## 8.1 Detailed Questionnaire Answers

Replies received from:

- South-Korea — Yoonho Song
- Japan — Kasumi Yasukawa
- Slovenia — Nina Rman
- Germany — Thorsten Hörbrand, Stephan Schreiber & Sebastian Bauer
- Switzerland — Peter Meier & Christian Minnig
- France — Christian Boissavy
- USA — Lauren Boyd
- Netherlands — Bas Godschalk

Relevant literature:

- Godschalk, B., Provoost, M., & Schoof, F. (2020). Netherlands Country Update. In Proceedings World Geothermal Congress. Pag. 1.
- Bakema et al. (2019). Aquifer Thermal Energy Storage in the Netherlands, a research programme (2010-2012), Extended English summary of a report by the Dutch research programme MMB (Meer Met Bodemenergie). Pag. 1-77.

### 8.1.1 LT-ATES

| **General Questions** | |
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| **G.1. What is the status of LT-ATES in your country? Are ATES projects already realized or still in development? If implemented, how many ATES projects are operational?** | |
| Korea | There is a site which is operational (completed at the end of 2022) |
| Japan | Experimental Stage |
| Slovenia | Not existing, only first ideas developed. |
| Germany | Sebastian Bauer:<br>Implemented, some operational |
| Switzerland | Christian Minnig:<br>1 in operation (Swatch/Omega) with success and exceeding it's expectations<br>1 in planification (Airport ZH) |
| France | For shallow plant (<200m depth) the injection temperature is limited to 32°C.<br><br>Few projects at the moment (<25) even if the first one was built in 1982 in Aulnay sous Bois (Ile de France) using the Ypresian sandstones reservoir at 80m depth. |
| USA | The U.S. considers ATES to include shallow aquifer systems that uses groundwater to store heat for later use and RTES to include deeper aquifer systems to transmit and store heat, while using the insulation capacity of geologic materials to limit thermal energy loss during the storage period.<br><br>Regarding ATES, Stockton University in NJ is a retro commissioned ATES system. DOE LBNL also evaluated the system in partnership with developer Mark Worthington. US ATES developer Mark Worthington provides a Case Study on the system at: ATES System Evaluation and Retrocommissioning (underground-energy.com)<br><br>Regarding Reservoir Thermal Energy Storage (RTES), GTO supported analysis at the USGS that reports on storage zones which share characteristics of traditional |

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| | geothermal reservoirs, particularly in terms of chemistry, flowrate, and poor connection with shallow fresh aquifers. The term reservoir thermal energy storage (RTES) is therefore used to distinguish thermal energy storage using slow-flowing, geochemically evolved aquifers from traditional aquifer thermal energy storage (ATES) applications (Burns et al., 2020). The U.S. Department of Energy's (DOE) GeoVision report (DOE, 2019) considers a range of geothermal technologies, market conditions, and barriers to adoption – notably identifying both low-temperature geothermal resources and thermal energy storage as hugely underutilized. They project that district heating and cooling systems could grow to supply more than 320 Gigawatt-thermal (GWth) of heating and cooling by 2050. The work described by the USGS preliminary assessment (also referred to in response to the survey questions pertaining to support) is an initial step towards understanding the extent to which RTES may supply part of the 2050 target. The U.S. Geological Survey, with support by the DOE Geothermal Technologies Office, is expanding national geothermal resource assessment and classification activities with a pre-assessment of RTES across a range of United States regions. Ultimately, activities are planned to be extended to include regional- and national-scale RTES resource assessments, driven by new model- and data-driven analyses. The pre-assessment is intended to further gauge RTES potential in the United States and aid in the development of new geothermal resource classification standards. |
| Netherlands | Big business. > 4000 ATES projects and still growing. |
| **G.2. Is there any policy on LT-ATES in your country? Are there support/subsidy schemes?** | |
| Korea | No |
| Japan | No. (Subsidy for general GSHP exist.) |
| Slovenia | According to the Slovenian Ministry of the Environment, Climate and Energy, our current policy is to increase RES share in energy mix but storage does not (yet clearly) contribute to this goal. But it does fit sector coupling, storage of excessive heat or electricity produced by OVE. The new directive will have mandatory annual plans of intersectoral coupling where this could fit it. Policy finds interesting to store heat as is has lower costs as storage of electricity in batteries, however, usability of heat is smaller than of electricity. Also, we foresee to "solve" bigger users, town, networks faster than smaller, individual users.<br><br>Support schemes exist for ground source heat pumps with no special linkage to ATES or similar technologies. |
| Germany | Sebastian Bauer:<br>Research incentives, and mainly restrictive policy by regulators |
| Switzerland | Christian Minnig:<br>No specific policies or support schemes in place. Political activity for support has started. National climate policies and the net zero target on national and cantonal levels are considered helpful factor for increased interest in ATES.<br>Currently project can be supported via a pilot+demonstration program that is also tied to transnational collaboration programs for energy projects such as Geothermica and CETP. |
| France | No dedicated policy. |
| USA | The DOE Geothermal Technologies Office supported Deep Direct Use Thermal Energy Storage and Reservoir Thermal Energy Storage projects. USGS conducted a pre-assessment National-scale reservoir thermal energy storage pre-assessment for the United States (usgs.gov) of the cooling potential for reservoir thermal energy storage (RTES) in five generalized geologic regions (Basin and Range, Coastal Plains, Illinois Basin, Michigan Basin, Pacific Northwest) across the United States. Reservoir models are developed for the metropolitan areas of eight cities (Albuquerque, New Mexico; Charleston, South Carolina; Chicago and |

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| | Decatur, Illinois; Lansing, Michigan; Memphis, Tennessee; Phoenix, Arizona; and Portland, Oregon) so that computed metrics can be compared to evaluate RTES potential across diverse climates, geologic settings, and physiography. Permeable, semi-confined/confined units that underlie more-utilized aquifers and contain low-quality groundwater are selected for each city. Energy storage metrics are computed for the anticipated total thickness of stratigraphy for which RTES might be feasible, including estimated required well spacing, thermal storage capacity, and thermal recovery efficiency over time. Falta et al. (2016) showed that for a modern 25,000 square-foot (2,323 square-meter), two-story office building, cooling needs exceed heating demand for almost every region of the country. We therefore use Falta et al.'s cooling demand for each city as the representative RTES stress condition for metric computation, allowing comparisons across regions. Results indicate that favorable RTES conditions exist in each region, particularly in the Illinois Basin, Coastal Plains, and Basin and Range. Thermal recovery efficiencies are very high in all regions and increase over time. The thermal storage capacity metric is most informative in the pre-assessment and underscores the importance of mapping reservoir thicknesses and porosities to permit detailed mapping of thermal storage capacity per unit area as a key RTES resource classification standard. This assessment provides a basic understanding of the RTES potential in several metropolitan areas and geologic regions throughout the United States and will aid further evaluation of national RTES efficacy.<br><br>A recent USGS publication includes an illustration of deeper RTES systems of the type that GTO supported from about 2017-2022. **Fact Sheet 2022–3082:** Geologic Energy Storage<br>**Suggested citation:**<br>Buursink, M.L., Anderson, S.T., Brennan, S.T., Burns, E.R., Freeman, P.A., Gallotti, J.S., Lohr, C.D., Merrill, M. D., Morrissey, E.A., Plampin, M.R., and Warwick, P.D., 2023, Geologic energy storage: U.S. Geological Survey Fact Sheet 2022–3082, 4 p., https://doi.org/10.3133/fs20223082.<br><br>This publication is available online only. The graphic is excerpted below showing deeper RTES systems.<br><br>Primarily, GTO supported developing heating and cooling systems (GDHC) from deep confined reservoirs known as RTES (Portland State University) as well as from man-made geological thermal energy storage systems that can store heat from higher temperature sources such as power plants (INEL). |
| Netherlands | Good legal framework and protection of your system.<br>No real subsidies for LT. |
| **G.3. How do you see the future role of LT-ATES in your country?** | |
| Korea | Getting more important |
| Japan | Technically high possibility, but low possibility because district heating is not common while ATES is more effective for large systems. |
| Slovenia | We want to develop this technology and provide good geological grounds for sustainable development. In 2023, Geological Survey of Slovenia will employ a young researcher, investigating which hydrogeological-geothermal properties of Slovenian rocks/sediments enable these applications. We foresee that the technology can be applied mostly in Miocene sandy aquifers of lower yield in eastern Slovenia, which are locally exploited for drinking water.<br>There is also an idea of using MTES in old coal mines where they have to do restructuring of the regional economy and energy sources. |
| Germany | Sebastian Bauer:<br>Large contribution to heating and climatization of buildings; favourable geological settings in principle available |

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| | Publication(s) on ATES by e.g. Fleuchhaus et al. 2021 (projects), Stemmle et al. 2022 (potential)<br>Information on UTES: https://www.saisonalspeicher.de |
| Switzerland | Christian Minnig:<br>Efficiency gains of energetic use of shallow - GW, allowing densified use.<br><br>Reduction of power consumption in critical winter months → balancing of a resilient power grid.<br>Generally a potential for making the energy transition cheaper. |
| France | Small |
| USA | We believe RTES has the potential to play a significant role in meeting the energy storage shortfall in the coming decades by assisting with peak demand ramping, easing stress on transmission, providing regional storage to support sustainable community and industrial heating, cooling, and processing applications, and providing a variety of grid stabilization benefits.<br><br>An example of a future role for RTES in the U.S. is being demonstrated by the Industrial Decarbonization Heat Shot initiative focused on reducing emissions from industrial heat through the utilization of thermal energy storage for industrial processes. |
| Netherlands | Mature business. Growing business. Development from single solutions to more integrated solutions. |

| **Detailed Questions** | |
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| **D.1. Is there an overview of all the LT-ATES (or other UTES) projects in your country? If so, provide the link or add to mail.** | |
| Korea | Y. Song will introduce a brief overview of the project and contact information on Thursday |
| Japan | No |
| Slovenia | Geological survey of Slovenia every year provides a country update for geothermal energy use in Slovenia. Results are published in a bulletin Mineralne surovine/Mineral resources, online available at https://www.geo-zs.si/index.php/en/products/publications2/periodicals/mineral-resources.<br>However, up to now we did not encounter any ATES systems. |
| Germany | Sebastian Bauer:<br>Publication(s) on ATES by e.g., Fleuchhaus et al. 2021 (projects), Stemmle et al. 2022 (potential)<br>Information on UTES: https://www.saisonalspeicher.de |
| Switzerland | Christian Minnig:<br>No, overview based on personal in-sights into the community |
| France | No |
| USA | - |
| Netherlands | There is a country report. |
| **D.2. What is needed to scale up (the number) of LT-ATES projects?** | |
| Korea | Government support<br>Public awareness<br>Technology development: case studies |
| Japan | Sharing success stories of pilot projects |
| Slovenia | Identification of favourable regions and geological structures.<br>Pilot/demonstration projects<br>Transfer of approaches to research, project development and technologies to Slovenia, with strong promotion of good practices |
| Germany | Sebastian Bauer:<br>Demonstration projects for dissemination of experiences and knowledge<br>Better knowledge on local energy systems and their future energy mix |

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| | Reworking and reinterpretation of regulatory framework and education of regulators<br>Public availability of subsurface information |
| Switzerland | Christian Minnig:<br>Revised GW regulation (max. temp. alterations)<br>Demonstration / enablement of economic viability<br>Identification, localisation and communication of potential<br>Higher electricity costs in winter than in summer<br><br>Peter Meier:<br>clarity about environmental rules like the 3°C groundwater protection rule, guidelines for cantonal authorities |
| France | Communication and share best practises |
| USA | The most important gap that can be filled is a better understanding in the operational activities and costs associated with this technology through a comprehensive techno economic analysis of a full scale demonstration |
| Netherlands | More brains and hands. |
| **D.3. Do you have an overview of relevant innovation or R&D projects in your country? If so, provide the link or add to mail. Are there any knowledge gaps? Are there any innovation opportunities?** | |
| Korea | Not at the moment |
| Japan | https://webmagazine.nedo.go.jp/practical-realization/articles/202104jgd/<br>(In Japanese only) |
| Slovenia | On LT-ATES we are not aware of any targeted projects in Slovenia.<br><br>GeoZS is performing R&D project GeoCOOL FOOD - Cold food storage using shallow geothermal energy (https://www.geo-zs.si/index.php/en/?option=com_content&view=article&id=1157) on exploration of shallow geothermal energy potential of geoprobes for vegetable's cold storage systems. However, this is not about directly ATES systems. |
| Germany | Sebastian Bauer:<br>Currently collection of research projects funded by German Ministry of Education and Research |
| Switzerland | Christian Minnig:<br>No general overview.<br>There are several projects running or in evaluation that look into ATES in fractured aquifers, such as crystalline rock or limestone formations. These projects range from analytical and/or numerical analyses to laboratory tests on the meter to decameter scales<br>Peter Meier:<br>https://www.flughafen-zuerich.ch/de/unternehmen/magazin/2023/nachhaltigkeit_energiepfaehle |
| France | No |
| USA | See draft publication in email for high level discussion of recent R&D projects. |
| Netherlands | Interesting program was the Meer met Bodemenergie program. Large scale results to effects and options for ATES. There is an English summary. |
| **D.4. What are the barriers (technical, economic, environmental, social) for LT-ATES in your country? What are the opportunities for ATES in your country?** | |

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| Korea | Social > technical > environmental |
| Japan | Social (awareness, energy supply system).<br>Not only ATES, but generally importance of heat energy is not well understood. |
| Slovenia | LT-ATES:<br><br>Barriers:<br>Lack of awareness/visibility/knowledge on this technology.<br>Currently only high temperature district heating grids are used (no low temperature grids exist or are planned).<br>Lack of knowledge on processes and environmental impact alternated by geothermal use of aquifers - legal framework is not or is poorly defined for geothermal applications.<br>No legislative frame is yet established or discussed about.<br>We are very conservative, so regulators strictly do not allow new projects if it is not guaranteed that they will not do harm.<br>Shallow aquifers are the main source of drinking water in Slovenia (priority use) and much area is projected for it.<br>Lack of control on drilling rigs, also lack of experienced drillers.<br>No interest from investors is yet noticed.<br>No skilled personnel on this topic, only GeoZS has started networking in Europe on a research level.<br><br>Opportunities:<br>Slovenia will in very near future strongly support photovoltaic for which ATES and BTES or MTES could provide important energy transformation option. So a favourable environment with high need to use ATES technology will be established in this and next year.<br>GeoZS will get a young researcher for 4 years to study favourable geological-hydrogeological settings for ATES in Slovenia. |
| Germany | Sebastian Bauer:<br>Missing financial incentives<br>Missing subsurface information and knowledge on energy system<br>Difficult regulatory situation<br>Increasing stresses and competition on groundwater<br>High geological potential, especially in Northern Germany |
| Switzerland | Christian Minnig:<br>Technical: High iron/manganese values in GW aquifers limit the potential for heat/storage utilization. This can vary strongly locally. Partly the cantons know these deposits, partly not.<br><br>Economic : narrow operational limits (GW regulation); Heat storage systems are economically interesting when energy costs vary seasonally. Current regulatory measures lead rather to equilibrating energy prices throughout the year.<br>Environmental: potentially conflicts of space use (competition between ground water use,…)<br>Social: none identified<br><br>Peter Meier: |

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| | clarity about environmental rules like the 3°C groundwater protection rule, guidelines for cantonal authorities |
| France | Temperature limits for shallow geothermal projects |
| USA | To establish RTES more fully as a viable option for energy storage, some important barriers need to be overcome. Further required research includes a full RTES techno-economic assessment (TEA) to develop a standardized approach to evaluating the feasibility of RTES in many different geographic and technical areas. Coupling topside and reservoir assessments with costs and efficiencies will help to conduct a more defined TEA for RTES. Additionally, an RTES potential map is needed to understand the geographic distribution of suitable sites. Although the USGS performed high-level analysis of eight U.S. cities, a full map of the U.S. RTES potential considering major reservoirs and varying population sizes is needed. This geographic distribution of RTES potential will help stakeholders identify potential projects and understand the energy storage resources that might have been overlooked. Technical risk assessments and mitigation strategies need to be analyzed from initial exploration stages through long-term operations. Ways to reduce these risks include upgrading of subsurface reactive transport models for high TDS brines, flow through experiments at reservoir conditions, mitigation measures for resource sustainability, and mesoscale experiments to demonstrate viability.<br><br>Additional research includes a scalability assessment of RTES. Important questions to answer are: what sizes of systems will be required for representative projects? What is the footprint/reservoir ratio when we are thinking about scales? One RTES system may be suitable for a house whereas another might be sufficient for a major metropolitan area. Scales will continue to be unknown until some of the required work is done to assess it. Another major assessment includes that of carbon avoidance. What carbon emissions can be avoided with various sizes of RTES systems? We need to take a closer look at the quantities of carbon that are kept from going into the atmosphere due to the establishment of RTES systems. |
| Netherlands | Lack in capacity |
| **D.5. Is international collaboration relevant? If so, what kind and how? What could IEA Geothermal/GEOTHERMICA do?** | |
| Korea | International collaboration may help initiating another projects |
| Japan | Information exchange by workshop, etc. |
| Slovenia | Yes, extremely. Without support from abroad there would be no development in Slovenia as we are very conservative in introducing new practices and technologies.<br>We aim for exchange of knowledge on methodology for evaluation of potential, transfer and upgrade of technologies from regions with similar geological conditions. |
| Germany | Sebastian Bauer:<br>Yes, as practise and examples can cross borders |
| Switzerland | Christian Minnig:<br>YES:<br>demonstration of<br>economic viability<br>adequate regulatory framework & practice<br>environmental impacts<br>technical competences. |

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| | communication of good practices e.g.<br>- integration in district heating systems. Ecoomy of ATES improves when DHS is run on low temperatures. → promote the construction of Lower Temp DHS<br>Peter Meier:<br>1) know-how exchange on technical aspects;<br>2) know-how exchange on regulatory aspects;<br>3) Networking for professional collaborations;<br>4) Geothermica: calls for heatstorage projects |
| France | For France, I believe there is a lot to do with conventional geothermal deployment before highlighting ATES |
| USA | Yes. ATES and RTES technologies are widely used in other countries and have higher TRLs but domestically, these technologies have little operational data for analytical purposes. |
| Netherlands | Yes. We have a lot of experience in NL and are open to share this and to support other countries to develop this ATES market. |

### 8.1.1 HT-ATES

| **General Questions** | |
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| **G.1. What is the status of HT-ATES in your country? Are ATES projects already realized or still in development? If implemented, how many ATES projects are operational?** | |
| Korea | No |
| Japan | Nothing |
| Slovenia | Not existing |
| Germany | Stephan:<br>Few sites operational (Neubrandenburg), ongoing research projects (VESTA, DEEEPSTOR, Berlin). Funding through Energy Research Program possible.<br><br>Sebastian:<br>In development, one operational, two abandoned |
| Switzerland | Peter:<br>Pilot project Bern in sandstone layers under construction. Stimulation with radial drilling Q4 2023. Pre-test with heat injection/withdrawal with moderate temperatures planned for Q1 2024.<br><br>Christian:<br>1 project under construction (Forsthaus). |
| France | No project.<br>A system was tested in the 80’s in Plaisir (Ile de France) to store high temperature water (160°C) in the Cretaceous sandstones, without success. |
| USA | - |
| Netherlands | About 10 projects. Some are closed. Recently, large scale HT-ATES at 85 oC. Interest in HT-ATES is growing rapidly. |
| **G.2. Is there any policy on HT-ATES in your country? Are there support/subsidy schemes?** | |
| Korea | No |
| Japan | No |
| Slovenia | According to the Slovenian Ministry of the Environment, Climate and Energy, our current policy is to increase RES share in energy mix, but storage does not (yet clearly) contribute to this goal. But it does fit sector coupling, storage of excessive heat or electricity produced by OVE. The new directive will have mandatory annual plans of intersectoral coupling where this could fit it. Policy finds interesting to store heat as is has lower costs as storage of electricity in |

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| | batteries, however, usability of heat is smaller than of electricity. Also, we foresee to “solve” bigger users, town, networks faster than smaller, individual users.<br><br>Our laws forbid storage of CO2 and do not say nothing about the ATES or BTES yet.<br>No support schemes exist. |
| Germany | Stephan:<br>Might be covered through BEW Funding (Infrastructure), at least in combination with geothermal. Research funding possible.<br><br>Thorsten:<br>Not besides research projects.<br><br>Sebastian:<br>Research incentives, planning stages |
| Switzerland | Peter:<br>In same cases in view of exploration for geothermal heat projects.<br><br>Christian:<br>No specific policies or support schemes in place.<br>political activity for support has started, as well for de-regulation of ground water protection. National climate policies and the net zero target on national and cantonal levels are considered helpful factor for increased interest in ATES.<br>Federal P&D research funding program supports the current project.<br>Currently project can be supported via a general pilot + demonstration program for energy projects that is also tied to transnational collaboration programs such as GEOTHERMICA and CETp. |
| France | No dedicated policy. |
| USA | The DOE Geothermal Technologies Office supported Deep Direct Use Thermal Energy Storage and Reservoir Thermal Energy Storage projects. USGS conducted a pre-assessment National-scale reservoir thermal energy storage pre-assessment for the United States (usgs.gov) of the cooling potential for reservoir thermal energy storage (RTES) in five generalized geologic regions (Basin and Range, Coastal Plains, Illinois Basin, Michigan Basin, Pacific Northwest) across the United States. Reservoir models are developed for the metropolitan areas of eight cities (Albuquerque, New Mexico; Charleston, South Carolina; Chicago and Decatur, Illinois; Lansing, Michigan; Memphis, Tennessee; Phoenix, Arizona; and Portland, Oregon) so that computed metrics can be compared to evaluate RTES potential across diverse climates, geologic settings, and physiography. Permeable, semi-confined/confined units that underlie more-utilized aquifers and contain low-quality groundwater are selected for each city. Energy storage metrics are computed for the anticipated total thickness of stratigraphy for which RTES might be feasible, including estimated required well spacing, thermal storage capacity, and thermal recovery efficiency over time. Falta et al. (2016) showed that for a modern 25,000 square-foot (2,323 square-meter), two-story office building, cooling needs exceed heating demand for almost every region of the country. We therefore use Falta et al.’s cooling demand for each city as the representative RTES stress condition for metric computation, allowing comparisons across regions. Results indicate that favourable RTES conditions exist in each region, particularly in the Illinois Basin, Coastal Plains, and Basin and Range. Thermal recovery efficiencies are very high in all regions and increase over time. The thermal storage capacity metric is most informative in the pre-assessment and underscores the importance of mapping reservoir thicknesses and porosities to permit detailed mapping of thermal storage capacity per unit area as a key RTES resource classification standard. This assessment provides a basic understanding of the RTES potential in several metropolitan areas and geologic regions throughout the United States and will aid further evaluation of national RTES efficacy. |

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| | A recent USGS publication includes an illustration of deeper RTES systems of the type that GTO supported from about 2017-2022. **Fact Sheet 2022–3082:** Geologic Energy Storage<br>**Suggested citation:**<br>Buursink, M.L., Anderson, S.T., Brennan, S.T., Burns, E.R., Freeman, P.A., Gallotti, J.S., Lohr, C.D., Merrill, M. D., Morrissey, E.A., Plampin, M.R., and Warwick, P.D., 2023, Geologic energy storage: U.S. Geological Survey Fact Sheet 2022–3082, 4 p., https://doi.org/10.3133/fs20223082.<br>This publication is available online only. The graphic is excerpted below showing deeper RTES systems.<br>Primarily, GTO supported developing heating and cooling systems (GDHC) from deep confined reservoirs known as RTES (Portland State University) as well as from man-made geological thermal energy storage systems that can store heat from higher temperature sources such as power plants (INEL). |
| Netherlands | Legal framework is in development.<br>No subsidy, but some of the projects are made by using subsidy as innovation budget. |
| **G.3. How do you see the future role of HT-ATES in your country?** | |
| Korea | Not important |
| Japan | Technically high possibility, but low possibility due to extremely low awareness. |
| Slovenia | Debatable, as our investors are very conservative. We have one 1,5 km deep reinjection well but with no ATES idea yet, also other user sites (about 50 wells active) have yet not thought about it.<br>For totally new investments, the technology is very poorly known among investors but there might be potential in some regions and under the capital of Ljubljana. But we need basic research and demo projects to even start thinking about it. |
| Germany | Stephan:<br>Key technology integrated in district heating networks<br><br>Thorsten:<br>Given the fact, that HT-ATES are able to supply a significant amount of energy, I see it as a viable option to provide middle and peak load energy in regions where conditions are favourable.<br><br>Sebastian:<br>Large contribution to heating and climatization of buildings |
| Switzerland | Peter:<br>Important potential<br><br>Christian:<br>Reduction of fossil fuel consumption for capping peak heat demands in winter. Generic potential for making the energy transition cheaper. |
| France | Very small |
| USA | We believe RTES has the potential to play a significant role in meeting the energy storage shortfall in the coming decades by assisting with peak demand ramping, easing stress on transmission, providing regional storage to support sustainable community and industrial heating, cooling, and processing applications, and providing a variety of grid stabilization benefits.<br>An example of a future role for RTES in the U.S. is being demonstrated by the Industrial Decarbonization Heat Shot initiative focused on reducing emissions from industrial heat through the utilization of thermal energy storage for industrial processes. |
| Netherlands | Will be seen, more and more as part of the heat transition. More HT-networks, will result in more interest in HT-ATES. |