

## Energy systems of Alanurmo School

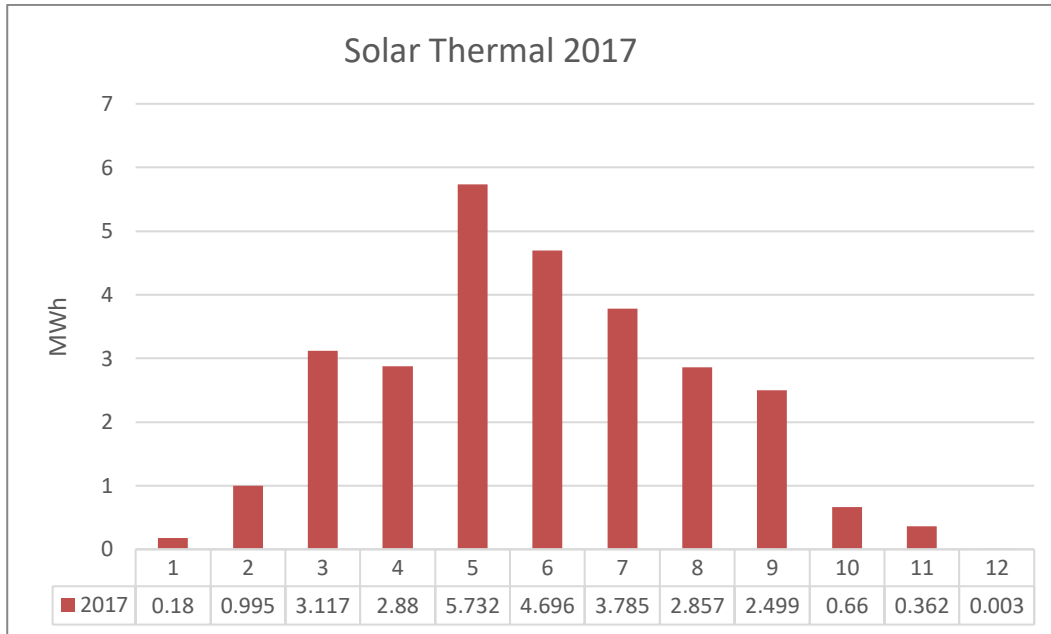
### Basics:

- Constructions of the school started at spring 2012 and the building was ready at beginning of autumn semester 2013.
- Alanurmo School is an elementary school (years 1-6), at semester 2014-2015 there were approximately 90 students and 10 staff members.
- The school buildings area is 2 620 m<sup>2</sup> and its volume is 13 440 m<sup>3</sup>.
- The school is a low energy building
- The school is connected small district heating network heated by wood chips in the winter and oil in summer.
- Energy solutions in the school:
  - Solar heating system installed.
  - Water circulating floor heating system.
  - Air conditioning appliances and convection machine is attached to heating system via own network and heat exchanger.
- To heat the water solar heating system is not efficient enough, so the district heating is needed to support the system.
  - The heating system is five individual heat exchangers.
- The solar heating system has own heat exchanger, which in summers is feeding the extra solar energy to the areal grid.
- If the temperature in hot water tank is higher than the central heating return water, the extra heat is fed to the areal grid.
- The heat exchanger is conducting the heat from the hot water tank to the grid via an adjustable pump.

### Solar thermal system:

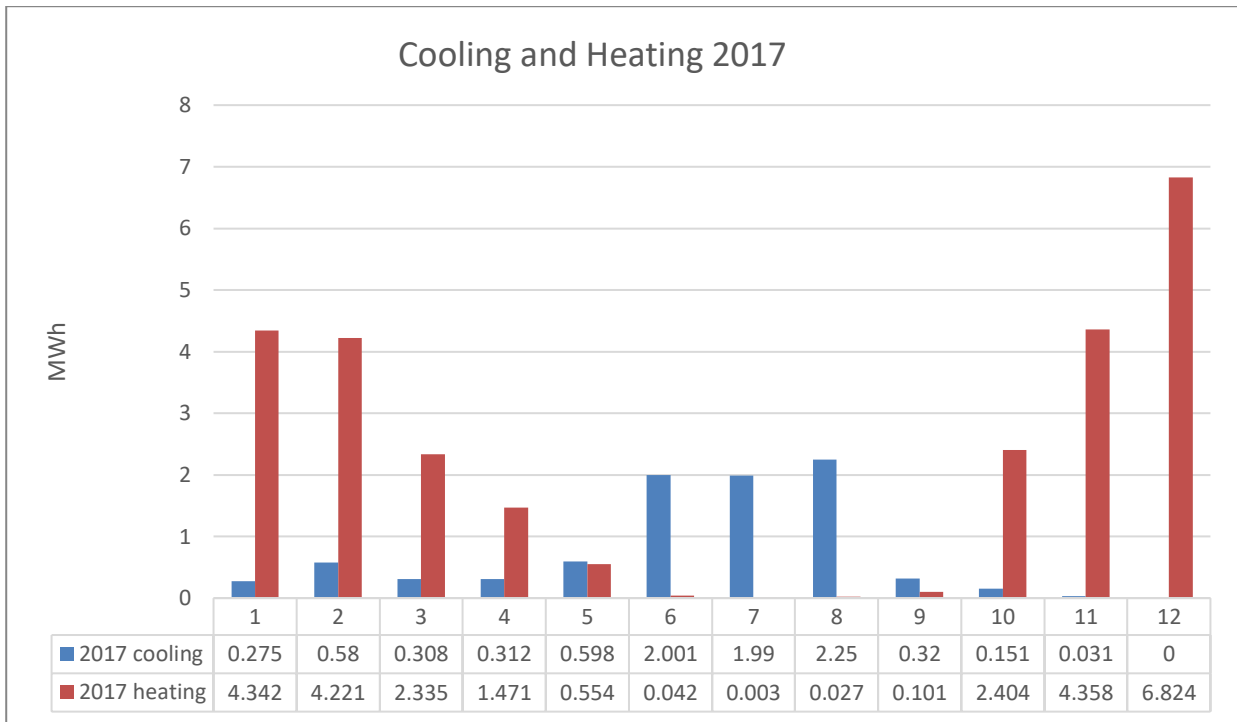
- Installed 12 flat plate solar thermal collectors - SolarRoof made by German Wagner & Co.
  - Gross area of solar collectors is 90,6 m<sup>2</sup> of which the effective area for solar heat production is 80 m<sup>2</sup>.
  - Total array: height 4,02 m and width 22,60 m.
  - The solar collectors are building integrated as part of the roof.
  - The collectors are divided in two groups of six, which are connected in series.
  - The pipeline of copper has closed cell rubber insulation.
  - Total pipeline length from heat exchanger to hot water tank (4000 litres) is 60 meters.
  - The water tank is set to 85°C, in summer everything above that is fed to the grid.
  - Inside the heat exchanger are two separate water circulations.
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- When the production temperature isn't high enough to keep the top part hot enough the production is directed to bottom of the storage.

- About 14 % of produced solar thermal energy is fed into the district heating network
- The produced solar thermal energy covers around 8 % of the heating load of the school



**Cooling and heating, air conditioning:**

- Boreholes connected to heaters in the air exchange units, heating in winter, cooling in summer, constant temperature
- Temperature of the wells varies between +4 to +7 degrees.
- Depth of a well is 200 m and there are four wells. The total range in solid rock is 800 metres.
- The pump circulates liquid ethanol-water- solution in the pipeline. Depending of the use (summer/winter) it is either releasing heat to the rock or taking heat from it.
- Warmed or cooled solution is circulated by pumps to heat exchangers in the air exchange unit
- The bore holes cover about 9 % of the schools heating need.



**The areal heat network, woodchip boiler:**

- Heating system in Alanurmo School is based on the bioenergy small scale district heating network. Inside the 700 kW Arimax- wood chip boiler the district heating water is at a 6 bar pressure and 135°C.
- Manufacturer of the boiler is Sykäke Oy from Toholampi Finland.
- The heating system can be used on a very large range from 20% to 100% of nominal power.
- Heated area in buildings is 22193 m<sup>3</sup>, floor area is 4430 m<sup>2</sup> and combined energy need is 570kW.