

ASCOT

IEA Annex56

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The ASCOT calculation program

- Energy savings
- Cost of energy saving measures
- Optimisation – financial value of savings in relation to investments
- Life cycle impact analysis

Energy savings

- The ASCOT tool calculations are based on international standards for energy calculation. Thermal performance of buildings – Calculation of energy use for space heating and cooling (ISO/DIS 13790), Heating systems in buildings
- The calculations are based on data within the program that can be modified by the users – example: next slide

Data in Ascot that can be modified - example

INSULATION STANDARD		User defined	no insulation	low insulation	med insulation	high insulation	new build	Super insulation	Reference	Wall thickness
External wall (light construction)	W/m ² K	0.20	1.10	0.50	0.30	0.20	0.20	0.15	0.50	0.253
External wall (heavy construction)	W/m ² K	0.20	1.60	1.10	0.40	0.30	0.20	0.15	1.10	
Basement wall	W/m ² K	0.20	0.40	0.34	0.34	0.30	0.20	0.15	0.34	
Floor	W/m ² K	0.15	0.40	0.40	0.30	0.20	0.15	0.10	0.40	
Floor with floor heating	W/m ² K	0.12	0.40	0.40	0.30	0.15	0.12	0.10	0.40	
Floor to inheated room	W/m ² K	0.40	0.80	0.50	0.40	0.40	0.40	0.40	0.50	
Roof	W/m ² K	0.15	1.90	0.40	0.20	0.15	0.15	0.10	0.40	
Windows and doors	W/m ² K	1.20	4.20	3.10	2.90	1.80	1.20	0.90	3.10	
Losses foundations	W/mK	0.15	0.50	0.30	0.25	0.25	0.15	0.12	0.30	
Losses around windows	W/mK	0.03	0.10	0.10	0.10	0.10	0.03	0.03	0.10	
Air tightness, 50Pa	l/sm ²	1.50	4.0	4.0	4.0	3.0	1.5	1.5	4.00	

Cost of energy saving measures

- Cost data is included in the tool – can be modified (example: next slide)
- A cost calculation is automatically made for each measure and the results are added to a total
- Payback and Net Present Value (NPV) calculations are made

Example of cost data table

Extra wall insulation	Costs DKK	New- build	Reno- vation	Life-time	Rest levetid	Lambda	Thickness
Reference		0	0	0	0	0.04	0
-100 mm insulation	0	-16	0	40	20	0.04	-0.100
-50 mm insulation	0	-8	0	40	20	0.04	-0.050
+50 mm insulation	232	10	232	40	20	0.04	0.050
+100 mm insulation	294	19	294	40	20	0.04	0.100
+150 mm insulation	337	28	337	40	20	0.04	0.150
+200 mm insulation	372	37	372	40	20	0.04	0.200
+250 mm insulation	401	46	401	40	20	0.04	0.250
+300 mm insulation	427	54	427	40	20	0.04	0.300
"Klimaskærm"	54	54	54	40	20	0.04	0.055
User defined	500	100	500	40	40	0.04	0.180
Actual	0			0	0	0.040	0.000

Optimisation for energy and cost:

		INVESTMENT
SOLAR HEATING	Reference	0 Eu
PHOTIVOLTAIC	Mono-crystalin	2.073 Eu
EXTERNAL WALL INSULATION	Reference	0 Eu
ROOF INSULATION	+150 mm insulation	582 Eu
FLOOR INSULATION	Reference	0 Eu
FLOOR ABOVE UNHEATED SPACE	100 mm insulation	544 Eu
BASEMENT INSULATION	Reference	0 Eu
WINDOWS	2-layer energy glass	8.150 Eu
VENTILATION	MVHR good system efficiency	3.333 Eu
AIR TIGHTNESS	Extra airtight	1.200 Eu
COOLING	Reference	0 Eu
HEAT SUPPLY	Reference	0 Eu

USERDEFINED INVESTMENT OR REDUCED COSTS

Investering: fx honorar til rådgiver. Fradrag: fx tilskudsordning (angives med minus)

SAMLET INVESTERING PR. BOLIG

15.881 Eu

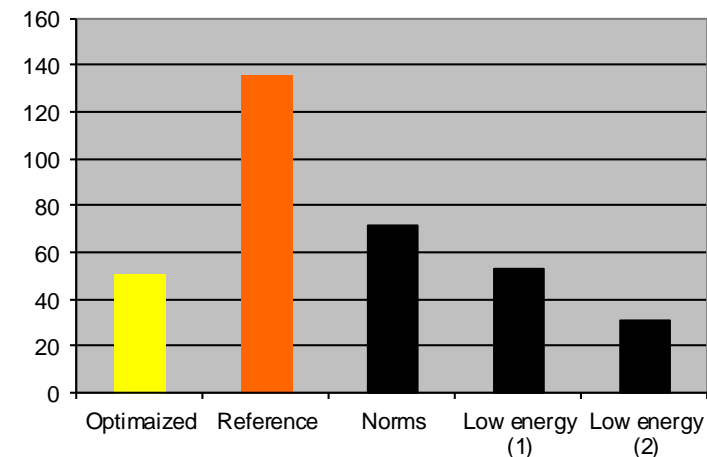
KEY FIGURES	Reference building	Optimised	
Space heating	96.8	38.3 kWh/m ² year	
Heating	120.7	62.2 kWh/m ² year	
Electricity	12.4	-13.2 kWh/m ² year	
Cooling	2.8	1.8 kWh/m ² year	
ENERGY SAVINGS COSTS	Heat	Electricity	
Actual Energy Costs	0.04	0.26	Eu /kWh
Energy Savings Costs	0.09	0.10	Eu /kWh
BUILDING ENERGY INVESTMENT		2.34	Eu /kWh
	Heat	Electricity	
(YEARLY SAVINGS x LIFETIME) / (INVESTM	0.63	2.07	

Fradrag for beholder

Collector area per housing unit **2.0** m²

PV cells area per housing unit **5.0** m² = **0.75 kWp**

Yearly energy consumption, kWh/m²



Optimisation for energy and cost:

- $(\text{YEARLY SAVINGS} \times \text{LIFETIME}) / (\text{INVESTMENT}) > 1.33$ in Denmark
- NPV of the investment $\Rightarrow 0$
- Cost of the energy savings: EURO/KWh – can be compared to the price of energy.

Life Cycle Impact Assessment (LCIA)

- GWP, Global Warming Potential [kg CO₂-Equiv.]
- ODP, Ozone Depletion Potential [kg R11-Equiv.]
- POCP, Photochemical Ozone Creation Potential [kg Ethene-Equiv.]
- AP, Acidification Potential [kg SO₂-Equiv.]
- EP, Eutrication Potential [kg Phosphate-Equiv.]
- ADP, Abiotic Depletion Potential [kg Sb-Equiv.]
- NRPE, Non-Renewable Primary energy [MJ]

Focus areas:

Elements included: product stage & use
 Elements excluded: replacement & end-of-life

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

LCA data sources

- ESUCO database
- Ökobau - Germany
- Individual data from producers

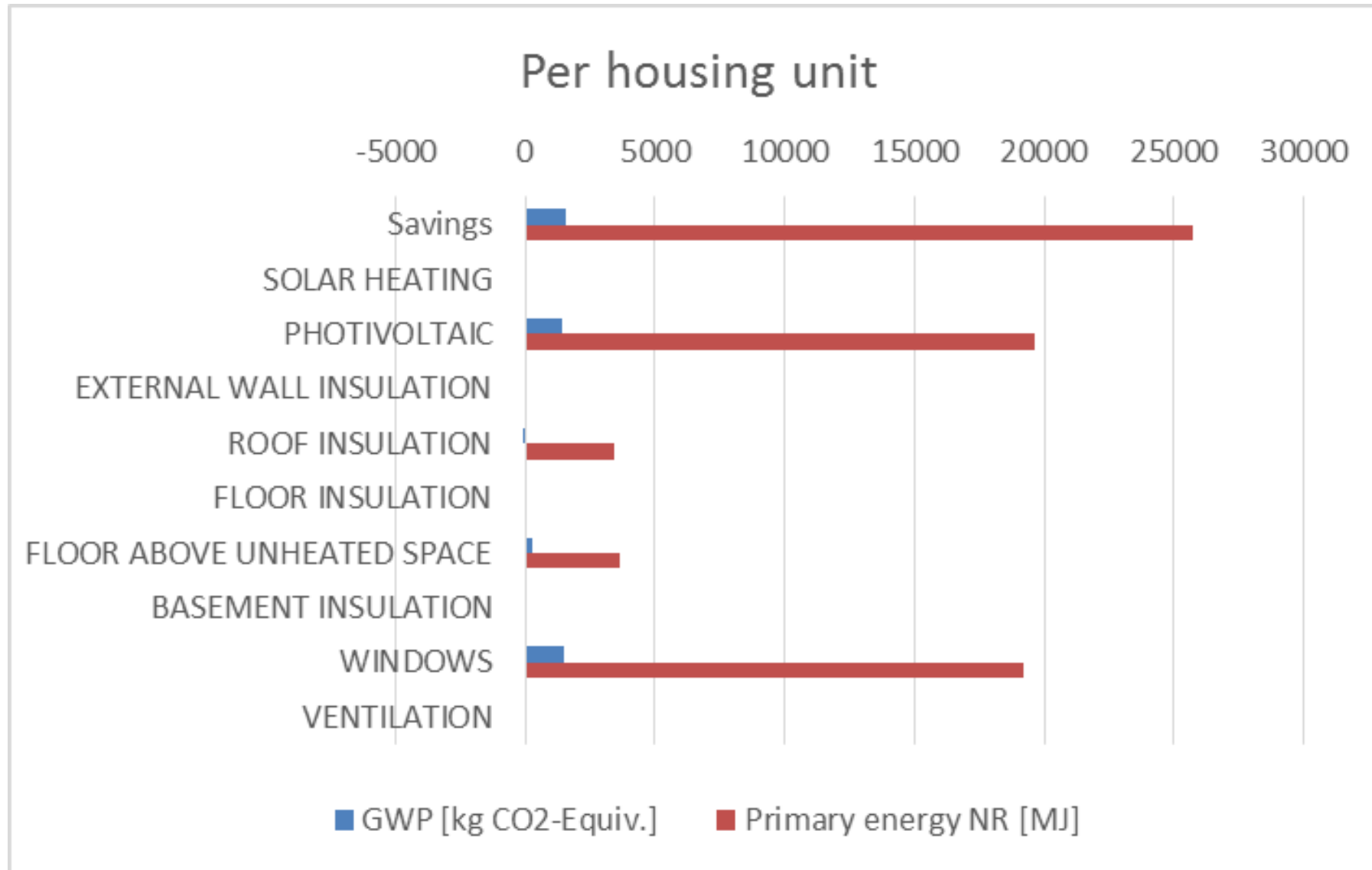
Energy source data in LCA calculations from ESUCO database:

Brugernavn	Kilde	Navn i kilde	Energi	Enhed	GWP
[-]	[e.g. ESUCO]				[kg CO2-Equiv.]
Fjernvarme, EU	ESUCO	EU_9.2.06_District_heating_r	3,6	MJ	2,22E-01
Naturgas, EU	ESUCO	EU_9.2.01_Thermal_energy_f	1,0	MJ	6,98E-02
Olie, EU	ESUCO	EU_9.2.03_Thermal_energy_f	1,0	MJ	9,19E-02
El, EU	ESUCO	EU_9.2.05_Power_grid_mix	3,6	MJ	6,03E-01
El fra vindmølle, EU	ESUCO	EU_9.2.05_Power_from_wind	3,6	MJ	7,26E-03
Solvarme, DK	ESUCO	DK_8.6.1_Use_-_flat-plate_cc	3,6	MJ	3,79E-02
El, Danmark	Fnr SBi	-	3,6	MJ	6,49E-01
Fjernvarme, Danmark	Fnr SBi	-	1,0	MJ	6,89E-02
Referencevarme, Danmark	SBi	-	1,0	MJ	6,92E-02
Flisfyr	ESUCO	DK_8.6.1_Use_Woodchip_bo	3,6	MJ	5,921E-03

LCA results: Payback years for the total renovation package

- GWP, Global Warming Potential [kg CO₂-Equiv.]
- ODP, Ozone Depletion Potential [kg R11-Equiv.]
- POCP, Photochemical Ozone Creation Potential [kg Ethene-Equiv.]
- AP, Acidification Potential [kg SO₂-Equiv.]
- EP, Eutrication Potential [kg Phosphate-Equiv.]
- ADP, Abiotic Depletion Potential [kg Sb-Equiv.]
- NRPE, Non-Renewable Primary energy [MJ]

LCA results from Ascot



LCA results cont. – payback times:

GWP, Global Warming Potential [kg CO ₂ -Equiv.]	2.0	years
ODP, Ozone Depletion Potential [kg R11-Equiv.]	0.6	years
POCP, Photochemical Ozone Creation Pot. [kg Ethene-Equiv.]	2.1	years
AP, Acidification Potential [kg SO ₂ -Equiv.]	2.2	years
EP, Eutrication Potential [kg Phosphate-Equiv.]	4.7	years
ADP, Abiotic Depletion Potential [kg Sb-Equiv.]	1.1	years
NRPE, Non-Renewable Primary energy [MJ]	1.8	years

NB: this approach means that we don't have to argue about lifetimes!

Easy changes in Ascot:

- Different building categories
- Climate – use existing climates in Ascot or add new climates
- Reference – Renovation: choose insulation level / new construction
- Data – edit or add for new materials
- Language
- Currency

Demonstrate Ascot LCA

- [BYG-SOL ASCOT v3 15.xlsx](#)