Federal Ministry of Economics and Technology

BUILDING FOR THE FUTURE

SECOND GERMAN-NORWEGIAN

CONFERENCE ON ENERGY EFFICIENCY IN BUILDINGS

THON HOTEL OPERA, OSLO

19.04.2010

ENERGY EFFICIENCY made in Germany

Zero Emission Buildings

- the Norwegian Approach

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FME-ZEB: Zero Emission Buildings

In February 2009, the Research Council of Norway assigned The Faculty of Architecture and Fine Art at NTNU to host one of eight new **national Centres for Environment-friendly Energy Research** (FME): **Zero Emission Buildings** (ZEB).

Duration: 2009 – 2016
Budget: approximately 38 mill Euro (300 mill NOK)

The Research Centres for Environment-friendly Energy Research (FMEs):

- Norwegian Centre for Offshore Wind Energy (CMR)
- BIGCCS Centre – International CCS Research Centre (SINTEF Energy)
- Subsurface CO2 storage – Critical Elements and Superior Strategy (CMR)
- Research Centre for Offshore Wind Technology (SINTEF Energiforskning)
- Centre for Environmental Design of Renewable Energy (SINTEF Energiforskning)
- The Norwegian Research Centre for Solar Cell Technology (IFE)
- Bioenergy Innovation Centre (UMB)
- The Research Centre on Zero Emission Buildings (NTNU)

The FME-ZEB goal:

The main objective of ZEB is to develop competitive products and solutions for ***existing and new buildings*** 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.**

Expertise in the ZEB Centre

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 and universities with relevant activities.

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

ZEB Consortium

- **NTNU** (The Norwegian University of Science and Technology).
- **SINTEF** (the largest research institute in Scandinavia).
- **Skanska** (large building contractor and developer)
- **ByBo** (housing developer)
- **Maxit** (building products producer/supplier)
- **Isola** (building products producer/supplier)
- **Glava** (producer of insulation materials)
- **Protan** (manufacturer of building materials)
- **DuPont** (building products producer/supplier)
- **Norsk Hydro** (producer of aluminium products and solar systems)
- **YIT** (technical installations contractor)
- **Brødrene Dahl** (HVAC equipment supplier)*:*
- **Multiconsult** (consulting company)
- **Snøhetta** (architect)
- **Forsvarsbygg** (state 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 and technological sector)
- **Statens bygningstekniske etat** (National Office of Building Technology and Administration)

Other institutions cooperating with ZEB:

International partners:

- VTT (Finland)
- Chalmers (Sweden)
- Fraunhofer (Germany)
- TNO (The Netherlands)
- LBL (USA)
- MIT (USA)
- University of Strathclyde (Scotland)
- Tsinghua University (China)

The reference group:

- Lavenergiprogrammet
- NBBL
- NVE
- Forbrukerrådet
- EcoBox
- Driftsforum
- Enova

In addition, we are actively involved in a number of IEA projects within the SHC and ECBCS programmes (Tasks 40, 41, 42,…, Annex 53,..), as well as in a number of EU and Nordic research projects.

ZEBs introduced in many countries:

1. Energy Policy and Industry Goals

USA: „The *Building Technologies Program* outlines the technology portfolio and activities that are necessary to **achieve our strategic goal of net-zero energy buildings** (ZEB) at low incremental cost **by 2025**."

[http://www.eere.energy.gov/buildings/about/, 01/2007]

UK: „The objective of the proposal is to set a timetable for moving towards **zero carbon development** as a contribution to meeting the UK target to reduce carbon emissions by 60% by 2050. "

[Department for Communities and Local Government, 13th December 2006 press release]

Canada: „ The **Equilibrium House Initiative** aims the community-scale demonstration of 1,500 Net Zero Energy Houses by 2010 and all new houses to be Net Zero by 2025" [http://www.cmhc.ca]

Austria: "Vision 2050 on energy in buildings: The building stock of the year 2050 should be in total over the entire life cycle (involves the production and operation of the building) **free of any carbon emissions**.

[http://www.e2050.at/pdf/energie_gebauede.pdf]

Netherlands: „In the Netherlands, the government and the construction sector aim at achieving **energy neutral new construction in 2020**.

[Chiel Boonstra, Trecodome]

Germany: „From current point of view future capable buildings are buildings architectural demanding with high user comfort, minimal primary energy demand, optimized technology equipment, meaningful integration into larger energy supply systems as well as altogether economic energy demand cover. **Zero emission houses are the long-term objective**."

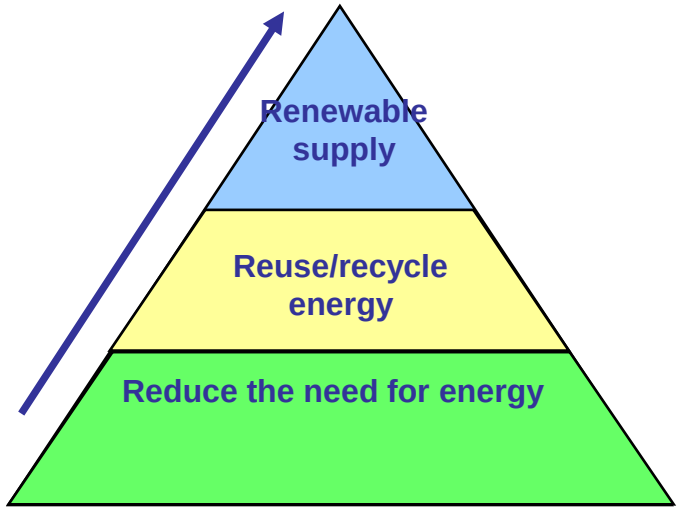
[„Das 5. Energieforschungsprogramm der Bundesregierung", BMWA, 07/2005]

Source: Karsten Voss, Wuppertal University.

Near ZEB in new EPBD

- Recast of the Energy Performance of Buildings Directive (Bygningsenergidirektivet): *All buildings built after 31 December 2019 will have to be near zero energy buildings*
- Norwegian goal: all new buildings from 2020 shall have passive house standard

Our strategy: Trias Energetica

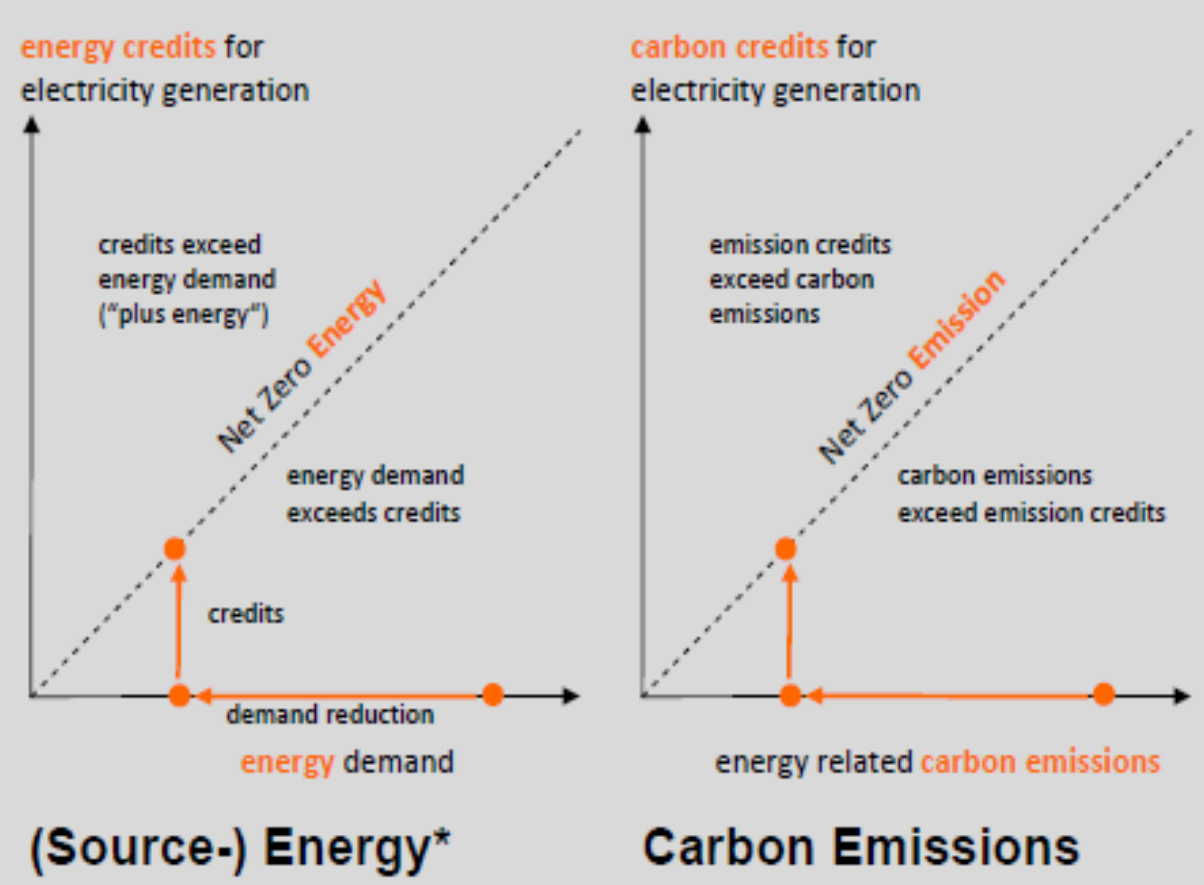


Source: Lechner, Lysen, etc.

The most environmentally friendly kWh is the one that is not used!

5.1 Definition of Zero Emission Buildings

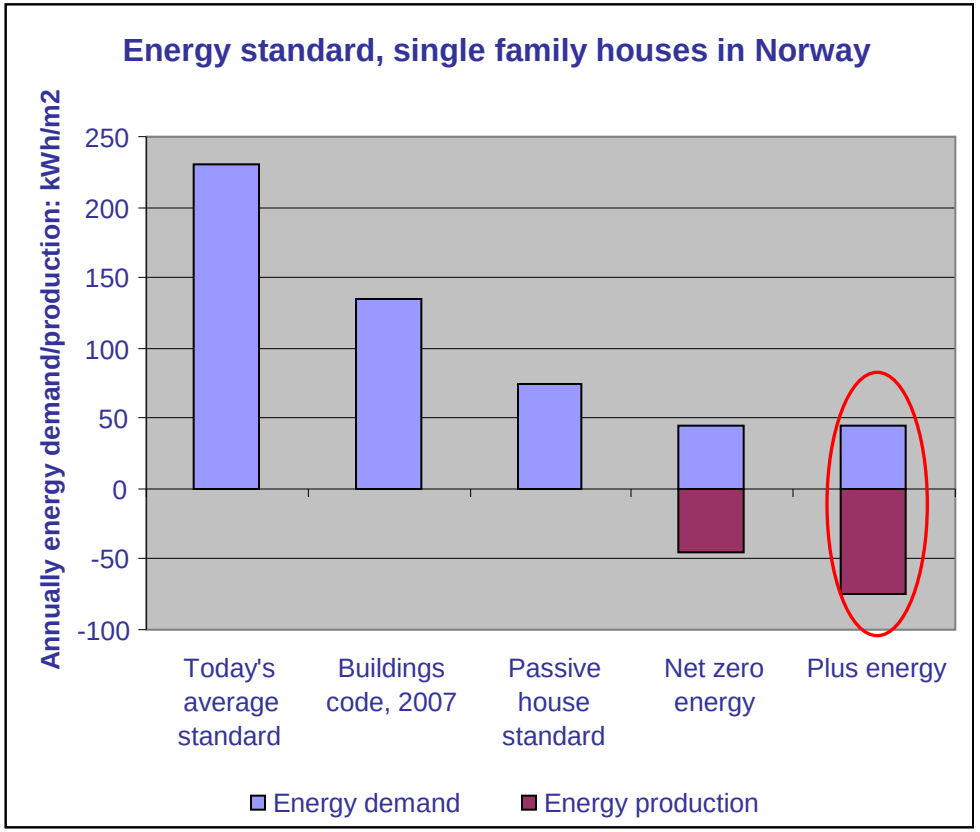
Example: ”the balance principle”



Source: University Wuppertal, School of Architecture, Building Physics and Technical Building Services. Prof. Karsten Voss

Our challenge:

Compensate for CO_2 emissions from the production of materials and construction by producing more energy than the building uses for operation.



Source: SINTEF Byggforsk

The ZEB research activities

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 services
- WP-4: Use, operation, and implementation
- WP-5: Concepts and strategies

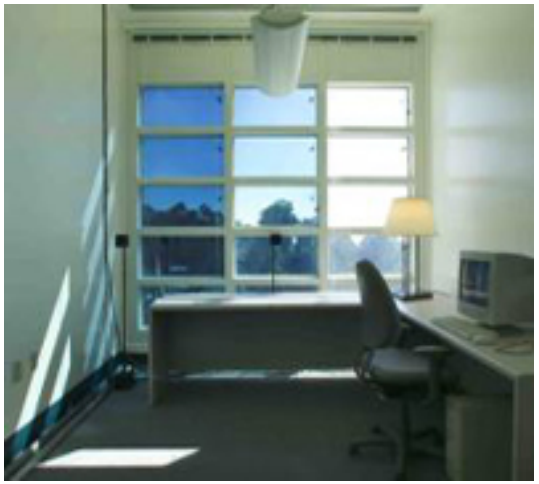
WP1 - Advanced material technologies

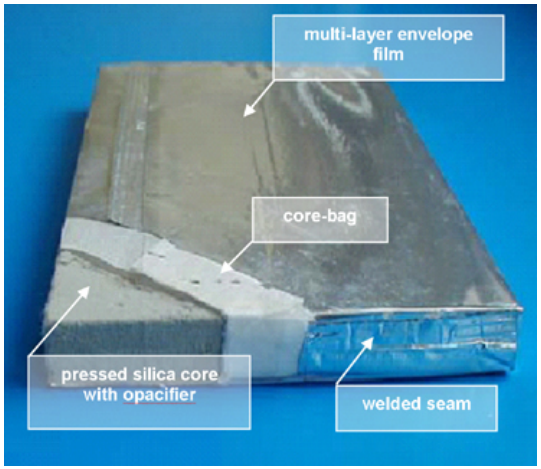
Main goal:

Development of new and innovative materials and solutions, as well as improvements of the current state-of-the-art technologies

Subtasks:

- 1.1: New concepts
- 1.2: Opaque and transparent solutions
- 1.3: Controllable materials and solutions
- 1.4: Energy storage solutions
- 1.5: Energy converting materials and solutions





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 the least possible heat loss and at the same time a reduced need for cooling.

Subtasks:

- 2.1: Optimal thermal performance
- 2.2: Integration of active elements in the building envelope
- 2.3: Daylight and solar shading systems
- 2.4: Development of windows and glazing systems

WP3 - Energy Supply Systems and 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.

Subtasks:

- 3.1: Available technologies for renewable energy
- 3.2: Interaction between user needs, energy supply, and building services
- 3.3: Integration of technologies and solutions
- 3.4: High performance building services
- 3.5: Test and pilot buildings - Follow up

Roof top wind turbines
Source: K.Voss

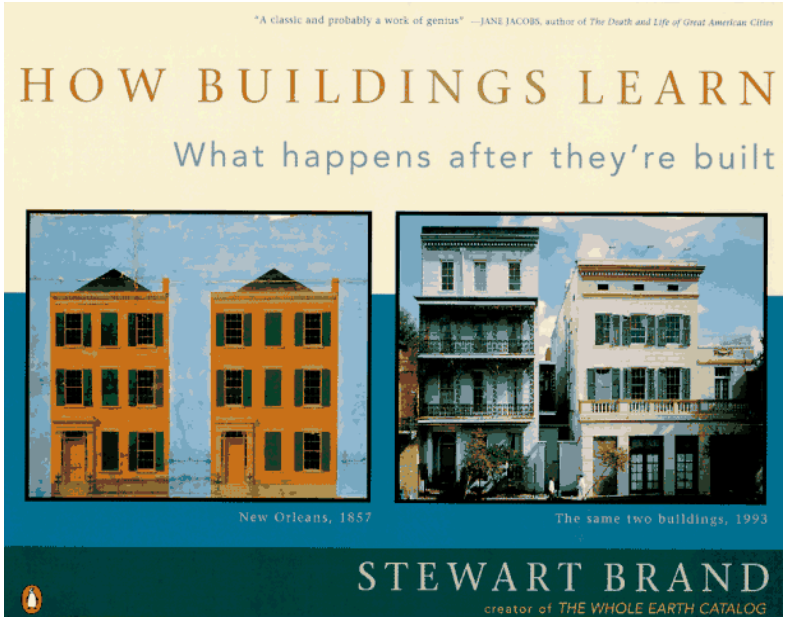
WP4 - Use, operation, and implementation

Main goal:

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

Subtasks:

- 4.1: Use
- 4.2: Operation
- 4.3: Implementation



WP5 - Concepts and strategies for ZEBs

Main goal:

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

Subtasks:

- 5.1: Definitions of ZEBs
- 5.2: ZEB concepts
- 5.3: Pilot buildings
- 5.4: Strategies and building processes

The ZEB Research Centre

Management:

Centre Director: Professor Anne Grete Hestnes, NTNU

Centre Manager: Research director Terje Jacobsen, SINTEF Buildings and Infrastructure

Work Package Leaders:

WP1: Professor Arild Gustavsen, NTNU

WP2: Research manager Berit Time, SINTEF

WP3: Professor Vojislav Novakovic, NTNU

WP4: Associate professor Thomas Berker, NTNU

WP5: Senior researcher Tor Helge Dokka, SINTEF

EU contact:

Professor Øyvind Aschehoug, NTNU

www.zeb.no

ZEB conference 7 - 8 June, 2010

www.sffe.no/conference

Renewable Energy Research Conference

Trondheim, Norway, June 7th-8th 2010

NTNU SINTEF IFE

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- Call for abstracts
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Renewable energy beyond 2020

Trondheim, Norway, June 7th - 8th 2010

The Centre for Renewable Energy welcomes you to Norway's largest research conference on renewable energy.

The Renewable Energy Research Conference is a scientific conference that focuses on renewable energy technologies. The conference represents an opportunity for making new contacts and to get an update on the ongoing research within various fields of renewable energy. In addition to interesting lectures on general issues concerning renewable energy, there will be detailed scientific parallel sessions within wind power, solar cells, hydropower, bioenergy, transport, ocean energy, zero emission buildings, as well as societal aspects of energy production and utilization.

The conference's target group are researchers in universities, research institutions and research intensive industry in Norway and other European countries.

The registration has now opened!

Updated 07.05.2010 . Centre for Renewable Energy © 2010

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