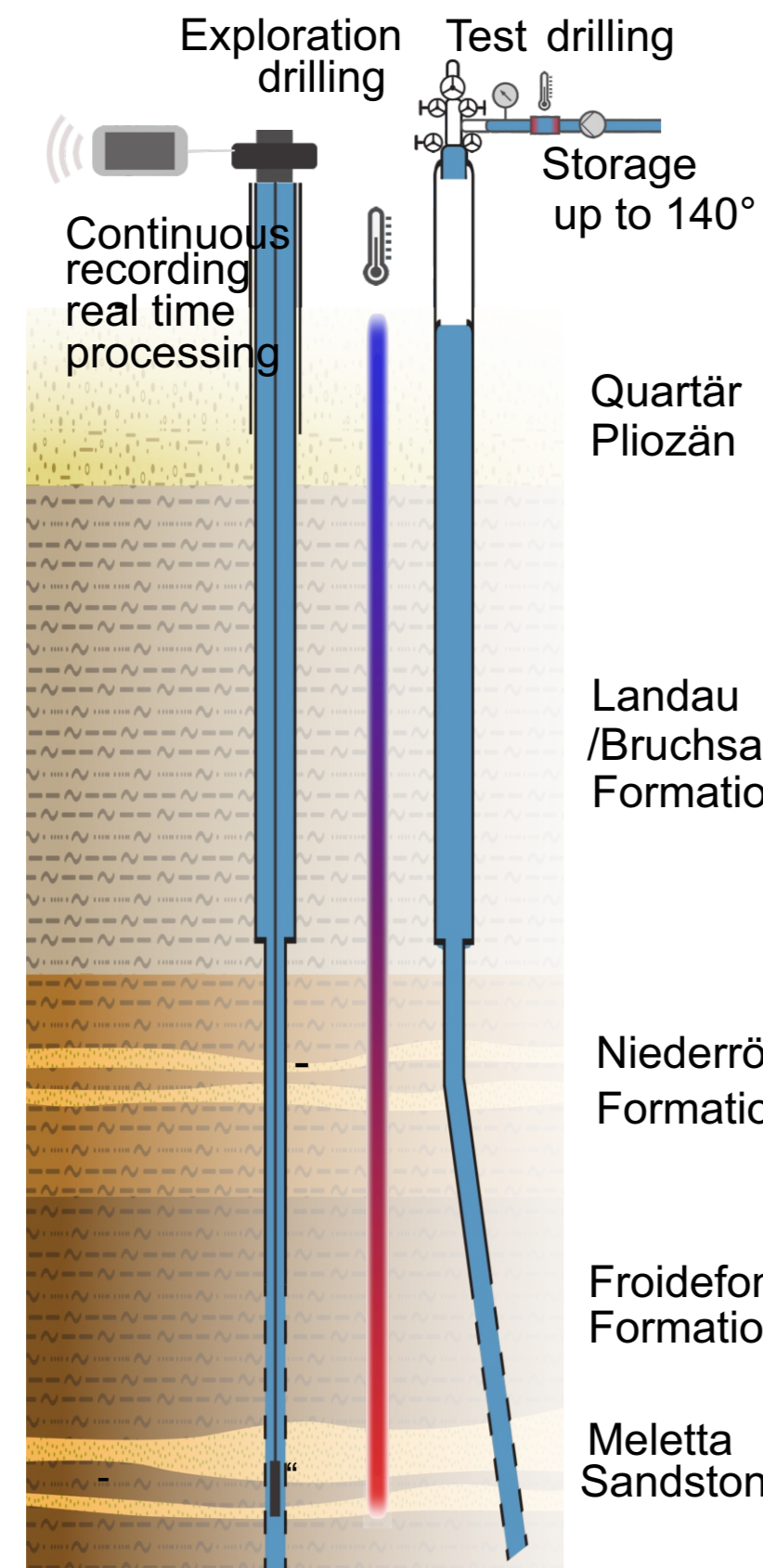
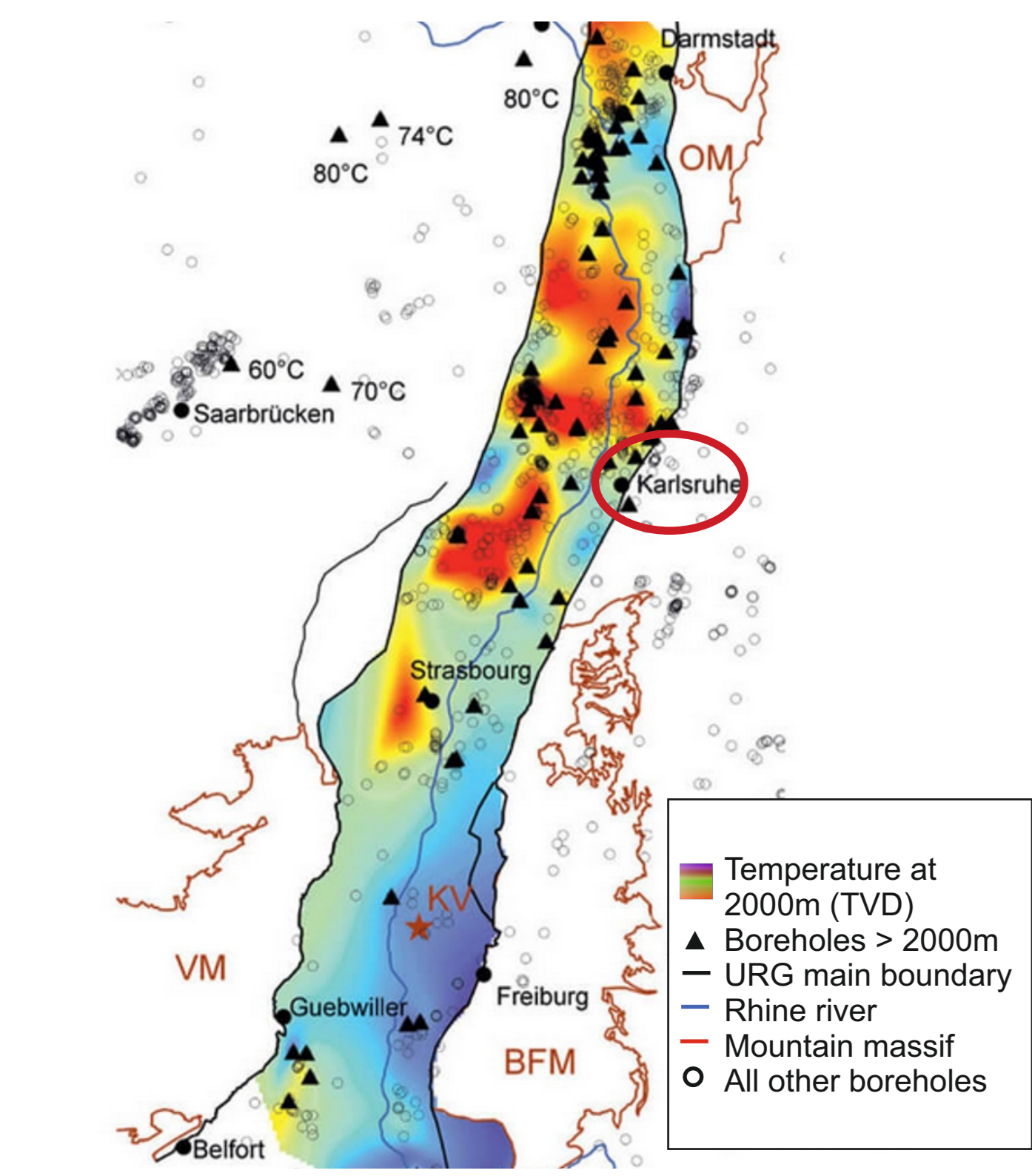


INTRODUCTION

- Geothermal projects might encounter challenges due to unfavorable societal perception, with discussions focused on perceived environmental risks (groundwater pollution or geophysical processes associated with deep reservoir operation)
- Discussions may arise due to a lack of information / ineffective communication between project developers and local communities.
- We develop a participatory approach aimed at addressing this challenge in the current development of the DeepStor research infrastructure - KIT Campus (Karlsruhe, Germany). DeepStor explore the feasibility of High-Temperature Aquifer Thermal Energy Storage (HT-ATES), which holds potential in meeting climate protection goals
- An approach
 - based on a transparent line of communication, promoting collaboration between researchers and individuals from surrounding communities
 - that aims at raising awareness and enhance scientific literacy among non-specialist citizens
 - that foster active involvement among citizens by allowing them to directly engage
- Deployment of RaspberryShakes® also seeks to increase the density and the spatial coverage of seismic stations for seismic data collection

1 - BACKGROUND

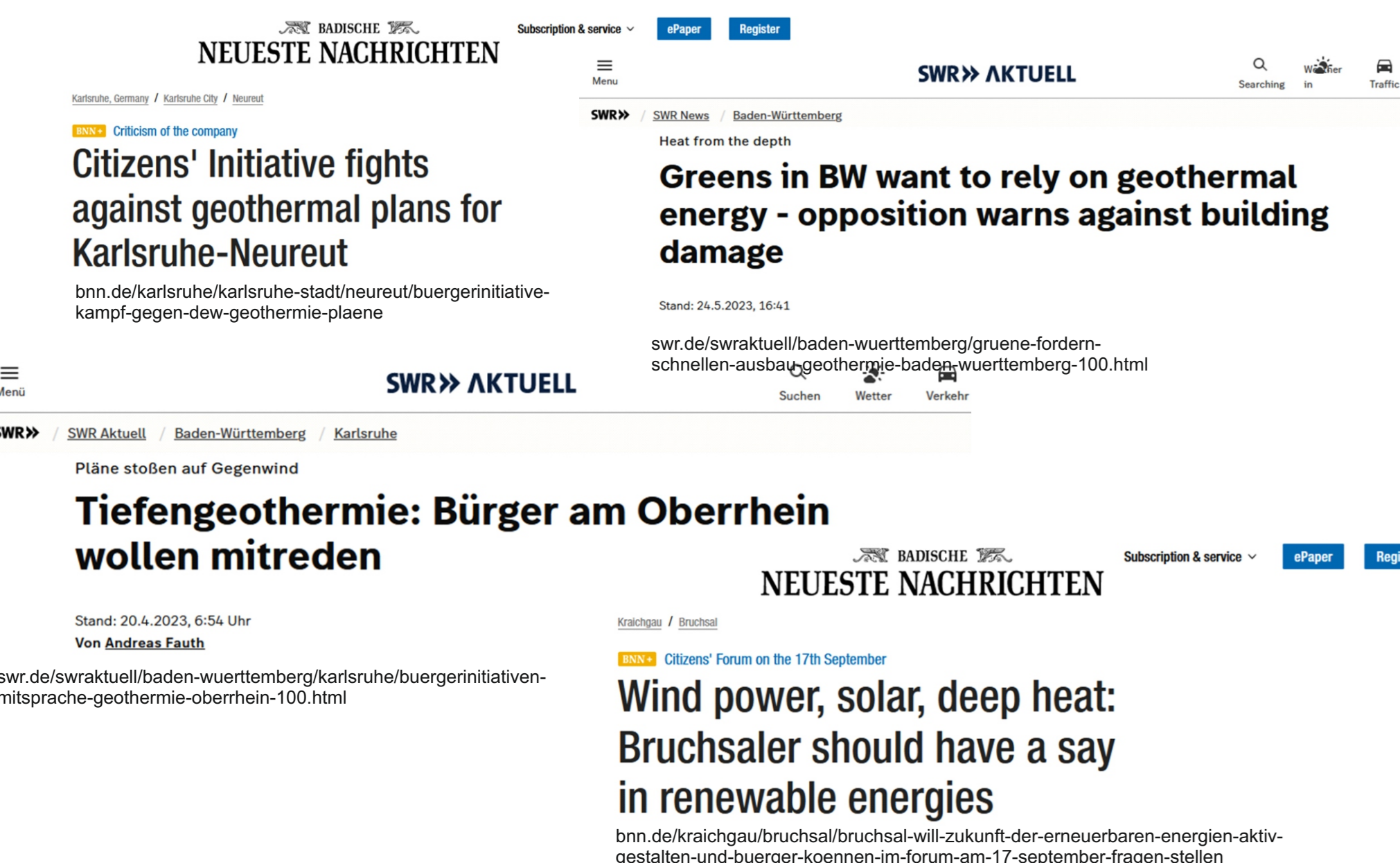
GEOTHERMAL ENERGY IN RHINE GRABEN



- German energy transition needs more action towards reduction of CO₂-emissions in heat supply: Geothermal Energy (GE) could significantly contribute to the energy mix.
- Heat distribution in the Upper Rhine Graben at a depth of two kilometers according to Baillieux et al. (2000)
- KIT campus aims at carbon neutrality. A pilot plant is planned for the use of deep geothermal energy (DeepStor project)
- High-temperature aquifer thermal energy storage (HT-ATES) to address seasonal fluctuations in heat demand, which often leads to excess heat in summer

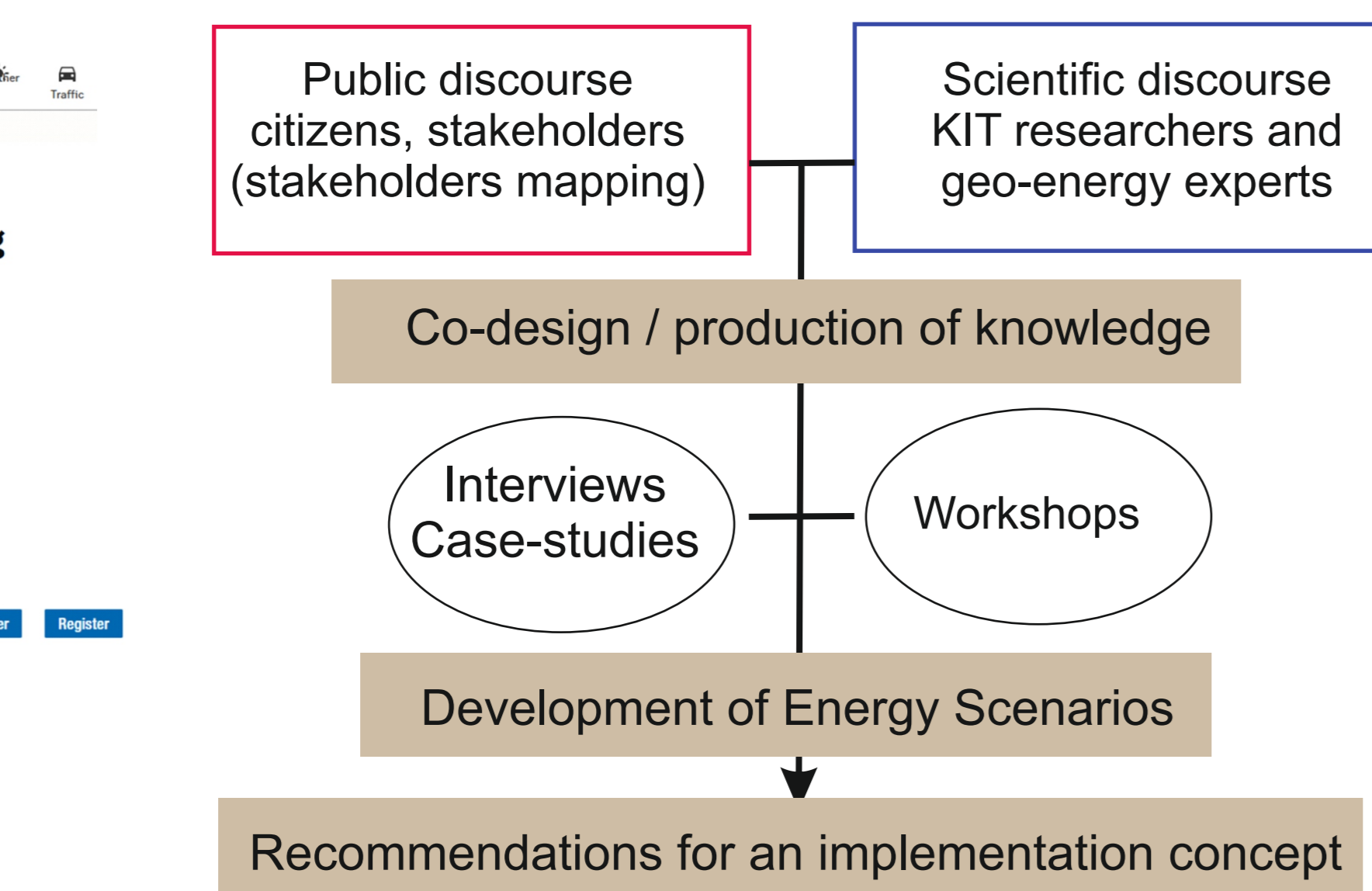
SOCIETAL PERCEPTION IN REGION

- Acceptability is a key aspect: renewable energy plants are often contested infrastructures, despite a broad consensus for the energy transition



GECKO PROJECT

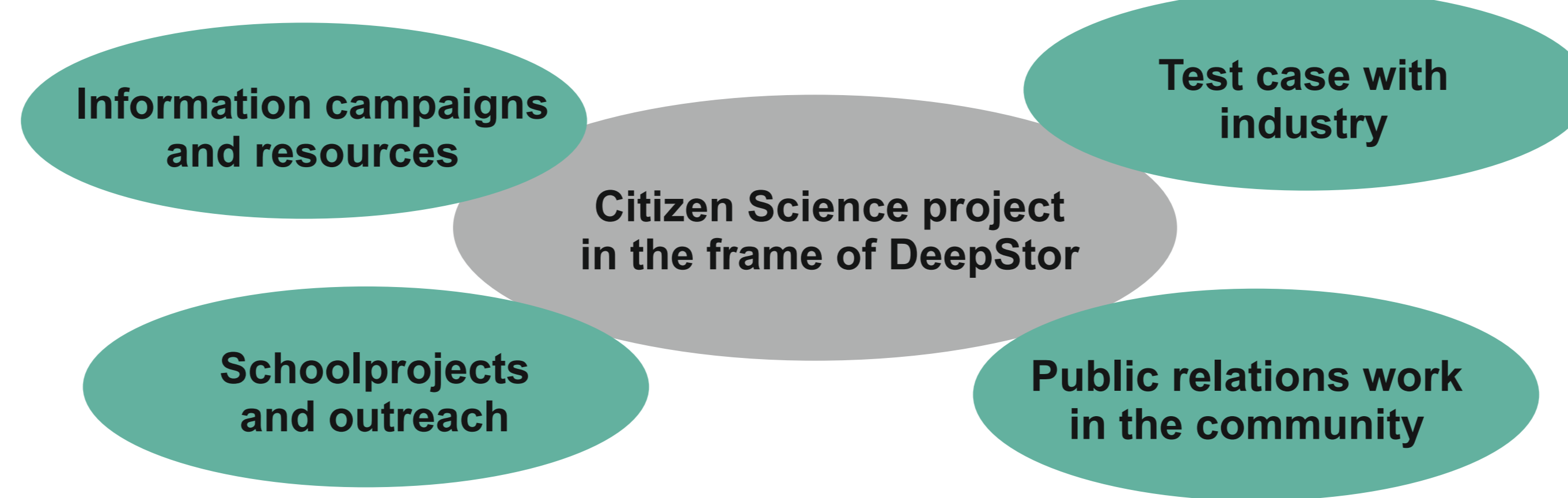
- A transdisciplinary project to engage local citizens in joint development of a concept for using geothermal energy to achieve a climate-neutral heat supply at KIT.



2 - ENGAGING CITIZENS IN GEOTHERMAL ENERGY PROJECTS

FRAMEWORK

- A citizen-science initiative including multiple aspects and levels of actions
- Multidisciplinary
- Featuring information and education campaigns



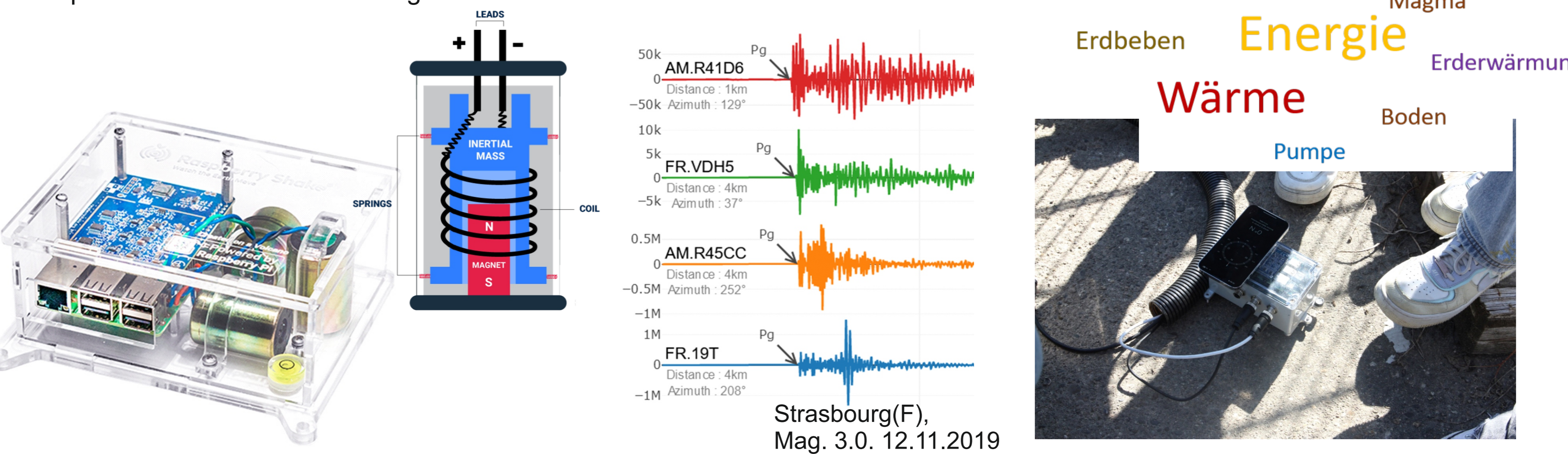
METHODOLOGY

From the perspective of geo-physics/-sciences

- Information and outreach
- Development of info. / educational resources
- Involvement of citizens in seismic monitoring effort
- Feasibility demonstrated by BCSF-RENASS (Strasbourg)
- Use of RaspberryShake® seismometers, motivated by
 - Ease of use, accessibility, affordability
 - A platform for hands-on learning

From the sociological perspective

- Carrying out surveys and interviews
- Affective imaging (Cousse et al., 2021; Zaunbrecher et al., 2018)
- Self assessment of knowledge (Linzenich et al., 2019)
- Risk evaluation (Kluge et al., 2015)
- Project evaluation



3 - PILOT PROJECTS AND EVENTS



MOBILAB

„DeepStor information: learn about heat storage in a playful way“

- Framework:** occasional event organized within a mobile participation laboratory for citizen science, science communication and participation / dialogue with society
- Content:** experiment with a Raspberry Shake to engage people on the topics of seismology and deep geothermal energy
- 18 participants

SCHOOL PROJECT

„Comparative seismic measurements around a geothermal plant A role-playing game as an introduction to scientific research“

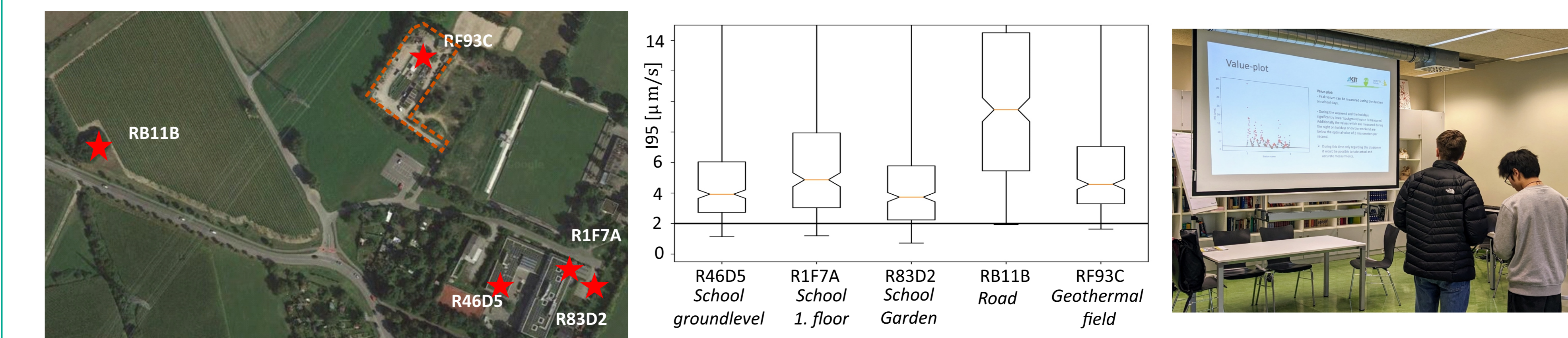
- Goal:** give an insight into the role of geophysicists / seismic measurements in the field of geothermal energies, in collaboration with EnBW
- Benefits:** hands-on learning experience, raise awareness by engaging with experts and technology, interdisciplinary approach to address the real-world complexities of seismology and geothermal energy technologies
- 14 participants



4 - RESULTS

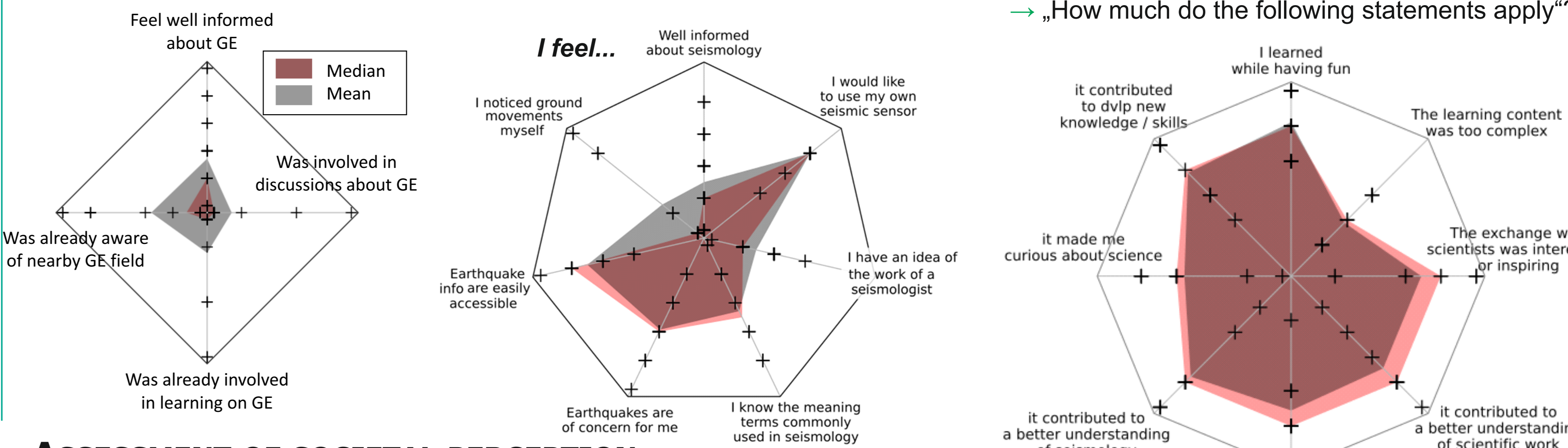
COMPARATIVE SEISMIC MEASUREMENTS (SEISMIC NOISE MEASUREMENTS)

- Background seismic noise quantification: a key step before installation of a new seismic monitoring station.
- Applied to the Bruchsal geothermal field, we test different locations with regards to the suitability for a new monitoring station

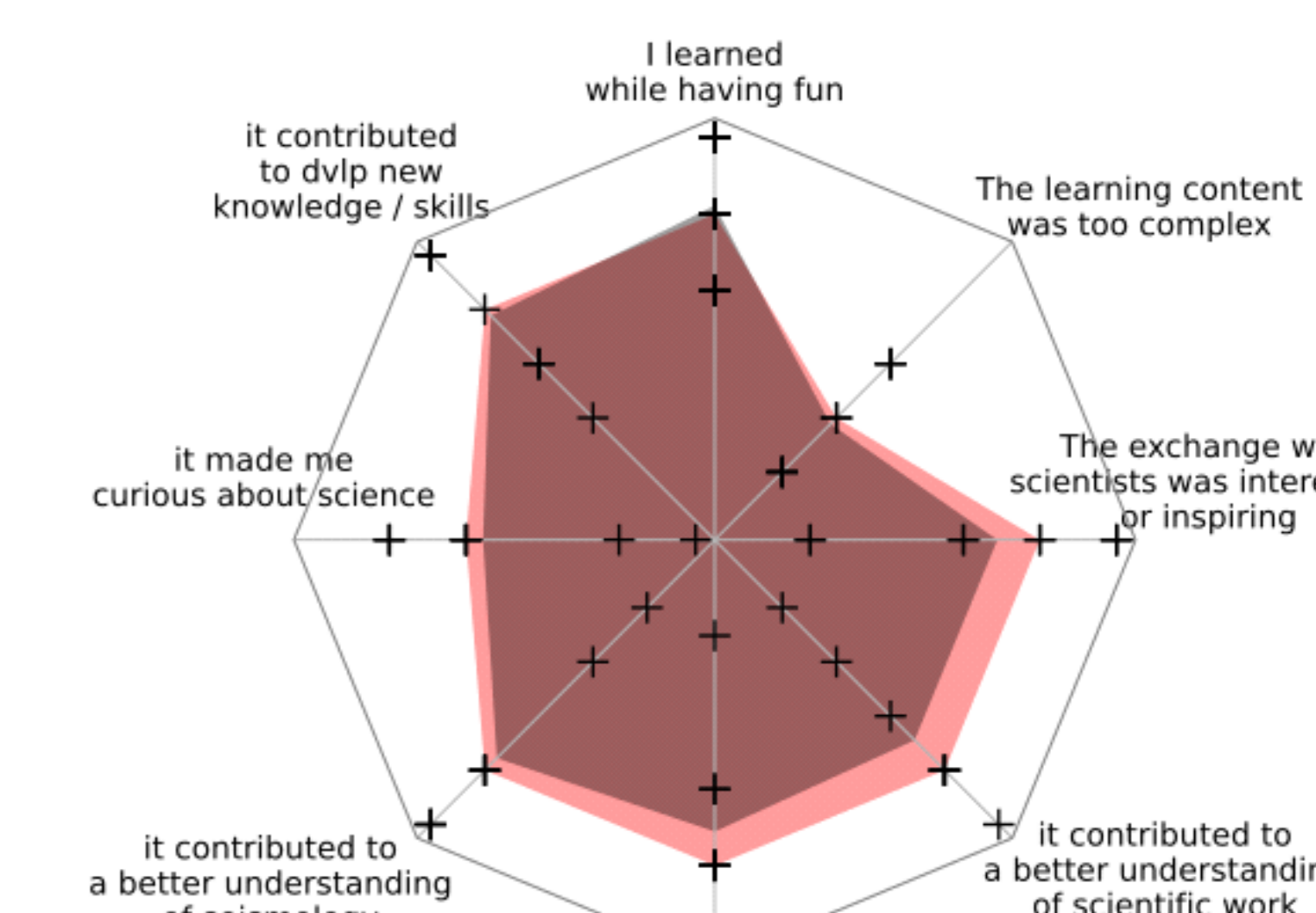


SELF-ASSESSMENT OF GEOTHERMAL ENERGY KNOWLEDGE

Assessment of the need for information on seismology / GE
→ „How much do the following statements apply to you personally?“



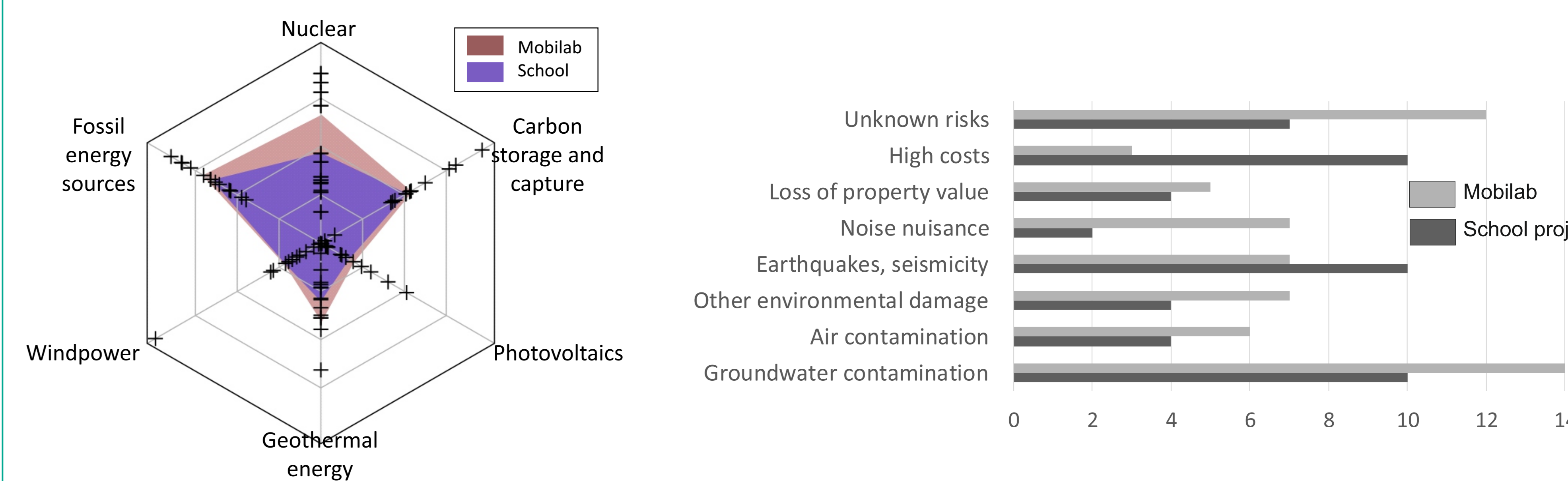
Evaluating the contribution of proposed teaching materials to the growth of scientific literacy
→ „How much do the following statements apply?“



ASSESSMENT OF SOCIETAL PERCEPTION

Evaluation of risks and benefits associated with various energy technologies

- How risky do you consider various energy technologies to be?
- Which risks of deep geothermal energy do you consider to be particularly relevant?



5 - TAKE HOME MESSAGES

- A concept for engaging citizens in geothermal energy projects is developed
- based on information / education campaigns and a citizen-science approach
- by leveraging technology and a multidisciplinary approach
- First pilot initiatives show a need of information about the related topics
- Technology and hands-on learning is a way to promote learning and interest in GE
- A larger number of participants needs to be involved to draw conclusions from the sociological studies

References

Cousse J, Trutnevte E, Hahnel UJJ. Tell me how you feel about geothermal energy: Affect as a revealing factor of the role of seismic risk on public acceptance. *Energy Policy*. 2021 Nov 1;158:112547.
Linzenich A, Arning K, Ziefle M. Acceptance of energy technologies in context: Comparing laypeople's risk perceptions across eight infrastructure technologies in Germany. *Energy Policy*. 2021 May 1;152:112071.
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Zaunbrecher BS, Kluge J, Ziefle M. Exploring Mental Models of Geothermal Energy among Laypeople in Germany as Hidden Drivers for Acceptance. *[Journal of Sustainable Development of Energy, Water and Environment Systems]*. 2018 Sep 30;6(3):4463-4463.