



## Background

Paper and presentation based on the book:

*Architecture and Energy*

Winner of Danish Energy Association's *ElforskPrisen 2007*

The 2007 prize for the best Danish research project on effective energy consumption and savings



## The Past

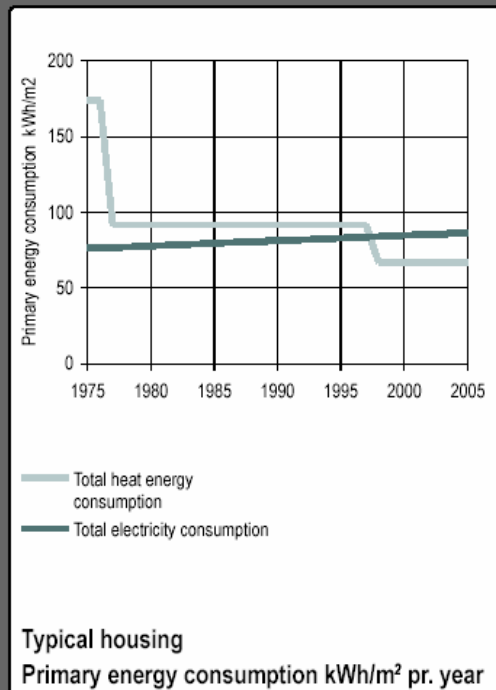
Since the 1970's oil crisis there has been a large effort to minimise buildings' heat consumption

Social and technological processes of change have resulted in a large growth in electricity consumption

Typical new housing 1975 - 2005:

- Heat consumption: - 65 %
- Electricity consumption: +10 %

Since the 1990's electricity consumption larger than heat consumption



## The Present

New Energy Regulations with holistic assesment method:

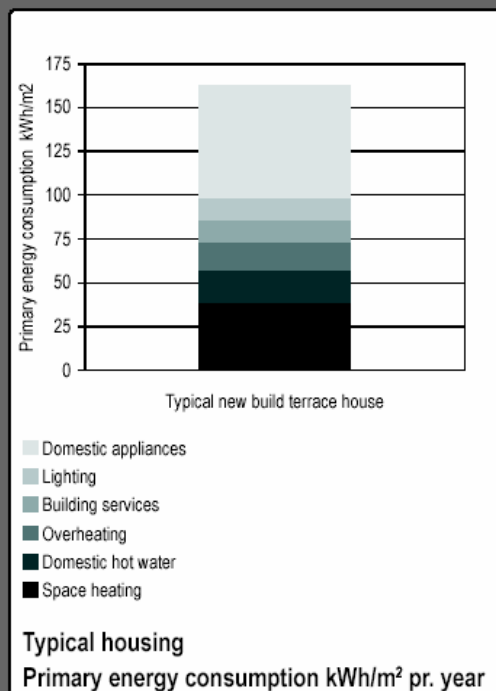
- Electricity consumption counts as primary energy
- Factor 2,5: equal to CO<sub>2</sub>-emissions

Electricity consumption more important than heat consumption for most important types of new buildings:

- Electricity consumption: 60 %
- Heat consumption: 40 %

For new housing:

- Electricity to domestic appliances: 40 %
- Space heating: 25 %



## The Future

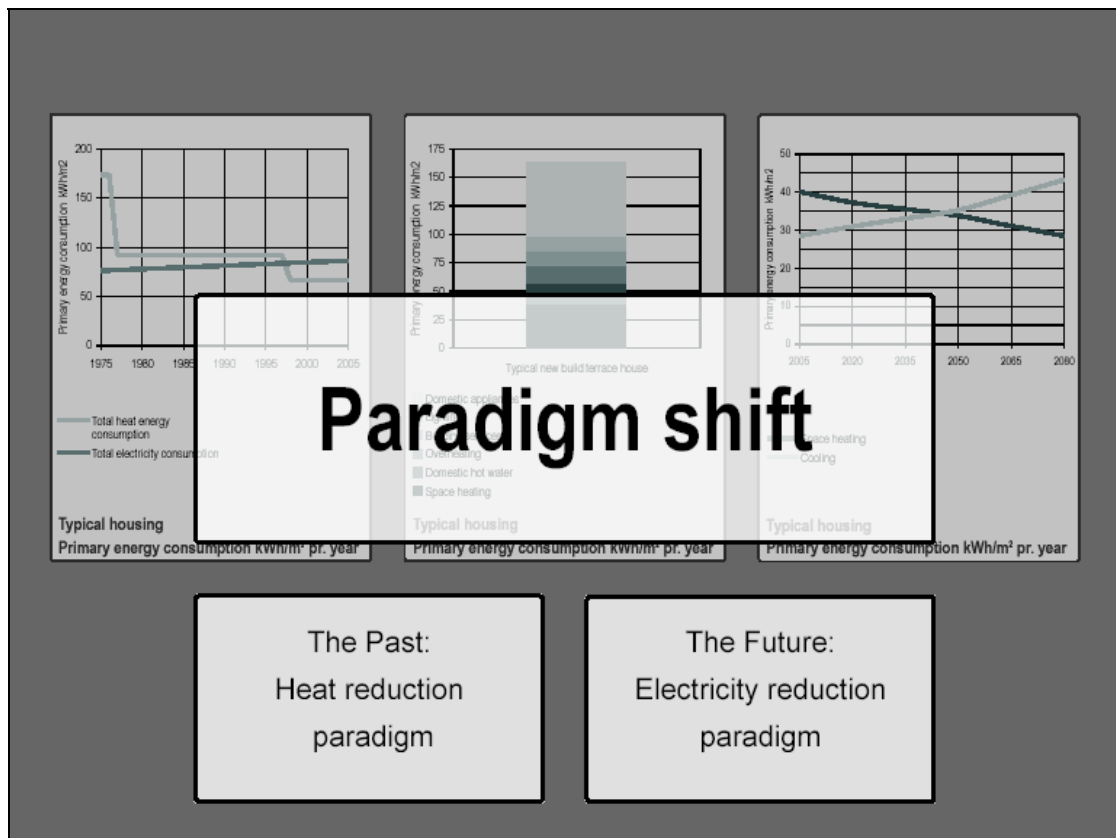
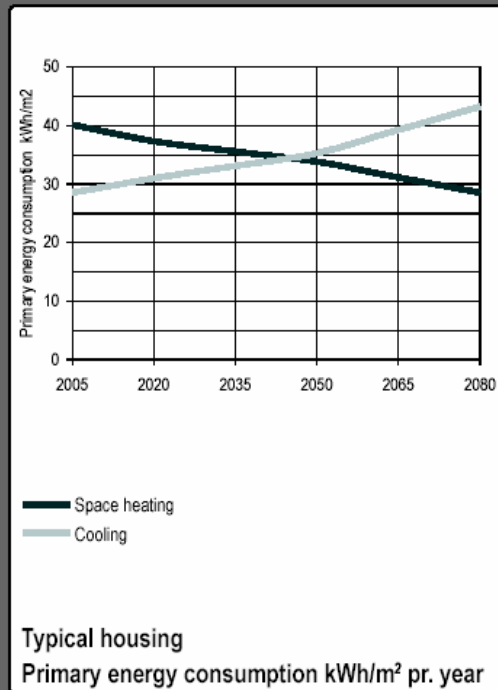
From 2001 to 2006: five of the eight hottest years since 1874 in Denmark

Global warming and climate change will result in summer and winter temperature increases in Denmark:

- Greater demand for cooling
- Reduced demand for heating

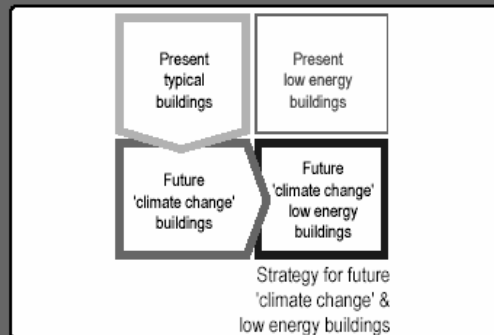
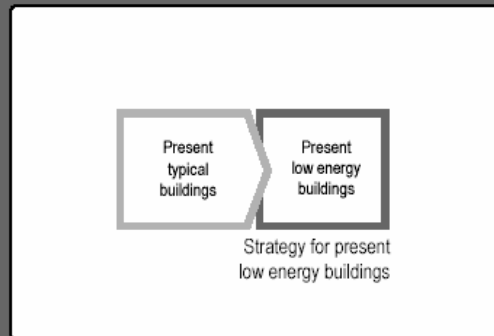
For typical housing 2005 - 2080:

- Energy for cooling: + 50 %
- Energy for space heating: - 30 %
- Cooling larger than space heating in 30 - 40 years



## The New Paradigm

- Focus on electricity and heat reductions in a holistic perspective
- Focus on electricity savings and reducing cooling demand
- Focus on minimising the effects of climate change



## Design Strategy

### 1 Functionality

User-orientated and functional strategies to reduce buildings' electricity consumption beyond the requirements of the current Energy Regulations

### 2 Spatiality

Spatial proportioning and façade design to improve daylighting and indoor comfort, whilst electricity consumption to lighting, cooling and ventilation is reduced

### 3 Materiality

Design of structural and constructional elements optimised to reduce energy to heating, cooling and material production

### 4 Technology

Building integrated energy saving and producing technologies optimised in relation to future climate change and energy supply scenarios for buildings

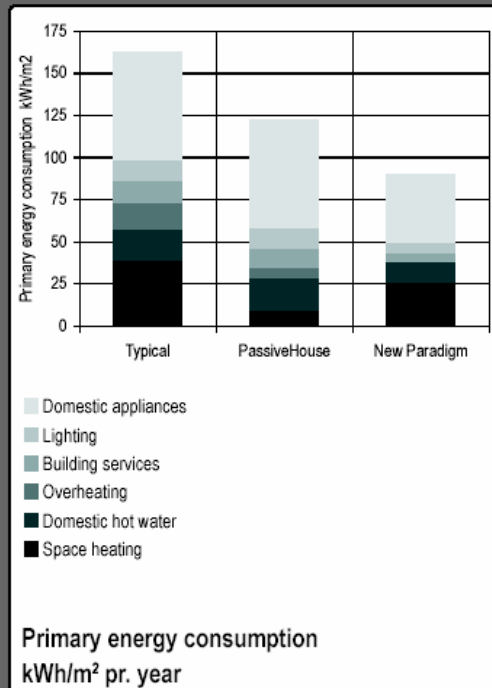


## Design Example: Energy Consumption

Cumulative effect of the new paradigm on the total primary energy consumption for housing

Following solutions compared:

- Typical terrace house
- Same house built after the so-called *PassiveHouse* standard which only reduces space heating demand
- Same house built after the *NewParadigm* with a focus on reducing electricity and heat consumption in unity



## Design Example: Climate Change

Total primary consumption as a result of expected temperature changes in Denmark because of climate change between 2005 and 2080:

- *PassiveHouse* gives increasing energy consumption because of growing overheating problems and cooling demand
- *NewParadigm* with a focus on reducing electricity consumption and overheating has lowest energy consumption both now and in the future

