

# ○ Towards best practices in environmental regulations

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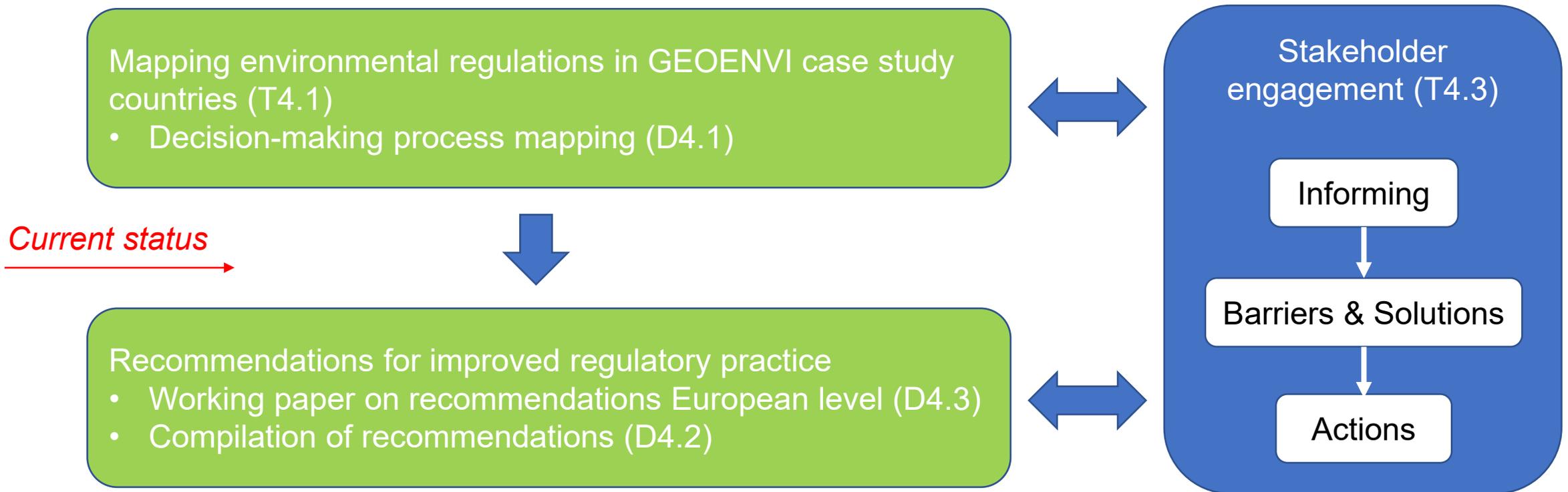


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## ○ **Ambition**

- Map and analyze the current status of environmental regulations and practices for deep geothermal energy development
- Engage with stakeholders and decision-makers to develop recommendations to improve environmental regulatory practice
  - From regulation to implementation

## ○ Work package structure



## ○ Mapping environmental regulations

Content [Deliverable 4.1](#)

- Provide the basis for the formulation of recommendations on environmental regulations
- 6 country reports and comparative analysis
- Overview
  - General data on deep geothermal
  - Institutional context
  - Policies and policy visions
- Regulation mapping
  - Definition, classification, and resource ownership
  - Licensing and authorizations
  - 11 specific environmental impacts and risks: International, EU and national level

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## Environmental impacts vs. policy themes

- Environmental impacts and risks covered under various environmental policy themes

	Water quality	Air quality	Waste	Noise and vibration	Landscape	Soil quality	Radioactivity	Pressure equipment	Liability
Surface disturbance (vibration, noise, visual, land occupation, dust)		X		X	X				
Degassing		X							
Ground surface deformation						X			X
Seismicity						X			X
Interconnection of aquifers and disturbance of non-targeted aquifers	X								
Reservoir physical and chemical modifications	X								
Effects of surface operations	X	X							
Waste production from surface operations			X						
Leaks due to surface installations and operations								X	
Liquid/solid effusion and waste	X	X	X			X			
Radioactivity							X		

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## ○ International and EU directives

- Example EU directives

Topic	EU legislation	Scope
Water quality	2000/60/EC ; 2008/105/EC	Water Framework directive: protection of inland surface waters, transitional waters, coastal waters and groundwater
	2006/118/EC	Specific measures to prevent and control groundwater pollution
	2013/39/EU	Priority substances in the field of water policy
	2014/80/EU	Threshold values for groundwater pollutants and indicators of pollution
Air quality	2008/50/EC	Air quality directive: Monitoring requirements and threshold values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter (PM10 and PM2.5), lead, benzene, carbon monoxide, and ozone
	2016/2284	National Emission Ceilings Directive: 2016/2284/EU requires annual information on emissions of a number of pollutants from EU Members States
	2004/107/EC	Target values, mitigation measures, monitoring and information requirements for a specific group of pollutants (arsenic, cadmium, mercury, nickel, benzo(a)pyrene and polycyclic aromatic hydrocarbons)
	2003/87/EC	ETS Directive: establishing a scheme for greenhouse gas emission allowance trading (ETS)
Waste	2008/98/EC ; 2018/851 ; Decision 2014/955/UE and 2000/532/EC	Classifies different types of waste, inc. Ordinary Industrial Waste (most applicable for deep geothermal) and hazardous waste and stipulates requirements for handling hazardous waste
	2018/850/EC	Regulates landfill of waste targeting a progressive reduction and mitigate possible negative effects on the environment in line with the ambitions of a circular economy.
Noise and vibration	2000/14/EC	Harmonises the laws of the Member States relating to (amongst others) noise emission standards and data collection concerning the control of noise emission by outdoor equipment
	2002/49/EC	Regulates the assessment and management of environmental noise intended to mitigate the exposure to environmental noise
	2015/996/EC	Defines common assessment methods for the determination of the noise indicators
Landscape	2003/35/EC	Supports the involvement of the community in decisions concerning the landscape by providing for public participation in the preparation of plans and programmes relating to the environment
Soil quality	COM(2006) 232	Sets out common principles for protecting soils from various threats (e.g. erosion, decline in organic matter, contamination, sealing, compaction, decline in biodiversity, salinisation, floods, landslides)
Radioactivity	2013/59/Euratom	Safety standards and thresholds for dynamic and cumulative radioactive doses for any planned, existing or emergency exposure situation which involves a risk from exposure to ionizing radiation.
Pressure equipment	2014/68/EU	Sets requirements for the design, manufacture and conformity assessment of pressure equipment (pressure > 0,5 bar) in different risk categories.
Liability	2004/35/EC	Environmental liability, based on the polluter-pays principle, for the prevention and remedying of environmental damage





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## ○ Mapping national level environmental regulations

### Overview tables

- Example of noise

Country	Regulation	Scope	Thresholds	Mitigation & monitoring
Belgium	VLAREM II Section 2.2.1: Environmental quality norms and target values for noise in open air. Section 4.5: Noise pollution control Annex 4.5.1 Measuring methods and conditions for background noise.	Regional (Flanders) Environmental quality norms and target values for noise in open air. General guidelines (Section 2.2.1) and specifications / additional requirements for high risk activities (Section 4.5)	General threshold values given in Annex 2.2.1 for 10 land use categories and three time periods (day / evening / night), see (accessed Dec. 2019): <a href="https://navigator.emis.vito.be/mijn-navigator?wold=10069">https://navigator.emis.vito.be/mijn-navigator?wold=10069</a> For example, residential area: Day (45dB), Evening (40 dB), Night (35 dB)	Section 4.5: Requirements for using Best Available Techniques for minimizing noise pollution. Monitoring original background noise. Further specification of thresholds for 'specific noise' (i.e. the noise specific to the project/activity/...) and 'fluctuating sound' (e.g. occasional peaks) for high risk activities. Requirements for monitoring method (Annex 4.5.1)
	Order of the Walloon Government of 4 July 2002 fixing the general conditions of exploitation related to the environmental permit	Regional (Wallonia) Noise	The threshold values are given according to three time frames per day (7-19h), transition period (6-7 & 19-22h), and night (22-6h), and different zones Day: btw 55 and 60 dBA Transition: btw 45 and 55 dBA Night btw 40 and 50 dBA.	Exceptions can be granted according to specific rules. Monitoring measures are foreseen in Section 3 of the Order.
France	Ministerial decree N°2006-1099 relative to neighborhood noise abatement	National Noise	Yes, and global noise emergence is limited to 5 dB(A) (day), and 3 dB(A) (night)	Monitored throughout the daytime (7h – 22h), during night (22h – 7h) time.
	The French Public Health Code	National	<30 dB	Fixes a spectral emergence in a certain octave band (article R 1334-34)

## ○ Some observations – classification and permitting

- Definitions and rules for ownership are largely similar, but classifications of different types of geothermal resources vary significantly.
- The number of authorities involved in permitting differs among countries.
- Environmental Impact Assessment is present in each country, but the way it is incorporated in the overall permitting procedure differs.

## ○ Observations – coverage of environmental impacts and risks

- Challenging to gain a full overview covering different levels (EU, national, regional, local)
- Environmental impacts and risks appear generally well covered by:
  - Specific legislations and guidelines
  - Covered in Environmental Impacts Assessments and permitting processes
  - Good practice among project developers and operators
- Further questions:
  - What are remaining regulatory gaps or challenges?
  - Further details on thresholds, technical prescriptions, and mitigation measures
  - How are legislations applied in practice? Which informal aspects come into play?
  - Which elements of national regulations and guidelines can be considered best practices that can be shared among countries?

## ○ 1<sup>st</sup> Policy workshops

1<sup>st</sup> round completed

- Policy, Industry, Research
- Flexible, but common format
- Plenary discussions, focus groups, survey



	City	Date	Organiser	Participants
<b>Italy</b>	Rome	17 april 2019	COSVIG+CNR+ ENEL GP + RG + CSGI	70
<b>Belgium</b>	Brussels	5 feb 2020	VITO	14
<b>Hungary</b>	Interviews Budapest	nov/dec 2019 26 feb 2020	MFBSZ	12
<b>France</b>	Paris	16 oct 2019	BRGM + ESG + ARMINES	14
<b>Turkey</b>	Izmir	15 oct 2019	JESDER+DEU	21
<b>Iceland</b>	Reykjavik	21 jan 2020	OS+ISOR+GEO RG	23

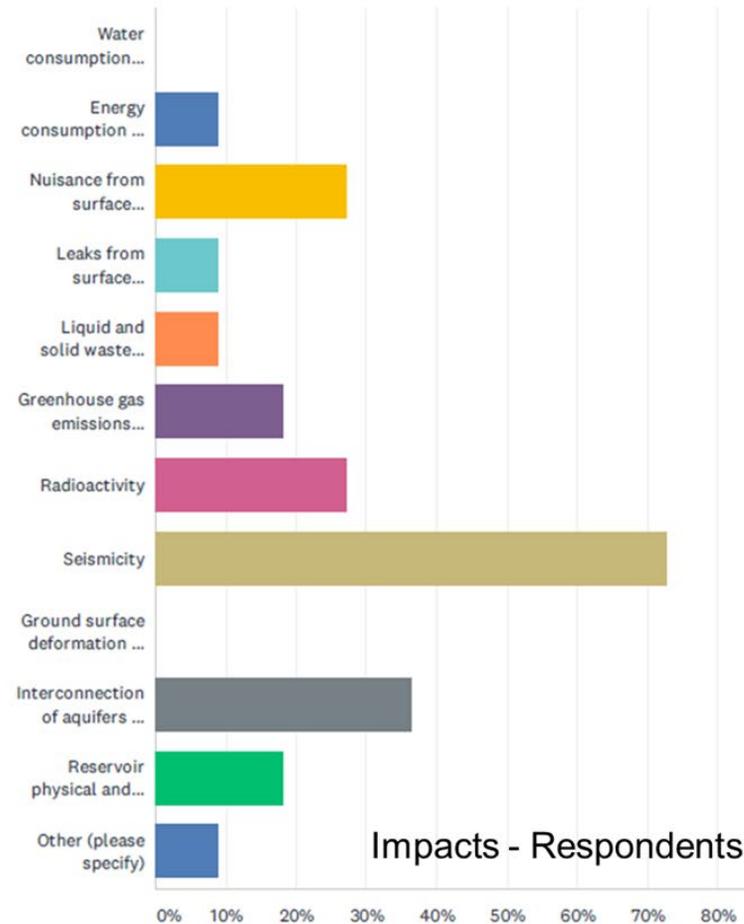


First insights in:

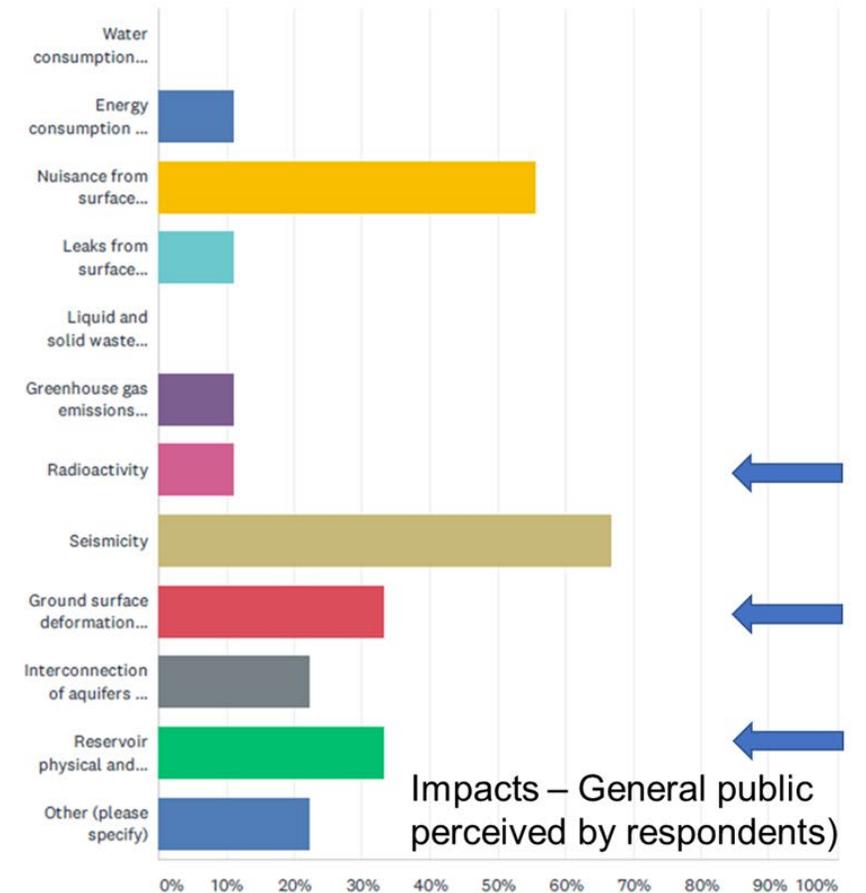
- Key impacts
- Regulatory challenges

## ○ Survey to workshop participants

- Interactive element during workshops
- Gathering views on:
  - Main impacts and risks
  - Regulatory framework
  - Public perception and participations



## Example from Belgium



## ○ Key impacts

	Belgium	France	Hungary	Iceland	Italy	Turkey
Surface disturbance (vibration, noise, visual, land occupation, dust)	X (noise / traffic)	X (for the public)	X (inhabited areas)	X	X (landscape, incidents and troubleshooting in wells or plants)	X (agricultural areas)
Degassing			X (GHG → CO <sub>2</sub> , CH <sub>4</sub> )	X (GHG, H <sub>2</sub> S)	X (GHG, H <sub>2</sub> S)	X (GHG)
Ground surface deformation		X				
Induced seismicity	<b>X</b>	<b>X</b>		X		
Interconnection of aquifers and disturbance of non-targeted aquifers	X	X	X (drilling technology)	X	X	X (ground water)
Reservoir physical and chemical modifications			X			
Effects of surface operations		X				X
Leaks due to surface installations and operations					X	X
Liquid/solid effusion and waste			<b>X</b> (thermal water discharge at surface)	X	X	X
Radioactivity	X					

Table 1: Main environmental impacts in the different countries according to experts. A bold **X** indicates that the impact was considered most important.

## ○ TOPICS 1

### Regulations on impacts and risks

- Induced seismicity and ground surface deformation
  - Regulations mostly related to soil quality and environmental liability,
  - Variety of guidelines for monitoring (including remote sensing data) and in some cases establishing a threshold, a contingency plan and a traffic-light protocol
- Interconnection of aquifers:
  - Well regulated in the water framework directive and associated water quality legislation in particular for groundwater.
  - However, from country to country, monitoring guidelines appears very different and technical prescriptions seems to vary.
  - Also linked to physical (thermal pressure) and chemical changes in the reservoirs.
- Emissions from degassing:
  - GHG / CO<sub>2</sub> not well regulated with different tracks for managing this issue (e.g. Iceland vs. Italy)
  - Other substances (e.g. H<sub>2</sub>S) well regulated under EU and national air quality regulation.
  - Monitoring parameters (emission thresholds, measuring frequency, ..) are not always specified
  - Remains important issue for social acceptance (e.g. Iceland, Turkey, Italy)
- Liquid waste:
  - Waste of geothermal fluids

## ○ TOPICS 2

### Process issues

- Complex licensing and delays
  - I.e. involvement of multiple organisations in the licensing process (c.f. Hungary, Turkey), the need for multiple licenses (c.f. Hungary),
  - Also broader relevance for other RES
- Accounting for nature of individual projects
  - I.r.t. to EIA procedure,
  - Role of EIA as a gatekeeper for implementing mitigation measures (e.g. radioactivity, strict norms, but does not need to be a burden)
- Dealing with uncertainty and R&D
  - Environmental risk (financial risk covered in GEO-RISK)
- Communication and social acceptance, including Information sharing, Trust, Positive communication, Creating local benefits
  - Looking also at benefits e.g. employment, how royalties are used for the territories, role of LCA.
- Organizing public participation

## ○ Conclusions & Next steps

A good basis for (co)-developing and disseminating recommendations:

- A thorough review of current regulations
- Engagement of a network of stakeholders and key players
- 1<sup>st</sup> insights into key regulatory challenges

Next steps:

- Sharing of best practices among case study countries on cross-cutting topics
- Templates to be developed for each topic (ongoing)
- Gathering info (ongoing)
  - From partners, but also: advisory board, external contacts, workshop participants
- Collect feedback in next workshop round (September – November 2020)
- Compilation of recommendations



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**G E O E N V I**