GEOENVI

Presentation of WP2 – preliminary results

Annick Loschetter (BRGM), on behalf of WP2 partners

16 May 2019 - webinar

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GEOENVI – WP2 – FACT SHEET

WP leader: BRGM

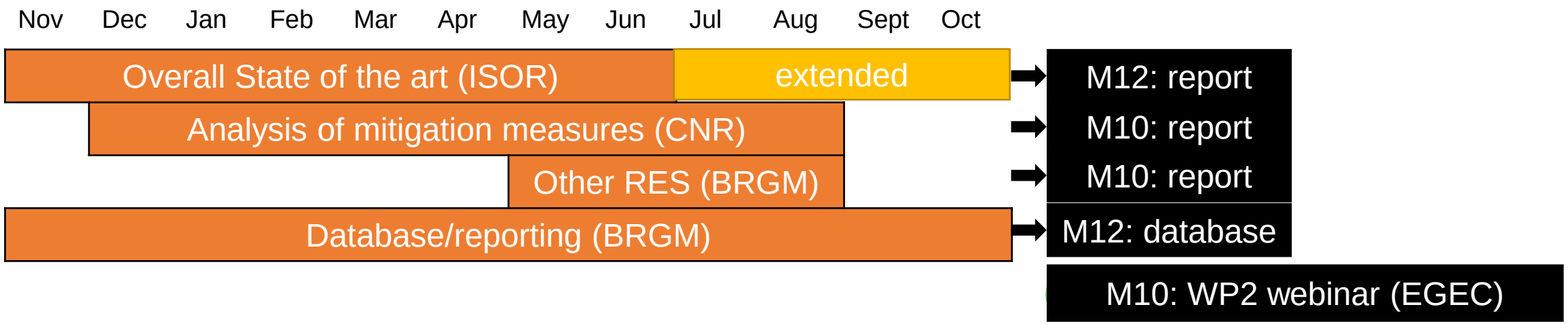
Start Month: 1 → End Month: 12

Main objective: map environmental impacts and risks

Total Man-Month: 53

Main partners: BRGM (8MM), ISOR (6 MM), CNR (5MM), CSGI (4MM), DEU (4MM)

Tasks & deliverables:



Objectives 1/2

- The main objectives of WP2 will be to **map environmental impacts and risks**, as well as their **perception** and to define how environmental footprint of deep geothermal plants in Europe is measured and controlled in different countries.
- Partners will also analyze adopted **solutions to reduce or circumvent impacts and risks**, and quantify their potential and their technology readiness level.
- Although the objective does not focus on societal concerns, partners will nevertheless pay attention to the **perception of environmental concerns by the society and the decision-makers.**

Objectives 2/2

- Finally, in order to broaden the common understanding of environmental aspects of deep geothermal energy, **the environmental impacts and risks will be discussed with regard to other renewable energies** (and other fields, whenever considered of relevance).
- The results of this WP2 will take the form of a public report with an associated multidimensional database, dedicated notably to stakeholders of deep geothermal projects.
- The results of WP2 will also constitute a rich source of information for other WPs. In particular, the results of WP2 **will help framing the works within WP 3**, for instance to identify the focus of attention during the development of LCA guidelines and models.

Overview of the database outline

First part: documentation

GEOENVI

GEOENVI description. Link website and other deliverables of the project

What we find there

- A documentation on environmental impacts and risks
- A documentation on European regulations
- A database gathering information on environmental issues concerning European deep geothermal sites

Perimeter of the database

How you can contribute

Acknowledgement Europe

Etc.

Impacting phenomena:
According to ISO 31000, risk is …
An impact is defined as ...
An impacting phenomena, or dangerous phenomena, is a phenomena resulting from …
Effect of operations:
The category gathers risks and impacts caused by geothermal operations that …
- Energy and resource consumption:
- Surface wastes production:
- Emissions to the environment due to surface operations:
- Vibration/Noise/Smell/Visual/Dust:
- Leak due to surface installations/operations:

Surface emission from underground:
This category concerns all risks and impacts related to …
- Liquid / solid effusion and wastes:
- Degassing:
- Radioactivity:
- Blowout:
- Heat emission:

Geomechanical disturbance:
Concern phenomena that …
- Ground elevation:
- Induced seismicity:
- Surface disturbance:

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Home | Terminology | Doc on environmental issues | Sites database

Filters

- [ ] Highlight causes and consequences of impacting phenomena
- [ ] Discriminate impacting phenomena depending on risk/impact
- [ ] Show consequences and phenomena that can be assessed with LCA

Influencing context

- [ ] During drilling
- [ ] During operation
- [ ] After closure
- [ ] Need of stimulation
- [ ] High gas content

CAUSES

Planned operations

Exploration	Construction work	Drilling, work-over
Well testing	Stimulation work	Inhibitor injection
Exploitation	Decommitment	Abandonment

Uncertain context

Well design & engineering choices	Aggression or Extreme natural event
Lack of knowledge on geological properties (rock and fluid)	Corrosion and scaling

Incidents & technical failure

Surface reservoir and storage unit defaults	Incidents during well drilling
Defective BOP	Tubing & cementing defaults
Human error	Power failure, water supply default

IMPACTING PHENOMENA

Effects of operations

- Energy and resource consumption
- Surface wastes production
- Emissions to the environment due to surface operations
- Vibration/Noise/Smell/Visual/ Dust
- Leak due to surface operations/installations, explosions

Surface emissions from underground

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Geomechanical disturbance

- Ground elevation
- Induced seismicity
- Surface disturbance

Underground fluid disturbance

- Pressure/flow changes in reservoir
- Disturbance of non-targeted aquifer
- Connection of aquifers

Thermal and chemical underground disturbance

- Thermal changes
- Chemical changes

CONSEQUENCES

Humans

- Accident
- Effects on human health
- Alteration of living conditions
- Psychological impact

Ecosystems

- Soil pollution
- Marine and freshwater pollution
- Biodiversity alteration

Atmosphere

- Climate change
- Particulate matter
- Other (incl. increase of local temperature)

Underground water

- Aquifer alteration (including drinking water aquifer)
- Aquifer depletion (including drinking water aquifer)

Activities

- Buildings & infrastructures
- Other underground uses
- Resource consumption
- Land use
- Cultural and natural reservation
- Other (tourism…)

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Legend

Click on an impacting phenomena to highlight main direct relations:

- causes
- consequences
- May be cause and/or consequence

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Legend

- Mainly a risk
- Mainly an impact
- Risk and/or impact, depending

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Induced seismicity

Geothermal projects modify the characteristics of a reservoir by injecting or pumping hot and/or cold fluid into it. If the reservoir is a fractured reservoir (fluid moves principally within fractures and not within a porous rock) these modifications can induce seismic events. The fluid injected can directly cause induced seismicity by lowering the fracture resistance to slip or by thermal cracking (micro-fracture are created by the generally cold fluid injected). There are some indirect effects like redistribution of stress due to variations in fluid volume within the reservoir that can also cause induced events. Most of this seismicity is what is called microseismicity and only in some rare cases, there are some higher events that are induced. Induced seismicity occur mostly during stimulation phases even if some events (generally microseismicity) can occur during the production phase or during drilling. That is because during stimulation the stimulation characteristics are not stable and some high variation of pore pressure or temperature can be induced to increase reservoir permeability.

Microseismicity is an impact while induced seismicity is a risk that must be mitigated. In any case, all kind of seismicity must be monitored. The **consequences of induced seismicity are most often psychological** but in some rare projects, injuries to people or destroyed buildings have occurred.

Induced seismicity has a very negative perception in some contexts (France, Switzerland) and not in others (Iceland).

Example of area with microseismicity are Icelandic deep geothermal projects in volcanic context or French EGS projects in Alsace rift basin. On the opposite deep geothermal project with no significant microseismicity are deep geothermal project within the Paris basin

Induced seismicity

1. Origin
2. Risk and/or impact?
3. Consequence
4. Project phases
5. Influencing contexts
6. Monitoring
7. Prevention & Mitigation
8. Perception
9. Illustrative example
10. References

Precisions concerning sheets on environmental issues

- **These sheets will:**
  - Constitute the core of deliverable 2.1
  - Be available in the public online database (deliverable 2.4)
- **An editorial chart was written by ISOR & BRGM** to have all sheets similar.
- Keeping in mind the overall idea of GEOENVI (remove obstacles to the development of deep geothermal):
  - The sheets should be written with a neutral and reassuring tune, not focusing only on worst cases. If there are no problems in 95% of operations, we should mention it.
  - We should also explain the intensity of issues and how they are managed
  - Monitoring and mitigation sections are important to show how these issues are managed

Discussion: how public access and translated database will be perceived?

- The page *Doc on environmental issues* shows all potential risks and impacts of geothermal operations without showing all the benefits. This is indeed what was promised in the description of work. How will it be perceived?
    - Transparency, neutral information, confidence building

      vs.
    - Fear building, material for opposition
- What should be done?

  1) add introduction in each risk/impact sheet: explaining a risk seriousness/occurrence, how it can be managed and mitigated by operational methodologies (predictive + corrective), regulations, etc. (work done on T2.2 monitoring and WP4)

  2) discuss with WP4, 5 and 6 on how to present it (through communication WP, collaboration with EGEC)

  3) add results of T2.3 (assessment of other RES) on the website (through additional page ?)

Overview of the database outline

Second part: site-specific data

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Home | Terminology | Doc on environmental issues | **Sites database**

- General filters
- Geological context
- Reservoir characteristics
- Reservoir operations
- Surface operations
- Environmental documents
- Environmental keywords
- LCA filters

143 results

What do you search | OK

Add a new site in the database

Soultz-sous-Forêts, France

Located in Alsace, in the Rhine rift, to produce both electricity (xMWe) and xxx, since AAAA. The following documents are available: EIA, RA and LCA. Main environmental issues are xxxxxx, yyyyyyyyy, zzzzzz

Name of the site, Country

Usus linguae Latinae continuo ab antiquitate usque ad tempora hodierna extenditur. Saeculo X multas peperit linguas quae linguae Romanicae vocantur, sicut Catalanam, Dacoromanicam, Francogallicam, Gallaicam, Hispanicam, Italianam, Lusitanam, ne omnes afferantur.

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General filters
- Country
  - [ ] Belgium [14]
  - [ ] France [x]
  - [ ] Hungary [x]
  - [ ] Iceland [x]
  - [ ] Italy[x]
  - [ ] Turkey [x]
  - [ ] XXXXX
- Starting date
- Type of exploitation
- Use
- User

Geological context

Reservoir characteristics

Reservoir operations

Surface operations

Environmental documents
- [x] Environmental Impact Assessment [95]
- [ ] Risk analysis [x]
- [ ] Life Cycle Analysis[x]
- [ ] Report on incidents[x]

Environmental keywords

LCA filters

95 results

What do you search

OK

Add a new site in the database

Name of the site, Country

Click

Usus linguae Latinae continuo ab antiquitate usque ad tempora hodierna extenditur. Saeculo X multas peperit linguas quae linguae Romanicae vocantur, sicut Catalanam, Dacoromanicam, Francogallicam, Gallaicam, Hispanicam, Italianam, Lusitanam, ne omnes afferantur.

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General

Name of operation site*: Soultz-sous-Forêts
Source of information: BRGM
Privacy: public
Country*: France
Town/location*: Soultz-sous-Forêts
…

Geological context

Geological setting*: Rhine Rift (FR, D, CH)
Geological plays:
Heat source:
Heat transport: Convection

…

Environmental documents

Is there a Life cycle analysis? YES
If YES: **Download ⬇**

Which of the following impact categories were investigated? (several boxes possible)

- ☐ *Climate change*
- ☐ *Ozone depletion*
- ☐ *Photochemical ozone formation*
- ☐ *Respiratory inorganics*
- ☐ *Ionizing radiation*
- ☐ *Acidification*
- ☐ *Eutrophication*
- ☐ *Human toxicity*
- ☐ *Eco-toxicity*
- ☐ *Land use*
- ☐ *Resource depletion*
- ☐ *Other*

Perspectives

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Next steps

Clarify the perimeter of the project : what is deep geothermal in the case of GEOENVI?

Deep literature review topic by topic

Development of the site

Improve the design, reduce the risk of negative perception, maybe simplify the public version

Finalize and enrich the site-specific part

Organize the presentation of results in an harmonized way with task 2.2 (monitoring and mitigation), with work on regulation (WP4) and with other WP.