



# Life-cycle cost & environmental assessment of nearly zero-energy buildings (NZEBs) in four European countries

## Speaker:

Ove Mørck  
Kuben Management A/S

## Authors:

Ove Mørck and Miriam Sanchez Mayoral Gutierrez (1),  
Kirsten Engelund Thomsen and Kim B. Wittchen (2)  
1 Kuben Management A/S  
2 Danish Building Research Institute, Aalborg University

## LCC & LCA calculations

### Life Cycle Cost (LCC):

- The cost and value of the energy savings of each energy saving measure are added and a life cycle cost (LCC) calculation is made to reach the Net Present Value (NPV)

### Life Cycle (Impact) Assessment (LCA/LCIA) of the energy saving measures covers:

- Global warming Potential CO<sub>2</sub>-emissions [kg CO<sub>2</sub>-Equiv.]
- Non-renewable primary energy (NRPE) consumption MJ
- ODP, Ozone Depletion Potential [kg R11-Equiv.],
- POCP, Photochemical Ozone Creation Potential [kg Ethene-Equiv.],
- AP, Acidification Potential [kg SO<sub>2</sub>-Equiv.],
- EP, Eutrication Potential [kg Phosphate-Equiv.] and
- ADP, Abiotic Depletion Potential [kg Sb-Equiv.]

# Elements included in the LCA: product stages & use



A 1-3 Product stage			A 4-5 Construction process stage		B 1-7 Use stage				C 1-4 End-of-Life			D Next product system				
Raw material supply	Transport to manufacturer	Manufacturing	Transport to building site	Installation into building	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/demolition	Transport to EoL	Waste processing	Disposal	Reuse, recovery or recycling potential

# THE ASCOT\_LCA CALCULATION TOOL



## In one calculation step:

- Energy savings
- Cost of energy saving measures
- Financial value of savings in relation to investments (LCC)
- Life cycle impact analysis (LCIA)

## Easy changes:

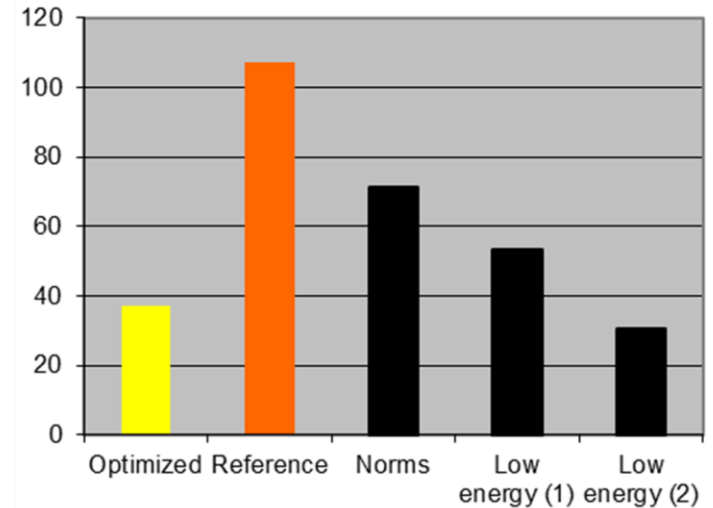
- Different building categories
- Climate – use 33 existing climates in Ascot or add new climates
- Reference building for renovation or new built: Insulation level, etc.
- Building materials/component data
- Language & Currency

# ASCOT LCA optimisation



SOLAR HEATING	Reference	0 kr
PHOTIVOLTAIC	Mono-crystalin	12.589 kr
EXTERNAL WALL INSULATION	+200 mm insulation	7.938 kr
ROOF INSULATION	Reference	0 kr
FLOOR INSULATION	Reference	0 kr
FLOOR ABOVE UNHEATED SPACE	Reference	0 kr
BASEMENT INSULATION	Reference	0 kr
WINDOWS	2-pane energy glass	57.117 kr
VENTILATION	Reference	0 kr
AIR TIGHTNESS	Reference	0 kr
COOLING	Reference	0 kr
HEAT SUPPLY	Reference	0 kr
USERDEFINED INVESTMENT OR REDUCED COSTS		0 kr
<b>TOTAL INVESTMENT PER APARTMENT</b>		<b>77.644 kr</b>

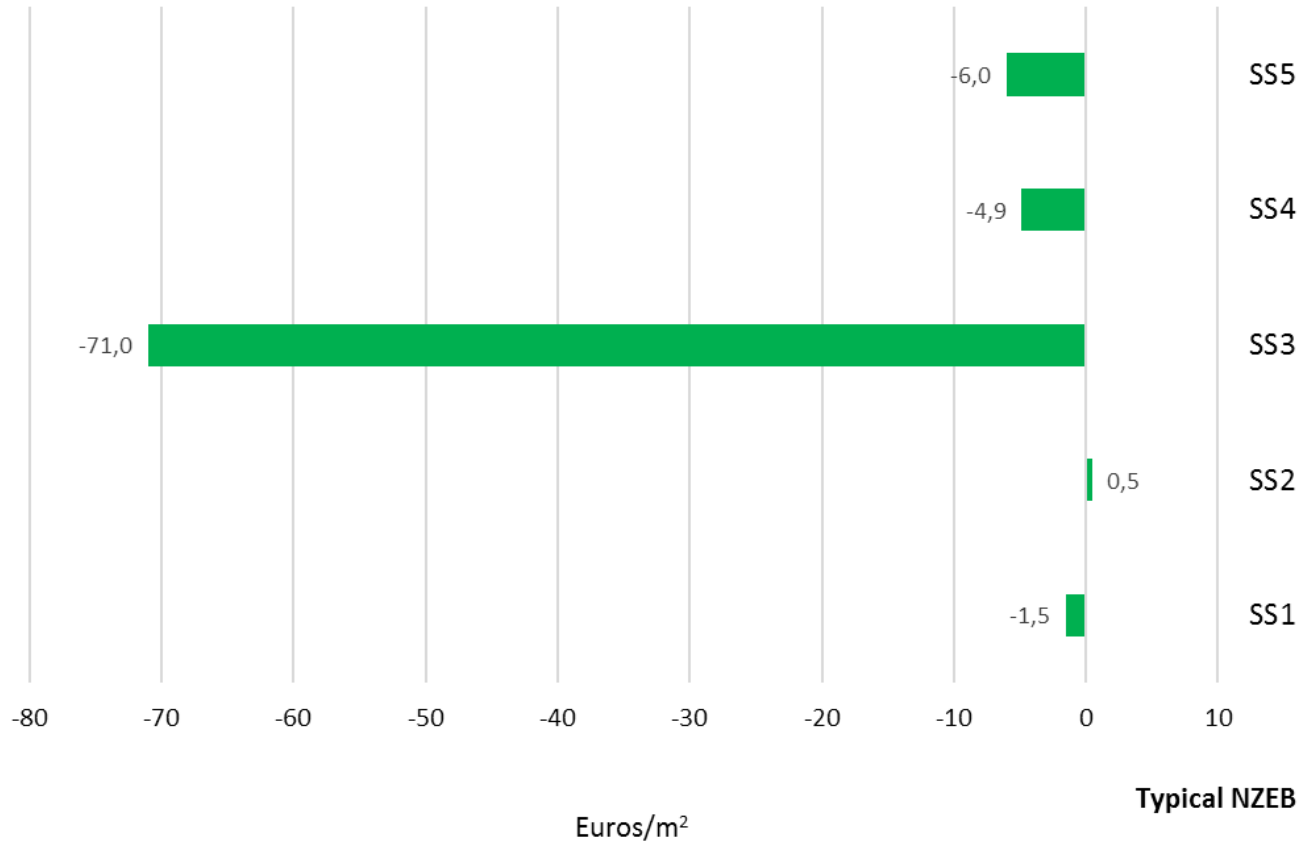
## KWH/M<sup>2</sup>/YEAR



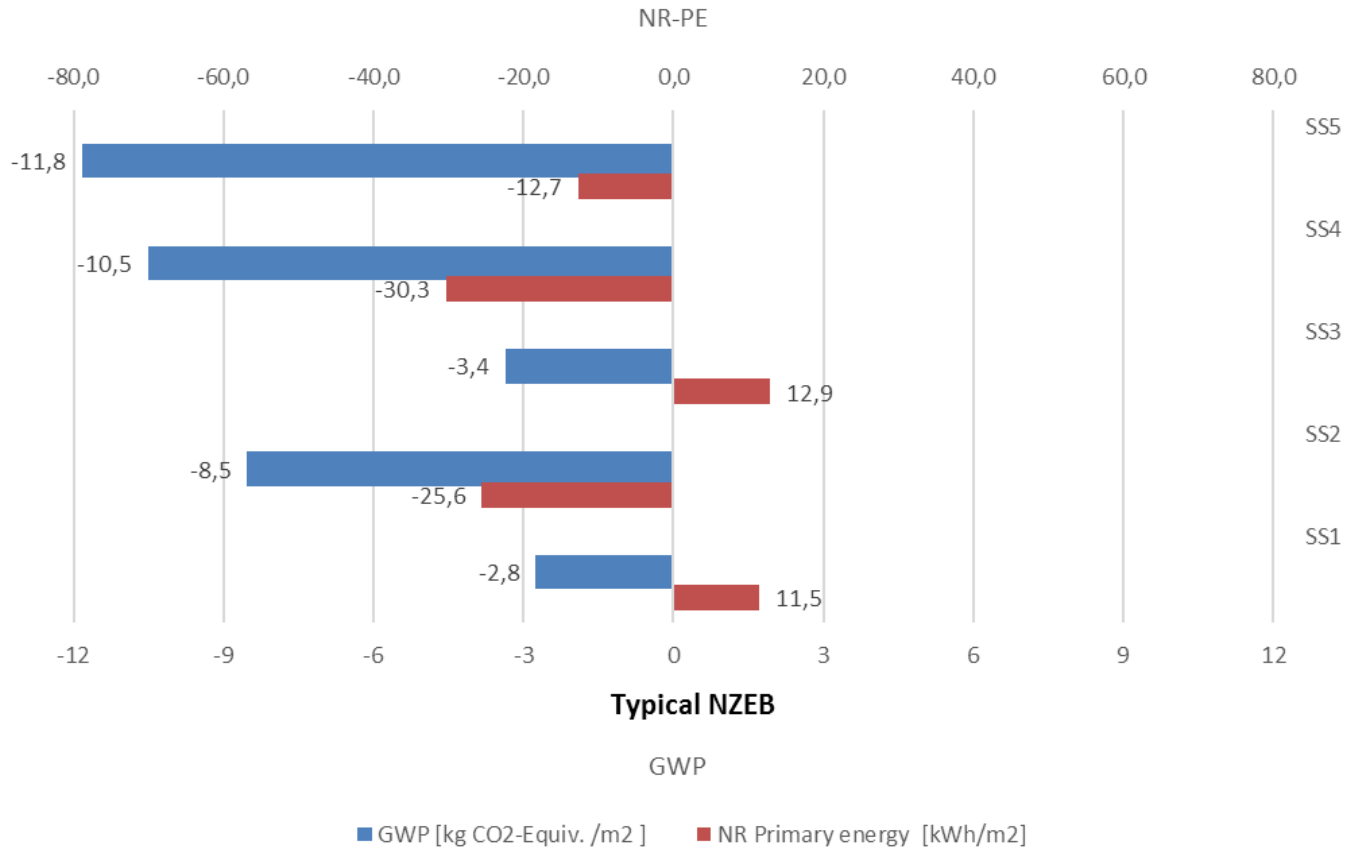
# Danish Solution Sets (SS)

TECHNOLOGY	SS1	SS2	SS3	SS4	SS5
Lower lambda value of the insulation	X				
4-layer windows			X		
reduced insulation in ext. wall		X		X	X
Reduced insulation in roof		X		X	X
Reduced insulation in floor		X		X	X
MVHR – decentralized				X	X
Natural ventilation			X		
Energy efficient water taps				X	
Heat recovery on grey wastewater			X		
PV-panels on roof					X
Solar heating		X			

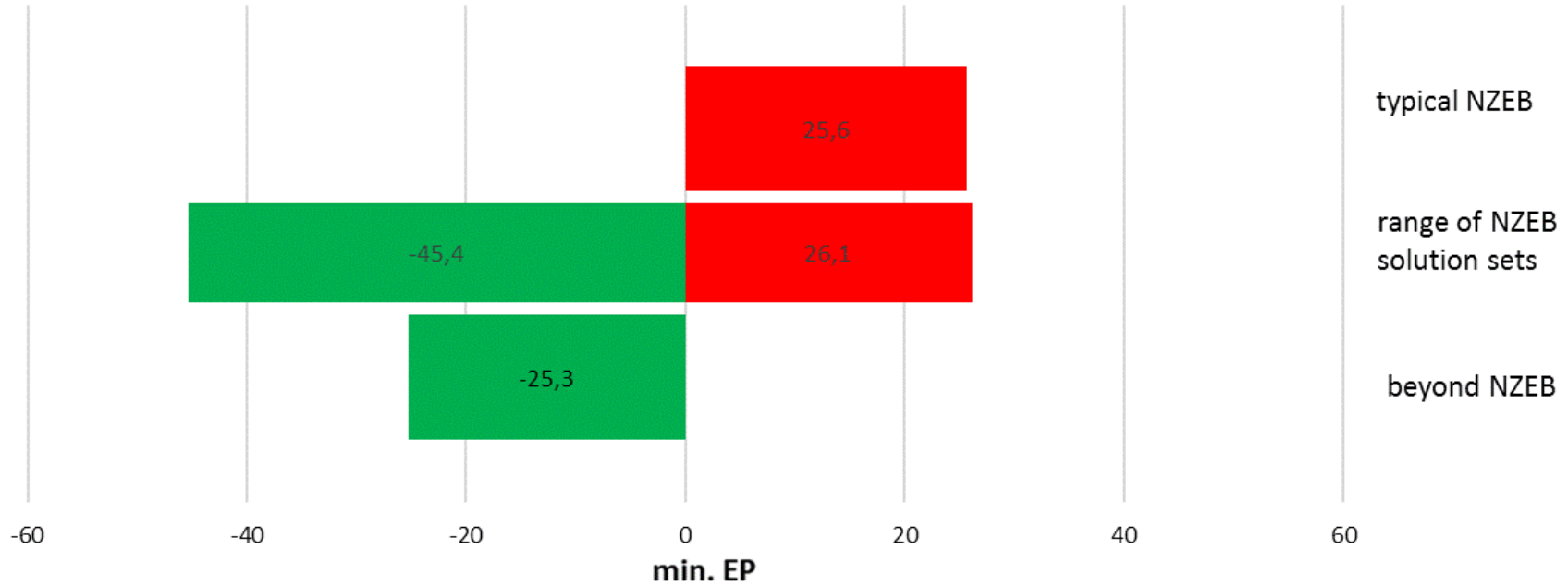
# LIFE CYCLE COST for 30 years



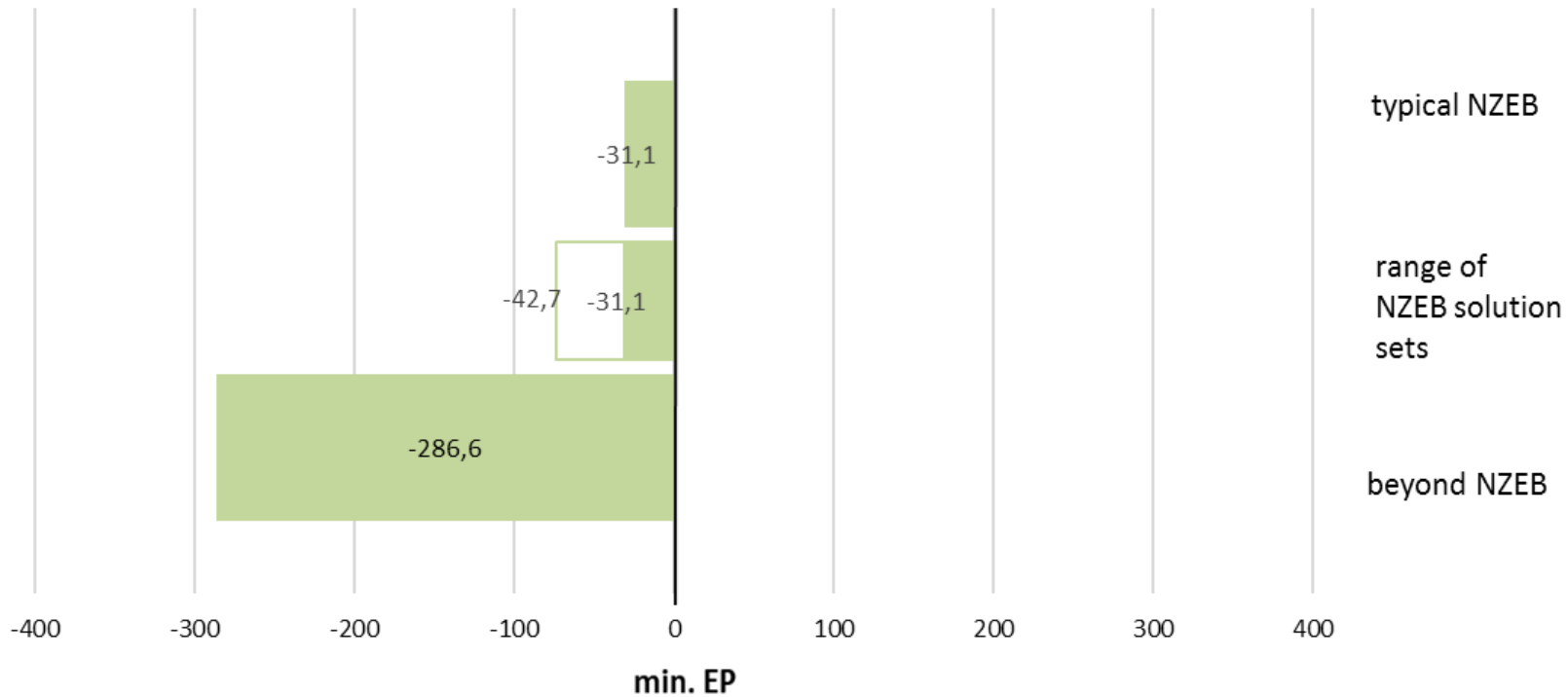
# LIFE CYCLE ANALYSIS for 30 years

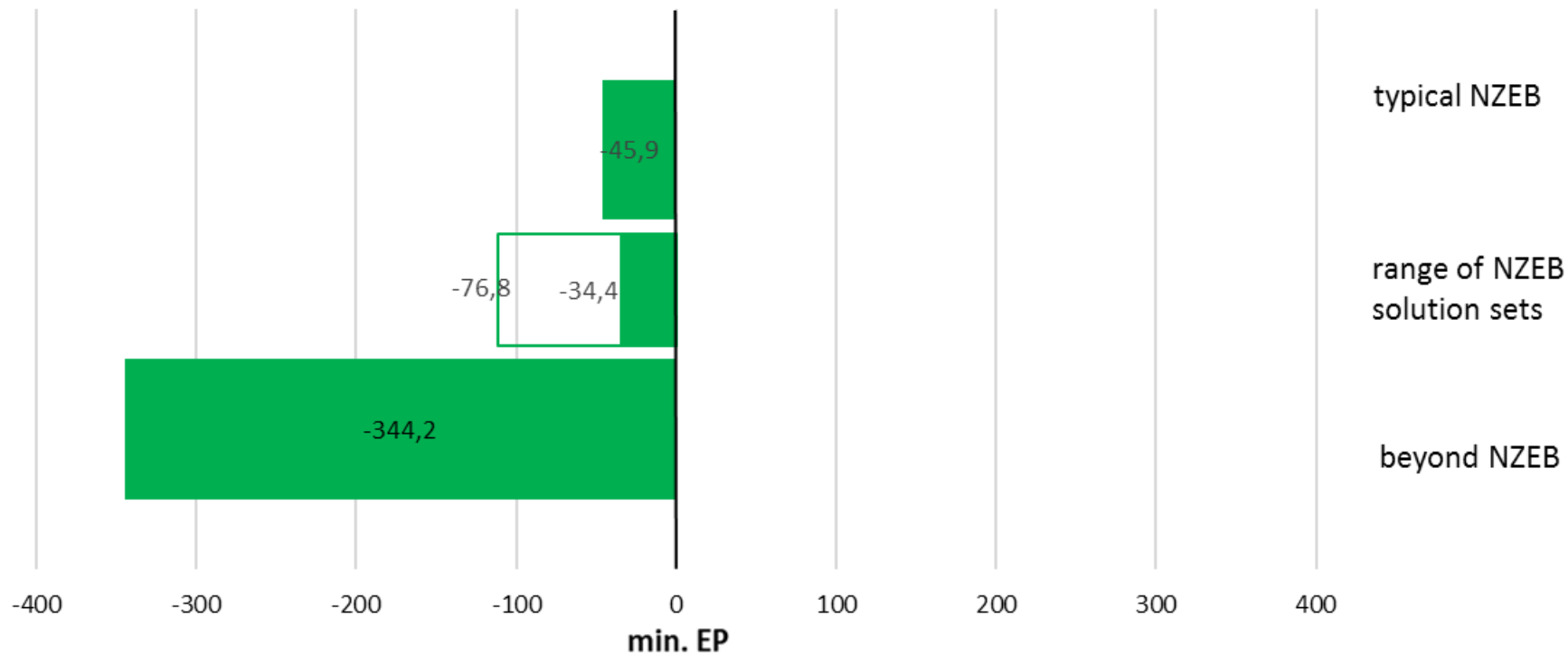






Euros/ GFAM<sup>2</sup>







# What does it mean? Three comparisons

1. The GWP and energy in construction in Denmark,   
 GWP reductions of the beyond NZEB building compared to the minimum EP in Denmark ~ the embedded energy in the construction. (NR-PE ~ 1/4)
2. The emissions from means and   
 The yearly GWP reductions from the Danish beyond NZEB example ~ 6369 person-km in a fossil fuel car.
3. The CO<sub>2</sub>-reductions from planting trees.   
 The GWP reductions of the Danish beyond NZEB house ~764 m<sup>2</sup> of forest

# Thank you for your attention!

## Questions and Comments

### Contact:

- ▢ Ove Morck
- ▢ Kuben Management A/S
- ▢ Ellebjergvej 52, DK2450  
Copenhagen SV
- ▢ E-mail: [ovmo@kubenmam.dk](mailto:ovmo@kubenmam.dk)



### Disclaimer:

- ▢ The CoNZEBs project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 754046.
- ▢ The presentation reflects the author's view. The Commission is not responsible for any use that may be made of the information it contains.