The ZEB Research Centre and Pilot Buildings

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Professor NTNU

ZEB's Main Objective

is to develop competitive products and solutions that will lead to market penetration of buildings with **zero greenhouse gas emissions related to their production, operation, and demolition**.

The centre will encompass both residential, commercial, and public buildings.

www.zeb.no


Illustration: Snøhetta/MIR

ZEB Facts

- ZEB is a Centre for Environment-friendly Energy Research (FME), funded by the Research Council of Norway (RCN) and 26 partners.
- Host institution is NTNU with SINTEF Building and Infrastructure and SINTEF Energy Research as research partners.
- Centre started in November 2009, and RCN funds the Centre for 8 years. 50% funding from industry.
- Total budget: ca. 290 MNOK (+ additional to research infrastructure)

ZEB Centre Partners

- Users (the reference group)
- Contractors
- Producers of materials and products for the building industry
- Consultants, architects
- Property managers
- Public administration
- Trade organizations
- University and research institutions
- The Research Council

Skanska
Caverion
Weber
Isola
Glava
Protan
Sapa Building Systems
NorDan
Velux
DuPont
Brødrene Dahl
Multiconsult
Snøhetta
ByBo
Entra Eiendom
Forsvarsbygg
Statsbygg
Sør-trøndelag fylkeskommune
Enova
Husbanken
Direktoratet for byggkvalitet
Byggenæringens landsforening
Norsk Teknologi
NTNU
SINTEF Byggforsk, SINTEF Energi
Norges forskningsråd

Other Institutions Cooperating with ZEB

International partners

- VTT (Finland)
- Chalmers (Sweden)
- Fraunhofer (Germany)
- TNO (The Netherlands)
- LBNL (USA)
- MIT (USA)
- University of Strathclyde (Scotland)
- Tsinghua University (China)
- Shanghai JiaoTong University (China)
- Politecnico di Torino (Italy)
- EMPA (Switzerland)
- ..

Reference group

- Lavenergiprogrammet
- NBBL
- NVE
- Forbrukerrådet
- EcoBox
- Driftsforum
- Arkitektbedriftene

ZEB Research Activities

WP1 Advanced materials technologies

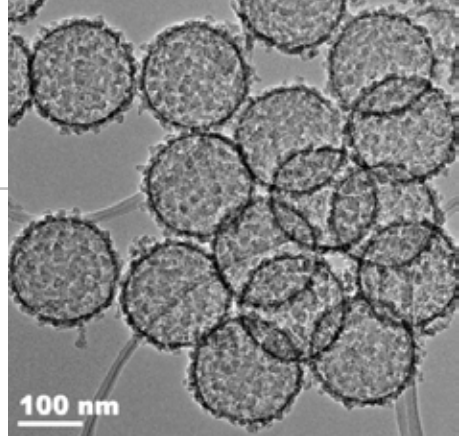
WP2 Climate-adapted low-energy envelope technologies

WP3 Energy supply systems and services

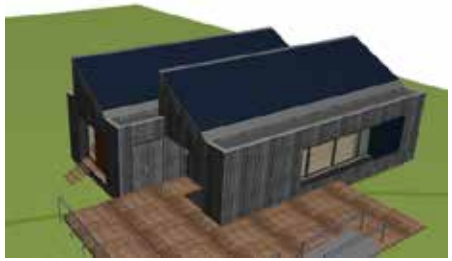
WP4 Use, operation, and implementation

WP5 Concepts and strategies and Pilot buildings

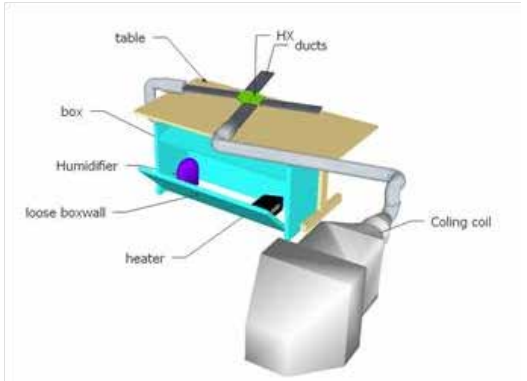
VIP Leca Isoblokk



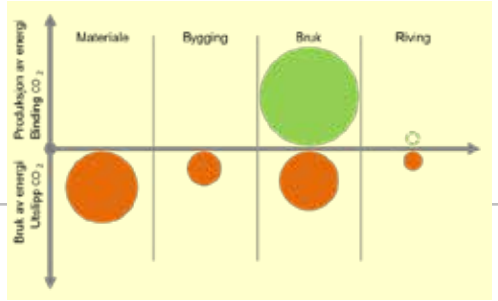
Nano insulation material



ZEB Living Lab



Membrane heat exchanger



ZEB Definition

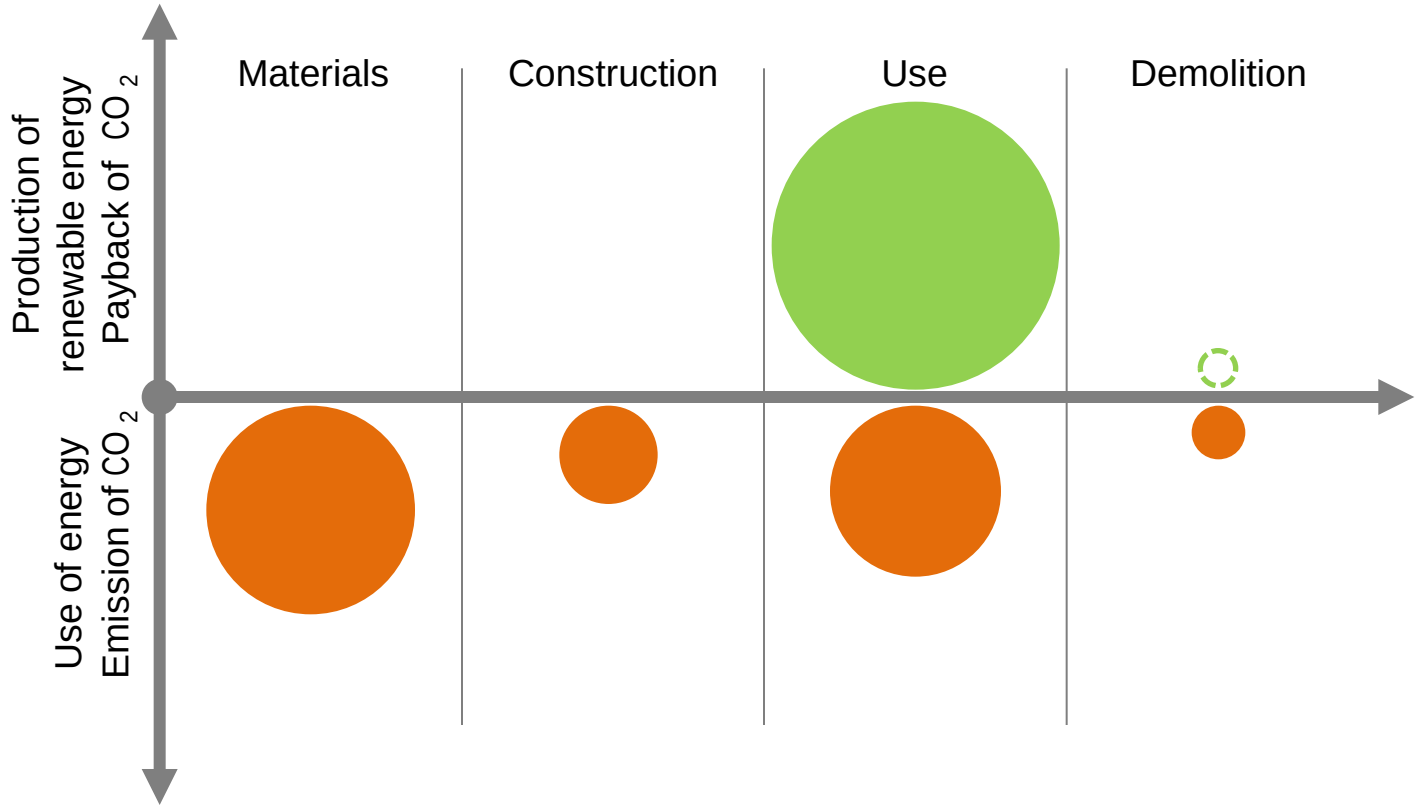
ZEB Pilot buildings

The Research Centre on Zero Emission Buildings

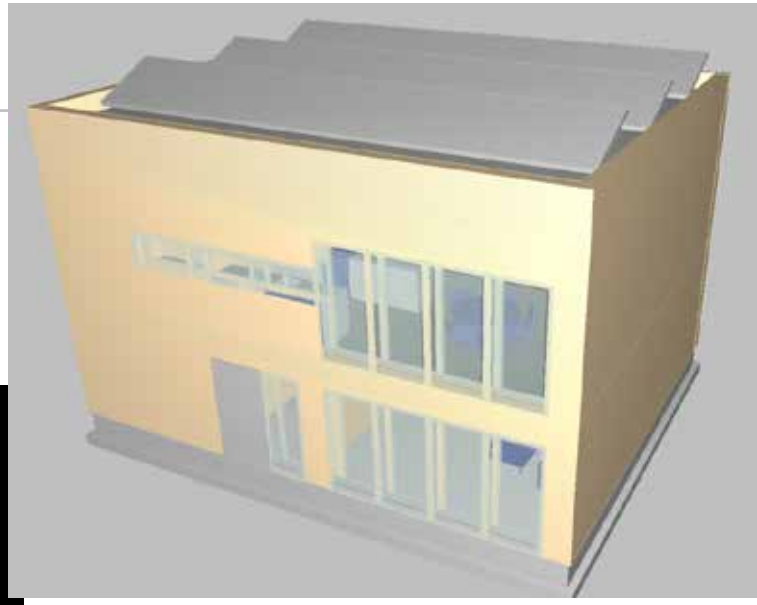
ZEB Pilot Buildings

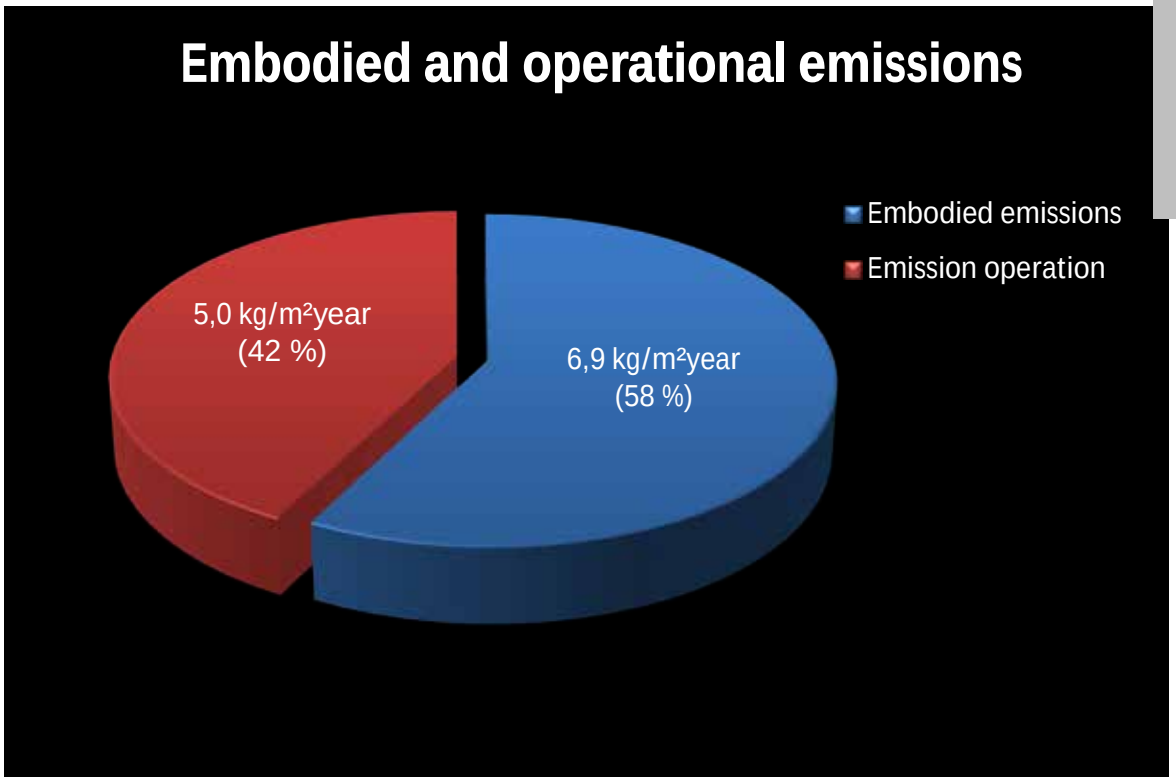
Pilot Building	Type of Building	ZEB-ambition	Built area
1. Skarpnes, Arendal	20 new apartments and 20 new detached houses	ZEB-O	4 500 m^2
2. Powerhouse Kjørbo, Sandvika	Renovation of two office buildings	ZEB-COM÷EQ	5 000 m^2
3. Multicomfort, Larvik	New detached demonstration house	ZEB-COM	200 m^2
4. Ådland, Bergen	720 new dwellings	ZEB-O (område) ZEB-OM (bygg)	80 000 m^2
5. Haakonsvern, Bergen	New office building	ZEB-O÷EQ	2 000 m^2
6. Powerhouse Brattøra, Trondheim	New office building	ZEB-O	14 000 m^2
7. ZEB Living Lab, Trondheim	New research dwelling	ZEB-O	100 m^2
8. Heimdal VGS, Trondheim	New upper secondary school	ZEB-OM	25 000 m^2
9. Campus Evenstad	New office building	ZEB-COM	1 100 m^2

Zero Emission Building Definition



Concept Work - Dwelling



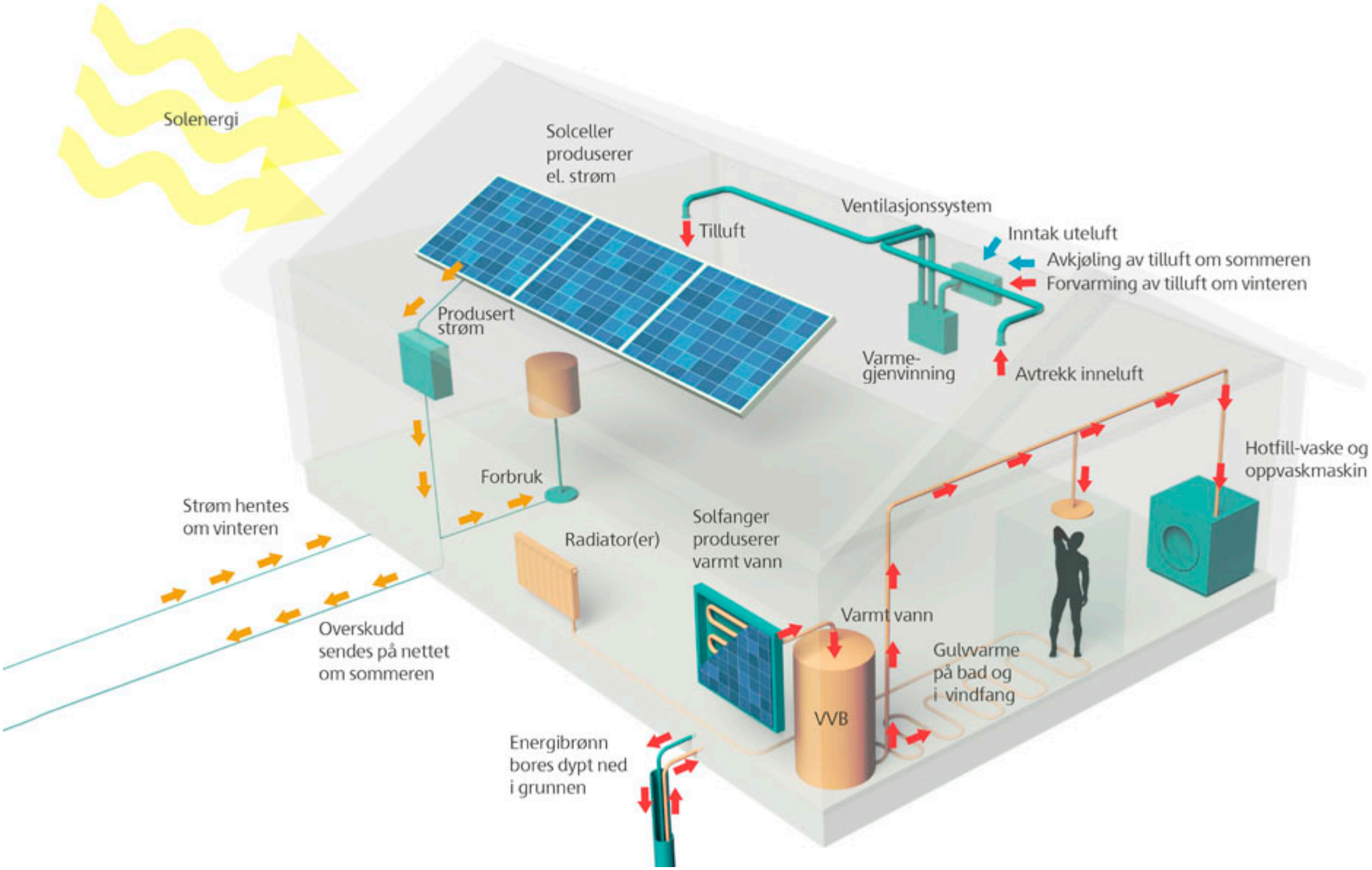


Important Outcomes of Pilot Buildings

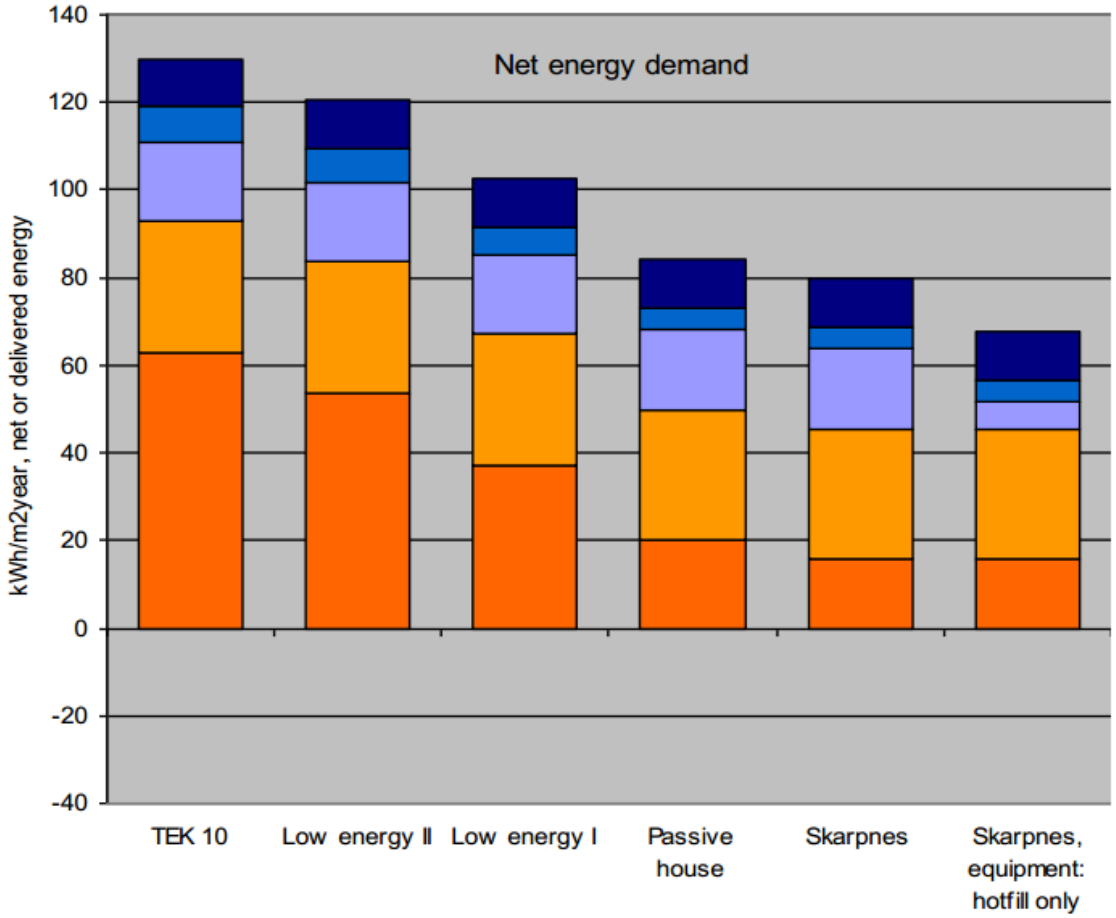
- Verification of calculation procedures
- Verification of technical installations performance
- Testing of new materials/building assemblies/façade solutions
- Demonstration and testing of integrated solutions/the entire building
- Demonstration and testing of design, construction, and operation processes and tools
- Transfer of knowledge to the Norwegian building industry

ZEB Pilot building Skarpnes Dwelling area, Arendal

ZEB The Research Centre on Zero Emission Buildings


Solenergi
Solceller produserer el. strøm
Ventilasjonssystem
Tilluft
Inntak uteluft
Avkjøling av tilluft om sommeren
Forvarming av tilluft om vinteren
Produsert strøm
Varme-gjenvinning
Avtrekk inneluft
Hotfill-vaske og oppvaskmaskin
Forbruk
Strøm hentes om vinteren
Radiator(er)
Solfanger produserer varmt vann
Varmt vann
Overskudd sendes på nettet om sommeren
Gulvvarme på bad og i vindfang
VVB
Energibrønn bores dypt ned i grunnen

Energy demand, single family house, Skarpnes (154 m2)



- Energy production (PV)
- Electric demand
- Thermal demand
- Lighting
- Fans and pumps
- Equipment
- Hot water
- Heating (room and ventilation)

Foto: I. Andresen, 21.11.2014

ZEB Pilot Building: Powerhouse Kjørbo, Sandvika

Illustrasjon: Snøhetta/MIR

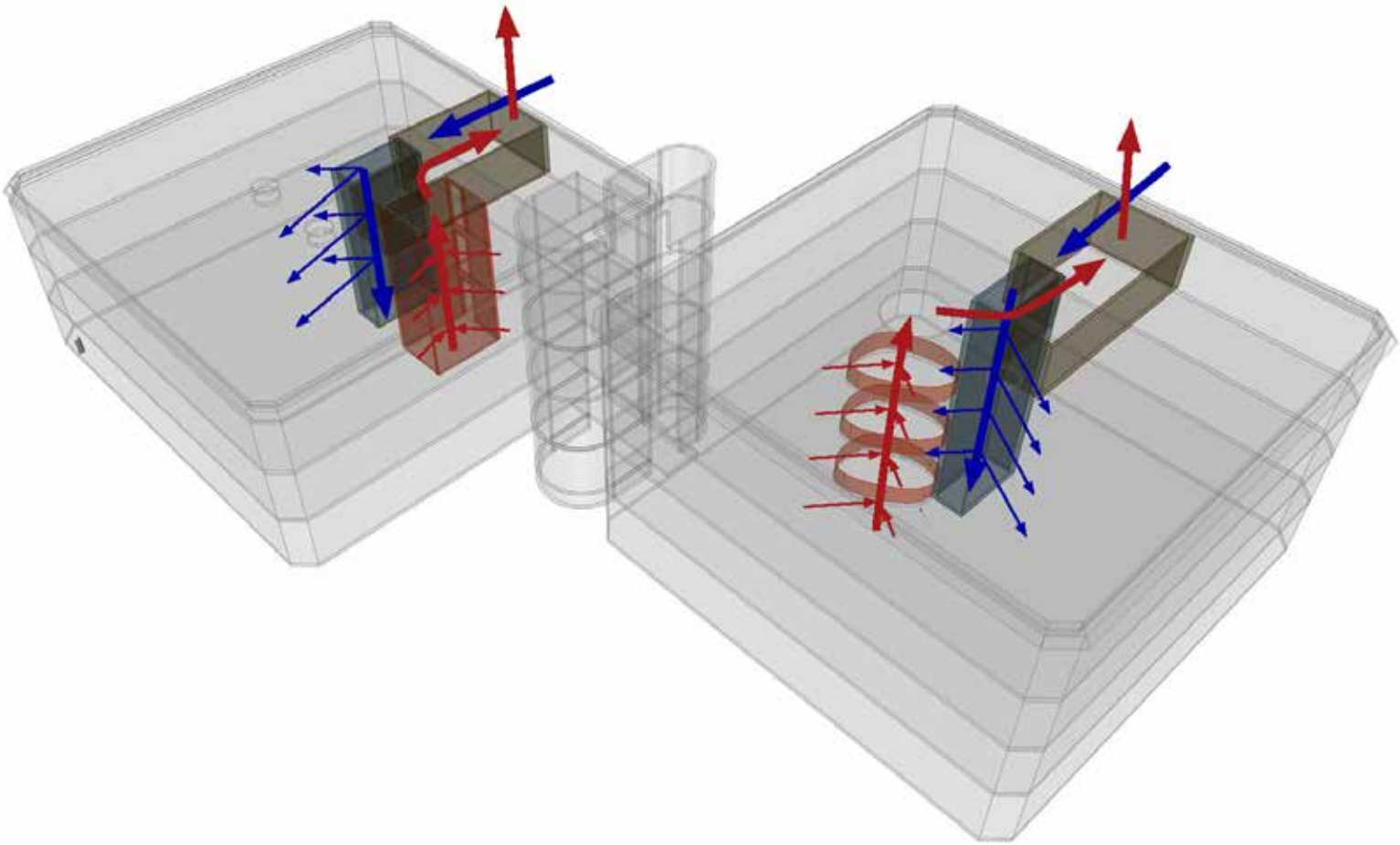


Foto: Caroline Drefvelin

Multikomfort Larvik - demonstration home

Owner: Brødrene Dahl and Optimera, Architects: Snøhetta, Illustration: MIR

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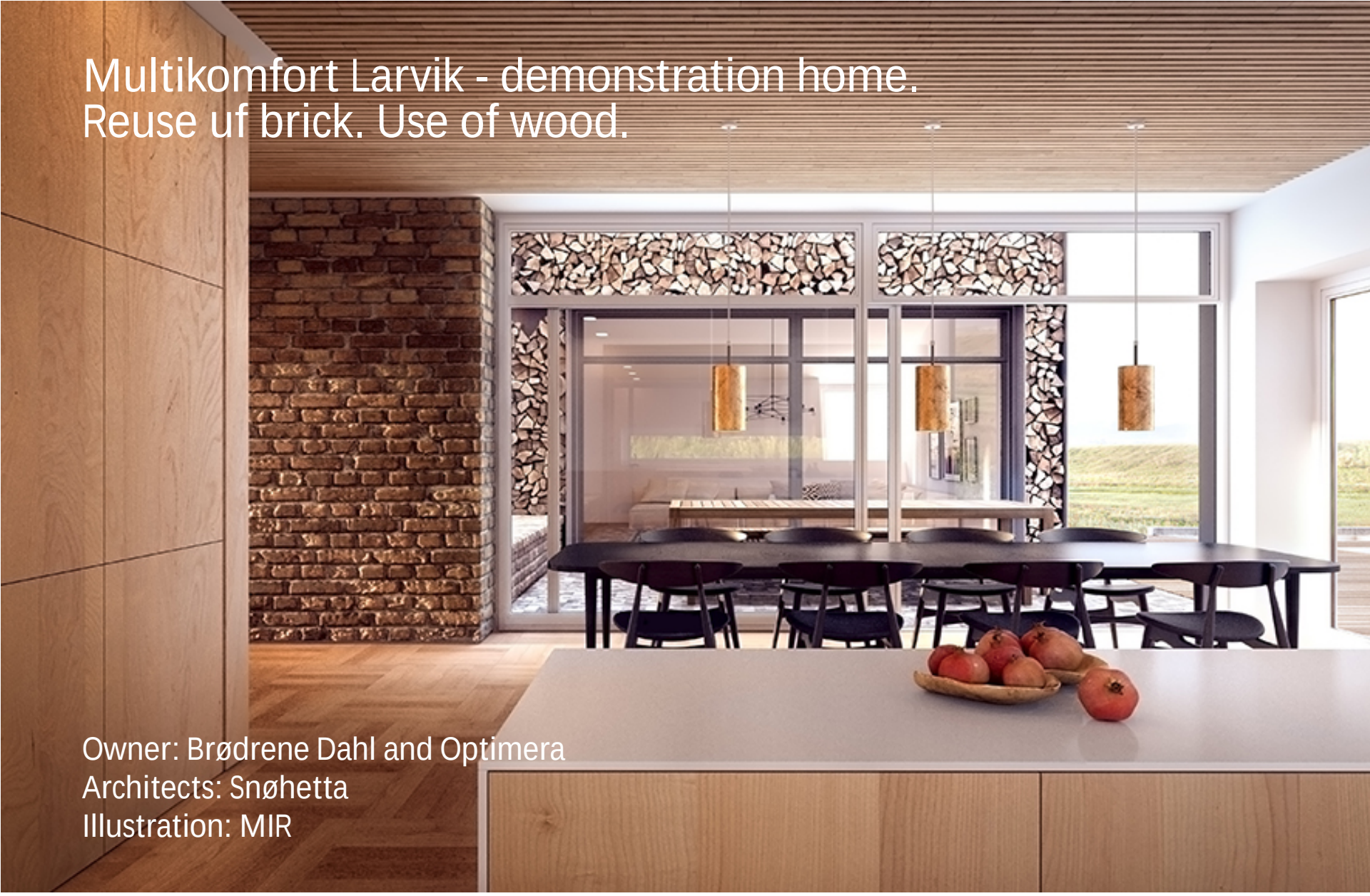
ZEB The Research Centre on Zero Emission Buildings

Multikomfort Larvik - demonstration home.
Reuse uf brick. Use of wood.



Owner: Brødrene Dahl and Optimera
Architects: Snøhetta
Illustration: MIR

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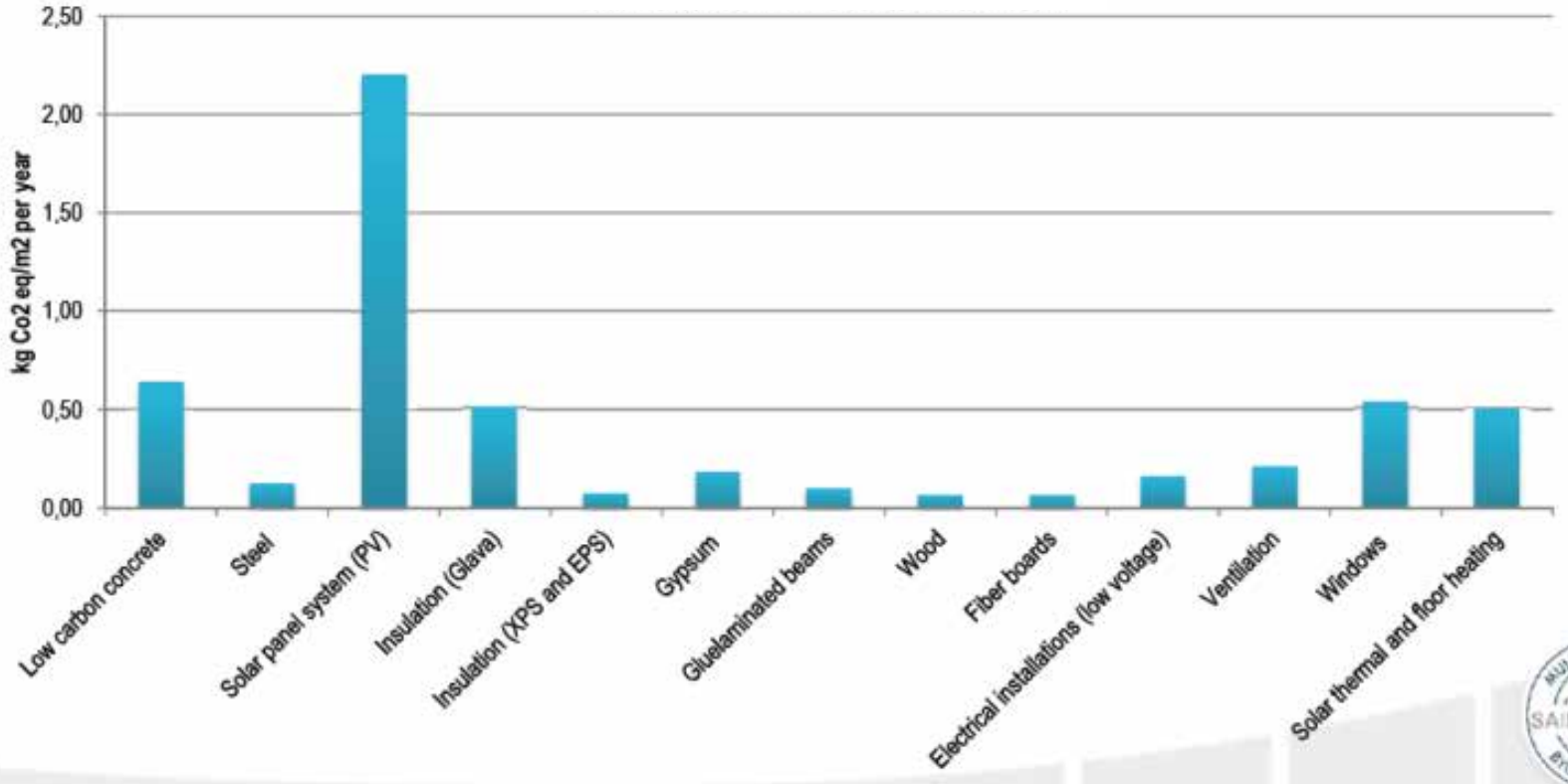
Multikomfort Larvik - demonstration home

Material usage



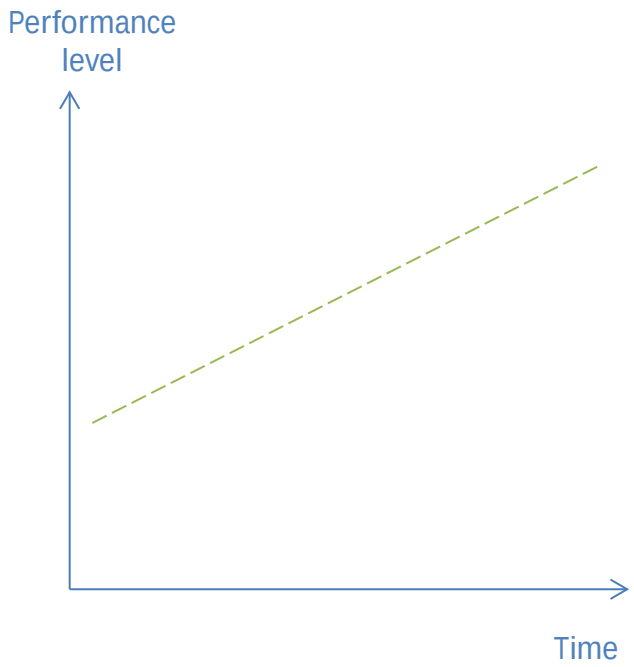
BRØDRENE DAHL

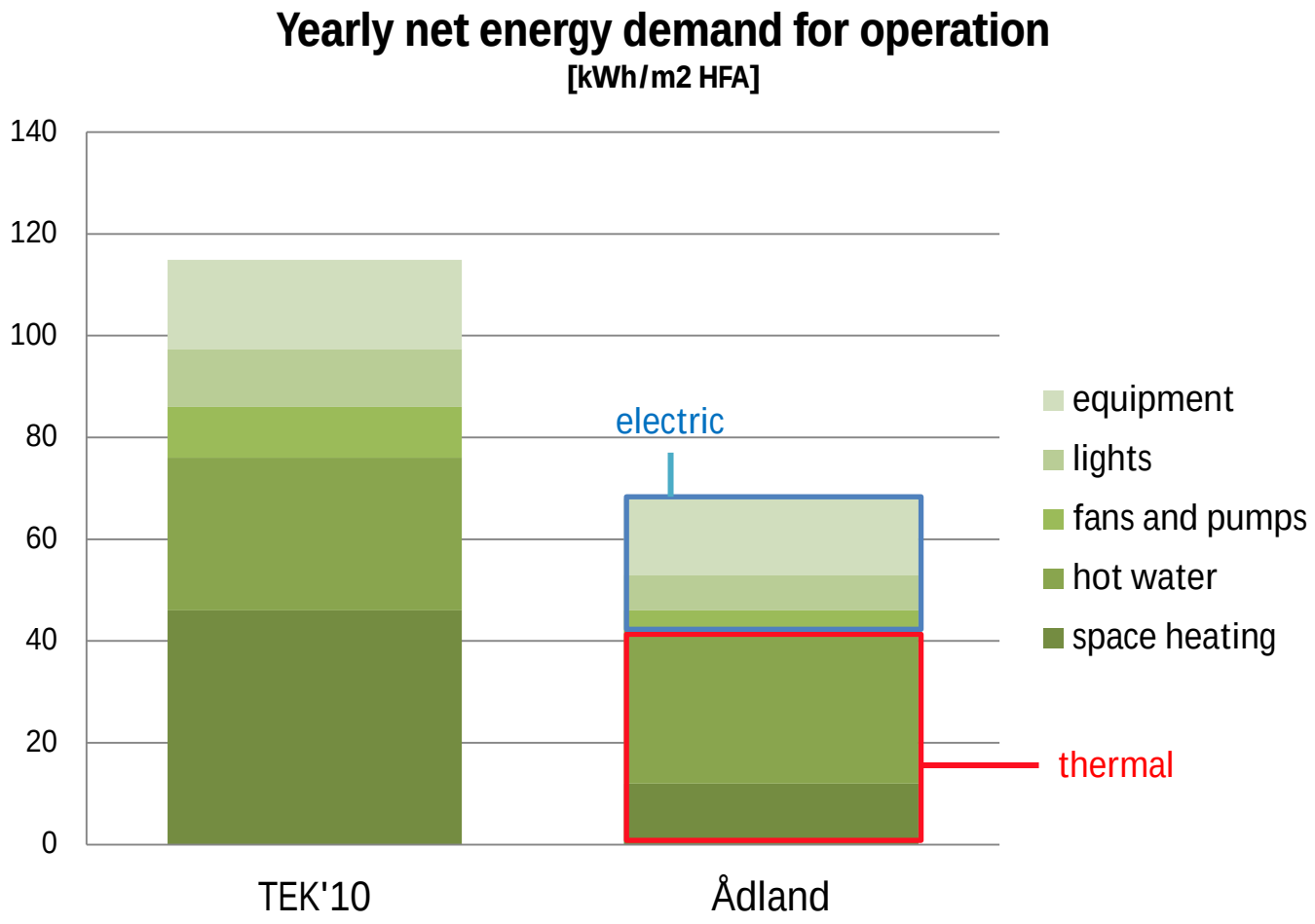
www.dahl.no

A Zero Emission Neighbourhood Development at Ådland, Bergen

ZEB Challenges for Zero Village Bergen

- Setting more and more ambitious energy performance goals for each construction phase
- Echange of energy between buildings, to/from grid, storage, and with electromobility
- Business models: Cooperatoin with local utility company (BKK)



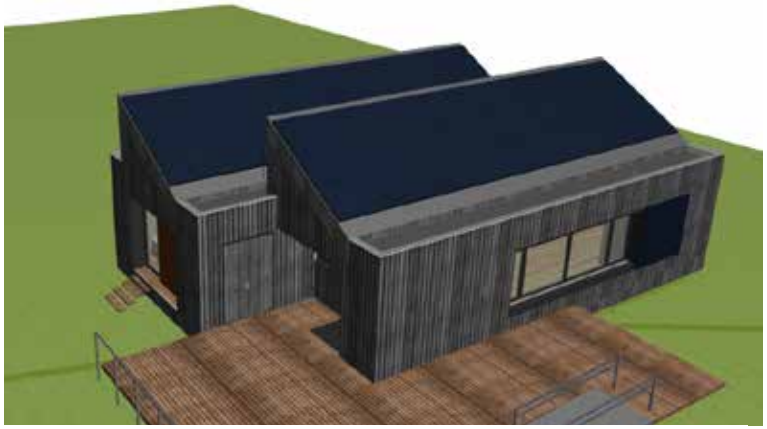

Yearly net energy demand for operation
[kWh/m2 HFA]
140
120
100
80
60
40
20
0
electric
thermal
equipment
lights
fans and pumps
hot water
space heating
TEK'10
Ådland

Energy concepts - 1st proposal

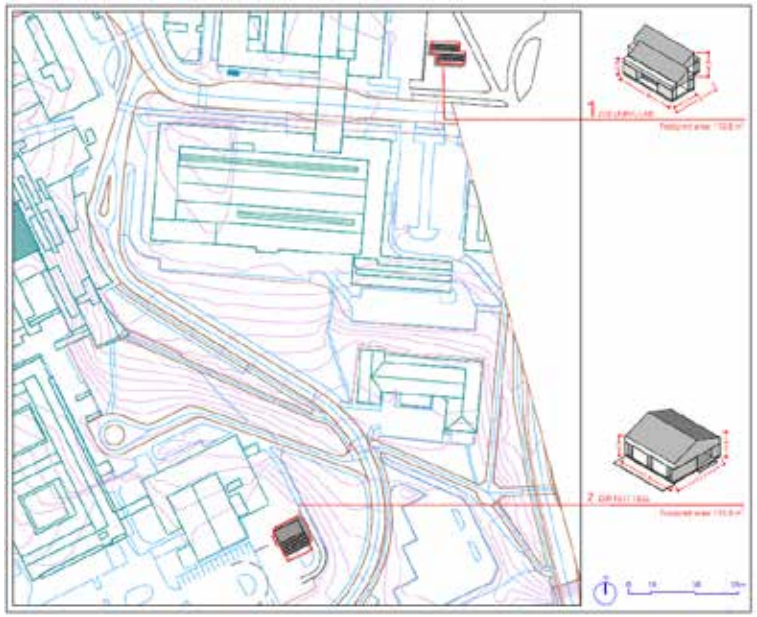
	Alternative 1	Alternative 2
Building envelope and technical installations	Passive house standard Highly efficient ventilation system with heat recovery Natural ventilation and passive cooling in summer Lighting based on LED Hot fill washing machines	Passive house standard Highly efficient ventilation system with heat recovery Natural ventilation and passive cooling in summer Lighting based on LED Hot fill washing machines
Energy supply systems	Thermal solar collectors Ground source heat pump Photovoltaics	Thermal solar collectors Biogas based CHP Photovoltaics

Illustrasjon av bomiljøet i klyngetunet. Illustrasjon: Snøhetta

ZEB Living Lab and Research Cell



ZEB Living Lab – A dwelling for user-technology studies



ZEB Test Cell for testing av different technologies

Thank you for your attention

Contact:
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NTNU
Kunnskap for en bedre verden

SINTEF