Centre for Environment-friendly Energy Research (CEER/FME)

Zero Emission Buildings (ZEB)

FORSKNINGS-
SENTER FOR
MILJØVENNLIG
ENERGI

The Research Centre on Zero Emission Buildings

In February 2009, the Research Council of Norway assigned The Faculty of Architecture and Fine Art at NTNU to host one out of eight new national Centers for Environment-friendly Energy Research (FME):

Zero Emission Buildings (ZEB).

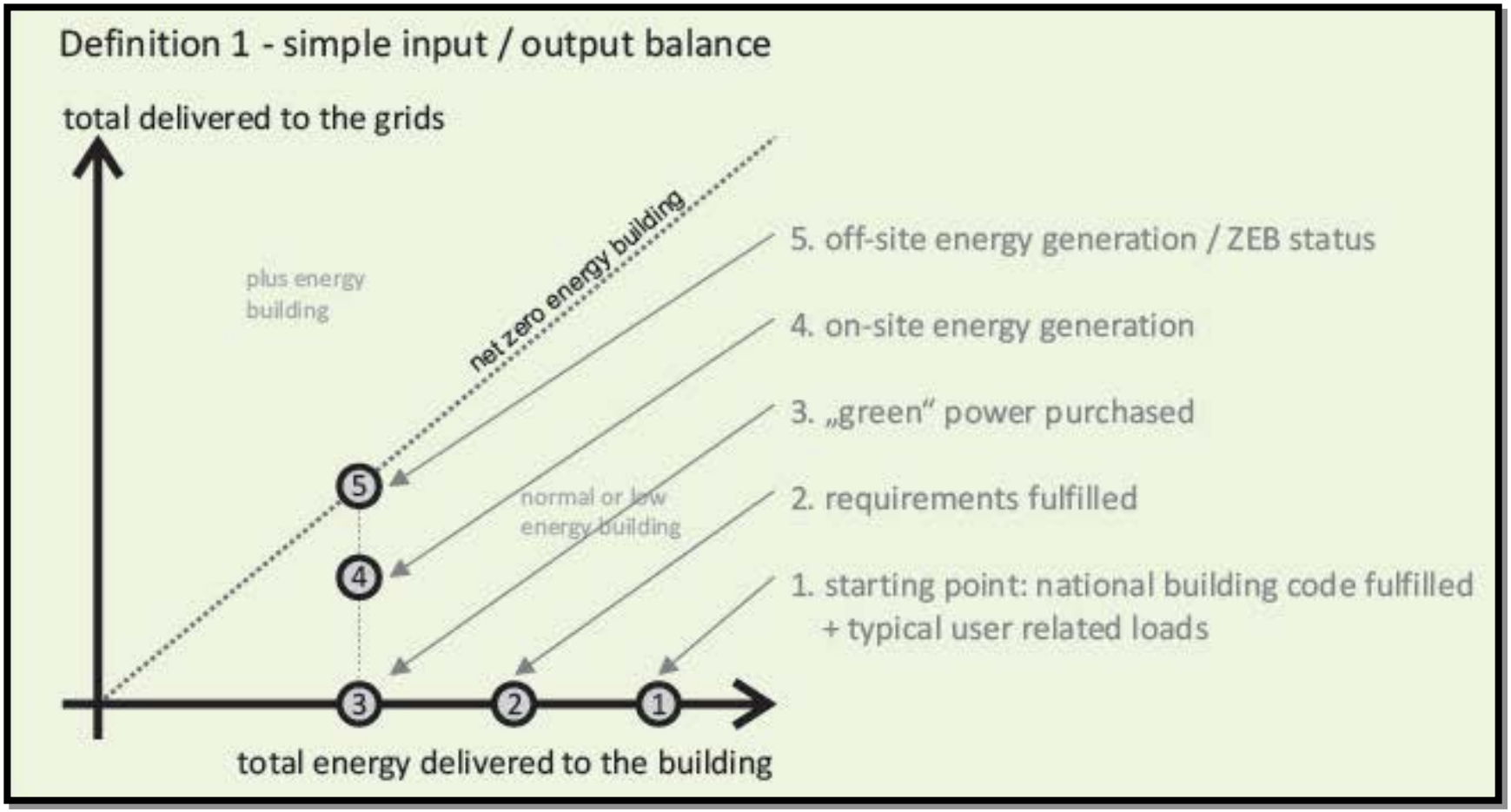
The Research Centre leadership is shared between
NTNU (The Faculty of Architecture and Fine Art) and
SINTEF (Building and Infrastructure).
Duration: 2009 – 2016
Budget: 300 mill NOK
(about 38 mill EUR)

Buildings – energy and emissions

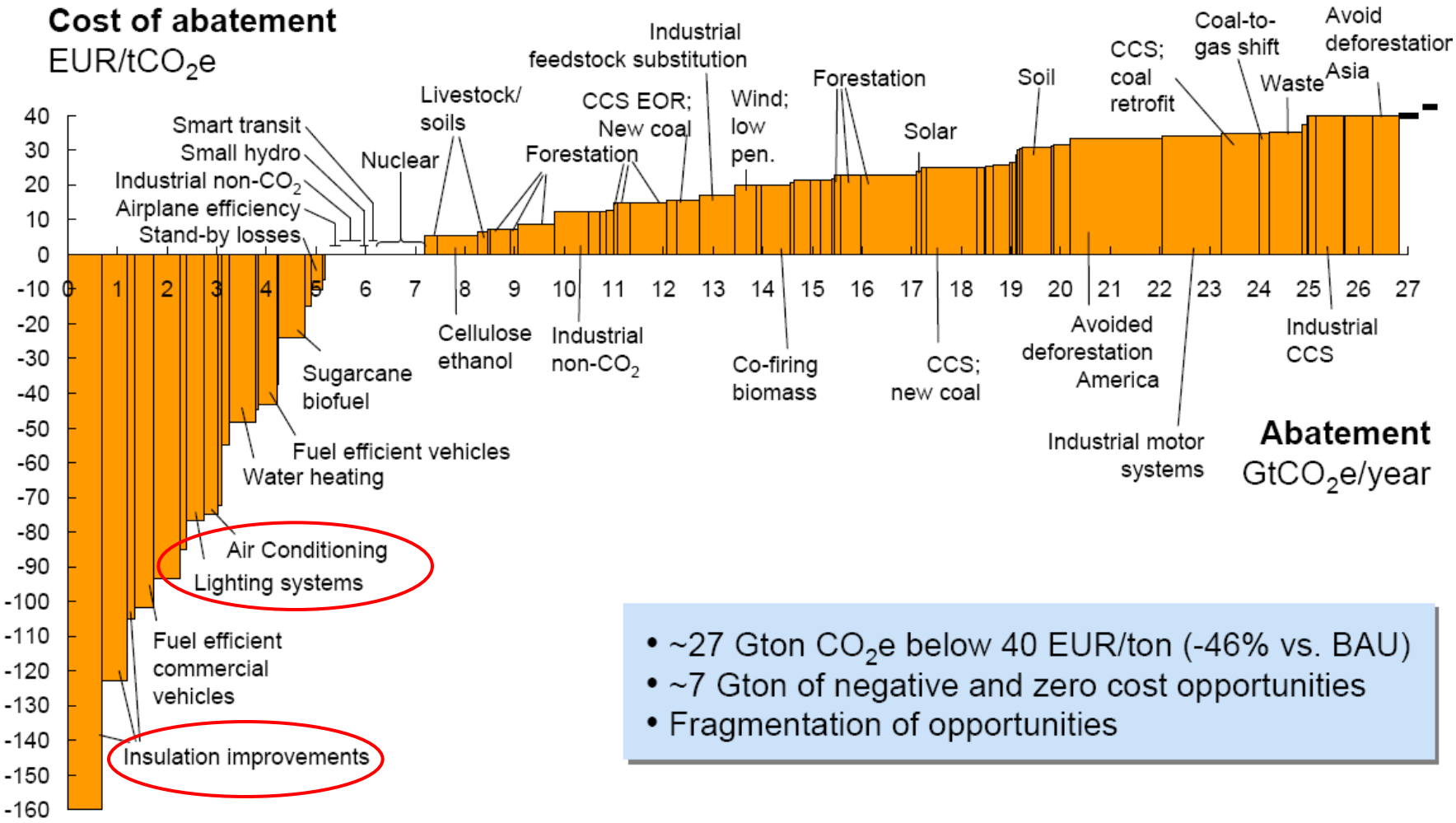
- Operation of buildings consume around 40% of total energy use in industrialised countries.
- Buildings in Norway consume around 50% of the electricity use
- GHG emissions from buildings depend on primary energy source for electricity and heat
- Buildings in Norway has lower GHG emissions than in most industrialised countries because of our hydro power electricity
- Growth in the Norwegian electricity use is associated with increased household and other building demand
- A Zero Emission Building will have to generate energy on-site to compensate for energy investments in materials and construction
- Hydro-power electricity saved in the building sector can replace GHG emission energy use in other sectors

What is a ”Zero Emission Building”?

No agreed definition available!



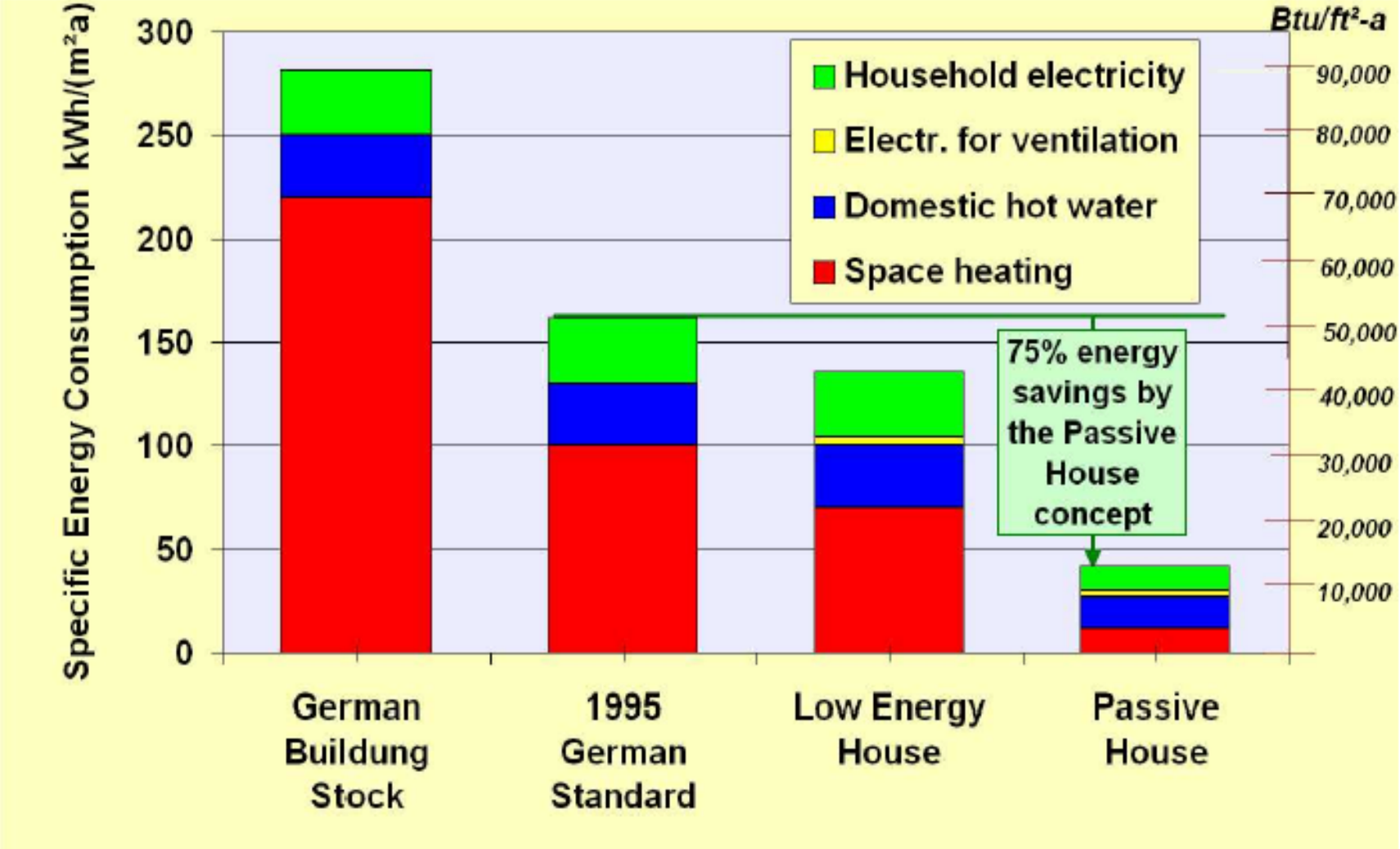
Energy Effiency – cheaper than new energy



- ~27 Gton CO_2e below 40 EUR/ton (-46% vs. BAU)
- ~7 Gton of negative and zero cost opportunities
- Fragmentation of opportunities

Cost for various GHG measures in 2030. Source: McKinsey (2009)

Low-Energy and Passive Design



From CEPHEUS final report, 2001

The ZEB vision and main objective

- The Centre's vision is to create a national research centre that will put Norway in the forefront with respect to research, innovation, and implementation within the field of energy efficient Zero Emission Buildings.

- The main objective of ZEB is to develop competitive products and solutions for existing and new buildings that will lead to market penetration of ZEB related to their production, operation and demolition.

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

Expertise

ZEB will include experts within *material science, building technology, energy technology, architecture and social science*. Strong industry involvement will put focus on finding cost-effective and competitive solutions.

ZEB will therefore encompass the whole value chain of market players within the Norwegian construction sector.

ZEB will also cooperate with international well-known research institutions with relevant activities

The expected volume of formally trained research personnel is 15 PhD-students, 5 post-doctoral fellows and at lest 50 MSc-students.

ZEB – a national team

- University and research institutions
- Producers of materials and products for the building industry
- Contractors, consultants, architects
- Trade organizations
- Public administration
- Property managers
- Users

The consortium

- **NTNU** - The Norwegian University of Science and Technology
  - Dept. of Architectural Design, History and Technology (host institution),
  - Dept. of Civil and Transport Engineering,
  - Dept. of Interdisciplinary Studies of Culture and
  - Dept. of Energy and Process Engineering.

- **SINTEF** (largest research institute in Scandinavia)
  - SINTEF Building and Infrastructure,
  - SINTEF Materials and Chemistry, and
  - SINTEF Energy Research

- **Skanska** (large building contractor and developer)
- **ByBo** (housing developer)
- **YIT** (technical installations contractor)

- **Snøhetta** (architect)
- **Multiconsult** (consulting company)

The consortium (cont.)

- **Norsk Hydro** (producer of aluminium products and solar systems)
- **Maxit** (building products producer/supplier)
- **Isola** (building products producer/supplier)
- **Glava** (producer of insulation materials)
- **Protan** (manufacturer of building materials)
- **Brødrene Dahl** (HVAC equipment supplier)

- **Forsvarsbygg** (defense property developer/owner)
- **Statsbygg** (state property developer/owner)
- **Husbanken** (state housing bank)

- **Byggenæringens landsforening** (Federation of Construction Industries) including **Byggevareindustriens landsforening** (Construction Products Association)
- **Norsk Teknologi** (Norwegian Technology; Confederation of companies within the technical sector)
- **Statens bygningstekniske etat** (National Office of Building Technology and Administration)

International cooperation:

International partners:

- VTT (Finland)
- Chalmers (Sweden)
- Fraunhofer (Stuttgart, Freiburg; Germany)
- TNO (The Netherlands)
- LBNL (USA)
- MIT (USA)
- University of Strathclyde (Scotland)
- Tsinghua University (China)

In addition, we are participating in several relevant IEA- and EU projects.

Several of our industry partners are also multi national companies and/or they have international partners.

ZEB Workplan

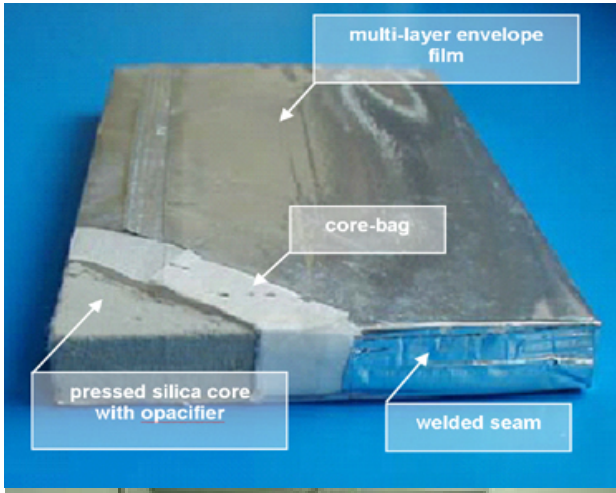
ZEB will focus its work in five areas that interact and influence each other:

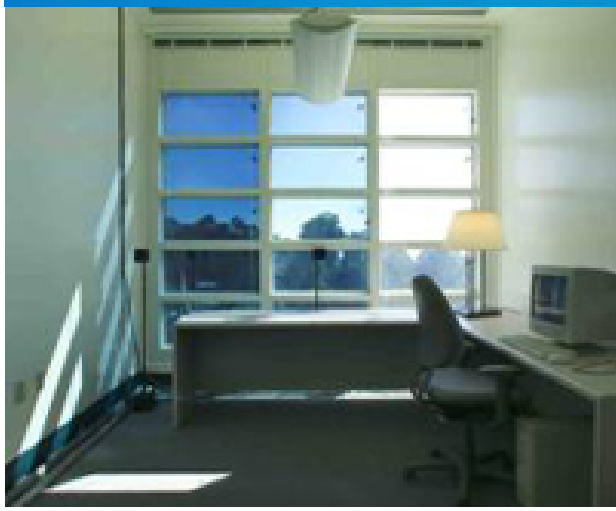
- WP-1: Advanced materials technologies
- WP-2: Climate-adapted low-energy envelope technologies
- WP-3: Energy supply systems and building services
- WP-4: Energy efficient use and operation
- WP-5: Concepts and strategies

WP1 - Advanced Materials Technologies

Main goal:

- Develop new and innovative materials and solutions, as well as improvements of the current state-of-the-art technologies
- Nano- and vacuum-technology will be important inputs





WP2 - Climate-adapted low-energy envelope technologies

Main goal:

- Develop climate adapted, verified and cost effective solutions for new and existing building envelopes (roofs, walls and floors) that will give a least possible heat loss and at the same time a reduced need of cooling.

WP3 - Energy supply systems and building services

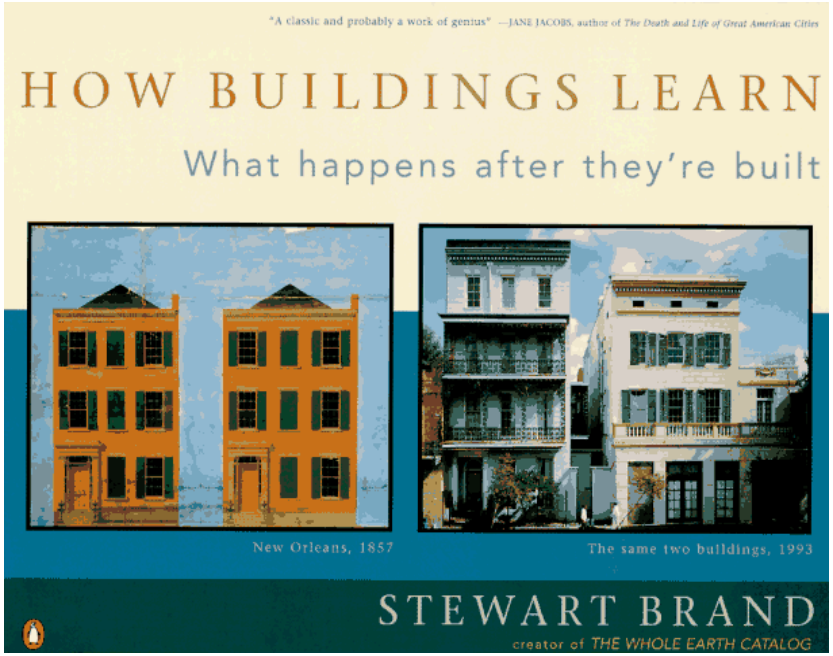
Main goal:

- Develop new solutions for energy supply systems and building services systems with reasonable energy and indoor environment performance appropriate for zero emission buildings.

WP4 - Use, operation, and implementation

Main goal:

- Provide knowledge and tools which assure usability and acceptance, maintainability and efficiency, and implementation of ZEBs.



WP5 - Concepts and strategies

Main goal:

- Develop concrete concepts for zero emission buildings which can be translated into realized pilot buildings within the time frame of the Centre.

Contact persons

- **Centre Director : Professor Anne Grete Hestnes**,
  - NTNU, Dept. of Architectural Design, History and Technology
- **Centre Manager: Research Manager, PhD, Marit Thyholt**,
  - SINTEF Building and Infrastructure.

- WP-1 Leader: Professor, PhD Arild Gustavsen, NTNU
- WP-2 Leader: Senior researcher, PhD Berit Time, SINTEF
- WP-3 Leader: Professor, PhD Vojislav Novakovic, NTNU
- WP-4 Leader: Associate Professor, PhD Thomas Berker, NTNU
- WP-5 Leader: Senior researcher, PhD Tor Helge Dokka, SINTEF

- Centre Industry Liaison: Vice President Terje Jacobsen, SINTEF
- Centre European Research Contact: Professor Øyvind Aschehoug, NTNU

www.zeb.no

Zero Emission Building?

…is this the one?

Press release

All new buildings to be zero energy from 2019 say MEPs

All buildings built after 31 December 2018 will have to produce as much energy as they consume on-site, says the European Parliament, amending the 2002 Energy Performance of Buildings Directive. MEPs also call for more public investments in energy-efficient buildings. The legislative report was adopted by 549 votes in favour, 51 votes against and 26 abstentions.

By 31 December 2018 at the latest EU Member States must ensure that all newly-constructed buildings produce as much energy as they consume on-site - e.g. via solar panels or heat pumps, says a report drawn up by Silvia-Adriana **Ticău** (PES, RO). The Commission proposal did not include any specific target dates for zero-energy buildings.

Parliament also wants Member States to set intermediate national targets for existing buildings, i.e. to fix minimum percentages of buildings that should be zero energy by 2015 and by 2020 respectively.

MEPs define zero-energy buildings as buildings "where, as a result of the very high level of energy efficiency of the building, the overall annual primary energy consumption is equal to or less than the energy production from renewable energy sources on site". By the end of 2010, the Commission should establish a detailed common European definition of "net zero energy buildings", states the amended directive.