

Low energy domestic buildings

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Why low energy houses ?

- Policy goal of large cities: will build energy neutral from 2015 (zero net fossil energy on local level)
 - Amsterdam: from 2010 for 40% of built volume
- Also outside large cities:
 - New development areas in rural communities in the province of Utrecht
 - Several smaller cities
- Increase in energy performance requirements for houses from **0.8** at present to **0.6** in 2011 and **0.4** in 2015
- Independence from fossil energy suppliers and market prices

The way to climate neutral houses

- Trias Energetica
 - Reduction of demand
 - Use available renewable energy / individual energy production
 - Energy efficient equipment and systems
 - Collective renewable energy production
- Reduction of demand:
 - Insulation, air tightness, heat recovery
 - Low energy houses (including passive houses)

Low energy houses

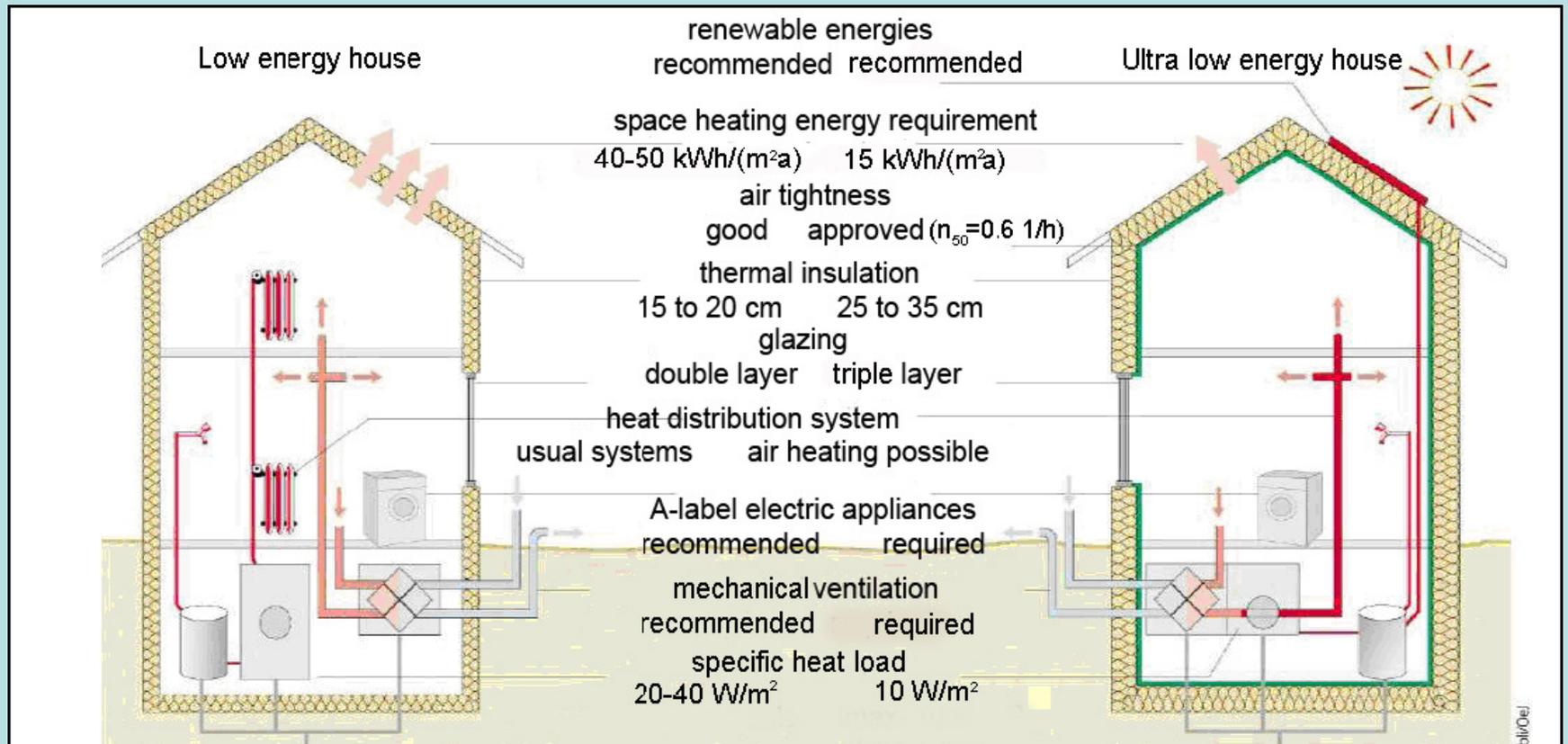


Berckelbosch LEW EPC 0,4



Sliedrecht passive house EPC 0,4

Low – and ultra low energy houses



Tender 'Towards energy neutral houses' (Naar energieneutraal wonen UKR)

- 42 applications
- 15 granted
- 11 new constructions and 4 renovations
- 45% CO₂-reduction compared to 1990, including domestic energy

Climate neutral renovation project Amsterdam



HAARLEMMERLIEDE EN SPAARNWOUDE

CLIMATE READY NIEUWBOUW





EINDHOVEN

BERCKELBOSCH



Tender 'Towards energy neutral houses'

- EPC's ranging from 0,18 to 0,51 (new construction)
- Heat pumps in most projects (new and renovation)
 - Collective brine-water (2 new, 2 renovation)
 - Collective air-water (1 renovation)
 - Individual ground/brine-water (4 new)
 - HP Boiler (1 new, passive)
 - No WP or not decided yet (5 new)
- Building cost increase from € 10.000 up
- Pay back time on energy costs from 12 years
- 5 passive house projects (from 15 total) have been granted

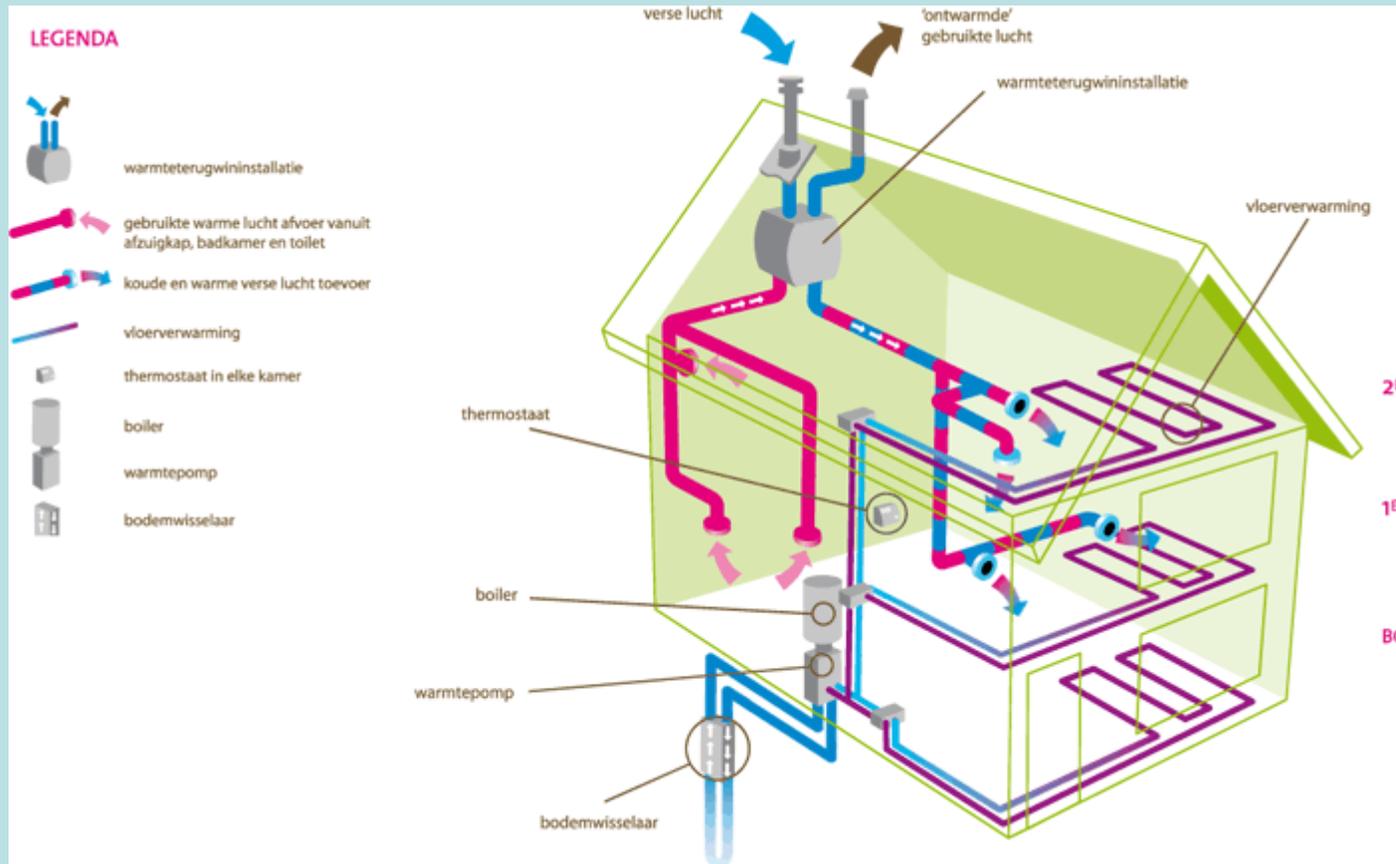
Specifications low energy house

- In the Netherlands no official definition for a low energy house exists ..
- Practical requirements
 - $R_c = 5$
 - HR++ glass ($U=1,1 \text{ W/m}^2\text{K}$)
 - Optimize for the use of day light
 - Low temperature heating system
 - Avoid thermal bridges
 - Air and vapour tight to passive standard
- Essential: good build quality

Specifications low energy house

- Installation
 - Heat pump
 - Solar storage water heater
 - Shower heat recovery
 - Balanced ventilation or heat pump boiler on ventilation air
 - Hot fill washing machine and dish washer
 - Standby killers

Integrated system, all components matched



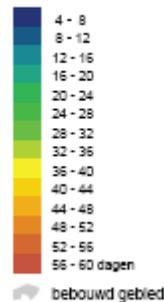
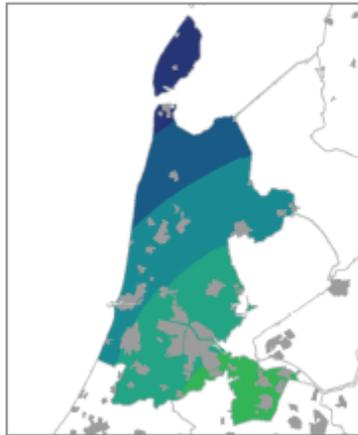
Limits to air as a heating medium

- Maximal capacity 10 W/m² for heating (50 °C)
- Maximal capacity for cooling 2 W/m² (16 °C)
- Dry air in winter
- No temperature differentiation possible, all rooms have the same temperature (passive house)
- Combination with low temperature system solves these problems
- Good indoor air quality is essential !

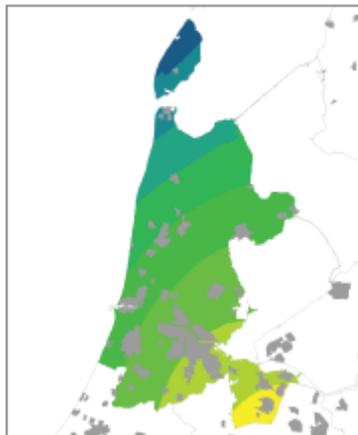
Cooling: do we need it ?

Aantal zomerse dagen per jaar (maximumtemperatuur $\geq 25^{\circ}\text{C}$)

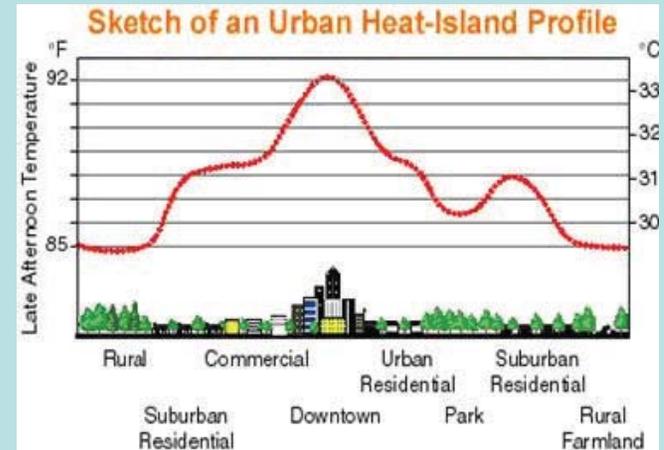
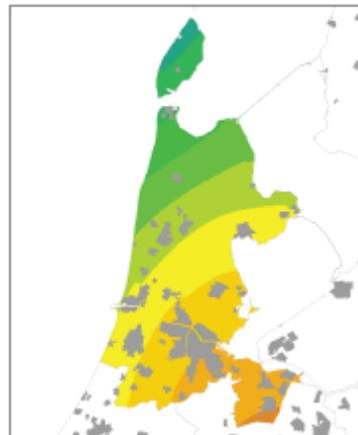
1978 - 2005



2050 W



2050 W+



- 70 % more Sun-days (over 25 degrees) per year in 2050
- Up to 6 degrees warmer in cities (heat island, airco)
- Limited capacity of mechanical ventilation
- Heat load: shower, electrical equipment

Economy, flexibility, sustainability

- The applications for the tender UKR include information on cost increase for energy neutral houses:
 - Goal achievable from € 10.000 (EPC 0,4) per house
 - Mean cost increase low energy houses € 18.000
 - Mean cost increase passive houses € 25.000
- Study Amsterdam City Council for energy neutral houses compared to the minimum requirement for typical housing projects: € 13.000
- Pay back time 12 years achievable, mean 20 years

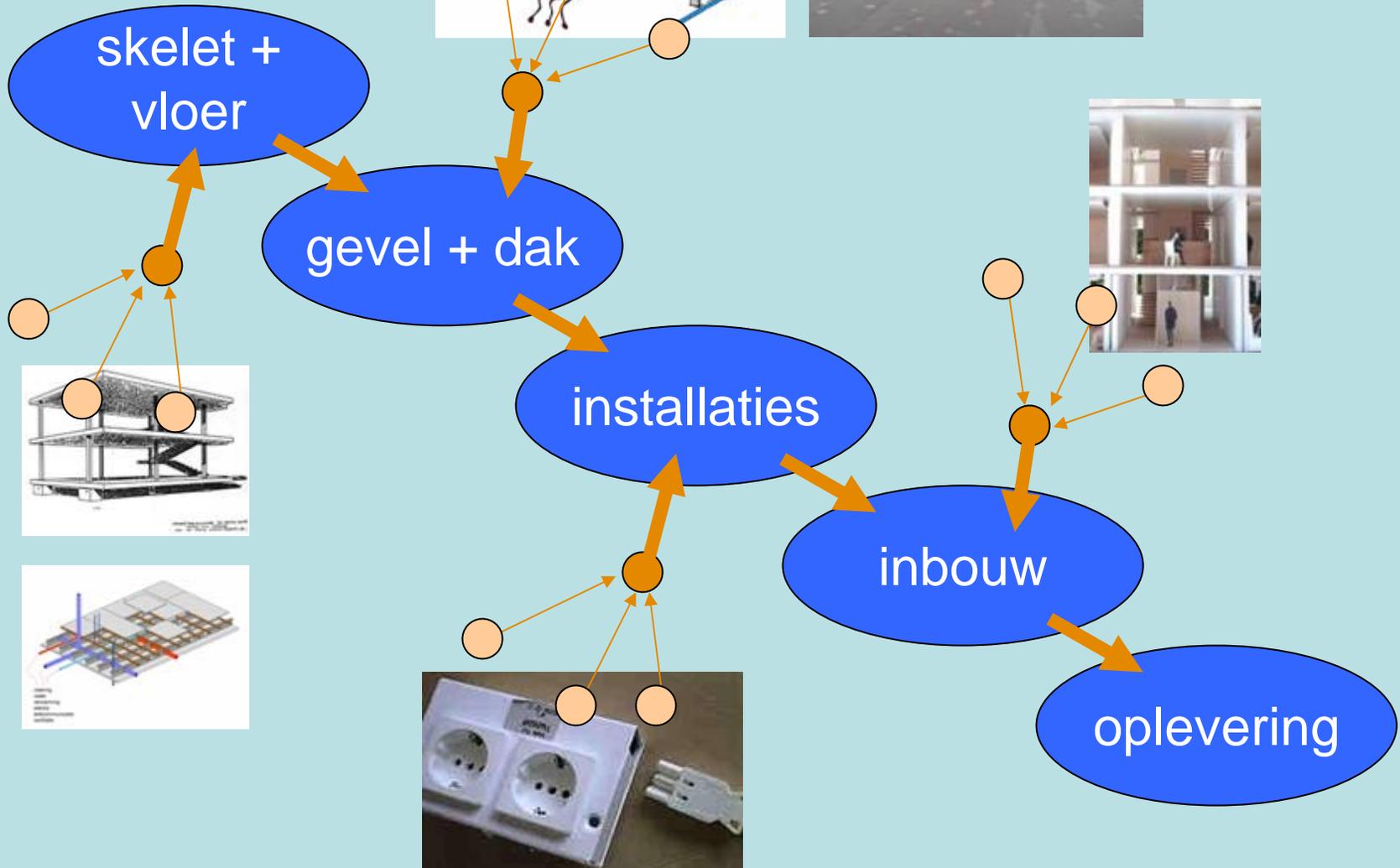
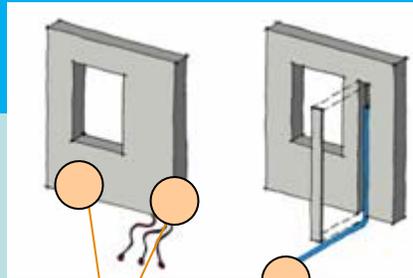
Flexibility, IFD

- Advantages flexibility
 - Flexible buildings allow for function changes and adapt to future developments
 - Flexibility increases life span, reduces the consumption of materials, energy, the transport volume and the volume of building waste
 - Better market value (sell and rent)
 - Lower maintenance costs
- IFD: Industrial, flexible, and removable building construction
 - Better building quality / industrial production and quality control
 - Lower costs (even small series)
 - Shorter building times
 - Removable means re-usable
 - Production of waste can be avoided

Changes to the building process are necessary

- Building parties accept responsibility for the energy performance and built quality
- Suppliers involved in the planning and design process
- Influence of buyers / owners
- Buyer / owner will have to learn to define their needs over time
- Coordination of the process and cooperation by a general manager, who will take care of responsibilities
- Sustainable procurement of buildings: decide on life time effects and not first investment

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Conclusions

- At the moment, it is already possible to build energy neutral houses at acceptable costs
- This goal can best be achieved by low energy houses with a long life span.
- Passive houses use more material and are less flexible. This increases the environmental footprint
- Changes in the building contracts, building process and commitment procedure are necessary, so that building parties can accept responsibility for the energy performance and the overall quality
- As a stakeholder, the local government should see to a well informed setting of ambitions in projects and to a precise fulfilment of the requirements of the building code