Geophysical Research Abstracts
Vol. 19, EGU2017-16747-1, 2017
EGU General Assembly 2017

Smart Grids for Aquifer Thermal Energy Storage (ATES): a case study for the Amsterdam Zuidas district

Marc Jaxa-Rozen (1), Martin Bloemendal (2,3), and Vahab Rostampour (4)

(1) Faculty of Technology, Policy and Management, Delft University of Technology, Delft, The Netherlands (M.Jaxa-Rozen@tudelft.nl), (2) Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, The Netherlands, (3) KWR Watercycle Research Institute, Nieuwegein, The Netherlands, (4) Delft Center for Systems and Control, Delft University of Technology, Delft, The Netherlands

In the context of increasingly strict requirements for building energy efficiency, Aquifer Thermal Energy Storage (ATES) systems have emerged as an effective means to reduce energy demand for space heating and cooling in larger buildings. In the Netherlands, over 2000 systems are currently active, which has already raised issues with spatial planning in some areas; current planning schemes may lack the flexibility to properly address variations in ATES operation, which are driven by uncertainties across a broad range of time scales – from daily changes in building energy demand, to decadal trends for climate or groundwater conditions. This work is therefore part of a broader research effort on ATES Smart Grids (ATES-SG), which has focused on more adaptive methods for ATES management and control. In particular, improved control schemes which allow for coordination between neighboring ATES systems may offer more robust performance under uncertainty (Rostampour & Keviczky, 2016).

The case studies for the ATES-SG project have so far focused on idealized cases, and on a historical simulation of ATES development in the city center of Utrecht. This poster will present an additional case study for the city center of Amsterdam, which poses several geohydrological challenges for ATES: for instance, variable density flow due to salinity gradients in the local aquifer, and varying depths for ATES systems due to the thickness of the aquifer. To study the effect of these conditions, this case uses an existing 15-layer geohydrological model of the Amsterdam region, cropped to an area of 4500m x 2500m around the Amsterdam Zuidas district. This rapidly developing business district is one of the densest areas of ATES use in Amsterdam, with 32 well doublets and 53 monowells currently registered. The geohydrological model is integrated with GIS data to accurately represent ATES spatial planning; simulated well flows are provided by a model predictive control component. This model is then simulated for two cases: a baseline decoupled configuration without coordination, and a case in which a subset of adjacent ATES systems is managed centrally to avoid overlaps between stored thermal volumes. Given that the thickness of the local aquifer offers significant potential for further ATES adoption in the area, such a coordinated approach could help maximize the benefits of future ATES development.

References

Rostampour, V., & Keviczky, T. (2016). Probabilistic Energy Management for Building Climate Comfort in Smart Thermal Grids with Seasonal Storage Systems. Submitted to IFAC World Congress 2017. Available at https://arxiv.org/abs/1611.03206