Proposed Joint Activity

# Financial Instruments and Funding of *Geothermal Projects*

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***Geothermal ERA NET Meeting***
***Hotel Livada Prestige, Slovenia***
***14 October, 2016***

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# Overview of the presentation

- Objectives and Structure of the Project
- Funding of RD&D
- Funding of Geothermal Projects

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- Objectives and Structure of the Project
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# The Overall Objective

- To improve the synergies between different players

- Better understanding of this financial landscape - to highlight barriers and recommend practical solutions

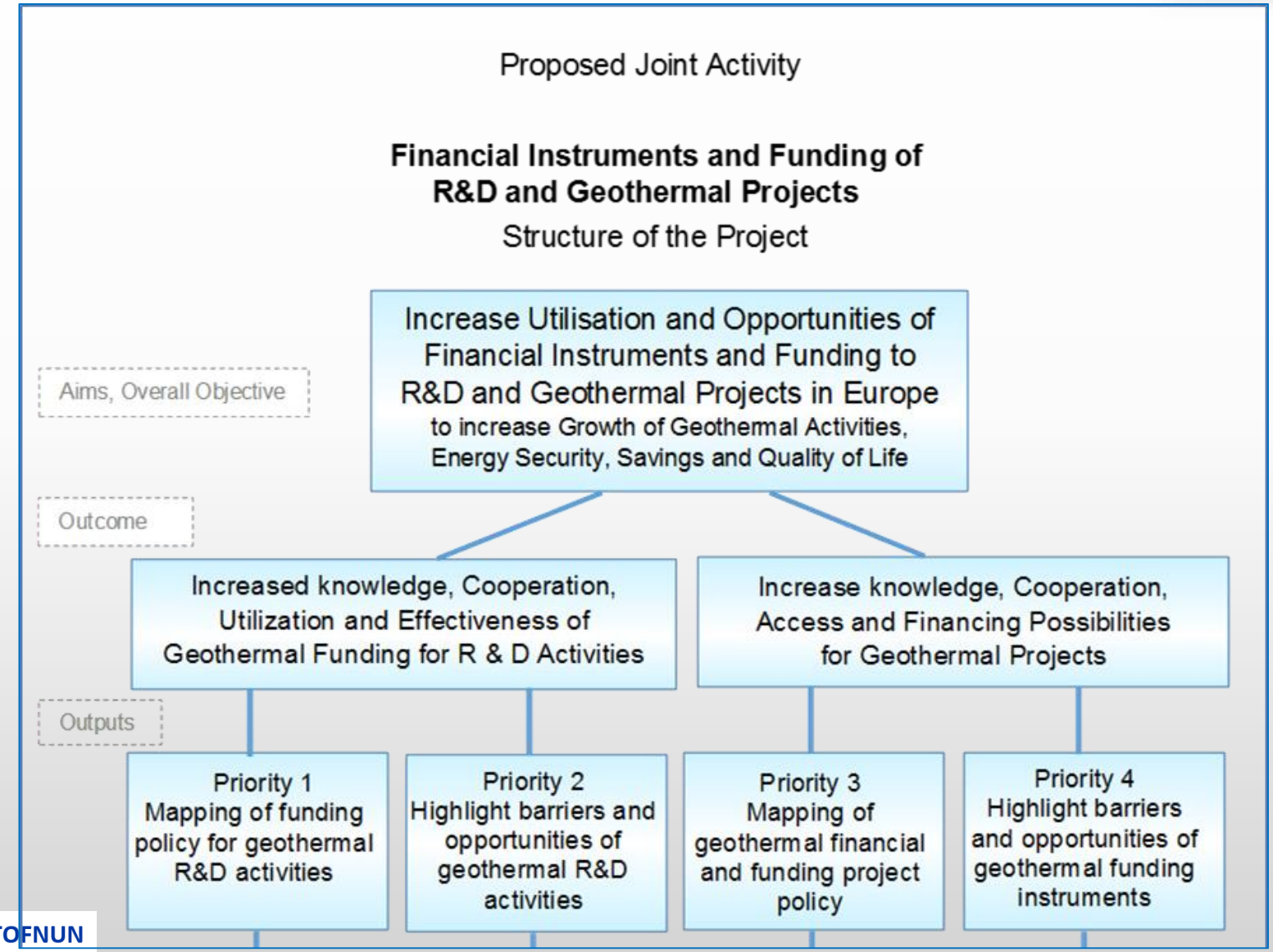
- Knowledge exchange will enhance cooperation and lower barriers and improve joint programming and better funding instruments and opportunities.

# Process description

- Analyse the financial instruments that are available - and map the operational structure of the different national funding bodies

- Highlight the main barriers and opportunities, and how these instruments can more easily work together

# Aims, Outputs and Priorities



# Activities and Deliverables

Activities

- Coordinated desk research – meeting with experts – collection of data from countries
- Evaluation of existing instruments and national markets
- Working meetings e.g. with stakeholders regarding relevant topics
- Drafting report
- Evaluation of option regarding - possible Joint Call

Deliverables

- Report - Recommendations for financial instruments for the development of geothermal R&D and for the development of geothermal projects in Europe.
- Conclusion Seminar - Barriers & Opportunities and Policy recommendation.
  - National research funding
    - Needs –Barriers – Opportunities and Policy recommendation.
  - Financial funding for geothermal projects
    - Needs –Barriers – Opportunities and Policy recommendation
- Implementation of Joint Call

# Overview of the presentation

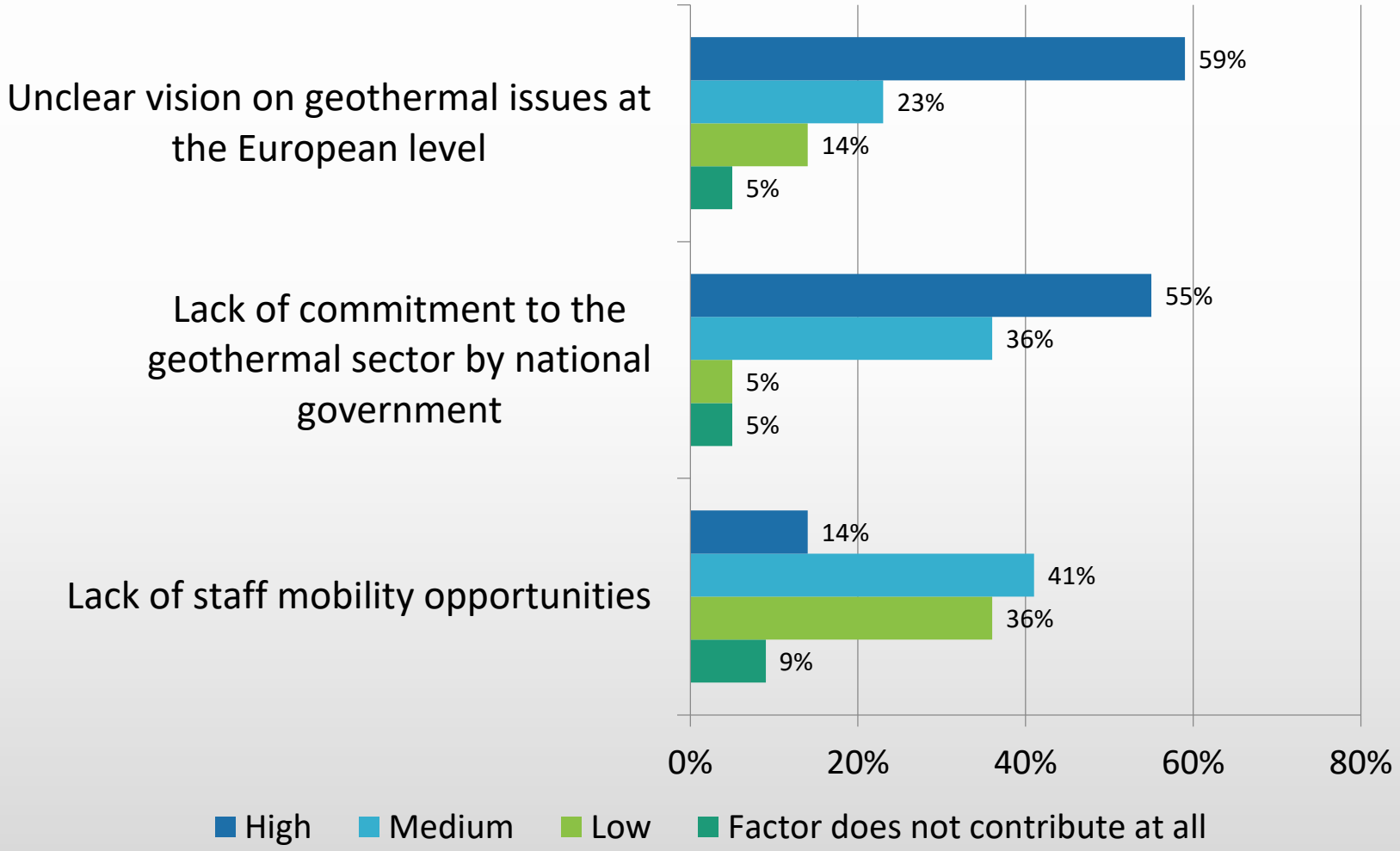
- Objectives and Structure of the Project
- Funding of RD&D Survey
- Funding of Geothermal Projects

# RD&D General Mapping

- As perhaps was to be expected the responses are very varied and unique to each country.

- Geothermal is not high on the agenda of most partners and statistical data on geothermal as part of renewable is scarce.

# Policy and Sectorial Factors

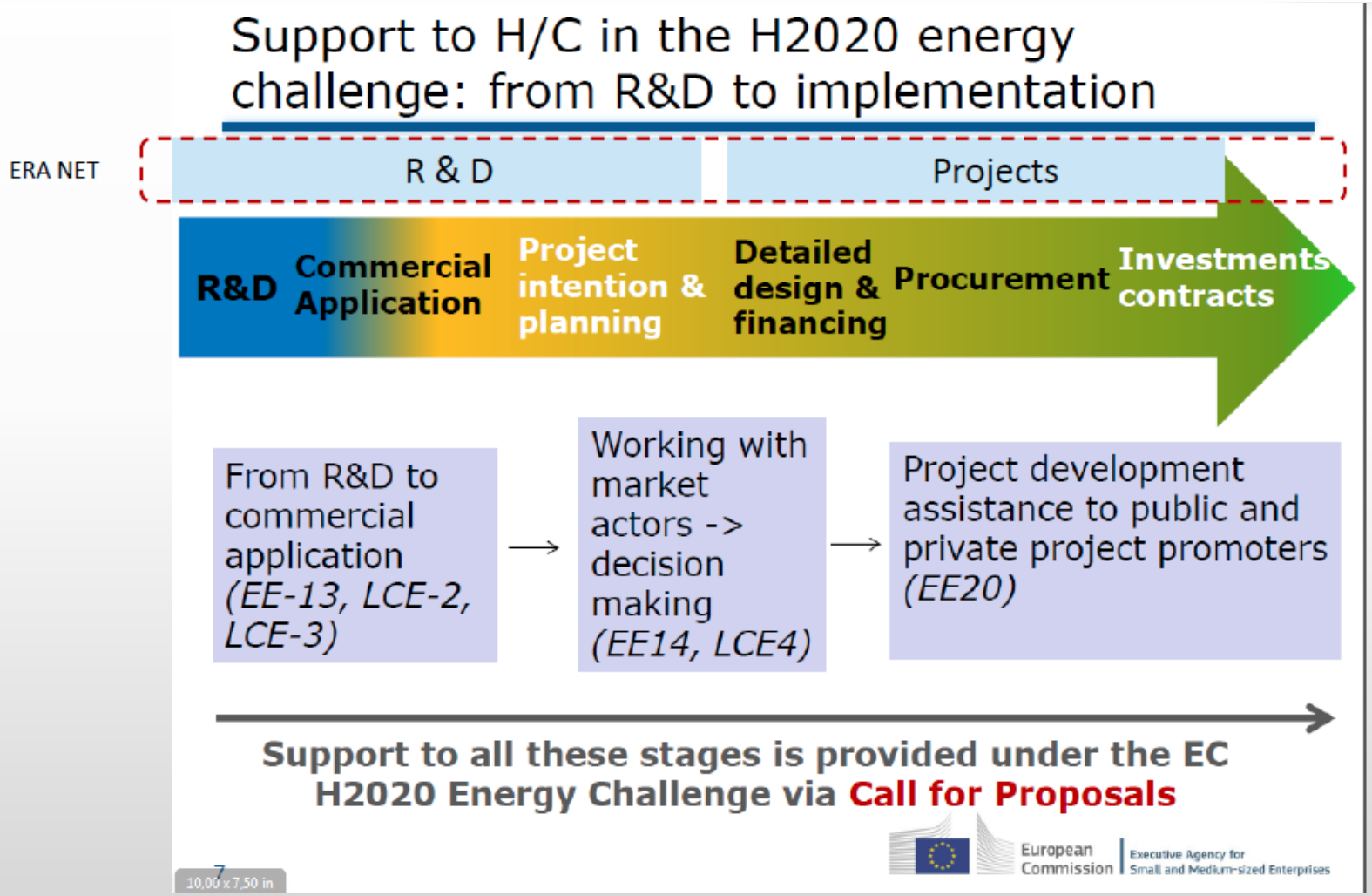



Source: Geothermal ERA-NET WP 6.2 Identification of Training Needs and Knowledge Gaps

# Funding of RD&D

- Funding is allocated by public competitive funds.
- In many cases more than one fund is applicable for a category of research.
- However, one fund can also be applicable to more than one type of category of research.
- Occasionally funding is dedicated to geothermal energy research however more often not.
- Funding is mostly national, and only a few countries have the possibility of funding foreign parties.

# RD&D Funding Challenges



# RD&D Funding Challenges

## Where is H/C in the H2020 energy challenge?

### Energy efficiency

- Buildings, consumers, products
- **Industry – heat recovery (EE18)**
- **Heating and Cooling (EE-13, EE-14)**
- Finance for sustainable energy

### Smart Cities and Communities

- **SC&C solutions integrating energy, transport and ICT sectors – lighthouse projects (SCC-1)**
- others

### Low Carbon Energy

- **RES E and H/C technologies (LCE-2, LC-3, LCE4)**
- Energy storage
- Sustainable bio fuels
- others

H/C is included in a number of topics of the Energy Challenge

Actions supported go from R&D to market uptake and include DHC

# RD&D Funding Challenges

**Topic EE 14: Removing market barriers to the uptake of efficient H/C**

## *1. SPECIFIC CHALLENGES*

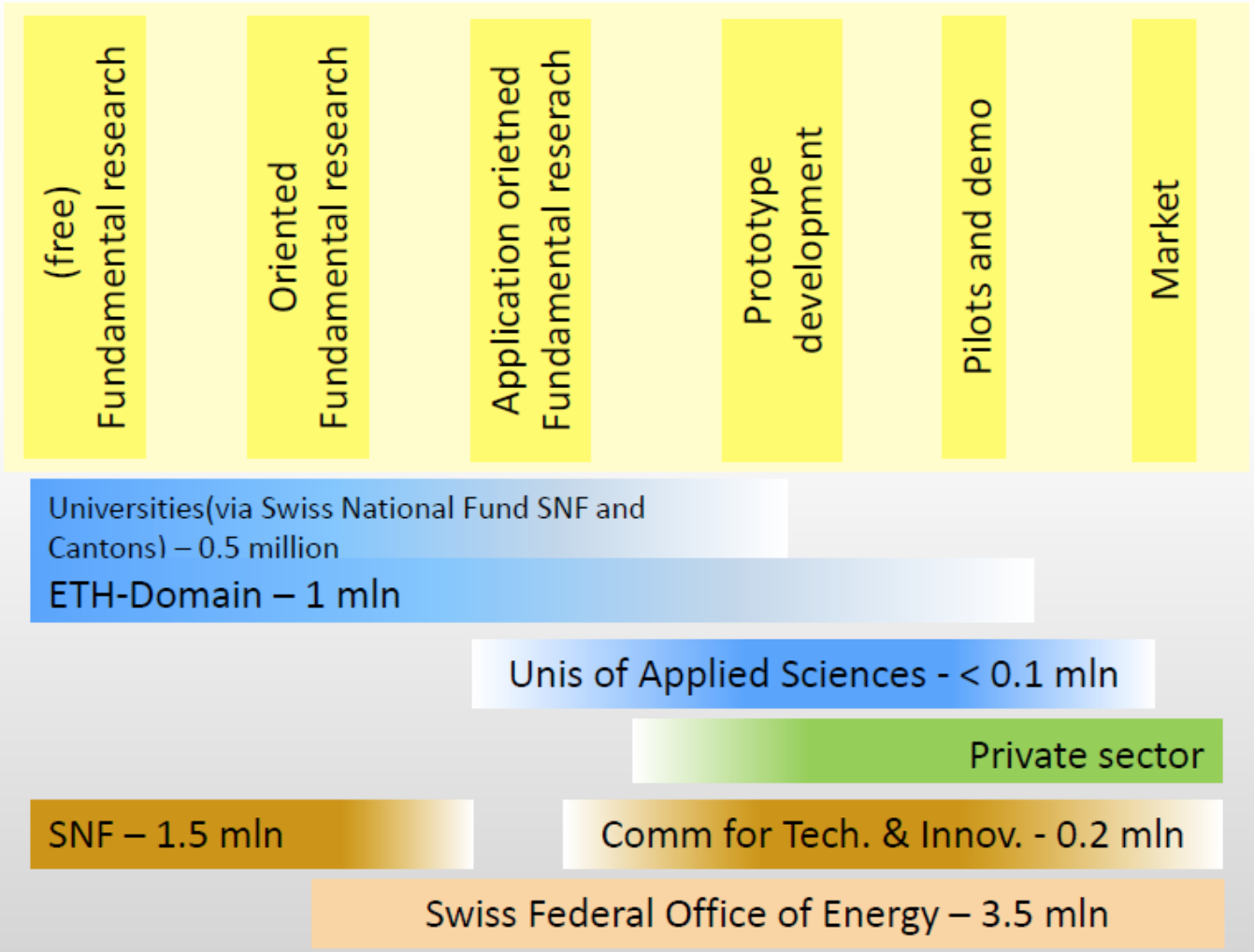
Action is needed to **remove non-technological** (including legislation) **barriers** to exploit the full potential of efficient H/C

## *2. SCOPE*

A number of areas relate to **DHC**, for example:

- Identifying, developing, and promoting **new markets for the recovery of heat from industry**
- **For district heating and cooling industry**
  - improve the transparency of the market and increase consumer trust
  - exchange of information, best practice examples, consumer practices, motivations and barriers
- **Heating and cooling planning**

# RD&D Funding Challenges

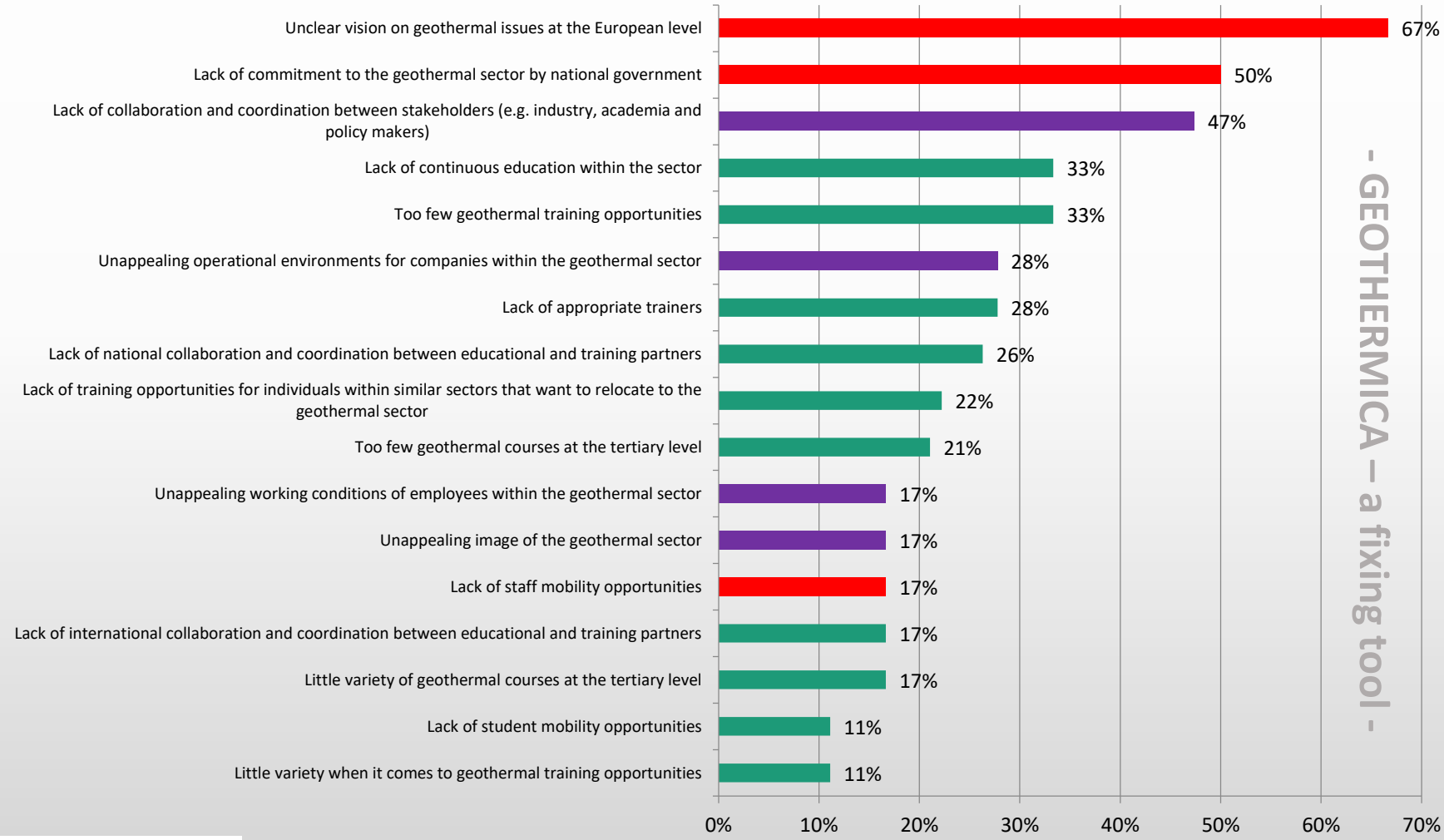



- Legal basis
- Dedicated / general funding
- Ability to fund activities abroad
- Call process
- Selection process
- Award process
- Reporting
- Quality control
- Assessment of impact

# Barriers and opportunities RD&D

- A lot of barriers are mentioned in regards to geothermal energy research
- In all categories; technological, economical, commercial, organizational and political
  - … most in technological and political
- Opportunities were also mentioned by all participants, both already established ones as well as future ones. Ranging from awareness raising to the potential of collaboration between stakeholders.

# Barriers according to survey

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# Key Recommendations RD&D

- Amount of funding is not enough. More joint plan and cooperation between national and European stakeholders.
- Look at the market and try to see what elements are needed for the market. Role of public authorities is important there.
- Being able to speak in a single voice, and express the opinion of the geothermal industry.
- Strengthening the organization. Bring together academia and industry. Position the sector as one that can provide reliable affordable technology.
  - Action: Geothermica
- The geothermal sector is very broad one. We need to create better links between these sectors.
- Stick to the geothermal roadmap. Funding by national programme owners with an add-on from EU and the Industry is recommended.

# Key Recommendations RD&D

… from the Brussels meeting:

- more funds fully committed to the field of geothermal energy are needed
- mutual virtual funds for international cooperation, leaning on transnational agreements for intellectual exchange
- more cooperation
  - bringing academia and industry closer together
- technological platform
- awareness raising of geothermal energy

# Future Growth of Geothermal

Conditions, necessary for further growth of the utilization of geothermal energy in general fall into three categories:

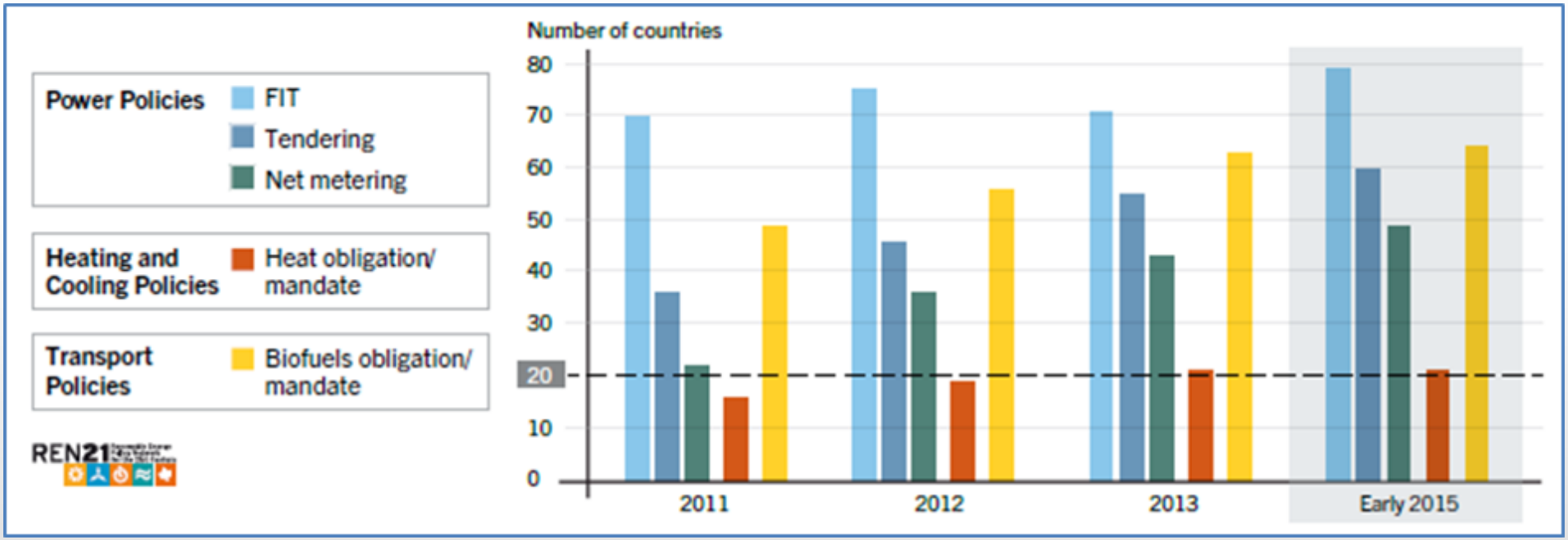
- Financial:
  - instruments that meet the challenges of high investments, uncertain success, long pay-back period for district heating systems.
- Legislation/regulation:
  - a need for adequate and transparent legislation. Adjustment period for permits should be reasonable.
- Geological issues:
  - knowledge of the resources, availability of relevant data, knowledge on re-injection issues (WP2 D2.1).

# Seminar of Experts in Brussels 5 October 2015, on Geothermal Opportunities and Policy Recommendation

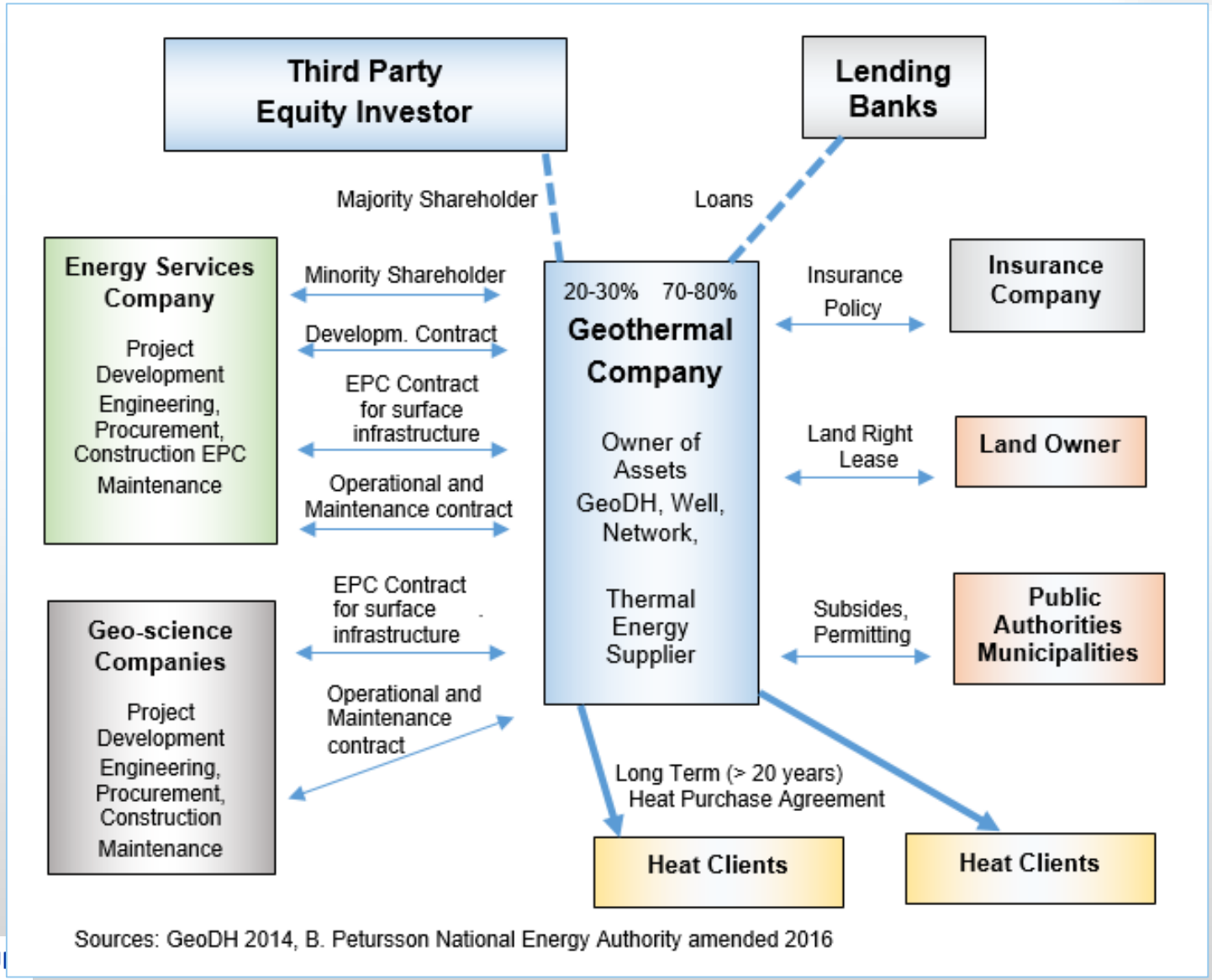
# Overview of the presentation

- Objectives and Structure of the Project
- Funding of RD&D
- Funding of Geothermal Projects
  - The Geothermal Structure
  - The Questionnaire
  - The Brussels Seminar
  - Awareness Raising - Climate concerns

# Number of Countries with Renewable Energy Policy, by Type, 2011 – 2015

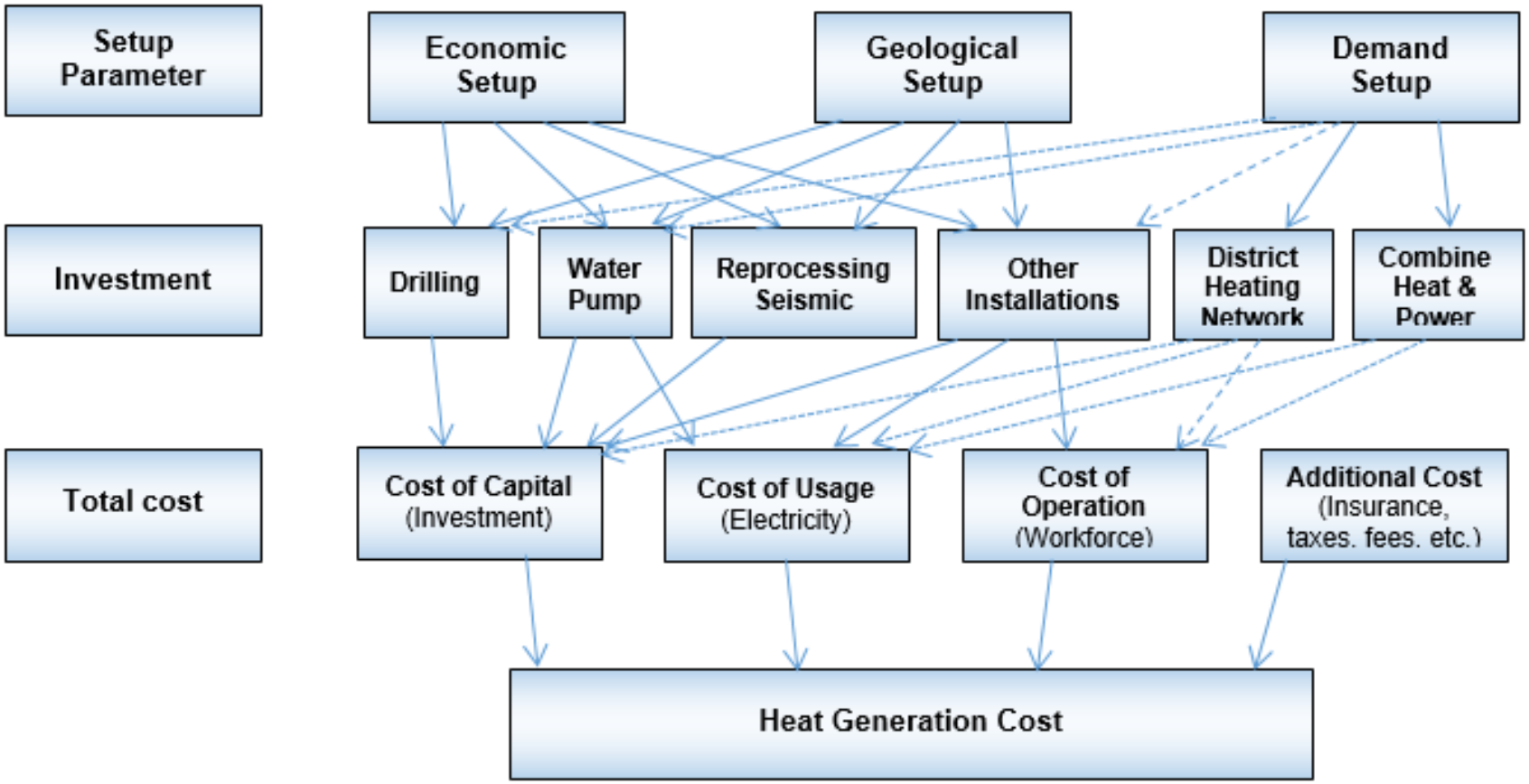


# Understanding better benefits of GeoDH
# Legal and Financial Framework for GeoDH



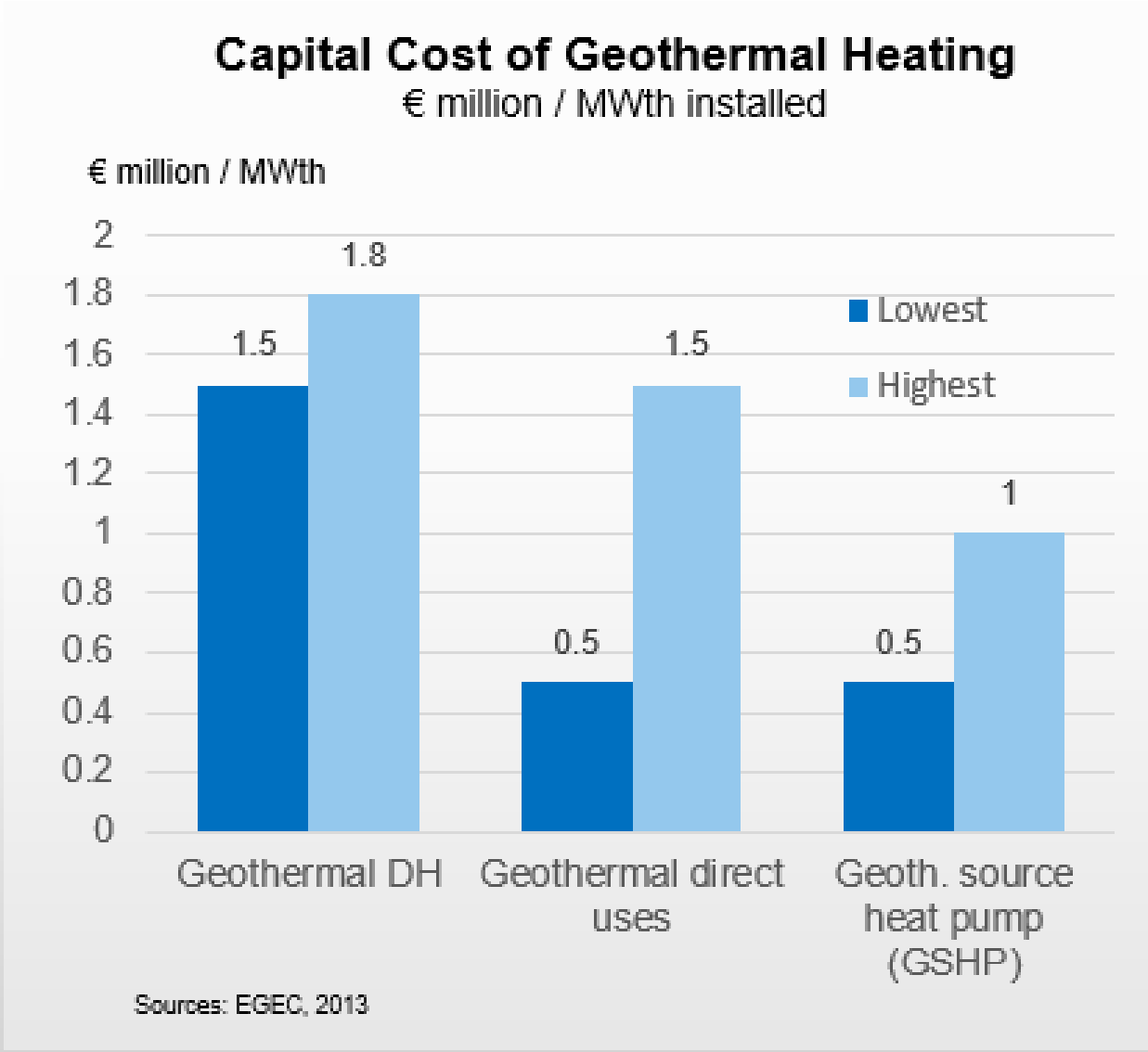

Sources: GeoDH 2014, B. Petursson National Energy Authority amended 2016

# Cost Structure of Geothermal Heat Generation Project




Sources: GeoDH 2014, B. Petursson National Energy Authority, amended 2016

# Understanding better benefits of GeoDH
# Capital Cost Structure of Geo Projects

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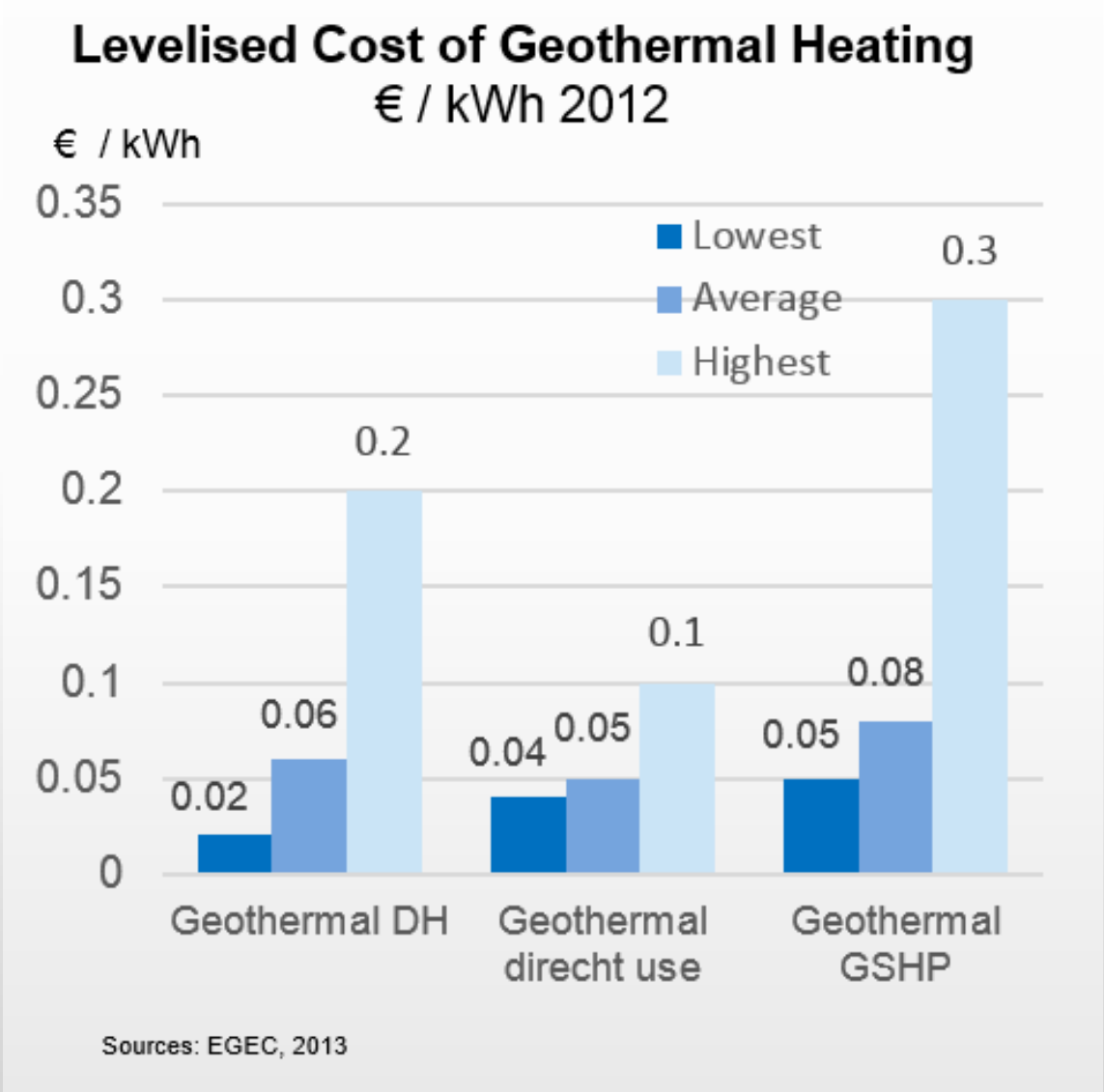


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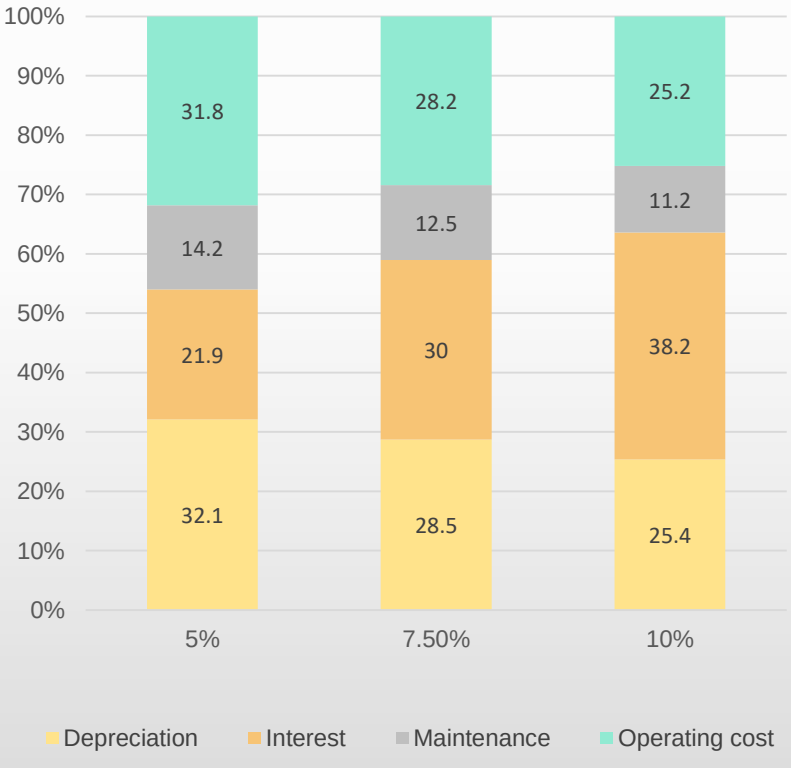
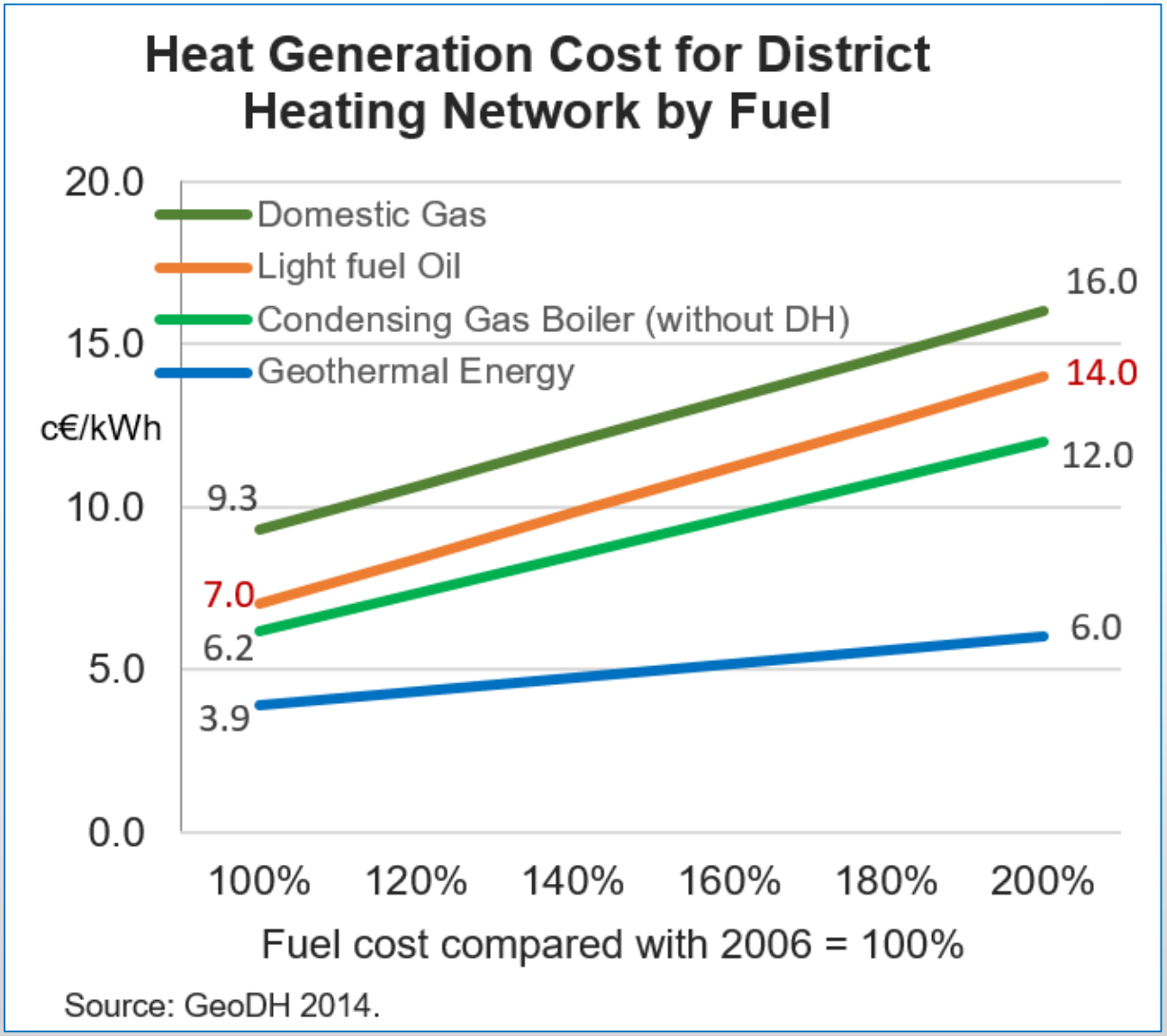
# Legal and Financial Framework for GeoDH


Sources: GeoDH, 2014



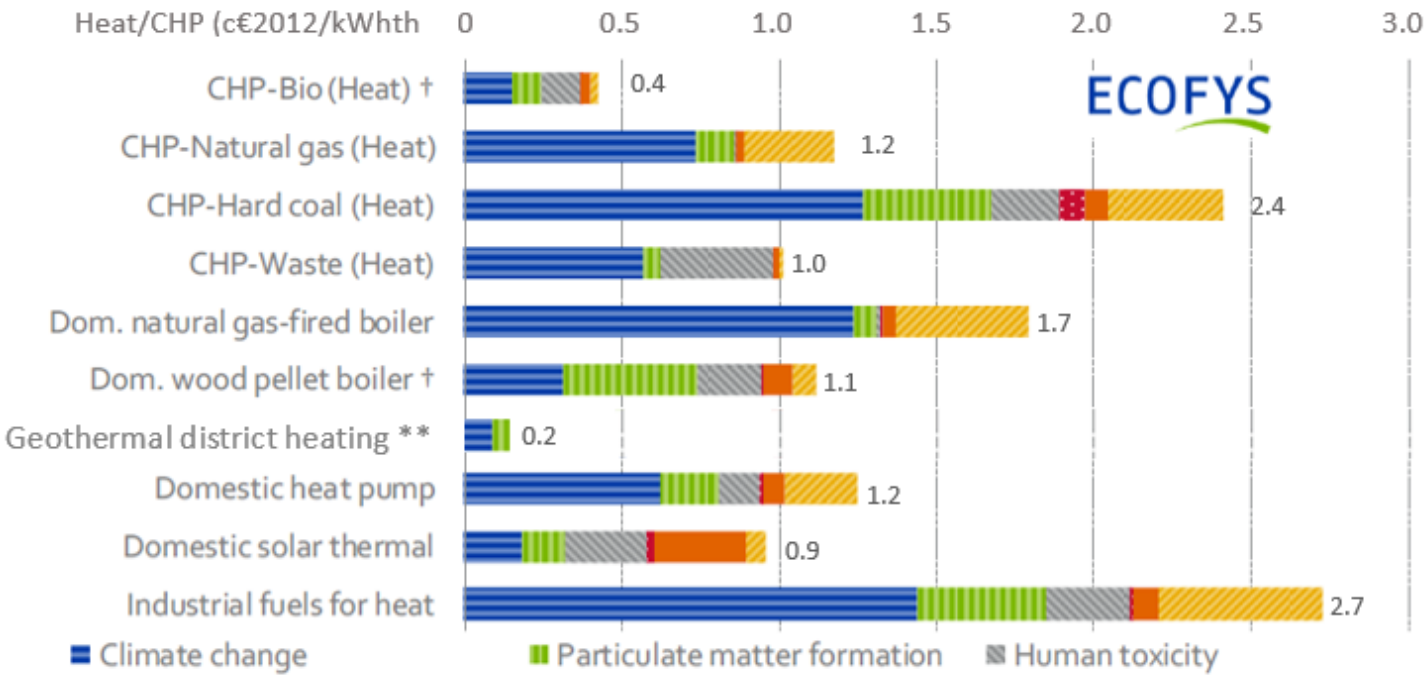

Sources: GeoDH, 2014

# Understanding better benefits of GeoDH
# Price Structure of Geo Projects



# Overview of the presentation

## External cost per technology for heat and CHP technology, in Europe

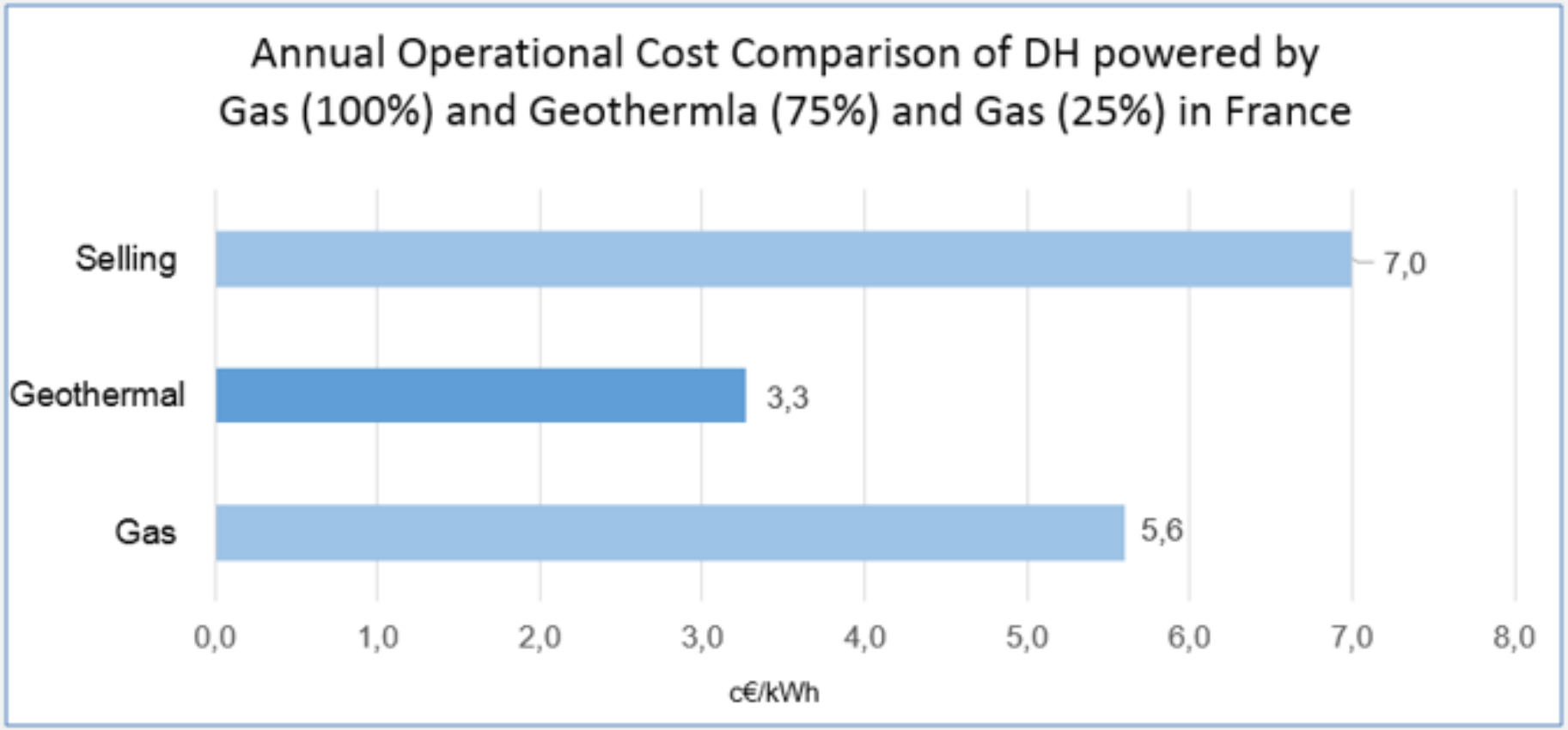



*** In a closed circulation, and if renewable energy is also used powering the pumps, very little external cost is resulting from geothermal district heating. National Energy Authority Iceland.*

*Source: ECOFYS, Europe 2014*

# Understanding better benefits of GeoDH Price Structure of Geo Projects

Figure 2.4.6.2.



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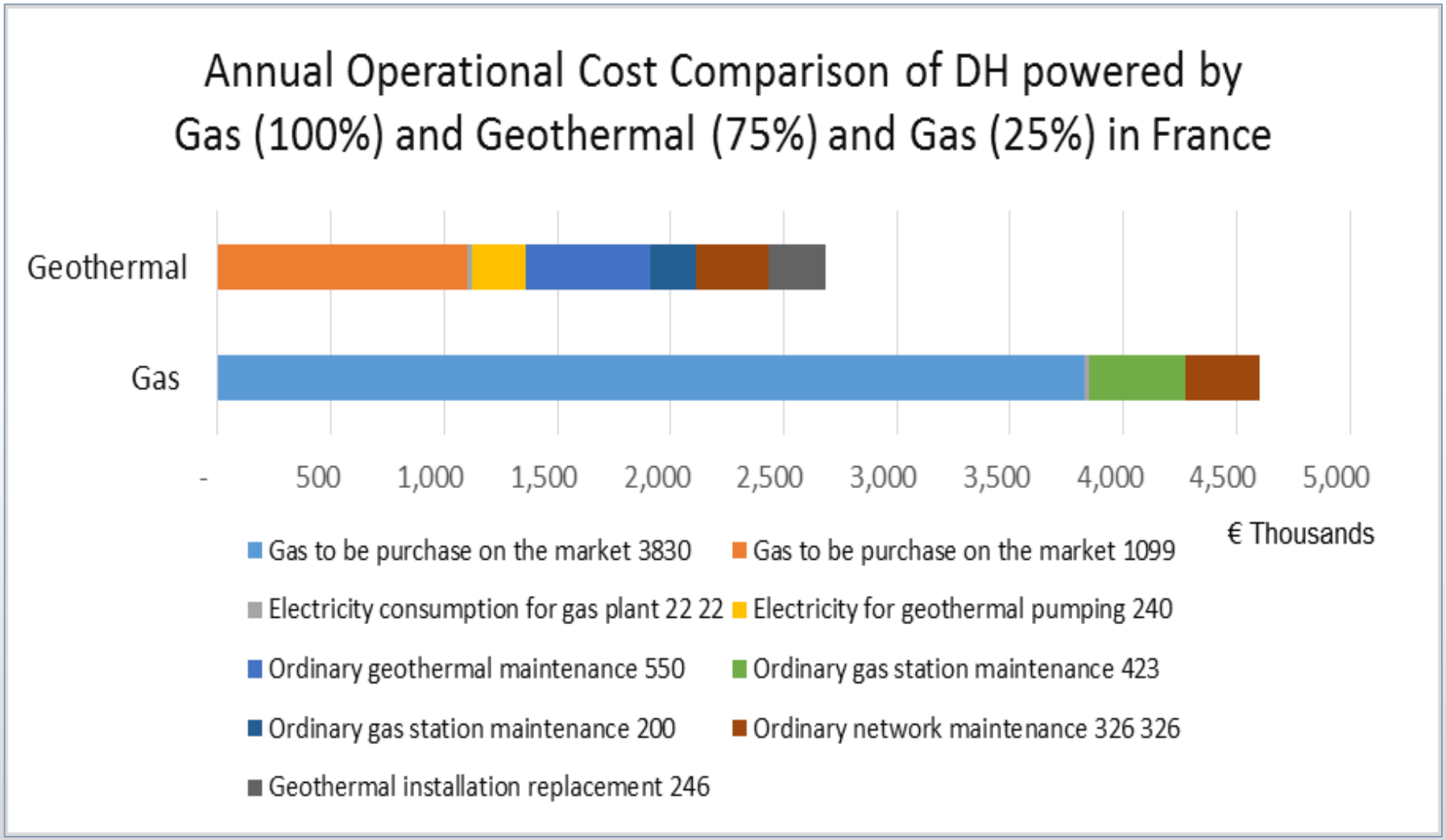

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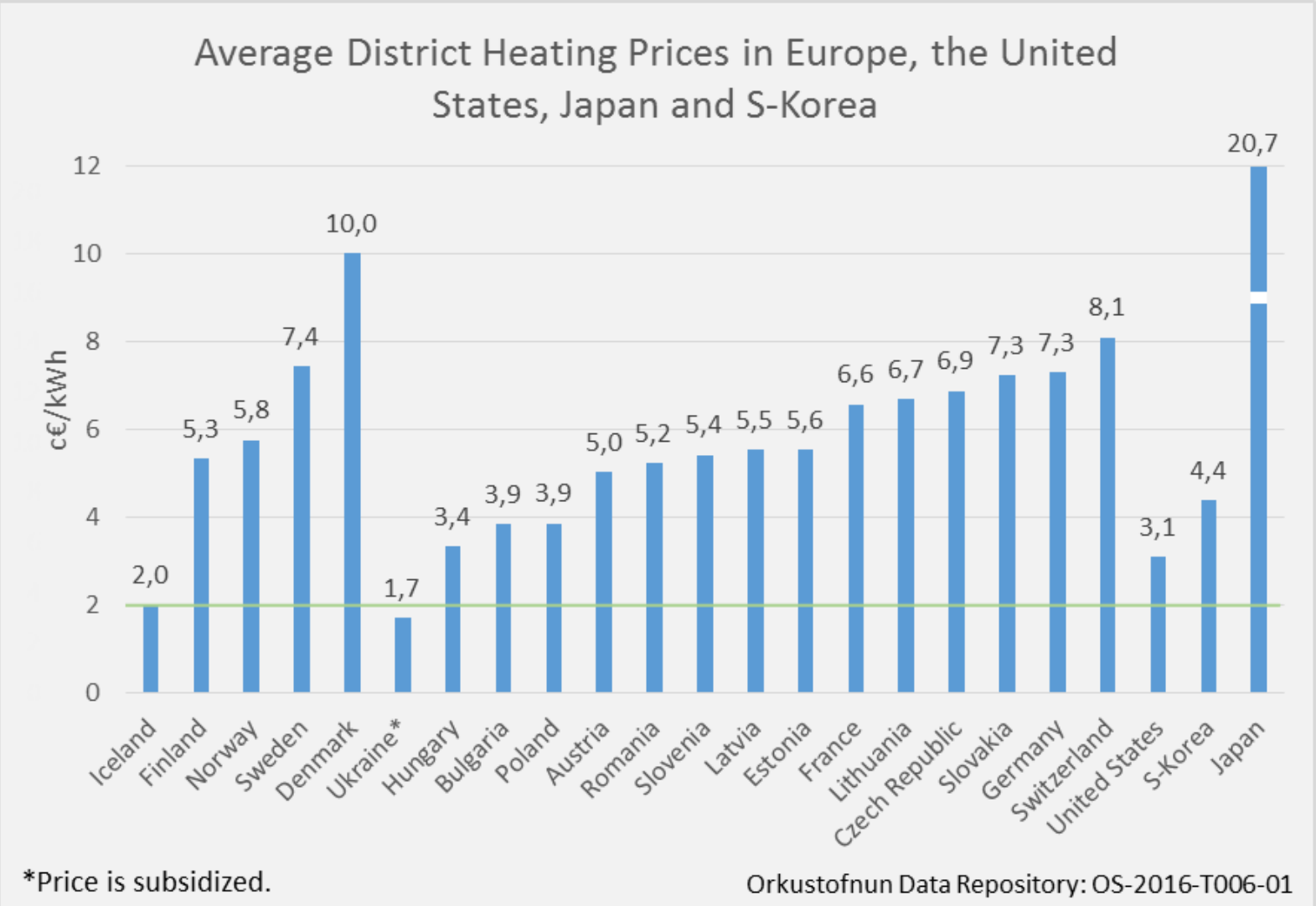


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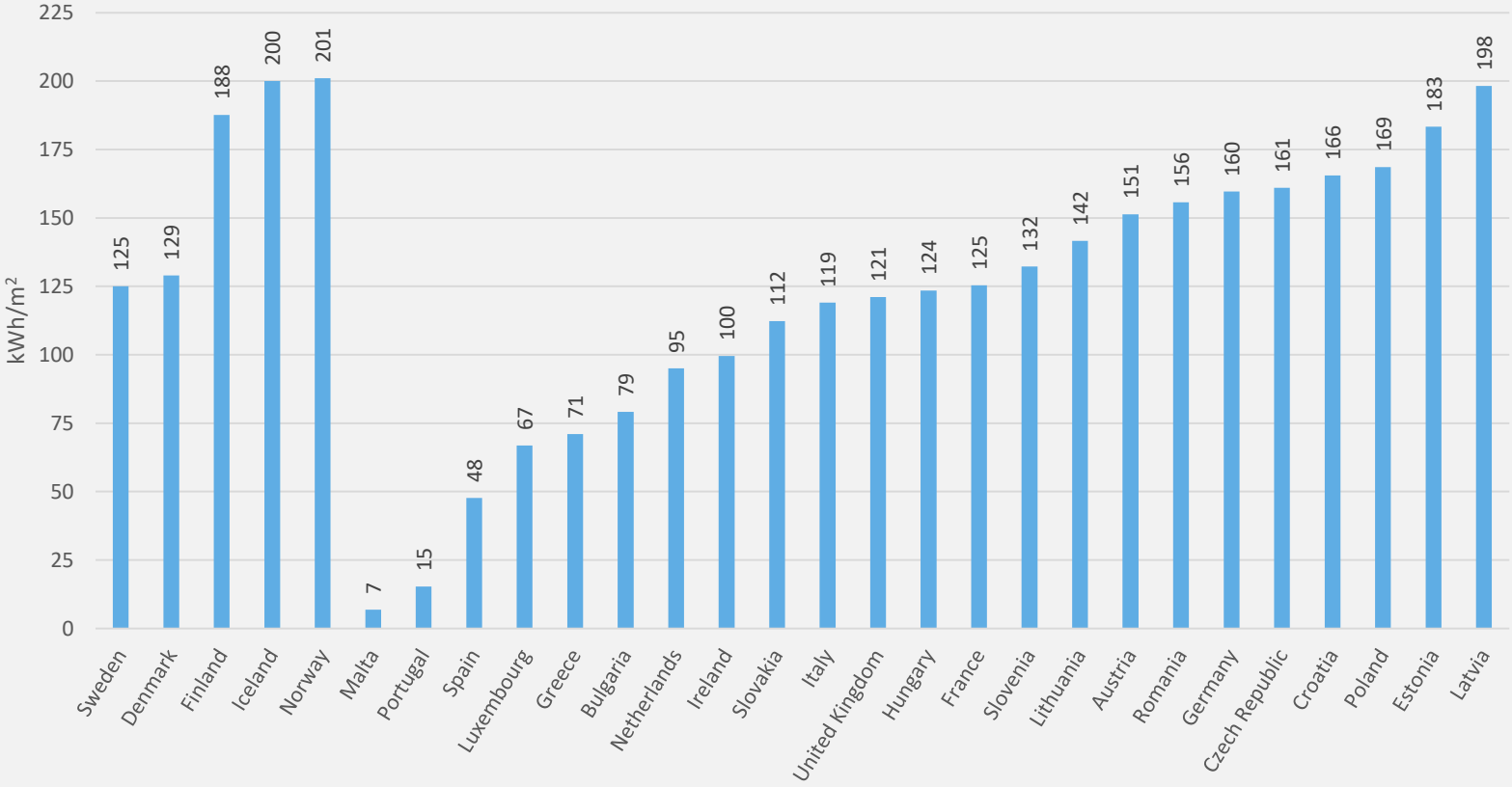


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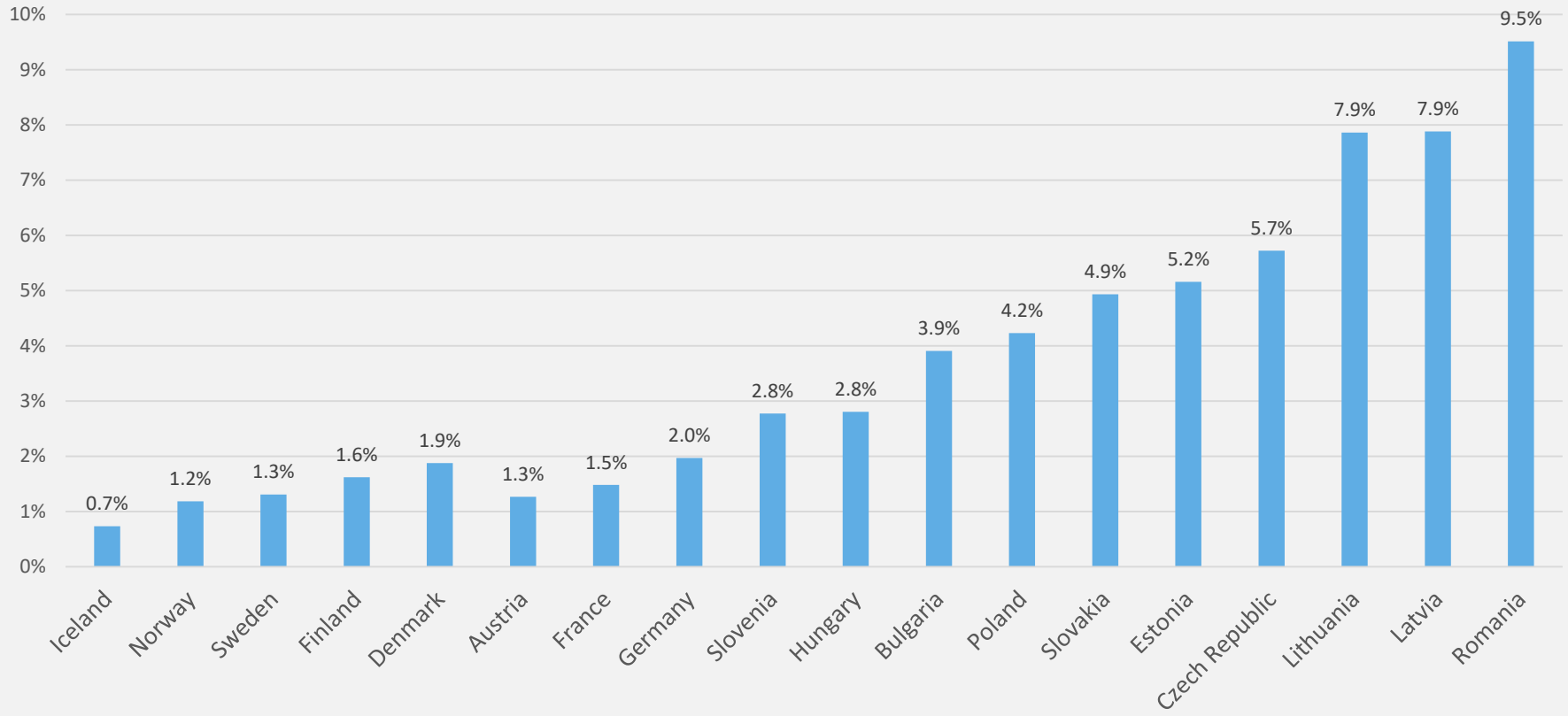


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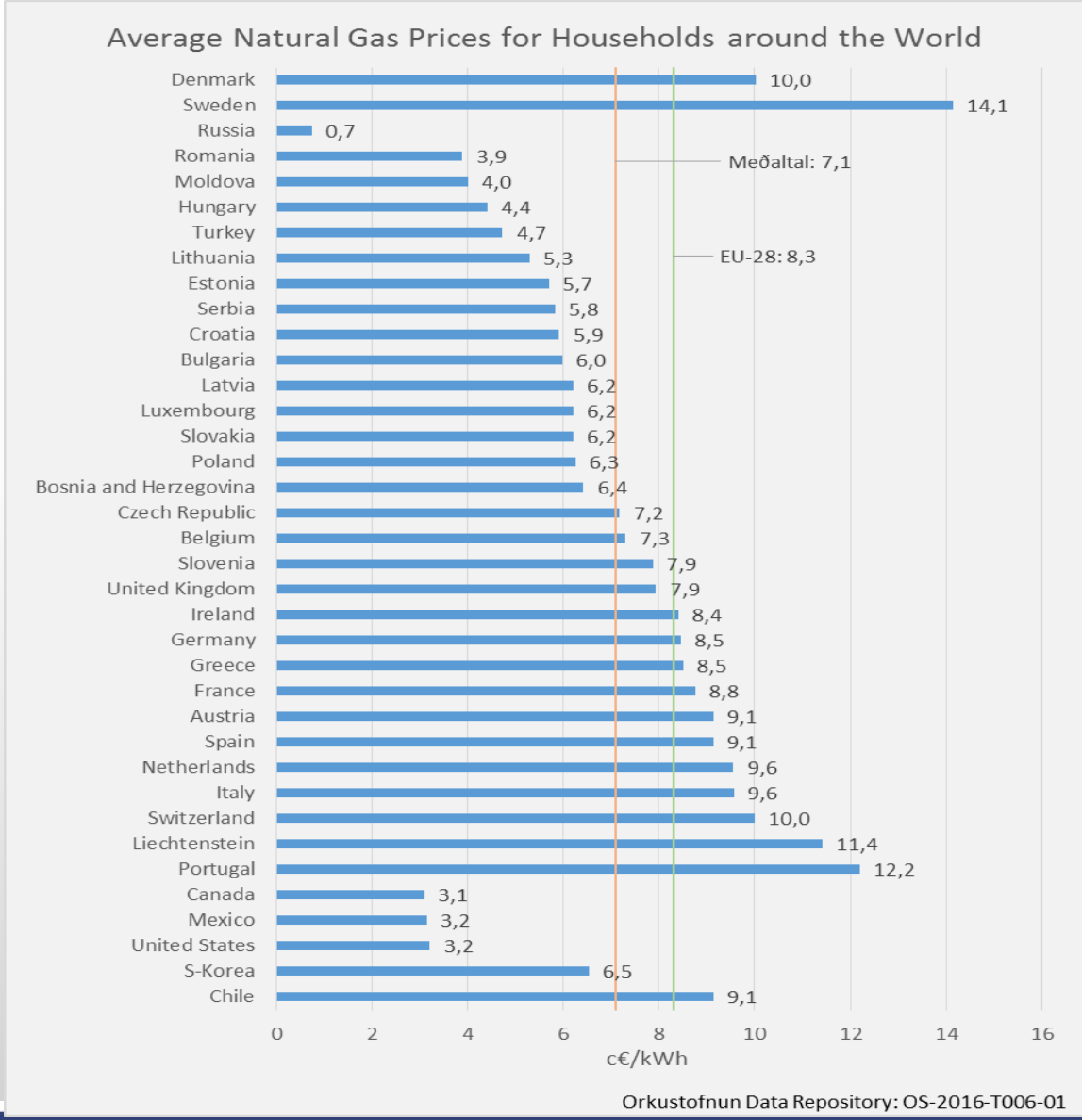


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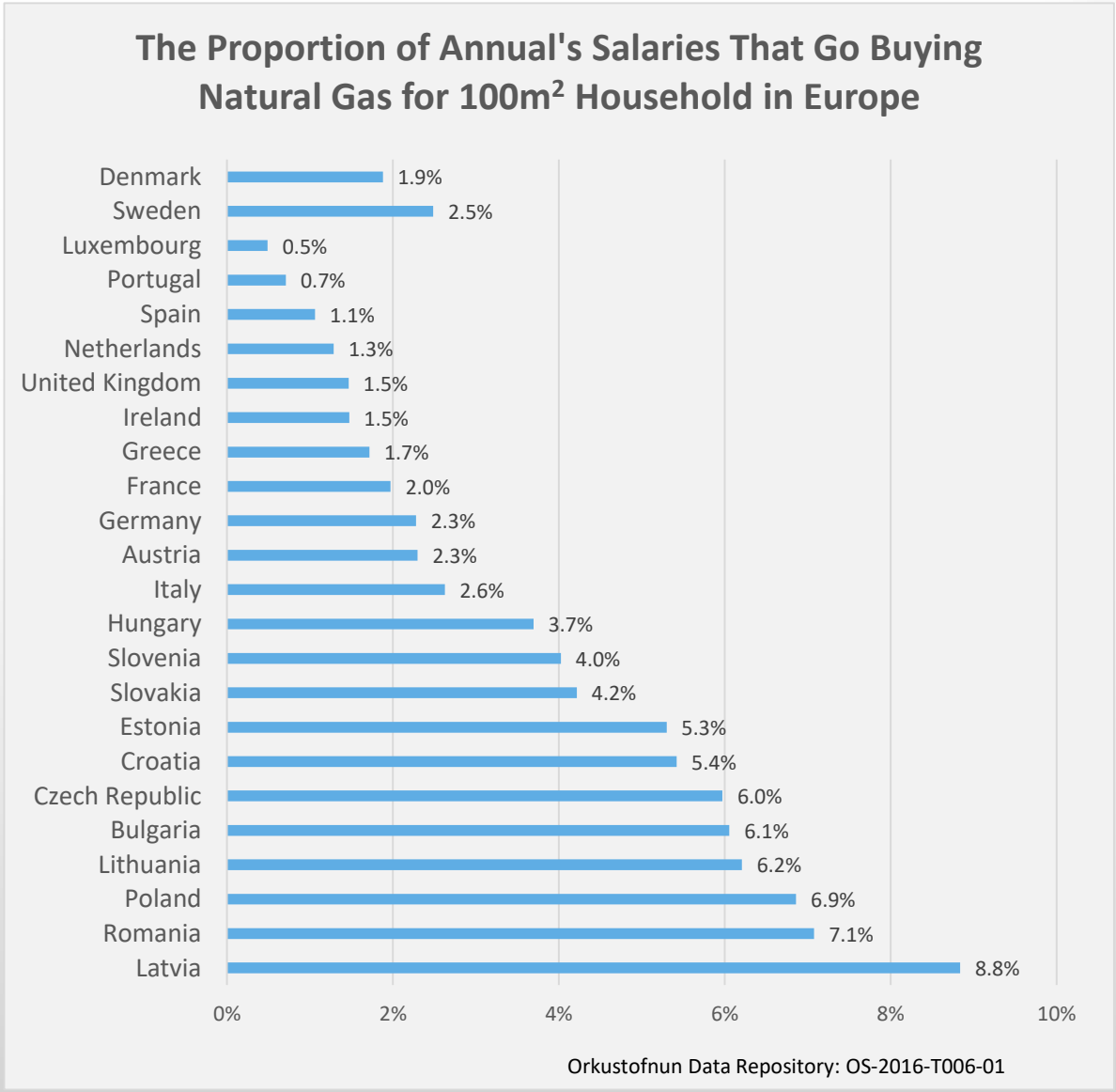


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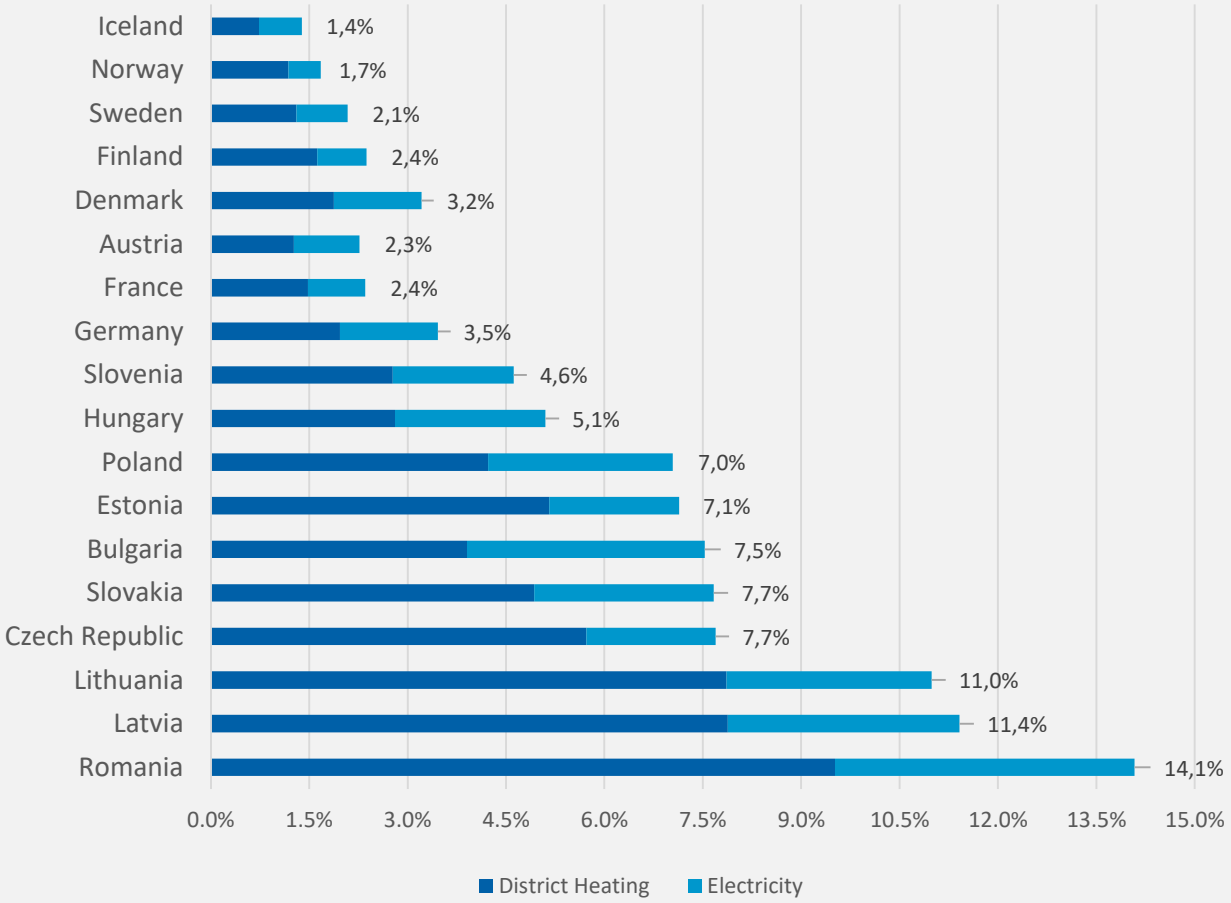


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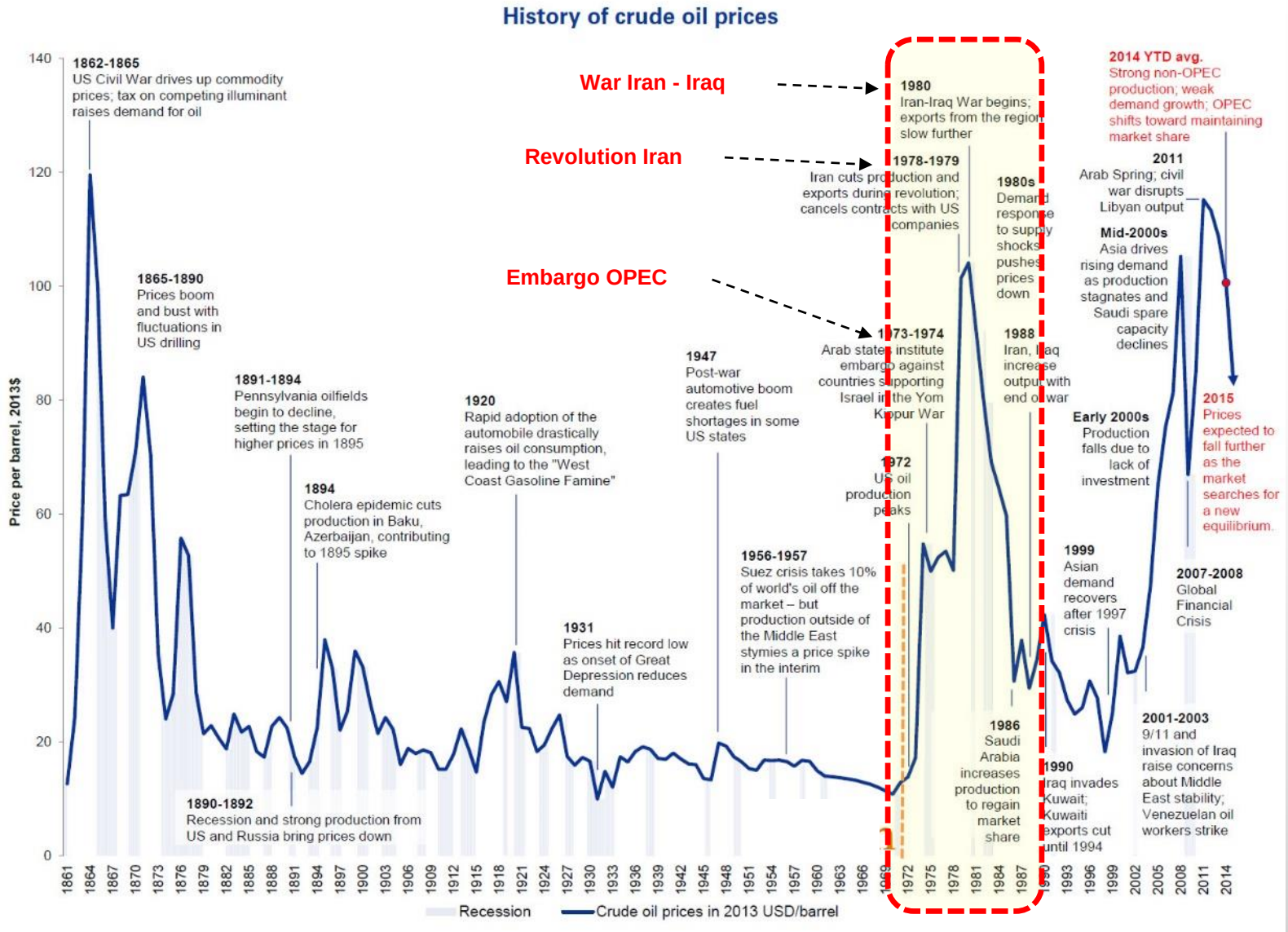
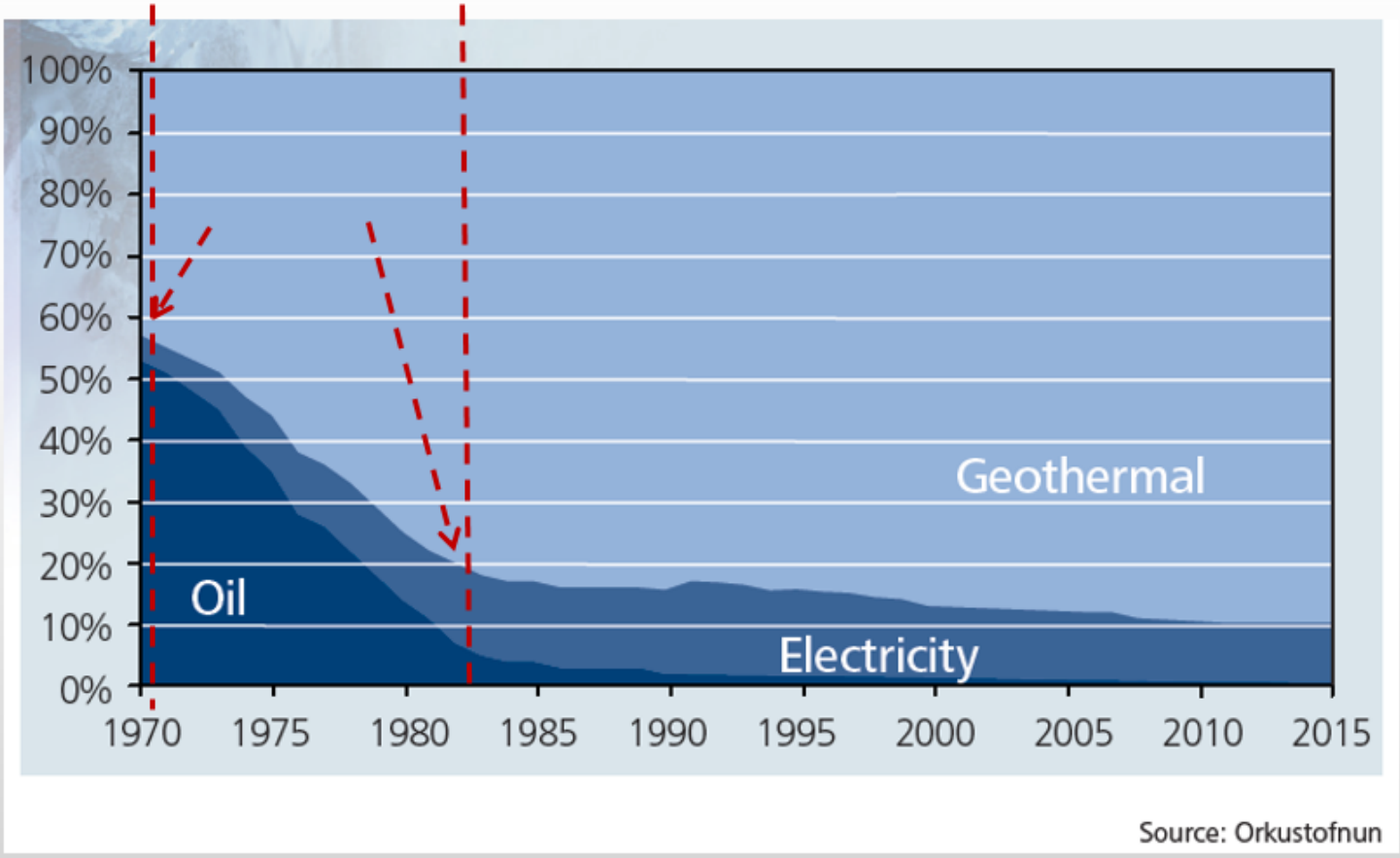
# Then the Oil Crises – Now the Climate Crisis

## The Crises was the Awareness Trigger 1970 -1980



# Expansion of GeoDH
## Space Heating by Source 1970–2013

- Biggest steps in GeoDH were taken during the oil & war crisis 1970 – 1982
- External conditions – raised the need of evaluation and GeoDH Planning
- Policy goals to increase geothermal – both national and within main cities
- It took only 12 years to increase GeoDH from 40% to 80% of total space heating

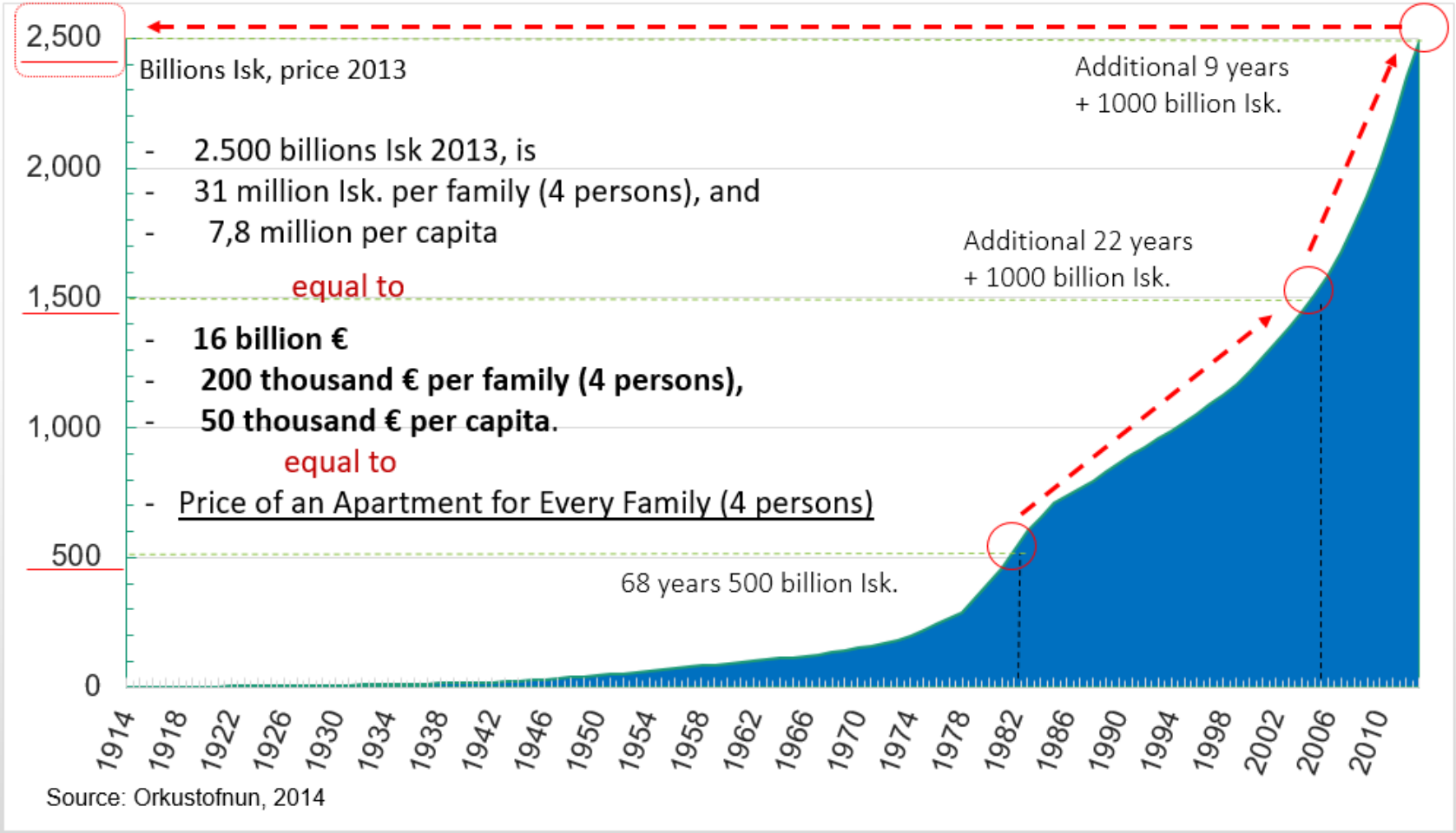


# Awareness Raising

## Cumulative Savings of Geothermal District Heating

**1944–2013, (mostly since 1978, last 35 years)**

**2% interests, fixed price**

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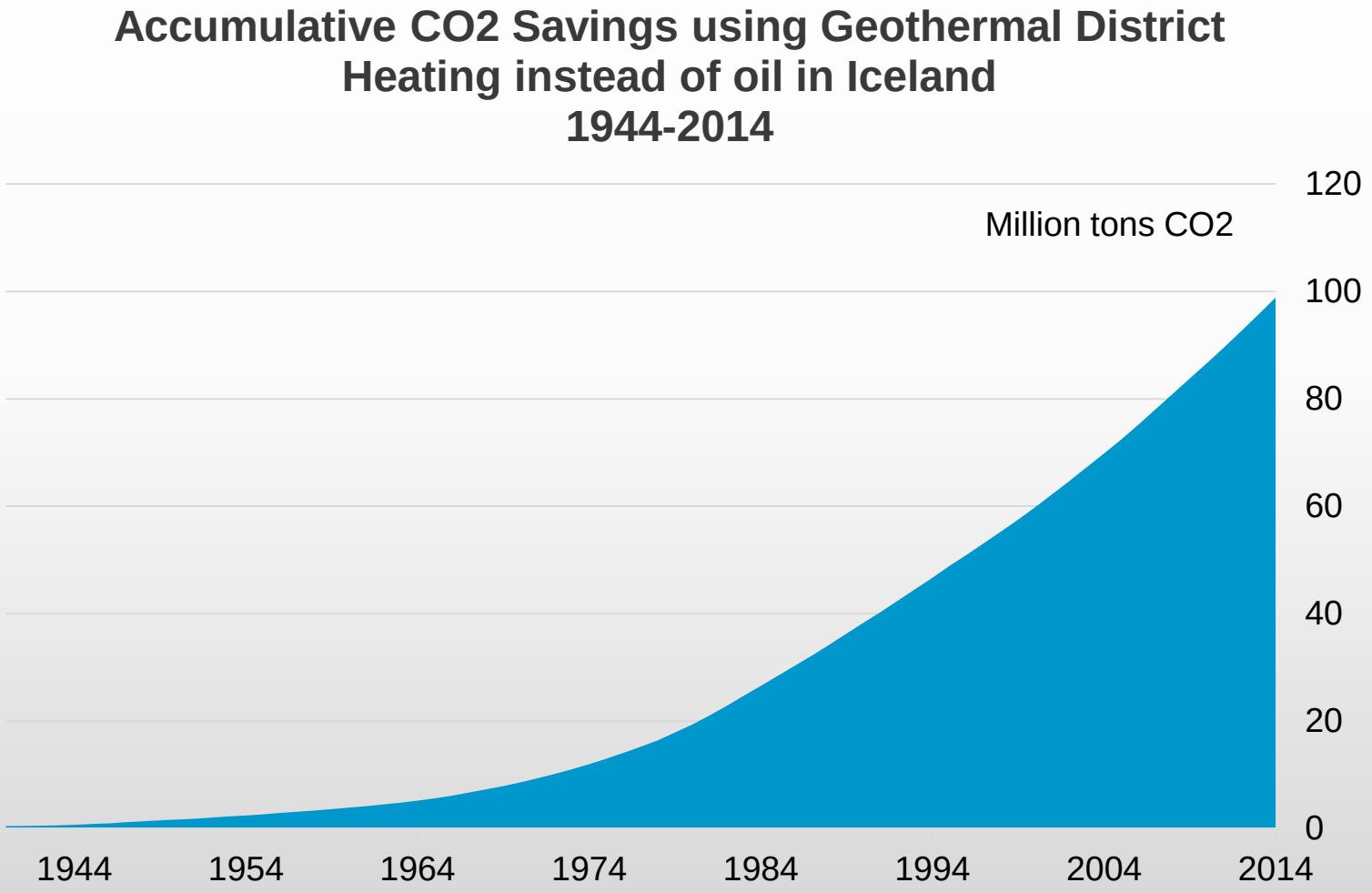
# Awareness Raising – linked to Climate
# Contribution of Geothermal to lower CO2

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# Awareness Raising – linked to Climate
# Contribution of Geothermal to lower CO2

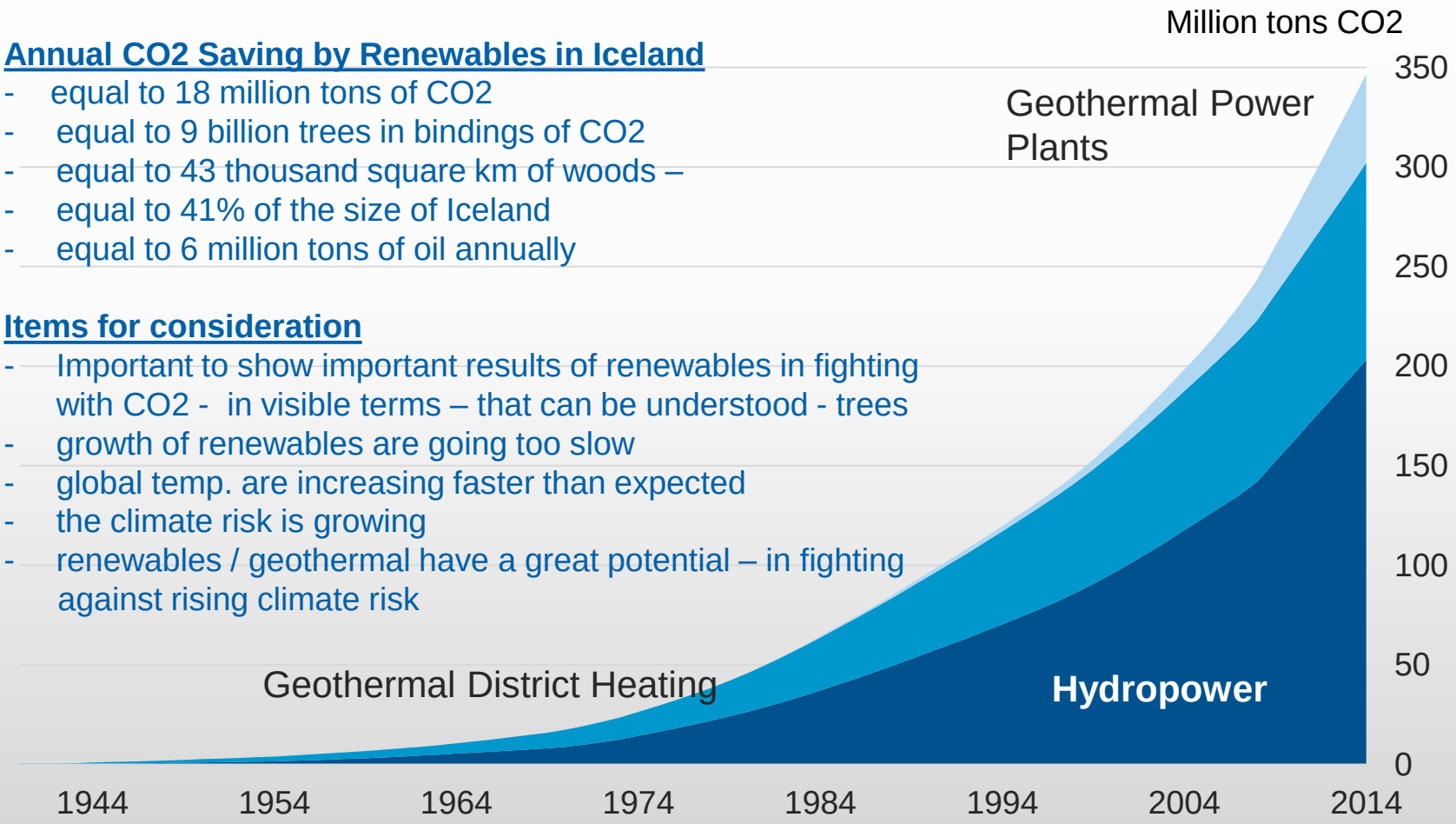
## Accumulative CO2 Savings using Renewables instead of oil in Iceland 1944-2014

**Annual CO2 Saving by Renewables in Iceland**

- equal to 18 million tons of CO2
- equal to 9 billion trees in bindings of CO2
- equal to 43 thousand square km of woods –
- equal to 41% of the size of Iceland
- equal to 6 million tons of oil annually

**Items for consideration**

- Important to show important results of renewables in fighting with CO2 - in visible terms – that can be understood - trees
- growth of renewables are going too slow
- global temp. are increasing faster than expected
- the climate risk is growing
- renewables / geothermal have a great potential – in fighting against rising climate risk

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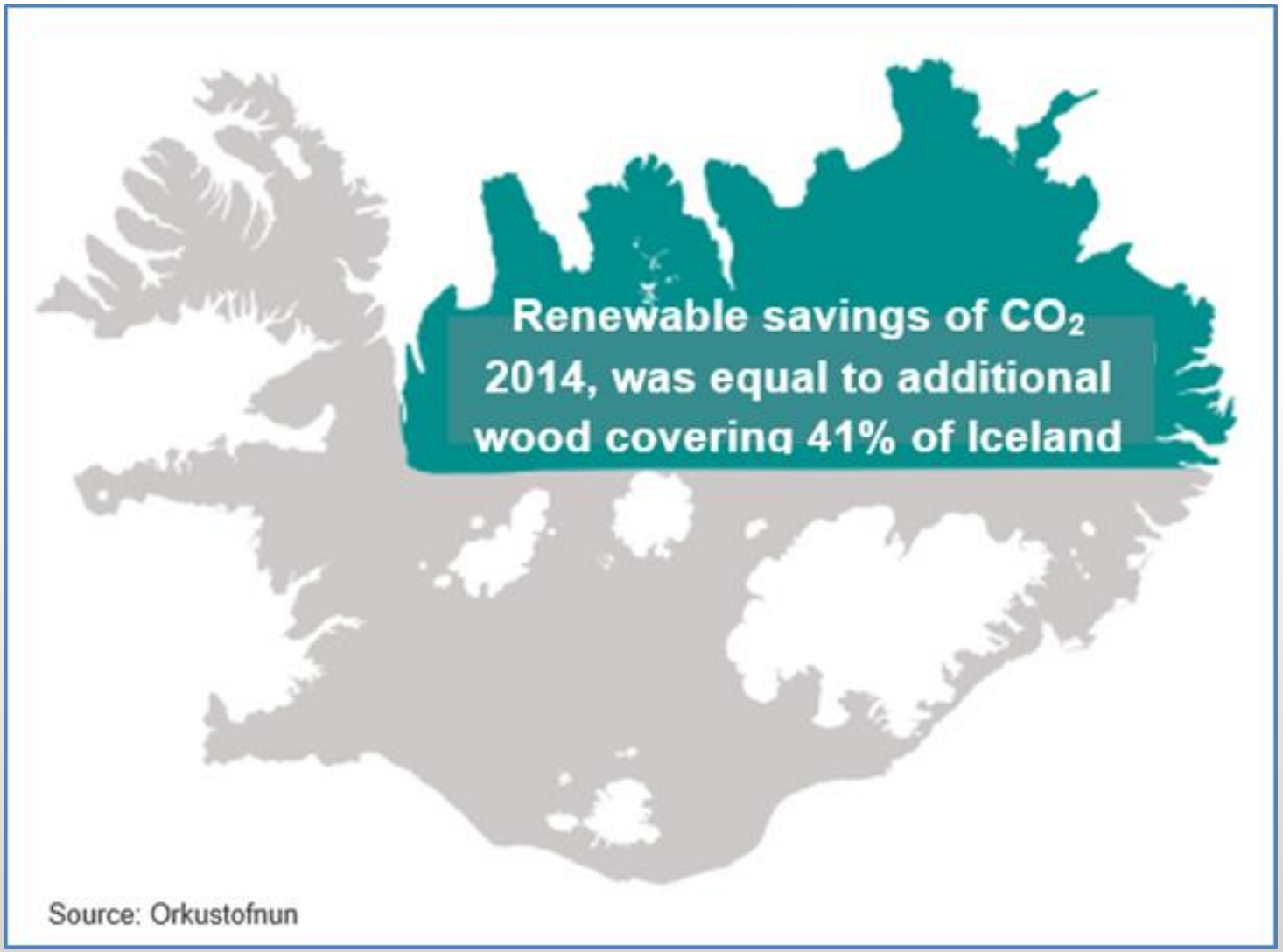
# Activities and Opportunities by using Geothermal Resources

# Awareness Raising – linked to Climate
# Contribution of Geothermal to lower CO2

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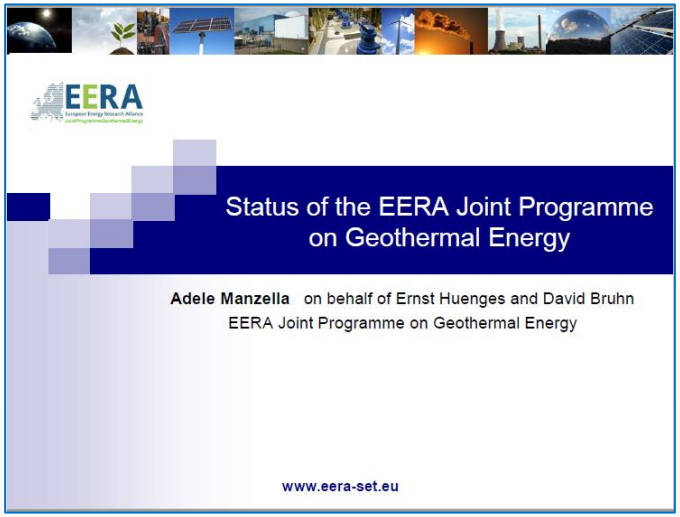
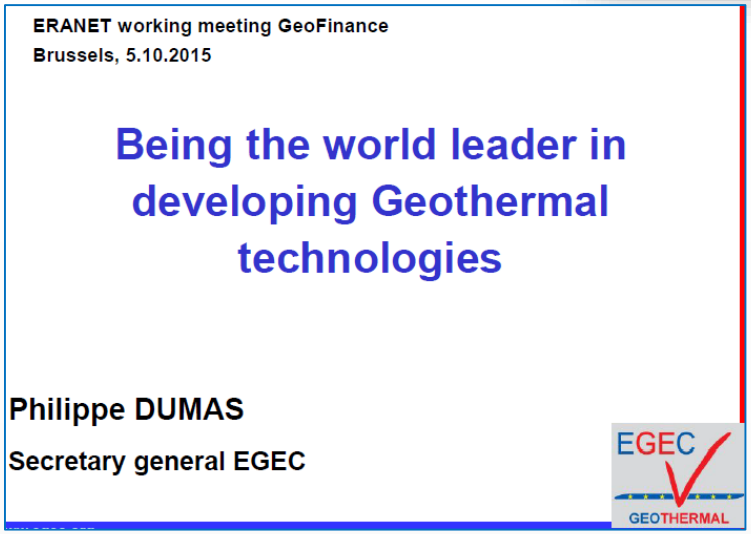
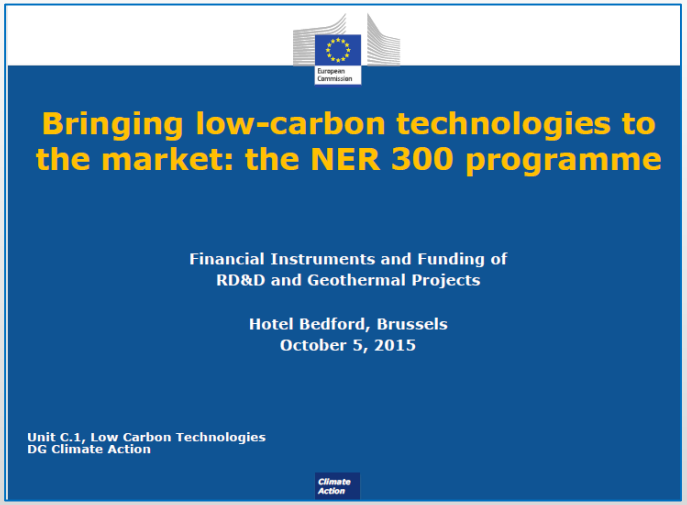
# The Brussel Meeting – Geo Projects

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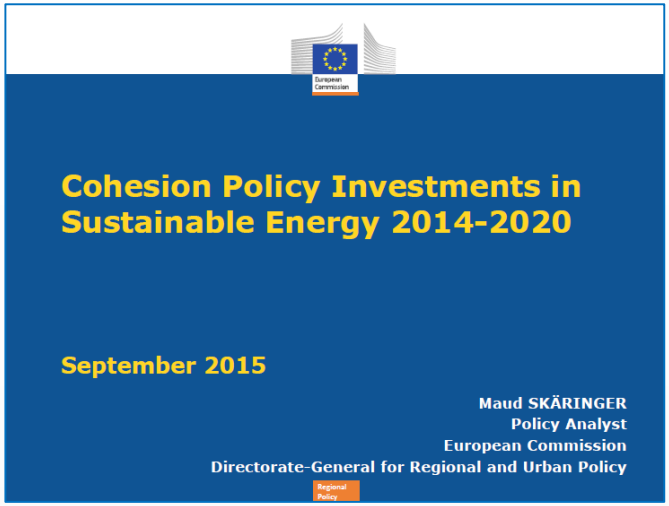
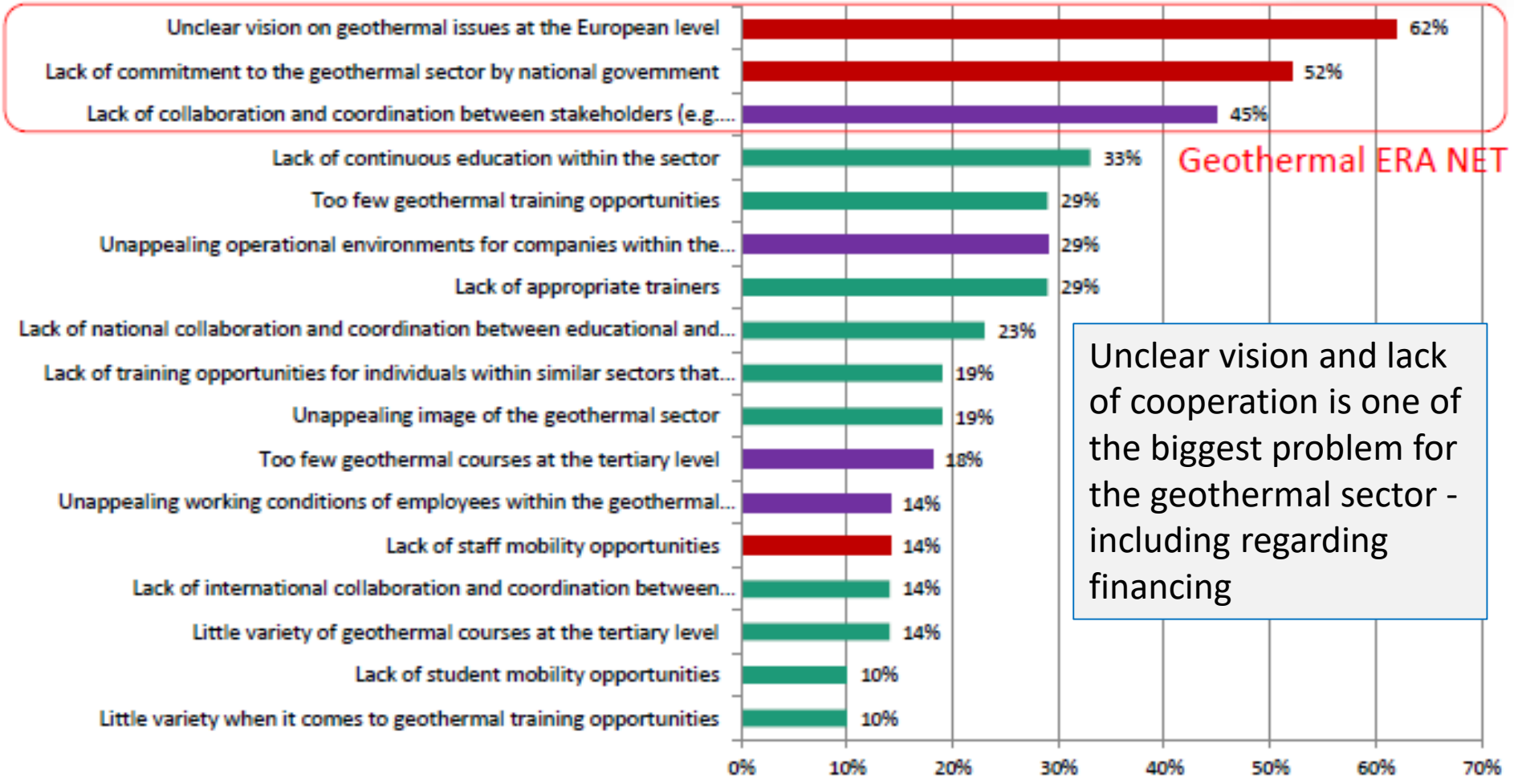




# The Main Geothermal Problems



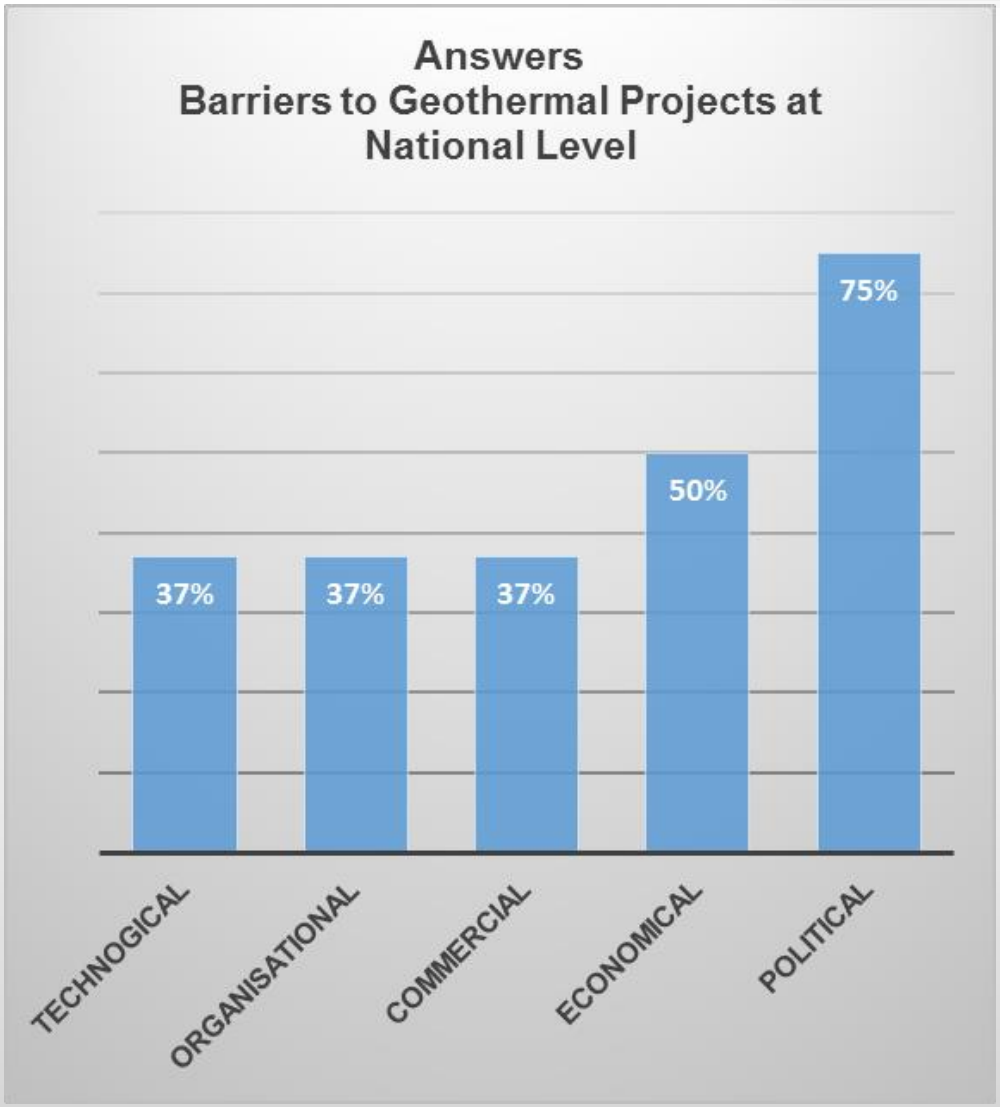

Unclear vision and lack of cooperation is one of the biggest problem for the geothermal sector - including regarding financing

Factors deemed of high importance as contributors to a lack of human resources within the geothermal sector. Educational factors are coloured green, policy/sectorial factors red and industry factors purple

Geothermal ERA NET
Coordination Office
Orkustofnun, Iceland

# The Survey – Geothermal Projects

- Several barriers, mainly, economical and political

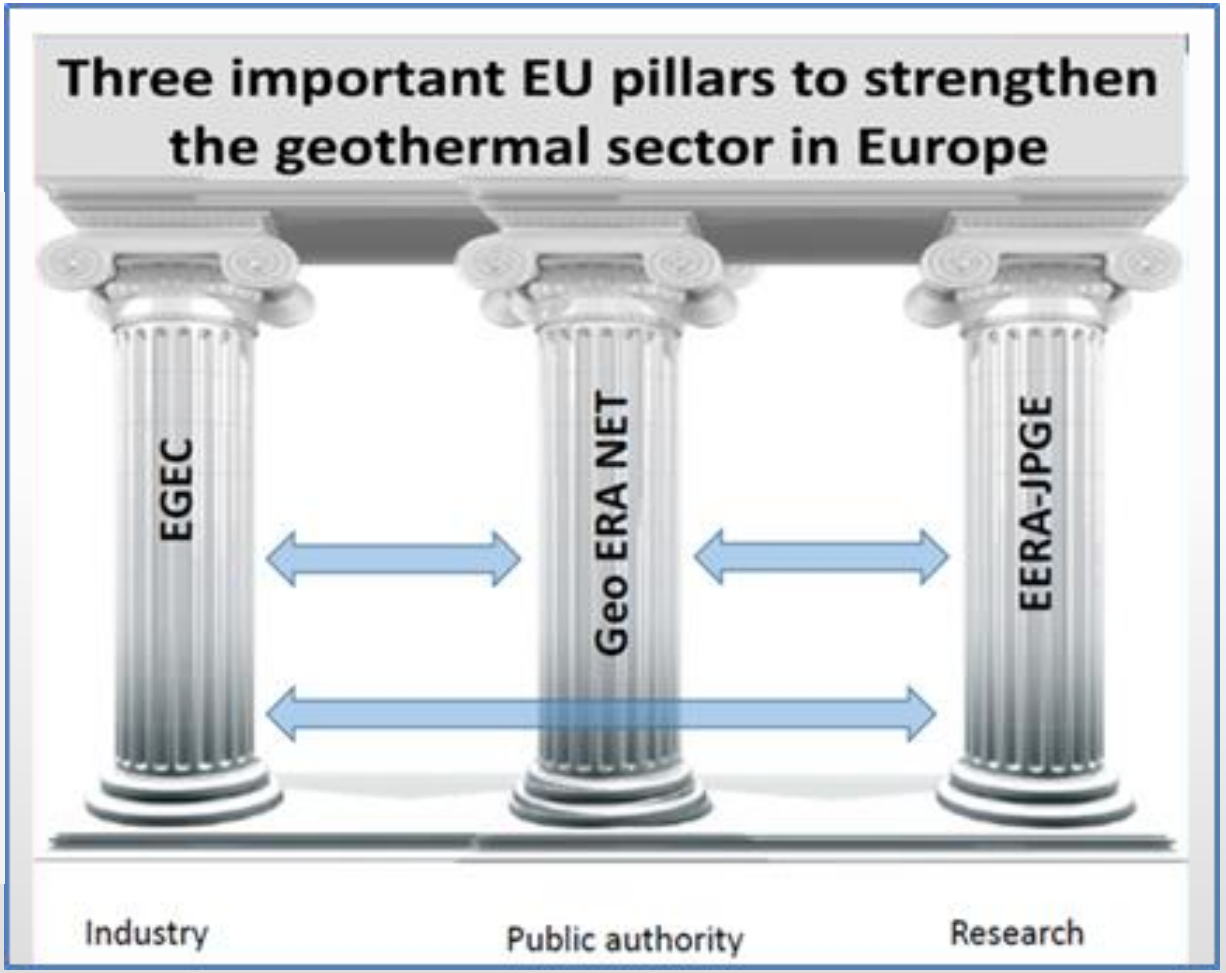


# Three important Geo EU Pillars

**More cooperation and communication necessary at European level, National level and Company level**

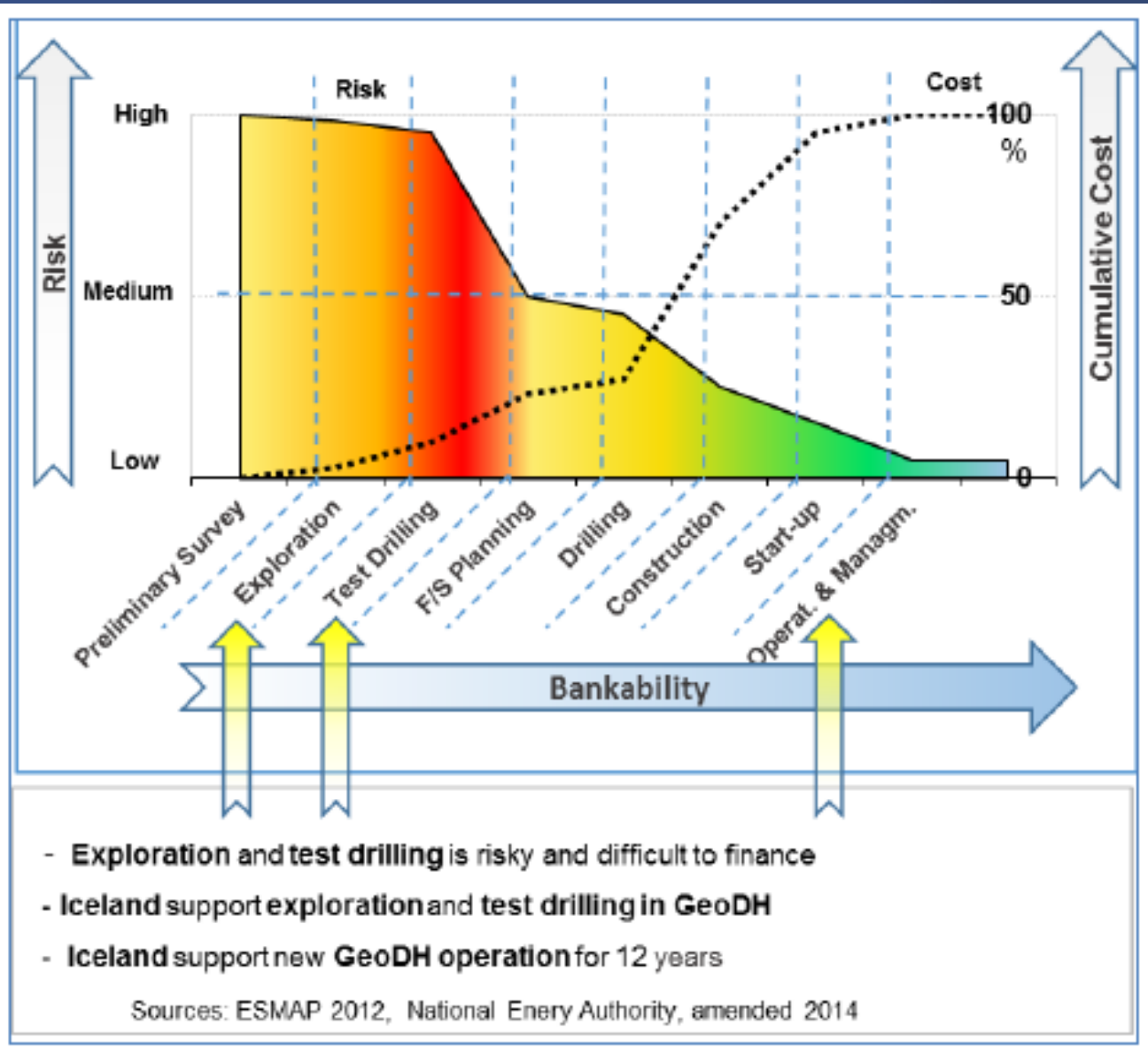
**Industry, RD&D, Banks, etc - Cooperation**

- Practical information
- Using existing information
- Highlight barriers
- Financial - opportunities
- Awareness – building
- Policy - recommendation



# The Survey – Geothermal Projects

- Financial barriers on early stages geo. process



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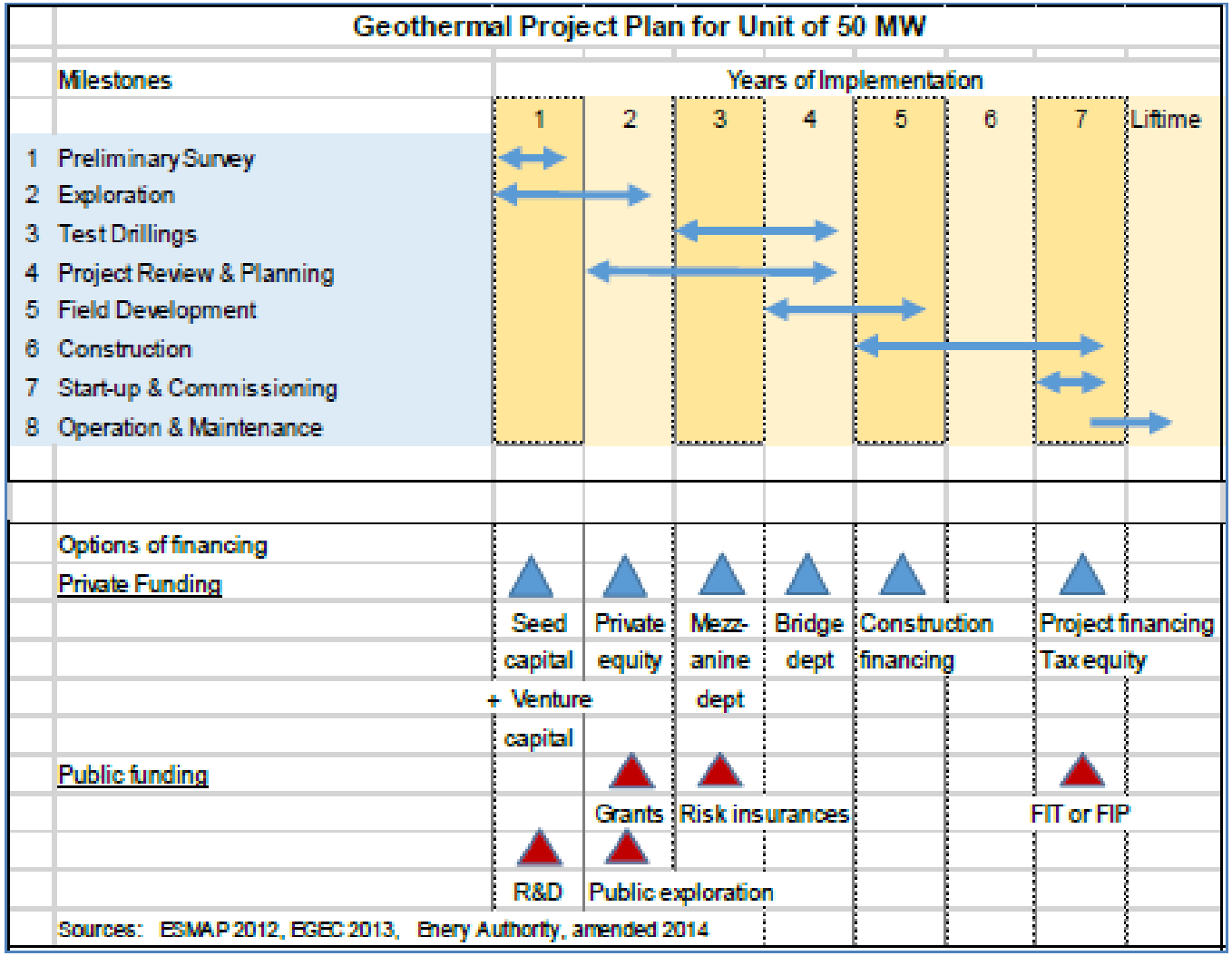

# National Support for Renewable Energy

## NATIONAL SUPPORT FOR RENEWABLE ENERGY

**EU Member States' use of different instruments for electricity, heating and transport (biofuels).**

| Sources: | | Austria AT | Belgium BE | Bulgaria BG | Cyprus CY | Czech Rep. CZ | Germany DE | Denmark DK | Estonia EE | Spain ES | Finland FI | France FR | Greece GR | Hungary HU | Ireland IE | Italy IT | Lithuania LT | Luxembourg LU | Latvia LV | Malta MT | Netherlands NL | Poland PL | Portugal PT | Romania RO | Sweden SE | Slovenia SI | Slovakia SK | United Kingdom UK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Electricity | FIT | X | X | X | X | X | X | | X | X | | X | X | X | X | X | X | X | X | X | | | X | | | X | X | X |
| | Premium | | | | | X | | X | X | X | | | | | | | | | | | X | | | | | X | | |
| | Quota obligation | | X | | | | | | | | | | | | | X | | | | | | X | | X | X | | | X |
| | Investm. grants | | X | | X | X | | | | | X | | X | X | | | X | X | X | X | | | | | | | | |
| | Tax exemtions | | X | | | | | | | X | X | | X | | | | | | X | | X | X | | | X | | X | X |
| | Fiscal incentives | | | X | | | X | | X | | | | | | | | | | | X | X | X | | | | | X | | |
| Heating | Investm. grants | X | X | X | X | X | X | | X | | X | | X | X | X | | X | X | X | X | X | X | X | | X | X | X | X |
| | Tax exemtions | X | X | | | | | X | | | | X | X | | | X | X | | | | X | | | | X | | | X |
| | Fiscal incentives | | | X | | | X | | X | | | X | | | | | | | | | | | X | | | | | |
| | Premium | | | | | | | | | | | X | | | | | | | | | | | | | | | | |
| Transport | Quota obligation | X | | X | X | X | X | X | | X | X | X | | | X | | X | X | X | | X | X | X | X | | X | X | X |
| | Tax exemtions | X | X | | X | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | | X | X | X | X | X | X | X |

*Sources: SEC (2011) 131 Review of European and national financing of renewable energy in accordance with Article 23(7) of Directive 2009/28/EC*

# Overview of reply by countries

| National Support for Renewable Energy Projects | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Use of different support & policy instruments for electricity, heating & cooling | | Germany | Hungary | Iceland | Italy | Portugal | Netherlands | Slovakia | Slovenia | Switzerland | Turkey | Ranking |
| Electricity | FIT | X | X | | X | | | | X | X | X | 6 |
| | Premium | | | | | | X | | X | | | 2 |
| | Quota obligation | | | | X | | | | | | | 1 |
| | Investments grants | | X | | | | (x) | X | X | X | X | 6 |
| | Tax exemptions | | | | | | X | | | X | X | 3 |
| | Fiscal incentives | X | | | | | X[1] | | | | | 2 |
| | Risk guarantee | X | | | | | X | | | X | | 3 |
| | Auctions / tendering schemes | | | | | | X | | | | | 1 |
| | Capacity markets | | | | | | | | | | | |
| | Renewable portfolio standards | | | | | | | | | | | |
| | Contracts for difference | | | | | | | | | | | |
| Direct use of geothermal energy for heating (e.g. district heating systems) | Investments Grants | X | X | X | | | X[2] | X | X | X | X | 8 |
| | Tax exemptions | | | | | | X | | | X | X | 3 |
| | Fiscal incentives | | | X | X | | X | | | | | 3 |
| | Premium | | | | | | X | | | | | 1 |
| | Risk guarantee | X | | X | | | X | | | | | 3 |
| | Auctions / tendering schemes | | | | | | X | | | | | |
| | Capacity markets | | | | | | | | | | | |
| | Renewable portfolio standards | | | | | | | | | | | |
| | Contracts for difference | | | | | | | | | | | |
| Small heating and cooling applications (e.g. shallow geothermal heat pumps, etc.) | Investments Grants | X | | X | | | | X | X | X | X | 6 |
| | Tax exemptions | | | | | | X | | | X | X | 3 |
| | Fiscal incentives | X | | X | X | | X | | | | | 4 |
| | Premium | | | | | | | | | | | |
| | Risk guarantee | | | | | | | | | | | |
| Emission | Emissions trading certifies | X | X | X | | | X | X | X | X | | 7 |
| Other measures | (Please provide very short description) | | | | | | | | | | | |
| National support for fossil fuels (oil, gas, coal) | Fiscal incentives for electricity generation | X | X | | | | | X | | | | 3 |
| | Fiscal incentives for district heating | X | X | | | | | | | | | 2 |
| Sources: Geothermal ERA NET, 2015 | | | | | | | | | | | | |

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# The Survey – Geothermal Projects

- **Technical barriers**
  - Lack of information on geothermal energy resources – regions, areas
  - Lack of information on economic and technical data about the industry
- **Regulatory barriers**
  - Lack of national geothermal regulatory framework
  - Bureaucracy – too long and complex – requests from authorities for licensing for exploration and drilling
- **Financial barriers**
  - Lack of financial risk funds / loans for geothermal exploration and first drilling
  - Capital intensive for power production – less for district heating
  - Need for new business models to make GeoDH more economic viable
  - Limited and fragmented financial support
  - Unfair competition with conventional sources
- **Awareness barriers**
  - Limited awareness within the industry and on national level – more activity is needed (ERA NET has raised the awareness – but more is needed on various levels)
  - Negative view of geothermal in some areas / countries – due to lack of information

# ERA NET - Geothermal Activities - Benefits

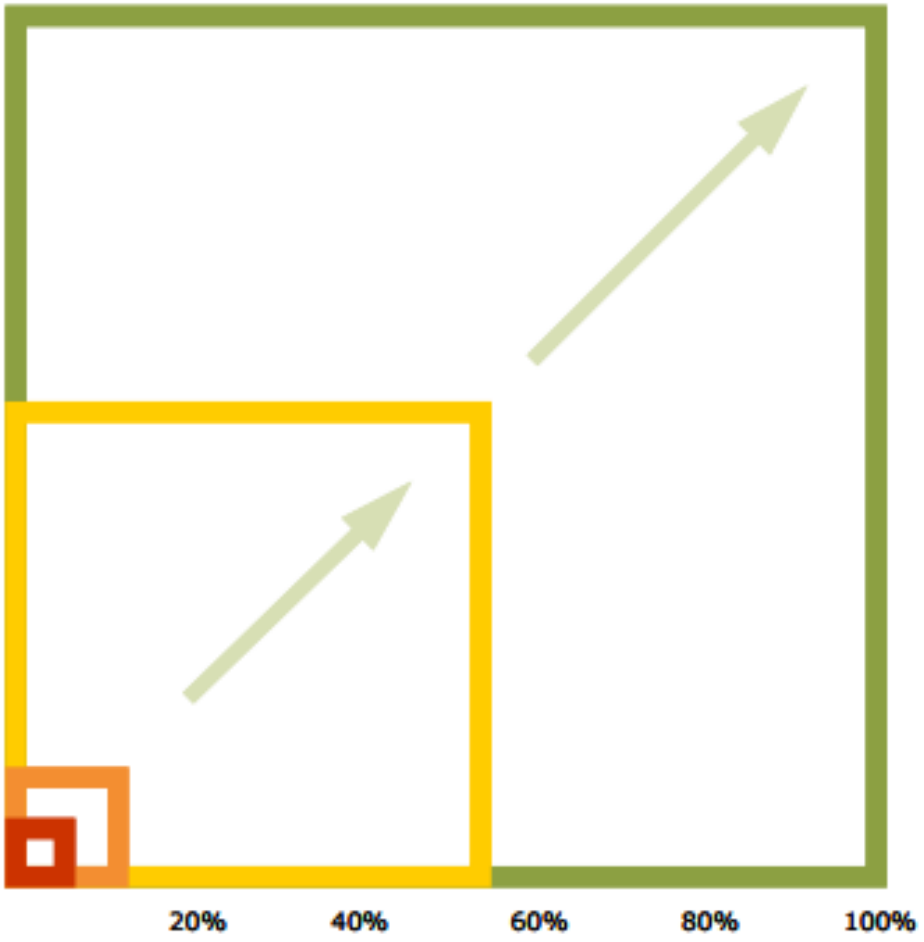
| Value | Activities – benefits in general | ERA NET | National | EU / EEA |
|---|---|---|---|---|
| **Policy coordination** | Better quality policy and success | Relevant | Relevant | Relevant |
| **Cooperation on different topics** | More national and international activities | Relevant | Relevant | Relevant |
| **Building networks information cooperation** | More networks<br>Working with additional bodies like EU bodies, IEA, Eurostat, IGA, etc. | Relevant | Relevant | Relevant |
| **Economic benefits** | Economics of scale & more competitiveness | Relevant | Relevant | Relevant |
| **RD&D & Technical benefits** | More projects & funding | Relevant | Relevant | Relevant |
| **Financial issues** | Better understanding of Geo funding - better funding | Relevant | Relevant | Relevant |
| **Climate contribution (CO2) Quality of life** | Less CO2 – better environment – more Geothermal Projects - less pollution - reducing climate risks – raising quality of life | Relevant | Relevant | Relevant |

# ERA NET - Geothermal Activities - Benefits

## Various benefits are expanding from ERA NET activities to other levels

- Quality of life
- Mitigate Climate change
- Better air quality
- Better environment
- Economic benefits
- Policy
- Cooperation
- Networks
- Economics
- R&D & Funding
- Financial issues

ERA NET




Total geothermal benefits / projects within EU/EEA

Additional geothermal funding / benefits within EU/EEA

Additional geothermal national funding / benefits

ERA NET

# International Cooperation – EEA Grants

## Opportunity for many countries

New program (-2021) is under final preparation

Important for interested countries (E-Europe) to act now

http://eeagrants.org/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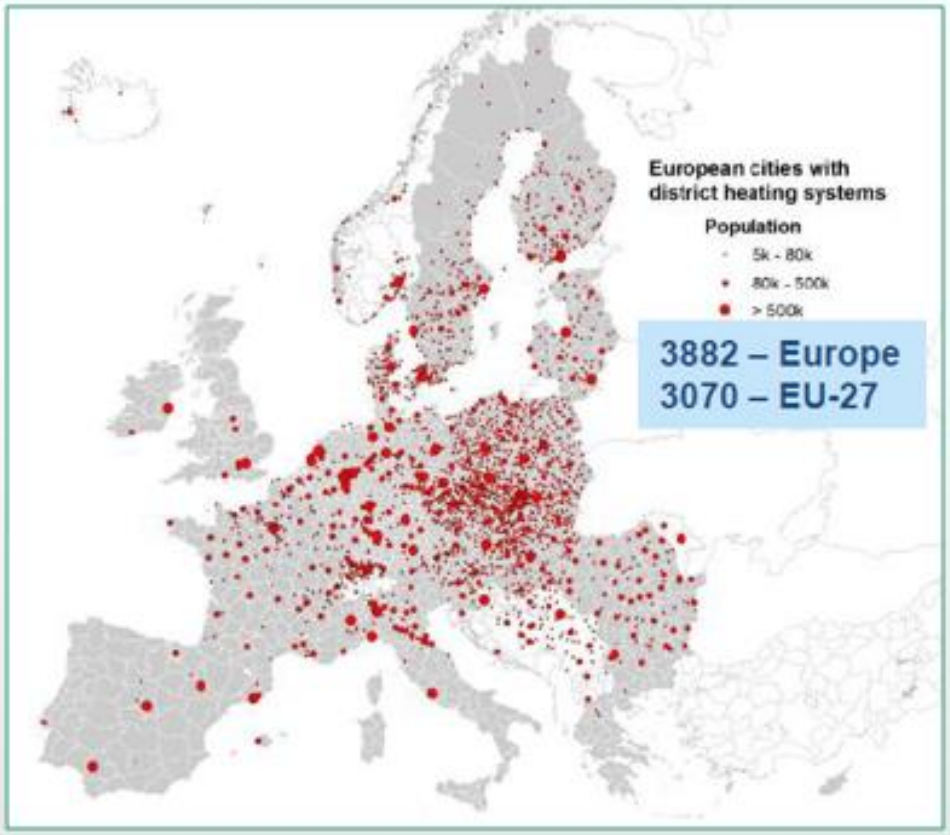
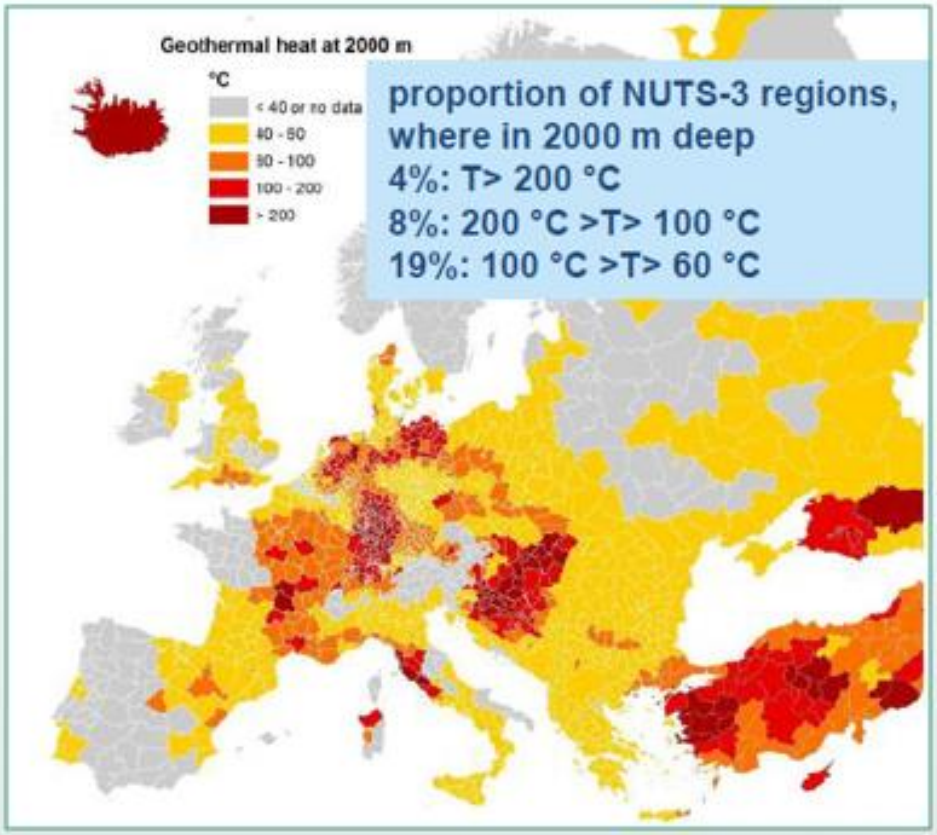
# Geothermal District Heating
# Great Potential in Europe

Geothermal ERA-NET

***Geothermal cities with district heating systems***




***Geothermal heat at 2000 meters***

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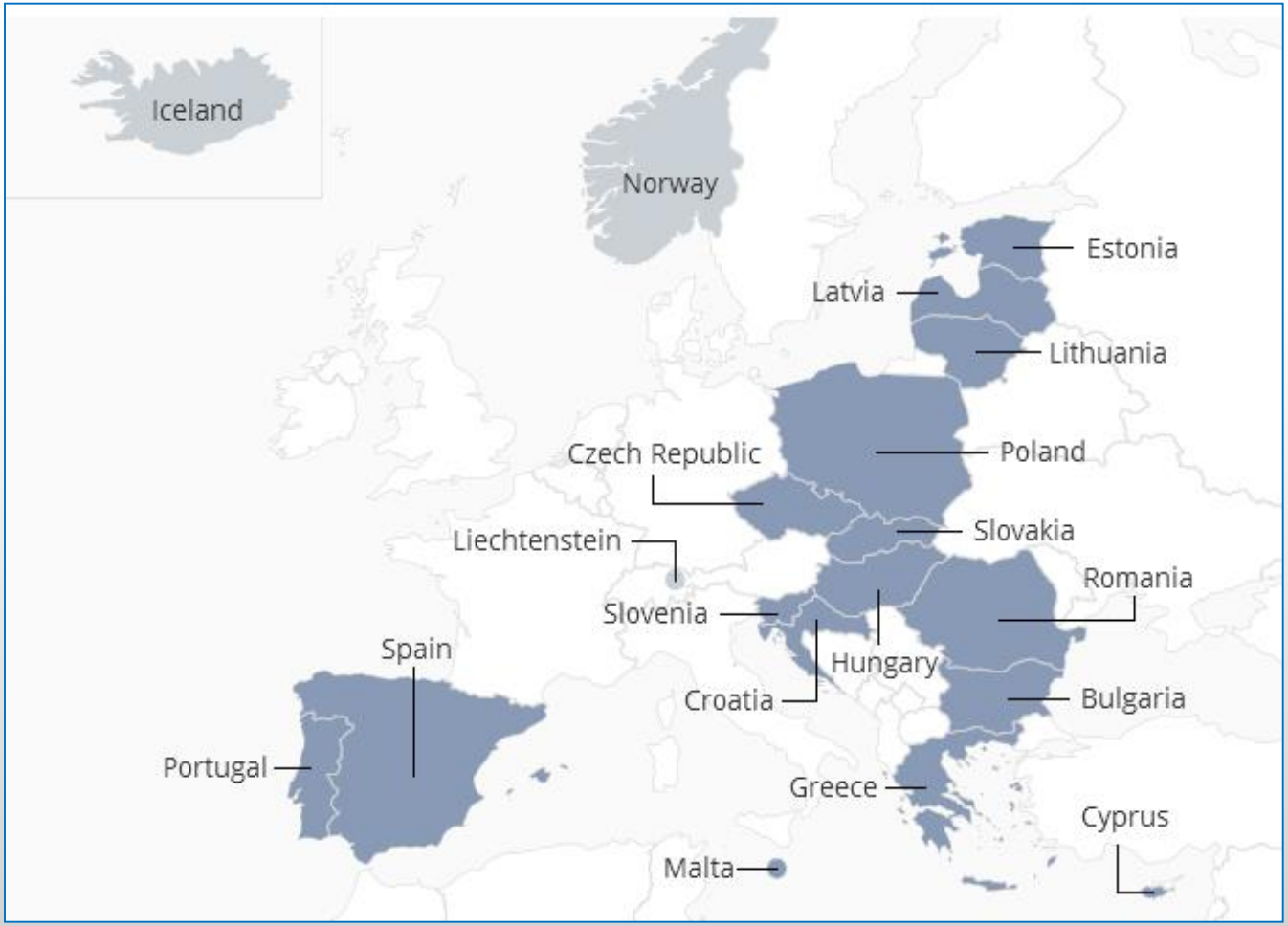
# International Cooperation – EEA Grants

## Orkustofnun is Donor Program Partner (DPP)

Geothermal ERA-NET

## Renewables Programs in some Countries



# EEA-Grants:
## Template for the Programme Area Renewable Energy

**Objective:**

**Increased share of renewable energy in energy use**

**Expected outcome**

- **A less carbon-dependent economy**
- **Increased renewable energy production**
- **Increased use of renewable energy in the transport sector**
- **Increased feed-in of renewable energy to existing energy infrastructures**

**Improved energy efficiency in buildings**

- **Developed strategies to improve the use of green investment schemes**
- **Improved capacity at national, regional and local level on renewable energy solutions**
- **Increased awareness of and education in renewable energy solutions**

# International Cooperation – EU Grants Opportunity for many EU countries

Geothermal ERA-NET

## Conclusions

European Commission

- Cohesion Policy 2014-2020 playing a strong role in **delivering the Energy Union on the ground**, with significant opportunities for sustainable energy
- **Commission support** includes:
  - **EMA Network of Energy and Managing Authorities** to support the best possible use of the funding
  - **Smart Specialisation Platform on Energy**
  - Advisory platform for financial instruments, ***fi-compass***
  - Off-the-shelf financial instruments, including **'Renovation loan'**
  - Guidance documents, workshops

Regional Policy

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# Awareness Raising - COP21

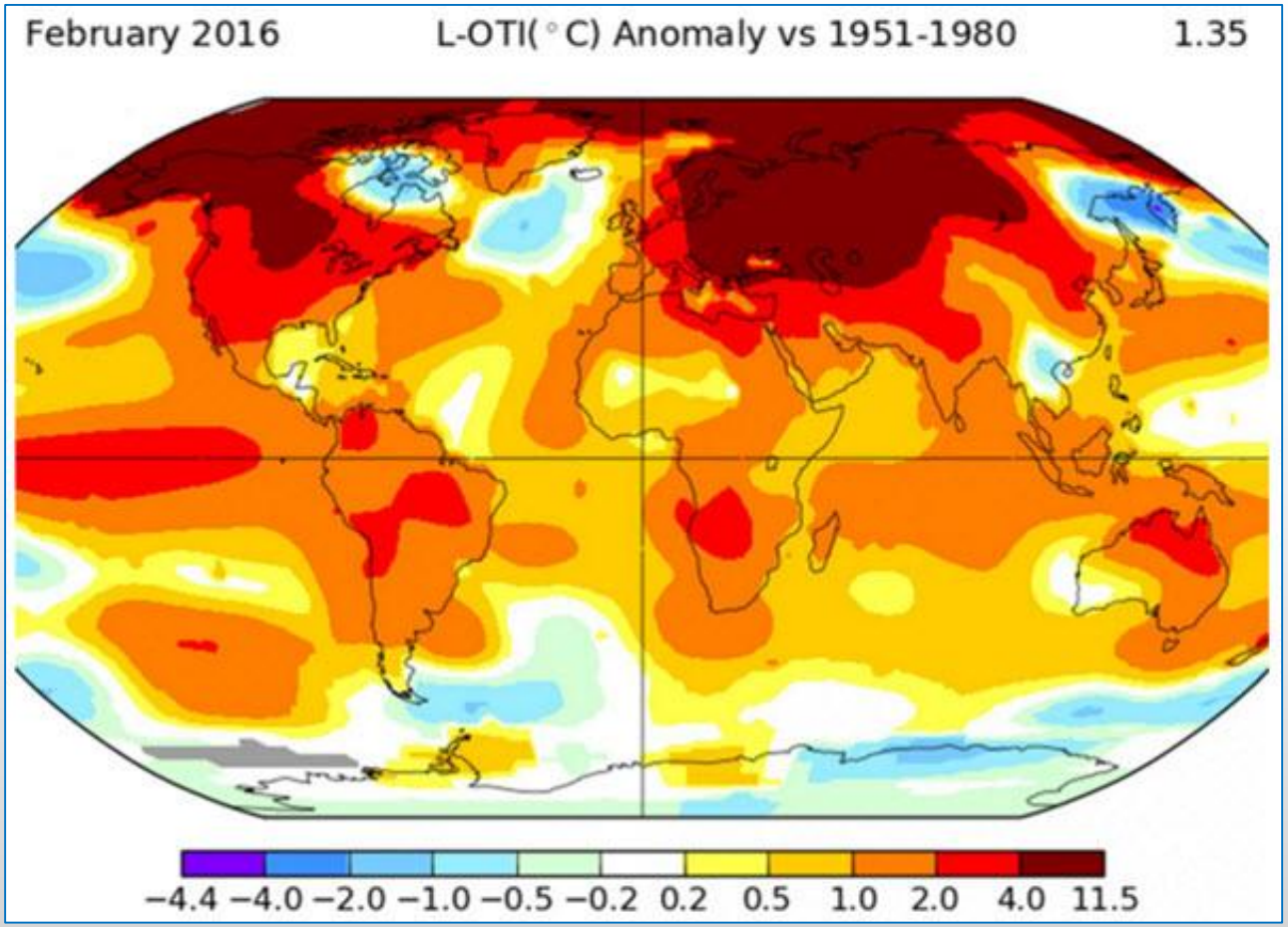
# Awareness Raising - COP21

## 21 years since Kyoto – climate actions goes slowly

# Awareness Raising – the Climate Crises
# The temperature is increasing fast in some areas and is already there over limits of risks

## Slow reaction time – 21 years from Kyoto!
## More awareness is needed – competing against time
## Important to highlight the risk – closer to people – in time and space

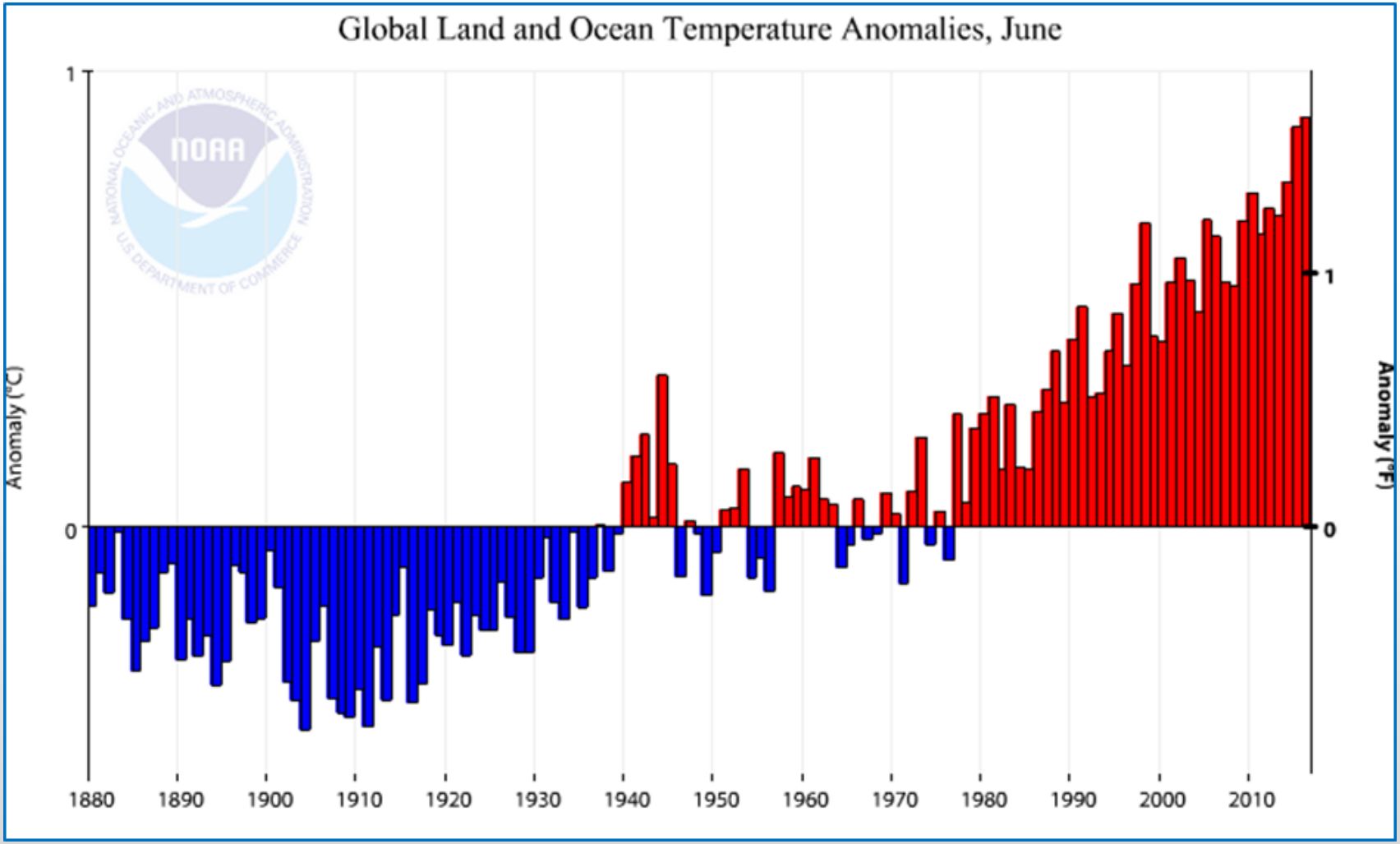
- Last 24 months there have been heat record every month around the globe.
- In February the temperature was on average 1,35 degrees on Celsius, higher than 1951 – 1980.
- In some areas – N-America, Northern Europe and central Asia – the average monthly temperature increase was even 4–11,5 degrees C, far beyond the average 1,5 - 2 C
- Like having one foot in a water too hot – and the other in a water too cold – average ok – but one foot is burning – the other on ice.
- Therefore more regional consequences are foreseen – and more action is needed.




Source: NASA

# Renewables and Global Warming

Temperature in February 1.35 °C on average warmer than 1951 – 1980, and even up to 11.5 °C in some areas NASA



# Awareness Raising
# The temperature is increasing fast in some areas

## New Report - University of Massachusetts
## Boston will be under 1,5 meter of sea 2100 - But Europe ??
## Bring the problem closer – in time, space to face reality – Europe 2050 ??

- DeConto says, **"This could spell disaster for many low-lying cities. For example, Boston could see more than 1.5 meters [about 5 feet] of sea-level rise in the next 100 years.** But the good news is that an aggressive reduction in emissions will limit the risk of major Antarctic ice sheet retreat."
- If this is true – what about Europe – Asia and other places – what regions will be under sea level?
- What kind of additional, economic, social and environmental disasters will follow?
- Will this development create huge trend of relocation of people – with stressing and challenging pressure on societies?
- If this is true – countries have to react much faster – to avoid disaster in near future.

### Sea-Level Rise Could Nearly Double Over Earlier Estimates in Next 100 Years

UMass Amherst, Penn State researchers model effects of melting Antarctic ice sheets

*March 30, 2016*
*Contact: Janet Lathrop 413/545-0444*

AMHERST, Mass. – A new study from climate scientists Robert DeConto at the University of Massachusetts Amherst and David Pollard at Pennsylvania State University suggests that the most recent estimates by the Intergovernmental Panel on Climate Change for future sea-level rise over the next 100 years could be too low by almost a factor of two. Details appear in the current issue of *Nature*.

DeConto says, "This could spell disaster for many low-lying cities. For example, Boston could see more than 1.5 meters [about 5 feet] of sea-level rise in the next 100 years. But the good news is that an aggressive reduction in emissions will limit the risk of major Antarctic ice sheet retreat."

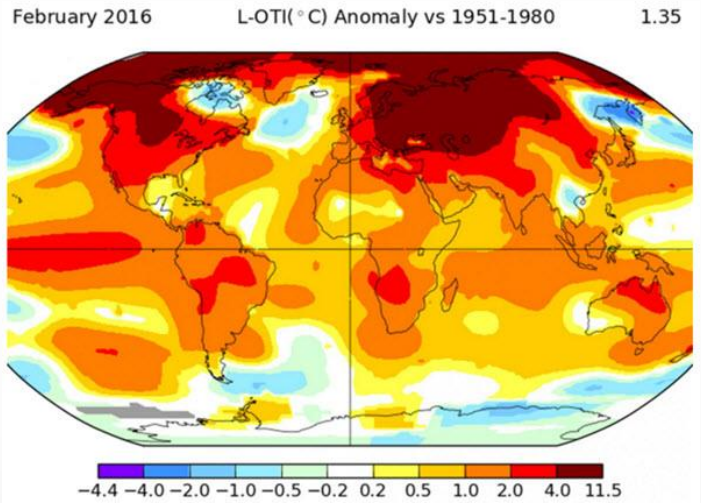
The 100-meter terminal ice cliff of Helheim Glacier in Southeast Greenland, which is retreating rapidly. DeConto and Pollard say processes like this on Greenland could become more widespread in Antarctica if thick parts of the ice sheet at the ocean's edge begin losing their protective ice shelves. Photo: Knut Christianson, University of Washington

With mechanisms that were previously known but never incorporated in a model like this before, added to their ice-sheet model to consider the effects of surface melt water on the break-up of ice shelves and the collapse of vertical ice cliffs, the authors find that Antarctica has the potential to contribute greater than 1 meter (39 inches) of sea-level rise by the year 2100, and greater than 15 meters (49 feet) by 2500 if atmospheric emissions continue unabated. In this worst case scenario, atmospheric warming (rather than ocean warming) will soon become the dominant driver of ice loss.

# Awareness Raising - the temperature is already increasing fast in some areas

For consideration

- Climate change trend are moving faster than expected – higher temperature of air and sea – and greater ocean acidification
- Increasing renewables are moving slowly – including utilisation of geothermal district heating
- Great possibilities in Europe regarding geothermal district heating - however things are moving slowly
- Can geothermal projects do more to fight the global CO2 / climate problem - after 10 - 50 years!



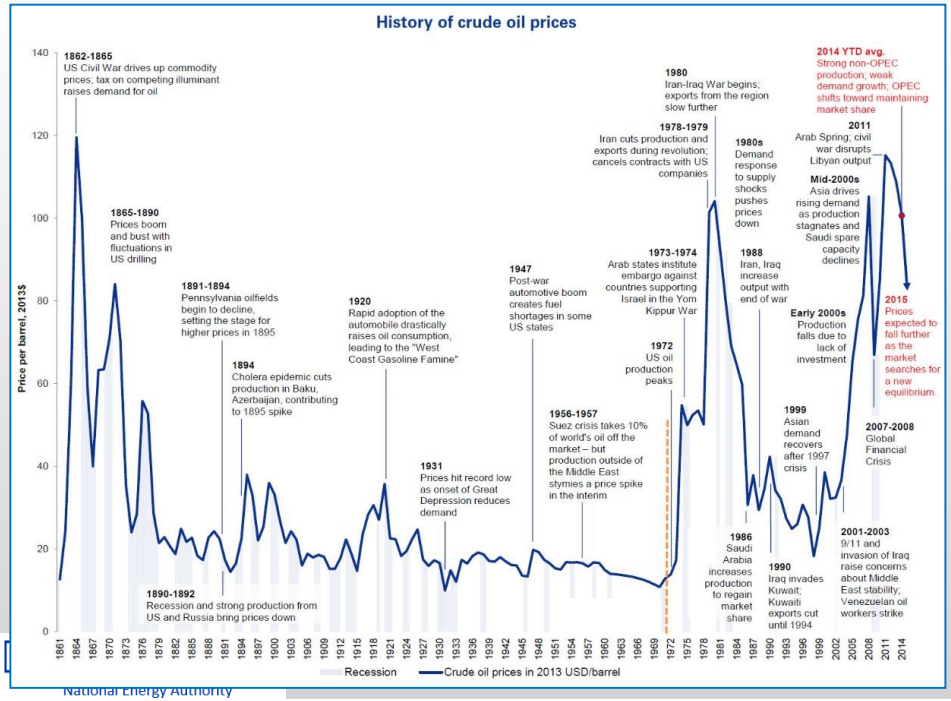

# The Oil Crisis – and the Climate Crisis
## Fundamental differences

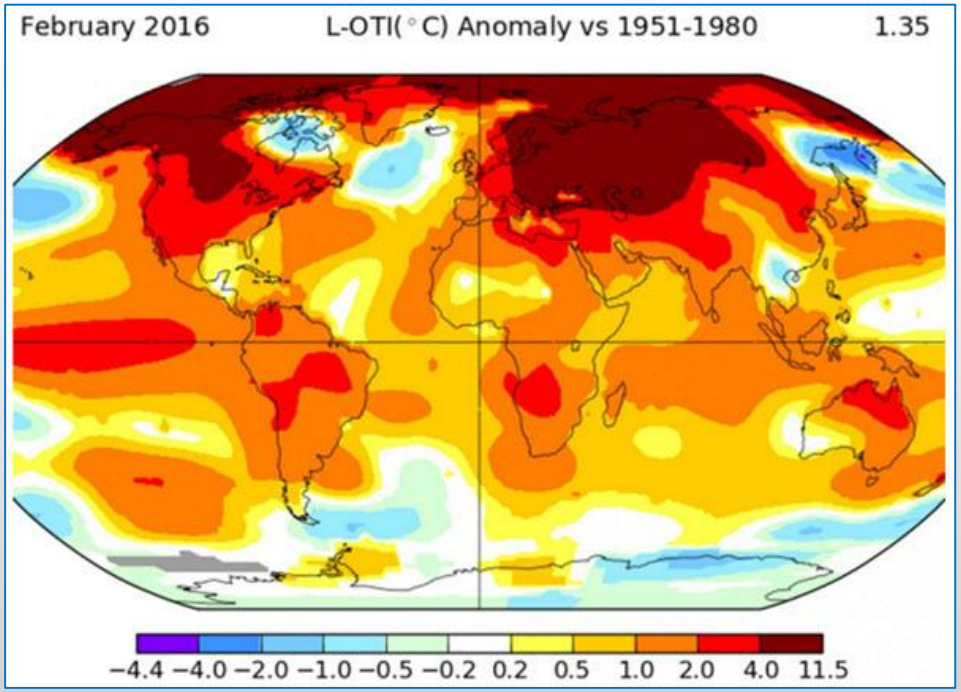
**Oil crisis**

–> very visible –> automatic awareness raising –> fast reaction time –> focus on economic issues –> economic balance fairly quickly –> no global environmental risk

**Climate crisis**

–> hidden problems, not visible –> very slow reaction time (21 years from Kyoto)
–> denial of problems –> very problematic and poorly managed awareness raising
–> globally very risky and urgent on all levels of societies (economic, social, envirom. etc.)
–> increasing risk of slow action and more damage and disaster than expected



# Renewables and Global Warming

## More and more weather extremes

One area in Iceland – no rain - summer 2016

Floods in Iceland – autumn 2016

Lakes are shrinking in California recent

Forests on fire in California 2016

# Renewables and Global Warming

## More and more weather extremes

Floods in Germany June 2013,
damage 3 billion € - insurance claims

Floods in Paris 2016

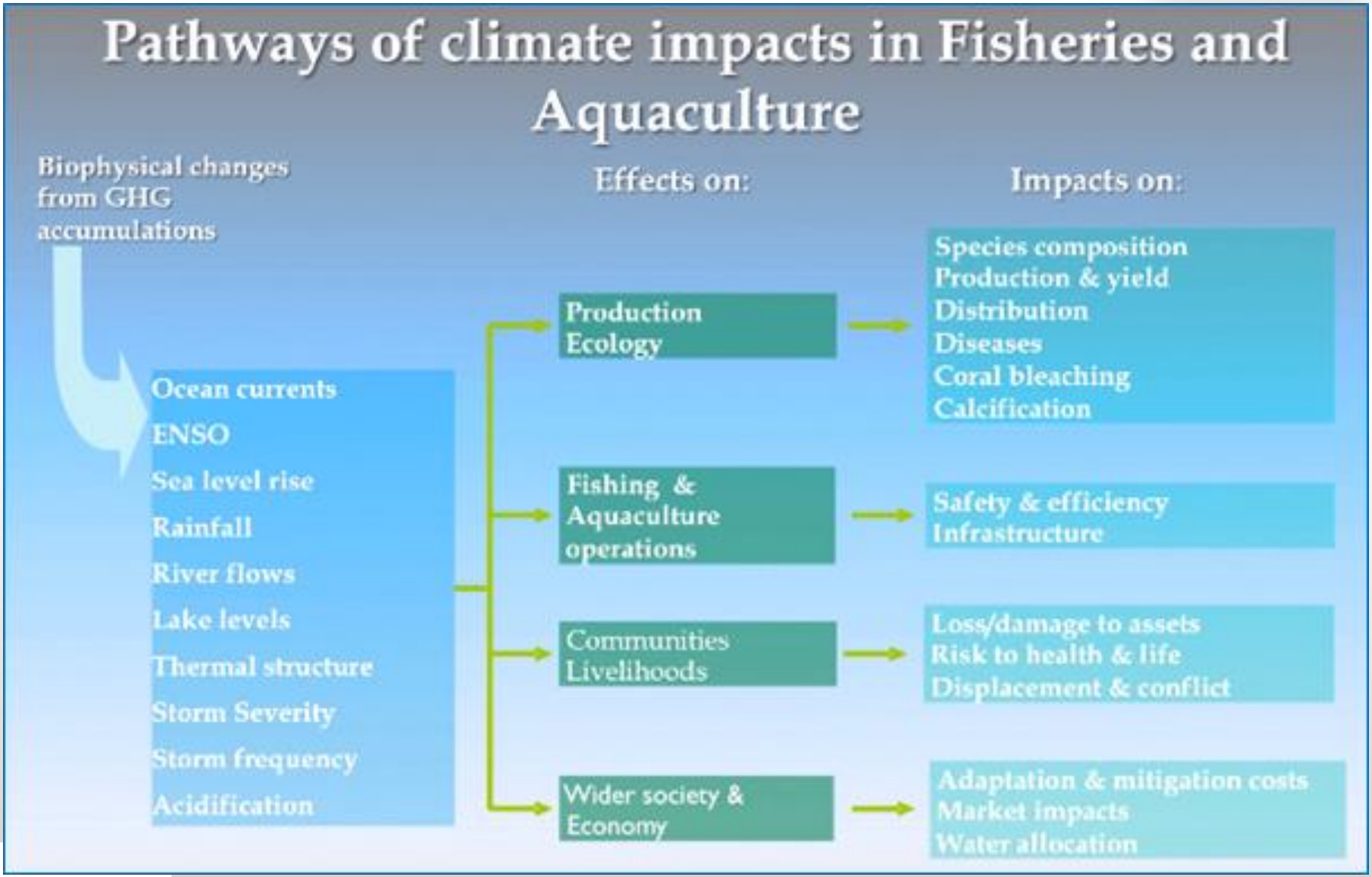
Long Islands, New York “Frankenstorm”
Hurricane Sandy

Philippines 2013

# Renewables and Global Warming

Temperature in February 1.35 °C on average warmer than 1951 – 1980, and even up to 11.5 °C in some areas NASA

Geothermal ERA-NET



# Climate Awareness – We have to succeed
# "There is no Plan B - or Planet B"

**We are over "point of no return"**
**Therefore the climate battle must be successful**
**All renewables have a role in the battle – including various geothermal opportunities**

## Ban Ki-moon: Engin „áætlun B" því við eigum ekki „reikistjörnu B"

INNLENT | 20:08 | 08. OKTÓBER 2016

Líkar þetta 2


NADINE GUÐRÚN YAGHI SKRIFAR

ORKUSTOFNUN
National Energy Authority

# Competitiveness of the Geothermal Sector

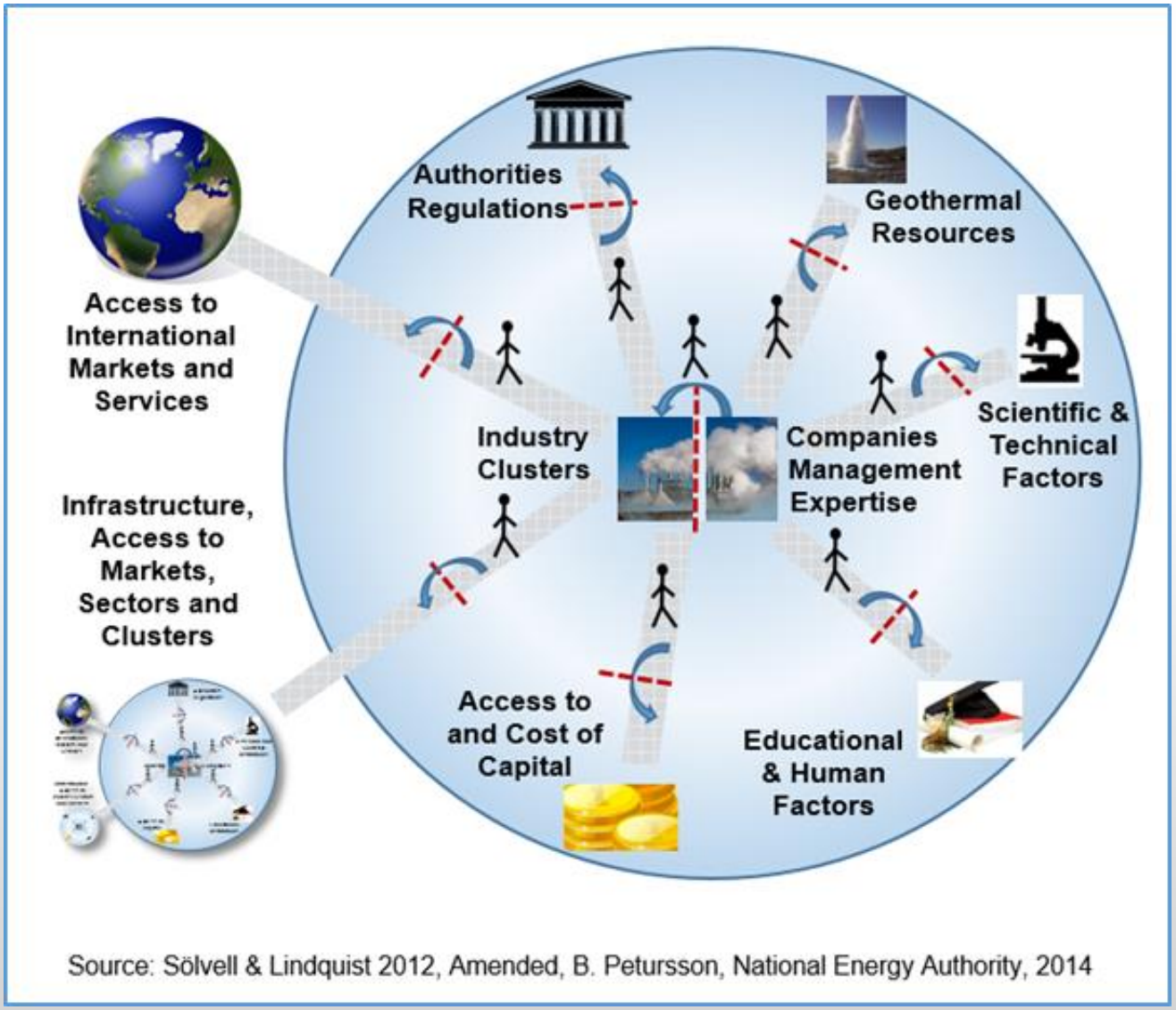
## Success of Geothermal District Heating is based on 8 Key Factors

Geothermal ERA-NET

### 8 Key Elements of Success in the Geothermal Sector and District Heating

1. Authorities and regulation,
2. Geothermal resources,
3. Scientific & technical factors,
4. Education & human factors,
5. Access to capital,
6. Infrastructure and access to markets, sectors and other clusters,
7. Access to international markets and services,
8. The company, management, expertise & industry, clusters assessment

In cooperation with international and domestic experts, on geothermal resources, finance, legal, management and other expertise.




Source: Sölvell & Lindquist 2012, Amended, B. Petursson, National Energy Authority, 2014

# The Geothermal ERA - Recommendation

**1. Authorities and Regulatory Factors**

- Design regulation specific to the promotion of direct uses of geothermal energy
- Publicise the characteristics and benefits of geothermal energy for regional development
- Promote cooperation with international organisations

**2. Geothermal Resources**

- Improvement of geothermal regulation
- Improvements for data analysis of reservoirs in regions

**3. Scientific and Technical Factors**

- Promote relationships with industry
- Promote alliances with research centres and educational institutions for the formation of specialised human resources

**4. Companies, Management, Expertise – Industry Clusters.**

- Promote alliances with research centres and educational institutions for the formation of specialised human resources
- Promote cooperation with IFI for financing, donor support and consulting
- Organize workshops and conferences to improve knowledge on geothermal energy
- Identify geothermal energy-related productive chains

# The Geothermal ERA - Recommendation

**5. Educational and Human Factors**

- There is not enough support for the generation of the human resources needed for the geothermal industry
- Creating seminars and specialized courses on the different stages of a geothermal project and adding them to the existing engineering degrees
- Give the personnel technical training to participate in the different stages of a project
- Implement programs for technical development

**6. Access to, and Cost of Capital**

- Promote additional access to financing geothermal projects – domestic and international
- Increase access to capital by providing capital to exploration and test drilling and DH networks e.g. soft loans or donor grants, to lower the risks at the beginning of projects

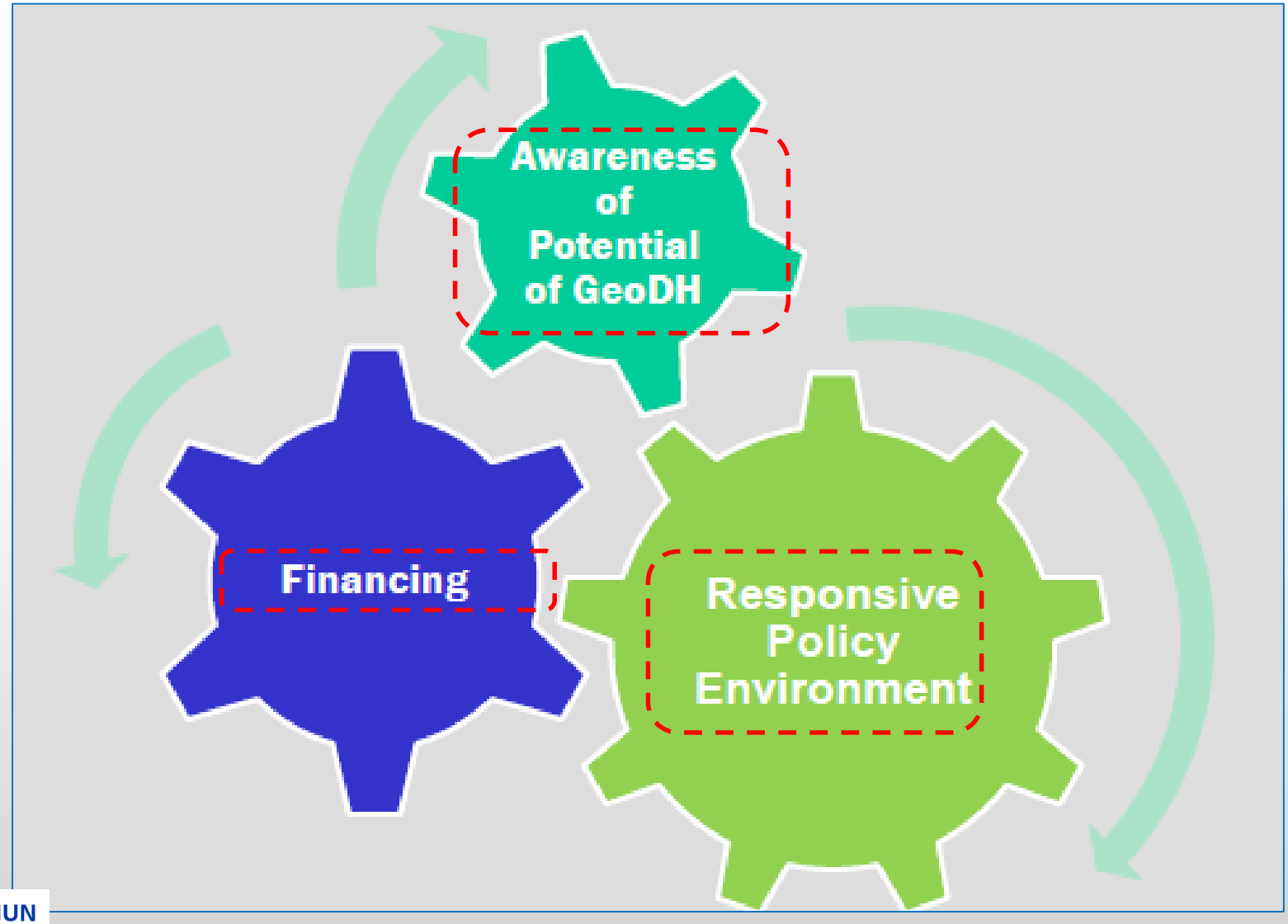
**7. Infrastructure, Access to Markets, Sectors and Clusters**

- Promote training in the banking system for the development of financial mechanisms specific to geothermal energy
- Awareness; organize workshops & conferences to improve knowledge of geothermal energy
- Increase the available knowledge about opportunities and benefits of geothermal resources

**8. Access to International Markets and Services**

- Support international cooperation in area of geothermal knowledge, training and service
- Promote international cooperation with IFI and donors on finance, grants and funding
- Support international consulting cooperation on various fields of geothermal expertise

# The Geothermal ERA - Recommendation



# The Geothermal ERA - Recommendation

- **Awareness raising**
  - Link geothermal awareness raising with the risk of climate trend and concerns
  - Geothermal programs and projects are valuable – fighting the climate crisis
  - Geothermal options can create valuable economic, environmental and climate opportunities
  - Increased awareness within the industry and on national level – more activity is needed
  - Focus on special groups / regions, national level and EEA/EU level

- **Financial barriers**
  - More financial risk funds / loans for geothermal exploration and first drilling
  - Develop new business models to make GeoDH more economic viable
  - Better financial support
  - Equal competition with conventional sources

- **Better Policy Environment**
  - Better national geothermal regulatory framework
  - More simpler and faster process on geo. licensing for exploration and drilling etc.
  - More information on geothermal energy resources – regions, areas
  - More information on economic and technical data about the industry

# The Geothermal ERA - Recommendation

## Sponsors

- Geothermal Expertise
- Local knowledge
- Financial Resource
- Scale to be able to finance on a corporate/portfolio basis

Source: IFC

## Regulatory / Sector Framework

- Transparent, predictable and sustainable
- Geothermal Incentives
- Standardized contracts
- Public role in bearing geothermal resource risk?

## Scaling up Geothermal Financing

## Technologies

- More accurate and faster resource assessment
- Faster and less costly drilling
- Reduction in US$ per MW and equipment lead-time

## Lenders

- In-house resource engineer (or close collaboration with outside resource consultant)
- Geothermal financing experience
- Creativity and innovation

# Thanks