The Norwegian ZEB definition
and lessons learnt from nine pilot zero emission building projects

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www.fmezen.no
www.zeb.no
The ZEB Definition
A Zero Emission Building is a building that over its life time compensates for all greenhouse gas emissions related to production, construction and operation of the building.
Functional unit: kg CO$_2$-equivalents per m$^2$ heated floor area per year over a life time of 60 years.
ZEB definition – ambition levels

Greenhouse gas emissions

ZEB-O÷EQ
- Energy for operation*
- Emissions from materials
- Energy for equipment**
- Emissions from construction
- Energy for heating, cooling, ventilation, DHW, and lighting
- Energy for white goods, IT, etc.

ZEB-O
- Energy for operation*
- Energy for operation*

ZEB-OM
- Emissions from materials
- Emissions from construction
- Emissions from end-of-life

ZEB-COM
- Emissions from materials
- Emissions from construction
- Emissions from end-of-life

ZEB-COME
- Emissions from materials
- Emissions from construction
- Emissions from end-of-life

*Energy for heating, cooling, ventilation, DHW, and lighting
** Energy for white goods, IT, etc.
The ZEB Pilot Buildings
Design process
Integrated design process

- Energy- and environment skills in from the beginning
- Specific goals and systematic plan for follow-up
- Culture of sharing and trust
- Solutions as part of a whole
ZEB – Design strategy

1) Reduce the demand
2) Use effective technologies
3) Utilize renewables
ZEB – strategies and solutions

Source: ‘Zero Emission Buildings’, Fagbokforlaget 2018
Construction process
Lessons learnt from the construction process

• Can be challenging to follow-up the material emission budget:
  – Changes, unforeseen challenges, decisions taken on-site, sub-contractors not on board

• Bring sub-contractors on board:
  – Transition from design phase: facilitator
  – Highlight the skills and knowledge development benefits for participants in such projects
Operation and use
Lessons learnt from the operation and use

- Quite good match between predicted and measured energy performance
- Good indoor environment
- Special care for non-professional users (residential buildings)

Predicted and measured energy performance for Powerhouse Kjørbo (office building, renovated)
Addressing the users

Berker: We need to address:

1) The level of end-user control
2) The level of complexity of systems
3) The need for information about correct use

Sources:
Thank you!