The Problem in 4-Season Countries

The problem with thermal energy in 4-season countries is the seasonal fluctuation of the amount of thermal energy and sun available.

For example, here in Finland:

**Summer**
Lot’s of sun and often a lot of waste heat but no need for heating.

**Winter**
Need for heating but often no low-carbon ways to produce the thermal energy.
The Problem in Hot Climates

The problem with thermal energy in hot climates is the continuous need for cooling.

Every day
Residential and industrial buildings and processes need cooling.
BTES is the answer

A Borehole Thermal Energy Storage or BTES can solve both of these problems.

Example of a BTES by Heliostorage installed in Kaustinen Evangelical School
How the heating works

BTES can solve the seasonal (or shorter period) fluctuation of the availability of the thermal energy by storing it into the ground.

For example:

- Hot water from the solar collector or waste heat collection in summer.
- Hot water from the BTES in winter.
How the cooling works

If you need cooling, just add an absorption chiller to the circuit and you have an effective cooling system.

The energy comes from the BTES in the night time or on cloudy days.
BTES’ have been researched in Universities for over 30 years
# 3rd Generation BTES

<table>
<thead>
<tr>
<th>Example Installations</th>
<th>1st Gen (90’s)</th>
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<th>3rd Gen 2016</th>
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2nd Generation Structure

Here’s an example of the structure of the system in Drake Landing. The BTES is connected in series and because of that large water tanks are needed as a short term thermal storage.
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Why is it so effective?

Due to the patented structure where circles of boreholes are connected in circles, we can store and take out different temperatures into different circles. This allows us to utilize even low temperatures that otherwise usually goes to waste to prevent the heat loss from the hot core. The structure also allowed us to get rid of the large water tanks needed for the 2nd generation systems.

Different temperatures in different circles of boreholes

70-85 C  

15-20 C
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0 co2 emissions*

*When solar panels are used to produce the electricity used by the circulator. If not, carbon emissions are approx. 0,0003 kg co2/MWh
Building-integrated Solar Thermal Roof

Why build a traditional roof and then install solar energy systems when you can build the entire roof with an integrated system? In our offering we have a building-integrated solar thermal roof by Heliostorage. This roof can replace the entire roof of a building and will be the water coverage. It is BRooF-Certified so it can be used in public building in Finland.

Example of an installation in Kokkola Finland
Many Use Cases

The BTES and the solar collector systems can be implemented to many different use cases

For example

- Halls
- Factories
- District heating
- Schools, Hospitals & Other Public Buildings
- Villages
- Industrial Scale Solutions
- Housing Companies
- Sports Venues
- Hybrid Systems
Example case - Finn Spring

Finn Spring soft drink factory at Toholampi, Finland, uses Heliostorage's BTES to store waste heat produced in the bottle compressing process. The system heats up the factory area in winter replacing the district heating used previously.

A photo of the construction of the 63 hole BTES with capacity of 500 MWh
"After the implementation, our usage of district heating collapsed even that the heating of the BTES is not yet half way through. We are planning to cancel the district heating in near future"

Hannu Ali-Haapala - CEO - Finn Spring Oy
Example case - Kaustinen Evangelical School

At Kaustinen Evangelical School, there is a hybrid system build due to the height of the building. There the BTES is combined with a heat pump. The most of the heating comes from the BTES but during the coldest days of winter the heat pump is activated.

A photo of the construction of the 36 hole BTES
Example Case - Guangzhou Power Supply

Our cooling capabilities will be put to the test in two large pilot projects in China with one of the world's largest energy companies China Southern Power Grid.

These cases include:

- After the first pilot we have an option for 10 GWh BTES in the area.
Example Case - Multiple Smart Village Projects

Currently we have preliminary contracts with 6 smart village projects where the solar collector roof will be put on the rooftops of all of the houses and the energy is combined into one large BTES.

The largest of these projects contains 320 detached houses and 4 GWh BTES.
The calculation is done to a hall of 1500 square meters using real data. In the project, the entire roof of the hall will be replaced with Heliostorage's solar collector roofing and a BTES is done under the parking lot. Before the project, the hall is heated with district heating. All prices are prices in the Finnish market.
How much space is needed?

The storage capacity goes up rapidly when the diameter of the storage is grown

Some example sizes of the BTES

Capacity 500 MWh
Diameter 25 m

Capacity 4 GWh
Diameter 102 m

Capacity 10 GWh
Diameter 130 m
How can we work together to make decentralized district heating solutions?
Thank you
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