



Energy research Centre of the Netherlands

Sustainable Energy in the Built Environment in the Netherlands

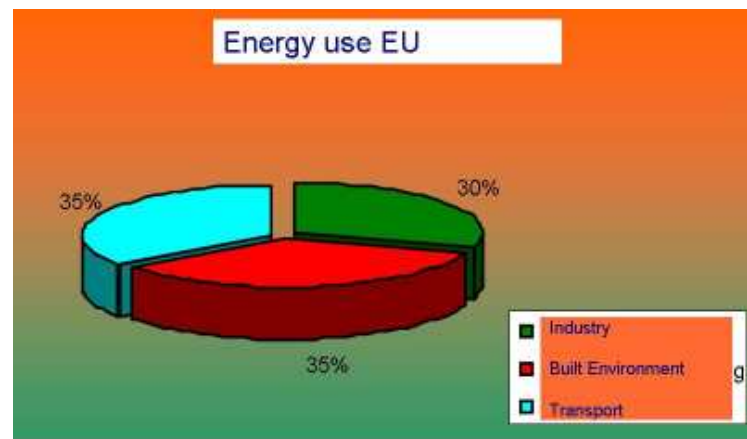
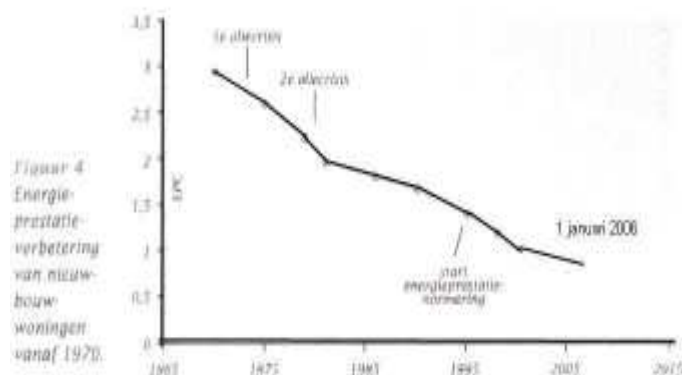
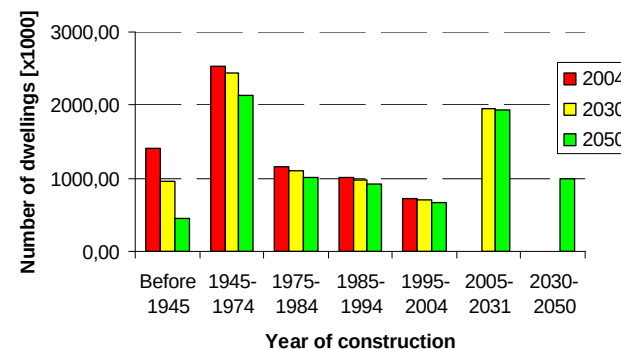
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The built environment in numbers

- ± 1000 PJ/year; 2/3 houses, 1/3 offices
- Existing housing stock $\cong 6$ million
- Mainly gas and electricity
- About 50% is privately owned

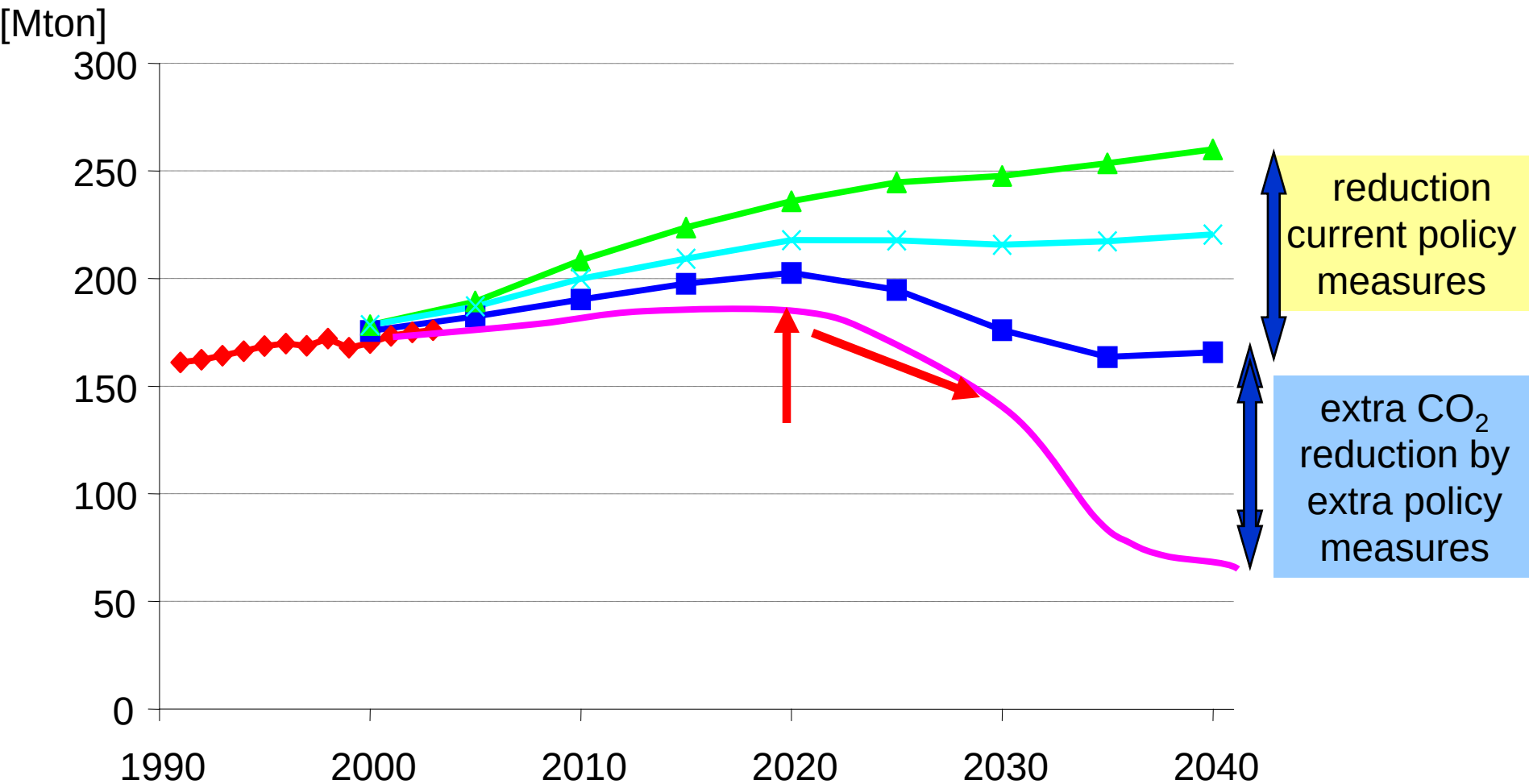


EU and national targets 2020

	EU agreement	Coalition agreement Balkende IV
Greenhouse gases emission reduction	20 % (± 30 %, dependent on commitment U.S, China, India)	30 % ¹
Energy efficiency improvement	20 % in 2020, action plan EE	2 %/ year
Biofuels	10% binding minimum	10%
Renewable energy sources	20 %	20 % (including biofuel)

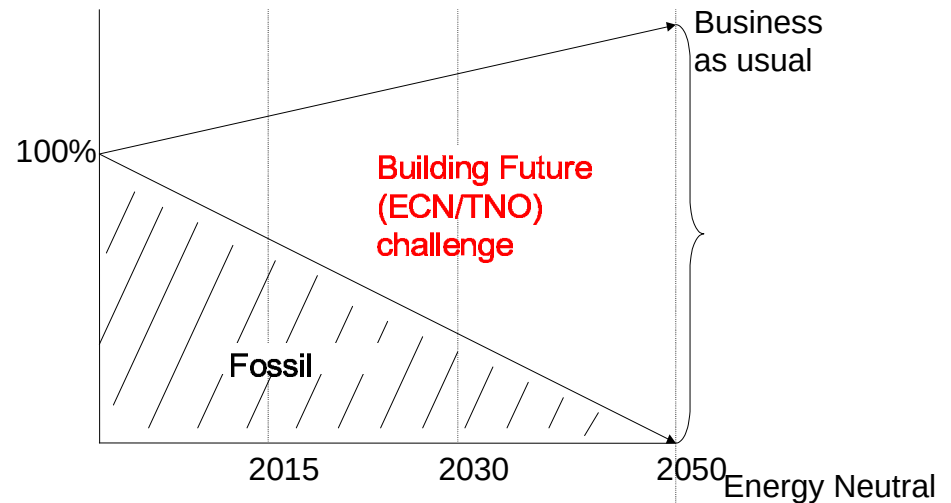
¹ reference year 1990

NL CO₂ emissions



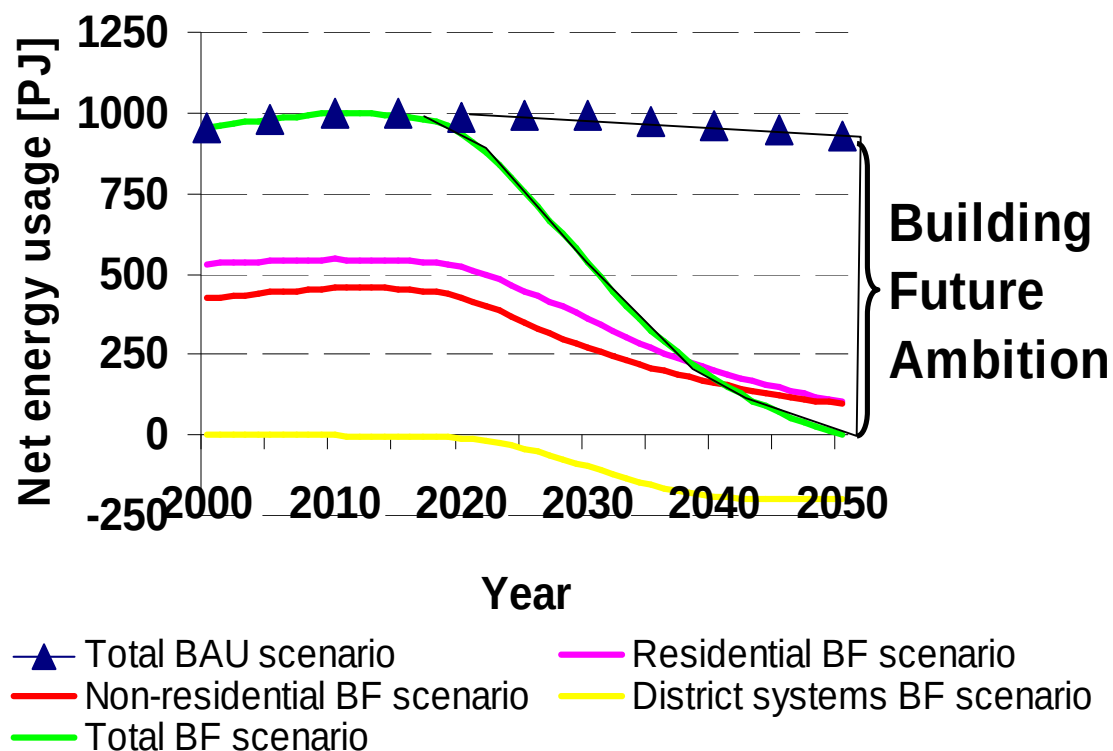
The challenge

- Energy neutral Built Environment around 2050
 - Total Energy
 - Building-related + User-related + Built Environment-related
- Net energy neutral
- All buildings
 - Residential
 - Non-residential



The ambition in numbers

- All measures for residential buildings combined: -385 PJ
- 5% E-reduction / year non-residential buildings: -410 PJ
- All building-related measures combined: -755 PJ
- Ambition for measures at district level: -200 PJ



Energy impact of measures

- Using the Energy pyramid:

1. Reduction of demand
(energy saving)

2. Employ renewable
energy sources

Demand reduction:

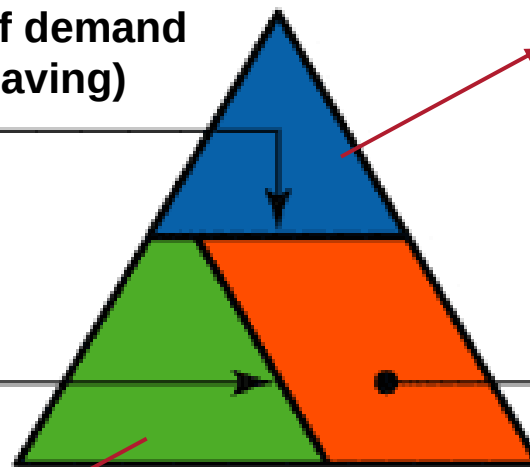
- air tightness (0.6/h)
- insulation (R_c 7.5 m².k/W)
- ventilation with heat recovery
- external shading
- domestic hot water
- electricity use for household appliances towards 2000 kWh/year in 2050



3. Make fossil fuel use
as clean as possible

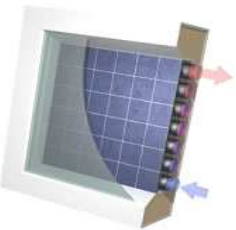
Efficient/clean fossil
energy:

- stirling μ -CHP
- fuel cells
- district heating



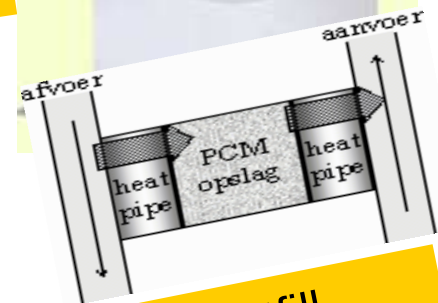
Renewable Energy:

- Solar thermal (space heating and DHW)
- Geothermal (HP)
- Electric: PhotoVoltaics, small-scale wind
- Hybrid: PVT, heat-driven μ -ORC



Implications for R&D

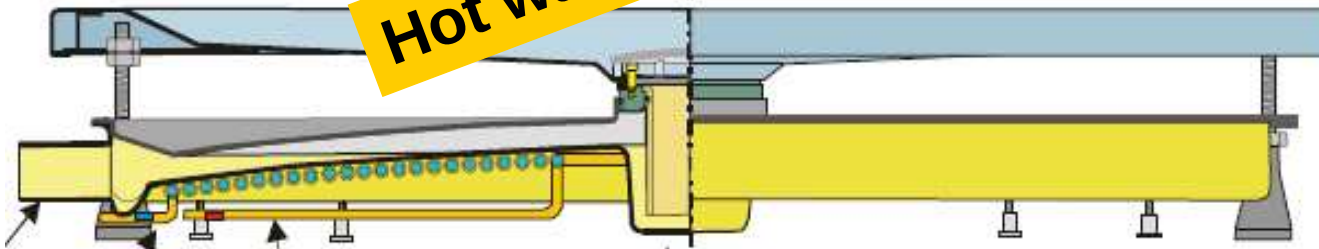
- “Break through” technologies and improvements
 - μ -CHP
 - Multifunctional building components for RE-generation (e.g. PVT)
 - Compact (Seasonal) Heat storage
 - Solutions for reduction of HHA-energy demand
- Intelligent integration in complete concepts
 - E+ new buildings
 - Factor 4 (over all!) retrofitting aligned to renovation-motivation
 - Community systems (RE)
- Harvest the full potential of the (designed) concepts
 - Influence of Building Process
 - Influence of End-Users



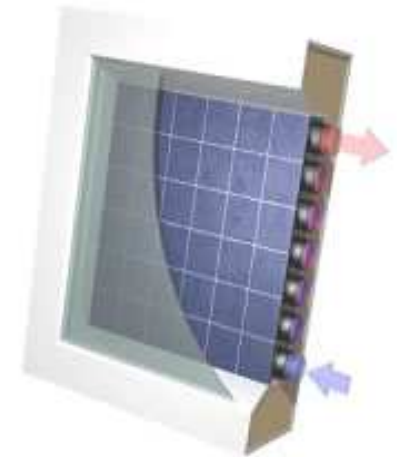
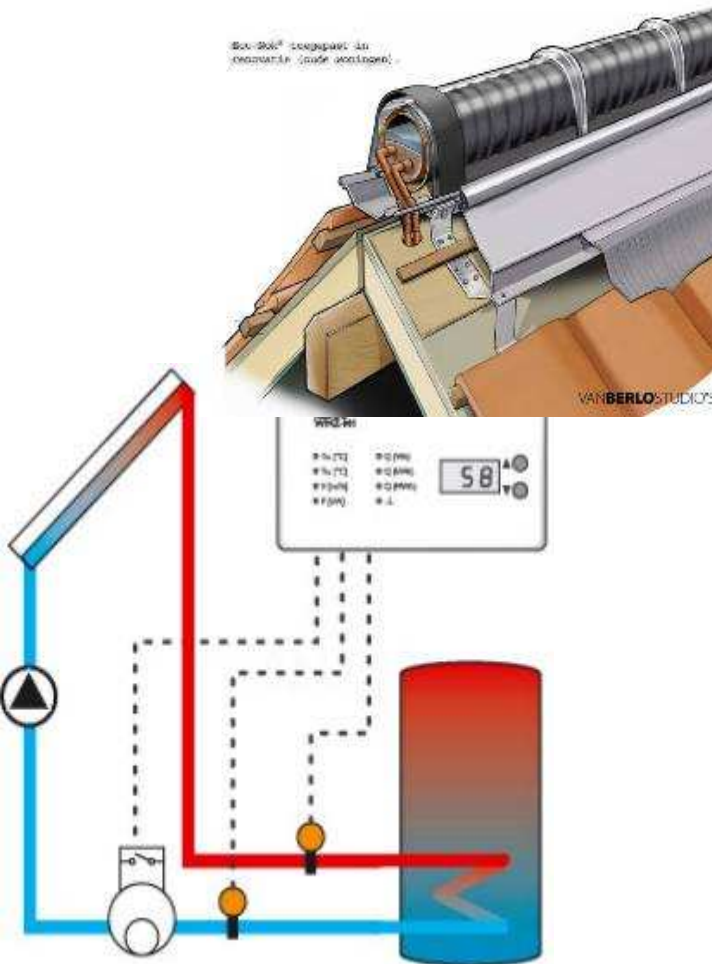
Hotfill



Hot water



Thermal Systems: multifunctional RE Generation



PVT collector

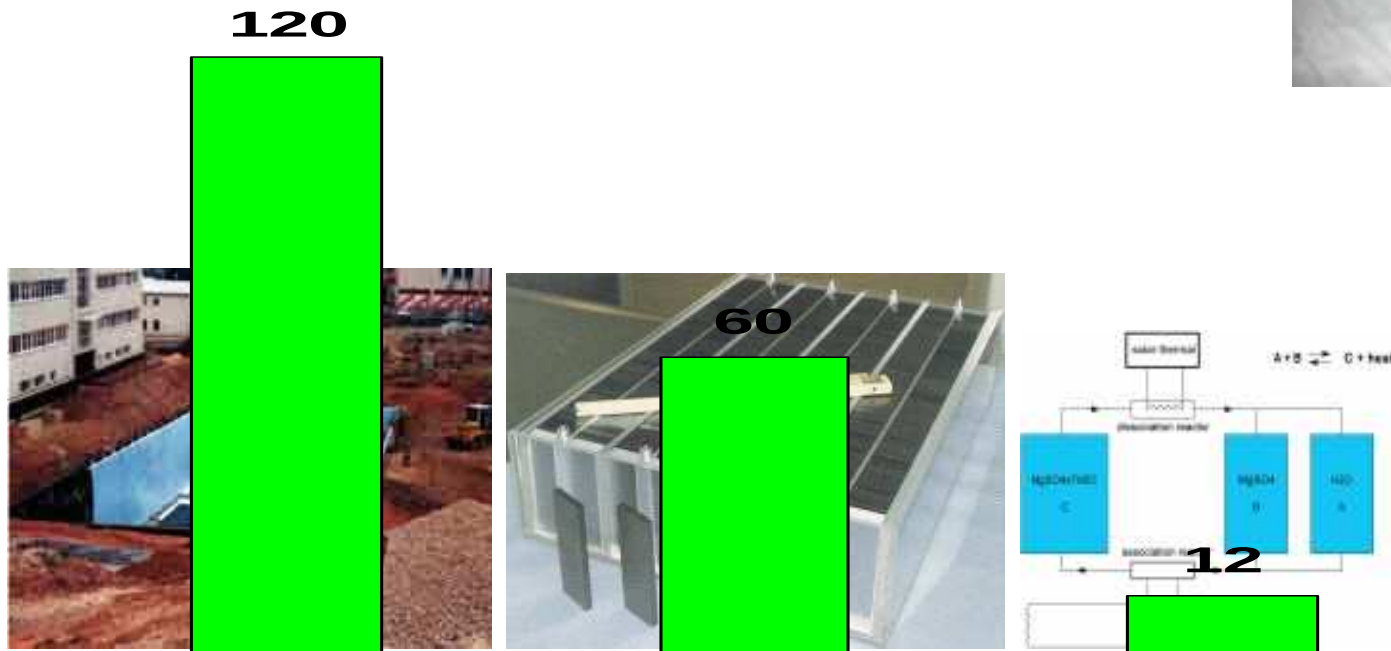


Vacuum tube solar collector
(+ μ -ORC)

Storage systems: heat and electricity

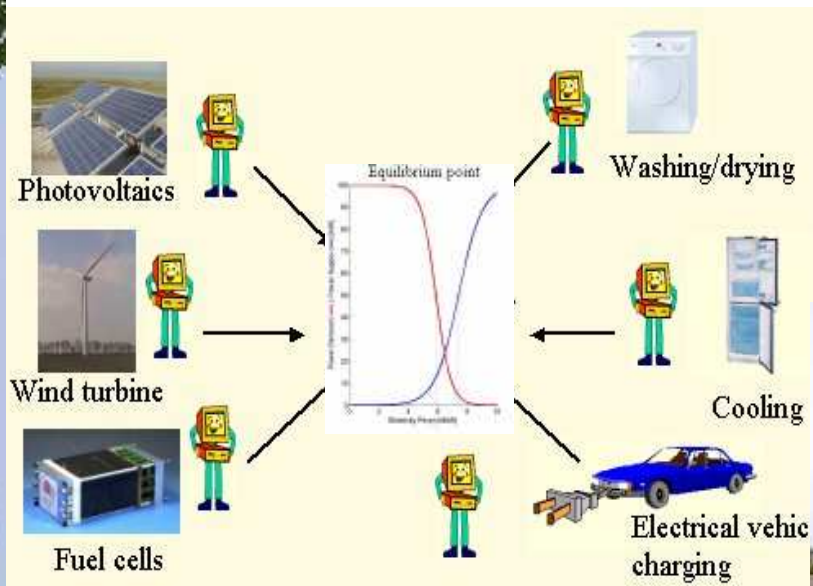
Maximising renewable energy yield

- Day-based supply-demand matching
- Seasonal storage
 - Heat/Electricity storage in (local) grids
 - Compact heat storage integrated in the façade



Building energetics

- System Integration and energy management



DSM behind the meter



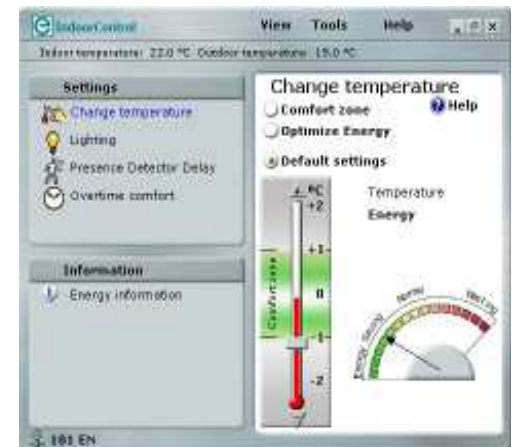
Building energetics

Technological system integration:

- Integration in buildings
- Connection to the grid
- Matching of demand and supply
- Introduction of storage systems (heat & electricity)

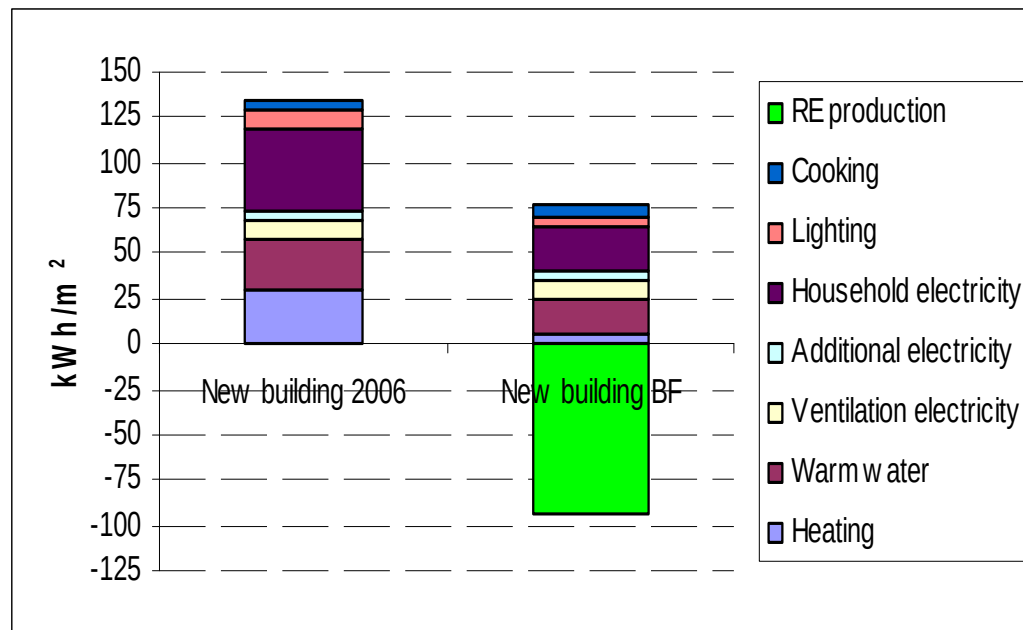
System integration is more:

- New processes
- Social aspects
- New players on the market
- Easy use, comfort



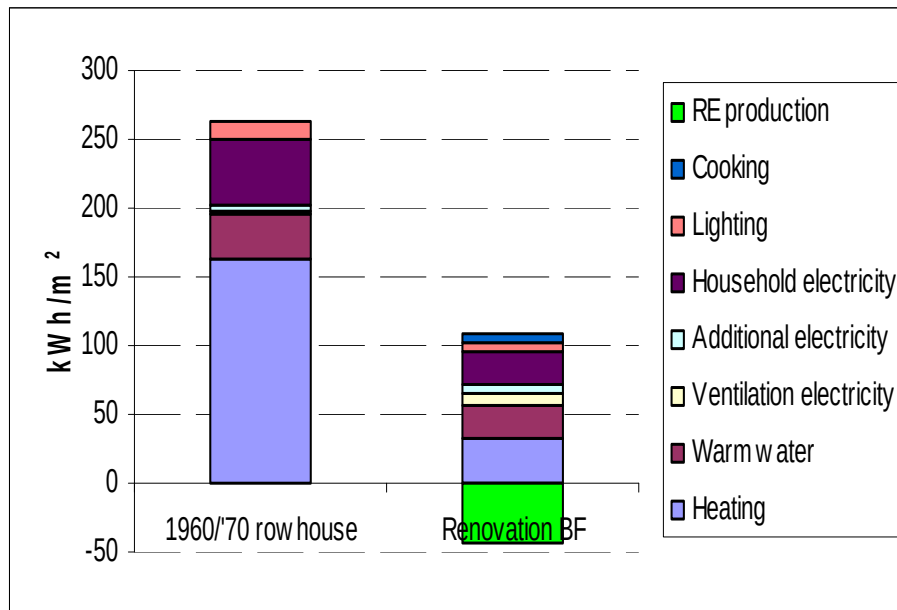
Building concepts: new buildings E⁺

- Minimise demand (passive houses), integrate RE (storage!), optimise EE
- No regret options



Building concepts: -75% renovation terrace house

- Measures adapted to renovation motivation (e.g. comfort)
- Minimise demand, integrate RE (storage!), optimise EE

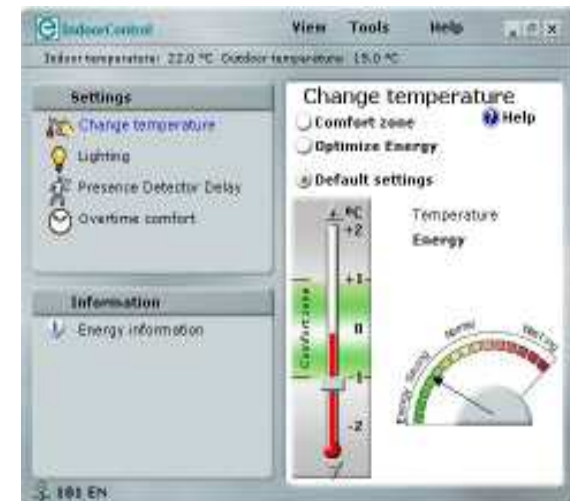


Optimal Energy & Comfort Management

- Environment adaptive
 - Daylight-control lighting
 - Natural ventilation night cooling
 - Active shading
- User adaptive
 - Presence based ventilation
 - Presence based lighting
 - Presence based heating
 - Standby Killer
- User educative
 - Ventilation behavior
 - Smart meters & feedback
 - Commissioning and maintenance



'Standby
killer'



Advanced Energy-management

How to achieve these ambitions

- National Platform for energy transition in the built environment; cooperation of government, research and industry
- Participation in international technology platforms: ECTP, ESTTP, Smartgrids, PVTP, etc.
- (Inter)national cooperation with industry, other research groups, etc.
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DeltaNeth in the Netherlands

- Related to R&D&I
 - R&D&I agenda
 - Open network
 - To Connect people and ideas
 - Support to consortia and proposals
- Participation European level
 - ECTP (High Level Group, Support Group, Focus Areas)
 - National Technology Platforms
 - EurekaBuild / EraNet / ...



DeltaNeth
Netherlands Technology Platform

Some conclusions

- High ambitions on a national level
- The built environment can contribute considerably via energy savings and the introduction of sustainable energy
- It will be a challenge for many years for all stakeholders to come to large scale implementation
- Its the combination of introducing new technologies and system integration