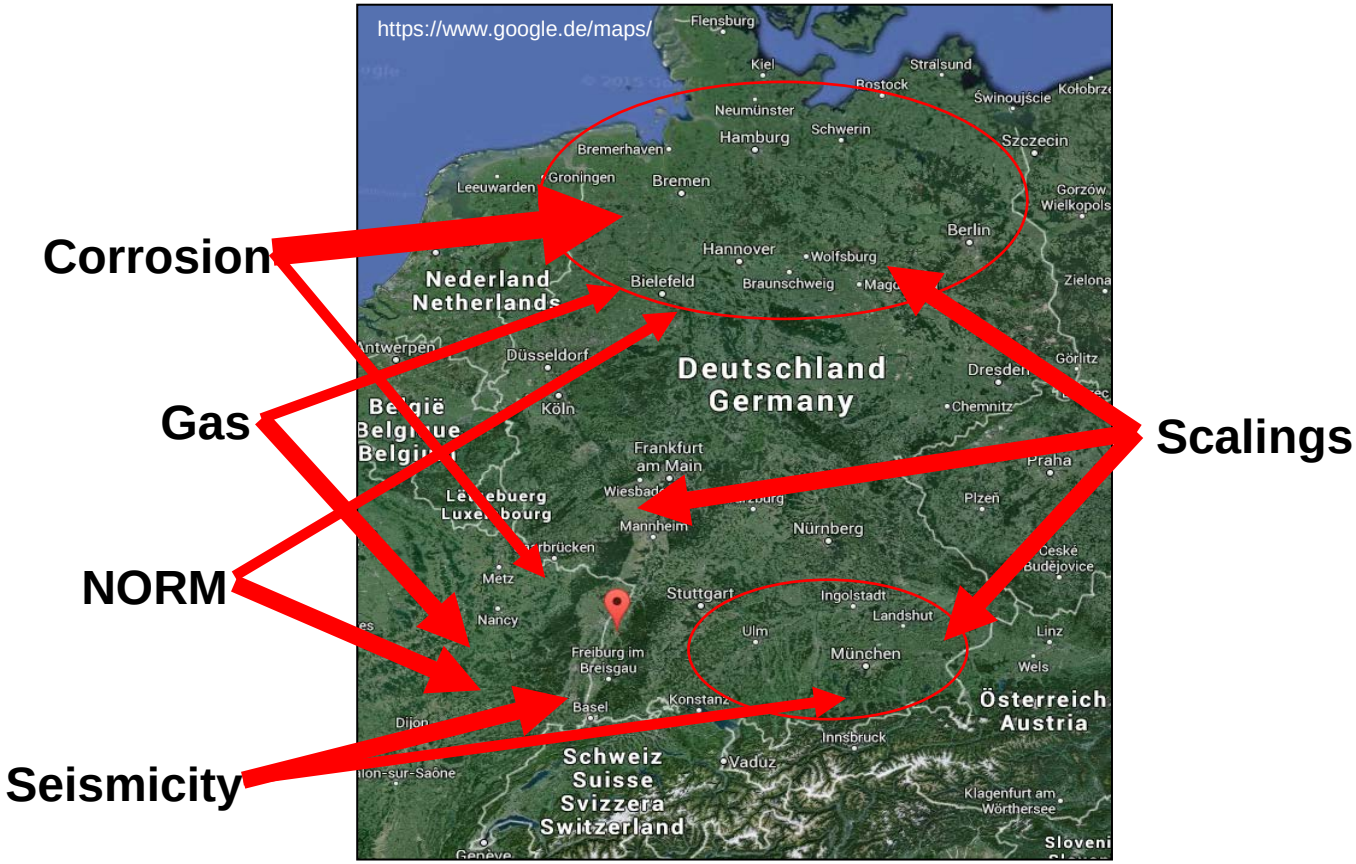
Why OpERA?

- Mentioned by:



- Therefore: Knowledge exchange on operational issues can help to:
  - Use knowledge on already solved problems European-wide
  - Cluster research efforts
  - Merge budgets for a higher output

Why OpERA? Example Germany



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The Concept of **OpERA**

Overview of Operational Issues in participating countries

Trans-national **knowledge and information Exchange**

First approach for **trans-national cooperation** on specific topic

*Building the **base for further cooperation**,*

if the benefit of this approach is proven

First Joint Activity: **OpERA**

- **OpERAtional issues** of geothermal installations
- **workshop – october 2015**
  - Scaling
  - Corrosion
  - Gas content
  - Reinjection

- **follow-up**
  - Expert group > solved/unsolved issues/best practices (JA1)
  - Joint studies (JA2/JA3)
  - …

OpERA – the EuRopeAn team

Coordination

D + NL

EraNet Partners

IS + SLO + H + I + F + CH

Extra Partners

DK + A

OpERA Participants

- Selected group of experts
- Invitation only
- Operators, hands-on consultants & researchers

37 participants from 11 European countries. 27 speakers

- Building a network
- OpERA as a platform to solve Operational Issues on a European scale
- You're part of that network!

We need to solve operational problems for Geothermal Energy to flourish

OpERA Program

DAY 1 oct 2015 12:00-22:00

Registration & Welcome Snack

Welcome & Introduction

Ia Country overviews

Break

Ib Country overviews

Summary, Conclusions & Follow up

Dinner

DAY 2 oct 2015 9:00-17:00

II Scaling

Break

III Scaling & Gas content

Lunch

IV Corrosion

Break

V Reinjection

Final discussion, Conclusions & Next Steps

Geothermal ERA-NET

Geothermal ERA-NET Workshop "OpERA"

Operational Issues of Geothermal Installations in Europe

Preliminary Program (status: 09/09/2015 update)

Thursday, 1st of October 2015:

Moderator: Dario Frigo (Plinius Chemical Consulting)

12:00 - 12:45	**Registration and Welcome Snack**
12:45 - 13:30	**Welcome & Introduction** Era-NET Coordination Office OpERA Steering Committee Ministry of Economic Affairs Netherlands Rijksdienst voor Ondernemend Nederland
13:30 - 15:10	**Session I: Country overviews** 13:30 - 13:50 Hungary - Annamária Nádor (MFGI) 13:50 - 14:10 Italy - Adele Manzella (CNR) 14:10 - 14:30 Netherlands - Martin van der Hout (DAGO) 14:30 - 14:50 Slovenia - Andrej Lapanje (GeoZS) 14:50 - 15:10 Germany - Florian Eichinger (Hydroisotop GmbH)
15:10 - 15:30	**Coffee break**
15:30 - 17:10	**Session I: Country overviews (continued)** 15:30 - 15:50 Iceland - Guðni Á Jóhannesson (Orkustofnun) 15:50 - 16:10 Switzerland - Bernd Frieg (Nagra) 16:10 - 16:30 France - Christian Boissavy (AFPG) 16:30 - 16:50 Denmark - Søren Berg Lorenzen (DGDH) 16:50 - 17:10 Austria - Gregor Götzl (GBA)
17:10 - 18:15	**Summary, Conclusions and Follow up** Dario Frigo (Plinius Chemical Consulting) Paul Ramsak (RVO) Stephan Schreiber (PtJ)
19:00 - 22:00	Dinner at Kasteel Vaalsbroek

Geothermal ERA-NET

Geothermal ERA-NET Joint Activity "OpERA"

Operational Issues of Geothermal Installations in Europe

Friday, 2nd of October 2015:

Moderator: Dario Frigo (Plinius Chemical Consulting)

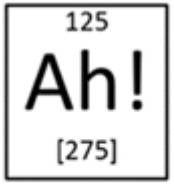
09:00 - 10:15	**Session II: Scaling** 09:00 - 09:15 Netherlands - Radboud Vorage (Aardwarmtecluster 1 KKP BV) 09:15 - 09:30 Hungary - Janos Szanyi (Szeged University) 09:30 - 09:45 Italy - Giordano Montegrossi (CNR) 09:45 - 10:15 Discussion - Dario Frigo (Plinius Chemical Consulting)
10:15 - 10:35	**Coffee break**
10:35 - 11:50	**Session III: Scaling & Gas content** 10:35 - 10:50 Germany - Andreas Rauch (gec-co GmbH) 10:50 - 11:05 Netherlands - Niels Hartog (KWR) 11:05 - 11:20 Iceland - Bjarni Már Júlíusson (Reykjavik Energy) 11:20 - 11:50 Discussion - Dario Frigo (Plinius Chemical Consulting)
11:50 - 13:00	**Lunch at venue**
13:00 - 14:15	**Session IV: Corrosion** 13:00 - 13:15 Iceland - Ingólfur Óm Þorbjörnsson (ISOR) 13:15 - 13:30 Germany- Simona Regenspurg (GFZ) 13:30 - 13:45 Netherlands - Hans Veldkamp (TNO) 13:45- 14:15 Discussion - Dario Frigo (Plinius Chemical Consulting)
14:15 - 14:35	**Coffee break**
14:35 - 16:05	**Session V: Reinjection** 14:35 - 14:50 Netherlands - Wart van Zonneveld (Floricultura) 14:50 - 15:05 Hungary - Miklós Hlatki 15:05 - 15:20 Germany - Marion Schindler (BESTEC GmbH) 15:20 - 15:35 Slovenia - Evgen Torhač (Petrol Geoterm d.o.o.) 15:35- 16:05 Discussion - Dario Frigo (Plinius Chemical Consulting)
16:05 - 17:00	**Final Discussion, Conclusions and Next steps** Dario Frigo (Plinius Chemical Consulting) Paul Ramsak (RVO) Stephan Schreiber (PtJ)

Venue	Kasteel Vaalsbroek, Vaalsbroek 1, Vaals, NL www.bilderberg.nl/en/vaals/castle-vaalsbroek (about 7 km from Aachen Central Station)

let OpERA begin…

OpERA Moderator

Dario Frigo



Consult your PC
& avoid the element
of surprise

PLINIVS CHEMICAL CONSVLTING

Contact Geothermal Energy
coordinator WP2 Information Exchange

NL Enterprise Agency
Geothermal ERA-NET

www.rvo.nl/aardwarmte
www.rvo.nl/topsector-energie

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Energy Department
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» Focus on energy and climate change

Netherlands Enterprise Agency

Geothermal ERA-NET

OpERA
welcome

Paul Ramsak
Netherlands Enterprise Agency
OpERA steering committee

OpERA Expert workshop
Vaals (NL/D/B/(M))
1 oct 2015

https://youtu.be/Un0VLiP

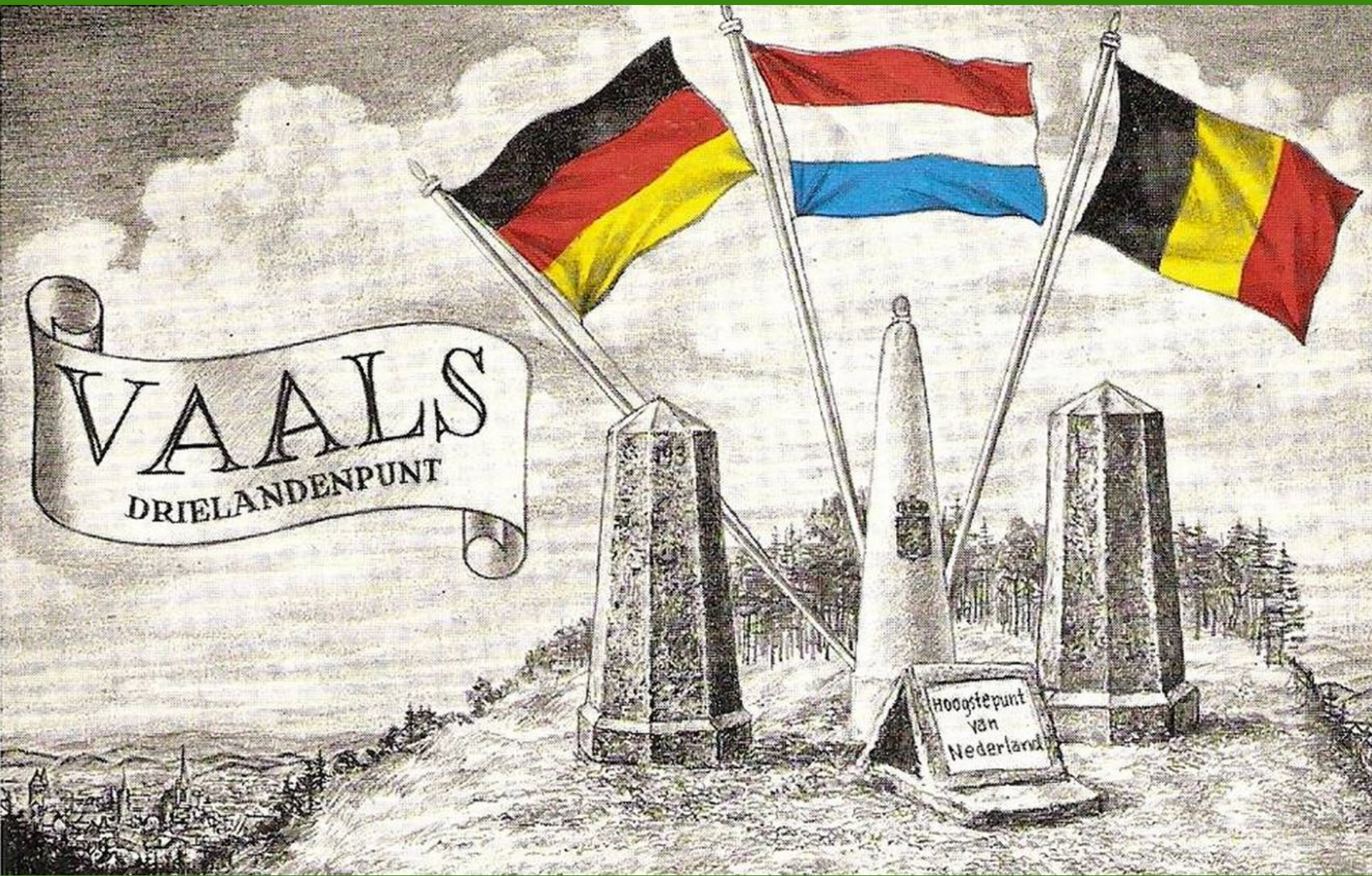

Welcome
to the
Dutch Mountains

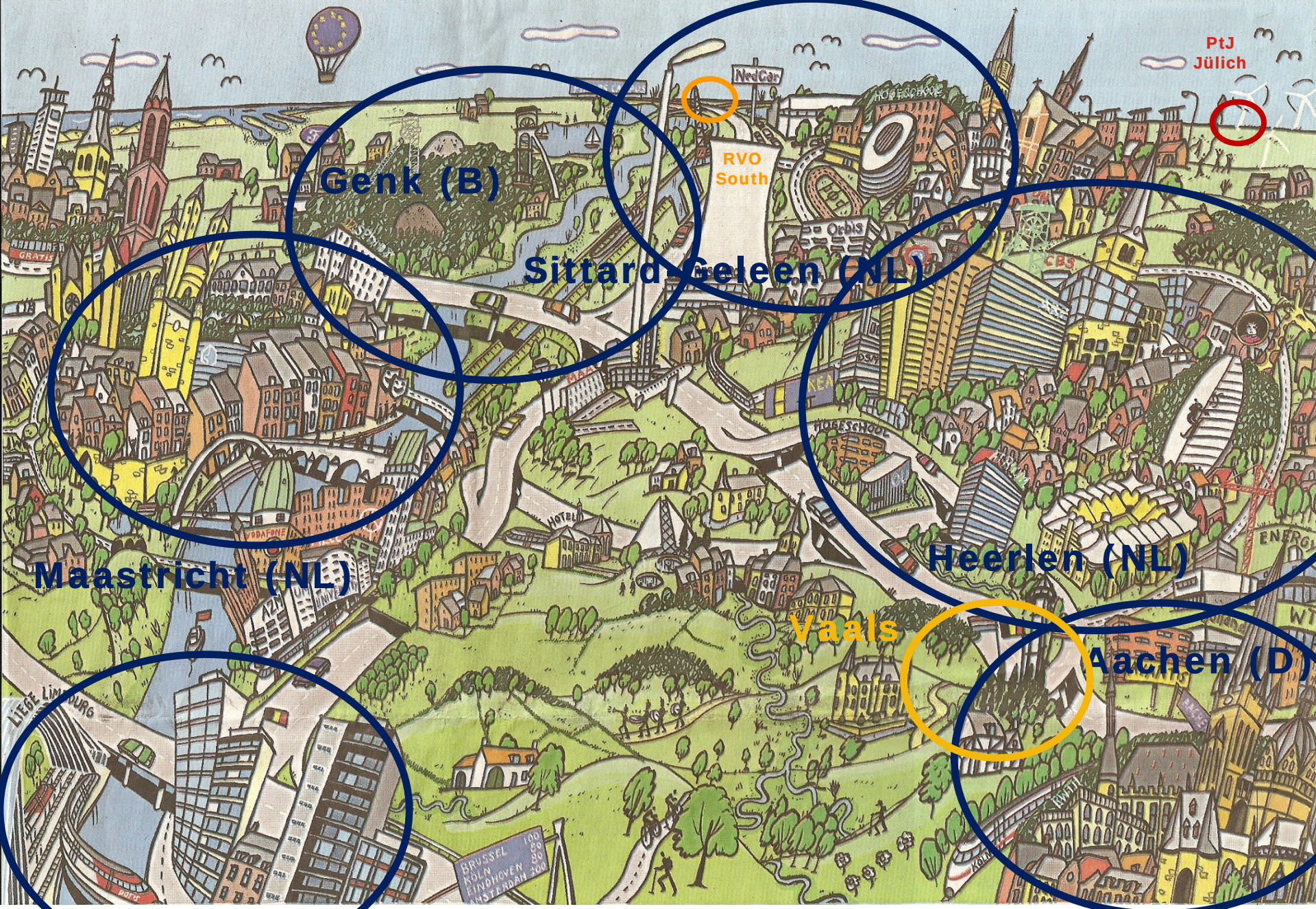

Welcome to Vaalsbroek

Skiing in the Dutch Mountains

Almhütte in the Dutch Mountains

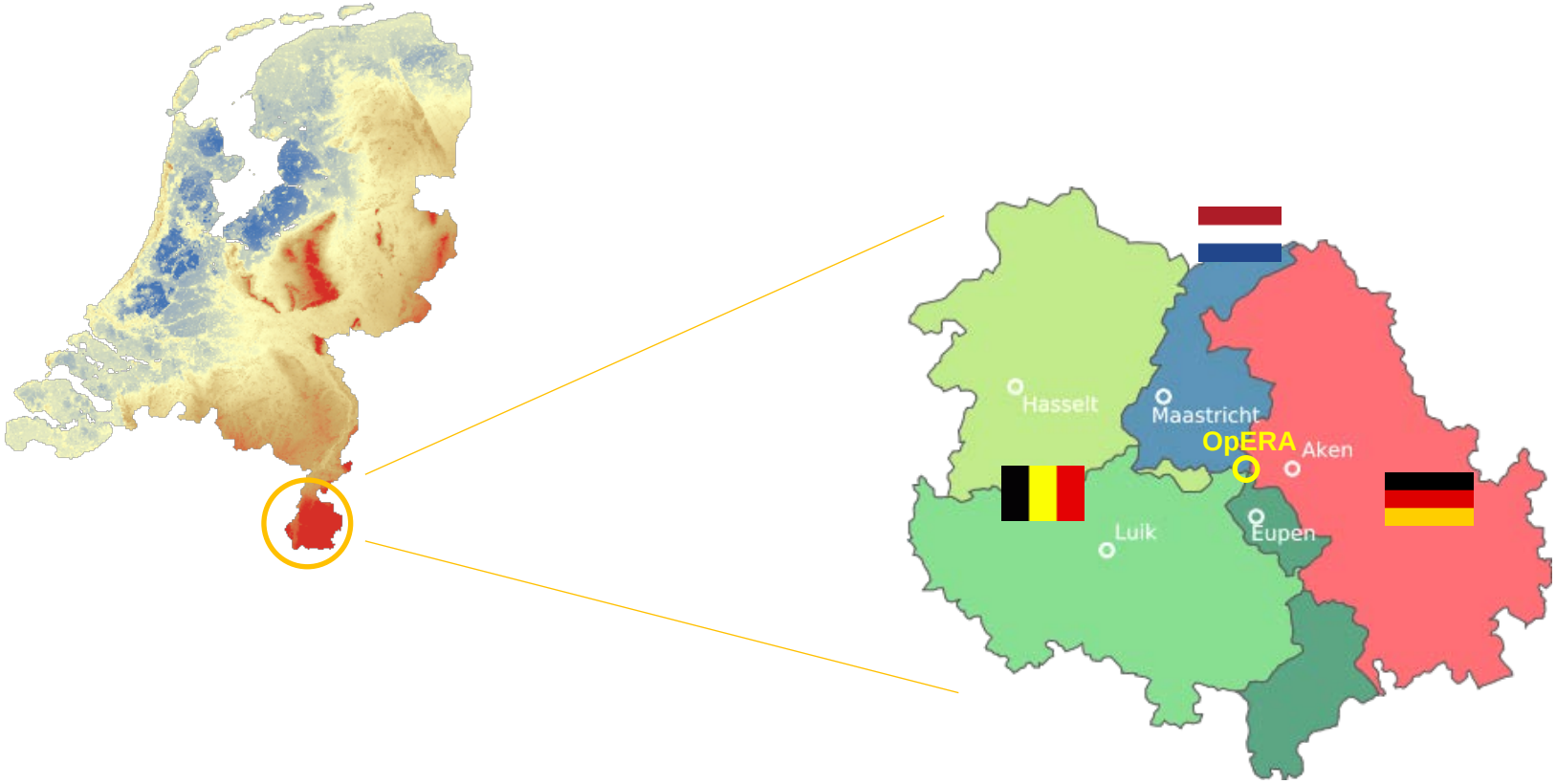
Wine from the Dutch Mountains

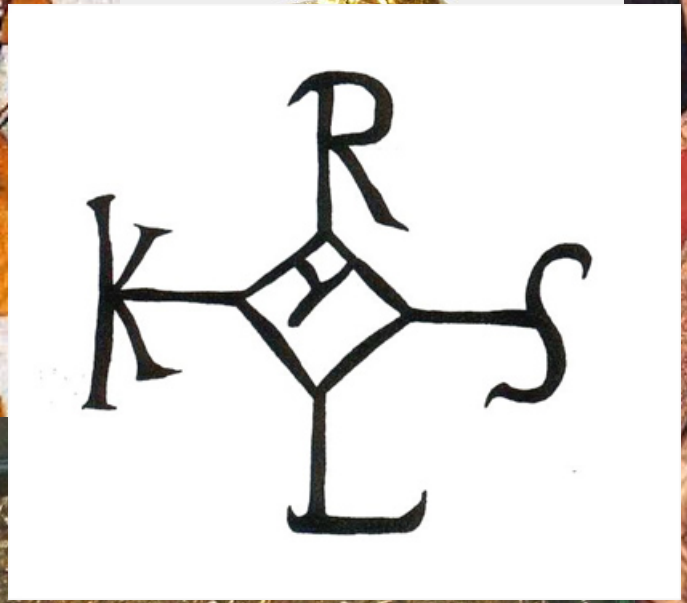

VAALS
DRIELANDENPUNT
Hoogstepunt
van
Nederland

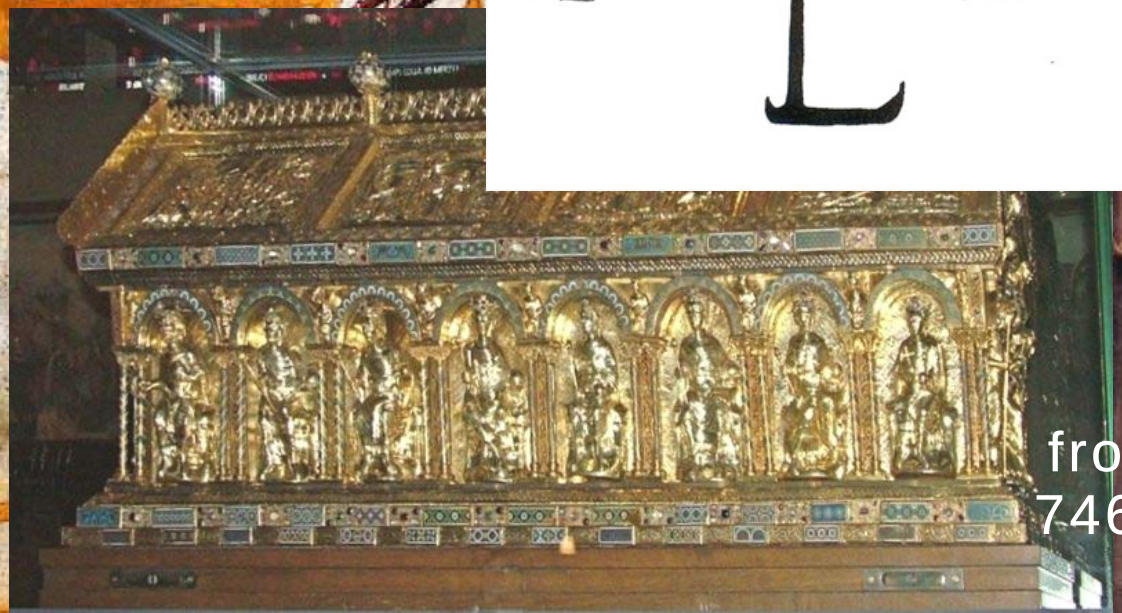


The greater Dutch Mountains

Over 3½ Million people…
living in the greater Dutch Mountains







Charlemagne

from the … mountains

746 - 800 - 814 - Now


Geothermal naturally !

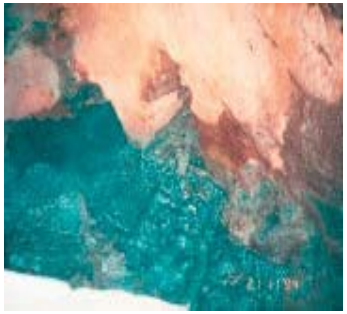
Geothermal wells in Aachen

Aachen-Innenstadt

Name	Temperatur	Förderung	Nutzung
Kaiserquelle	52° C	12 m³/h	Mineralwasser
Rosenquelle AC	47°C	43 m³/h	Carolus Thermen, Quellenhof
Nikolausquelle	31°C		ungenutzt
Großer Monarch	26°C		ungenutzt
Komphausbadquelle			ungenutzt

Burtscheid

Name	Temperatur	Förderung	Nutzung
Landesbadquelle	70°C	69 m³/h	Kurklinik
Schwertbadquelle	67°C	2 m³/h	Kurklinik
Rosenquelle BS	62°C	14 m³/h	Kurklinik
Schlangenbadquelle	50°C		ungenutzt
Kochbrunnen	44°C		ungenutzt
Mephistoquelle	39°C	6 m³/h	Mineralwasser
Gartenquelle	34°C		ungenutzt
Michaelisquelle	32°C		ungenutzt
Pockenpützchen, Pockenbrünnchen und Schlangenquellchen	28°C		ungenutzt



Landesbadquelle

Gartenquelle

Quellkammer Rosenquelle AC

Charlemagne came…

Had a look at the
geothermal waters…


…and decided to stay


Geothermal naturally !
The last renewable capital of Europe …
below the Dutch Mountains

One of the best states ever… including the Dutch Mountains

Treaty of Meerssen 870

The start of the trouble…decided in the Dutch Mountains

Karel de Grote
Charlemagne
Karl der Große

Carolus Magnus

Geothermal
ERA-NET

Aken
Aix-la-Chapelle
Aachen

800 AD

European

Geothermal

takk fyrir

ORKUSTOFNUN
National Energy Authority

rannís

dank u

NL Agency
Ministry of Economic Affairs

merci

ADEME
Agence de l'Environnement et de la Maîtrise de l'Energie

grazie

Geothermal
ERA-NET

Schweizerische Eidgenossenschaft
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teşekkürler

TÜBİTAK

danke

PtJ
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Forschungszentrum Jülich

ďakujem

Ministerstvo školstva, vedy, výskumu a športu Slovenskej republiky

hvala

Welcome to OpERA

obrigado

EDA

köszönöm

MFGI

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coordinator WP2 Information Exchange Geothermal ERA-NET

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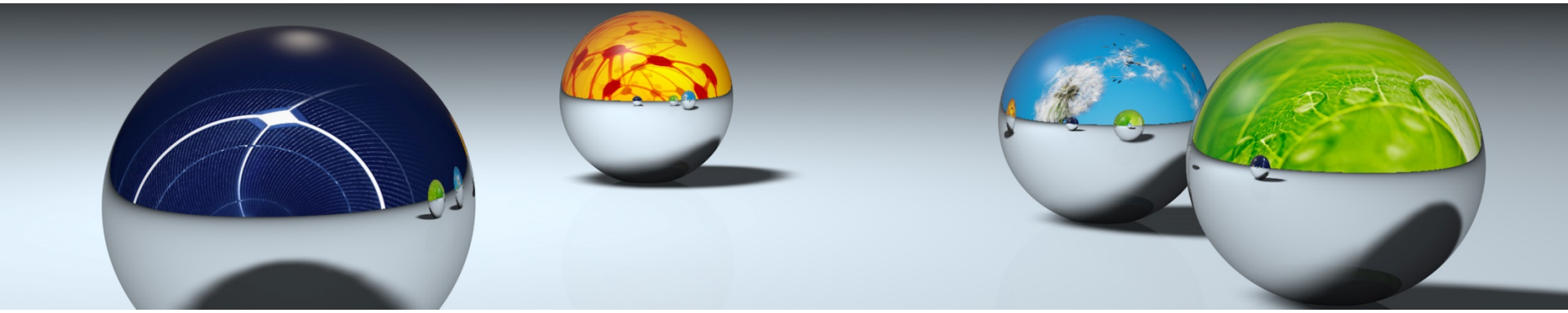


› OpERA „Operational Issues across Europe“

Next Steps

WP4: Development of Joint activities

Dr. Stephan Schreiber

Project Management Jülich

Geothermal Energy and Cross-cutting Programs

Overview

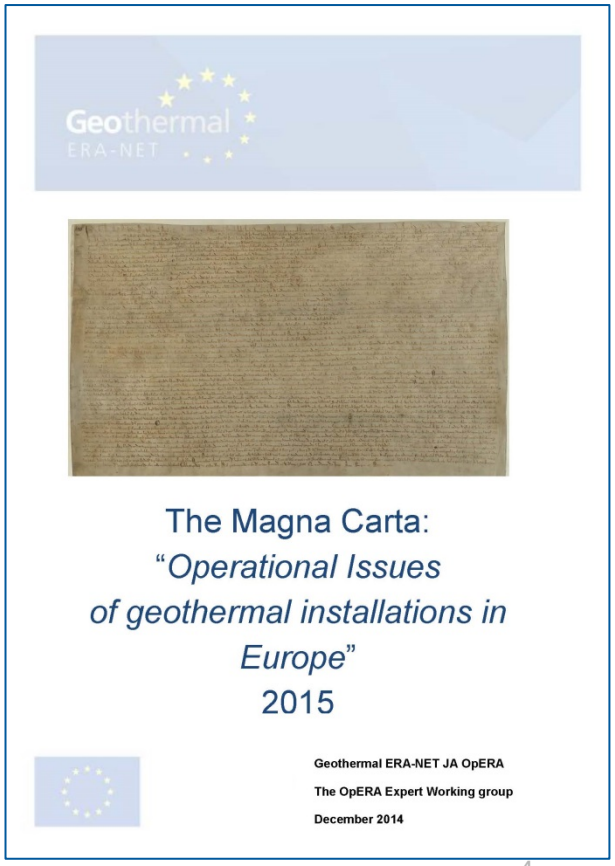
- The Publication
- The OpERA Expert Working Group
- Follow-up Joint Activities

The Publication

- …should summarize the results of the last two days
- …should give an overview of the existing solutions for operational issues in 2015
- …should give an overview of the most urgent operational issues which have to be solved

The Publication

- Est. 20-30 pages
- Geothermal ERA-NET Publication
- Available via the Geothermal ERA-NET website
- Promoted by the country representatives of the ERA-NET Members



The Publication - Structure

1. Introduction (Approach, concept etc.)
2. Status of operational issues in Europe
   a) Country A
   b) Country B
   c) …
3. Corrosion issues
   a) General, solved and unsolved issues
   b) Examples from different countries
4. Scaling issues
   a) General, solved and unsolved issues
   b) Examples from different countries
5. Gas issues
   a) General, solved and unsolved issues
   b) Examples from different countries
6. Re-injection issues
   a) General, solved and unsolved issues
   b) Examples from different countries
7. Conclusions
8. Recommendations for support of specific RD&D topics

The Publication - Structure

1. Introduction ch, concept etc.)
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   a) Country A
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   a) General nd unsolved issues
   b) Examples from different s
6. Re-injection issues
   a) General nd unsolved issues
   b) Examples from different s
7. Conclusions
8. Recommer for sup specific RD&D topics

The Publication – Workload and Timeframe

- Request for contributions (country- or topic-specific)
  - Mid October 2015
- Estimated only ca. 1-2 pages per expert
- Submission of your contribution
  - End of November 2015
- Review
  - December 2015
- Publication
  - January-February 2016

The Expert Group

Paul & Stephan

Annamária

Andrej

Hjalti Páll

Adele

Søren ?

Martin ?

Florian ?

Christian ?

Bernd ?

Gregor ?

<u>+ Experts for specific topics & Examples:</u>

- ENEL, IT
- Low T°C expert, IC
- You ?
- You ?
- You ?
- You ?
- …

Follow-up: Future JA

- Discussion and decision on the next steps (JA2/JA3)
  - Next week
- Implementation of follow-up JA
  - Until April 2016
- Start
  - April 2016
- All activities related to a follow-up JA will be in parallel to the work of the expert group

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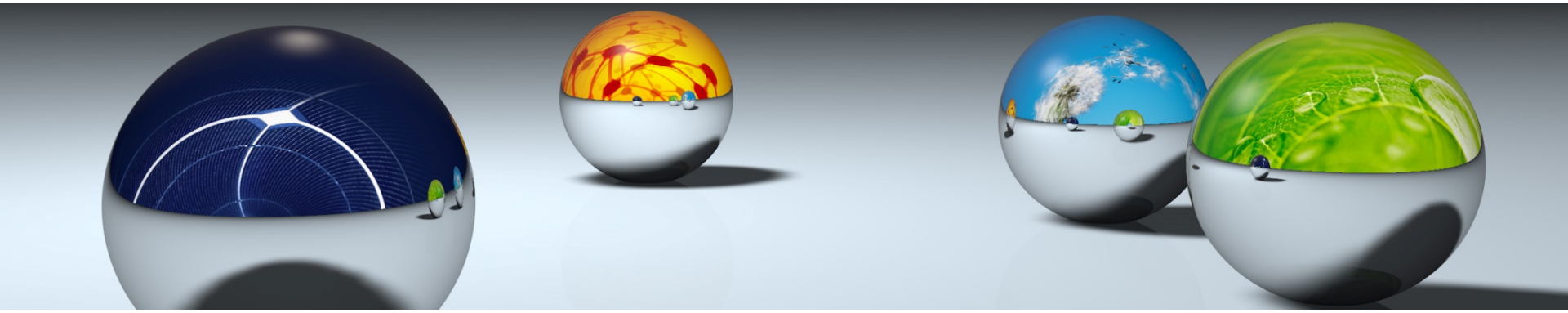

What do you think?

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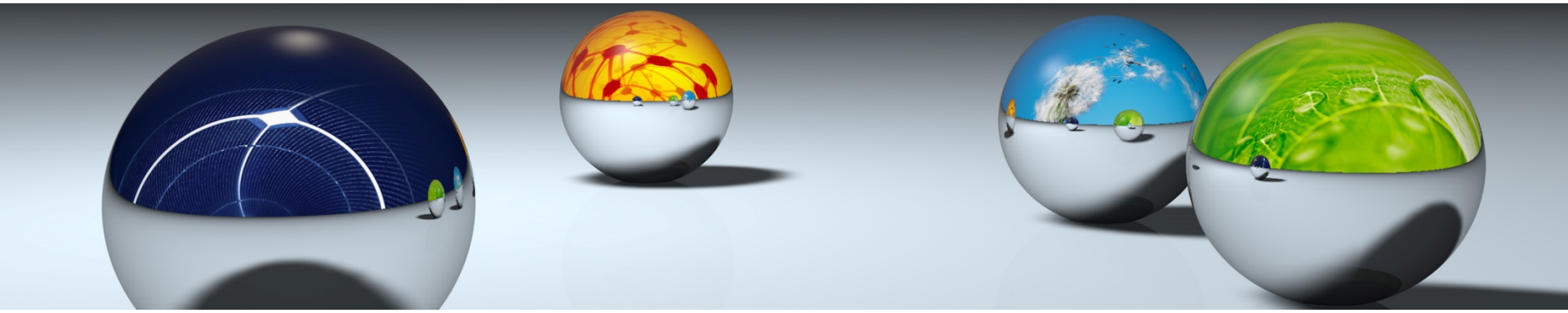


› OpERA „Operational Issues across Europe“

Summary and Follow-up

WP4: Development of Joint activities

Dr. Stephan Schreiber

Project Management Jülich

Geothermal Energy and Cross-cutting Programs

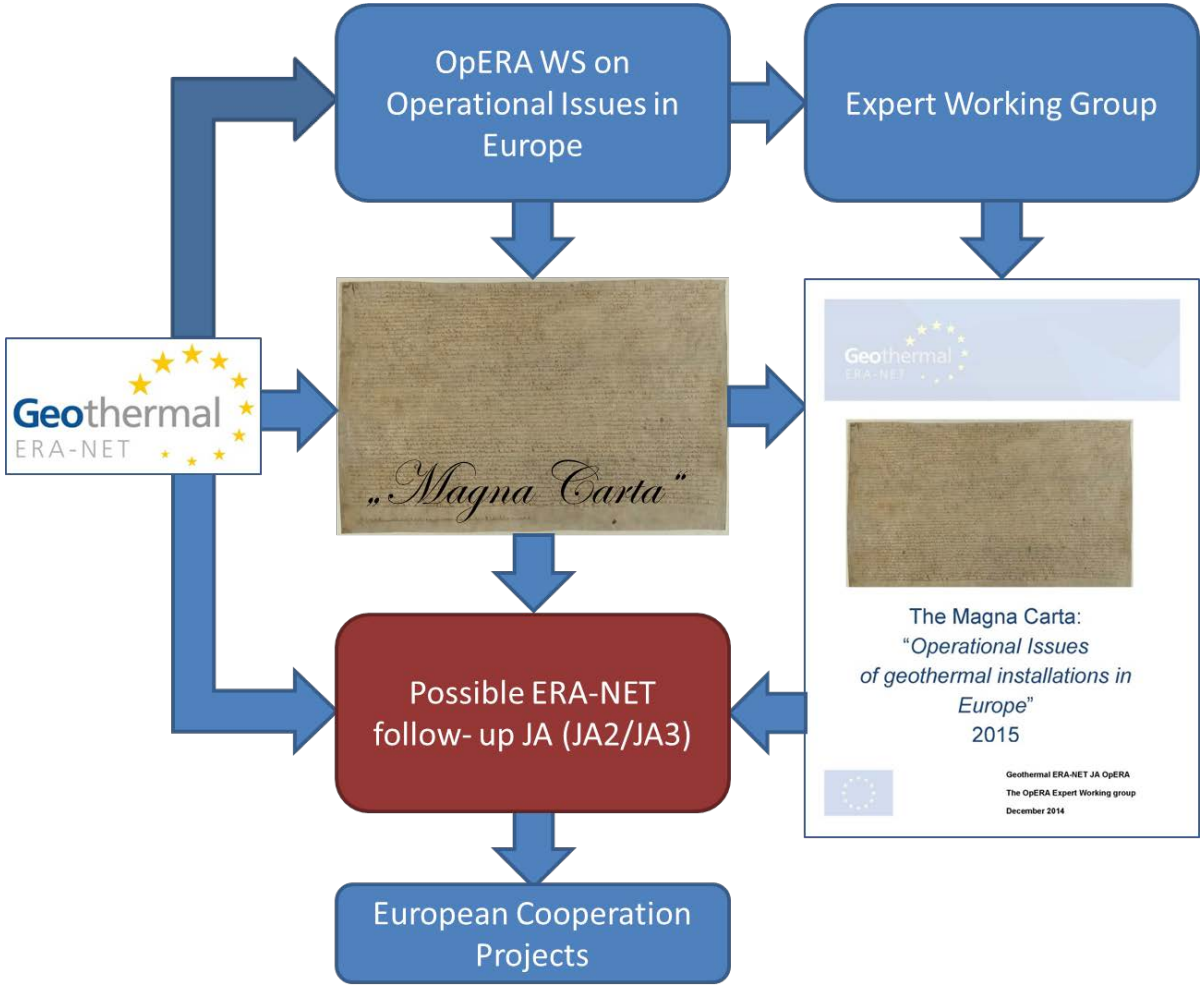
Overview

- The Concept
  - Step 1a: The MAGNA CARTA
  - Step 1b: Expert Publication (Follow-up)
  - Step 2: Future Joint Activities & possible level (JA2?/JA3?)
- Summary and Results of Day 1

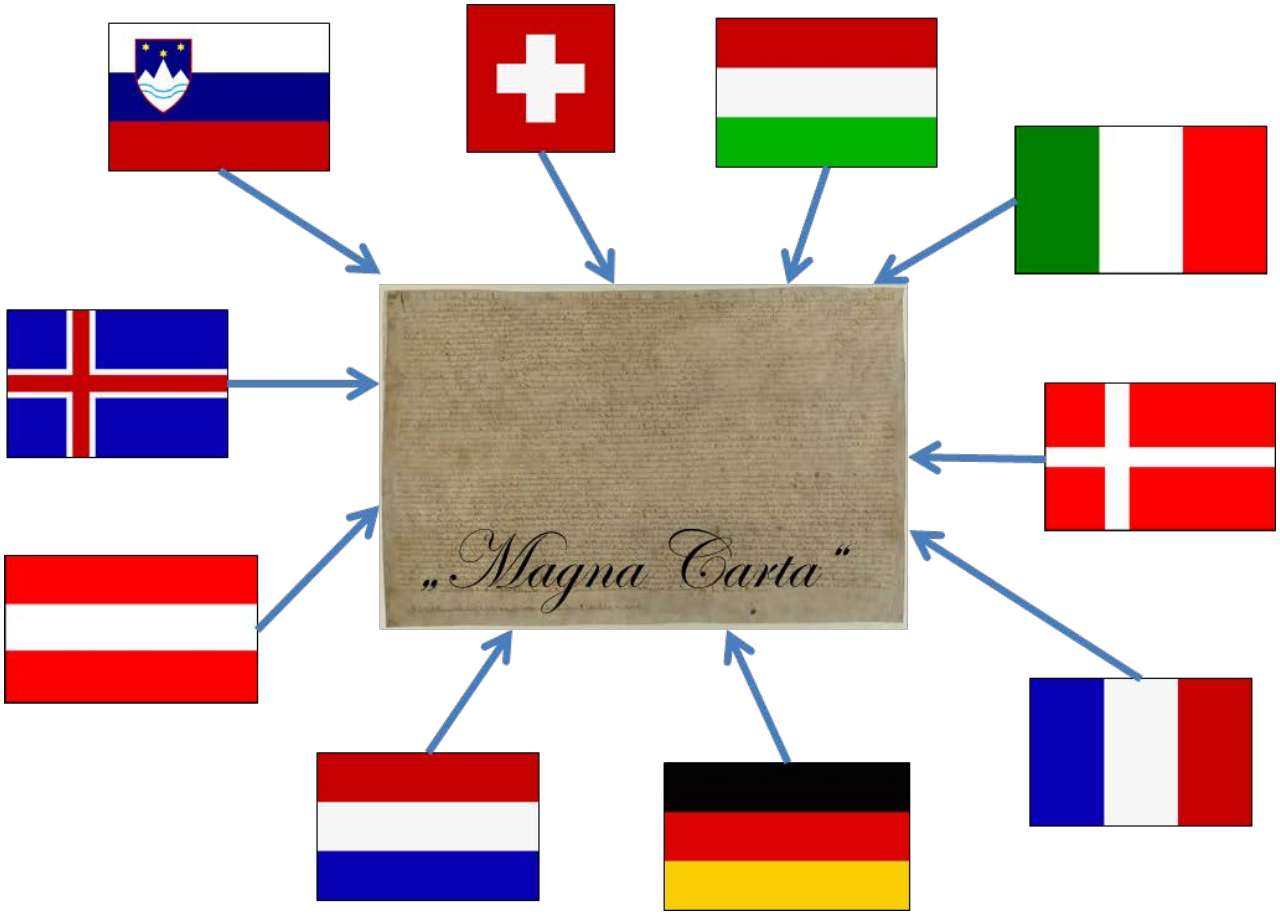
The Concept of OpERA

- Summary of operational issues in the participating countries
- Trans-national knowledge and information Exchange
- First approach for trans-national cooperation on specific topic
- Building the base for further cooperation, if the benefit of this approach is proven

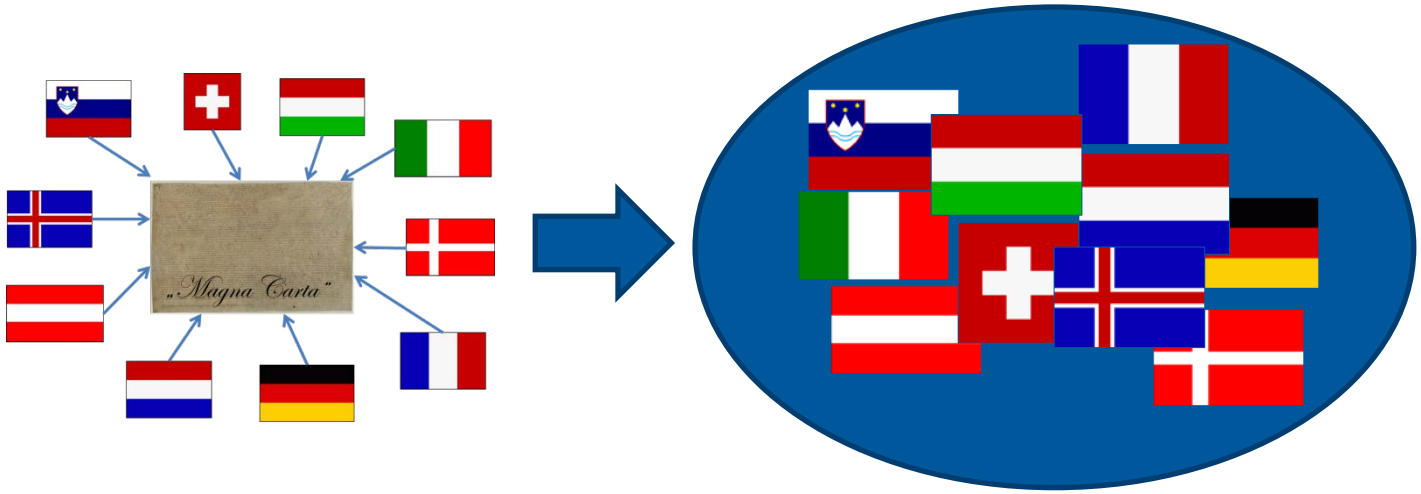
The Concept of OpERA



The „MAGNA CARTA“



The „MAGNA CARTA“ – The next logical step



› Deepen the cooperation by forming an expert group

Follow up: The Expert Group

- Task:
  - Summarize the Magna Carta and the Results of the WS in a publication
- Who?
  - You + the OpERA steering committee
- Timeframe?
  - End of 2015 – early 2016
- Workload?
  - Managable (~1DINA4 page per expert, layout by us)

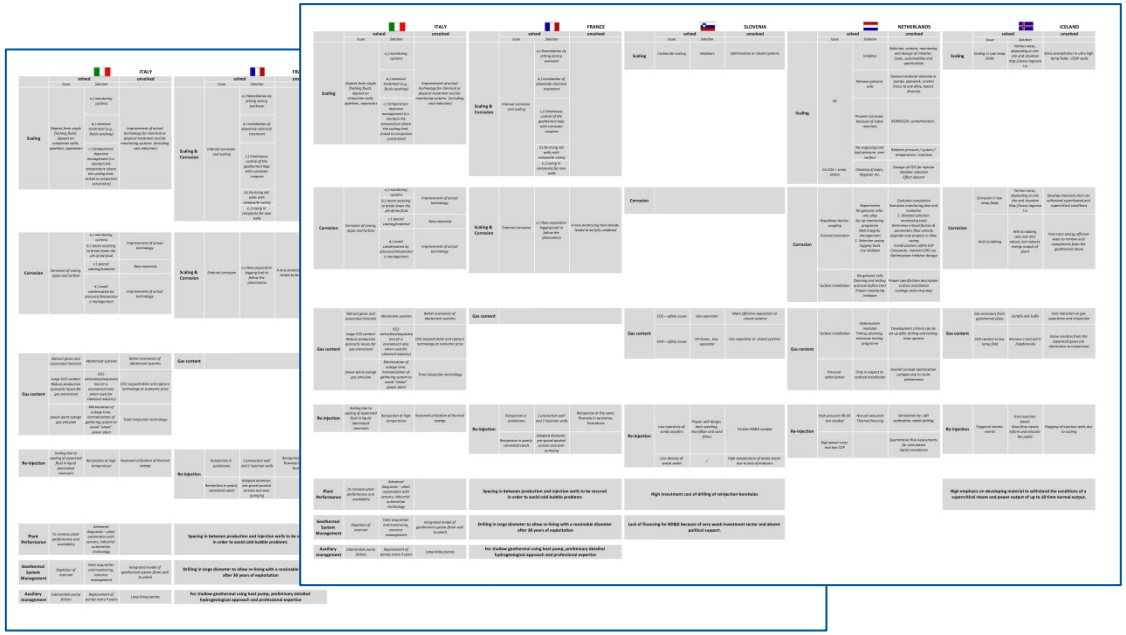
Follow-up: Future JA (JA2/JA3?)

- Based on the results of the workshop, the urgency of RD&D and the need for cooperation in Europe can be quantified
- The Geothermal ERA-NET Committee will discuss the results and findings next week in Brussels
- A decision on possible follow-up JA
- At least further cooperation schemes for the field of operational issues will be proposed.
- <u>All activities related to a further JA will be in parallel to the work of the expert group</u>

Summary and results

With this concept in mind…

…Let´s have a look at the Magna Carta



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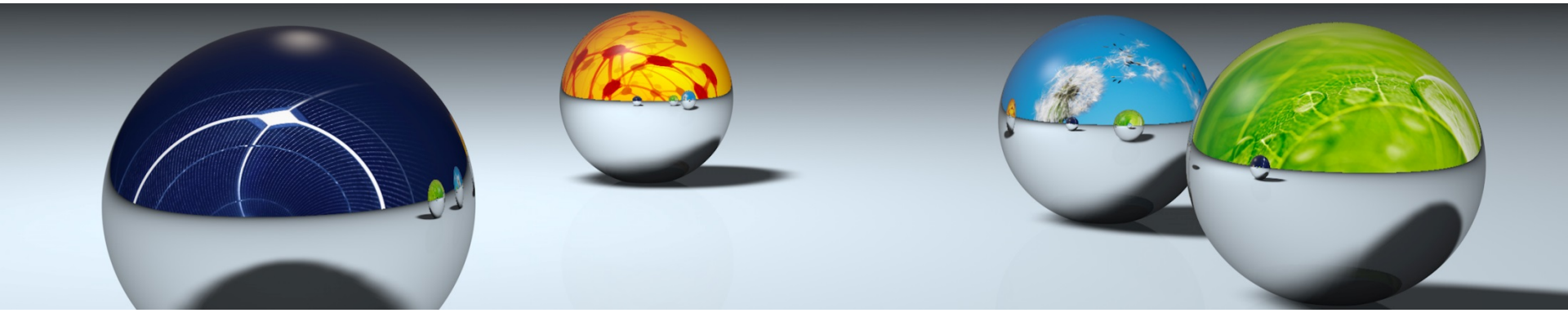

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