TREES

Training for Renovated Energy Efficient Social housing

Intelligent Energy Europe programme - Contract n° EIE/05/110/SI2.420021

Intelligent Energy Europe

Section 3 - Case study

3.1 Gårdsten, Sweden

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TREES

CIT Energy Management AB
A Chalmers Industriteknik Company

TOPIC BOUNDARIES

- Renovation of multifamily buildings in a Northern European Climate
- Municipal housing
  - Management
  - Economy
- Solar collectors as one of several options

EC – THERMIE PROJECTS

Solhus 1 (SHINE) – 1997-2001
255 unoccupied apartments
Total contract - SKANSKA

Solhus 2 (RegenLink) - 2000-2004
243 occupied apartments
Several contracts


High-rise
Low-rise
Before renovation

Ongoing renovation – 255 apartments

After renovation – 255 apartments

GENERAL APPROACH

- **Different opportunities** in different building areas (age, design, maintenance)
- **The approach should be the same**
  - Comprehensive feasibility studies
  - Experienced consultants
  - **Reduced energy requirements**
  - Appropriate contracts (5 year guarantee ?!)
  - Evaluation – Follow-up !

ENERGY – EXIST. MF BUILDING

CAUSE	ACTION
Behaviour (Tenants)	Ongoing information
Equipment (Electr.)	Change of equipment **10-15 years**
Incorrect use of equipment	Education and adjustment **1-3 years**
Heat demand (Indoor climate)	Rebuilding/renov./replacement Systems **15-20 years** Building comp. **30-50 years**

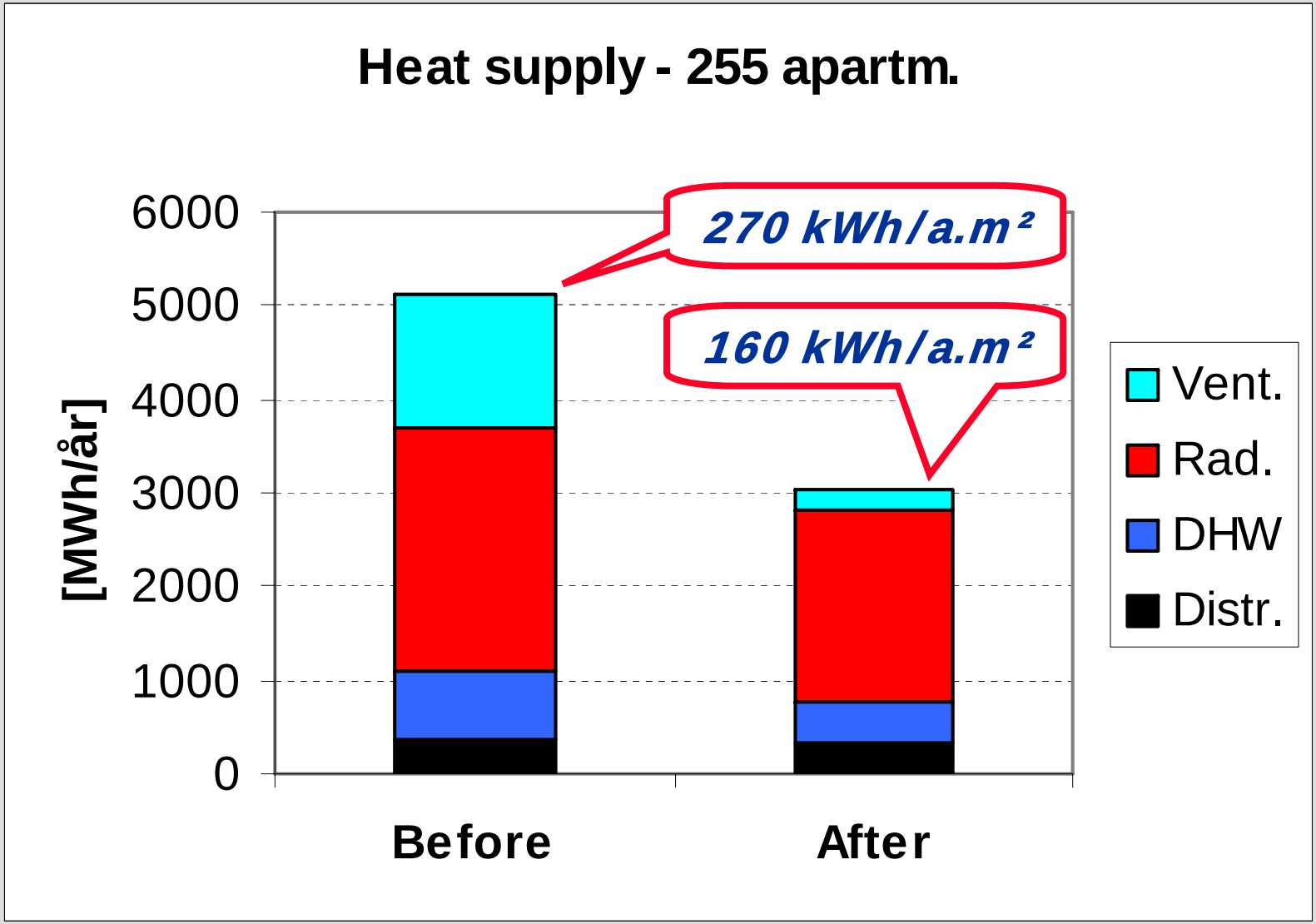
HOLISTIC APPROACH

- Requirements vs. Feasibility
- Maintenance vs. Improvements
  (Re-use if possible)
- Traditional vs. New technologies
- Architectural integration
- LCC vs. Investments

ENERGY TARGETS

- Building envelope - Heat (losses)
- Ventilation - Heat (losses)
- DHW – Heat (demand), water (use)
- Equipment (fans, etc.) - Electricity
- Systems operation – Heat & electr.
- Tenant behaviour – Heat, electr. & water

”Design study”



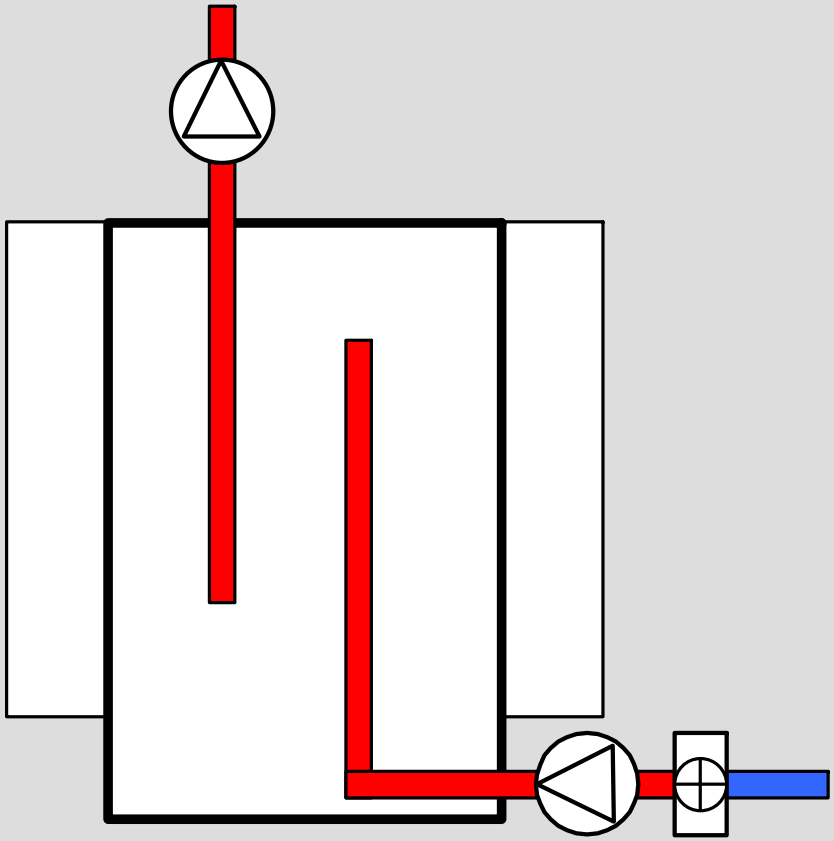
”TRADITIONAL” MEASURES

- Ventilation to be inspected - Improved systems
- Roofs to be renovated - Additional insulation
- Balconies to be renovated - Glazed balconies
- Windows to be renovated
  - Inner window panes replaced by low-e
- Gables to be renovated – Additonal insulation
- Drainage to be improved
  - Additional insulation on floor slabs

”NEW” MEASURES

- Roofs to be renovated
  – Roof-integrated solar collectors (DHW)
- Laundries to be replaced - New washing machines and laundry dryers connected to the hot water system
- White goods to be replaced
  - Energy labelled white goods
- Presence controlled lamps in common spaces
- PC-based supervision system
- Individual metering

“High-rise” - **Before**



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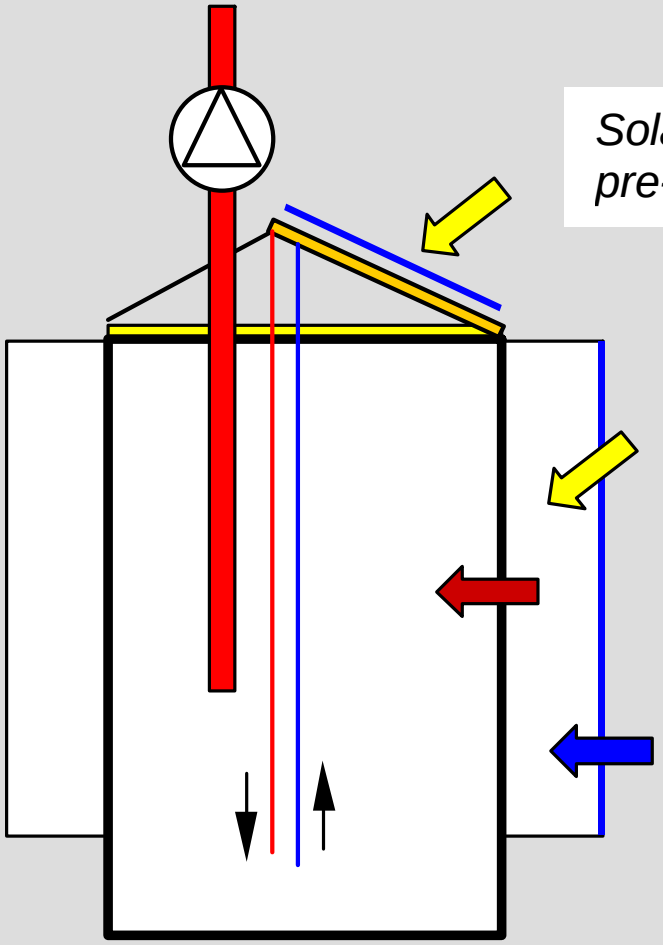
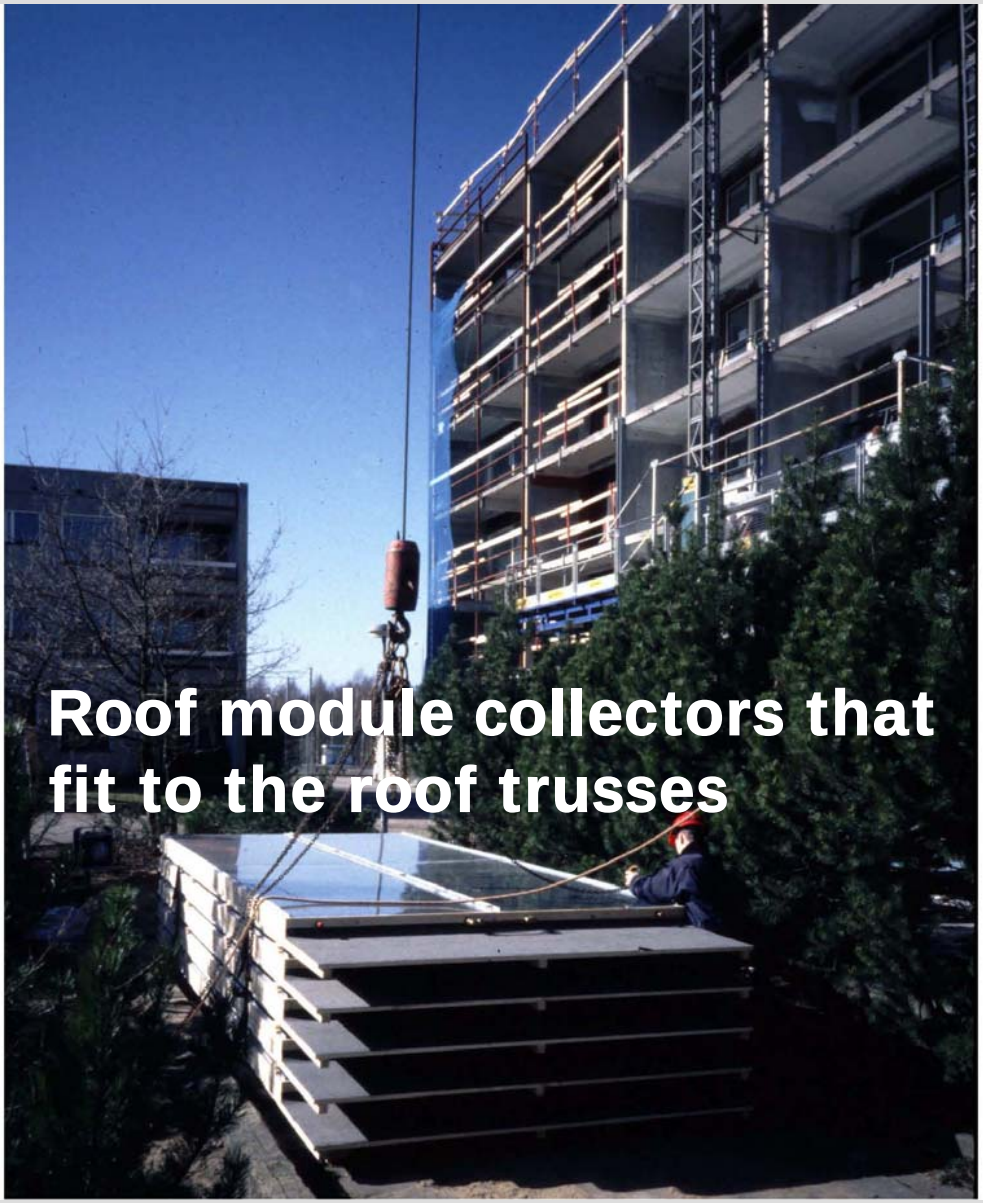


Solar collectors for pre-heating DHW

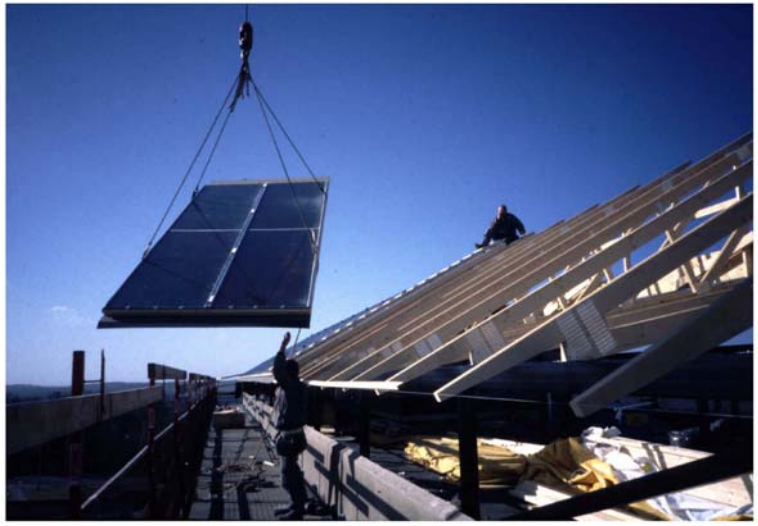
Supply air via glaced balconies

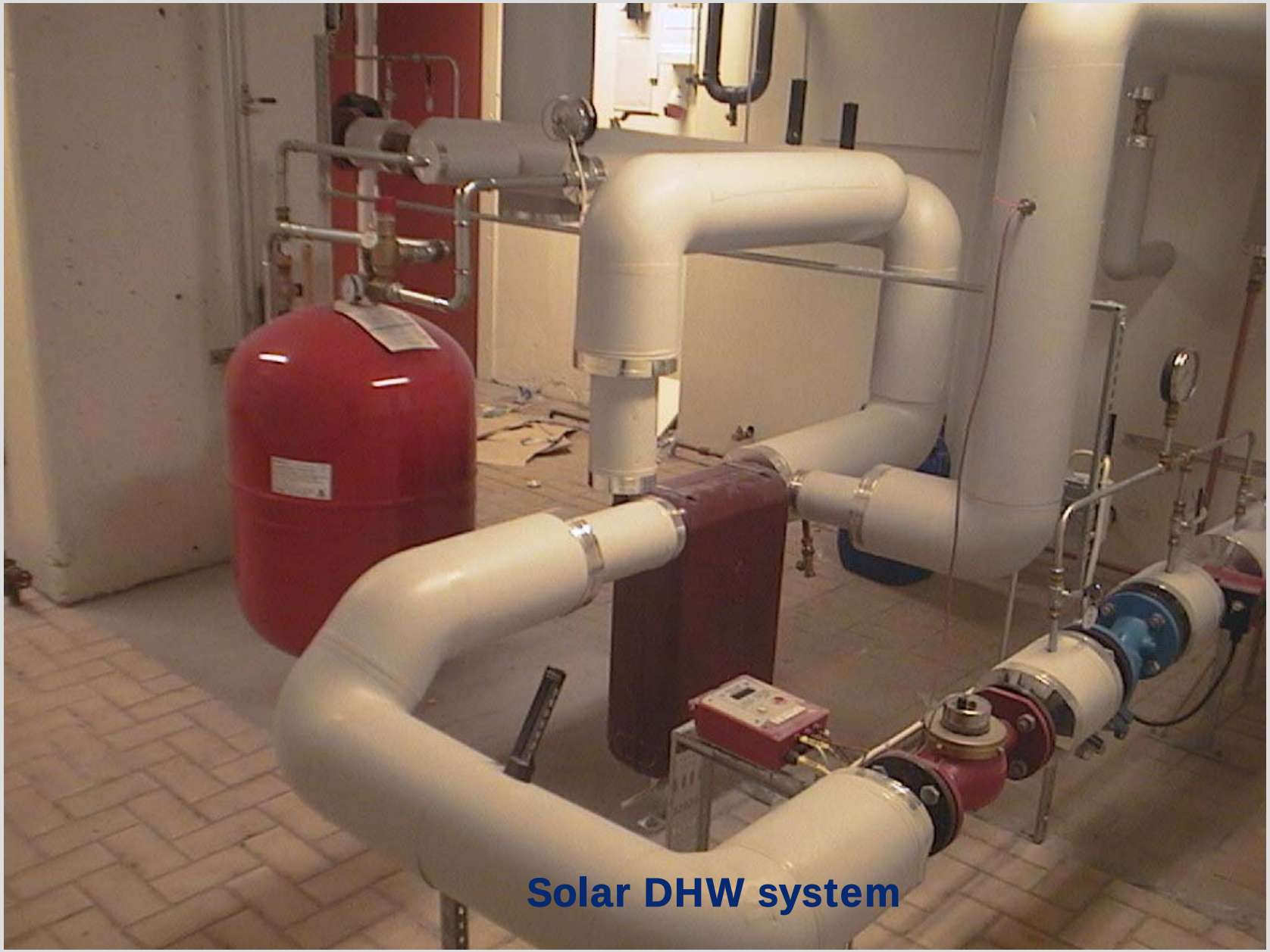
Glazed balconies

Roof module collectors



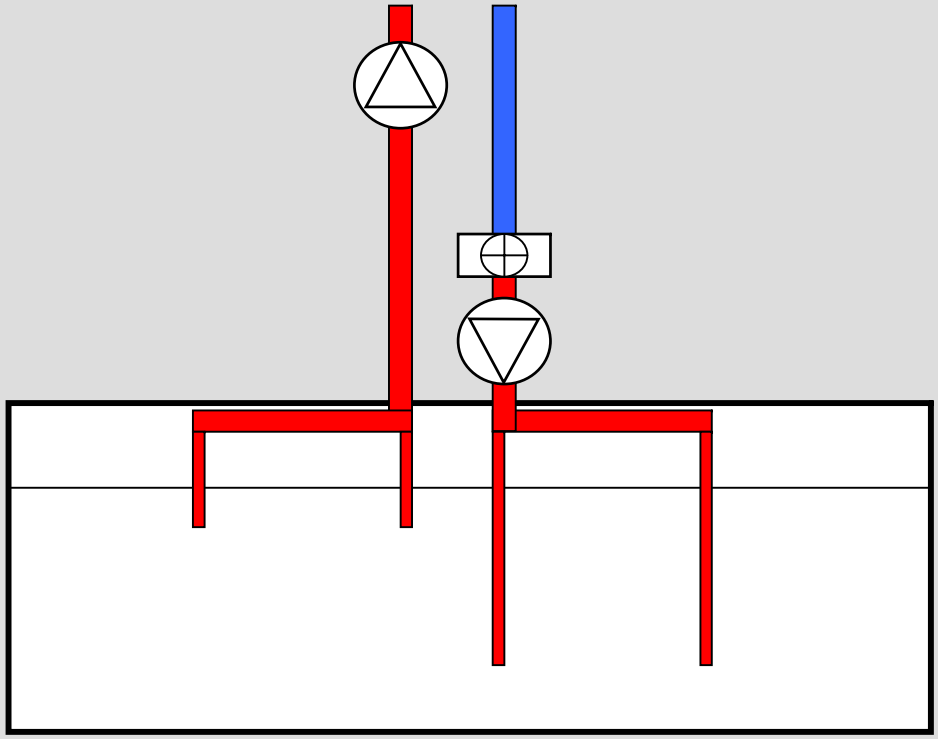
Roof module collectors that fit to the roof trusses





Solar DHW system

”Low-rise” - **Before**



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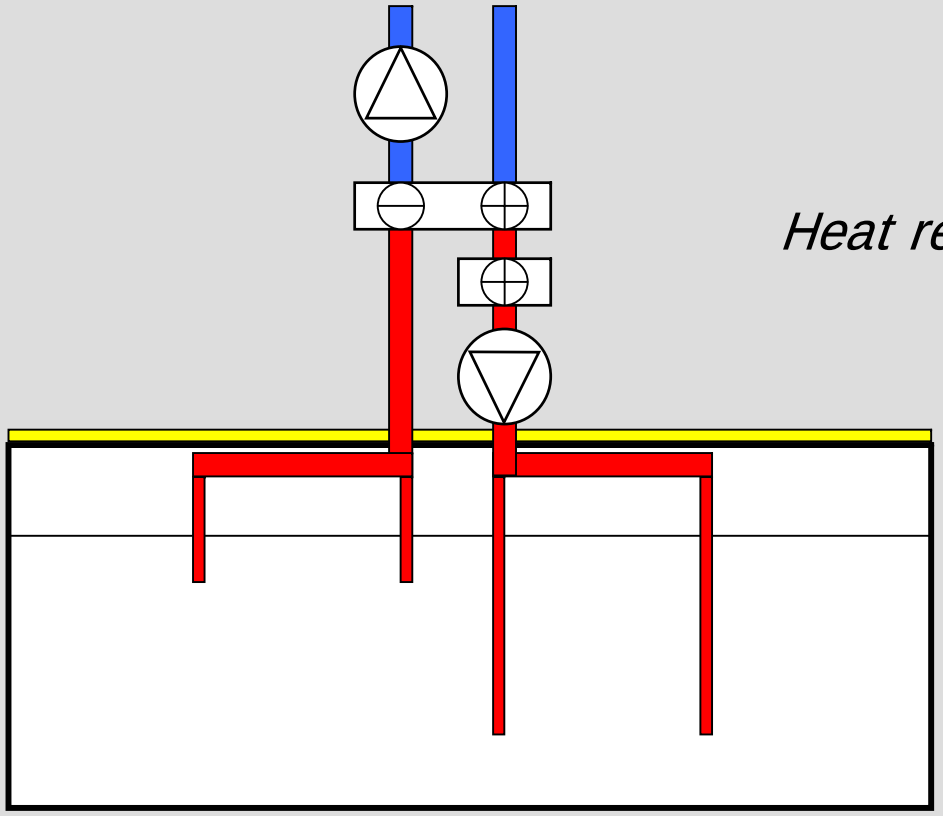


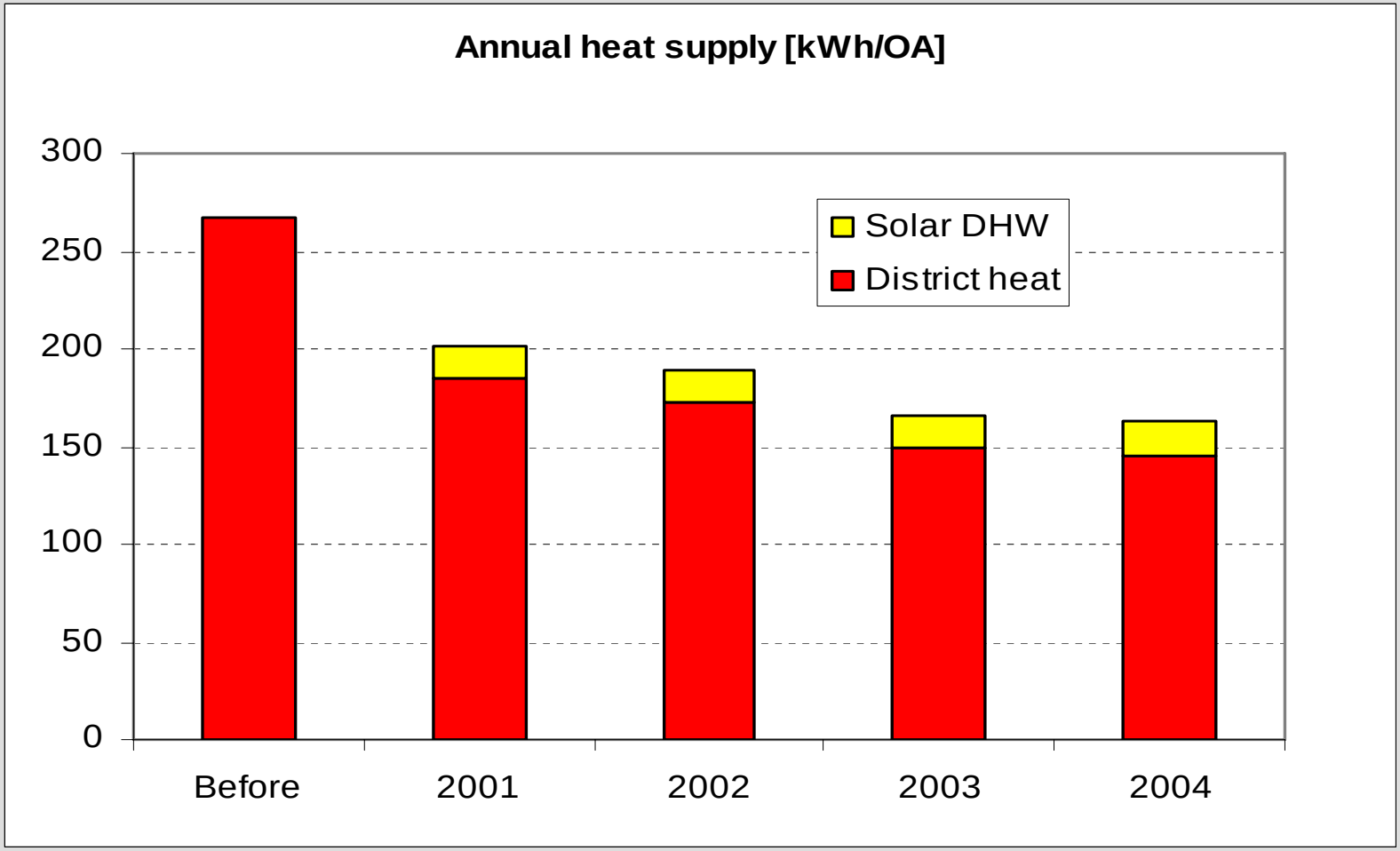
Heat recovery

Heat recovery

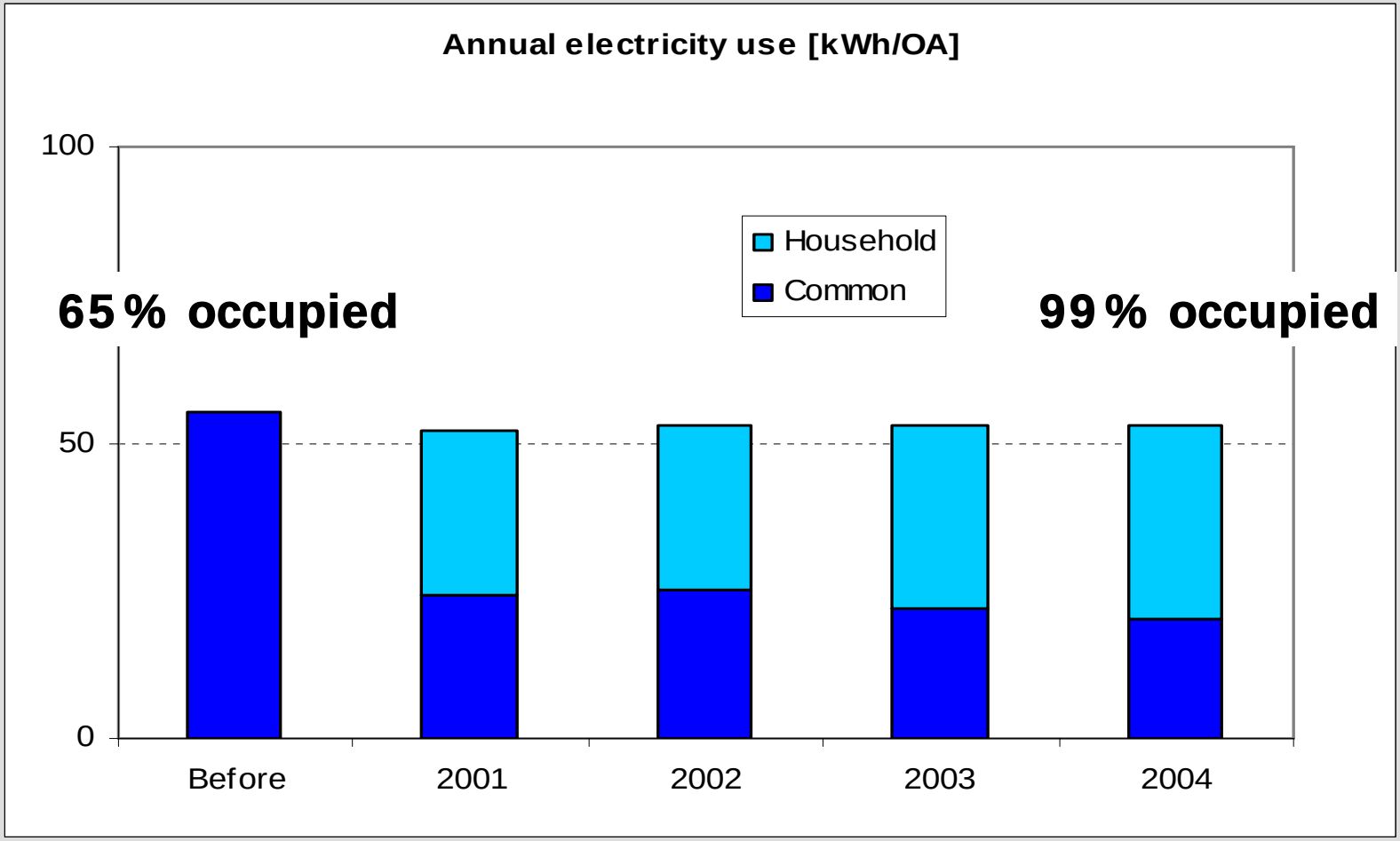
RESULT

- **Heat** supply reduced >35%,
  i.e. more than expected
- **Electricity** supply reduced >25%
- **Water** supply reduced >40%
- **Opportunities for further reductions**

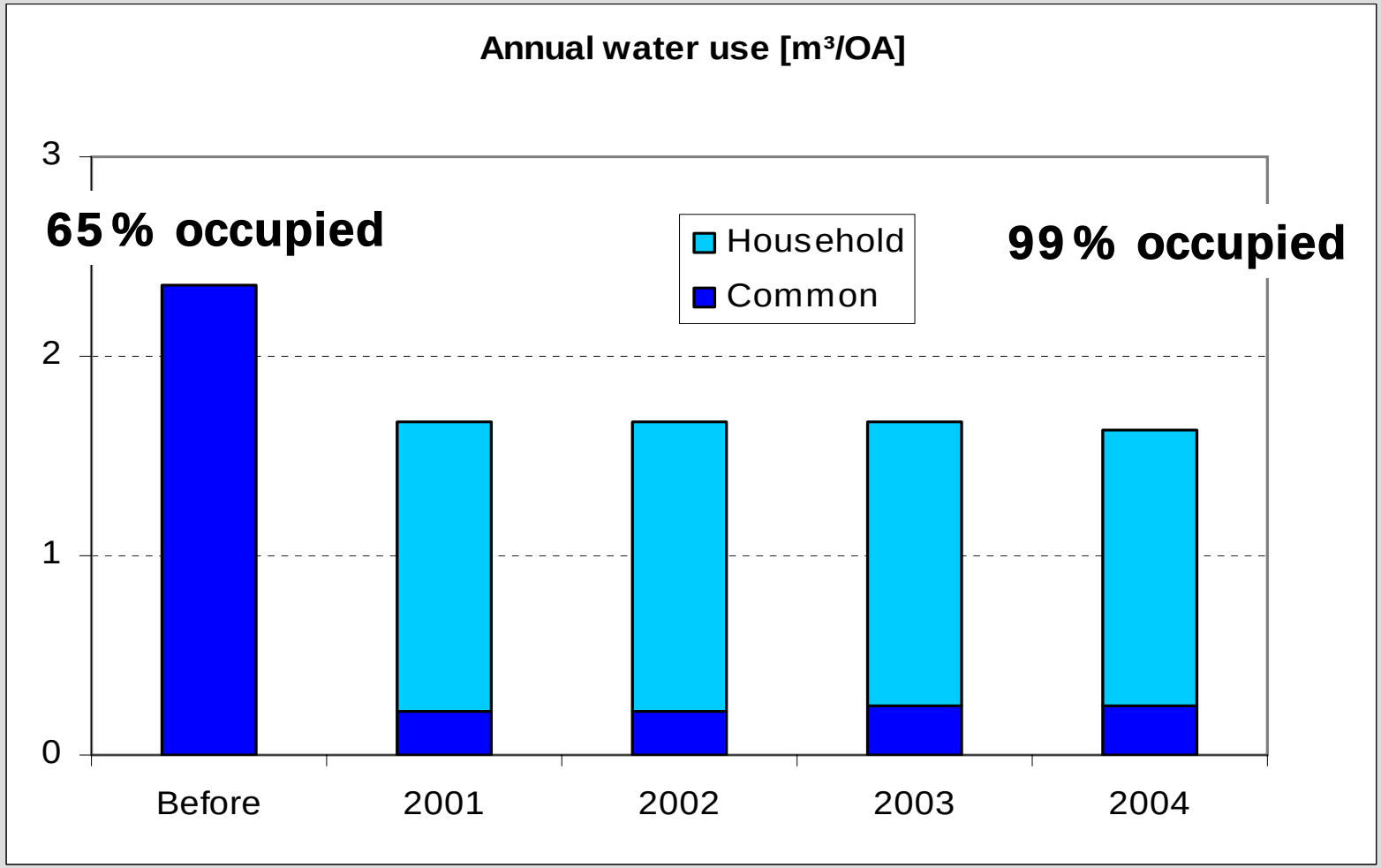
Heat supply ~ 145 kWh/m² occupied area



Total electricity ~ 50 kWh/m² occupied area



Total water use ~ 120 m³/apt



ECONOMICS

- **Total investment ~ 12 M€**
  incl. VAT and management cost
  (~ 47 000 € per apartment)
- **Energy measures ~ 2,1 M€**
  (~ 8 400 € per apartment)
- **Operational savings ~ 0,15 M€/a**
  (~ 600 € per year and apartment)
- **Feasible without subsidies !**

CONCLUSIONS

- **Building renovation with a succesful combination of traditional and new energy measures**
- **Major requirements are:**
  - Interest and knowledge
  - Comprehensive pre-design
  - Follow-up and Evaluation