INTRODUCTION TO THE TOTAL CONCEPT

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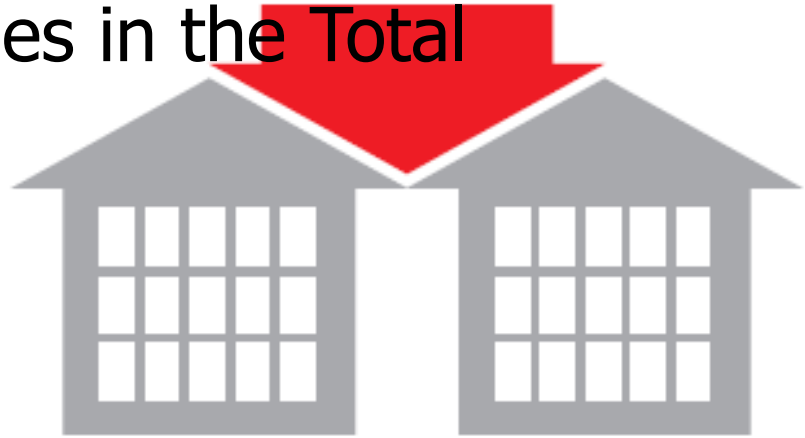
Content of the presentation

- Background and motivation
- Fundamentals of the Total Concept method
- Reference projects
- The economic principles of the Total Concept method
- Carrying out different stages in the Total Concept method



Non-residential building sector

- Business relationship between property owners/managers and tenants
- A need to well-manage, properly maintain and continually refurbish a building
- To keep running costs at a competitive level
- The demands made by society for high energy efficiency will become stricter

The prerequisites for energy investments

- The investments deemed necessary to carry out the required measures must be profitable
- The assessment of the necessary investments and the future annual savings must be reliable

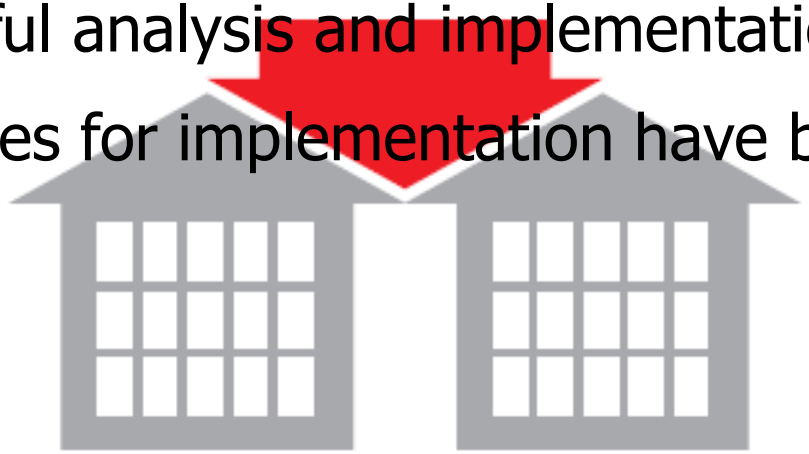
The prerequisites for improving energy efficiency

- The quality of the building and its function is maintained or improved
- The aim is to get the greatest possible savings using the allocated sources

Total Concept (TC) method

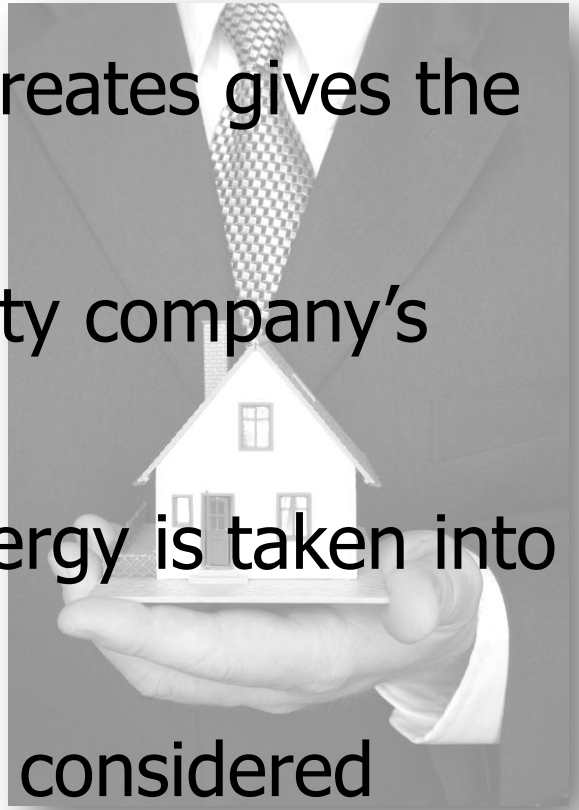
A working method for improving energy efficiency

- Refined systematic approach
- Core aim: Forming a package of measures that *together* meets the client´s profitability requirements
- Decrease in the energy use up to 50% and even more...
- Requires careful analysis and implementation
- Some guidelines for implementation have been developed



Profitability assesment in the TC method

- Based on internal rate of return method
- The actual yields the investment creates gives the *internal rate of return*
- Comparison made with the property company's profitability requirements
- Future relative price change of energy is taken into account
- Economic lifetime of investment is considered



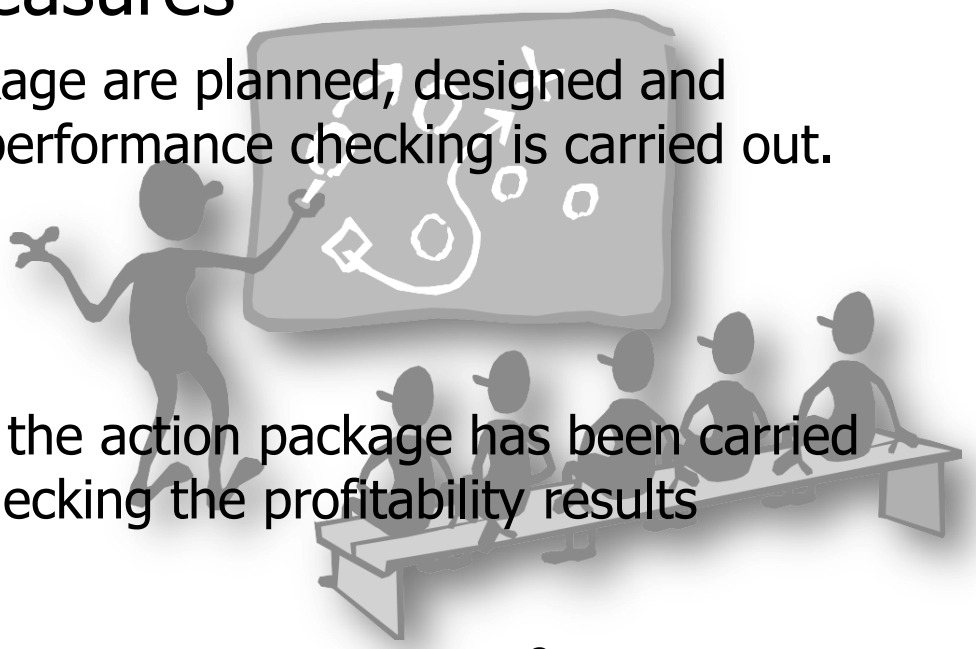
Total Concept method

Step 1: Create the action package

Analyses of the building ▶ Identification of energy saving measures ▶ Creation of a profitable action package

Step 2: Carry out the measures

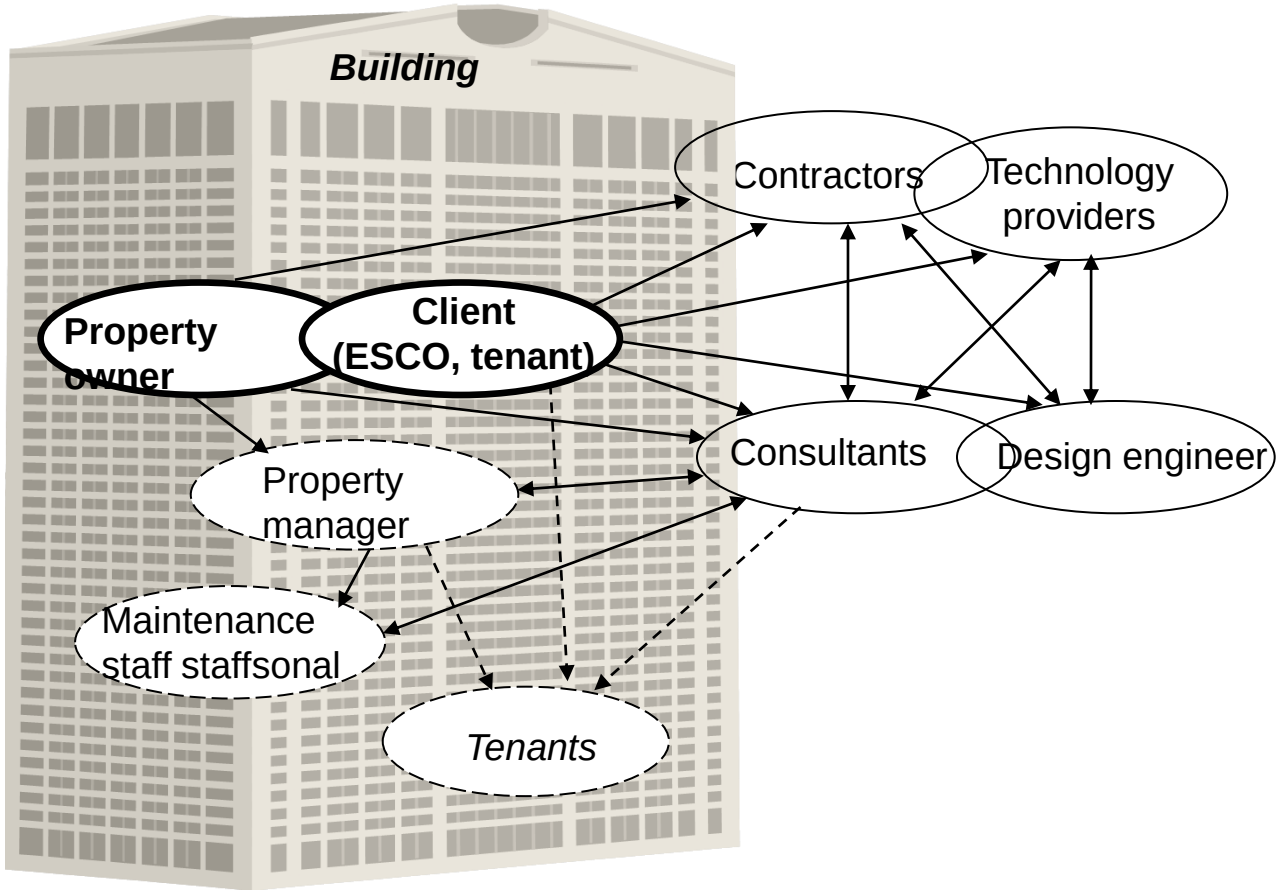
All the measures in the ation package are planned, designed and constructed. A careful functional performance checking is carried out.



Step 3: Follow up

The energy use is measured after the action package has been carried out. The results are used when checking the profitability results

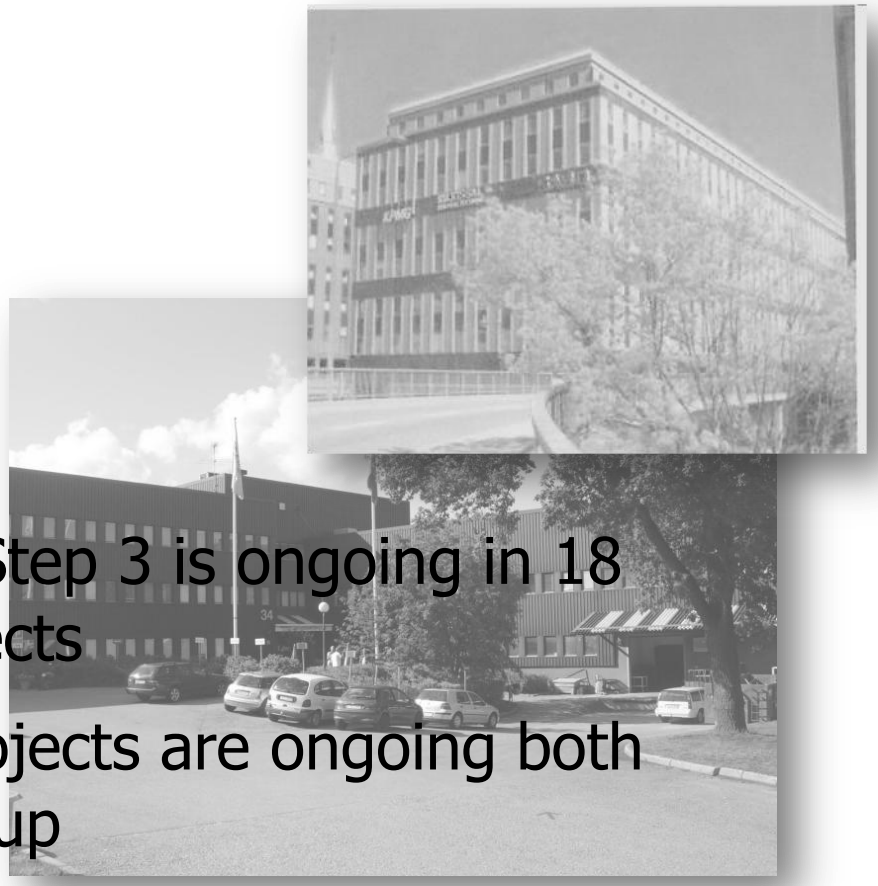
Different parties involved in a TC project interact



Reference projects

- First projects initiated 2007

  7 offices
  5 hospitals
  7 schools
  3 universities
  3 stations
  1 museum
  1 airport building



- So far Step 2 is finished and Step 3 is ongoing in 18 buildings from the initial projects
- A number of additional TC projects are ongoing both inside and outside BELOK group

Reference projects

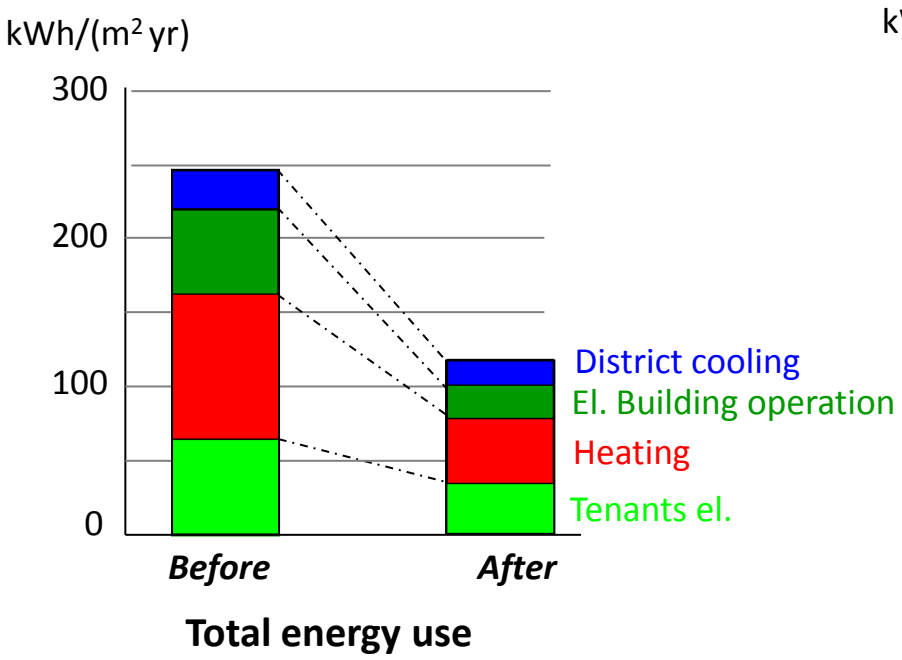
Getholmen
Stockholm, Skärholmen
Office building 8.460 m^2
Built 1975

No	*Energy saving measure*	*Investment* [kSEK]	*Saving* [kSEK/yr]
1	New communal lighting	35	14
2	Reduced basic heat load	35	7
3	Improved roof insulation	40	6
4	Introduction of night cooling	8	1
5	New ventilation system	270	21
6	New windows	120	3
	Summa	***508***	***52***

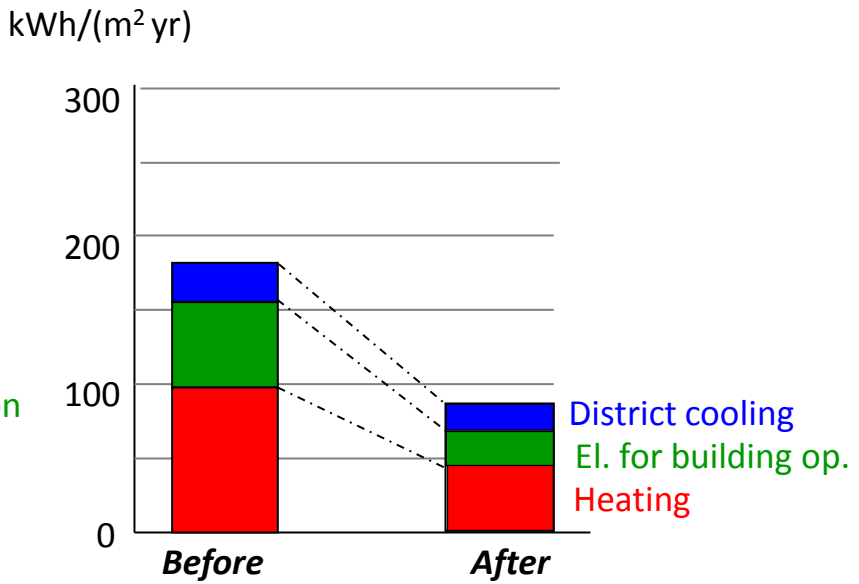
Calculated profitability in Step 1 was ~7 % internal rate of return for the action package
Actual profitability after Step 3 was ~ 13 %

Reference projects

Actual results from Getholmen (measured during 1 year)



Total energy use



Energy use for building operation only

Decrease in energy use ca 50 %, decrease in cost for energy ca 580 kSEK

Reference projects

Before

After

Pennfläktaren
Stockholm, Vasagatan
Office and restaurants, 12 600m^2
Built 1975, renovated 2008-2010

Energy use [kWh/m^2]	***2006 Before action package***	***2011–2012 After action package***
Heat energy	**122**	**69**
Electricity for building operation	**55**	**36**
Cooling	**110**	**19**
Total	**287**	**124**

Actual profitability after Step 3 was ~ 15 %

Decrease in energy use ca 55 %

Reference projects

Hägern mindre 7
Stockholm, Drottninggatan
Offices and shops, 17 200m^2
Built 1970, BTC project 2010-2011

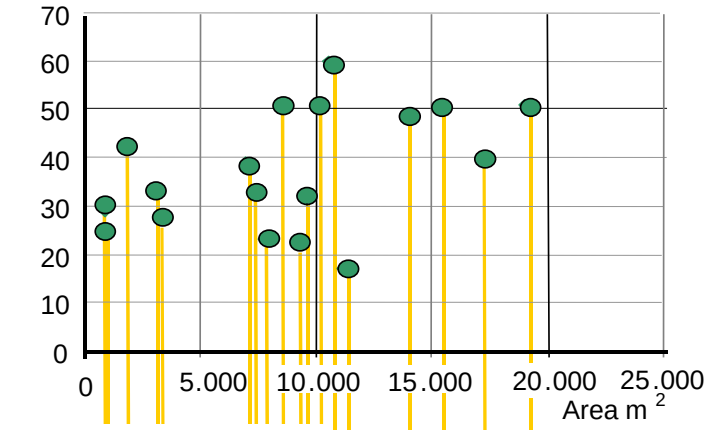
Energy use [kWh/m^2]	***2006 Before action package***	***2012 After action package***
Heat energy	**130**	**56**
Electricity for building operation	**43**	**25**
Cooling	**18**	**18**
Total	**191**	**99**

Actual profitability after Step 3 was ~ 12 %

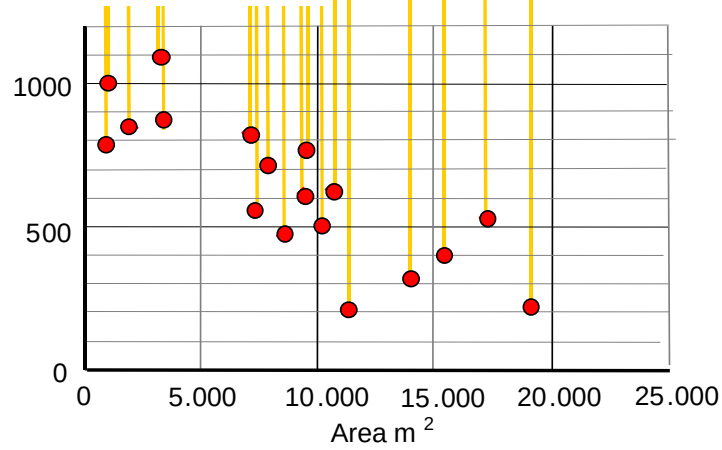
Decrease in energy use ca 50 %

Reference projects

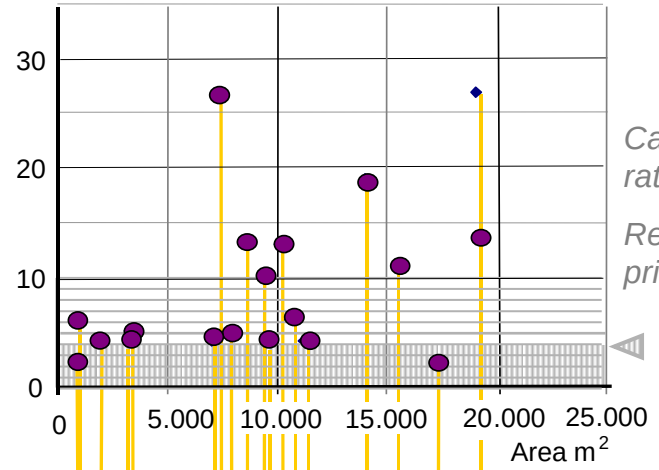
Energy saving %



Investment SEK/m²



Internal rate of return %

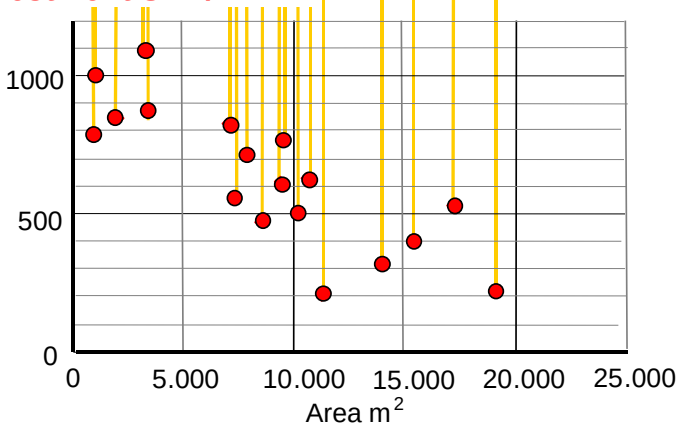


*Calculation interest rate **6 %***

*Relative increase in the price of energy **2 %***

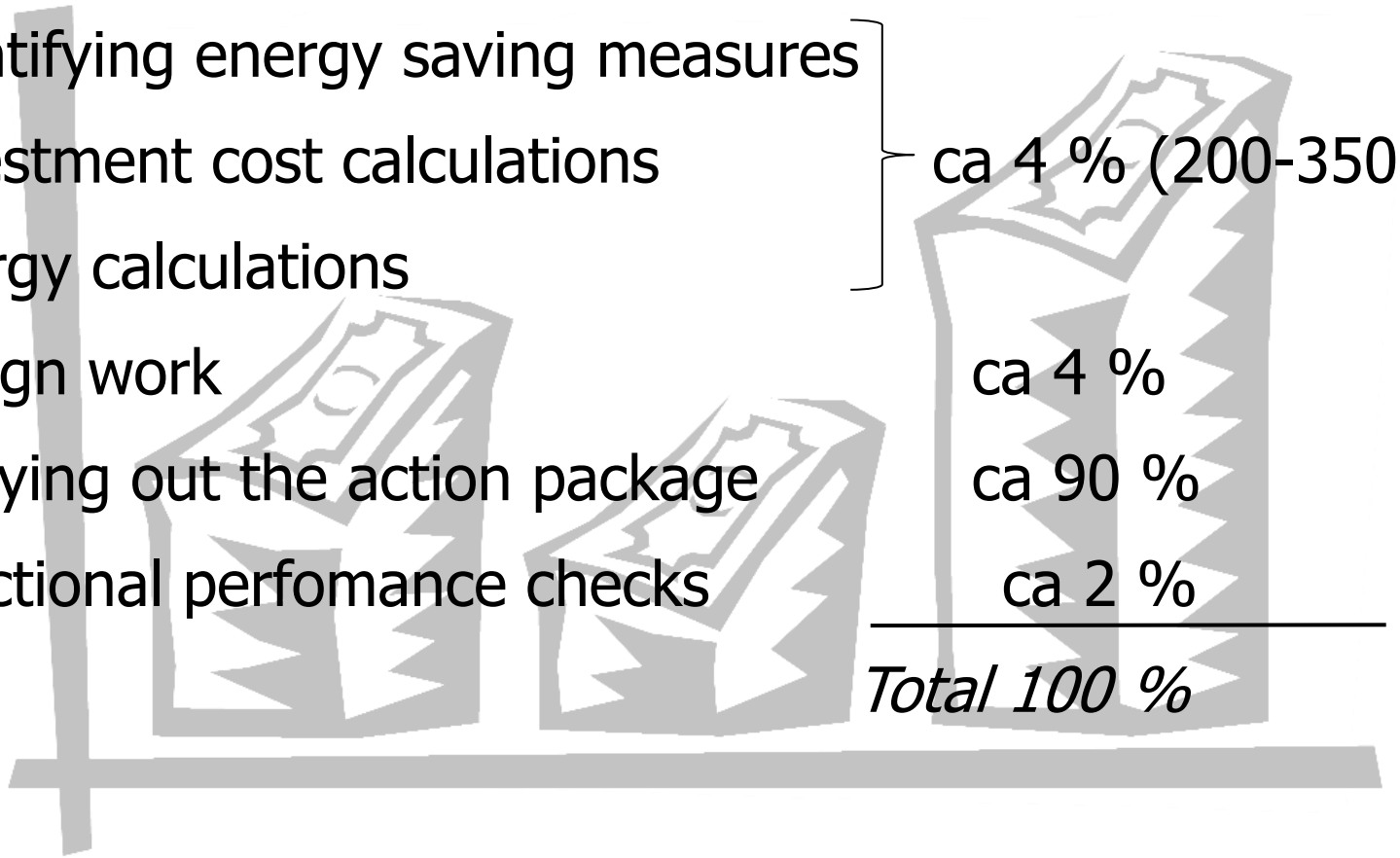
6 - 2 = 4 %

Investment SEK/m²

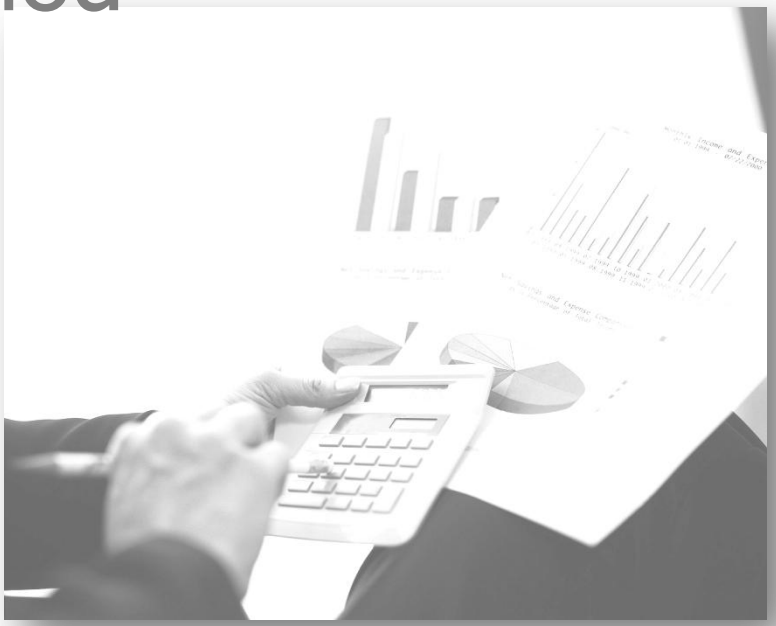


Cost for carrying out a TC project

Identifying energy saving measures	ca 4 % (200-350 h)
Investment cost calculations	
Energy calculations	
Design work	ca 4 %
Carrying out the action package	ca 90 %
Functional perfomance checks	ca 2 %
	Total 100 %

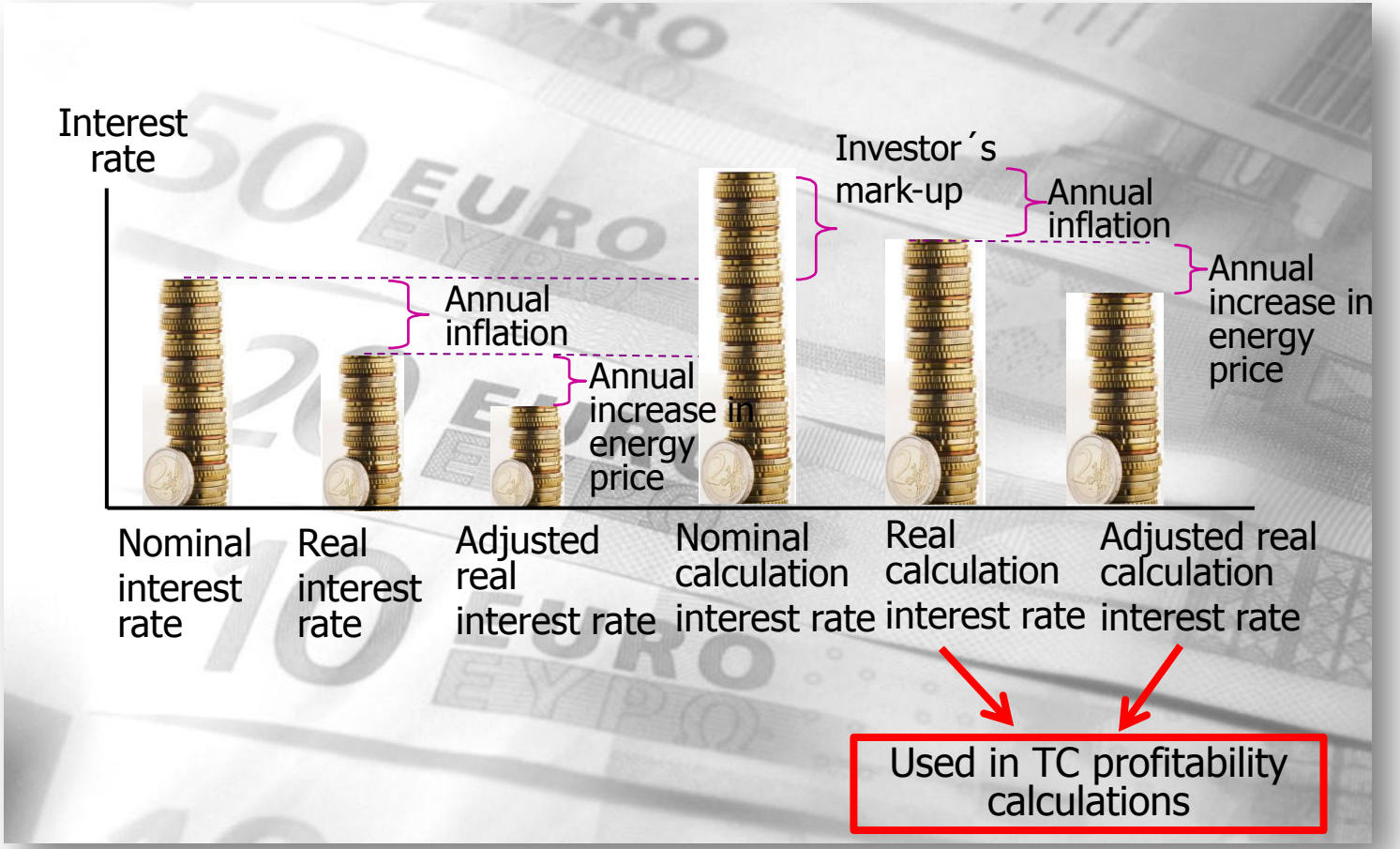


The economic principles of the Total Concept method



Terms used in the profitability calculations

Interest rate used in the calculations



Concepts of time in profitability calculations

Technical lifetime

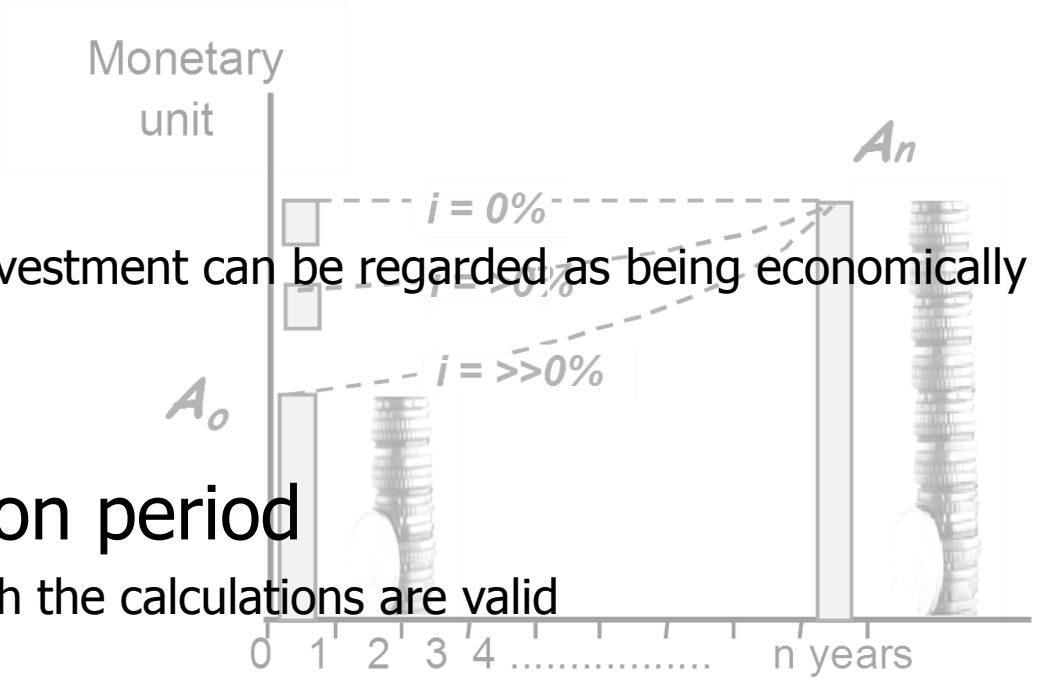
the length of time that an investment can be regarded as technically useful

Economic lifetime

the length of time that an investment can be regarded as being economically profitable

Economic calculation period

the length of time over which the calculations are valid

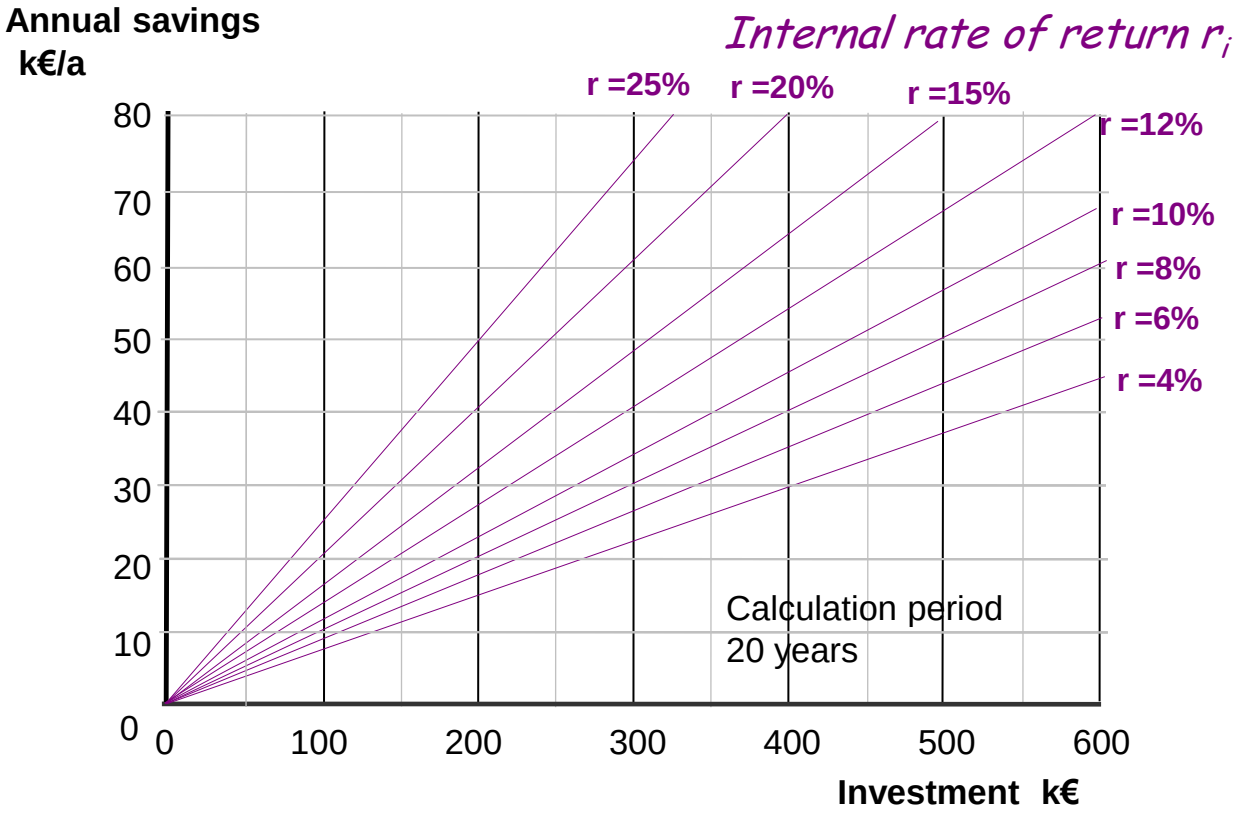


Examples of economic lifetimes

Measure	Economic lifetime [years]		
	Reference projects (Sweden)	CEN 15459	2006/32/EC
Facade insulation	40	-	25 – 30
Roof insulation	40	-	25
Foundations insulation	40	-	25
AHU with heat exchanger	20	15 – 20	17 – 20
Energy-efficient windows	40	-	30
Demand controlled ventilation	15	15	15
Individual domestic hot water metering	15	10	-
Solar heat	20	15 – 25	20
Solar cells	20	-	23
Tighter building envelope	40	-	5
Extract air heat pump	15	15 – 20	15
Better control of heating system	15	15 – 25	10
Replacement of domestic hot water fittings	15	-	15
Energy-efficient lighting	15	-	10 – 15
Property measures (lighting and SFP)	15	-	-

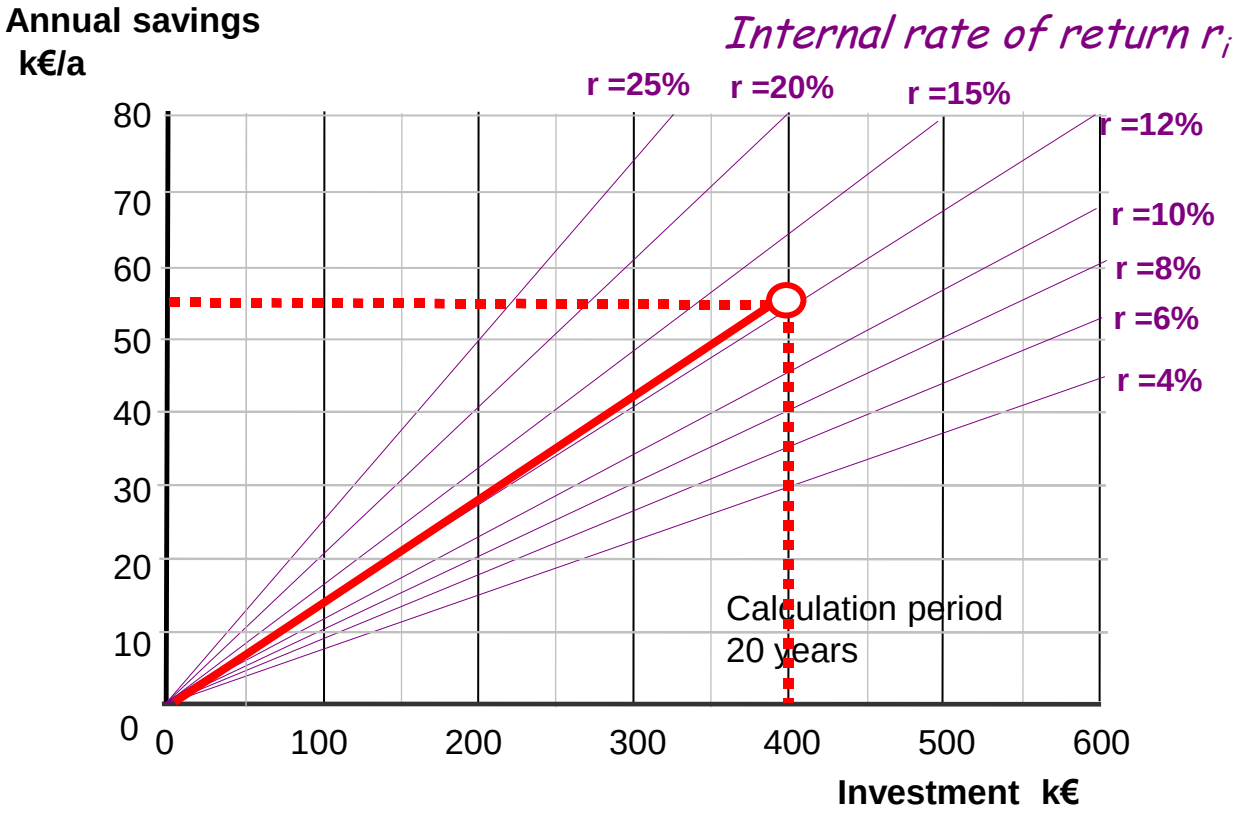
Internal rate of return method

Internal rate of return diagram

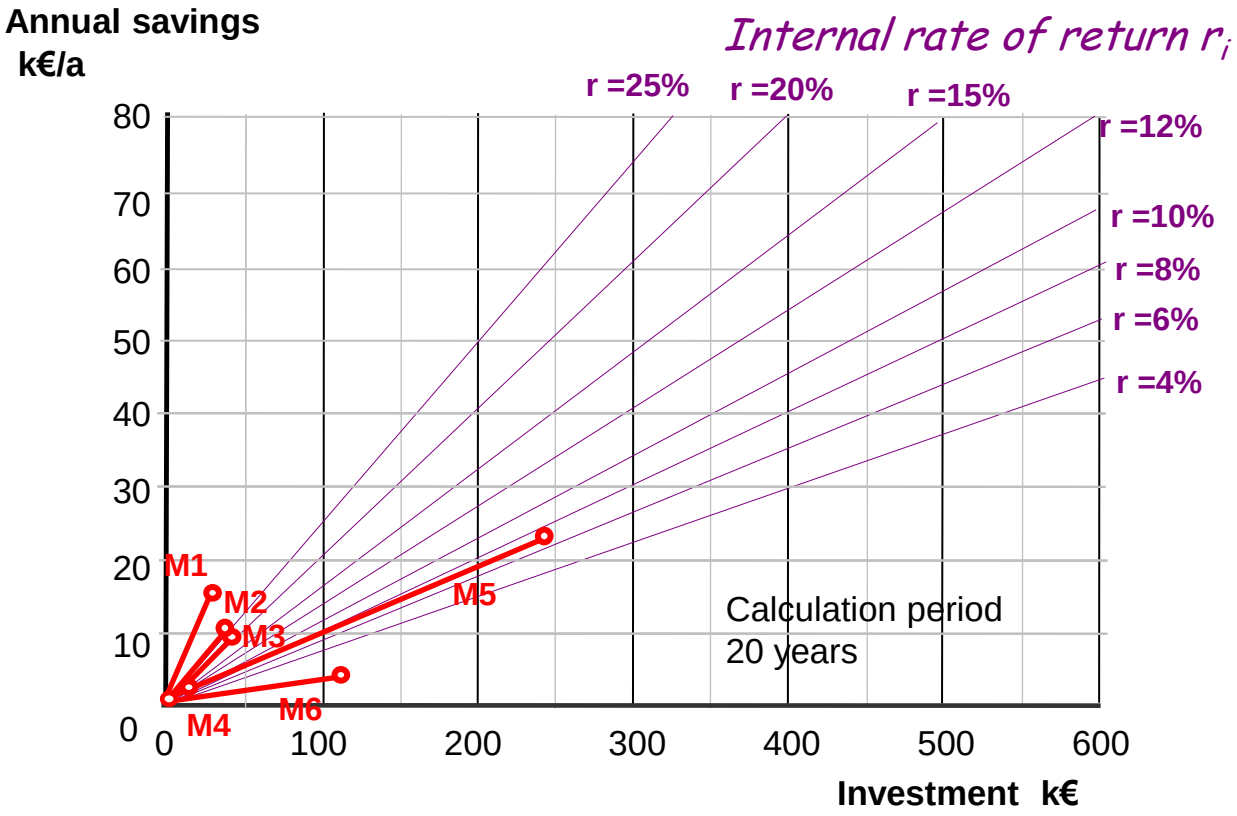


Internal rate of return method

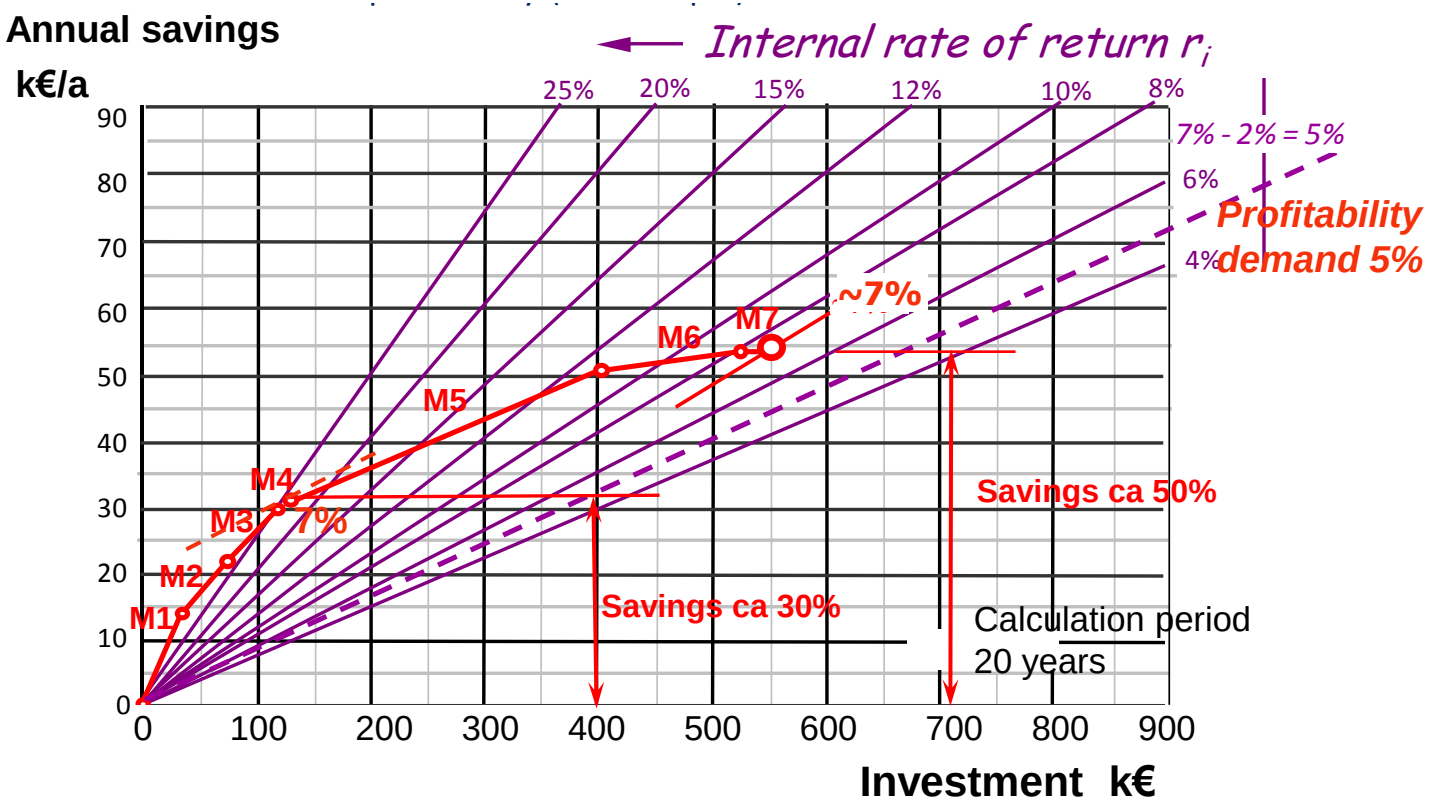
Internal rate of return diagram



The action package in the internal rate of return diagram



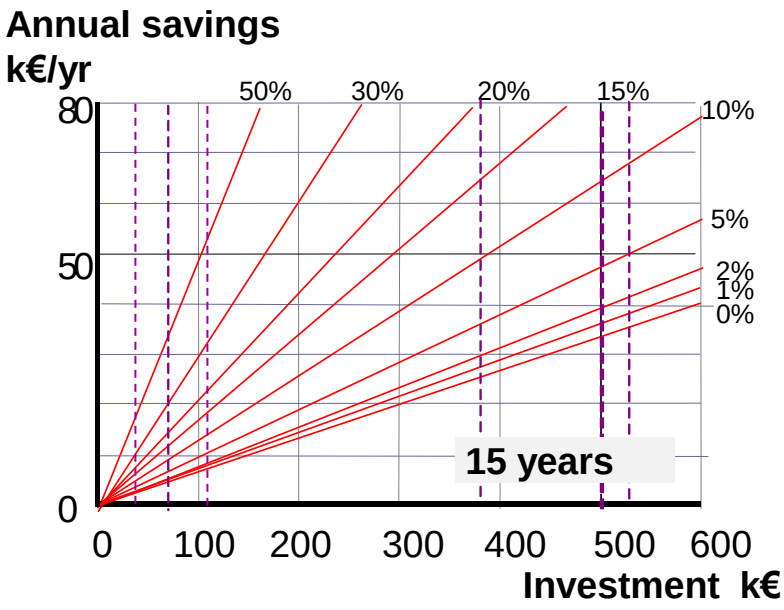
The action package in the internal rate of return diagram

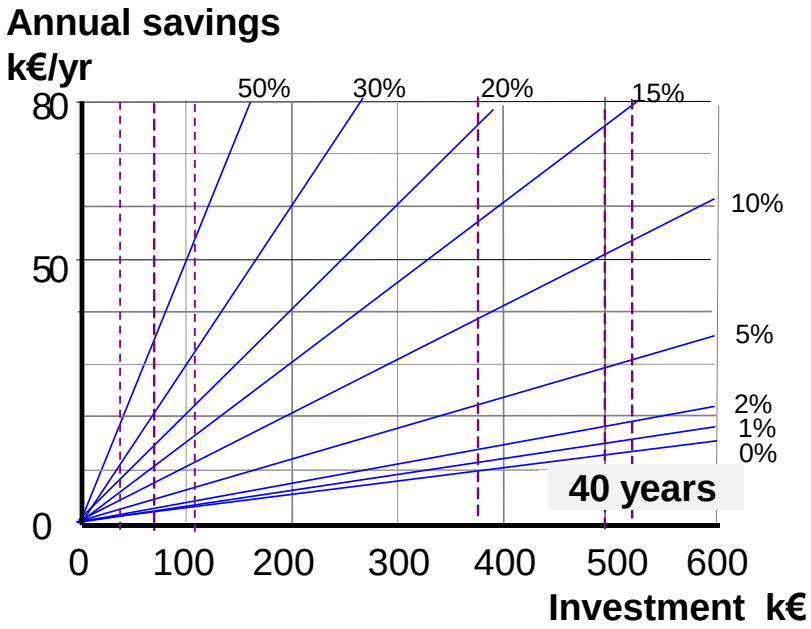


The most profitable measures make up for the investments that, on their own, would not have been profitable at the same time as the action package is still profitable…

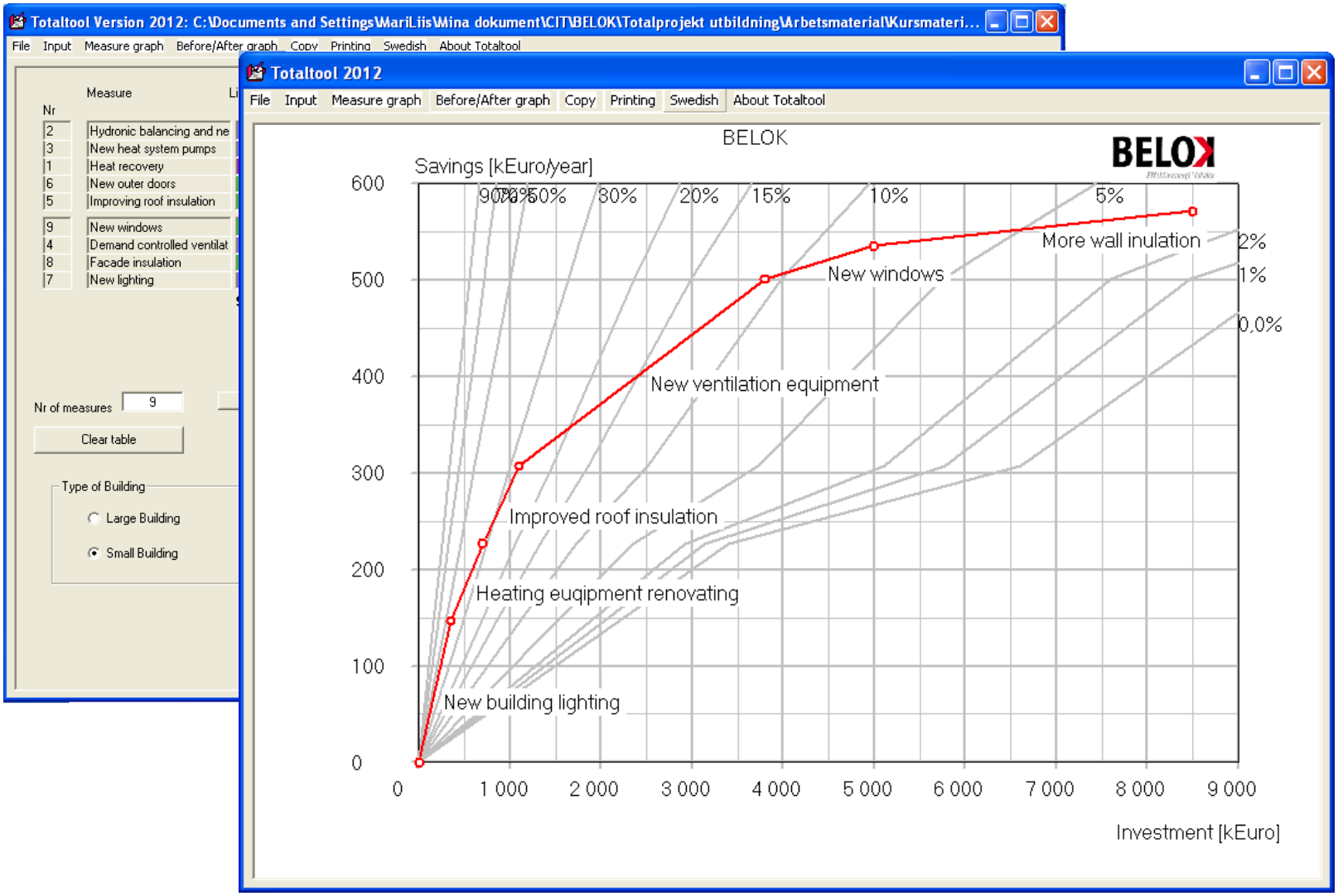
Different economic calculation periods

Internal rate of return diagram



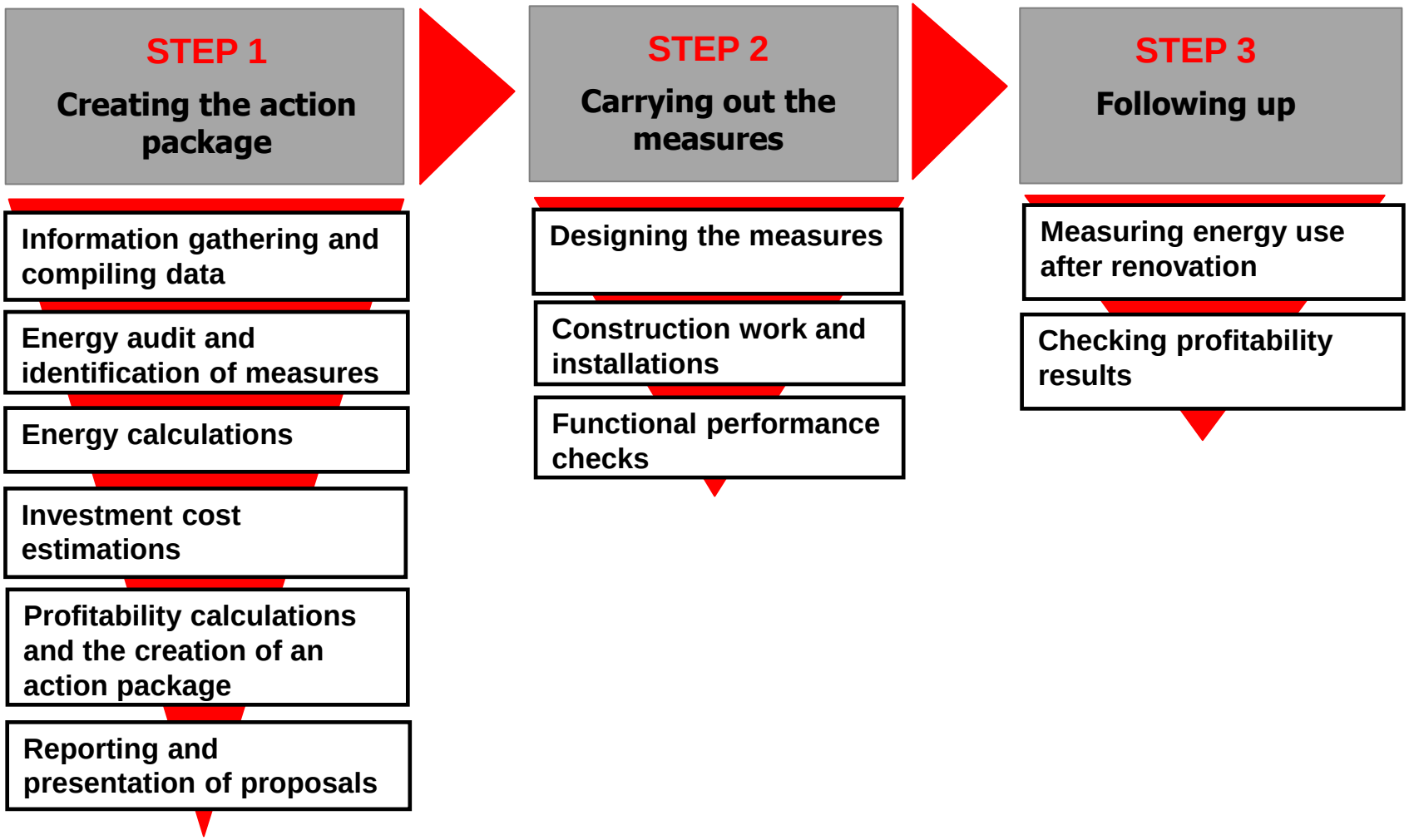


BELOK Totaltool



Carrying out different stages in the Total Concept method

Total Concept method



Total Concept method

STEP 1
Creating the action package

- Information gathering and compiling data
- Energy audit and identification of measures
- Energy calculations
- Investment cost estimations
- Profitability calculations and the creation of an action package
- Reporting and presentation of proposals

STEP 2
Carrying out the measures

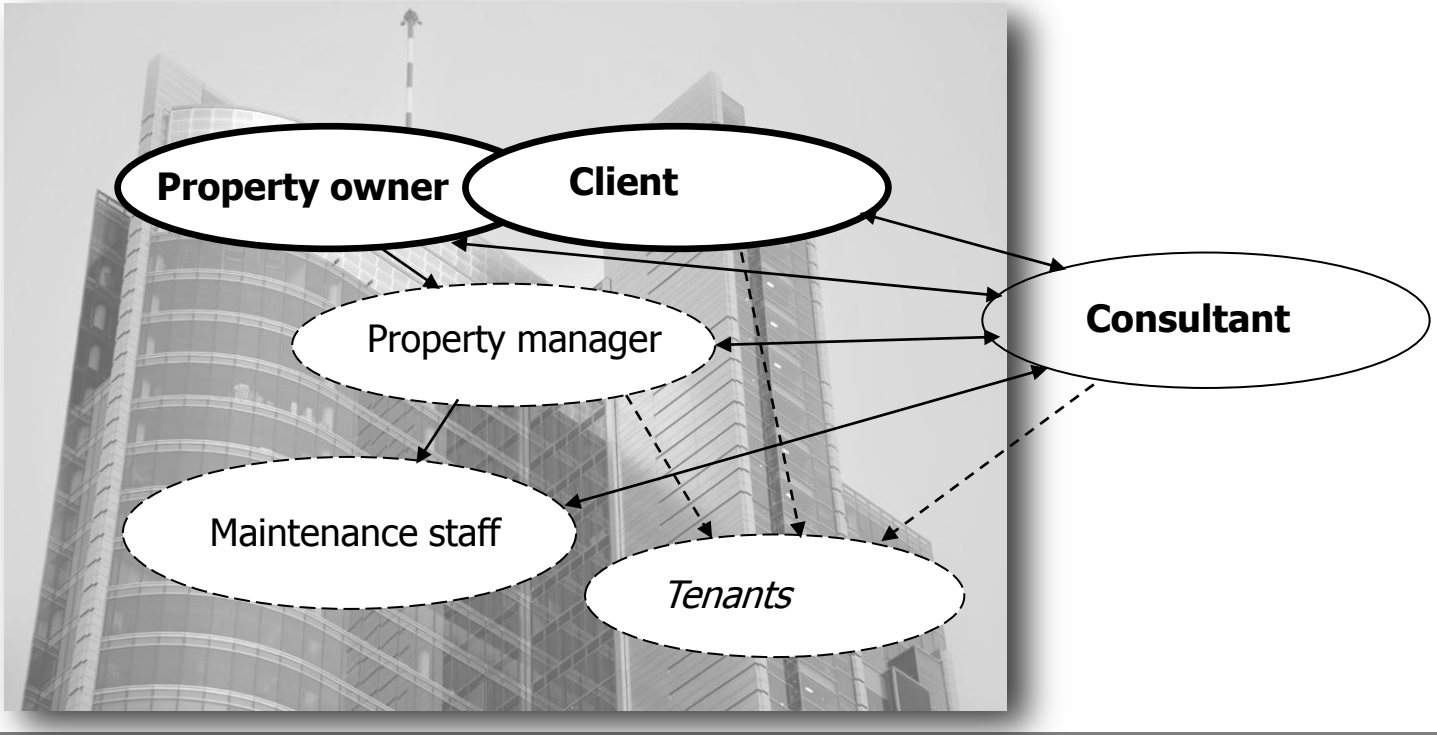
- Designing the measures
- Construction work and installations
- Functional performance checks

STEP 3
Following up

- Measuring energy use after renovation
- Checking profitability results

Step 1: Creating the action package

Cooperation between the **energy consultant,** property owner, property manager and maintenance personell



Tasks in Step 1

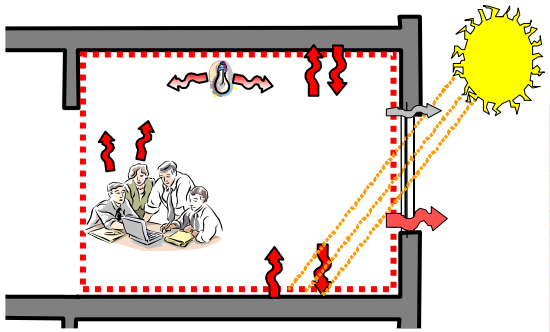
- Gathering of basic information about the building and compiling technical data
  - ✓ The building and how the building is used
  - ✓ Indoor climate requirements
  - ✓ The energy use
  - ✓ The technical systems

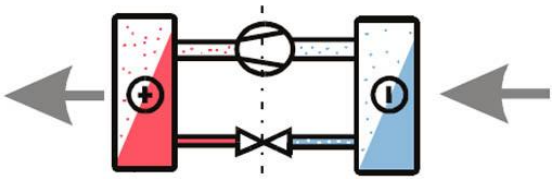
Tasks in Step 1

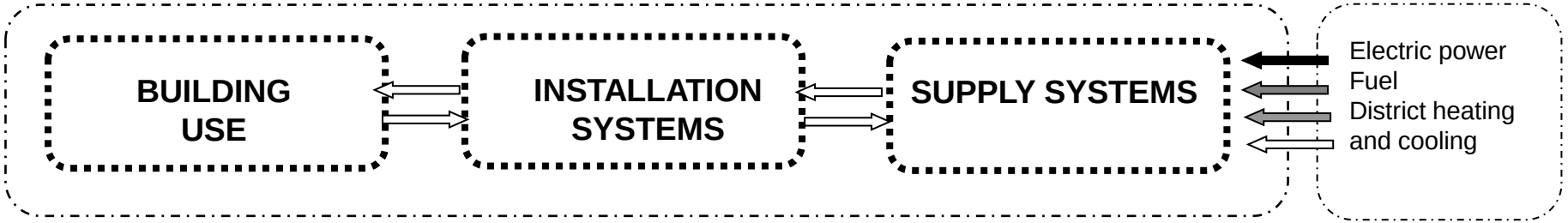
- Gathering of basic information about the building and compiling technical data
- Energy audit and identification of energy saving measures

Basic approach

- Building *as a whole* approach
- Building use set the demands/requirements that must be met by the technical systems







Tasks in Step 1

- Gathering of basic information about the building and compiling technical data
- Energy audit and identification of energy saving measures
- Energy calculations

Energy calculations

Energy saving measures

1.

Savings are only results of the measures themselves, no influence on other systems

e.g. heat recovery system in the ventilation system

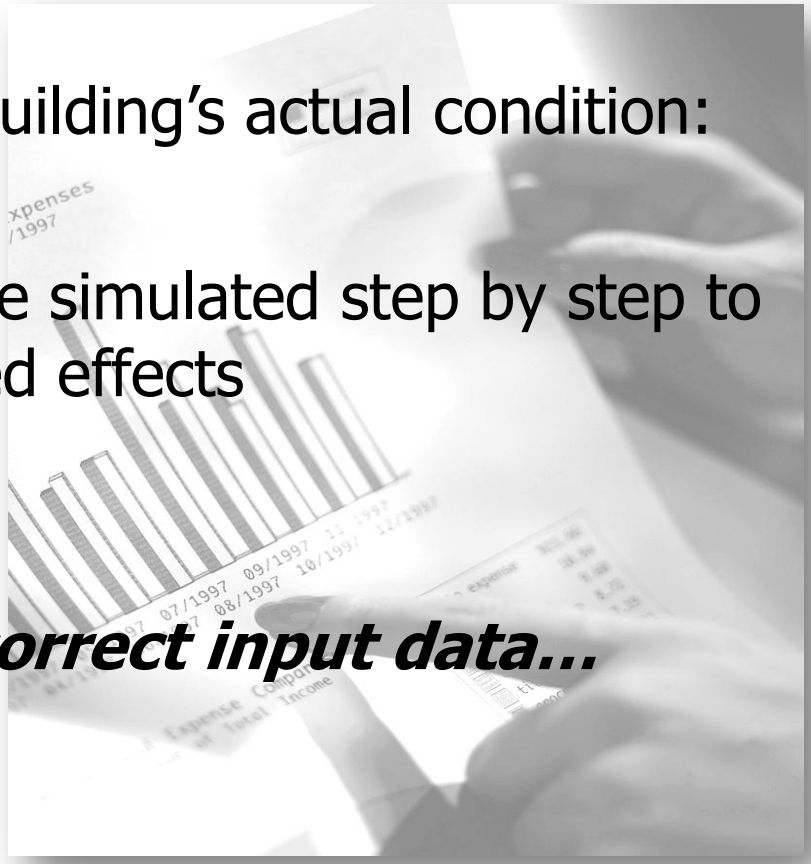
2.

In addition to the direct savings, also have indirect effects on the energy use of other systems

e.g. replacing windows, changing to energy efficient lighting, rebuilding from CAV to VAV system

Energy calculations

- The building is simulated with a validated energy simulation software
- Calculations are based on the building's actual condition: current layout and operation
- The energy saving measures are simulated step by step to take into account their combined effects



It is important to have correct input data…

Tasks in Step 1

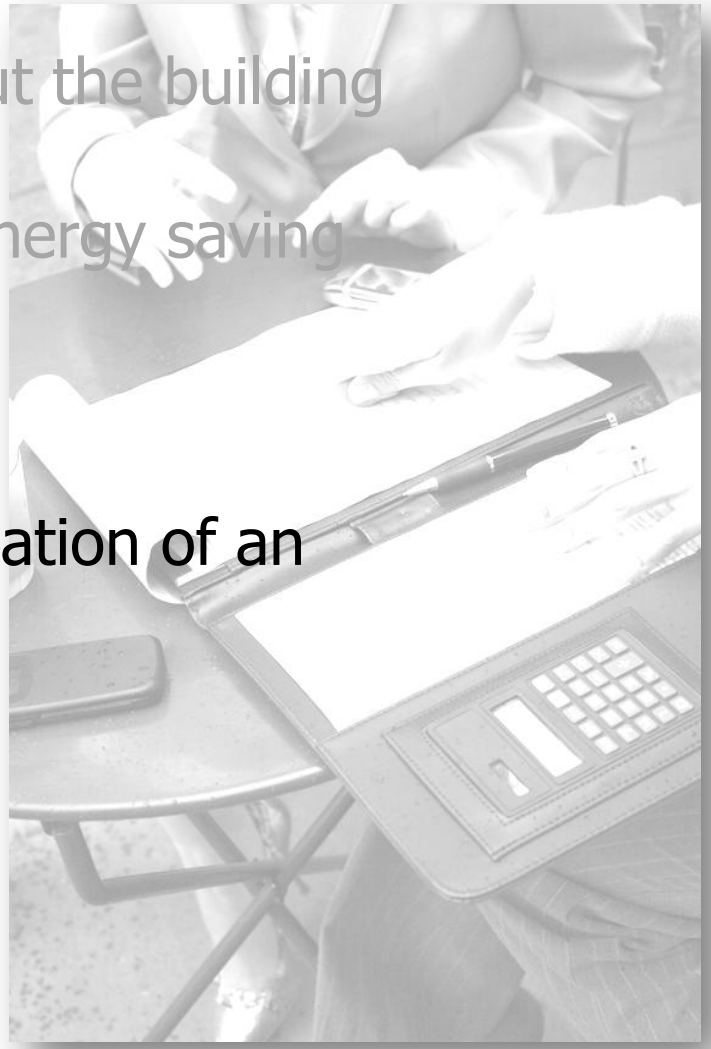
- Gathering of basic information about the building and compiling technical data
- Energy audit and identification of energy saving measures
- Energy calculations
- Investment cost estimations

Investment cost calculations

- The cost of each measure is calculated
- The simultaneous implementation of the different measures is taken into account
- The property owner/client who decides the conditions for the investment cost calculation
- Only costs related to enery efficiency improvement should be included

Tasks in Step 1

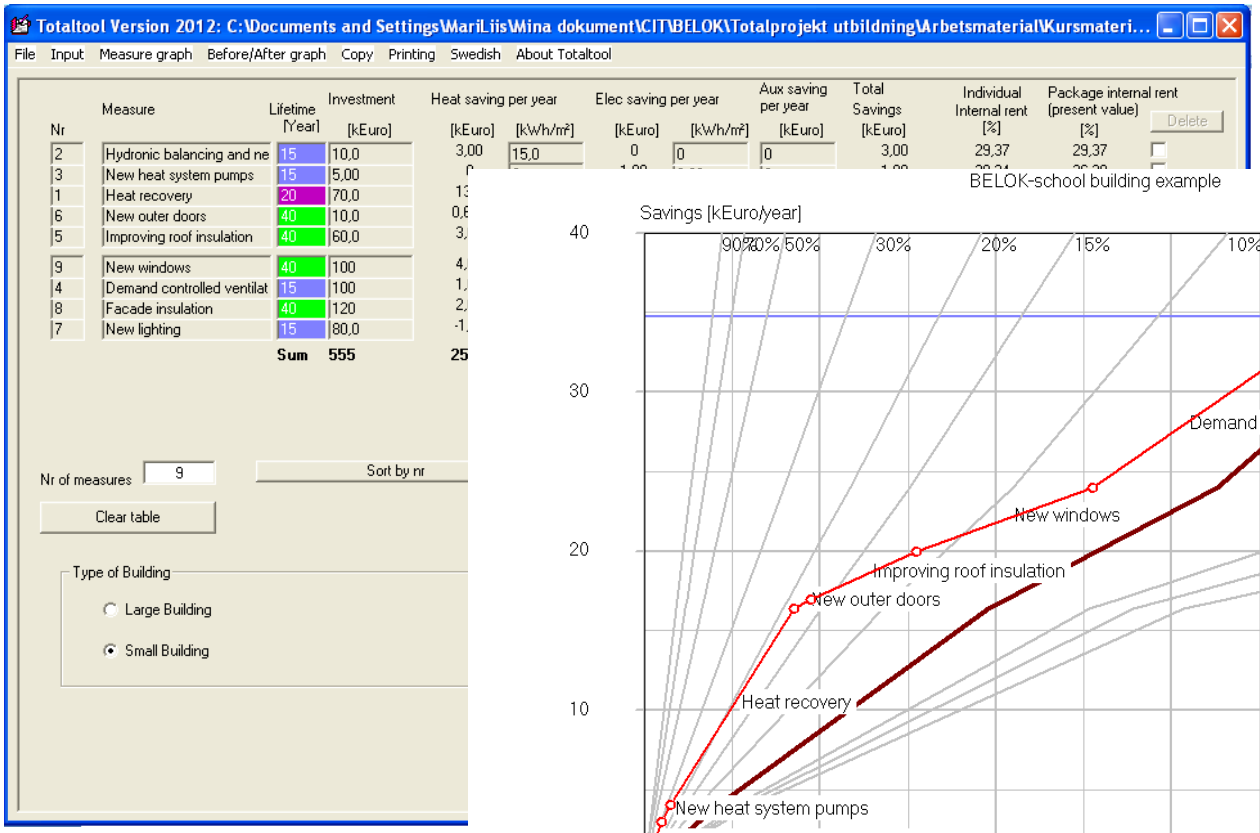
- Gathering of basic information about the building and compiling technical data
- Energy audit and identification of energy saving measures
- Energy calculations
- Investment cost estimations
- Profitability calculations and the creation of an action package



Profitability calculation

Identified measure (M)	Invest. cost k€	Calcu-lation period yrs	Heat energy saving kWh/m^2·yr	Heat energy saving k€/yr	Electrical energy saving kWh/m^2·yr	Electrical energy saving k€/yr	Other savings k€/yr	Savings in total k€/yr
M1. Ventilation heat recovery	70	20	65	13	-2	-1	0	12
M 2. Hydronic balancing and new thermostats	10	15	15	3	0	0	0	3
M3: New heat system pumps	5	15	0	0	3	1	0	1
M4: DCV system	100	15	5	1	20	7	-0,5	7,5
M5: Improved roof insulation	60	40	15	3	0	0	0	3
M 6: New outer doors	10	40	3	0,5	0	0	0	0,5
M 7: New lighting	80	15	-5	-1	10	3,5	0,5	3
M8: Facade insulation	120	40	10	2	0	0	0	2
M9: New windows	100	40	20	4	0	0	0	4

Forming an action package with BELOK Totaltool



Tasks in Step 1

- Gathering of basic information about the building and compiling technical data
- Energy audit and identification of energy saving measures
- Energy calculations
- Investment cost estimations
- Profitability calculations and the creation of an action package
- Reporting and presentation of proposals for measures to be carried out

Results from Step 1…

… forms the basis for the investment decision

… forms the basis for the design in Step 2

Included to the Step 1 report:

- Input data in the form of technical details about the building, energy statistics, input data for the feasibility calculations
- A detailed description of the measures
- Calculated energy and investment cost savings for each measure in the package
- Final results of profitability calculations: feasibility of the action package and the energy use before and after

Total Concept method

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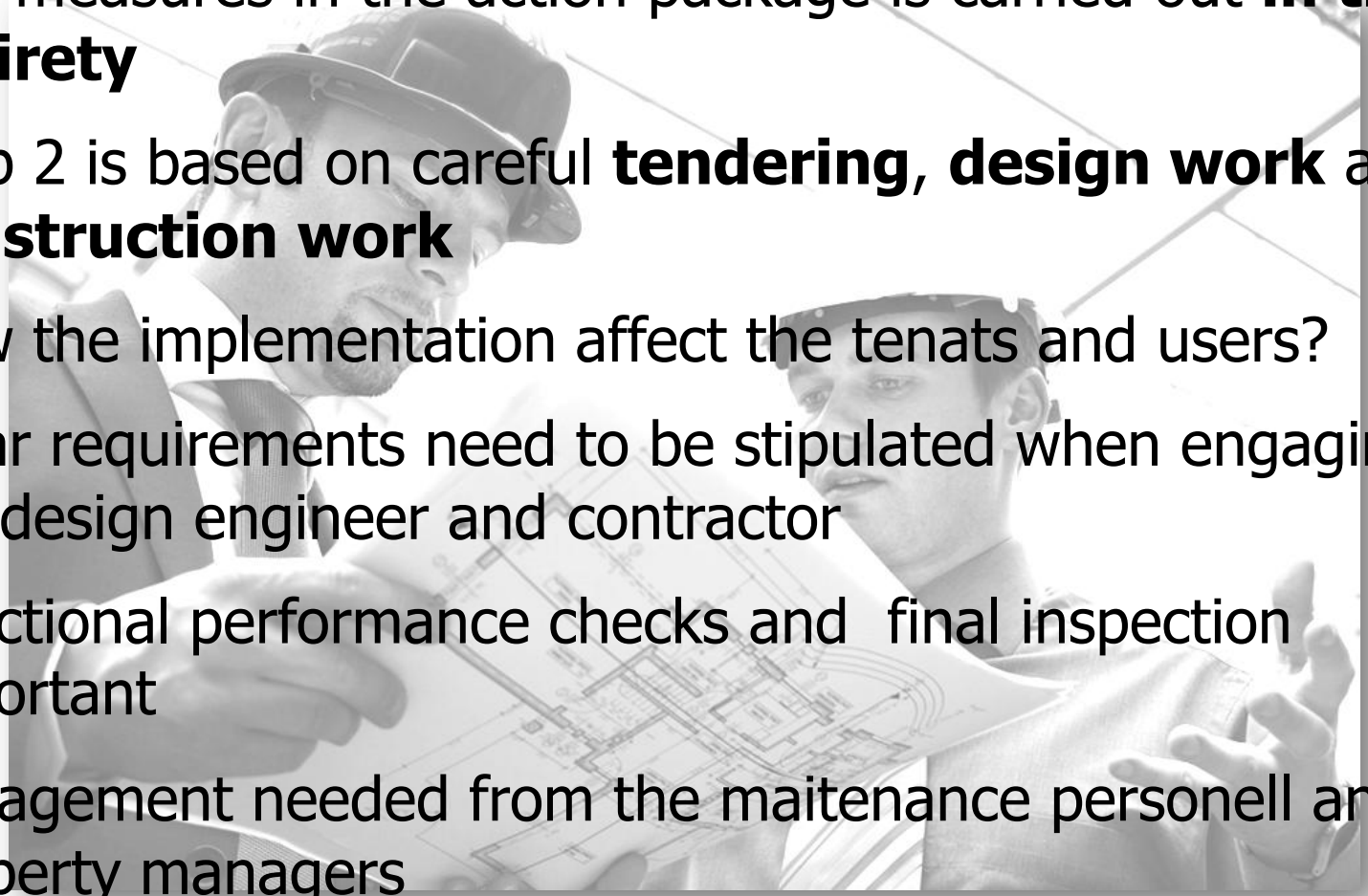
STEP 2
Carrying out the measures

- Designing the measures
- Construction work and installations
- Functional performance checks

STEP 3
Following up

- Measuring energy use after renovation
- Checking profitability results

Step 2: Carrying out the measures



- The measures in the action package is carried out **in their entirety**
- Step 2 is based on careful **tendering**, **design work** and **construction work**
- How the implementation affect the tenats and users?
- Clear requirements need to be stipulated when engaging the design engineer and contractor
- Functional performance checks and final inspection important
- Engagement needed from the maitenance personell and property managers

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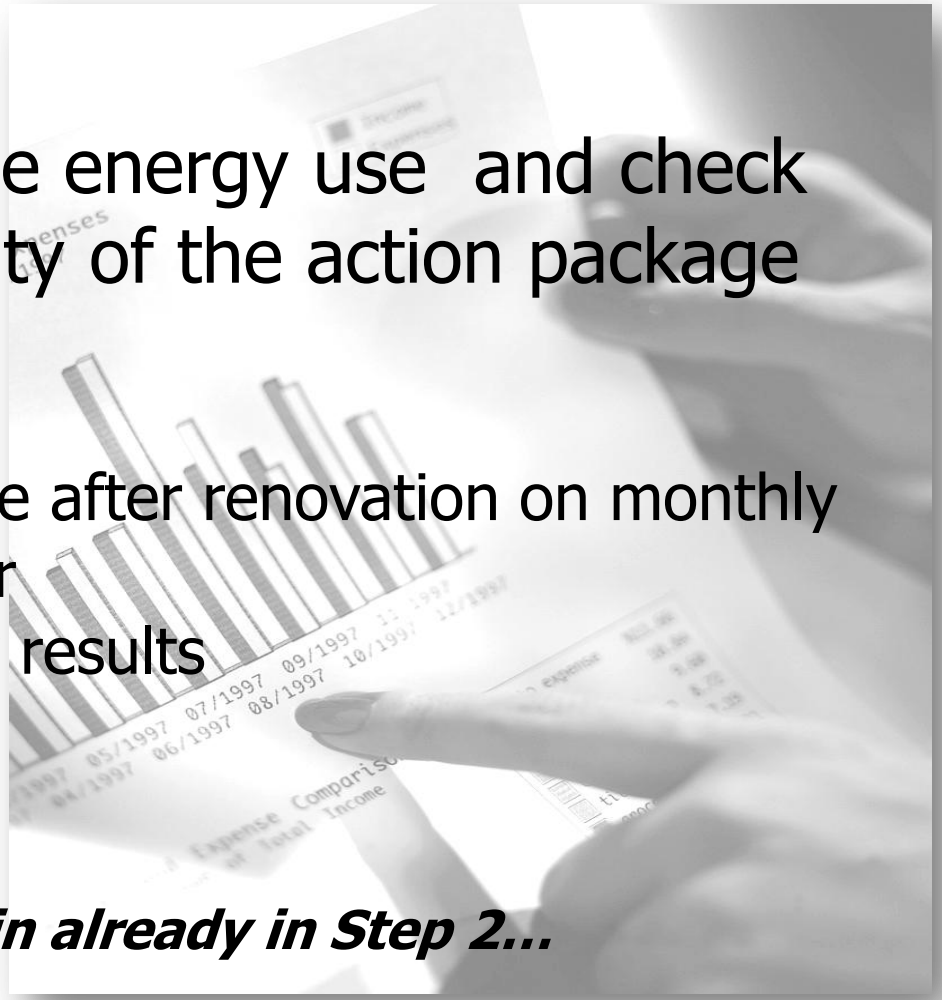
Step 3: Following up



Aims to follow up the energy use and check the actual profitability of the action package

Main Tasks

- Measuring energy use after renovation on monthly basis during one year
- Checking profitability results

Planning of Step 3 should begin already in Step 2…

Questions?