

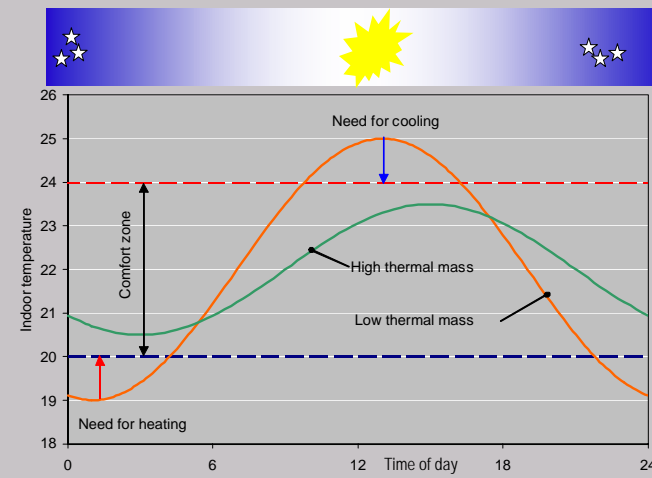
Thermal advantages of concrete – a European study

Jesper Sand Damtoft
Aalborg Portland Group



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Bedre termisk komfort med beton



Source: CEMBUREAU 2006 Research and Development Centre

Energy advantage of concrete

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Literature study, calculations on theoretical and real buildings, using 5 different calculating tools in several European climates



Results:

- “Light” buildings consume 2-9% more energy than “heavy” buildings
- In office buildings the difference is 7-15%
- Difference in cooling energy even higher: up to 20% for dwellings and 25% for offices

Source: CEMBUREAU 2006 Research and Development Centre

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Sample residential building

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Region	Predicted net energy use for heating				Mean monthly temperature
	kWh/m ² .year				Oct-Apr
	Solid	Light-weight	Diff.	%	C°
Polar circle	128,7	133,4	4,7	3,7%	-7,9
Northern Europe	66,7	70,7	4	6,0%	1,1
Northern Europe coastal	53,1	57,4	4,3	8,1%	3,4
UK	37,6	43,1	5,5	14,6%	5,9
Benelux	42,2	48,8	6,6	15,6%	5,6
Central Europe	49,2	53,3	4,1	8,3%	3,8
Alpine	60,6	65,9	5,3	8,7%	1,4
Mediterranean	8,0	12,2	4,2	52,5%	12,1

Consolis tool

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Effect of window orientation, theoretical dwelling building

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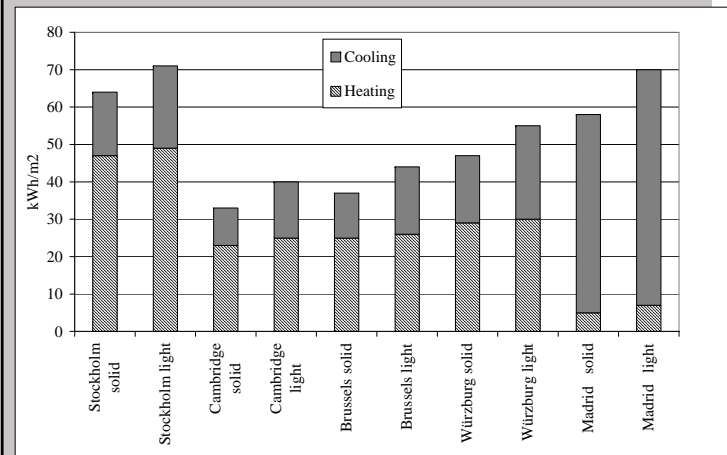
Climate	Programme	Orientation of windows	Energy use for heating/cooling kWh/m ² ,year		Difference Light/Solid
			Solid	Light	%
Stockholm	Consolis	E/W	66,7	70,7	6,0
Stockholm	Consolis	S	51,5	56,5	9,7
Stockholm	VIP+	E/W	64,5 11,3*	66,9 13,2*	3,7 16,5*
Stockholm	VIP+	S	54,5 12,4*	60,1 15,0*	5,3 20,3*
Würzburg	TCasa	E/W	60,3	61,7	2,4
Würzburg	TCasa	S	54,1	56,0	3,5
Denmark	Be06	E/W	47,3 3,4*	48,0 4,3*	1,2

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Theoretical office buildings

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VIP tool

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Theoretical office buildings

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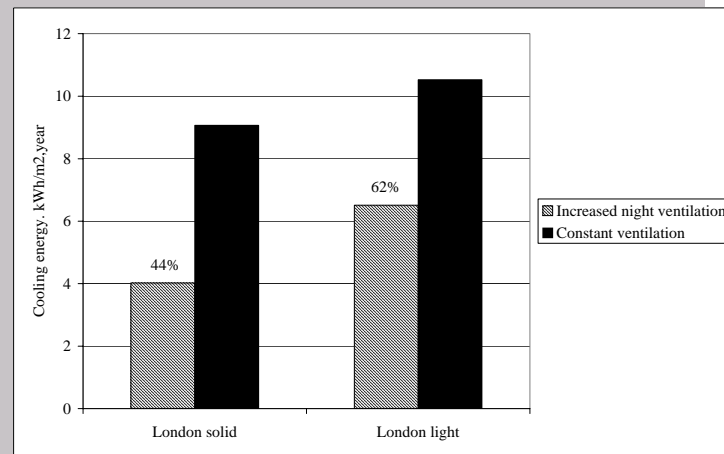
Climate	Programme	Orientation of windows	Energy use for heating/cooling kWh/m ² ,year		Difference Light/Solid
			Solid	Light	%
Stockholm	VIP+	E/W	50,0	54,1	7,3
			13,1*	15,9*	20,7*
Stockholm	VIP+	S	37,4	41,9	12,0
			14,5*	18,3*	26,3*
Denmark	Be06	E/W	38,0	43,6	14,6
			3,4*	4,3*	

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Effect of concrete on cooling energy

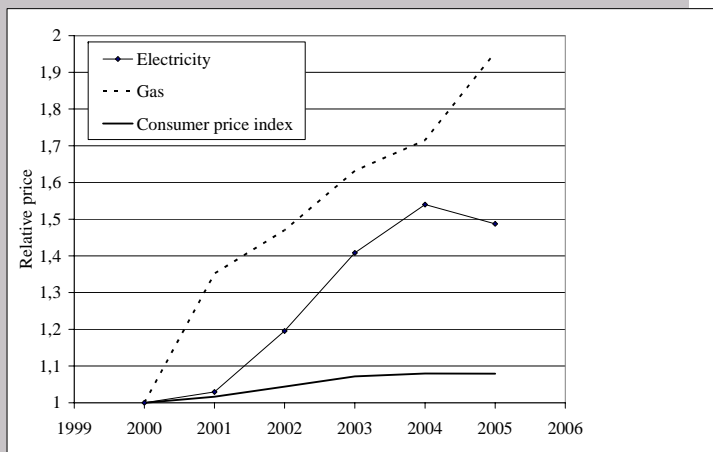
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Energy prices



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Utilising the energy advantage

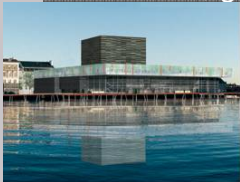
- Exposed concrete parts, e.g. coffered floor slabs, and night ventilation, e.g. under-floor ventilation, to provide free passive cooling during daytime.
- Use of free cooling in an air conditioning system by the use of hollow core concrete slabs through which air is distributed.
- Use of precast concrete elements as outer walls to provide very low transmission losses and excellent air-tightness.
- Use of water-cooled slabs containing pipe-work linked to the heating and cooling system.

Source: CEMBUREAU 2006 Research and Development Centre

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Possible energy savings

- Reduce energy consumption and CO₂ emission related to cooling by 75-80%
- Reduce heat consumption and related CO₂ emission by 35-50%
- Reduce the energy for ventilation and related CO₂ emission by 35-50%
- Use of renewable supply sources, i.e. seawater, ground water, air and solar energy

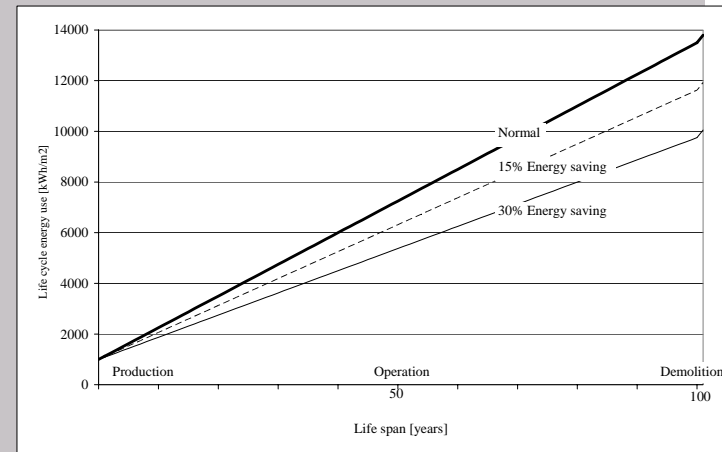


Source: Cowi 2006

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Realised and potential energy savings

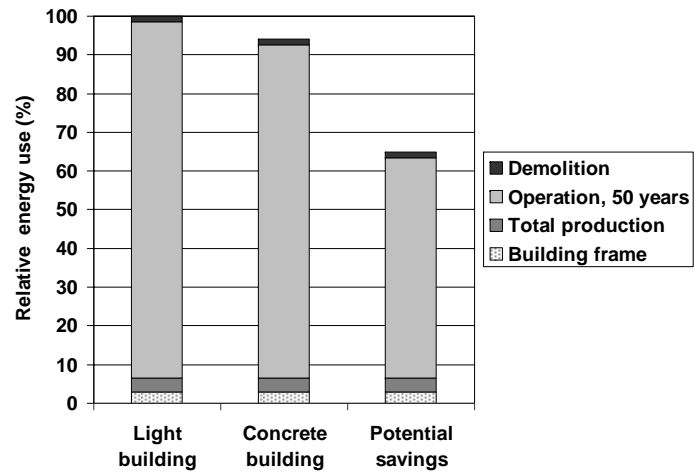


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Realised and potential energy savings

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