



# SQUARE

Intelligent Energy  Europe

A Quality Assurance System for Improvement of  
Indoor Environment and Energy Use when  
Retrofitting Residential Houses

**Pilot project Brogården in Alingsås, Sweden**

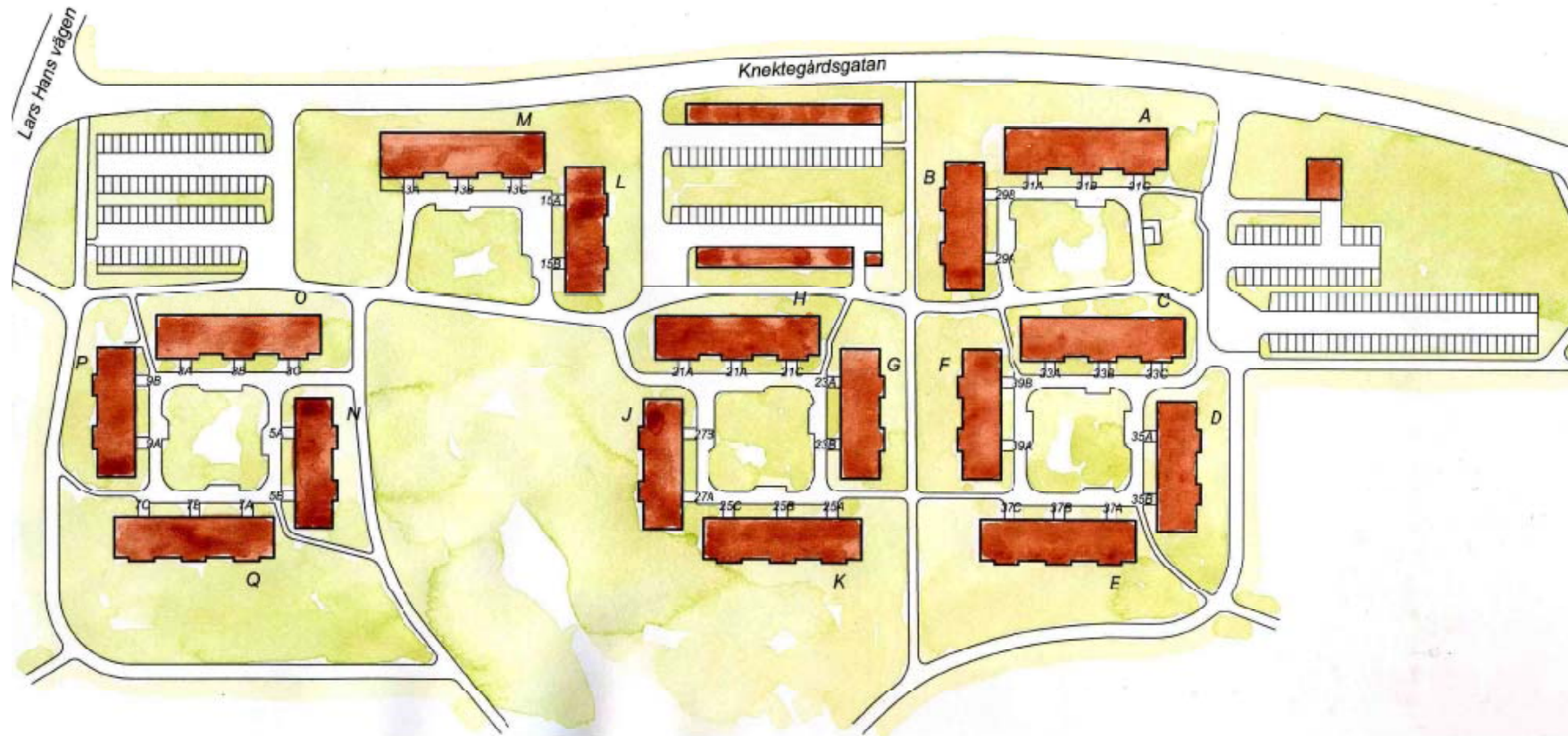


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## The residential area Brogården in Alingsås

A multifamily housing area of 300 apartments owned by the municipal housing association Alingsåshem AB.

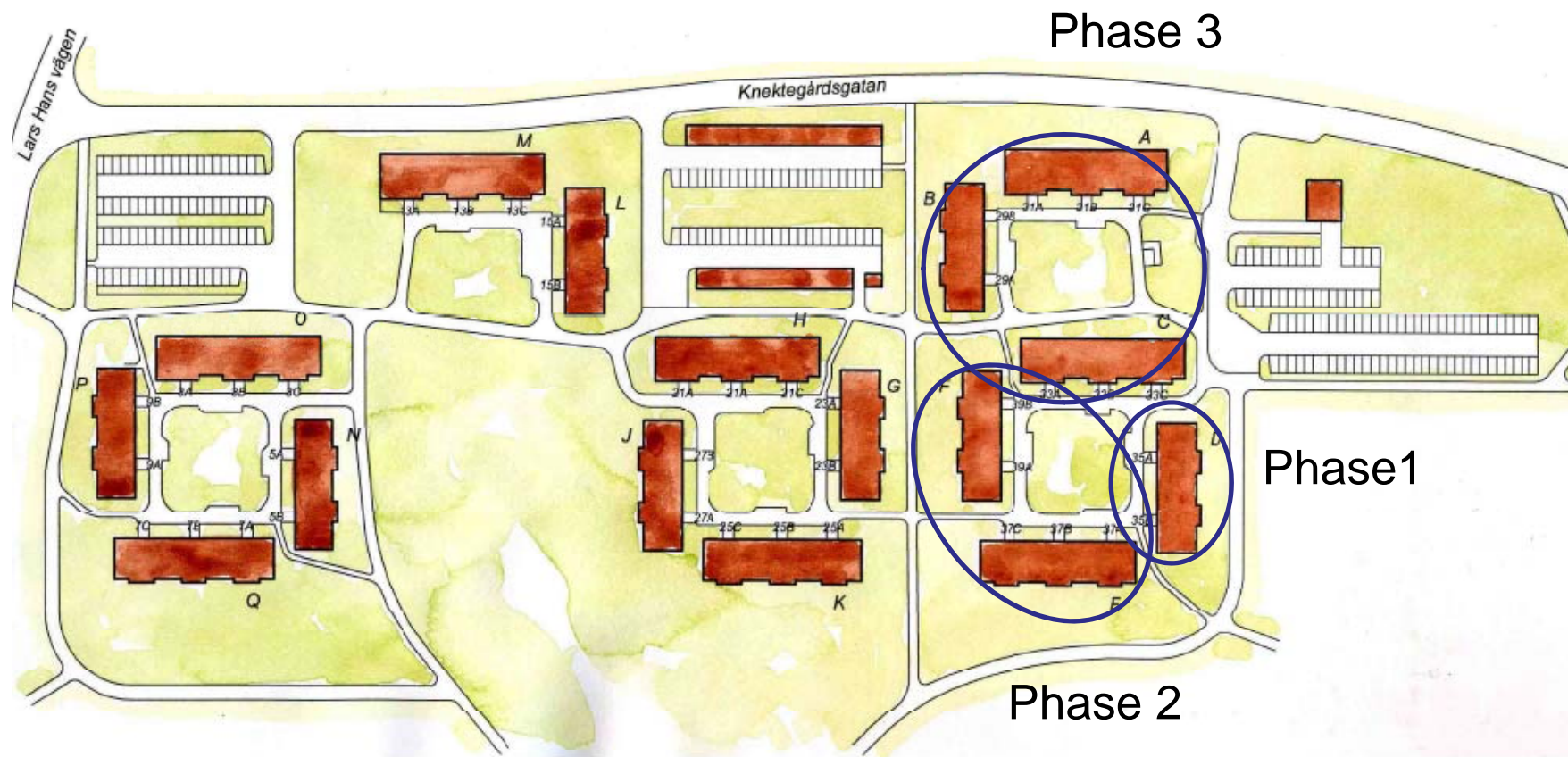






# The residential area Brogården in Alingsås

The intension is to renovate the area to "passive house standard".





## Brogården before retrofit

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- Extensive energy use would give high costs in the future.
- No financial incentive for the tenants to save energy and no feedback about their personal energy use.
- Poor indoor climate due to air leakages in the building envelope, thermal bridges and inadequate insulation.
- Moisture damages in the foundation slab.
- Poor building services.
- Small bathrooms.
- Limited access for disabled persons.
- Few meeting places for the tenants.





## Energy efficiency and good indoor environment

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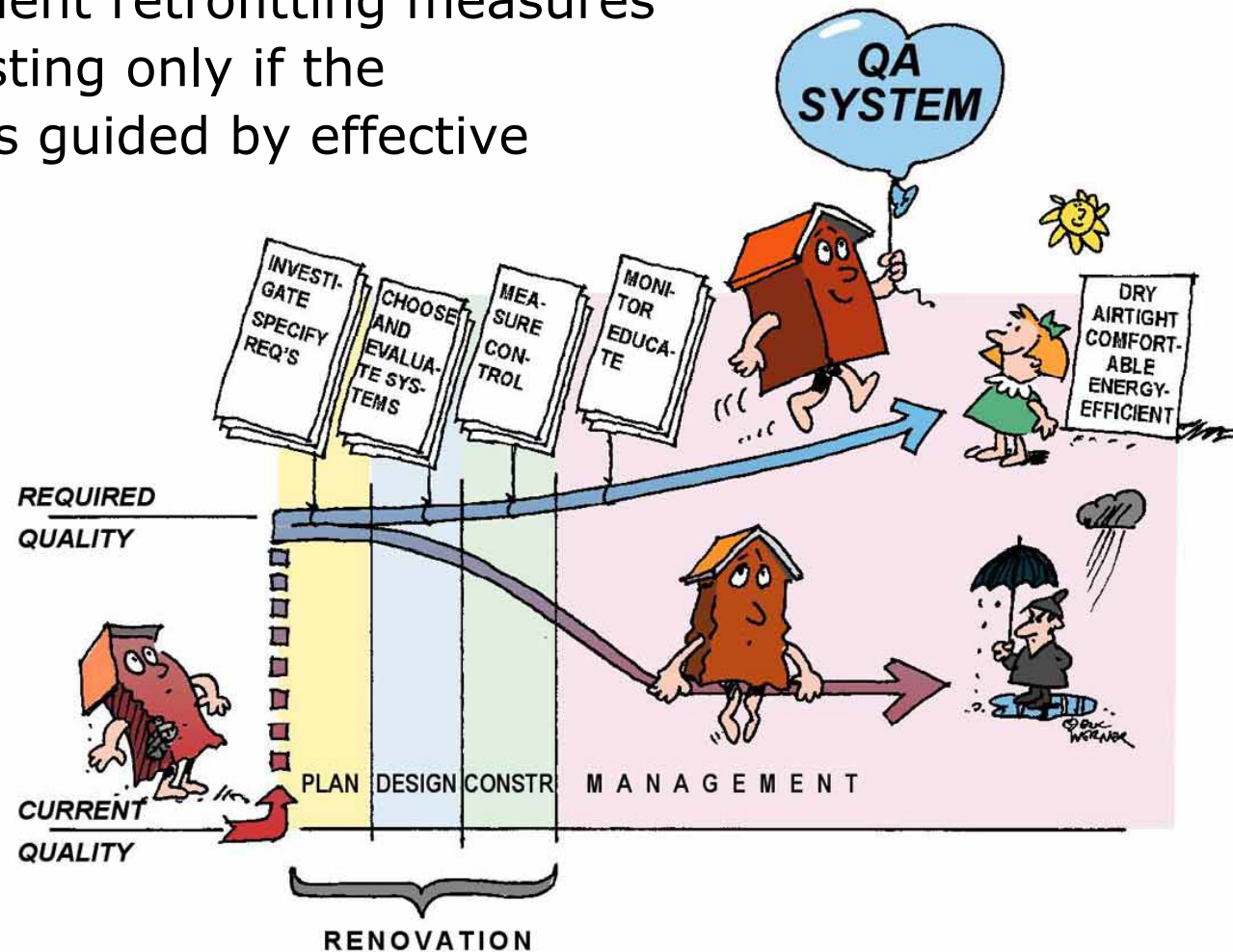
- Concentrating only on energy efficiency might cause negative effects on the indoor environment and vice versa.
- To achieve an energy efficient retrofitted building with good indoor environment, requires knowledge, continuity and communication.
- This can be assured by using a quality assurance system (QA system), describing a systematic and controlled way of working.





## QA system for retrofitting multifamily houses

Energy improvement retrofitting measures will be long-lasting only if the management is guided by effective routines.

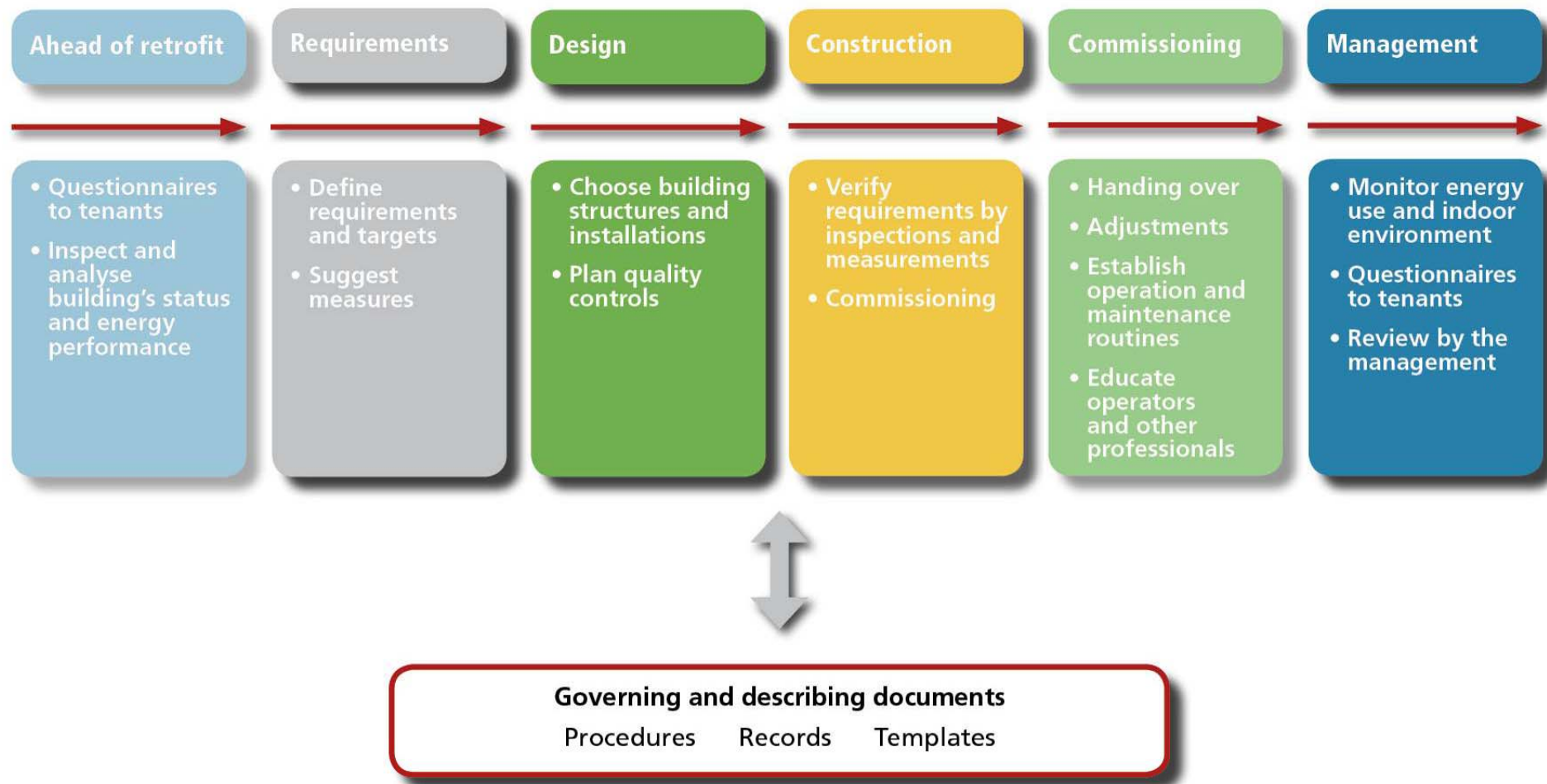






# Implementation of the QA system in Brogården

.....  
..in planning, design, construction, operation and maintenance.



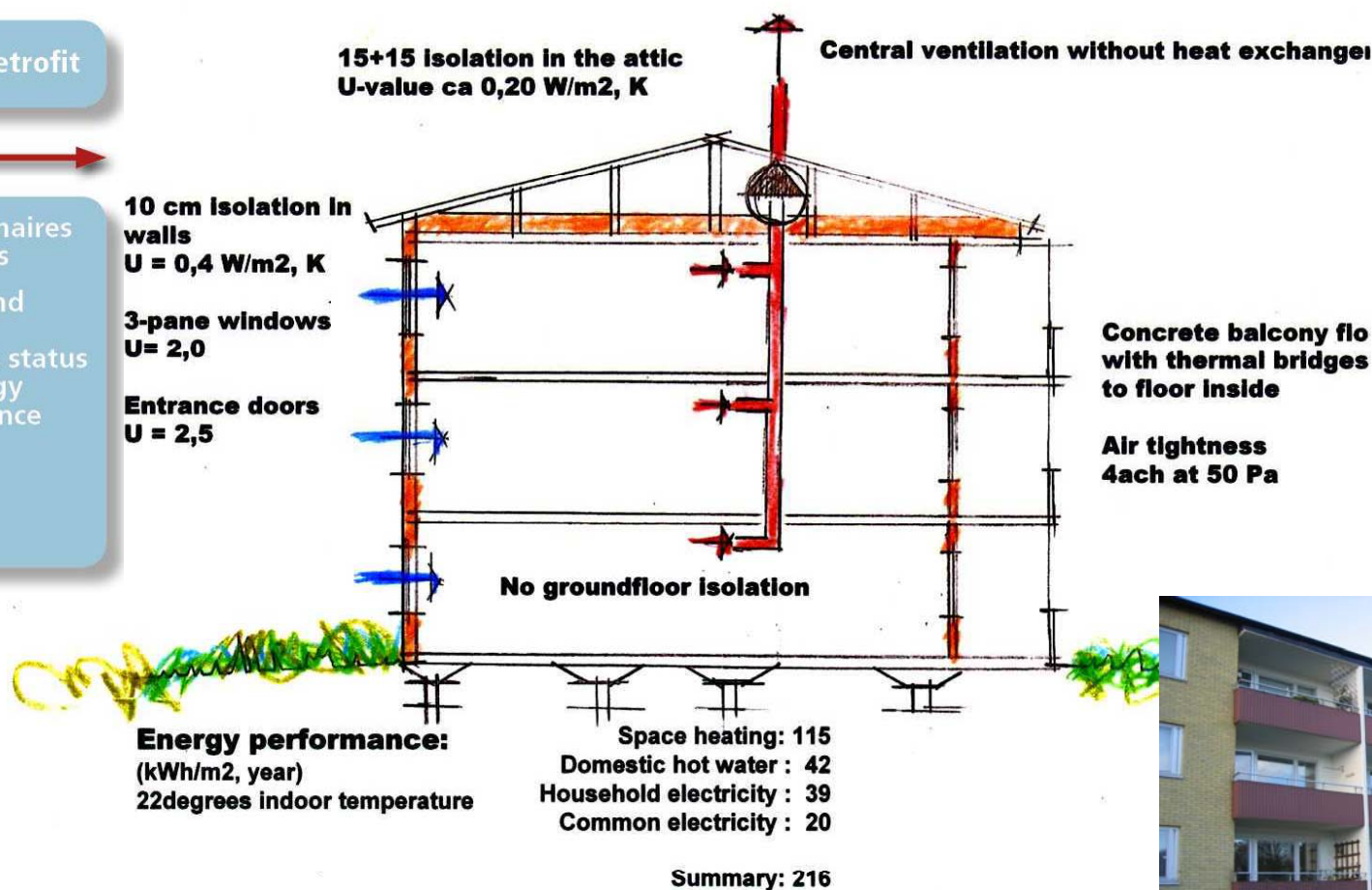


# Ahead of retrofit – Analyse building status and energy performance

## Brogården, Alingsåshem before renovation

Ahead of retrofit

- Questionnaires to tenants
- Inspect and analyse building's status and energy performance



Picture: Hans Eek







# Ahead of retrofit – Inspection of building structure

The inspections showed:

- Damages in brick façade
- Moisture damages in ground slab
- Air leakage

Ahead of retrofit

- Questionnaires to tenants
- Inspect and analyse building's status and energy performance

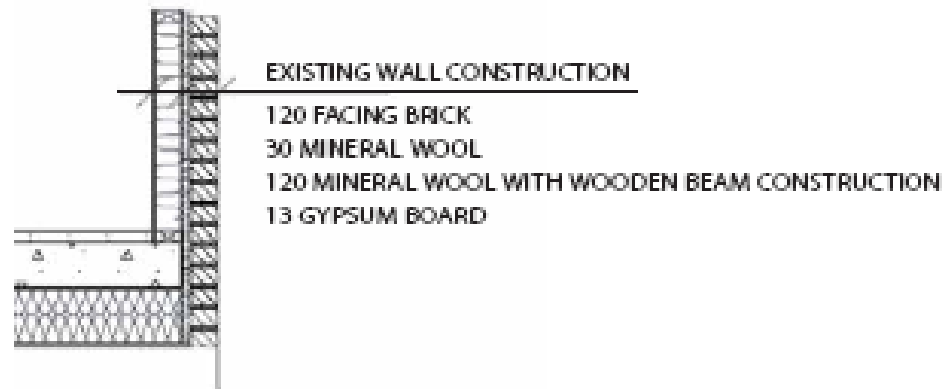


Figure 2.17 Exterior wall before renovation.

Picture: Ulla Jansson, 2008





## Requirements - Define requirements and targets

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Energy use: Passive house standard, increasing share of renewables (solar thermal)

Requirements

- Define requirements and targets
- Suggest measures

Indoor environment: Thermal comfort, air quality, moisture control etc.

Others:

- Individual control of energy use and indoor climate
- Easy to operate techniques
- Small maintenance needs through conscious choice of material
- Long-term stable rent levels
- Better access for elderly and disabled people
- Meeting places for tenants



## Requirements – Suggest measures

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### Requirements

- Define requirements and targets
- Suggest measures

- Additional insulation and highly improved air tightness of the building envelope
- New windows
- New heating and ventilation system including efficient heat recovery
- Include balconies in living room space
- Larger bathrooms
- Better accessibility
- Individual metering



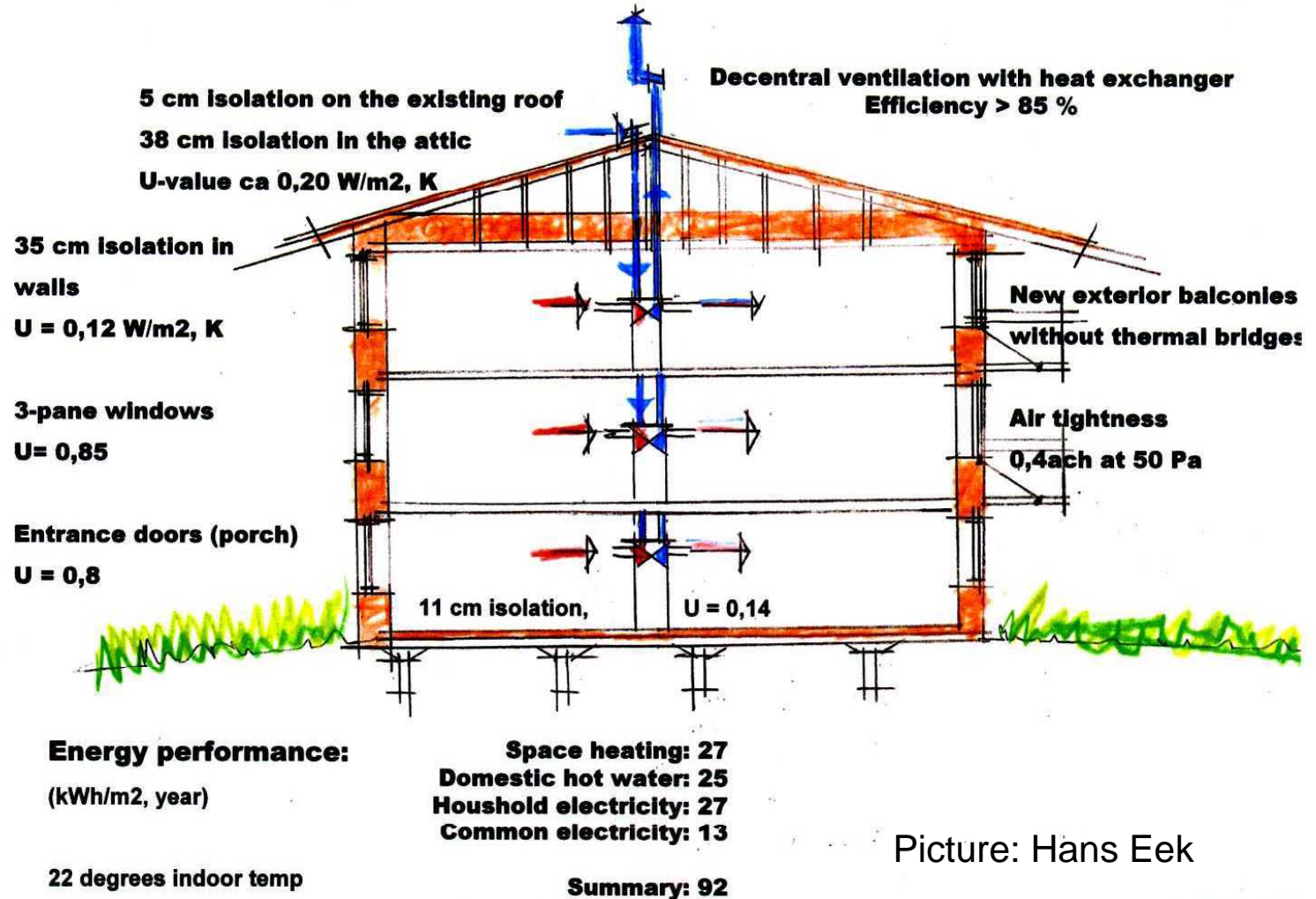


# Design – Choose building structures and installation systems

## Design

- Choose building structures and installations
- Plan quality controls

## Brogården, Alingsåshem after renovation



Picture: Hans Eek

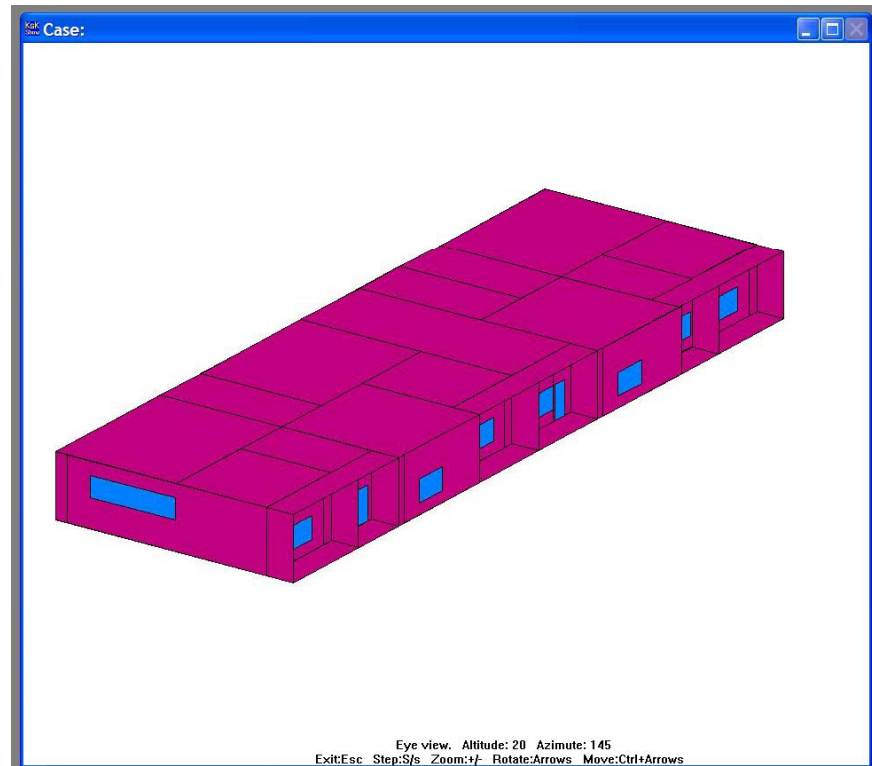


## Design – Energy simulations

- Energy balance calculations of the whole building with different measures in order to find optimum combinations of (energy efficient) improvement measures.

Design

- Choose building structures and installations
- Plan quality controls



Picture: Ulla Jansson

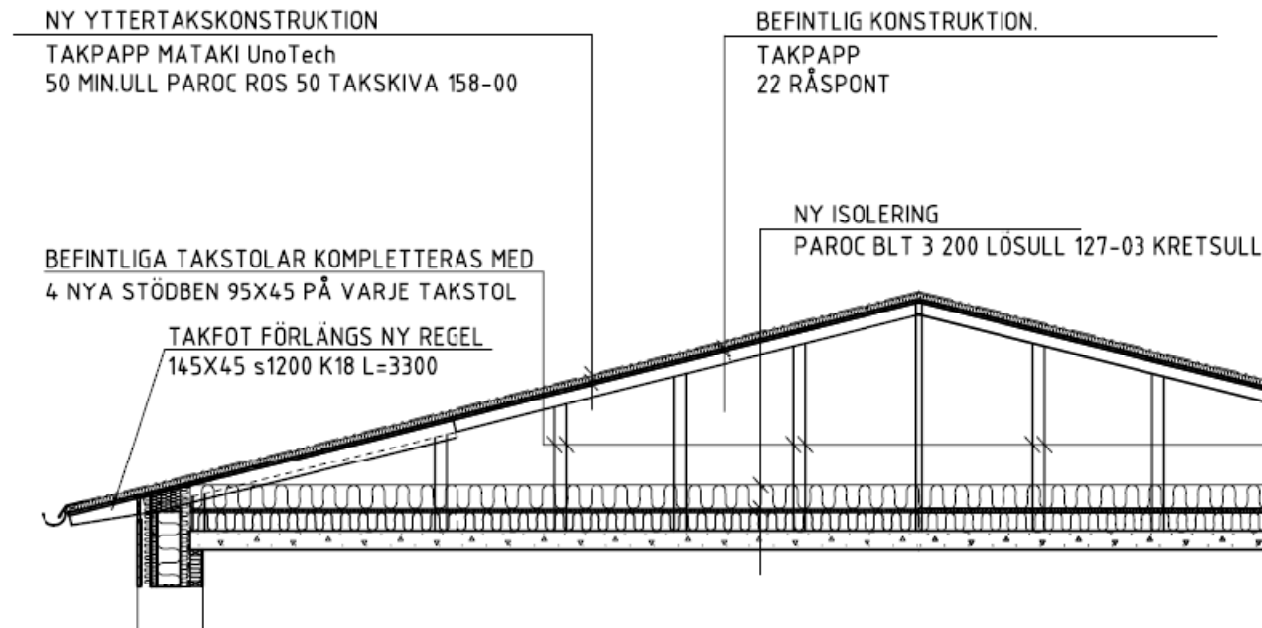


## Design – Moisture simulations

- Moisture calculations of additional insulated roof, walls and slab on ground

### Design

- Choose building structures and installations
- Plan quality controls



Picture: WSP



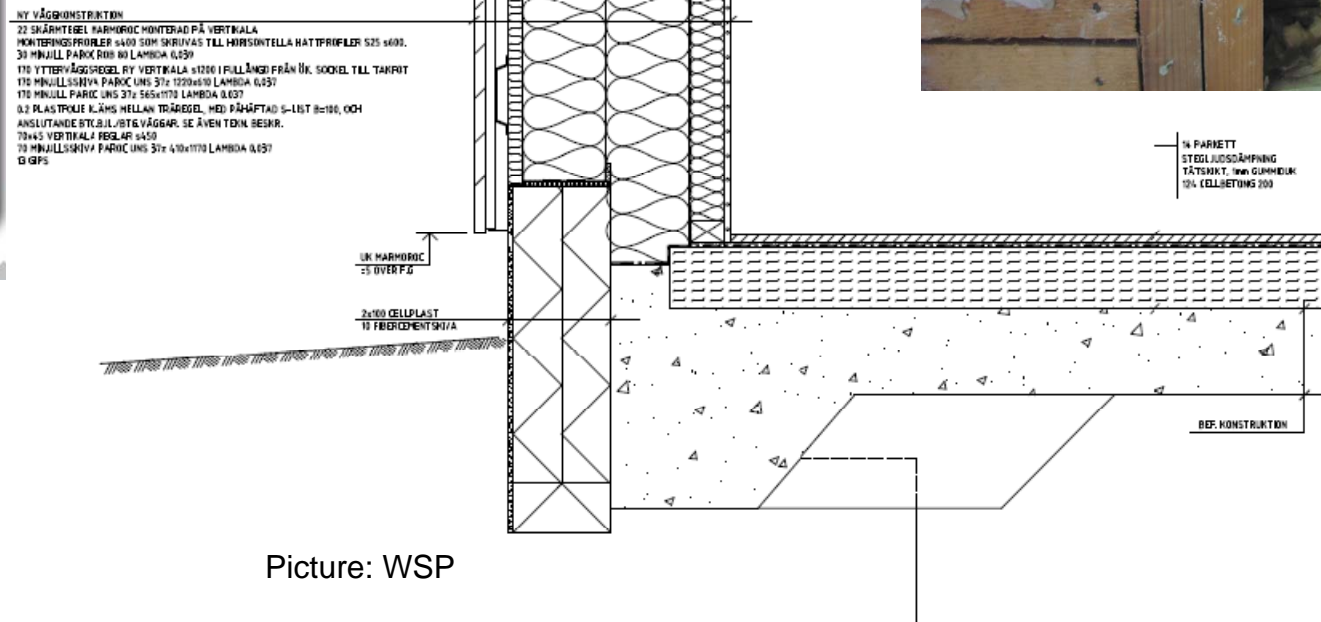


## Design – New walls and façade

### Design

- Choose building structures and installations
- Plan quality controls

- New walls instead of additional insulation on existing walls
- New façade material
- Cultural heritage preservation?



Picture: WSP



## Design – Plan quality controls

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- Follow-up meetings with designers
- Planning of weather protection
- Planning of moisture measurements and air-tightness tests

Design

- Choose building structures and installations
- Plan quality controls





## Ahead of construction – Display apartment

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Giving occupants the opportunity to examine the technical systems and practical arrangements in the new apartments.

Construction

- Verify requirements by inspections and measurements
- Commissioning







## Before construction starts

### Construction

- Verify requirements by inspections and measurements
- Commissioning

- Long time partnering contract with common targets and open cost accounting
- Information meetings with all project participants before construction starts
- Building contractor continually supplies information to employees on quality targets



SKANSKA





## Construction – Work at site

- Show prototype of wall element
- Do job planning before critical elements
- Use weather protection

### Construction

- Verify requirements by inspections and measurements
- Commissioning







# Construction – Verify requirements by inspections and measurements

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Construction

- Verify requirements by inspections and measurements
- Commissioning

- Moisture rounds at site
- Moisture measurements
- Air tightness testing







# Commissioning – Tenants

- Information meeting with tenants
- Continuous information at website and in newsletter

## Commissioning

- Handing over
- Adjustments
- Establish operation and maintenance routines
- Educate operators and other professionals





# Commissioning - Operators

## Commissioning

- Handing over
- Adjustments
- Establish operation and maintenance routines
- Educate operators and other professionals

- Handing over of the building
- Adjustments of the systems
- Establish operation and maintenance routines
- Educate operators

Commissioning is a long term process lasting for a year.



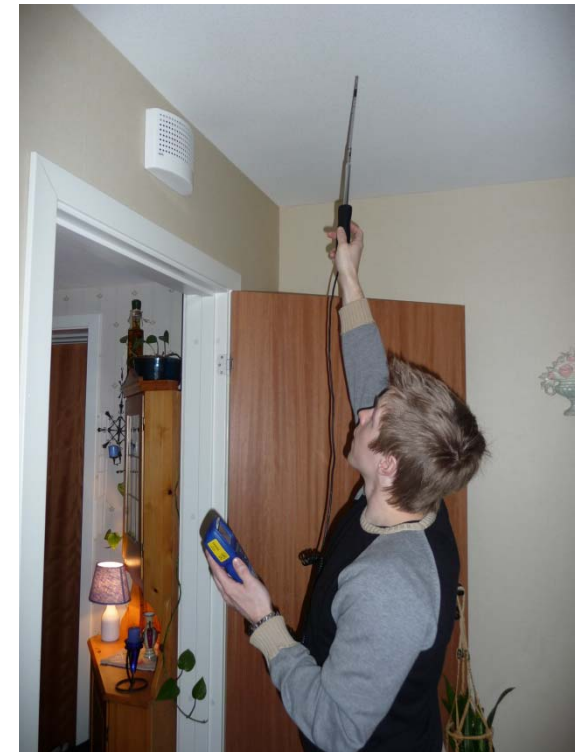


## Management – Monitoring

### Management

- Monitor energy use and indoor environment
- Questionnaires to tenants
- Review by the management

- Monitoring energy use (This is made by the local energy provider Borås Energi).
- Measuring indoor environment, mainly in case of complaints once commissioning is ready.







## Management – Tenants

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- Questionnaires to tenants
- Interviews with tenants
- Establishing good regular communication channels with tenants

### Management



- Monitor energy use and indoor environment
- Questionnaires to tenants
- Review by the management







## Management - Review

### Management

- Monitor energy use and indoor environment
- Questionnaires to tenants
- Review by the management

- Review by the management and handling of non-compliances
- Feedback to responsible parties
- Adjustment of targets, governing documents etc.
- Continual improvement





Thank you for your  
attention!