Acceleration of Underground Thermal Energy Storage

Publieke samenvatting / Public summary

Aanleiding

Thermal energy storage is considered crucial by the EU commission for achieving an independent, low CO2 energy supply system for urban heating. High-temperature underground thermal aquifer storage (HT-UTES) is marked by excellent storage densities of 1000kWh/m2 and can potentially solve the challenge related to the seasonal mismatch in heat supply & demand in urban heating. High-temperature aquifer thermal storage (HT- ATES) is not widely implemented yet for optimal embedding in heat networks in the energy transition phasing out fossil fuels. This is due to a variety of (non-) technical challenges. Most importantly, technical enhancements are required to improve the cost efficiency and to facilitate independence from government funding and large-scale implementation. In urban areas with existing and/or future district heating, the technical, economic, legal and organizational aspects of embedding HT-ATES in heat networks need to be considered from a system perspective.

Doelstelling

ACCEL-UTES aims to realize a flagship (HT-ATES) in Utrecht Science Park (USP), embedded in a complex heat energy system, marked by multiple renewable energy sources and consumers. The inclusion of HT-ATES is essential for phasing out fossil fuels (CHP) by 2030 without the need for grid enforcement for the area. This will be accomplished by including a first-of-its-kind seasonal storage of power-to-heat sourced from photovoltaic (PV). This will result in

Projectinformatie / Project information

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Algemene informatie / General information

Penvoerder / Secretariat
Nederlandse Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek TNO

Publicaties en materialen / Publications and attachments

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significant lowering of costs (LCOE) as well as CO2 emissions. Objectives for demonstration are: 1) Development of detailed site characterization methods to increase the possibility of success of pre-drill feasibility in view of optimal embedding in the energy system; 2) Application and demonstration of key subsurface engineering and monitoring improvements building from lessons learned from e.g. HEATSTORE-Middenmeer and WarmingUP; 3) Optimization of HT-ATES design, source strategies and operational scenarios of the energy system; and 2 4) Construction, scientific assessment and one-year operational success, to promote replication potential of HT-ATES in urban areas with heat networks in transition as well as future (collective)

Korte omschrijving

The project will be executed by a consortium involving the energy distribution company of Utrecht University (UUE) as main investor for the demonstrator project, supported by TNO and the Utrecht University Department of Earth Sciences. Main activities envisaged for the demonstrator include: 1) Detailed site characterization HT-ATES: enhancing geological and environmental performance assessment prior to drilling activities. Demonstration of advanced exploration methods for improved capacity estimates and design; 2) Demonstration of technical innovations for enhanced HT-ATES technical performance on well pipes, wellhead and operational envelopes for pumps. These include the implementation of thermal insulation of well pipes to avoid thermal losses, reduction of surface footprint of the wells, and mitigation of sand production; 3) Further enhancement and practical application of design tools (extending from Design Toolkit) for HT-ATES integration in evolving energy systems comprising multiple sources and consumers, capable of optimizing source strategies and P2H options; 4) Construction and operation of HT-ATES; and

Resultaat

The main results from ACCEL-UTES include: 1) Tested and validated novel methods for detailed site

characterization for HT-ATES potential; 2) Demonstration of HT-ATES technological innovations for engineering and monitoring of HT-ATES systems; 3) A validated practical workflow for optimizing the embedding and operational conditions for HT-ATES in a complex and evolving energy system, using state-of-the-art software models; and 4) Demonstration of the applicability of full-scale HT-ATES integrated in an existing district heat network in urban environment at USP, facilitating the transition from using CHP to solar power-driven heat pumps to decarbonize the heat network.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.
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