Feldballe Elementary and Middle School

Escola d'educació primària i secundària Feldballe
Escuela de educación primaria y secundaria Feldballe
Rønde, Denmark, 2019-2022
Henning Larsen Architects

Design Studio
Henning Larsen Architects

Engineer
Reeholm & Bredahl

Client
Feldballe School

Contractor
Høgh & Sønberg A/S
Carpenter Jakob Rasmussen

Supplier
EcoCocon

Start and Completion Year
2019-2022

Gross Area
250 m^2

Sustainable and healthy materials or systems
wood: compressed straw, low carbon

Photography
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More information

REPORT. Sustainable and Healthy Architecture

The extension of Feldballe School follows a forward-thinking framework for design that respects planetary boundaries, and addresses the entire life cycle of a project, while planning beyond. This framework was originally based on five key principles: using renewable materials to sequester carbon, utilizing locally sourced materials, avoiding toxic chemicals, reducing operational energy consumption with a healthy indoor climate, and designing for disassembly to enable repair and reuse.

The building is made almost entirely from biobased resources – including wood, straw, clay plaster and Zostera seagrass – and prioritizes materials that are non-toxic, fire-safe, and offer efficient insulation, improving the overall indoor climate. Designed for circularity, the structure features mechanical joints that enable easy reconfiguration, maintenance, and disassembly, ensuring an extended lifespan.

Operationalizing these principles, the design team surpassed targets, arriving at a lifetime carbon footprint of 6.8 kg of CO2e per m^2 per year, including embodied and operational carbon, which is well below the current Danish standard of 12 kg CO2e per m^2 per year over 50 years for larger school projects. The structure is a scalable solution for carbon sequestration, as the toxin-free building absorbs more carbon than it emits.

Integrating natural materials

Achieving a carbon-sequestering construction method, the project implemented EcoCocon's integrated panel system, using compressed straw in wooden cassettes that can be disassembled, decomposed, and reused. The exterior features certified heat-treated pine siding and untreated oak windows and doors. Inside, natural clay plasters with moisture and thermal regulation properties enhance the indoor environment, while acoustic panels effectively absorb sound. The roof features certified timber, and untreated plywood forms the inner walls and built-in furniture, with light-colored finishes that prioritize tactility and optimize daylight.

Post-occupancy studies confirm the effectiveness of the NOTECH natural ventilation system, which optimizes indoor air quality through wall-integrated filters made from carbon-binding eelgrass – an abundance sea plant in Denmark. Developed collaboratively by Volfdesign, the Danish Technological Institute, and WindowMaster, this technical system functions as an air filter and ambient noise attenuator. It is demand-controlled, drawing air through filters to regulate CO2 levels, temperature, and humidity. Enhancing student focus, well-being and learning, this system contributes to a healthier, more comfortable classroom environment, earning the project the Danish Design Award in the Better Learning category.

Passive strategies for reducing operational energy consumption

The project reduces its reliance on mechanical systems through carefully implemented passive strategies, including optimal orientation and natural ventilation assisted by operable skylights.

To maintain a stable indoor climate, the design leverages the thermal mass of clay plaster, the density of straw panels and wood fiber insulation, combined with strategically placed windows and a south-facing overhang. Roof-mounted photovoltaic panels generate a substantial part of the building's total energy needs. The exhaust air from the toilets and chemistry classroom is captured by a heat pump to heat the building and supply utility water.

Designed a learning environment for a generation facing the climate crisis, the project prioritized students' well-being and the planet they will inherit, through a deeply collaborative process between architects, builders, and the local community.