Life cycle primary energy use of nearly-zero energy building and low-energy building

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European Union Directive 2010/31/EU requires all new buildings to be nearly-zero energy building from 2020.

We analyse lifecycle primary energy use of a recently constructed 6-story concrete-frame building. We compare the building to a nearly-zero energy building (NZEB) and low-energy building.





Thermal characteristics of the analysed building variants

Description	Constructed	NZEB	Low-energy
U-values (W/m ² K):			
Ground floor	0.11	0.11	0.11
Exterior walls	0.32	0.11	0.11
Windows	1.2	0.8	0.8
Doors	1.2	0.8	0.8
Roof	0.08	0.053	0.053
Infiltration (I/s m ² @50 Pa)	0.6	0.3	0.3
Largest window orientation	West	West	North

Analysed building in Växjö, Sweden, has a heated floor area of 1686 m² and 24 apartments



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We analysed the primary energy use for production, operation and end-of-life of the buildings heated with:

- District heating for the constructed and low-energy building
- District heating + solar thermal collectors for the NZEB

District heat is cogenerated with electricity using biomass.

Electricity is produced in a stand-alone biomass-fired plant.

All energy and material flows are analysed for a lifespan of 50 years.

Total heat use & solar thermal collectors' generated heat



Annual operation primary energy use



Total life cycle primary energy use for 50 years



Conclusions

- 30-31% of the total life cycle primary energy use for the production of NZEB and low-energy building variants
- 17% of the total life cycle primary energy use for the production of the constructed building
- Life cycle perspective is needed to minimize primary energy use and climate impact of the built environment
- Current legislations do not consider the production phase of buildings

