#	Vraag	Antwoord
1	Why are abbreviations continuesly used for TTES LTES DH P2H and so forth, since we are (first-time) listeners.	Tank Thermal Energy storage (TTES), Large Thermal energy storage (LTES), District heating (DH), Power to heat (P2H), Combined heat and power (CHP). The abbreviations save us a lot of time and space, but I do understand that they can be a bit tricky to capture. Our brochure will introduce many of these abbreviations, so I recommend you to have a look at it (a link to it will be shared in the upcoming days and will be available on the IEA-ES Task 39 website)
2	What are typical storage times for TTES?	The storage time depends on the situation but usually it is used for daily storage. For example to store solor heat production and to delever the morning peak and evening peak load of district heating systems. Longer storage times such as weekly are being considerd in large District heating systems. Finally some large Tanks are used for seasonal storage but far less then for daily.
3	What is de investment for the TTES in Berlin?	Total investment costs = 50 million Euros, specific price is higher than TTES usually (because of extra installations). Indeed, auxiliary equipment and connecting pipes in Berlin made the investment costs higher than usual for just a tank.
4	Does the TTES work with stratification?	TTES is the most suitable large storage solution for stratification. So depending on the size and power output of the tank the stratification can be maintained. Bigger/higher tanks can have good stratification.
5	How big is the heat loss for TTES in relation to its state of charge and temperature?	Usually very little. For large volumes, for example >5,000m3 the losses can be less than 1% per day with storage of 90grC.
6	How do you decide optimal height of the tank?	Taking into consideration required storage power and required storage duration. Also look at available space. A higher/narrow tank is usually more costly than a broad/lower tank. But the benefit of higher is a better stratification.Typical range of height-to-diameter ratio range from 1.5 to 2.5 (so the TTES above-ground are usually rather narrow, 2 times higher than they are wide). For larger TTES, the ratio is closer to 1, because otherwise the water column pressure (static pressure) becomes too high.
7	In the cases where TTES was chosen for district heating, why was it chosen instead of PTES or ATES?	Usually it is chosen for the high power output and since it is for daily storage. PTES or ATES are usually lower power and longer storage duration. Also because they make no or little requirement for the underground conditions
8	Do you know of any cases where the techniques were combined? TTES and either PTES or ATES To get both high power and long storage?	Yes, at least one of the PTES in Denmark also has a daily storage TTES connected as well (solar district heating)
9	How are the TTES constructed (Concrete/metal) and how is the inside lined?	Usually, TTES have a steel core, and is made watertight by welding (see the inside view of the TTES in Berlin)

10	The 21% Solar Energy fraction you mentioned when loading a TTES. Is this with PV-panels, Thermal-panels or High Temperature PVT?	Usually this is solar thermal panels. Yes, all solar district heating installations are with either flat-plate solar thermal collectors, or concentrated solar thermal
11	is presure underground not allowed?	Ruud will probably answer this, but it's not that it isn't allowed, but pressure comes from height difference. The U-TTES being underground, then it cannot add or maintain pressure in the network (this would require for the U-TTES to be pressurized, which would make the construction more costly)
12	What is the difference between underground TTES and pit storage?	The TTES underground has vertical wall, reinforced for stability of the soil, while a PTES has soil slopes with usually no reinforcement. Also, in a PTES, the excavated soil is reused to build up the sides, enabling to creat more volume of water than the volume of soil that is excavated. This procedure saves costs of removing/transporting the excavated soil
13	So, the choice depends mostly on construction and logistics concerns?	TTES is usually for shorter storage periods and higher power output then PTES. Construction and logistics can also play a part Finally, space constraints can play a part. TTES can be deeper and has straight walls. Thus more storage volume compared to its footprint.
14	Does the bottum have isolation?	Answered live
15	Does the Ecovat come with its own electric heater/heat pump or is it solely the storage tank?	Solely the tank.
16	Hello. the water in the tank comes from what source (river, lake,...) must the water have a certain quality?	Answered live. For steel tanks, the water should be of District Heating Network quality (high PH, low content of salts) in order to avoid corrosion, both of the tank but also of the inlet/outlets and the heat exchangers
17	How many ecovat are build?	One. More projects in development phase.
18	what is the loss in temp % in the system?	Answered live
19	Is the efficiency higher than other systems?	The required efficiency is an input for the amout of required insulation. In general underground TTES are more efficient (assuming the same volume) then other systems due to a better surface/volume ratio, insulated walls, better stratification and smaller roof surface (which contacts the highest temperature).
20	What are the requirements for an optimal 'nozzle'for the diffusor?	The inlet water flow should be laminar, which is whi often it is done with wide-diameter metallic plates (several meters)
21	Can Ruud provide an estimaed cost for a typical non-rocky dutch soil 100k m3 storage?	Yes, ~150-250 €/m3