DRØBAK
MONTESSORI

THE MOST **ENVIRONMENTAL FRIENDLY** SCHOOL IN NORWAY

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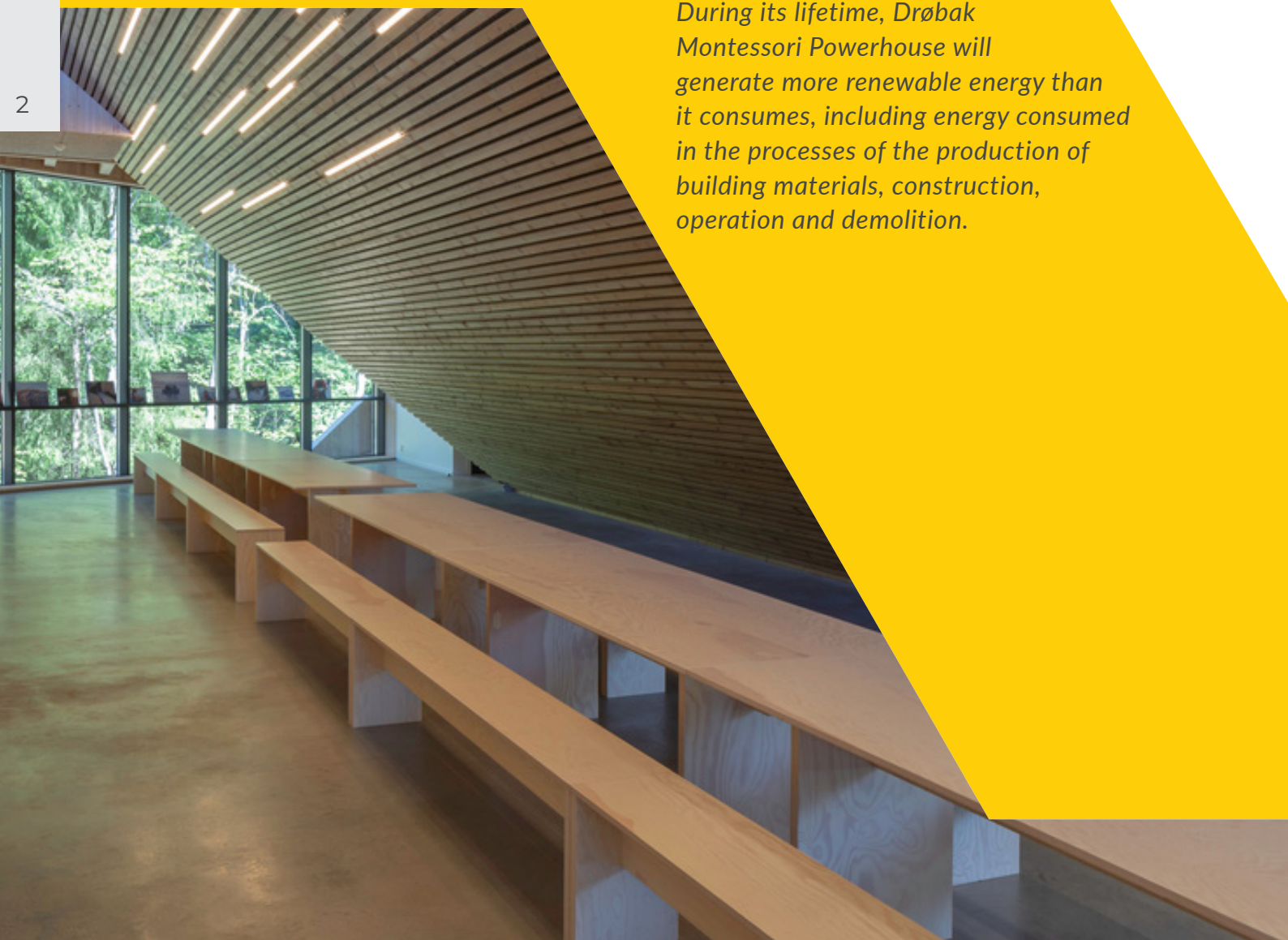
2018

POWERHOUSE

The first new building in the world to **meet Powerhouse energy requirements**



During its lifetime, Drøbak Montessori Powerhouse will generate more renewable energy than it consumes, including energy consumed in the processes of the production of building materials, construction, operation and demolition.

PROJECT REPORT

Publisher: Drøbak Montessori
Written by Mervi Flugsrud
2018

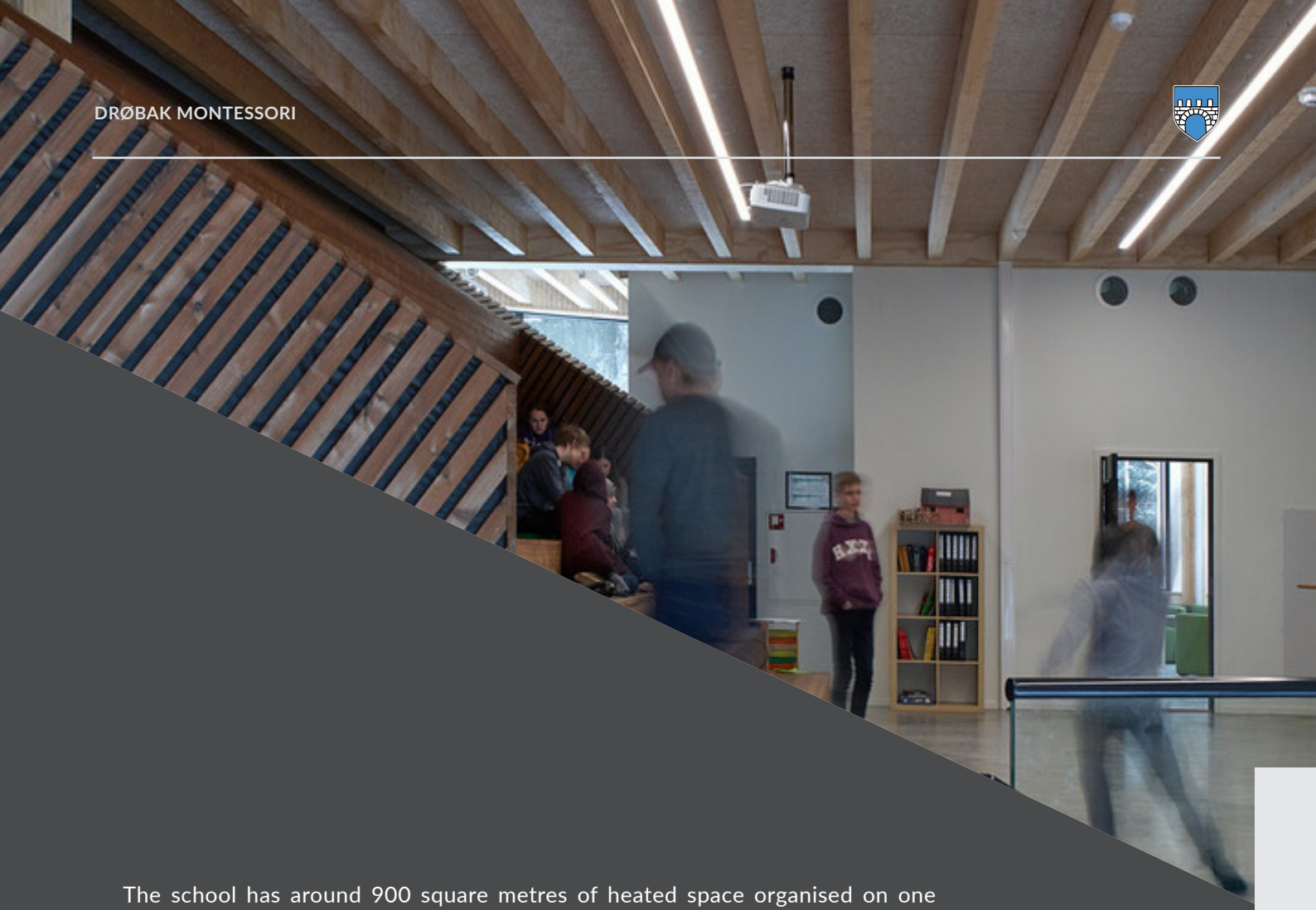
Summary

LOCATION: Drøbak
BUILDING TYPE: School
AREA: 886 m_2 GIA
THE BUILDING'S OWN ENERGY GENERATION: Appr. 30,500 kWh per year
SUPPLIED ENERGY, INCLUDING EQUIPMENT: Appr. 28,000 kWh per year
BUILDING OWNER: Drøbak Montessori
ARCHITECTS: Snøhetta
ENTREPRENEUR: Skanska

PROJECT OVERVIEW

The design arises from the energy concept, the qualities of the site and the Montessori education principles, in addition to a strict financial scope. The architecture is intended as a social and educational tool, built around the Powerhouse concept as the central design element.

A multi-disciplinary team was established from day one, working out the plans for how the world's first Powerhouse school could be realised. Teachers, students, school and foundation management, and the entire professional community needed to optimise the technical solutions, were gathered around the drawing table. Together, they found solutions which are in harmony with the Montessori education method, while also taking the environment into account.



The school has around 900 square metres of heated space organised on one storey, in addition to a lower storey under the parts of the building where there is a natural decline in the ground. The energy need constitutes less than a fourth of the usual level for schools of the same size. The building will produce 30,500 kWh through generation of solar electricity.

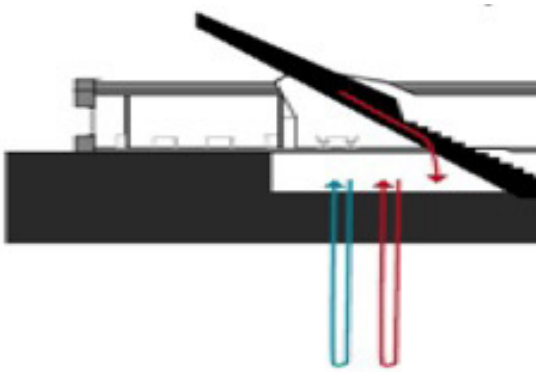
The body of the building is intersected by an angular plate, a so-called "solar plate." The solar plate collects fresh air and uses the stack effect to lead the extract air out. To achieve maximum effect of the solar cells, the solar plate is orientated directly towards the south with a 33-degree incline.

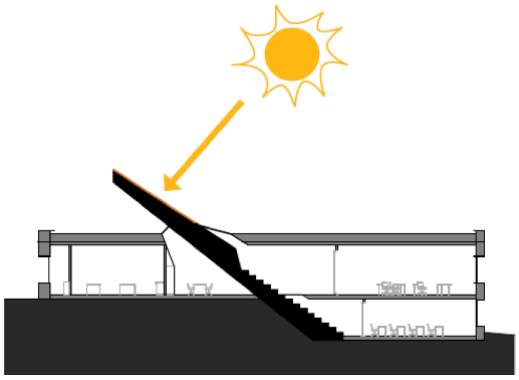
The solar plate also creates social and educational arenas in the form of outside and inside amphit-heaters and stairs which govern the school's spacial organisation and logic. The solutions for heating, cooling and ventilation have been further developed and optimalised with a view to the function and cost of the building.

The total cost of the building, including engineering, is NOK 32 million.

RENEWABLE ENERGY

- Two 300m energy wells to preheat or cool ventilated air
- A LowEx pilot building
  - The school is a pilot in the LowEx Research Project examinating how to optimalise the heating system to give the heat pump a new standard of working conditions, lowest possible temperature needed to produce heat.





- Solar energy production.
  Solcellemoduler på solskiven
- Maximum effect of solar cells achieved by turning the solar plate towards the sun with a 33-degree incline.
- Will produce more solar energy than consumed
  - The heat pump efficiency is 1:5, 1kWh produces 5 kWh energy.

OTHER KEY FACTORS

- Laminated tree and steel construction – bound energy minimum
- Displacement ventilation system utilising substantially reduced air velocity
- Maximum daylight utilisation
- Isolation concept to prevent leaks and thermal bridges
- Exterior sun shades

DRØBAK MONTESSORI

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