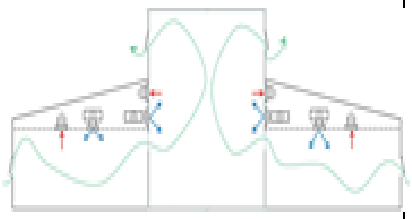
NO_Larvik_Solstad

Image 01: Exterior View © Maria Justo Alonso	**Image 02:** Interior View © Maria Justo Alonso	**Image 03:** Ventilation Scheme © Yngvar Oegaard
		

Building Specifications

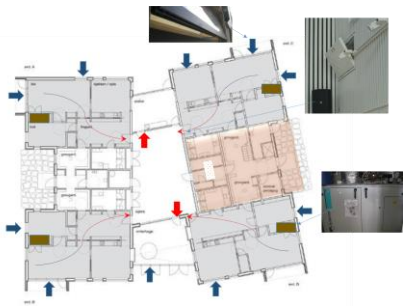
Address	Agnesveien 14, Stavern, Larvik, Norway
Building Category	Educational
Year of Construction	2011
Special Qualities	n/a
Location	59° northern latitude, 10° eastern longitude, 43 m above sea level, located in a forest area in a small town with a population of approximately 44.000 in the lowlands 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)

Solstad kindergarten is a low-energy, two-storey building in operation since January 2011. Solstad combines the controlled opening of motorised windows and the use of mechanical ventilation during periods when natural ventilation is either inadequate or inadvisable due to too low outdoor temperatures.

The use of window opening removes cooling demand due to average low outdoors temperatures.

Vent. Cooling Architectural Design Elements (Form, Morphology, Envelope, Construction & Material)



Morphology: The building can roughly be divided into 4 wings each one with a school level. Each wing has one kitchen, one bathroom and one playing room. All the wings are connected to the common area called Agora. The offices of the teachers are placed on the second floor. The area called winter garden is a room with glass walls where kids play if the weather is too bad to be outdoors.

Vent. Cooling Technical Components (Airflow Guiding Components, Airflow Enhancing Components, Passive Cooling Components)

The kindergarten has hybrid mixed-mode ventilation combining motor controlled operable windows with balanced mechanical ventilation. In total, the building consist of 54 top hinged, operable windows, and five separate decentralized mechanical ventilation systems, each consisting of supply- and exhaust air terminals, ductwork and an air handling unit with air heat recovery and a heating coil.

Natural ventilation from the operable windows is performed as combination of cross- and stack ventilation. There is a large common room called Agora in the centre of the kindergarten, and all branches are connected to it through open air hatches. As the Agora ceiling height is fairly large, air supplied to the wings will exit through operable windows placed at the top of Agora.

Actuators, Sensors and Control Strategies

(1) During winter, window operation is limited in order to prevent cold draught and large heating demands. Mechanical ventilation operates with a zone set point of 900 – 1200 ppm CO_2, whereas window operation has a CO_2-setpoint of 950 – 1500 ppm. Window operation is only allowed when the indoor temperature exceeds 19 °C, and is limited to 50 % of maximum opening. This setup entails that mechanical ventilation handles most of the ventilation needs as it has a stricter CO_2-setpoint than the windows. Window operation will only occur if the mechanical system is insufficient in controlling the CO_2 concentration in the zone. (2) During summer, the zone set point for window operation is an indoor temperature exceeding 21 °C. Mechanical ventilation operates with a CO_2-setpoint of 900 – 1300 ppm. Seeing that indoor temperatures will exceed 21 °C much of the summer season, mechanical ventilation is not utilized very often as air flow rates needed in order to remove surplus heat often are larger than air flow rates needed for CO_2 control. Summer operation also allows night-time ventilation. If zone temperatures exceed 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 %.

Building Energy Systems (Heating, Ventilation, Cooling, Electricity)

The kindergarten has a hydronic floor heating distribution system with a ground source heat pump covering the base load, and an electric boiler covering the peak load. The heat pump efficiency is measured to 2.4 on a yearly average. The hydronic system is 45/35 °C. The system is designed so that the electric boiler covers 10 % of the heating demand and 50 % of the hot water demand (pre-heating). Heating is provided to the building 24 hours a day, 7 days a week. The building is supposed to use 46.4kWh/m^2 for heating demands and 10 kWh/m^2 for domestic hot water needs.

Building Ownership and Building Facility Management Structures

Ownership: Larvik kommune

Architect: Pushak As, Oslo, advisor Energetica , Arne Førland Larsen

Aknowledgements

n/A

Datasheet Source:
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