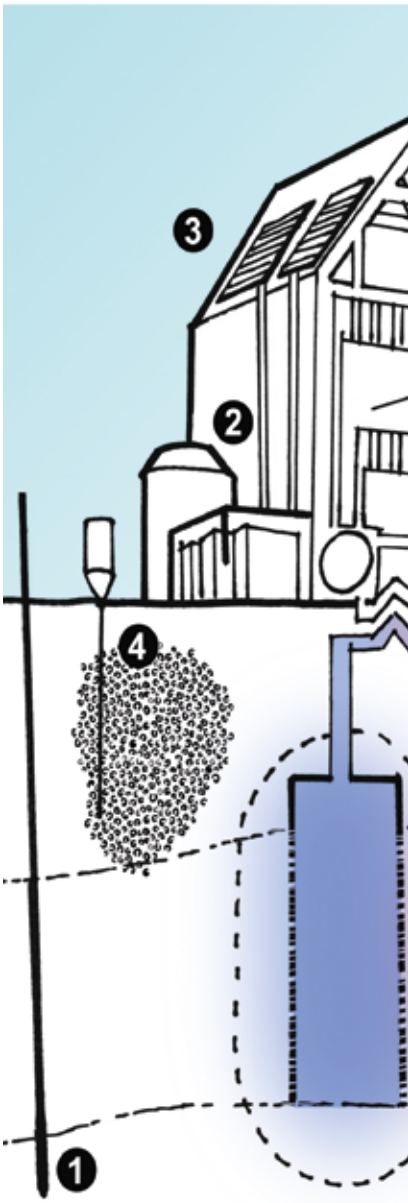
Maximising the returns from the ATES system



Aquifer Thermal Energy Storage is a sustainable way of heating buildings in the winter and cooling them in the summer. It also cuts costs considerably. Heating bills can be reduced by up to 45 per cent and savings on cooling can be as much as 85 per cent. So it is not surprising that the number of ATES systems is rising rapidly, in the Netherlands and in other countries. Even so, shortfalls in expertise mean that many ATES systems are not performing as well as expected. Five tips for maximising the returns from Aquifer Thermal Energy Storage

BY JOACHIM ROZEMEIJER

TIP 1

Always conduct a borehole survey

Efficient aquifer thermal energy storage requires a permeable sand layer so that the groundwater can be pumped up without difficulty. Less permeable layers can have an enormous negative impact on the efficiency of the system. Many ATES designs are based on regional maps of the subsurface. That represents a risk because soil structures can vary depending on the particular locality. A straightforward borehole survey can provide clear information about the local conditions and maximise the effectiveness of an ATES system. Borehole surveys measure the electrical resistance of the soil over depth. Electrical resistance in permeable sand layers is much higher than in peat and clay. The layer where permeability is highest can be located without difficulty by making a small investment, guaranteeing the optimal efficiency of your ATES.

TIP 2

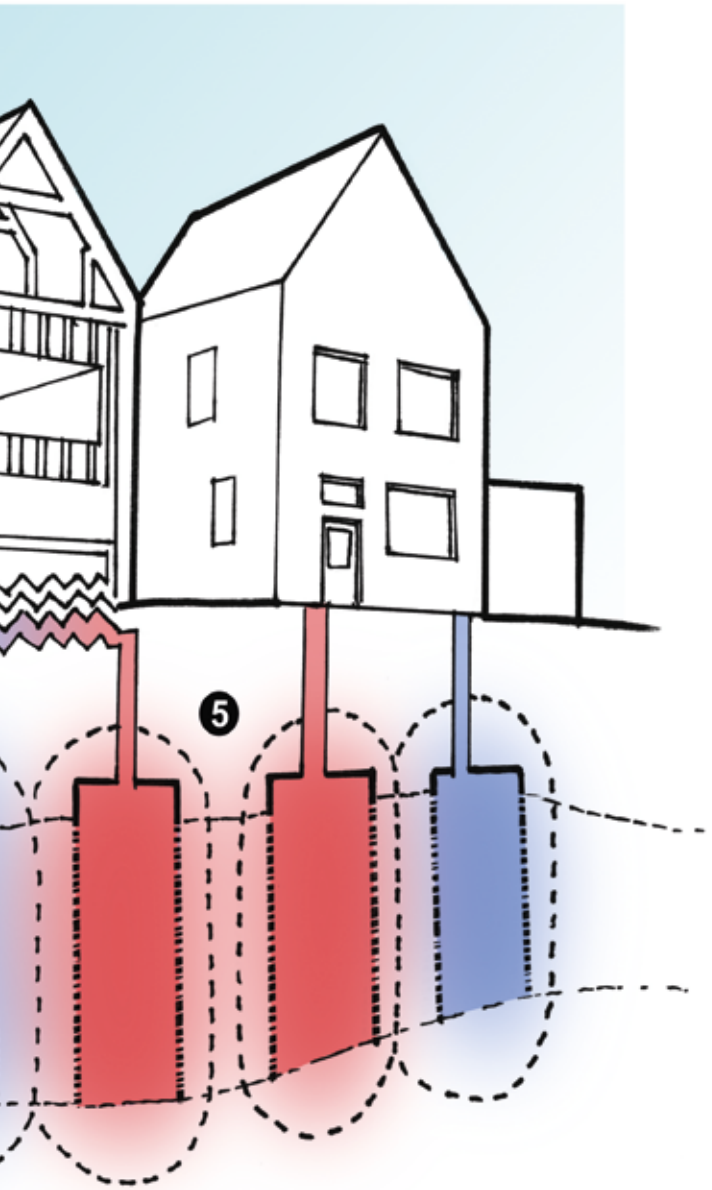
Make your ATES smart

Most ATES systems are quite stupid: the temperature in the building determines whether heat or cold from the subsurface is needed. A smarter approach is possible. Particularly on days when heating is needed in the morning and cooling in the afternoon. In these circumstances, it costs less energy to store the heat or cold above the ground for a while in a well-insulated buffer tank. Extra temperature measurements in the cold and warm stores and in buffer tanks can be used in a smart, automated control system. A system of this kind can also retrieve information from the Internet (such as current energy prices or weather forecasts) and use it to control the ATES in the best way. An appealing extra: present the current saving calculated by your smart ATES system in euros and CO2 emissions on a screen at the entrance to the building.

TIP 3

Store some extra heat or cold

Just imagine a very warm day. The ATES system is pumping up groundwater with a temperature of approximately 10°C to cool your building. The groundwater passes through the heat exchanger and heats up to 20°C. The heated water goes back into the ground and the heat is stored for the winter. This is a missed opportunity. Getting some extra heat into



HOW DOES AQUIFER THERMAL ENERGY STORAGE WORK?

ATES systems pump up warm groundwater in the winter. The heat is transferred to the heating system in the building through a heat exchanger. The cooled groundwater then goes back through another well to the cold store. In the summer, that cold water is actually pumped back up to cool the building. The number of ATES systems is on the rise throughout the world. The Netherlands currently has approximately 2,000 operational ATES systems, and this number is expected to increase to about 20,000 by 2020. Deltares experts are working on the optimisation of ATES systems, bringing together expertise about groundwater, subsurface structure, hydraulics, water quality and sustainable energy. For more information: wijb.sommer@deltares.nl

the water before it goes back into the ground is straightforward. For example, you can let the sun heat it up in a pond or send it through solar boilers on the roof. The groundwater available in the winter will be warmer, and the savings on energy consumption and heating costs will be even higher. When the weather is cold, we can cool off the water even more before it goes back into the cold store, making cooling in the summer even cheaper.

TIP
4

Clean up the soil immediately

Old industrial soil contamination is still found in the subsurface in many urban locations. Clearing up all that contamination is often too expensive, but we do need to stop it spreading further. An ATES system can actually spread the contamination as it pumps groundwater up and down, and so the authorities may refuse permission. However, an ATES system also creates opportunities to clear up old contamination. The higher temperature of the groundwater around the warm store may, in specific conditions, accelerate bacteriological breakdown. The bacteria can be given an extra boost, for example by adding nutrients. Another option is to clean the water pumped up by the system before it goes back into the ground.

TIP
5

Keeping up with the neighbours

More and more ATES systems are being installed and this makes it more likely that different warm and cold circuits will interfere with one another. Warm water from a warm store may flow in the direction of a cold store. In your own system, this problem can be tackled quite easily, for example by storing warm and cold water in different sand layers. Things get more complicated if other systems nearby also affect the temperature of the groundwater beneath your building. In that case, the trick is to design the new system so that the return is not impaired, but actually enhanced, by the extra heat or cold from the neighbours. This requires detailed information about the structure of the subsurface and the impact of the different ATES systems on groundwater flows and groundwater temperature.