



Heating and Cooling from Aquifer Storage Meeting minutes, 2016-11-28

Participants

<ul style="list-style-type: none">- Mohammad Abuasbeh, doctorand- Iullia Svrydonova, SWECO- Jonathan Udén, SWECO- Bo Jansson, Stures Brunnborningar- Marcus Gidekull, AVANTI- Erik Olsson, Thermia- Martin De Carmejane, Sindeq- Heiki Y, Sindeq- Lasse Ahman, Sindeq- Alberto Lazzarotto, KTH- Björn Kyrk, Cooly- Lars Hoppe, Bosch	<ul style="list-style-type: none">- Julian Lindgren, exjobbare KTH- Willem Mazzotti, KTH- Mats Fredriksson, EON- Davide Rolando, KTH- Malva Ahlkrona, WSP- Milan Stokuca, Bengt Dahlgren AB- Thomas Bergqvist, Vasakronan- Patricia Monzó, KTH- Laura Roecker, Bosch- Eric Granryd, KTH- Jan-Erik Nowacki, SKVP & NOWAB- José Acuna, projektledare KTH
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1. Welcoming words and selection of secretary:

José Acuña opened the meeting and welcomed everyone to KTH. He was appointed to take meeting notes. The previously sent agenda was approved.

2. Timetable status and working packages

Mohammad explained briefly what an ATES is and the project objectives. Four working packages were presented and a time line showing the plan for the different activities being carried out.

The microbiological part of the work is slightly delayed. Harald C (SLU) has started but is not ready with the literature review yet.

3. Work performed at the measurement facilities

Gallerian:

AMF Fastigheter has informed that the operation start of this installation is planned for late 2017 or 2018. Olof Andersson and SWECO have suggested to replace Gallerian with another installation, Hästskon, located nearby. However, the site will most likely be replaced by one or two sites in Norway where collaboration has been started with NTNU, Elverum and Melhus municipality. Gallerian is though keep in the project for a possible inclusion during the continuation of the effsys expand program.

Mohammad talked about his experience in the investigation drilling activities to characterize the Norwegian sites. Boreholes of between 25 and 30 m were done. The observations and tests done were in form of logged data of water pressure inside the hammer, visual observations every meter, water infiltration tests.

Rosenborg:

System Energy performance: During the Master Thesis project of the student Alexander Malley, a collection and identification of all the sensors installed at this site have been done. A data collection and visualization tool has been prepared in Matlab. With this tool, energy flows and energy balances easily collected and presented, including temperatures, pressures etc.

Chemistry: The sampling was stopped since September 2016 and they had been waiting for the operation to start. The next sampling campaign is planned for the beginning of December 2016. The first observations indicate that the Cadmium concentration has been increased. This is partly due to oxygenation effects. It is probable that the same behavior will be observed in the next sampling dates (to a lower extent since the water flows will be lower). Since the oxygenation effects will decrease, the effect on cadmium concentration is not expected to be so large. The tests were done at full flow, 40 l/s, but the installation will mostly operate at 20-25 l/s although the permission is 50 l/s.

Mohammad went through briefly about the Literature survey that he has been carrying out. In the temperature ranges between 5 to 24 degree Celcius, earlier studies seem to show negligible impact. Above this limit, some impacts have been reported.

The Master Thesis student Julien Lindgren presented himself. Julien will be carrying out his MSc within the frame of this project at WSP. The project consists on monitoring the chemical impact of ATEs systems, focused on data from Rosenborg.

Aquifer monitoring: Mohammad presented especial bottom bending elements to be able to install the optical fiber inside the aquifer.

First trials using the DTS technique together with heating cables has been tested at this site. The internship student, Elie Lacombe, did a summer job about this. Further work has been done with an electric heater instead of a heating cable. A set up has been manufactured in collaboration with Bengt Dahlgren AB and tests are being carried out. Publications by Seelwood et al 2015 and Andrew T Leaf et al, 2016 are being used as references. The method seems as an attractive way to characterize groundwater flow and as a complement to pumping tests where the hydraulic conductivity is measured.

The permanent installation of the optical fiber cable will be finished during the spring 2017.

Microbiology: Harald Cederlund från SLU is encharged of starting a literature survey about the microbiological impacts in aquifers. Harald has engaged to deliver a first draft in the middle of 2017. Laboraroty tests based on the water samples will be very limited from the microbiological point of view and they will probably be not sufficient for scientific publications.

Modelling: Mohammad shortly discussed a comparison between the two software planned to be used in the project, FEFLOW and MODFLOW.

Lilla Klåveröd:

Smaller installation in Southern Sweden that offers better possibilities for controlled experiments. One extraction and one injection well. There are other 7

observation wells. Mohammad showed sketches from Jorunn Falkenhaugs thesis showing the geological characterization of the site. Some preliminary planning has been done for the fiber cable installation. Mohammad is working on an inventory of the site based on the earlier reports.

4. Publications

- Oral presentation at svenska kyl och värmepumpdagen 2016
- Poster presentation at IGSHPA Sweden conference, September 2016

5. Homepage

The project homepage is www.energy.kth.se/energibrunnar/ates

6. Next meeting

2017-06-19, at KTH Energiteknik, Brinellvägen 68

José Acuña

Stockholm 2017-06-18