

# New building principles in consequence of legislative demands for reduced energy consumption in Danish housing

## Credits

Introduction

The House

The Contextual Approach

The Technological Approach

The Material Approach

Conclusion

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## Partners



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## **New demands**

- **Focus on indoor climate**
- **Primary energy consumption**
- **Cooling if necessary**
- **Alternative heating methods**
- **Dividing the building into components (windows, walls, floors, roofs)**

## **Introduction**

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## **Different Approaches to Optimization**

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## **Introduction**

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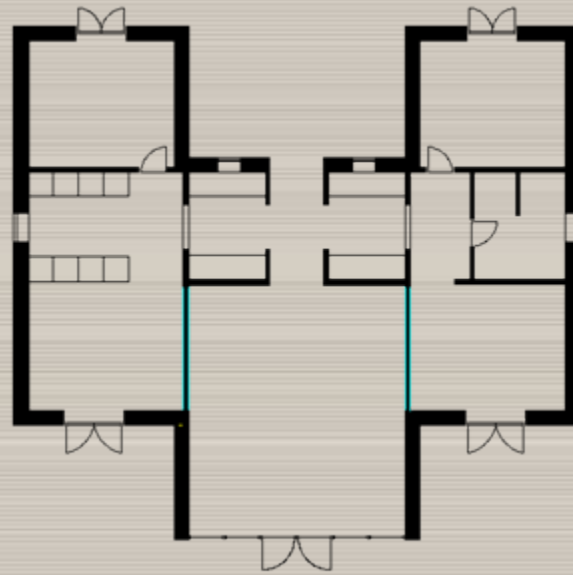
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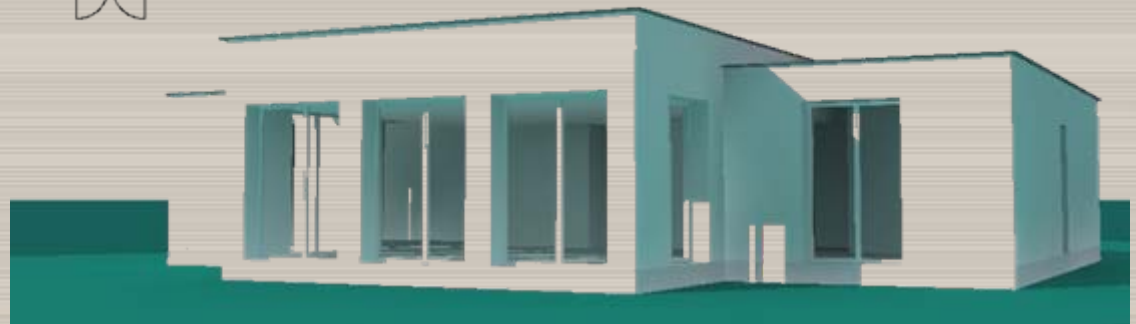


**Light**

**Functionality**

**Contact to surroundings**

**Flow**



## The House

ALWAYS

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## The energy frame

Basic:  $70 \text{ kWh/m}^2 + 2000 \text{ kWh/A} = 85,4 \text{ kWh/m}^2$

Low (class 2):  $50 \text{ kWh/m}^2 + 1600 \text{ kWh/A} = 62,3 \text{ kWh/m}^2$

Low (class 1):  $35 \text{ kWh/m}^2 + 1100 \text{ kWh/A} = 43,4 \text{ kWh/m}^2$

## The initial values

Heating:  $85,6 \text{ kWh/m}^2$

Electrical:  $0,6 \text{ kWh/m}^2$

Overheating:  $0 \text{ kWh/m}^2$

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**TOTAL**  $86,2 \text{ kWh/m}^2$

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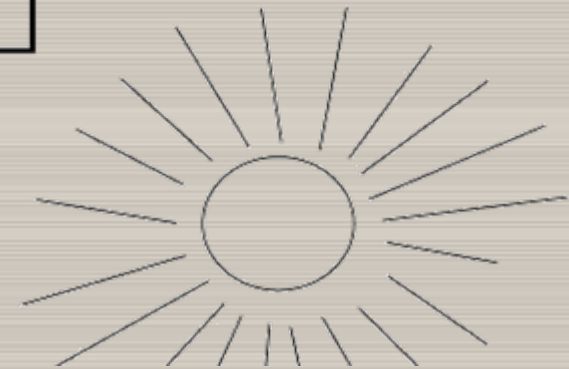
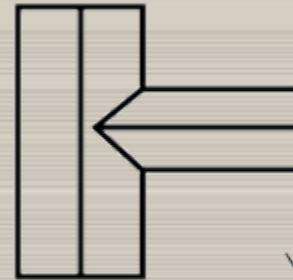
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## The Contextual Approach

ALFA 05

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## All the windows facing south

Heating:	75,9	kWh/m <sup>2</sup>
Electrical:	0,6	kWh/m <sup>2</sup>
Overheating:	3,7	kWh/m <sup>2</sup>
<b>TOTAL</b>	<b>80,2</b>	<b>kWh/m<sup>2</sup></b>

## All the windows facing east and west

Heating:	93	kWh/m <sup>2</sup>
Electrical:	0,6	kWh/m <sup>2</sup>
Overheating:	4,2	kWh/m <sup>2</sup>
<b>TOTAL</b>	<b>97,7</b>	<b>kWh/m<sup>2</sup></b>

## The Contextual Approach

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## Windows to the north rearranged to east and west

Heating:	80,1	kWh/m <sup>2</sup>
Electrical:	0,6	kWh/m <sup>2</sup>
Overheating:	2,1	kWh/m <sup>2</sup>
<b>TOTAL</b>	<b>82,8</b>	<b>kWh/m<sup>2</sup></b>

## By introducing overhang over southern windows

Heating:	80,2	kWh/m <sup>2</sup>
Electrical:	0,6	kWh/m <sup>2</sup>
Overheating:	0	kWh/m <sup>2</sup>
<b>TOTAL</b>	<b>80,7</b>	<b>kWh/m<sup>2</sup></b>

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## Technology to decrease energy consumption

Heating:	50,9	kWh/m <sup>2</sup>
Electrical:	8,1	kWh/m <sup>2</sup>
Overheating:	0	kWh/m <sup>2</sup>
<b>TOTAL</b>	<b>59</b>	<b>kWh/m<sup>2</sup></b>

**By introducing HVAC with heat recovery the building complies with low energy class 2**

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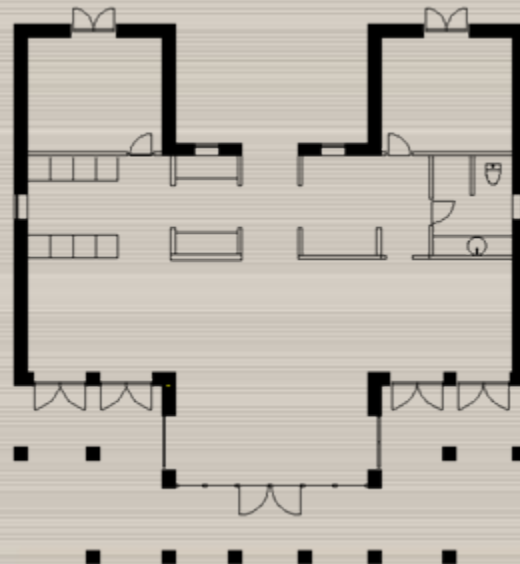
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## Technology to decrease energy consumption

Heating:	72,1	kWh/m <sup>2</sup>
Electrical:	8,1	kWh/m <sup>2</sup>
Overheating:	0	kWh/m <sup>2</sup>
<b>TOTAL</b>	<b>80,2</b>	<b>kWh/m<sup>2</sup></b>



Doubled amount of windows

Windows to the north

Large veranda to the south

Decreased energy consumption

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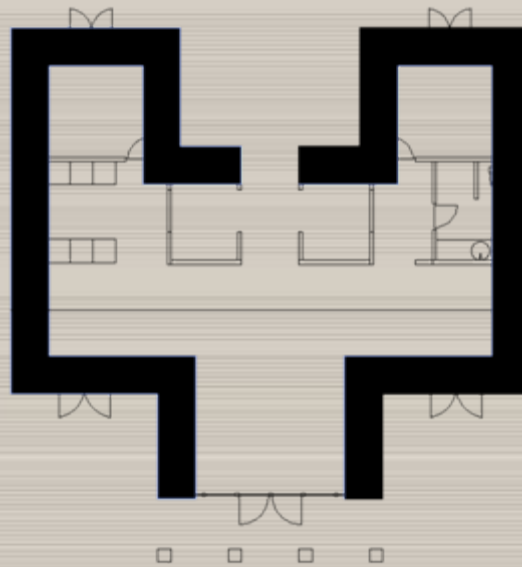
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Heating:	72,1	kWh/m <sup>2</sup>
Electrical:	8,1	kWh/m <sup>2</sup>
Overheating:	0	kWh/m <sup>2</sup>
<b>TOTAL</b>	<b>80,2</b>	<b>kWh/m<sup>2</sup></b>

**Decreased living area due to thicker walls**  
**Little impact due to large amount of windows**  
**Should follow the contextual approach naturally (obvious where to increase insulation)**

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**The new demands are only the beginning.**

**The methodology should be implemented in the initial design process.**

**The contextual and material approaches could save expensive technological steps.**

**Technology can counteract the effects of poorly designed houses.**

**The simulation software intended to be a verification tool can be used as a design tool.**

## Conclusion