Visits

3  Heat pump – spring 2013
2  Replacement of windows – spring 2012
1  Insulation of the attic and ventilation ducts – autumn 2011
Visit 3: Heat pump – spring 2013
Memo by Karin Buvik, SINTEF

In the autumn of 2012 the old oil burner was replaced by a heat pump, for space heating and preheating of sanitary hot water. The heat pump has 4 compressors and is dimensioned to 85% of the energy demand. Under normal conditions this is enough, and the backup system of electrical and bio heat will be used only a few days when it is very cold.

More information

Gjermund Vittersø from Thermoconsult explains how the heat pump works.
February 2013

The heat pump has 4 compressors and can deliver 70 °C hot water
Goodbye to oil burners

19 holes for collectors. Each 250 m deep

Combined digging:
Collector pipes, exterior insulation and drainage

Digging for the ground source heat. Picture from September 2012
Visit 2: Replacement of windows – spring 2012
Memo by Karin Buvik, SINTEF

Windows from different decades
Brandengen School opened in 1914. The buildings are of historical value. Windows have been replaced at different times since 1965. As the windows have caused high heating costs and not contributed to an optimal indoor climate, the municipality decided to replace all windows installed after 1965, aiming for new high performance windows, which also pay respect to the historic aspects of the buildings' aesthetics. Existing original windows are being refurbished. Most of the original windows are located along corridors, where the indoor temperature requirements are not as strict as in classrooms.

Design criteria for new windows
Design criteria for new windows were elaborated in cooperation between the architect N. Herland, a+form, the window manufacturer NorDan, and S. Tangen from SoF Advisory and Evaluation Group. Searching for modern high performance windows the following criteria were required:

• Looking similar to the original windows from 1914
• Long life expectation
• U-value ≤ 0.8 W/m²K (at affordable price)
• Affordable operational and maintenance costs
Description of chosen window solution

«Passive house» windows from NorDan were chosen to be installed. As these windows substantially decrease heat losses (U-value ~ 0.8 W/m²), they will contribute to both better indoor thermal comfort and reduced energy bill. Thanks to the glazing's low solar energy transmittance (g-value = 27 on south and west façades), the exterior sunscreen devices can be removed from the façades, in order to restore the façades aesthetics as close as possible to that of the original historic look. This is the only certified Norwegian passive house window. SINTEF is the approval body.

The old windows had wooden frames and bars. The new windows have wooden frames (split/insulated) with exterior aluminium cladding. The selected aluminium clip bars have a look closely to the original wooden bars with glazing putty. To get a similar look as the old painted frames, the aluminium profiles got a lacquer finish of 30 % gloss, which is less bright than standard. As outdoor play can be quite rough, the windows on ground floor got duplex bars.

More information


NorDan. 2012. Brandengen skole. Description of window deliveries from the manufacturer Nordan (Norwegian).
Visit 1: Insulation in the attic – autumn 2011
Memo by Karin Buvik, SINTEF

Avoiding heat leakage and moister problems
Heat leakage from the roof has caused icicles in winter. Icicles have to be removed because they can harm people when falling down, and they can also harm the rain gutters if they are allowed to gain weight. Previous winter Drammen had to spend one million Norwegian kroner to remove the icicles from poor insulated municipal buildings.

Two expert advisers from SINTEF were involved in finding solutions to avoid heat leakage and moist problems. The wall between the mansard windows, and the floor in the attic, got additional insulation of 30 cm mineral wool. Vents were installed to provide outdoor air to flow into the attic; to cool the attic and to remove moist. In 2001–2003 a ventilation system was installed and ventilation ducts were placed in the attic. These ducts were not so well insulated. In the autumn 2011 a layer of 10 cm additional insulation were wrapped around the ducts.

More information