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Drammen Eiendom KF

Best practices in energy efficient buildings
Example from 2 schools

Drammen - Norway
67.000 Residents

Geir Andersen Technical Manager

Drammen Eiendom KF – a municipality-owned real estate company

Drammen Eiendom KF

We take care off 380.000 m2:

- 21 schools
- 25 kindergardens
- 7 senior residences
- Sports facilities
- The city hall
- swimming pool
- Drammen theatre
- Parking Houses
- District houses, cottages
- 1100 apartments/housing

Energy- and environment center

Buildings managed by great energy “pilots”

Operating responsibilities:

Energy management, maintance, tecnical quality in new buildings.

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ENERGY STRATEGY

Goal : Good indoor air quality, low energy consumption, reduce greenhouse emissions

- ***Good building structure***
- ***Demand control system for heating, ventilation and lighting***
- ***Consume energy***
  - ***Where it's needed,***
  - ***When it's needed***
- **Building automation system and skills is our tool**

!

Build smart buildings and «drive» them smart

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Marienlyst school in Drammen
Norway's first passiv house school

FUTURE BUILT

KLIMAVENNLIG ARKITEKTUR OG BYUTVIKLING

Pilot prosjekt

At least 50% reduction of greenhouse gas emissions.

Smart technical equipment – Demand systems
Very good insulation in roof , walls and floor
Low air leaks and good windows

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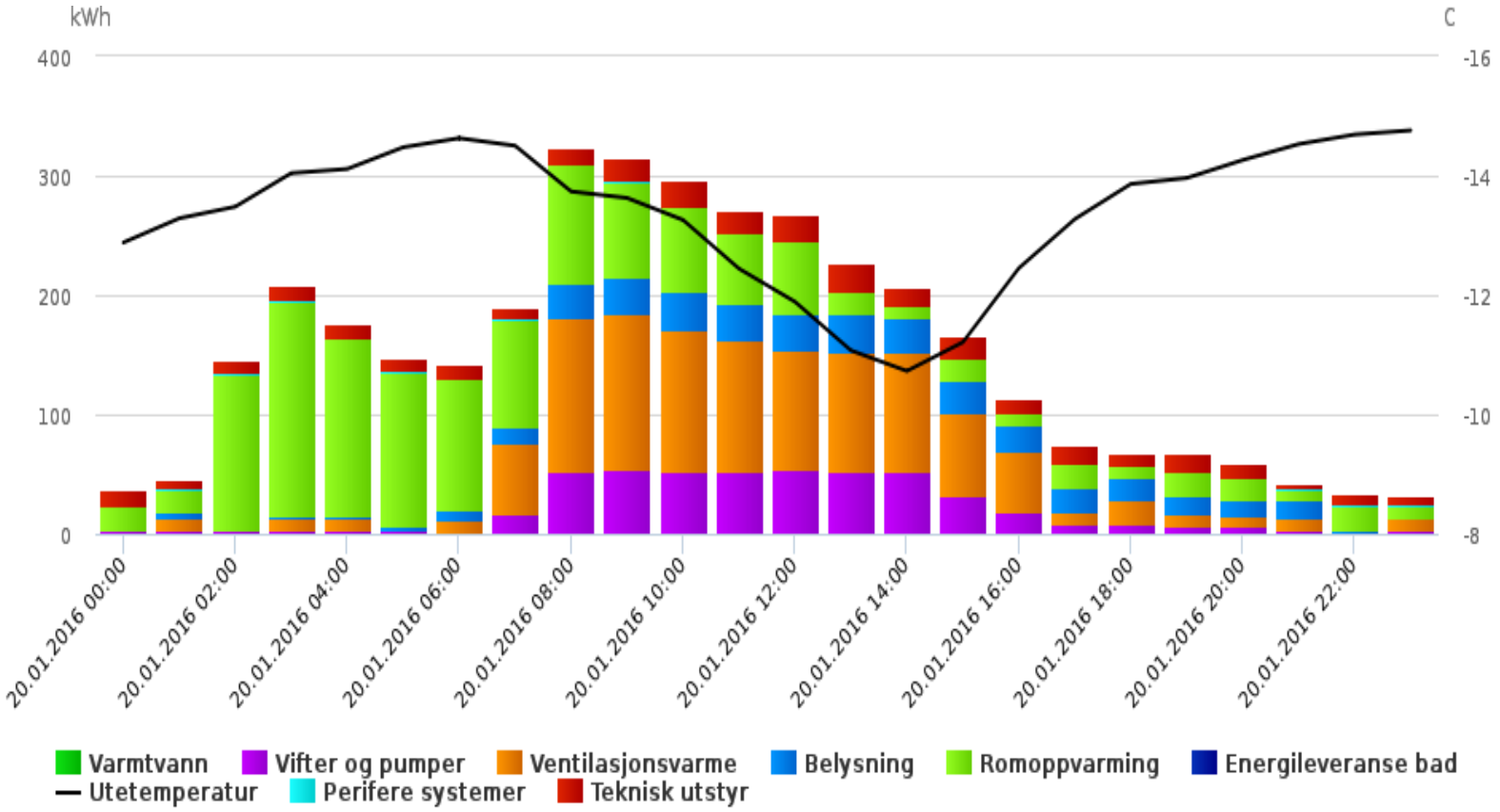
Marienlyst school

The measurement are divided in energyblocks)



Energy consumption pr. hour a cold day

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Energyblocks

Energy consumption kWh/ m2 - Year

Energy blocks kWh / m2	TEK 10 Regulation	Measurd Marienlyst school - Passivhouse.
Romheating	39	16
Heat water	10	4
Ventilation heat	10	7
Fans & pumps	25	12
Lighting	22	12
Technical equipment	13	13
Sum energiposter	120	64

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Heating system.

- Water based systems.
  - Floor heating – and cooling during summer

- Control
  - Temperature control of individual rooms using the building automation system (BAS), interaction with the ventilation system.- free cooling

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Ventilation

- Balanced ventilation system
  - High heat recovery efficiency (rotating heat exchanger)
  - Low SFP- factor, (Specific fan power)
  - Heat battery (Sufficient air when cold)

- Demand controlled ventilation
  - CO2 and temperature detectors
  - Temperature for free-cooling

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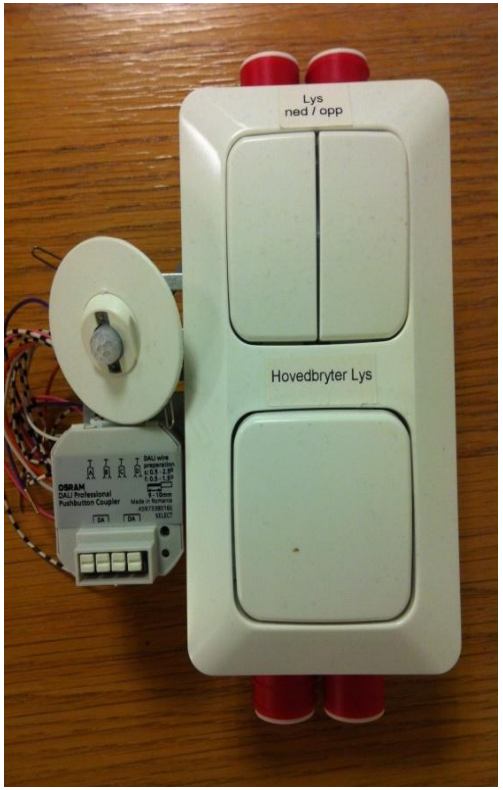
Lighting system

- Low energy light (LED)

- Advanced demand control system
  - Switch on/off – Motion detector, turns off
  - Adjusted lux-level
  - Light dimmer for consumers

- **And easy to use**



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EU Project FP7
«School of the Future - Towards Zero Emission with High Performance Indoor Enviroment»

4 Schools in Europa

Germany

Italy

Danmark

Norway

Brandengen school - Listed Brick building from 1914

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Transforms into a low energy building. (Rehabilitation project)

UN Security Council

Townhall in Oslo

Designed by Arnstein Arneberg, a famous Norwegian architect

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Energy performance

Existing building	230 kWh/m²a
National regulation normal practice - New	120 kWh/m²a
Calculated with suggested retrofit	81 kWh/m²a
Measurd energy Consumption 2017	75 kWh/m²a

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Brandengen school - Starting up rehabilitation 2012

Transforms into a low energy building. (Rehabilitation project)

Installing

- New windows
- New roof

Additional insulation

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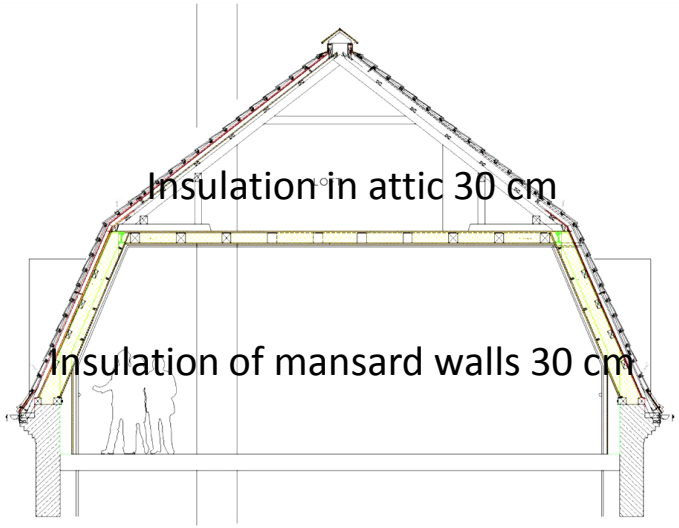
Additional insulation where possible; i.e. top and bottom of the building



Exterior insulation of basement walls

Ditches with triple function: drainage, insulation and collector pipes

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Renewable from the ground

- 19 energy wells for collectors
- Distance between wells: 15 m
- Well depth: about 250 m

«The green gold»

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Heat pump for high temperature requirement

The original central heating system was designed for high temperatures requiring 80°heat on «coldest day».

We have to use a new type heat pumps replacing oil burners in old 80/60 °C system.

This concept is based on high performance piston compressors.

New heat pump in the old boiler room

Heat pump piston compressors

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Oil tank

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Brandengen School
Now a low energy green building

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Thank you for your attention