United Downs Deep Geothermal Power project

# HOT TOPIC

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## Why communicate about Enhanced Geothermal Systems? A comparison of St Gallen and Basel in Switzerland

**When considering what strategy to use to communicate about new geo-technologies like Enhanced Geothermal Systems (EGS), companies often consider a range of factors, including confidentiality, cost, the current engagement by the community and past experiences. In this Hot Topic we propose that using past experiences is particularly important for communicating EGS as is demonstrated by these two contrasting, but comparable case studies in Switzerland that took very different approaches to communication about EGS and induced seismicity: Basel and St Gallen.**

Basel is a well-known case study in the EGS world, mostly due to the extremely well publicised M3.4 earthquake that occurred on the 8th December 2006, which was felt by a large number of residents of the city and resulted in financial claims of around seven million CHF and the suspension of the project after a reassessment of the associated risk. Less well known is the St Gallen geothermal project, which also induced an M 3.5 earthquake on the 20th July 2013. This event however had very little public acknowledgement and the project itself was only terminated upon completion of the testing phase which found that the environment was not as suitable for fluid flow production as had previously been thought.

Though there are some differences between the two projects on a technical basis (Basel was a petrochemical EGS project undertaken in crystalline basement and St Gallen was a hydrothermal EGS project undertaken in a sedimentary basin) and some differences in the factors of the earthquake events that contributed to the difference in public response (Basel happened during the day and the testing site was located closer to the urban centre; St Gallen happened at night, was further away from the urban centre and had less high frequency motion as a part of the event); the key difference between the two projects as concerns the public is the amount, type and quality of communication.

The Basel project is frequently criticised for the lack of communication and engagement with the local residents, even immediately after the event that caused the suspension and eventual termination of the project. Communication about the project was limited to government and official stakeholders, with very little recorded engagement with local residents. In contrast, the St Gallen project invested broadly in communications, engagement and outreach: producing a high quality website that is still active and displays live seismic records of the site area; collaborating with local government employed social researchers who studied the public perceptions of the project; and engaging frequently with local stakeholders. As a result when the M3.5 event happened residents surveyed stated that they were less surprised and frightened than in a similar study conducted in Basel found people to be. Furthermore, coverage in the media of the potential for seismic activity, in addition to some coverage of the previous activity in Basel, seemed to result in greater awareness of the problem in St Gallen, which reduced fearful responses during the immediate aftermath of the event. Because of the wide acknowledgement of these potential problems, there was virtually no public outcry and the project progressed despite the seismic event, retaining public support until its eventual termination in 2014.

These two case studies show that although some other factors influenced the difference in public perception of the induced seismic event, the main controllable factor of communication had a significant impact on the expectations and attitudes of local residents. By engaging early, frequently and through varied channels, and by being as open as possible with data, including seismic monitoring data, the St Gallen project reduced the public uncertainty about induced seismic events, so that when one did happen the framing of those events as being 'small and controllable'[1] was effective.

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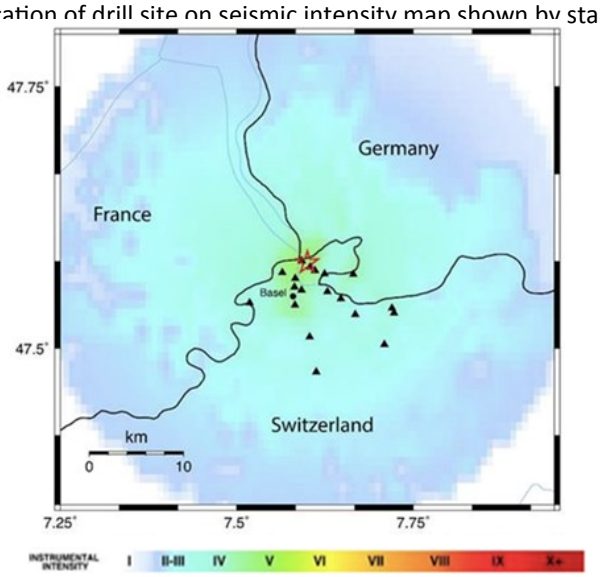
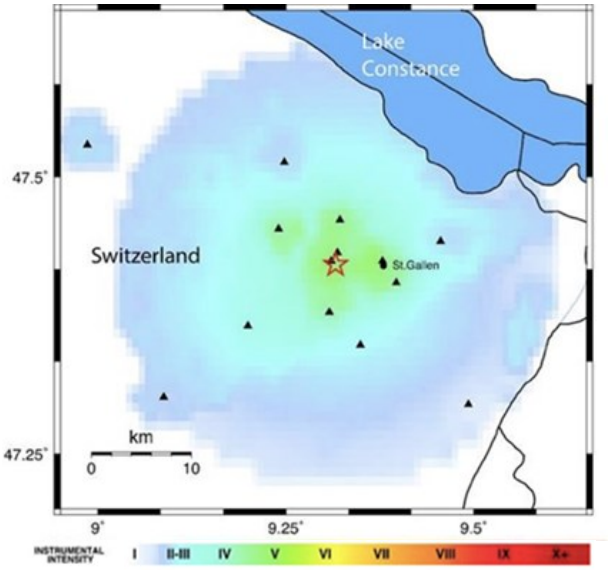
| BASEL | ST GALLEN |
|---|---|
| **Type of geothermal** | |
| Petrothermal | Hydrothermal |
| The Basel project was one of the first commercial EGS projects to take place and was designed to drill into the crystalline basement rock.<br><br>The objective was to enhance the permeability of the rock by injecting fluid in a 'step-wise manner' at high pressure at a depth of 4-5km, over a two week period[2], to create a geothermal reservoir where the liquid would circulate and heat up[3]. | The St Gallen project was a hydrothermal project but exploited geology of a similar depth. It targeted a pre-existing fault of 30km in length and 4.5km depth[4], and made use of water circulating in existing aquifers[5]. |
| **Project details** | |
| Project commenced in 1996 and ended in 2009. The project operators were Geopower Basel AG and Geothermal Explorers Ltd.<br>Location of drill site on seismic intensity map shown by star[6] | Project commenced in 2009 and ended in 2014. The project operators were ITAG Tiefbohr GmbH, a local utility company.<br>Location of drill site on seismic intensity map shown by star[7] |
|  |  |
| **Pre-existing seismicity** | |
| A modest level of natural seismicity was identified in the site area[8]. | The fault was thought to be inactive due to an absence of recent seismicity in the area[9]. |
| **Site demographics** | |
| In the city of Basel:<br>• 164,000 inhabitants, population density 6900km$^2$ [10]<br>• Historic old town<br>• Significant pharmaceutical industry[11] | Near the city of St Gallen:<br>• 76,000 inhabitants, population density 1900km$^2$ [12]<br>• Some industrial and commercial activity<br>• UNESCO-listed abbey district[13] |
| **Initial public reaction to project proposals** | |
| During the initial planning stages there was little social concern or unease from the public[14]. | After the experience in Basel, there were some limited social concerns about seismicity[15]. |

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## Communication Strategy

The communications strategy is not clear. There are reports of some media releases, guided site tours and exhibitions, but no active engagement or communication was produced for local residents or the general public[16].

Later, communications were reported as being 'deficient' on the part of both the company and the government[17].


The drilling rig at Basel (photo from RiskCom.de).

Communication strategy followed in St Gallen had a strong focus on engagement with local stakeholders. The risks from inducted seismicity were discussed but were framed as being 'small and controllable'[18]. Simultaneously the local government invested in a public study of the public perceptions of key stakeholders[19].

The Swiss Seismological Service (SED) monitored the St Gallen project and reported real-time information on seismicity to operators, authorities and the public in the site vicinity. Such detailed analysis of the induced seismicity associated with the St Gallen project made a "significant contribution to understanding its causes, communication with the public and ultimately the decision regarding the course of the project. This role was hugely appreciated by the St. Gallen public utilities company and the St. Gallen city council, particularly during the months of crisis in summer 2013"[20].

Key factors:

- Public vote was essential – the public felt they were taken seriously, and developed ownership
- Communication that addressed concerns was honest and transparent from the beginning
- Risks were communicated and measures in place to mitigate risks were emphasised
- A key role was played by a charismatic local leader
- Emotion played an effective part in communication through engagement of all parties.[21]

NOTE:

Both case studies are situated within the temporal context of a 10 year programme called Swiss Energy which was established in 2001 by the Swiss Federal Office of Energy. This programme was put in place to assist with developing more efficient use of energy, and this included the promotion of geothermal energy at a national level. The objective was to "develop a sound image for geothermal energy in general, to disseminate information on the various technologies. Therefore, at a national level the Swiss public may have had limited awareness of geothermal energy production, but this is an indication of how national narratives may not impact or contribute to local perceptions.

## Induced seismicity

On October 9 2006 the first micro-earthquakes were detected[22]. During the reservoir creation stage, tens of thousands of micro-earthquakes occurred[23].

During the initial stimulation a seismic event occurred measuring ML 2.6. This occurred when the maximum injection rate was reached and thus it was subsequently reduced and stopped as it exceeded safety limits[24]. Despite this, a seismic event measuring ML 3.4 (V Mercalli scale) occurred five hours later and was widely felt by the residents in Basel.

Main felt event: M 3.4, 8th December 2006 (day, 4.48pm)

During the initial injectivity stage seismic events occurred measuring ML 1.6 and ML 2.2 and reaching ML 3.5 (IV Mercalli scale)[25].

An increase in pressure during cleaning of the 4450m deep injection well, which could have led to a blowout, being equalised by swiftly filling the well with drilling fluid and water may have caused the felt 2013 event.[26]

Main felt event: M 3.5, 20th July 2013 (night, 3.30am)

## Public perception and response

The Basel earthquake occurred during the daytime and was more frequently reported by survey respondents as 'strong' or 'very strong', and felt by 'many' or 'almost all'. The seismicity in Basel appeared to catch people by surprise[27]. People in Basel also reported the sensation associated with 'a large bang'[28].

The project was temporarily suspended following an unfavourable reception from the public and media[29]. Compensation claims were paid out for damages, totalling approximately 9 million USD. The project was finally cancelled after an updated risk assessment was carried out in 2009[30].

The St Gallen earthquake occurred at night, and could have resulted in a "lower readiness to become uneasy". It was reported by survey respondents as shaking that was only felt by 'a few', with the people 'less surprised', 'less frightened', and 'less inclined to leave the building'. Furthermore, many people knew theoretically that seismic activity was possible due to the experience in Basel[31].

Despite measures similar to Basel being taken post-event, the public reacted calmly and compensation claims for damages amounted to only a few dozen[32].

## Events leading to project cancellation

The project was cancelled following a 2009 risk assessment, and the negative reaction to the induced seismic activity, but public fear and protest along with extremely large damage suits were a major contributing factor[33].

The project was cancelled due to insufficient water volumes found, and the limited options to increase permeability, as well as a highly seismically responsive fault zone.

## Commentary on induced seismic event follow up

It is acknowledged in several sources[34] that the failure of Basel has impacted the future development of EGS projects near urban centres because of the need to "assess and mitigate the nuisance, and potential seismic risk, posed by induced seismicity" (p274[35]). It is reported that the public feel a "material, sanitary and mental threat from earthquakes" and that any future earthquakes will "not be perceived as reasonable"[36]. Multiple comments from stakeholders mention the failure of communications throughout the project and state that the public are seeking "an exchange" of information[37].

It is suggested that the major felt event in St Gallen was perceived to be smaller than Basel by residents, possibly because of a lack of high frequency energy as part of the event[38] and because it happened at night[39]

## Post-project status and materials

Project materials related to the Basel geothermal exploration are more difficult to access. There is no project or post-project webpage disseminating information about the project, however the SED website does contain some information and the 2009 risk assessment is still available[40].

The SED have a webpage, which monitors and maps the seismic activity in the St Gallen vicinity, showing the location, scale and magnitude of earthquakes. In addition the project website is still publically accessible: https://www.geothermie.stadt.sg.ch/aktuell/uebersicht.html

**Recommendations**

Using the Geothermal Risk of Induced Seismicity Diagnosis (GRID) System can be useful to **screen indicators of seismic hazard, risk and social concern,** during the early stages of the project[41], in combination with social site characterisation.

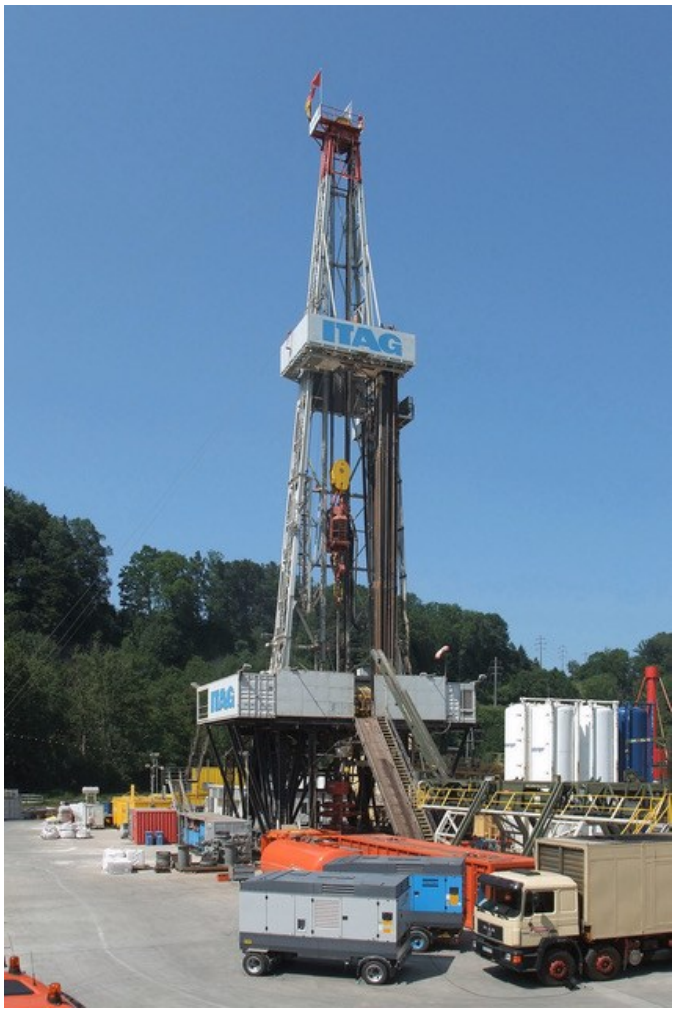
A 'traffic light system' (TLS) can assist with operational decision-making by providing a clear approach, **defining the acceptable levels of disturbance and providing processes to address any breach of these parameters**[42].

**The higher the seismic hazard, risk and social concern, the more extensive the information and public outreach in induced seismicity should be**. In the case of very complex risk issues and uncertainties, it is recommended to use two**-way engagement,** directly involving publics and stakeholder groups through consultation, collaboration and empowerment[43].

The seismic activity in Basel was likely to be interpreted differently by laypeople and experts, each with different concerns. However it is important to recognise that "**local people are also local experts**" with "context-related knowledge and experience" that may be valuable to project developers[44].

Barriers to gaining the social licence to operate are not only due to legitimate apprehension and concern from those in opposition to a development, although these need to be handled in a thoughtful way. Rather, **contention arises in a more serious manner when the interaction between communities and developers are not "handled efficiently"**[45].

**Transparency and accessibility of data is key**, this includes seismic monitoring data.




The drilling rig at St Gallen (photo by Kecko).

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