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From ZEB to ZEN

Matthias Haase

PhD, Senior Research Scientist
SINTEF Byggforsk | SINTEF Building and Infrastructure
+47-92260501

Visiting adress: Høgskoleringen 7B, NO-7465 Trondheim
www.sintef.no/byggforsk



Content

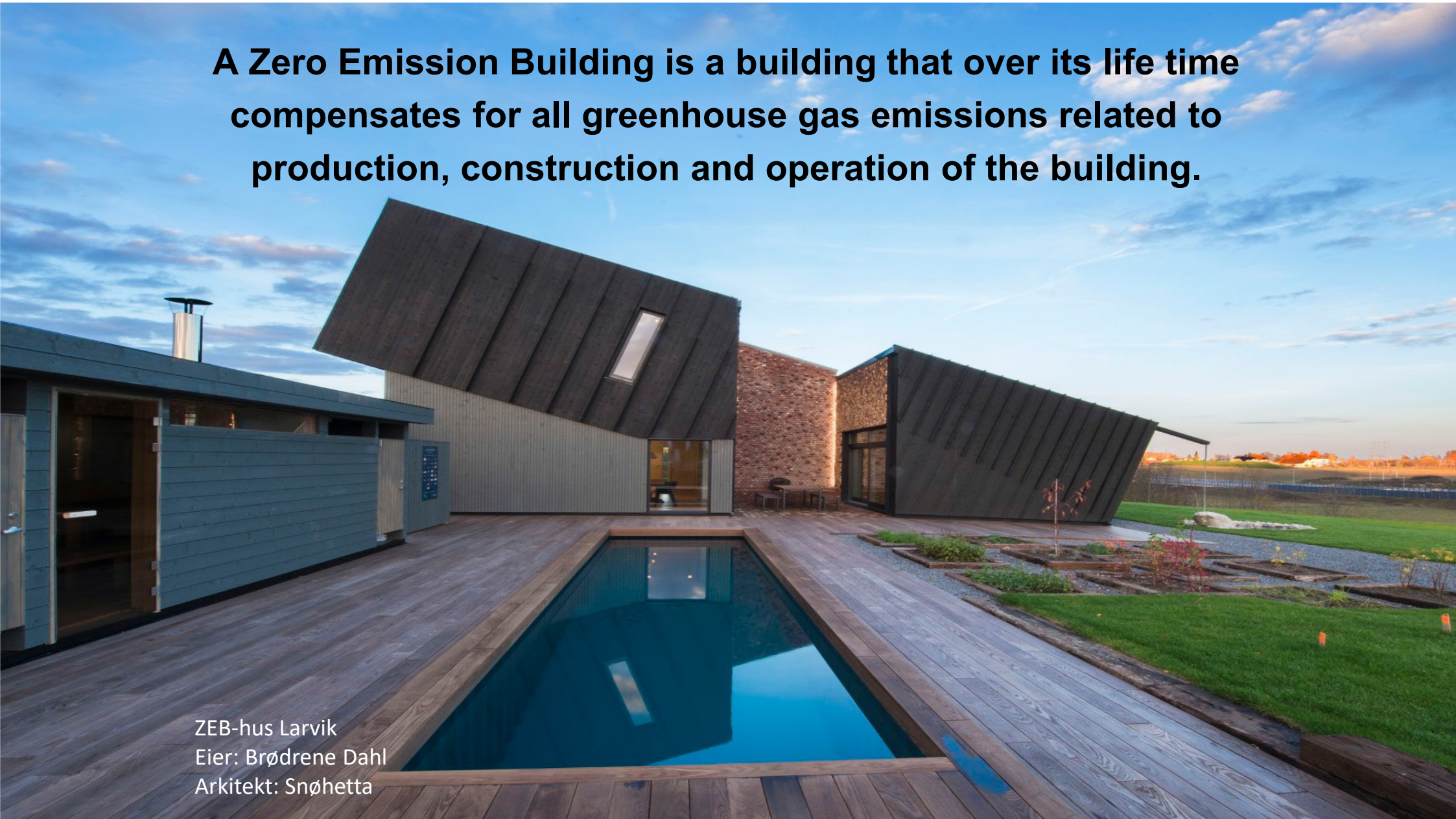
- Zero Emission Buildings
 - Definition
 - Pilots

- Zero Emission Neighborhoods
 - Work packages (related to Energy Master Planning)
 - Definitions (Pi-SEC)
 - Pilots

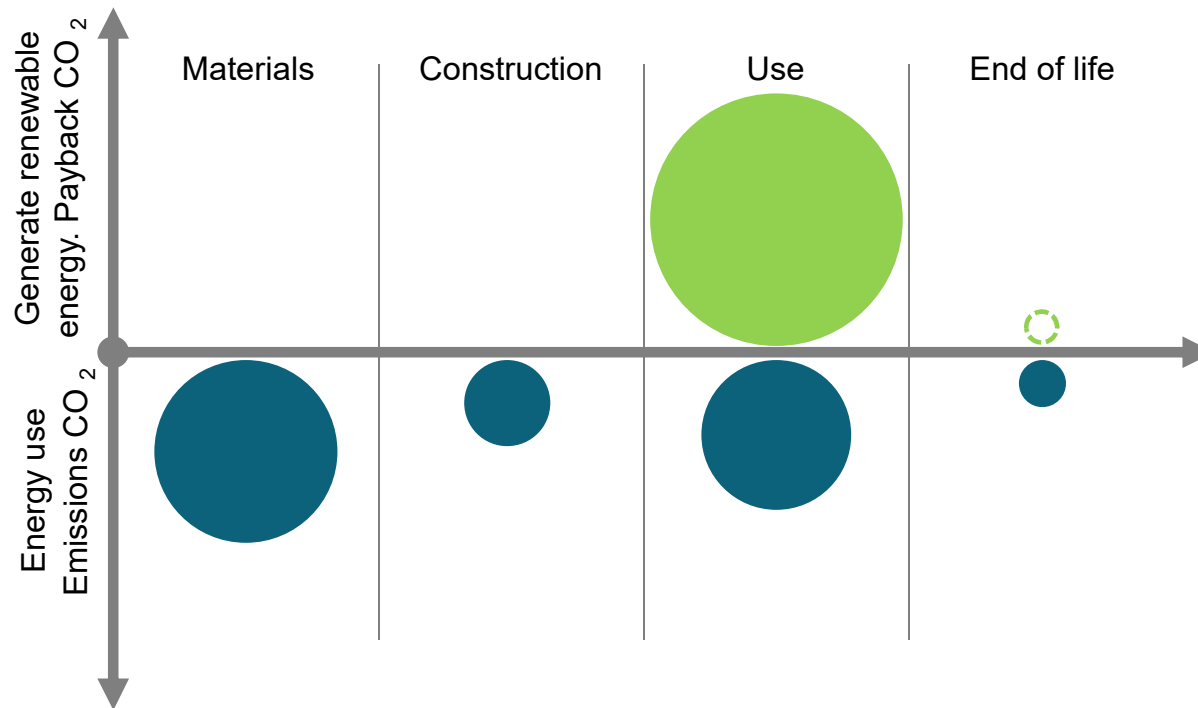
- Expose

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.

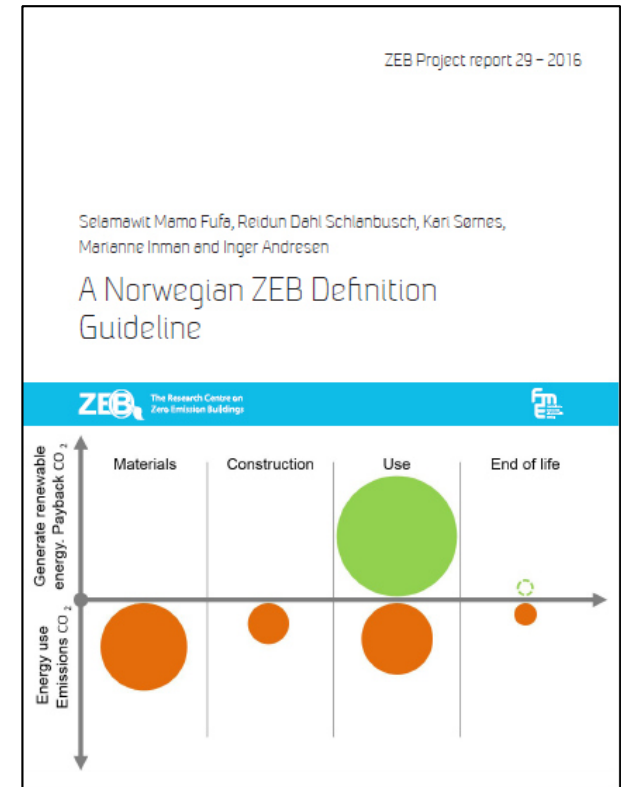
ZEB-hus Larvik
Eier: Brødrene Dahl
Arkitekt: Snøhetta



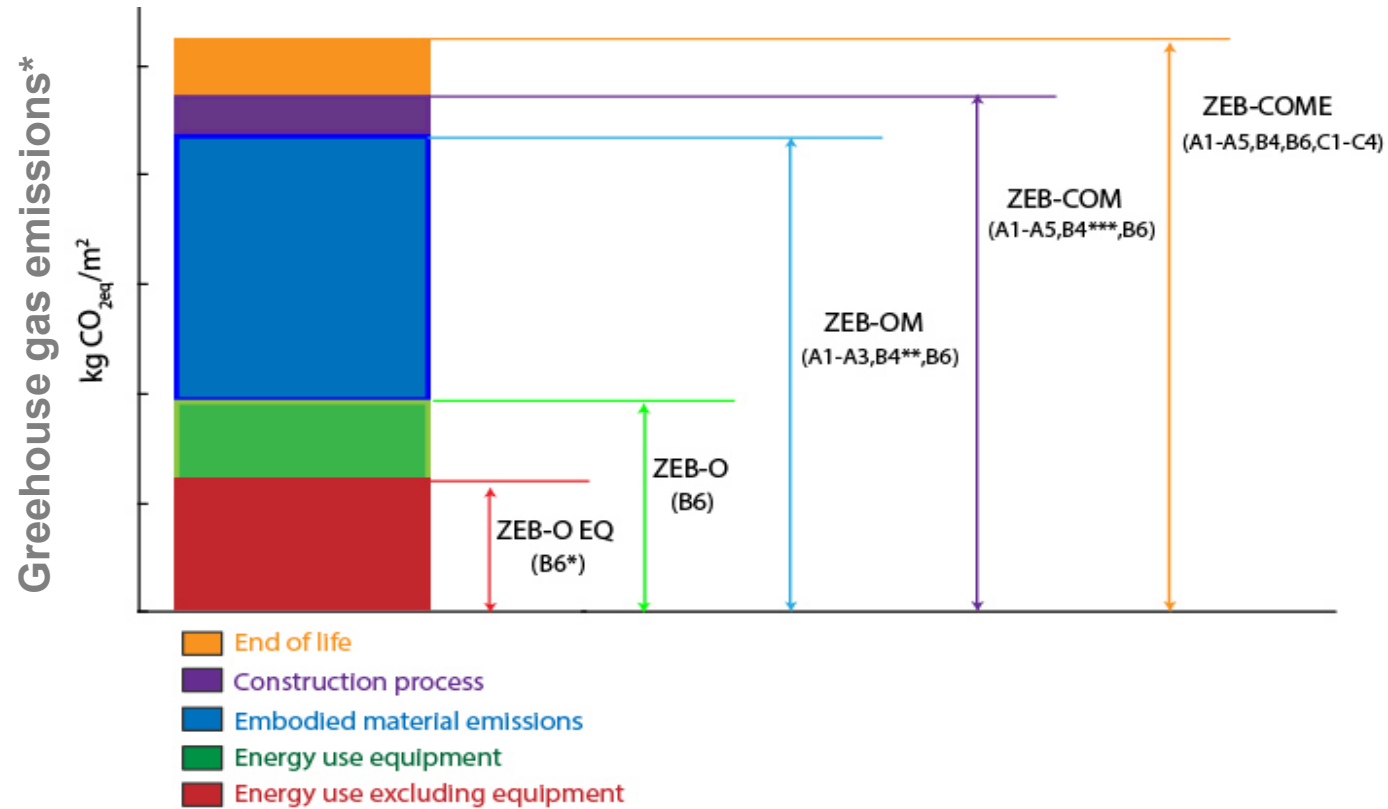
ZEB Definition



kg CO₂-equivalents per m² heated floor area pr year
 – Over a life time of 60 years



Different levels of ambition for ZEB



* Greenhouse gas emissions are calculated as kg CO₂-equivalents per m² heated floor area per year (distributed over a 60 years life time)

ZEB-O calculation requirements

Energy performance should be calculated using using dynamic simulation tools validated according to NS-EN 15265:2007 and documented according NS 3031

The buildings should at least satisfy the low energy criteria as defined in NS 3700:2013 and 3701:2012.



CO₂-factors for different energy carriers

Energy carrier	gCO ₂ _{eq} /kWh	References
Electricity from the grid	130	(Dokka 2011), (Dokka et al. 2013a), (Graabak and Feilberg 2011)
Oil (fossil)	285	(Dokka et. al 2013) (Dokka et al. 2013a)
Gas (fossil)	210	(Dokka et. al 2013) (Dokka et al. 2013a)
Wood chips	4 -15	(Dokka et al. 2013a), Lien (2013)
Pellets/briquettes	7 - 30	(Dokka et al. 2013a), Lien (2013)
Biogas from manure	25 - 30	(Dokka et al. 2013a), Lien (2013)
Bio-diesel and bio-oil	50	(Dokka et al. 2013a)
Bio-etanol	85	(Dokka et al. 2013a)
Waste incineration (heat only)	185 - 211	(Dokka et al. 2013a), (Lien 2013)

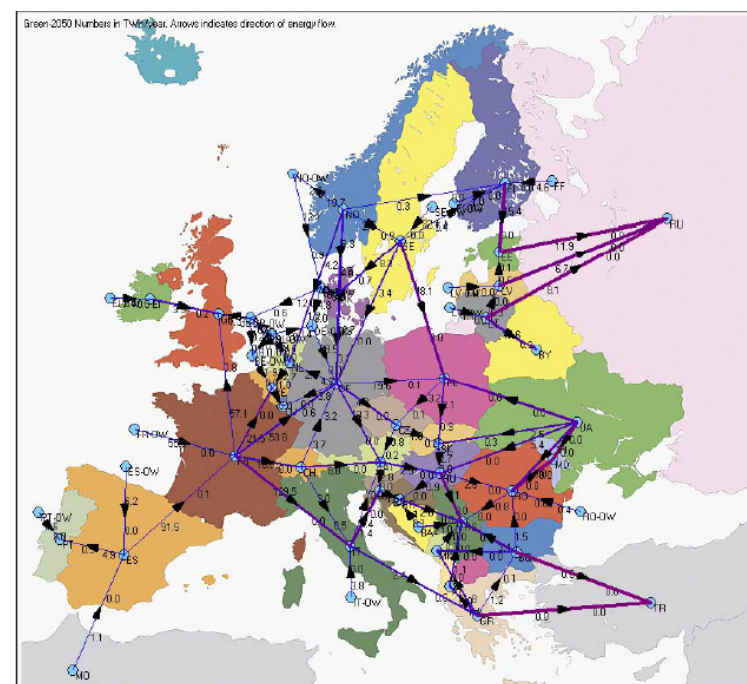
These are factors that have been used as default values in the ZEB centre. However, the factors may vary depending on different processes and and developments, and other factors may be used given proper documentation.

CO₂-factor for grid electricity

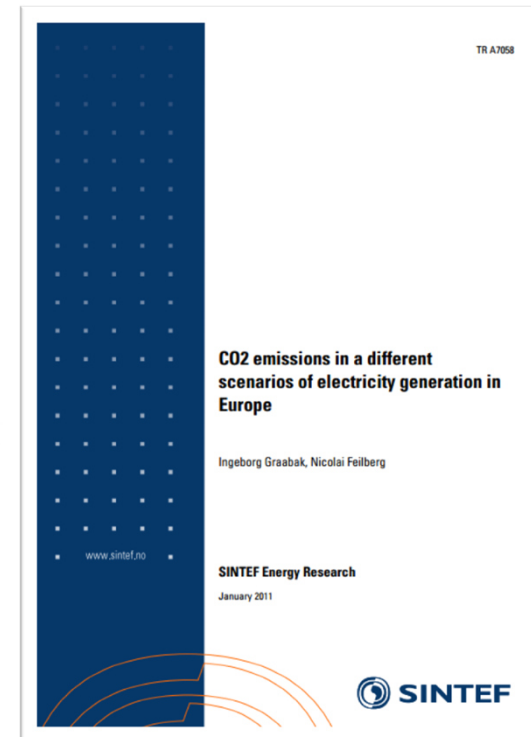
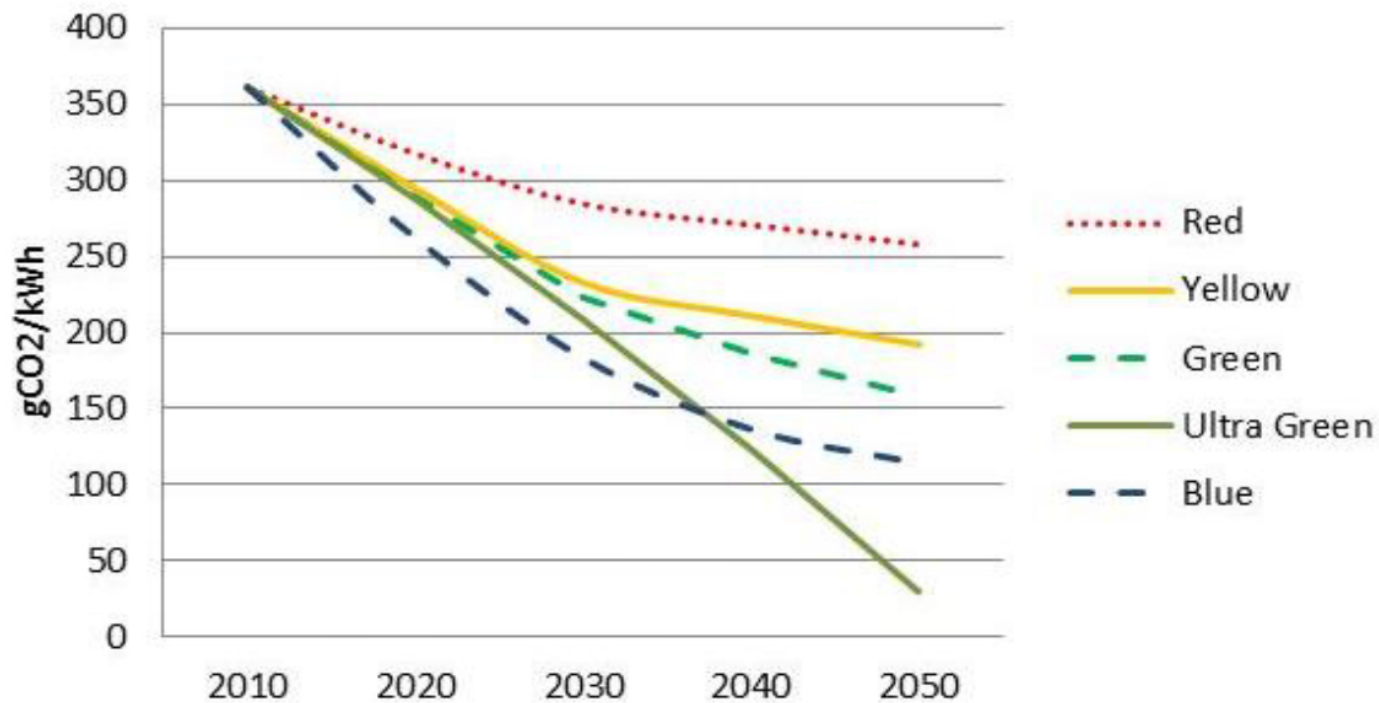
SINTEF Energy did simulations with the EPMS tool (European Power Market Simulator) to produce scenarios for the European power market towards 2050 (Graabak and Feilberg 2011).

Input to the model:

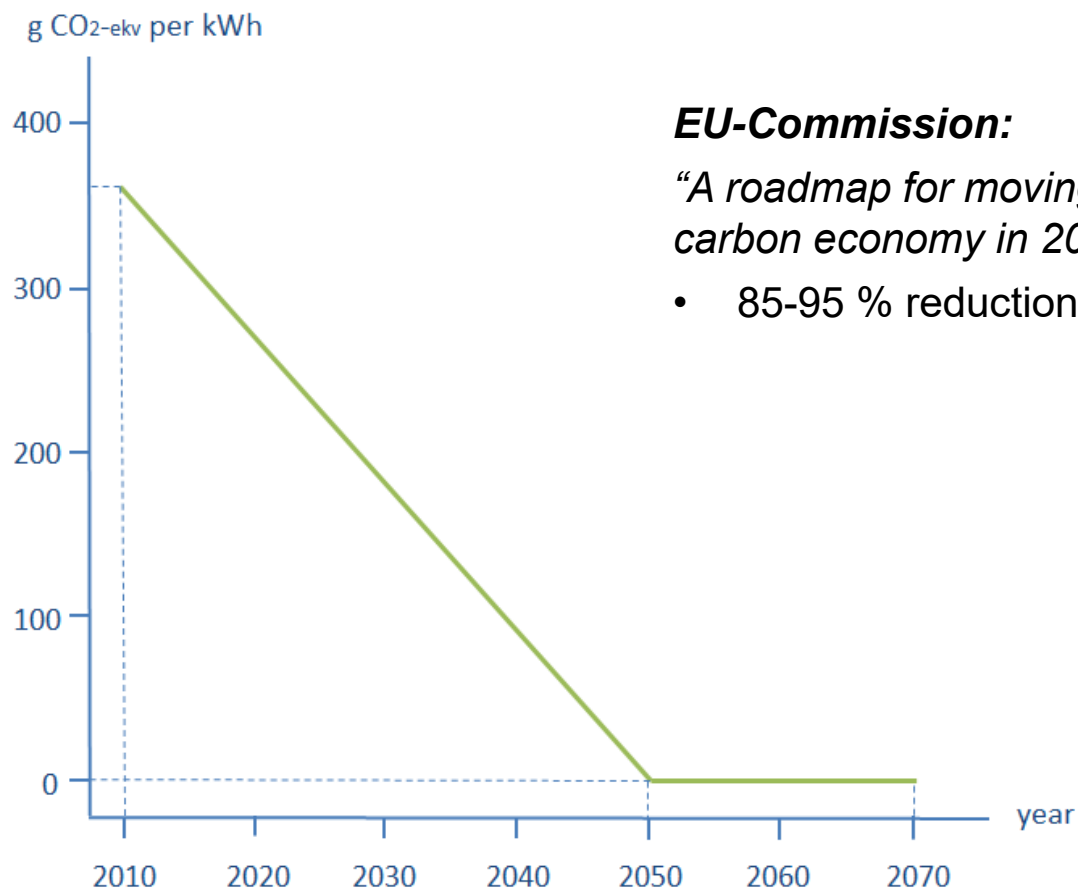
- Development of costs for fossil fuels, biofuels and CO₂ costs
- Availability of solar, wind and water resources
- Development of new renewable power and conventional power stations
- Development of energy use
- Transmission capacities between countries



CO₂-factor for grid electricity



CO₂-factor for grid electricity

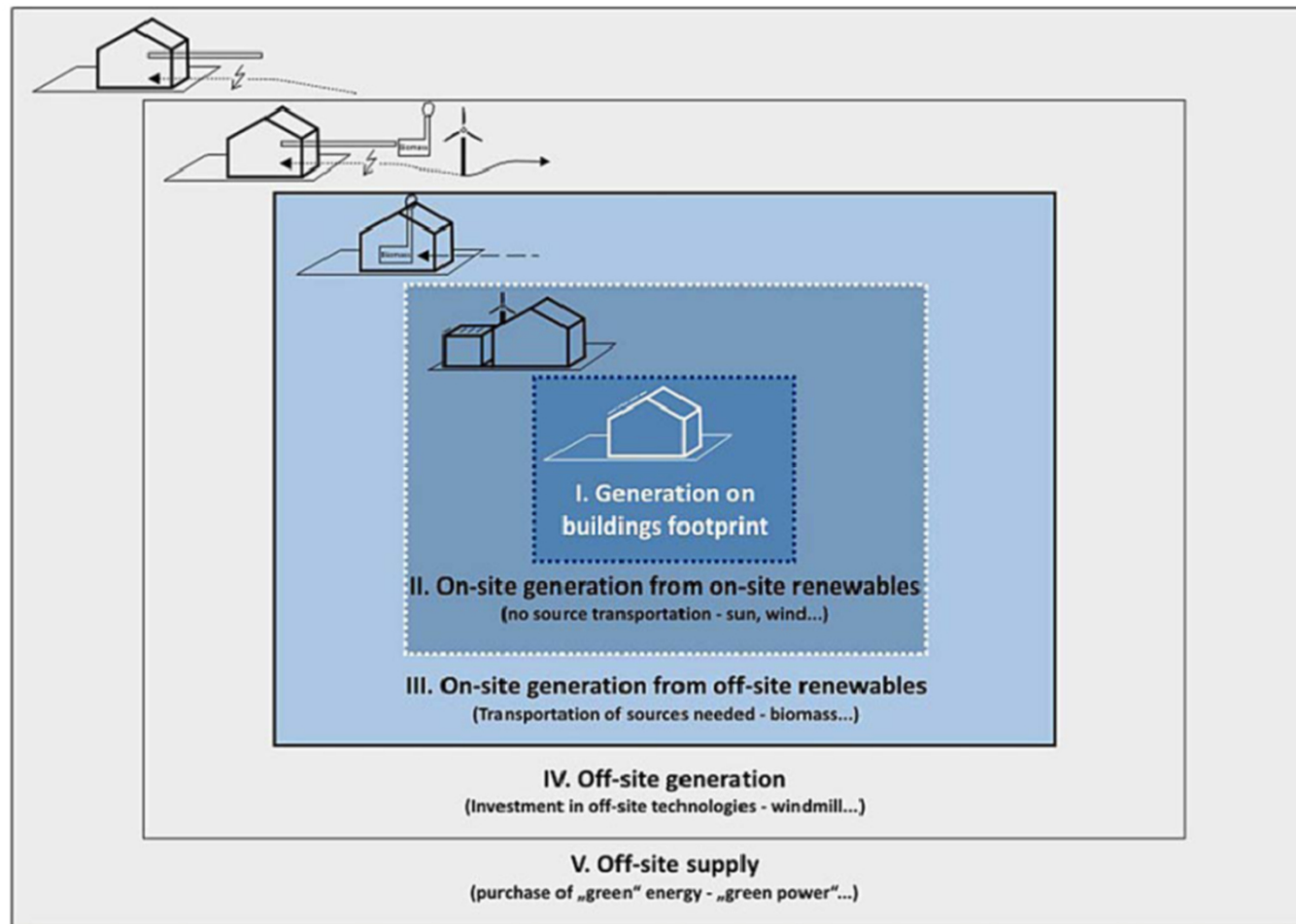


EU-Commission:

“A roadmap for moving to a competitive low carbon economy in 2050”

- 85-95 % reduction towards 2050

System boundaries – energy supply



System boundaries – energy supply

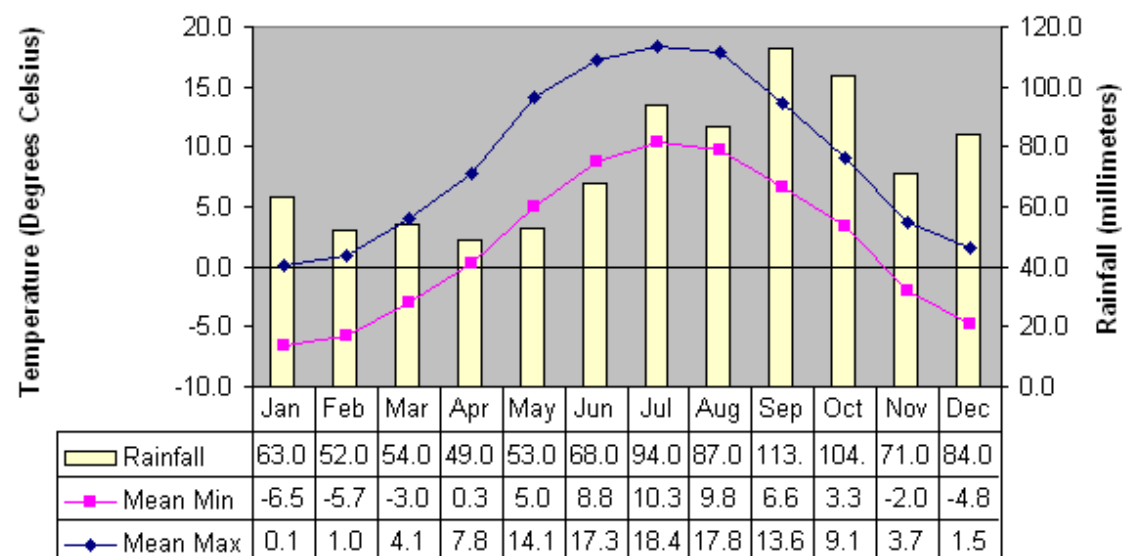
- For **renewable electricity production**, level III has been chosen.
 - the production unit of electricity for a building has to be located on-site, but off-site renewables (e.g. biofuels) may be used in the production of electricity.
- For **thermal energy production**, level IV has been chosen.
 - thermal energy production for the building (or cluster of buildings) can be either on- or off-site, but emissions from the actual energy mix shall be used.
 - Total system losses from the production site to the building shall be taken into account.



Weather data

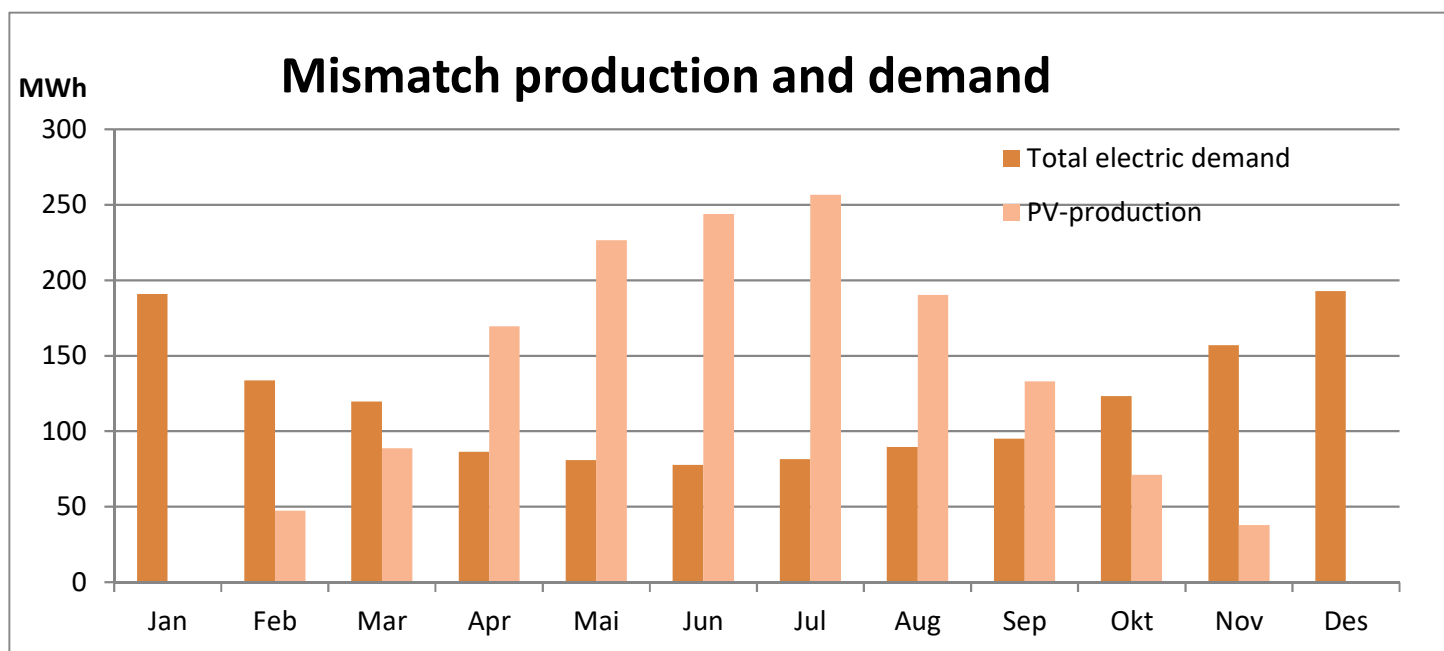
All energy performance simulations should be based on local statistical weather data

Long Term Climate Data for Trondheim, Norway (1961-1990)



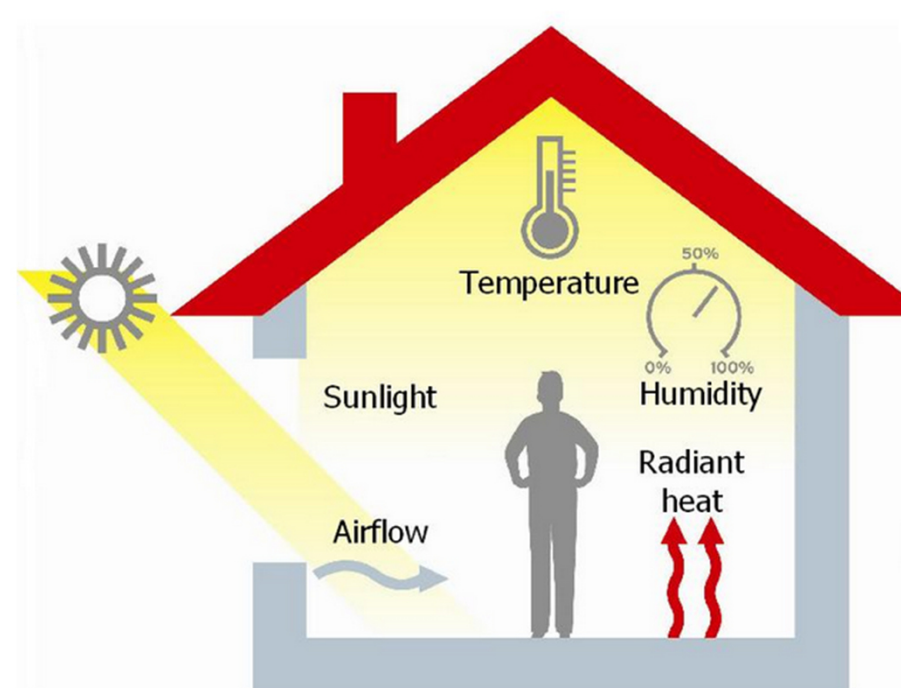
Mismatch between production and demand

- Simplified calculation – the same CO₂-factor is used for import and export of energy, independent of time of day/year
- Still, the mismatch between energy generation and demand should be calculated



Indoor environment

Must satisfy requirement in the regulations with respect to thermal comfort, air quality, acoustics and lighting



Verification in use

- 1) **Verification of annual energy performance and the ZEB balance:** Measurement of the imported and exported energy to evaluate if the designed performance is achieved.
- 2) **Verification of energy performance level:** Comparing simulated and measured energy use for the different energy purposes (heating, domestic hot water, fans, lighting, appliances).
- 3) **Monitoring of indoor climate parameters**
- 4) **3rd party check of materials**