

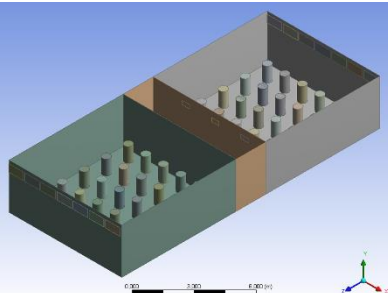


NO_Mellomhagen_school		
Image 01: Exterior view © Maria Justo Alonso	Image 02: Inner walls with thermal mass © Maria Justo Alonso	Image 03: Ventilation scheme © Maria Justo Alonso
		
Building Specifications		
Address	Mellomhagen 31, 3261 Larvik, Norway	
Building Category	Educational	
Year of Construction	2010 (year of renovation)	
Special Qualities	n/a	
Location	59° northern latitude, 10° eastern longitude, 37 m above sea level, located in a forest area in a small town with a population of approximately 44.000 in the lowlands of Southern Norway.	
Climate	Dfb (snow, fully humid, warm summer), monthly mean temperature below 17 °C, at least five months with a monthly mean temperature above 10 °C	
Vent. Cooling Site Design Elements (Solar Site Design and Wind Exposure Design, Evaporative Effects from Plants or Water)		
n/a		
Vent. Cooling Architectural Design Elements (Form, Morphology, Envelope, Construction&Material)		
<p>Form & Morphology: The design of the building has not been changed during the renovation. Cross ventilation is possible. The new windows are divided in two parts, the top part is normally used for winter ventilation and in summer time the whole window can be used.</p> <p>Construction & Material: The building is made of concrete with concrete pillars and an insulated wood framed facade. The building has a flat roof. Gable walls are clad with bricks. The ceilings are covered with wood panelling. The floors have smooth flooring on concrete. Inner walls are plate clad.</p>		
Vent. Cooling Technical Components (Airflow Guiding Components, Airflow Enhancing Components, Passive Cooling Components)		
<p>The school was renovated through the installation of new insulation, new windows and a hybrid ventilation system. The ventilation system is mixed mode type based on natural ventilation which promotes air exchange, but without a heat recovery mechanism. It combines the controlled opening of motorised windows and the use of an extractor fan during periods when natural ventilation is either inadequate or inadvisable due to too low outdoor temperatures. The fan is installed in a suspended ceiling between two rooms and only removes stale air. Each window is divided into an upper and a lower part. The lower part functions as a normal window, while the smaller, upper, part is opened and closed by a motorised system. Opening and closing these windows is essential to regulating both air quality and temperature in the rooms.</p>		

IEA EBC Annex 62 Ventilative Cooling

Actuators, Sensors and Control Strategies
<p>Sensors and Control Strategy: (1) During winter, window operation is limited in order to prevent cold draught and large heating demands. Operation of the window control system and exhaust fan is based on the outdoor temperature, wind conditions, and the CO₂ concentration and temperature in the classroom in question. Window operation is only allowed when the indoor temperature exceeds 21 °C, and is limited to 50 % of maximum opening. In case of CO₂ concentrations above 1300 ppm the windows will be opened as well. A local weather station records wind conditions, temperature and rainfall. These values are combined with classroom occupancy schedules to determine the correction parameters which control the timing of window opening and aperture. Under conditions of low temperatures or heavy rainfall, the windows will not open unless the occupants override the control system. The exhaust fan will then regulate the flow rate. Outdoor air pulses from the windows occur at a scheduled basis. (2) During summer the zone set point for window opening is set to an indoor temperature of 22 °C. Exhaust fan operates when the CO₂ concentration exceeds the set point of 1300 ppm. The summer operation also allows night-time ventilation. If the zone temperature exceeds 23 °C after operating hours, the building will use window ventilation to cool down the zones to a minimum of 18 °C with a limitation in window opening of 50 %.</p> <p>Window Master control program and windows actuators are used to operate windows and fans.</p>
Building Energy Systems (Heating, Ventilation, Cooling, Electricity)
<p>Heating: pellets boiler and electrical boiler Cooling: Cross ventilation</p>
Building Ownership and Building Facility Management Structures
<p>Building Owner: Larvik Kommune Facility Management: Larvik Kommune Architect: Øyvind Beyer, Larvik</p>
Aknowledgements
<p>n/a</p>
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