Results of ATES users survey on drivers and barriers for investing in ATES

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1. Goal of the survey

This survey is part of a research project on the development of ATES Smart Grids, currently carried out at TU Delft in collaboration with KWR, Waternet, TAUW, Province of Noord-Holland, DWA and Priva. One of the goals of this project is to better understand how the decision-making of ATES operators and owners affects the adoption and use of these systems. As such, this survey was a first step in assessing the perceived drivers and barriers for ATES use. The results will be used to design a more detailed questionnaire which will focus on the perceptions of ATES in comparison to conventional energy systems, and which will help evaluate different future scenarios for the adoption and planning of ATES systems.

2. Representativeness of population and results

In December 2015, the online survey was sent out to the members of the ATES user platform (www.gebruikersplatformbodemenergie.nl), consisting of a group of around 250 people owning and/or operating an ATES system. The number of respondents was 53, approximately 25%. The questioned and response population represents respectively 10 % and 2% of the operational ATES systems in the Netherlands, of which there are approximately 2500 (Heekeren and Bakema, 2015).

As a consequence of progressive energy efficiency regulations for buildings (Ministry-of-Internal-affairs, 2012; Nuiten et al., 2013), ATES is sometimes applied just to meet these standards. The members of the user platform are actively involved in operating their ATES systems, and they are therefore aware of what it requires to operate and manage an ATES system; not all ATES users are likely to do so.

Despite the fact that the response percentage of the survey was good, the number of respondents is limited with respect to the total population of operational ATES systems. It is not sure if the respondents are a representative cross-section of the population of ATES system users. Therefore, the results of the survey must be interpreted with care.

3. Questionnaire

The respondents were questioned about how they perceive and experience the level of importance of different barriers and boundary conditions. In order to make the results more easily comparable with previous research on energy-efficient innovations, the questions were chosen to cover generic issues which typically affect building energy technologies (e.g. Blok et al., 2004). Additional input fields were included so that respondents could provide more information or suggestions.

4. Results

The figures below present boxplots for the perceived importance of drivers and barriers for ATES investment, ranked by the mean of each variable on a scale of 1 (unimportant) to 5 (very important).

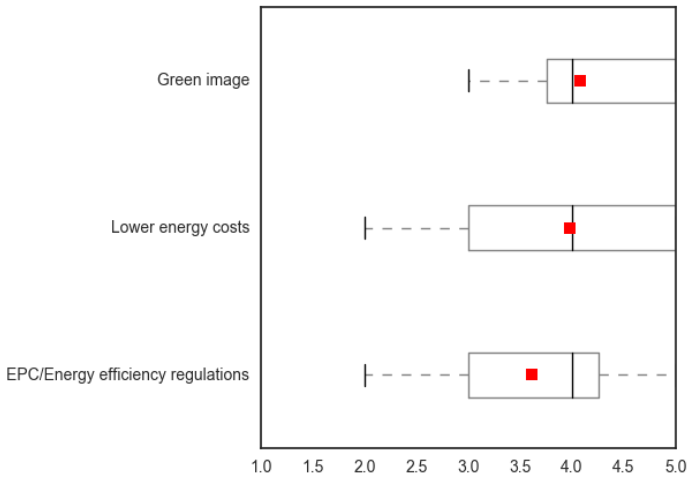

Figure 1: Perceived drivers for ATES adoption

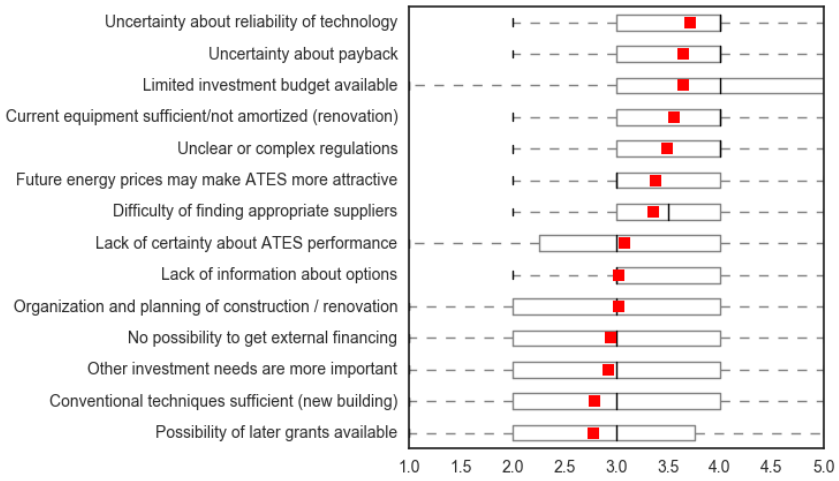

Figure 2: Perceived barriers for ATES adoption

Similarly, the following figure presents a boxplot of the perceived relative performance of ATES compared to a conventional energy system, ranked from 1 (significantly worse) to 5 (significantly better).

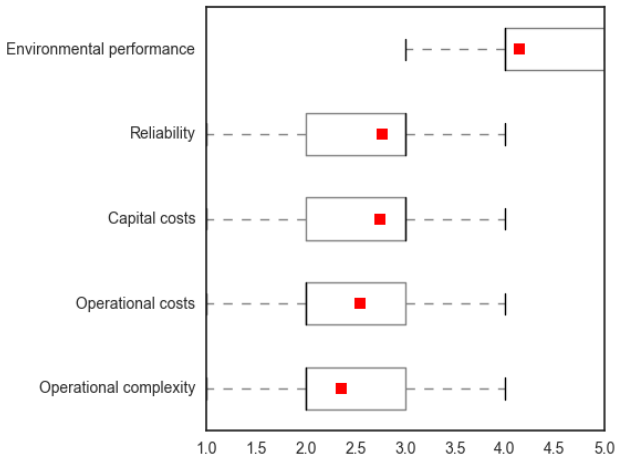

Figure 3: Perceived performance of ATES relative to conventional energy

5. General remarks by the respondents

Of the 53 respondents, 30 also gave specific remarks about their experiences. These remarks are categorized and summarized in the following. The number between brackets indicates how many times that specific aspect has been brought up (no number means; only brought up once).

a. Barriers for application of ATES

- Growing poor image (5). As a consequence of:
  - (Putative) poor performance
  - Negative experience with contractors
- Basis for business cases are uncertain, making it difficult to decide upon application (5)
  - At decision moment: investments are estimated and energy savings are very uncertain; TCO difficult to predict
  - Comparing different HVAC-systems in the long run there are not much differences
  - Operational costs are higher than expected
  - During exploitation operators don't look at energy cost, only comfort/meeting energy demand
- Legislation has become too complex and heavy (3)
  - Negative image of companies working on ATES systems, due to perception that they contributed to complex legislation
  - Legal enforcement of efficiency is exaggerated
- Unfamiliarity with technology
- Difficult to operate an ATES system; as a consequence, too many do not function properly
- Legislation for high (>25°C, current legal maximum) temperature storage is not yet available
- Operation of ATES requires too much attention, control software should improve to reduce operational effort of users/manager
- For renovation: temperature level of existing facilities does not match ATES temperature levels
- Lack of clear strategy/policy for large scale adoption of ATES
- Interaction with other ATES systems in neighborhood
- Maintenance of groundwater wells is a complicating aspect in operation phase
- Split incentive: real-estate developers consider ATES as a required energy system, to be built as cheap as possible. While it actually is a long term investment for sustainable and cheap comfort. The costs and benefits are often allocated at different parties.
- Lack of knowledge with contractors

b. Strong suits of ATES systems

- Passive/sustainable cooling (2)
- ATES key aspect in sustaining entire energy supply-chain (2)

c. Conditions / observations

- Sustainable heating and cooling with ATES requires more effort (5)
  - And this is not a bad thing, although others may think otherwise.
  - Communication/education about operational requirement to users would help to increase ATES systems' operational performance.
  - Poor performance is mostly a consequence of lack of expertise of operator
- Heating and cooling demand should more or less balance (3).
  - As a result: ATES is not very suitable for housing and housing of elder people in particular where heating demand is four times larger than cooling demand.
- System design has to be good, entire system should have enough redundancy (3)
  - To manage balance in wells
  - To deal with energy demand other than expected
- The electricity used to operate the ATES system is generated sustainably
- EPC is an important driver for ATES application
- Reliability of supply is a key aspect
- ATES is not always the best option, it should always be considered though

6. Discussion and conclusions

The aspects above can be related to the market development barriers identified in previous ATES research at the European level, summarized below:

Table 1: Market development barriers for ATES (Climate-KIC - E-USE, 2014; GEO.POWER, 2012; GROUND-REACH, 2007)

Issue	Description
Legislative framework	Many European markets have inconsistent and incomplete legislation for ATES systems, often resulting in a difficult licensing process. Legislation is typically lagging behind technical advances in ATES technology.
Technical quality	The absence of quality standards is currently a barrier for investor/operator confidence. Due to a lack of technical standardization, ATES requires a high level of operational control and multidisciplinary knowledge to maximize efficiency. The different types of required suppliers (specialized drilling contractors, HVAC installers) result in a complex supply chain. This separation in knowledge and skills requires more effort to obtain an efficient system.
Awareness and knowledge	Operators and technical suppliers lack experience with ATES systems, and with the required heat pumps in particular. Most suppliers specialized in the building installations are unfamiliar with subsurface engineering, which may lead to sub-optimal designs or to the choice of other energy-efficient technologies.
Capital costs	Groundwater wells and heat pumps require a significant upfront investment in comparison to conventional technologies for space heating and cooling. Due to the economic, technical and legislative uncertainty still surrounding ATES technology, investors may prefer proven technologies.

To a large extent, the same issues can be found in the survey results: for instance, the technical complexity of reliable ATES design and operation (which requires specialized suppliers and contractors), and the uncertainty of the energy savings that are realized, are both seen as important

barriers in the survey. These are likely to be generic issues affecting ATES technology, regardless of level of the market development and legislation. However, it is interesting to note that while other European markets are perceived to have incomplete legislation, the Dutch legislation is described by some respondents as overly complex and strictly enforced.

Furthermore, five respondents described the image of ATES systems as becoming a potential market barrier, due to complex legislation, issues with poor performance and experiences with contractors. Given that the respondents are drawn from a sample of "early adopters" which are likely to be more tolerant than average of such drawbacks, and considering the importance of reputation and "word of mouth" for the mainstream adoption of new technologies, this could become a particularly important issue over time for the further diffusion of ATES in the Netherlands.

The next stage of this research will therefore involve a more detailed questionnaire to better understand the perceptions of ATES technology compared to conventional energy systems for space heating and cooling.

7. References

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