



The ZEB Research Centre and its Pilot Buildings

Inger Andresen

Chief Scientist SINTEF Building and Infrastructure,
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



The Research Centre on
Zero Emission Buildings



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



The Research Centre on
Zero Emission Buildings



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

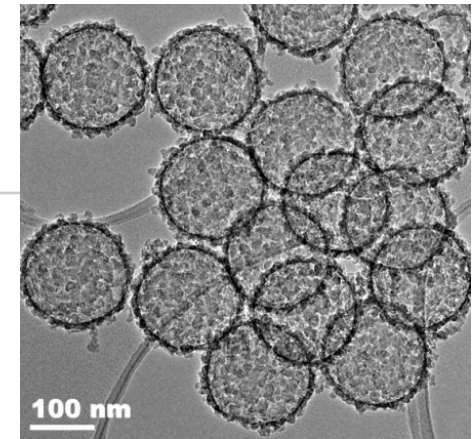
- Lavenergiprogrammet
- NBBL
- NVE
- Forbrukerrådet
- EcoBox
- Driftsforum
- Arkitektbedriftene

ZEB Research Activities

WP1 Advanced materials technologies



VIP Leca Isoblokk

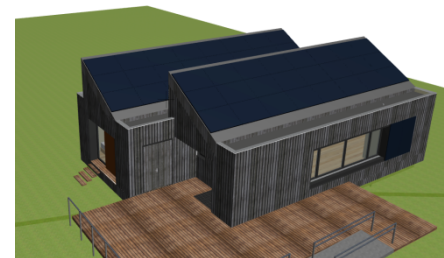


Nano insulation material

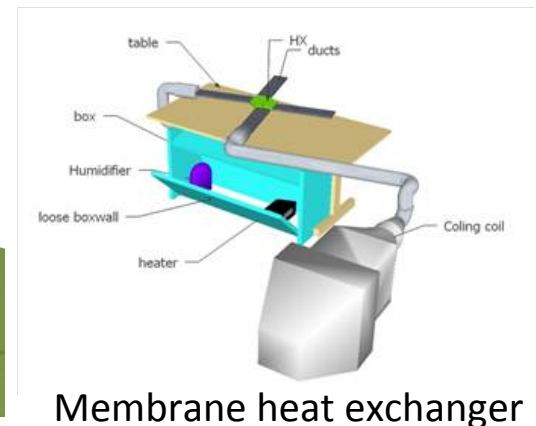
WP2 Climate-adapted low-energy envelope technologies

WP3 Energy supply systems and services

WP4 Use, operation, and implementation

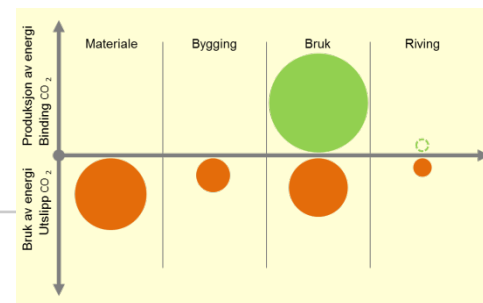


ZEB Living Lab



Membrane heat exchanger

WP5 Concepts and strategies and Pilot buildings



ZEB Definition

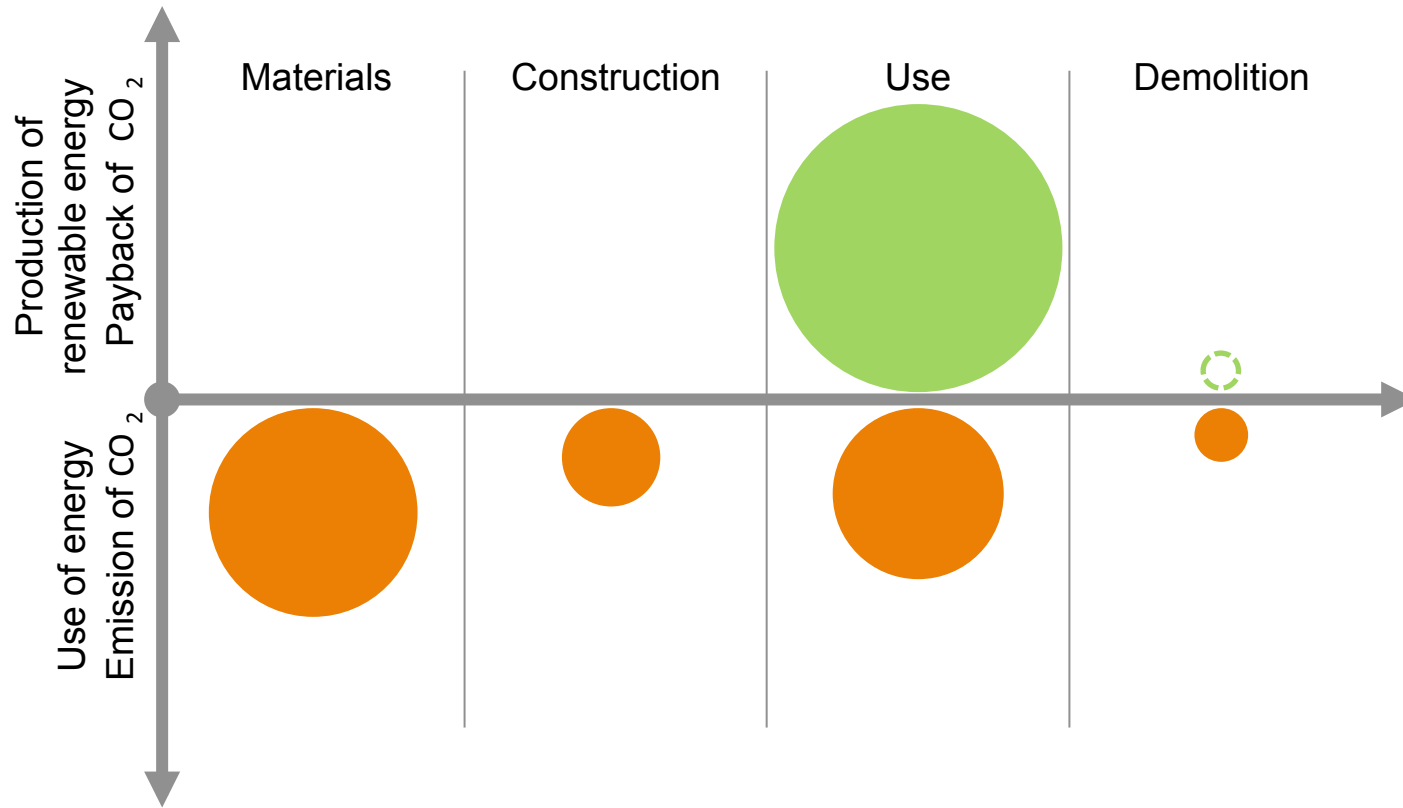
ZEB Pilot buildings



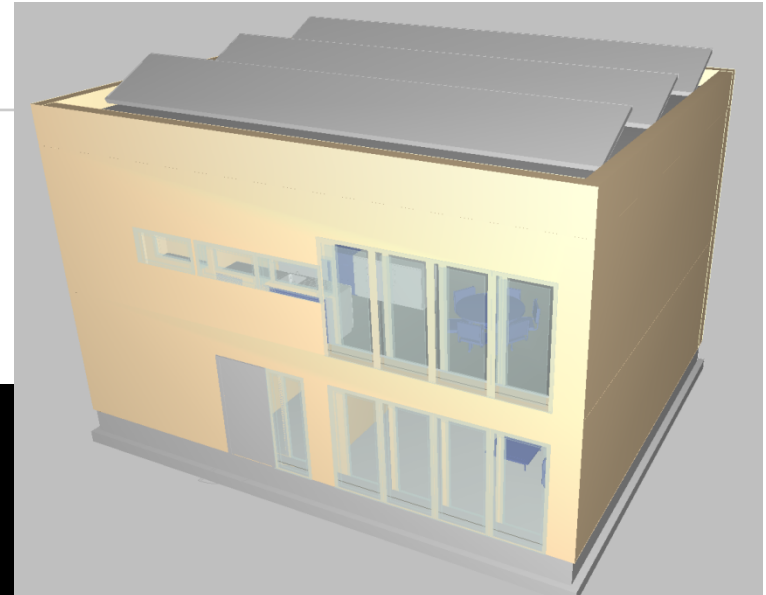
ZEB Pilot Buildings

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

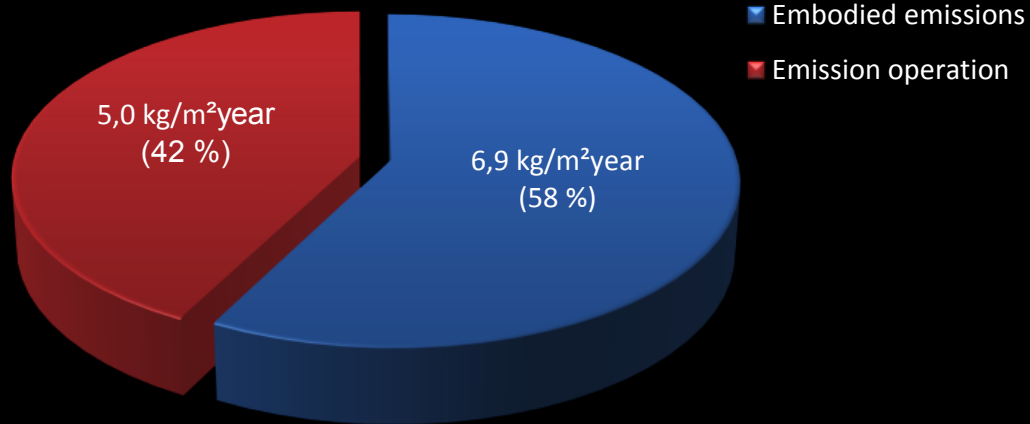
Zero Emission Building Definition



Concept Work - Dwelling



Embodied and operational emissions



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



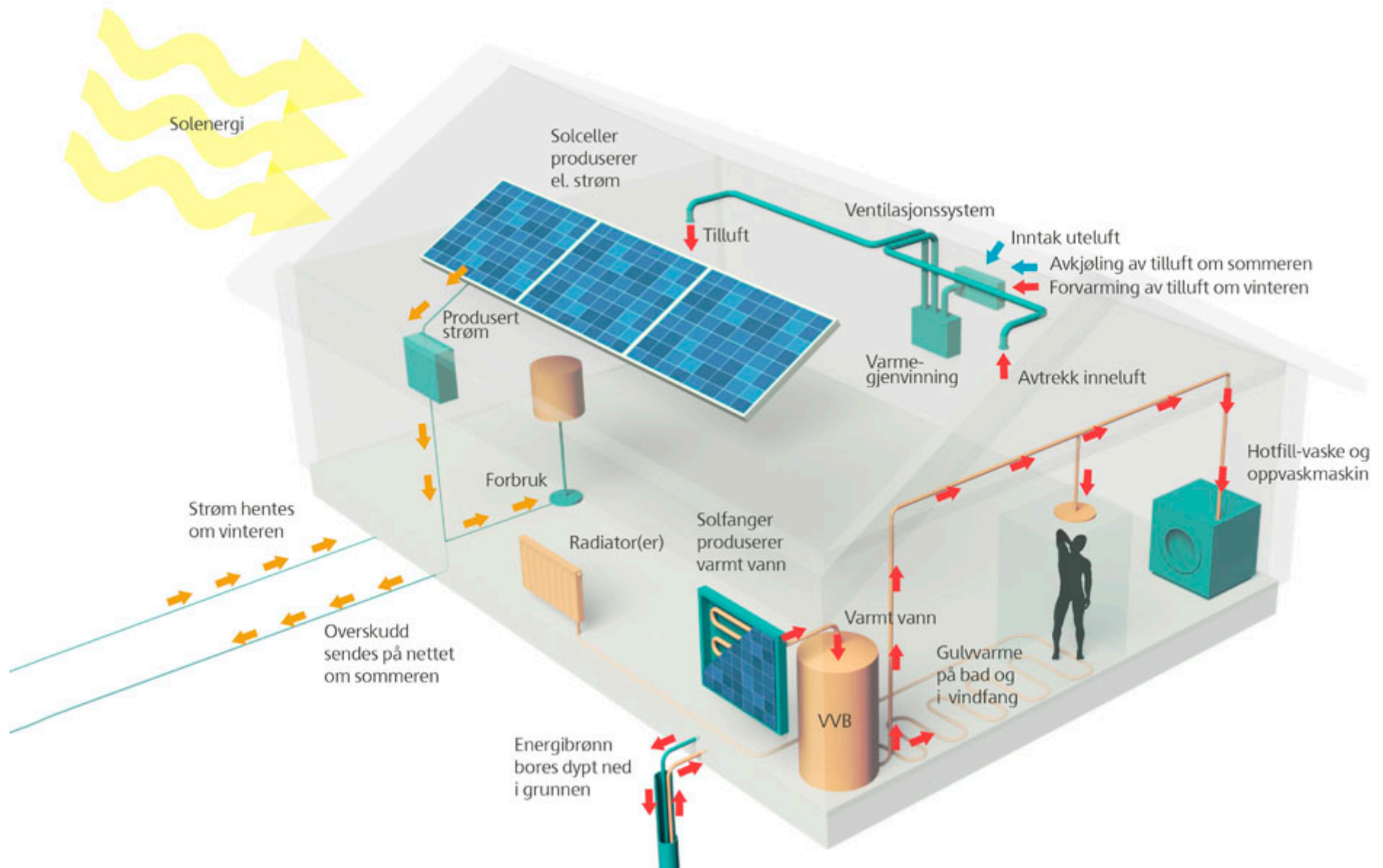
The Research Centre on
Zero Emission Buildings



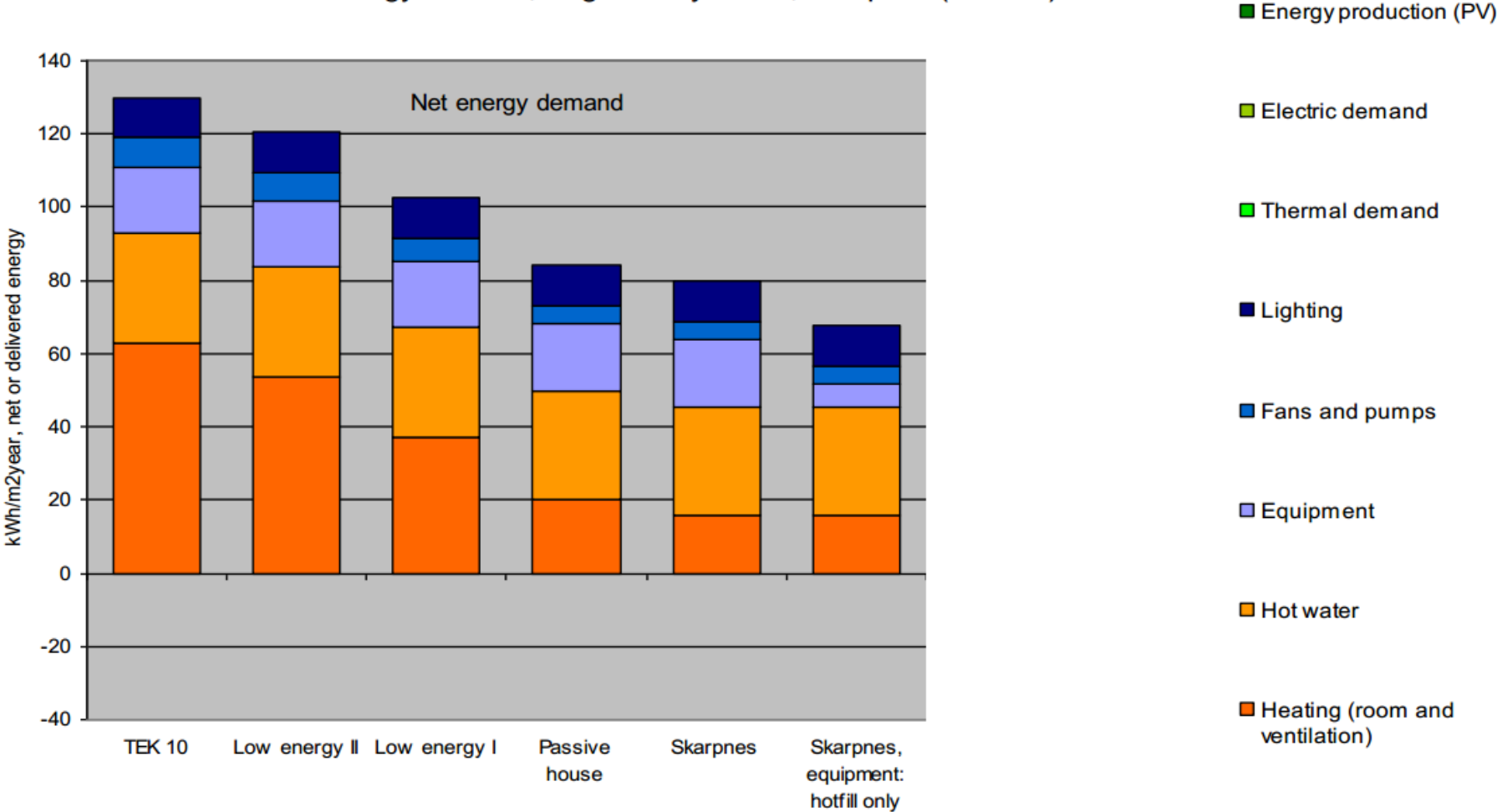


The Research Centre on
Zero Emission Buildings





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



The Research Centre on Zero Emission Buildings





Foto: I. Andresen, 21.11.2014

ZEB Pilot Building: Powerhouse Kjørbo, Sandvika

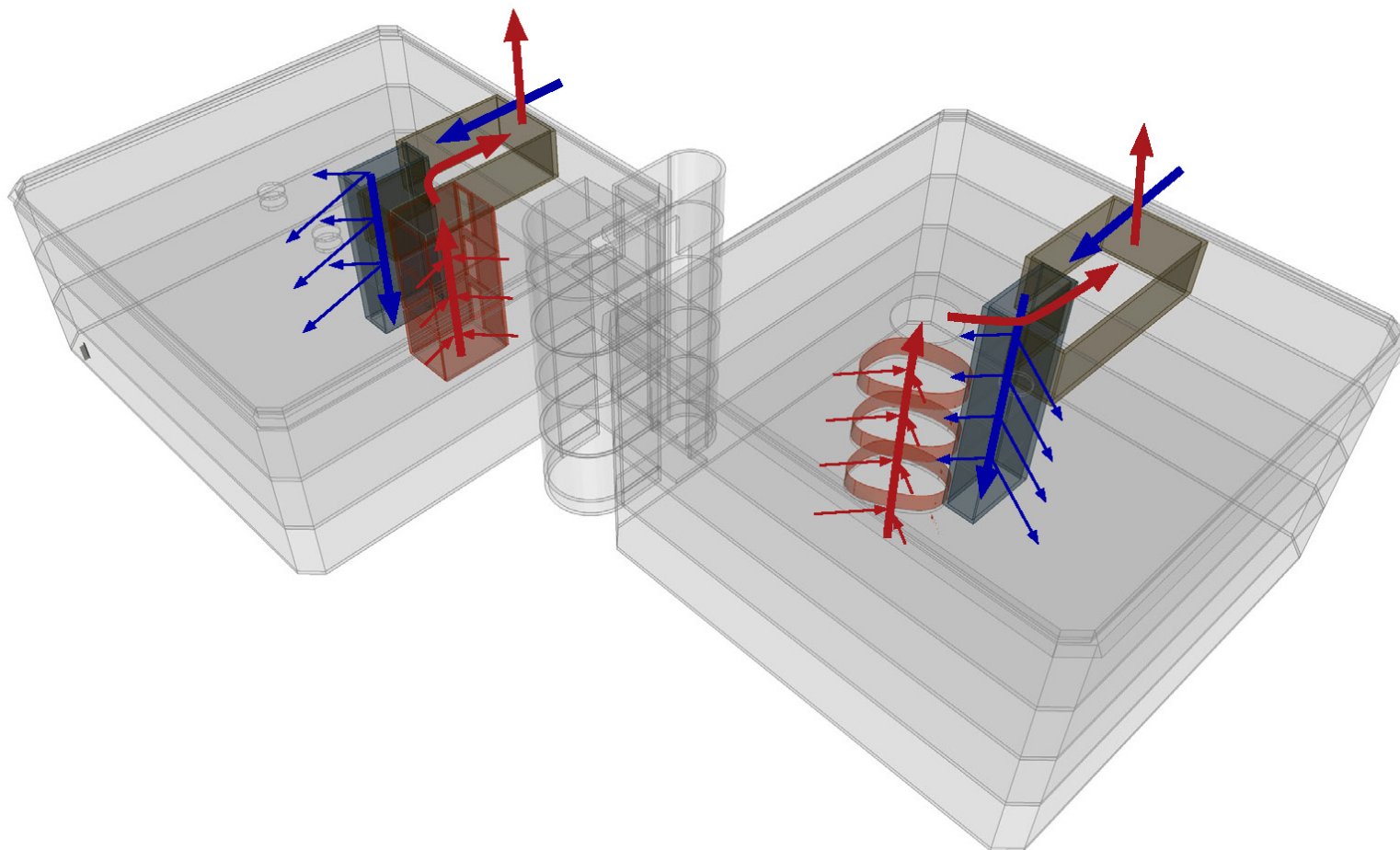


Illustrasjon: Snøhetta/MIR



The Research Centre on
Zero Emission Buildings





The Research Centre on
Zero Emission Buildings











Foto: Caroline Drefvelin



Multikomfort Larvik - demonstration home

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



The Research Centre on
Zero Emission Buildings





The Research Centre on
Zero Emission Buildings



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

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

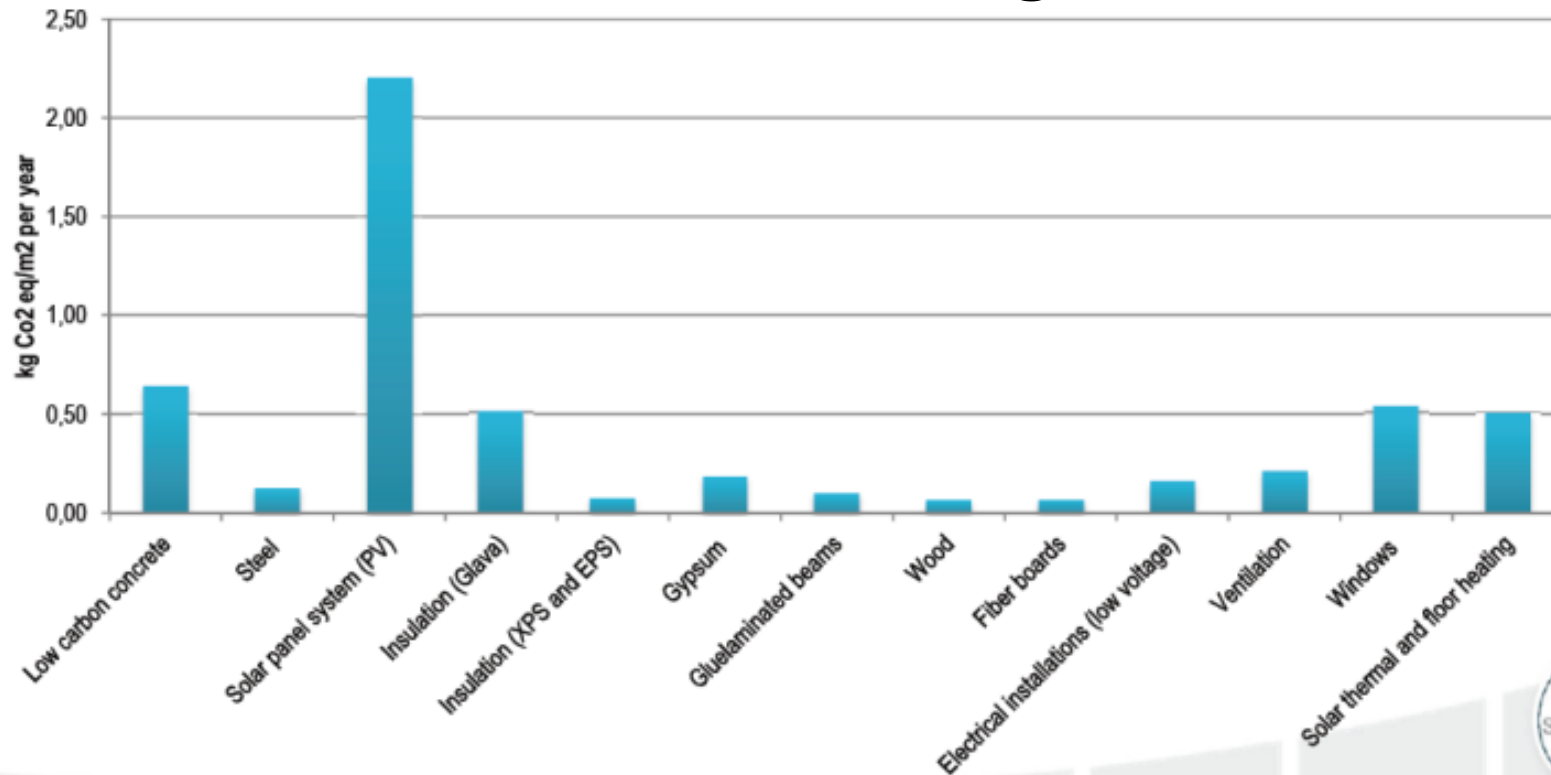


The Research Centre on
Zero Emission Buildings



Multikomfort Larvik - demonstration home

Material usage



 BRØDRENE DAHL



www.dahl.no



The Research Centre on
Zero Emission Buildings



A Zero Emission Neighbourhood Development at Ådland, Bergen

Developer: Bybo AS
Architect: Snøhetta
Illustration: MIR/Snøhetta



The Research Centre on
Zero Emission Buildings



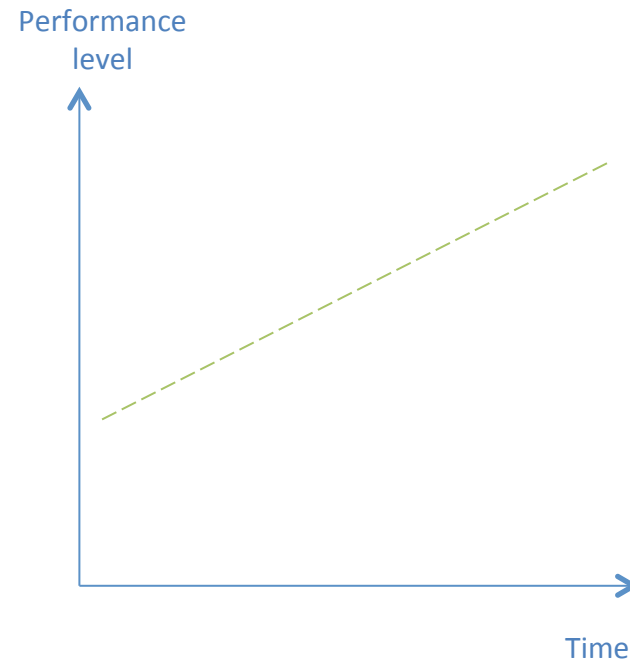


The Research Centre on
Zero Emission Buildings

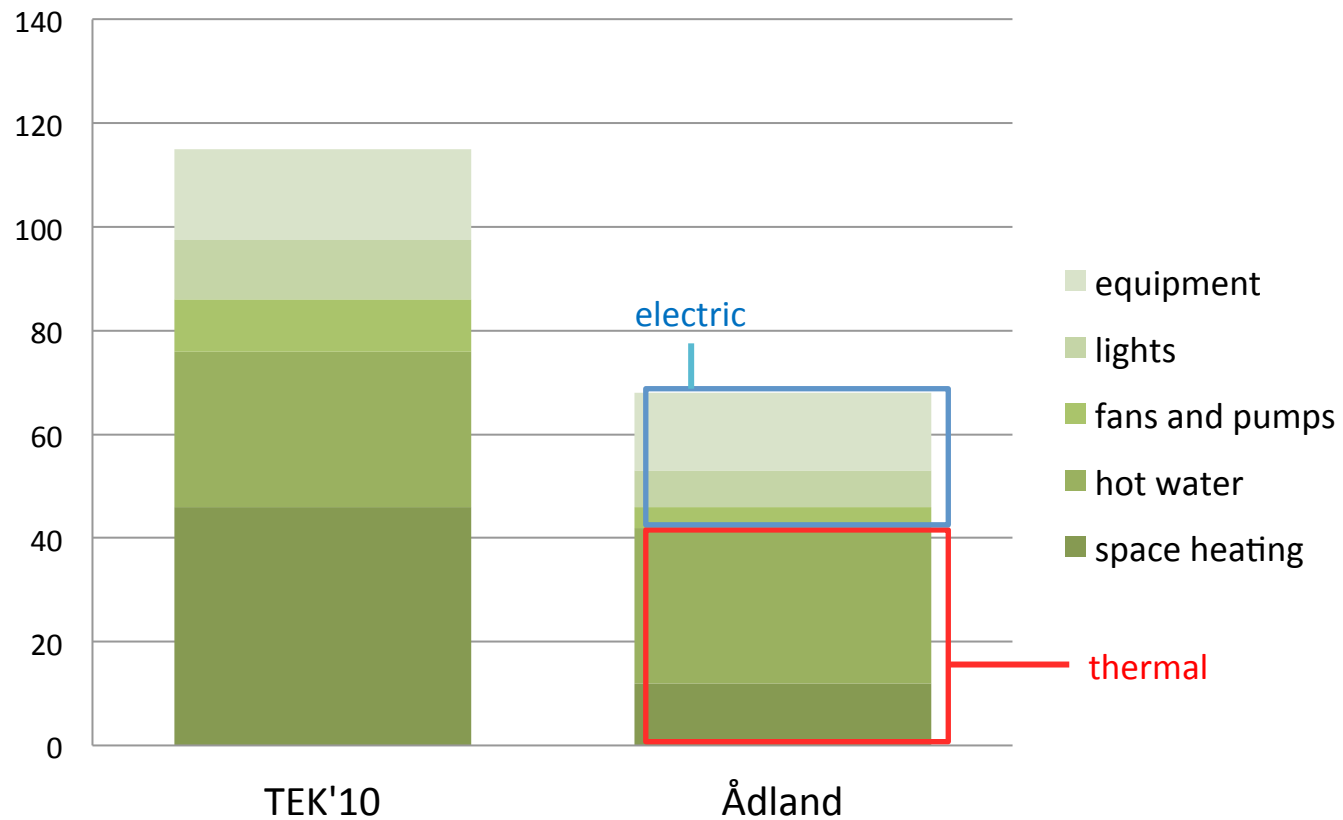


ZEB Challenges for Zero Village Bergen

- 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]



Energy concepts - 1st proposal

Alternative 1

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

Energy supply systems

Thermal solar collectors
Ground source heat pump
Photovoltaics

Alternative 2

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

Thermal solar collectors
Biogas based CHP
Photovoltaics



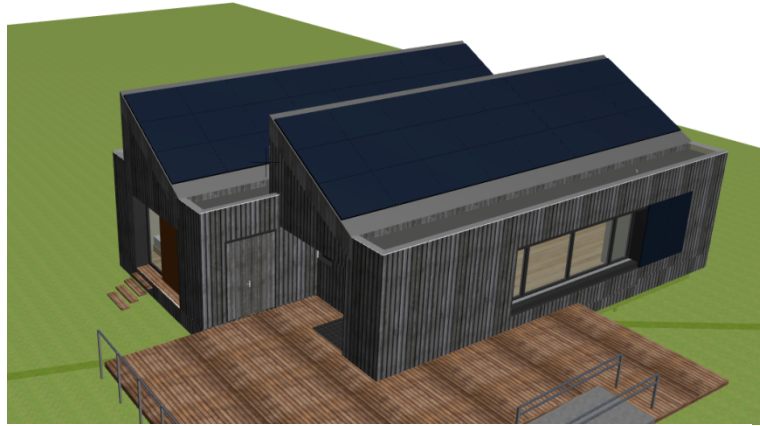
The Research Centre on
Zero Emission Buildings





Illustrasjon av bomiljøet i klyngetunet. Illustrasjon: Snøhetta

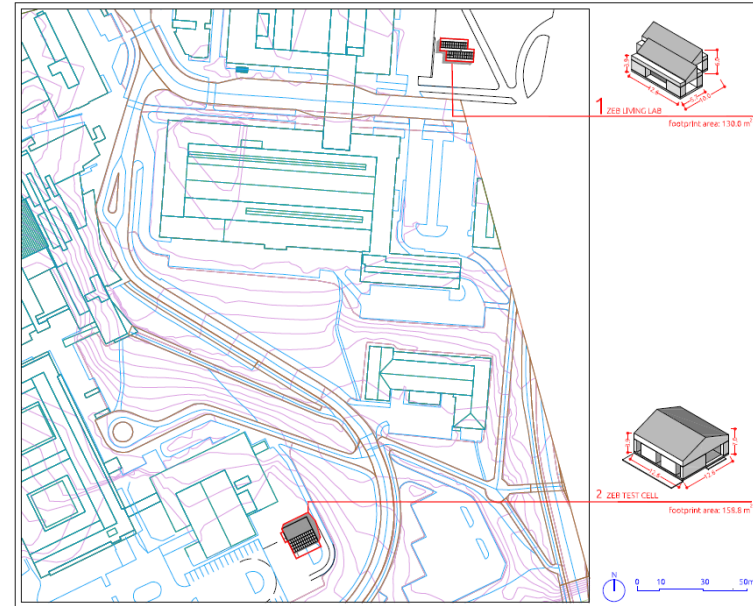
ZEB Living Lab and Research Cell



ZEB Living Lab – A dwelling for user-technology studies



ZEB Test Cell for testing av different technologies



The Research Centre on
Zero Emission Buildings



Thank you for your attention

Contact:

inger.andresen@ntnu.no

