The boreholes for geothermal heating and seasonal storage in front of the school.

Seasonal storage of heat is winning ground

Between 20 000 and 30 000 € yearly, that is the amount that is expected to be saved in heating in Kaustisen evankelinen opisto in Kaustinen after the combined system of geothermal heating and seasonal storage of heat from the solar thermal collector is taken into use.

The startup Heliostorage, located in Sokoja, Finland is the architect behind this innovative hybrid heating system. The school in Kaustinen has previously been heated up with oil. The Heliostorage solution is seasonal storage of heat. Borehole Thermal Energy Storage BTES is used to store wheat, in this case from solar thermal collectors, in the ground to be used under the cold time of the year to heat up the house. To simplify, the only costs caused by the system, when it has been taken in use, is the electricity that a circulation pump is using. The costs for the heating production will be zero, if this energy is produced with solar panels. Kaustinen Evangelical School is among the first customers that has opted for this unique and cost-effective heating system. In autumn 2109 KS Geoenergi drilled boreholes both for geothermal heating and for the BTES. The assembly of the solar thermal collectors is ongoing in spring 2020 and once insalled the roof of the school will start to product free energy that the school can use for heating the following winter.

-The solar thermal collectors are going to take an area of 530 square metres and going to product more than 200 MWh yearly. That is a third of the school's total energy consumption, says Timo Sivula, Senior Vice President and the marketing responsible of Heliostorage.

Aluminium profiles that are going to be assembled on the roof of Kaustisen evankelinen opisto.

Not all of the energy that the solar thermal collectors are producing, can be utilized due to transfer- and storage losses, but the net annual energy prodcution of the roof is calculated to be 125 MWh. Geothermal energy will cover for the rest or about 2/3 of the energy need of the property.

The production costs in use are about 2 €/MWh, which comprises the electricity consumption that the circulation pump is using. It is less than 5% compared to the costs of geothermal heating, not even mentioning the oil heating. The expectation is that the investment will pay itself back in 7-10 years, after which heating will be really affordable. The solar thermal roofing, in which the glycol mixture is circulating, are made of aluminium and are replacing the actual roof pans made of tiles. The solar thermal roofing is varnished with a special black absorber coating, to absorb as much heat from the sun as possible. The absorber is covered by a layer air and polycarbonate glass.

-The polycarbonate cover prevents wind from cooling the roof, it almost doubles the collector efficiency, says Sivula.

The polycarbonate glass is making the solar thermal collectors work as a greenhouse. A layer of mineral wool under the module makes the heat that is produced by the sun, stay and not dissipate into the building structures below. The heat is absorbed into the glycol mixture flowing in the roof and transported via the system controller to the 21 bore holes in the

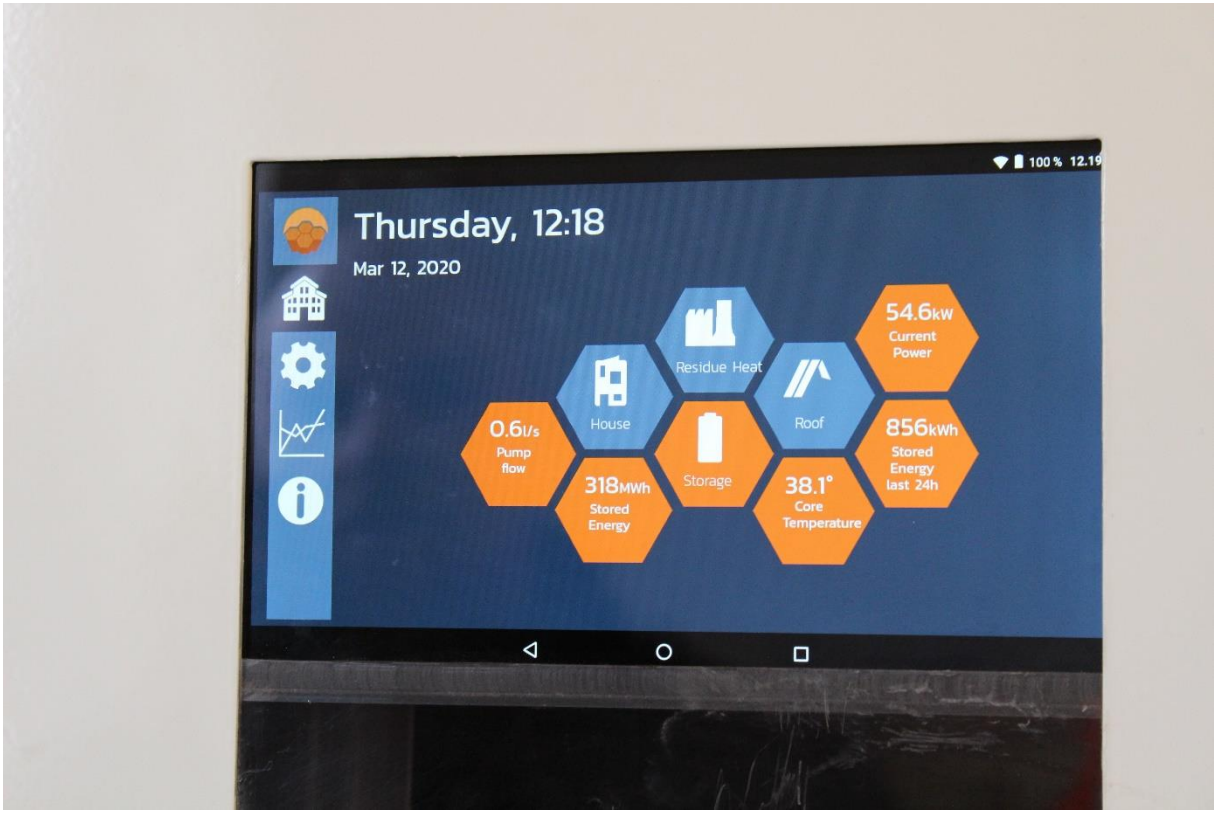
ground. The temperature in the bore holes can rise to 70 degrees. This heat is then transferred to the underground soil in the BTES.
-The heat from the solar thermal collectors should suffice to heat up the estate from April to October, says Timo Sivula.

He says that Heliostorage has good experiences of the technology in the field. Finn Spring Ltd in Sykäräinen, Toholampi, is bottling spring water for commercial use. At Finn Spring the waste heat from the production has been captured and stored in the ground. The waste heat was litterally going to waste before this. The heat from the compressors in the fabric is charged into the ground via 63 boreholes, 50 meter deep each since April 2019. There are also solar thermal collectors on the roof of the office building. They´re not as big as on the roof of Kaustinen Evangelical School, but they contribute to heat to the BTES in the summer time.
-About 90% of the heat that is stored is waste heat from the production and 10% is produced by the solar thermal collectors on the roof, says Sivula about the heat production.
The facatory has had the possibility spend less on district heat thanks to the new system. Before they spent almost 300 MWh yearly. The office and the swimming hall next to it are already heated up with the waste heat from the production that is then transported further to the bore holes in the ground.
-We have stored already over 300 MWh.

The production chief Jari Myllykangas is satisfied with the system at Finn Spring that stored waste heat from the factory compressors to the ground to be used later.

The factory is going to use the heat from the BTES-field for heating in winter, after the Borehole Thermal Energy Storage BTES is charged up in the summer with heat. The BTES was heating up with about with 10 degrees per month under the summer 2019.
-According to the Geological Survery of Finland, GTK, the core should achieve 65° C when full. Then it will provide a continuous power of 100 kW for 6 months. It's more than enough for space heating the office. The idea is that in the following winter Finn Spring will take heat from the BTES to be used to heat up the office. The system isn't dimensioned so that the fabric would be completely self-sufficient about the heat. Probably a bit of district heat will still be used during the coldest season in winter.
Heliostorage has had to solve multiple technical problems during the journey so far. One of them was to solve how to prenet the BTES from cooling down when the solar collector roofing produces cool glycol in autumn, spring and summer nights? The field will cool down if the cool flow is steered to to the hot BTES core. Heliostorage has solved this problem by dividing the BTES is sectords. The heat or the glycol mixture from the solar thermal collectors will be leaded to the BTES core, when the sun is high. When the weather is cooler, will the heat be leaded to the edge of the field. Heliostorage has developed a controller that automatically optimises the heat storage and recovery.

Timo Sivula shows the controller house, where the tubes to the BTES are collected. The tubes transport waste heat and the heat from the solar thermal collectors to the ground.



The controller menu is showing the numbers of heat energy that has been stored, the core temperature and energy distribution in the storage. Everything in real time.

Solar thermal collectors on a roof of a detached house in Sokoja.