

The Haute-Sorne EGS pilot project, Switzerland: regulatory approach to induced seismicity

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March 2025, 4th induced seismicity workshop, Davos



PREAMBLE



➤ **Swiss cantons hold the subsurface sovereignty**

- ⇒ they define regulations (rules) regarding its usage and exploitation
- ⇒ they assess subsurface permit applications and set conditions of authorization

➤ **Regulatory oversight is a duty of Swiss cantons (supervisory authority)**

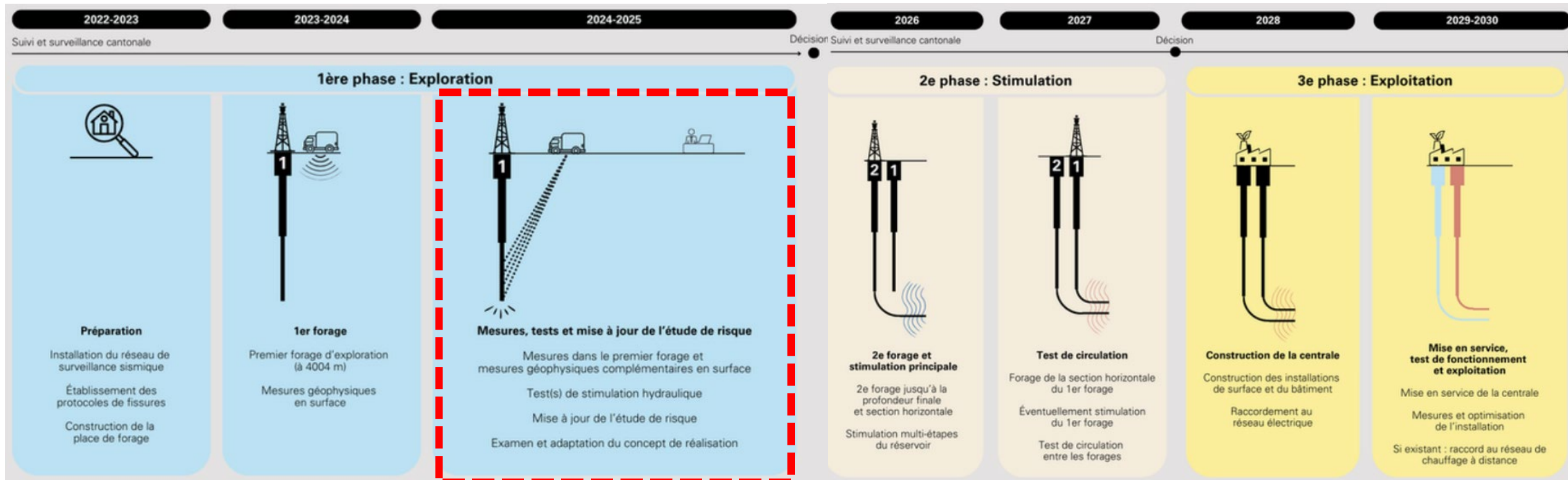
- ⇒ they ensure full compliance of works and operational programs with the legal and regulatory framework
- ⇒ they carry out a regulatory oversight on work programs and operations to control that risks are kept to an acceptable level

Induced seismicity is a matter of concern for cantons considering their role, responsibility and liability

But legal and regulatory frameworks specific to *induced seismicity* are still in their infancy

PREAMBLE

The Haute-Sorne EGS deep geothermal pilot project, Switzerland



➤ Regulatory strategy of the Jura canton (*induced seismicity*) :

- ⇒ Implement taylor-made and evolutive policies in compliance with existing laws, regulations and the principle of proportionality
- ⇒ Control their enforcement and monitor compliance with existing laws and best practices

➤ **Main objectives** : Public interest (transparency, protection of infrastructures, the environment and the population), contribution to the energy transition and the safe development of EGS technologies

OUTLINE

HISTORICAL TIMELINE

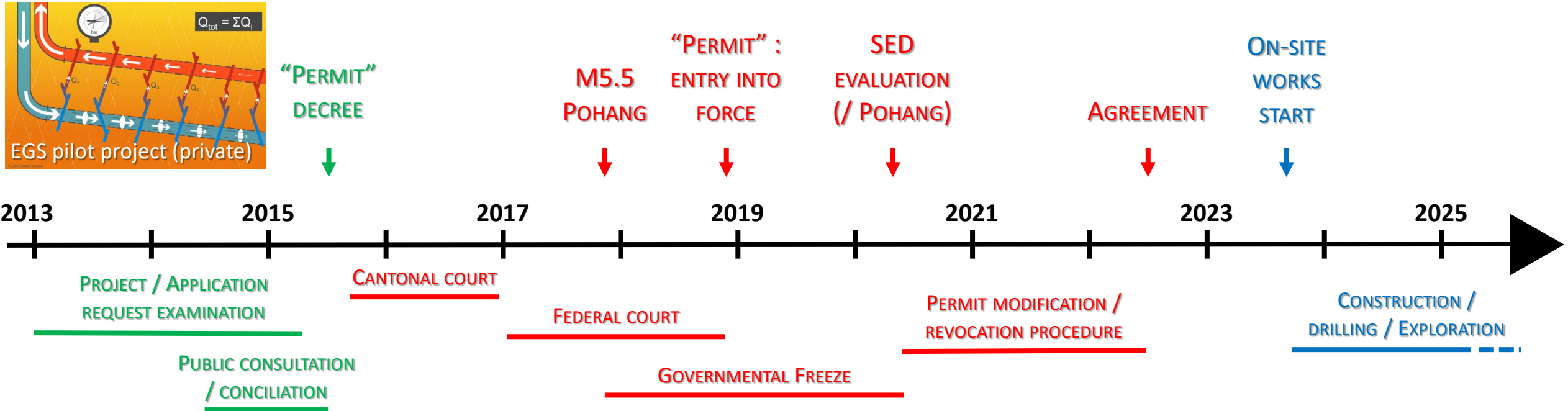
2013-2015 : AUTHORIZATION



2017-2022 : PROCEDURES



2022-PRESENT : EXPLORATION



AUTHORIZATION (2015)

PRIMARY REGULATORY SYSTEM (*induced seismicity*)

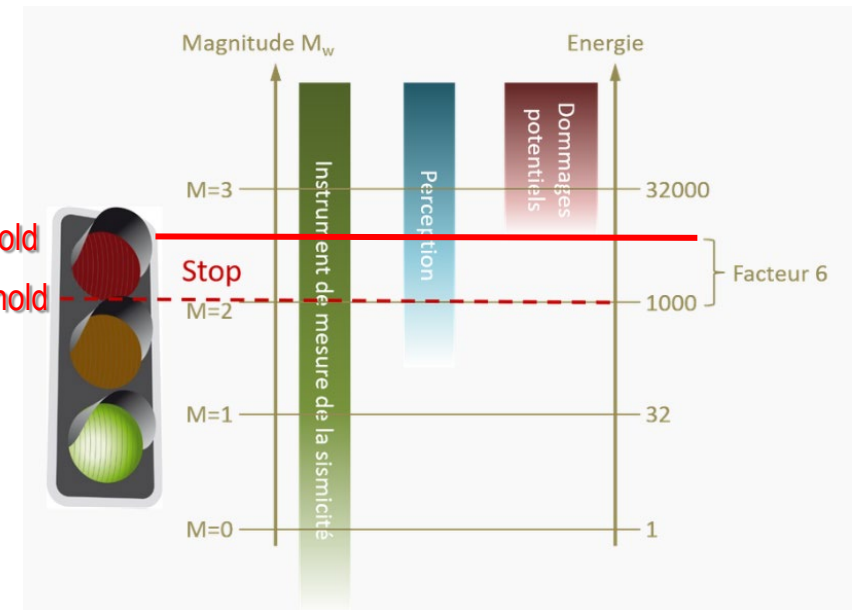
➤ Conditions and prescriptions

- ⇒ Independent expert group (GEI) in *induced seismicity*
- ⇒ State of the art seismic monitoring
- ⇒ Calibration of the velocity model
- ⇒ Magnitude threshold ($M_w = 2.6$)
- ⇒ 80M liability insurance
- ⇒ Risk analysis
- ⇒ Stimulations programs and tests
- ⇒ Traffic Light System (TLS)
- ⇒ Adapted Traffic Light System (ATLS)
- ⇒ Local buildings control and monitoring

Cantonal decision / continuation if :

- $M_w > 2.6$
- seismic risk increases

Regulatory threshold
Operational threshold



Source: Sismicité - Geo-Energie Suisse SA - Q-con



Specific measures targeting *induced seismicity* risks, mitigation, liability and transparency

PROCEDURES (2015-2022)

➤ Legal procedures (local opposition to the project)

⇒ Cantonal court (2016)

⇒ Federal court (2018)



➤ Pohang's earthquake & Governmental freeze (authorization reassessment)

Geo-Energie, preliminary inquiry, 2013 *"The range of magnitude around $M_w = 3.5$ represents, for an EGS project, an earthquake of exceptional intensity"*

Geo-Energie, impact report, 2014 *"The trailing effect is conservatively defined at 0.6 units of magnitude, which is the largest trailing effect ever observed in geothermal projects"*

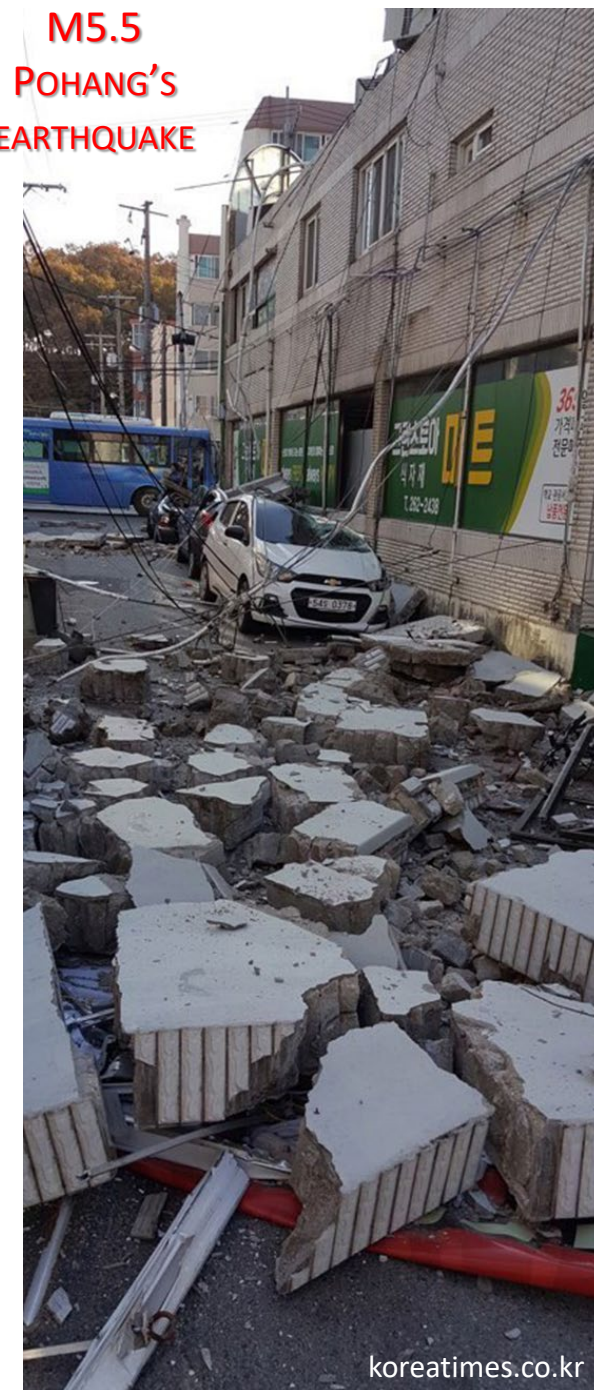
⇒ Scientific report and critical review by the operator (July 2019)

⇒ Critical review and recommendations by the SED (Sept. 2019)

SED, 2019

Recommendation 1: The overall framework for risk assessment, risk mitigation, and acceptance criteria defined by the canton has not been invalidated by the Pohang earthquake. The underlying principles have in fact been reinforced by the lessons learned from the Pohang project and they are now more accepted by the informed technical community. We recommend to the canton that this framework should continue to be used as the basis for permitting.

M5.5
POHANG'S
EARTHQUAKE



AGREEMENT (2022)

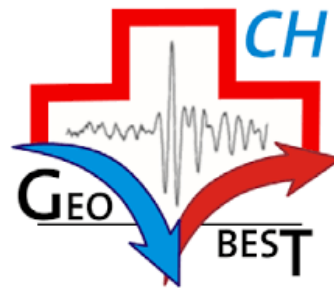
STRENGTHENING OF THE REGULATORY SYSTEM (2022)

➤ **Convention with the operator**

- ⇒ Phasing of the project and full risk reassessment
- ⇒ Adaptation of operational programs and cantonal policies/regulations
- ⇒ Governance and institutional framework strengthening
- ⇒ Reinforcement of the project and its exploratory phase
- ⇒ Preliminary crack expertise (perimeter = 2.5 km)
- ⇒ Human resources reinforcement
- ⇒ 100M liability insurance

➤ **Geobest collaboration agreement with the Swiss seismological service**

- ⇒ *Induced seismicity* : SED guidance, advice and assistance

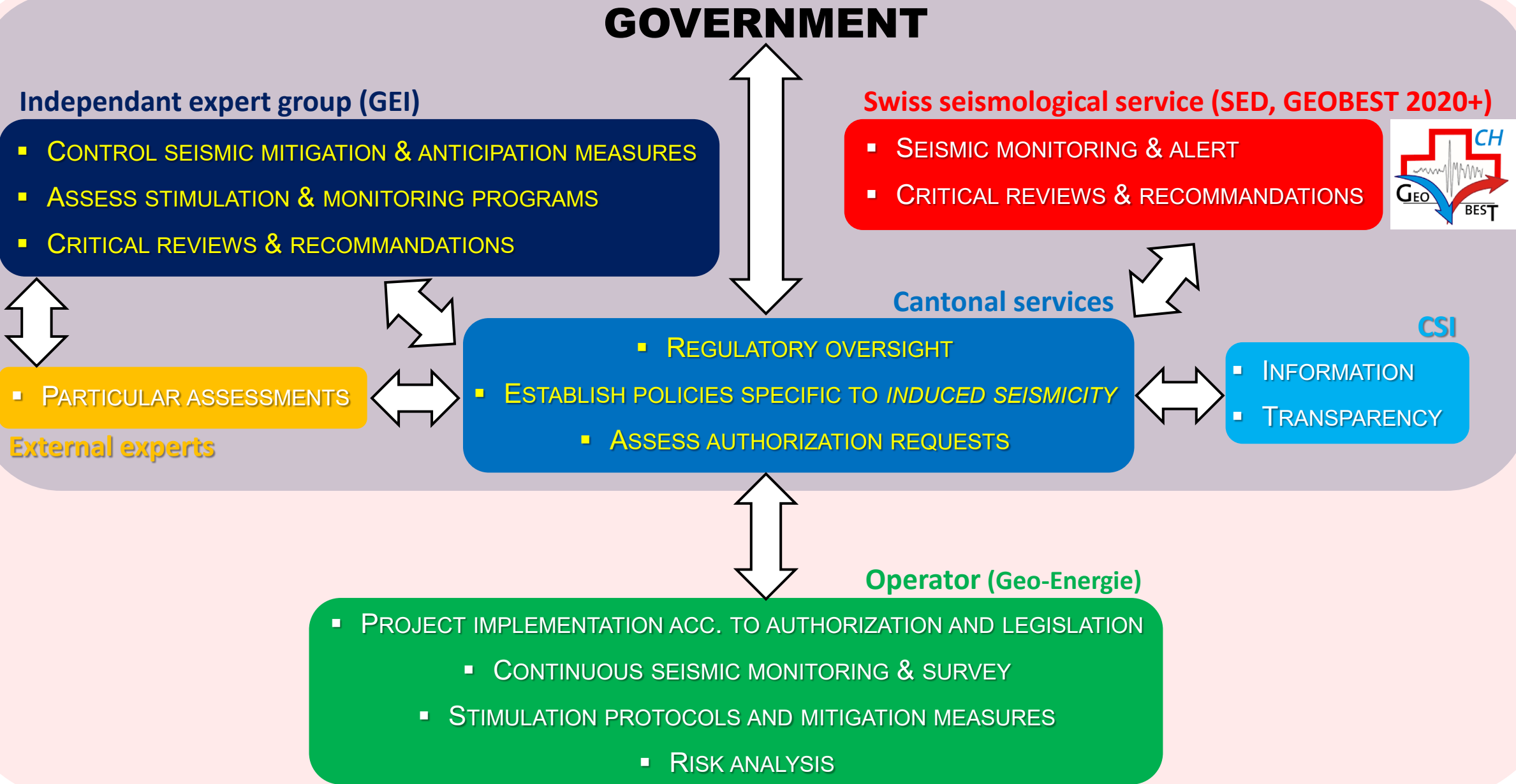


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PRESENT REGULATORY SYSTEM (*INDUCED SEISMICITY*)

Patronage committee



MAIN CONCLUSION

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- The background image shows an industrial site, likely a geothermal or EGS pilot project. On the left, a tall, dark drilling rig stands against a blue sky with white clouds. To the right, a large, modern building with a glass facade is visible. In the foreground, there's a paved area with some greenery and a fence. The overall scene is bright and clear.
- Induced seismicity, Haute-Sorne EGS pilot project : a regulatory system is in place, aimed comprehensive and adaptive
 - This system can benefit from your inputs during this workshop and at any time (sylvain.rigaud@jura.ch; +41 32 420 53 22)