Sustainable Passive Plus houses with Bio District heating, learnings from a case study in Tarm, Denmark.

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In Denmark 2/3 of building heat is District heating. The political aim is to reduce CO2emissions by 70% in 2030 with 1990 as reference. Buildings make up for 40% of the CO2 emissions – so reducing green house gas from building play a major role.

Greenhouse gas reduction may come from both saving energy and transforming the energy sector to non fossil. Biomass resources are not local grown. 2/3 of wood Biomass for District Heating is imported from Russia and the Baltic countries.

How can Denmark achieve climate goals, in a sustainable way, with Bio District heating with less Biomass – is more building insulation the answer?

A social housing project in Denmark supplied with local Bio district heating is analysed. The buildings are dense row housing in passivehouse plus standard. The District heating plant in the city of Tarm uses biomass Boilers to produce 76% of the heat energy, solar collectors covers 6% and a heatpump additional 18%. Gas and oil back up boilers covers less than 1%. The Net consists of 70 km of tubes.

A Life Cycle Analyze is used to calculate the total emission from the 5 boilers, heatpump, 18.585 m2 solarcollector, buffertanks, pumps, production, store, office building and net. The emission from energy and plant is calculated. Results show a factor 2,02 higher emission pr. kWh and 11% higher than the middle value of danish district heating.

CO2e emission from District heating	kg/kWh
Energy	0,035
Denmark middle 0,065 (value without plant and nett loss emission)	
District heat plant	0,023
Net loss	0,013
TOTAL District Heating	0,071

A building with 616 Heated Floor area, and 9 flats is analyzed. PHPPsoftware is used to calculate saved energy by better insulated walls. The emission from insulation material is calculated using LCA software and a balance as saved CO2 emission is the result.

Building energy standard	Insulation	U value	Total wall	More insulation	saved energy	Balance saved CO2e by more insulation
	mm	W/m2K	emission CO2e kg/m2			
2018 < 0,30	110	0,293	1,98			
2020/Passivhus < 0,12	310	0,118	2,14	0,15	3,17	3,02
Passivhus Plus, Tarm Blok 6 HT	390	0,096	2,20	0,21	3,18	2,97

Results show a faktor 15 higher Green house gas emission saving by using higher energy efficiency in buildings saving energy. This reduce the energy needed from district heating – making it possible in the future to cover the need of biomass with local og regional grown bio mass from forest plantations.