TREES
for Renovated Energy Efficient Social housing

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

Section 2 Tools

2.6 Cost calculation

Life Cycle Costing – as a tool for decision-making

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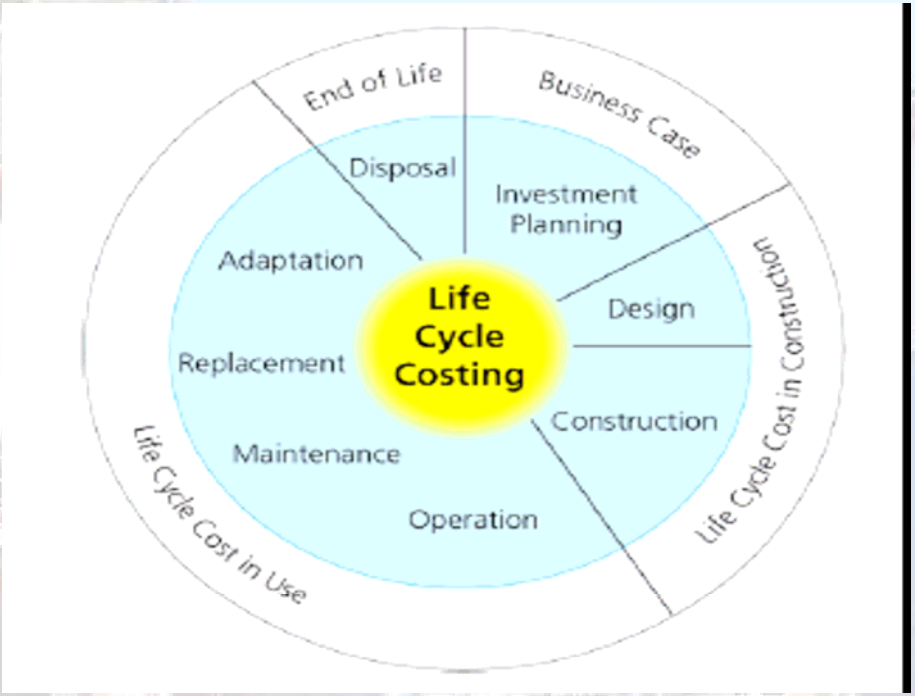
Introduction to the topic.

Life Cycle Costing



The following is an introduction to how to use calculation methods based on LCC-thinking as a tool for decision making

Content

- Introduction to the topic
- Definitions and principles
- Methods and range of use
- Tools and examples
- Addresses

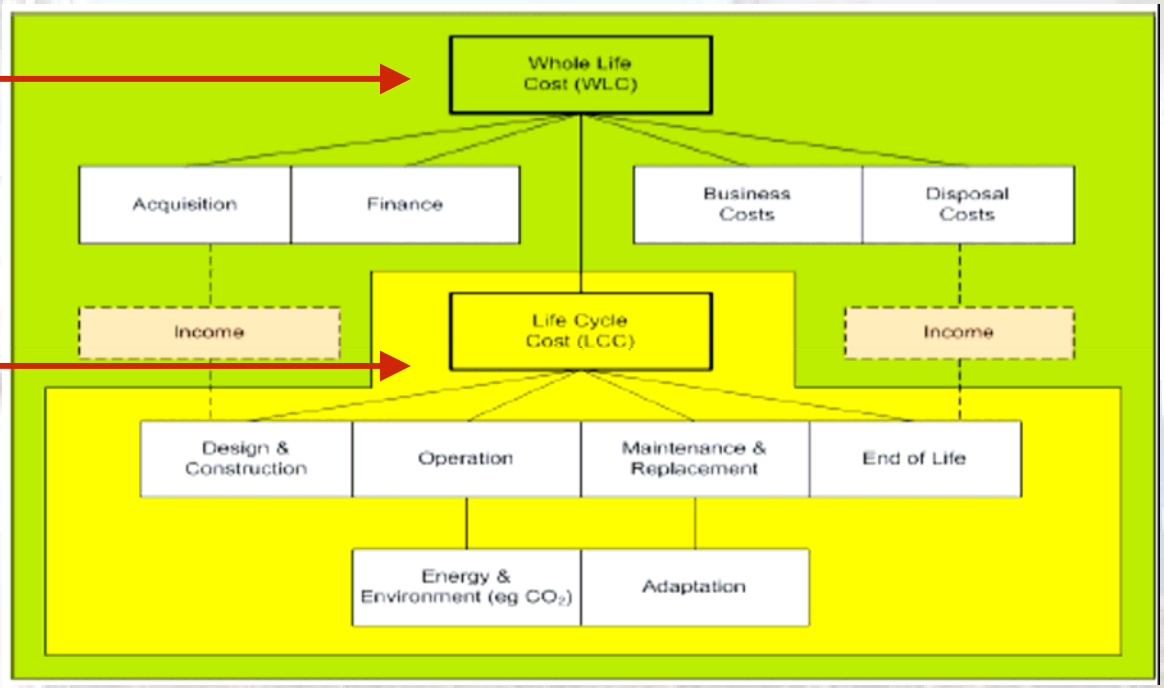
Main issues

- LCC enables comparative cost assessment to be made over a spesific periode of time eq. the whole building- or component`s service life.
- LCC can be made on both coare and detailed level.
- LCC used in the design phase gives opportunity to indicate both investment cost and future cost such as energy use, maintenance cost etc.

LCC put focus on cost , while WLC also put focus on income and benefit.

Whole life costing

Life Cycle Cost



Both methods can be used.

What is Life Cycle Costing ?

"Life Cycle Costing is a method to facilitate choices where there are alternative means of achieving the clients or key stake holders objectives and where those alternatives differ not only in their initial costs, but also in their subsequent operational and renewal costs over the service life time in the asset. "

(ISO 15686-5)

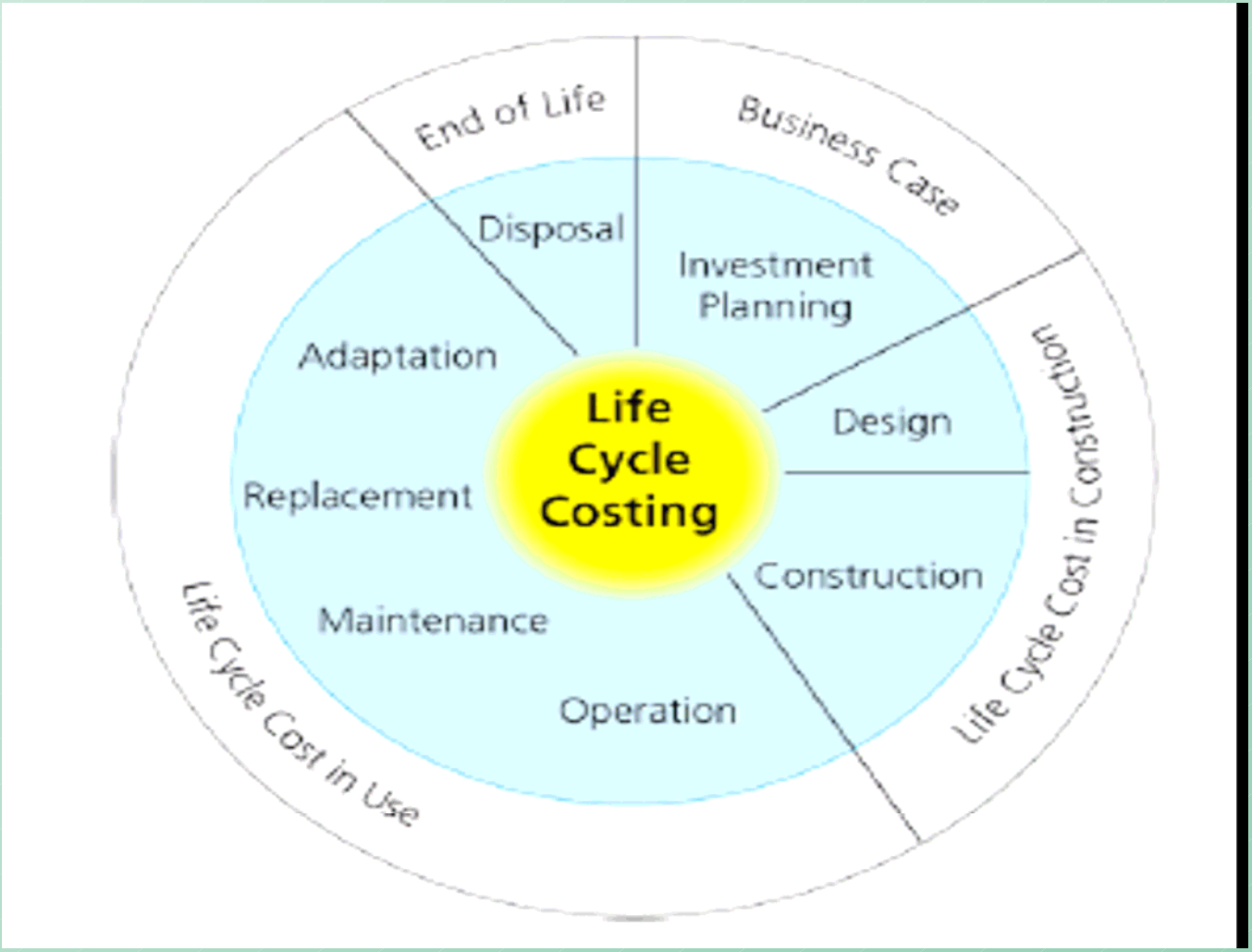
The purpose with LCC

Facilitate choices between alternative components or alternative design all of which have acceptable performance.

Evaluation of different investments scenarios

Estimation of future costs for budgets or evaluation of acceptability of an investment.

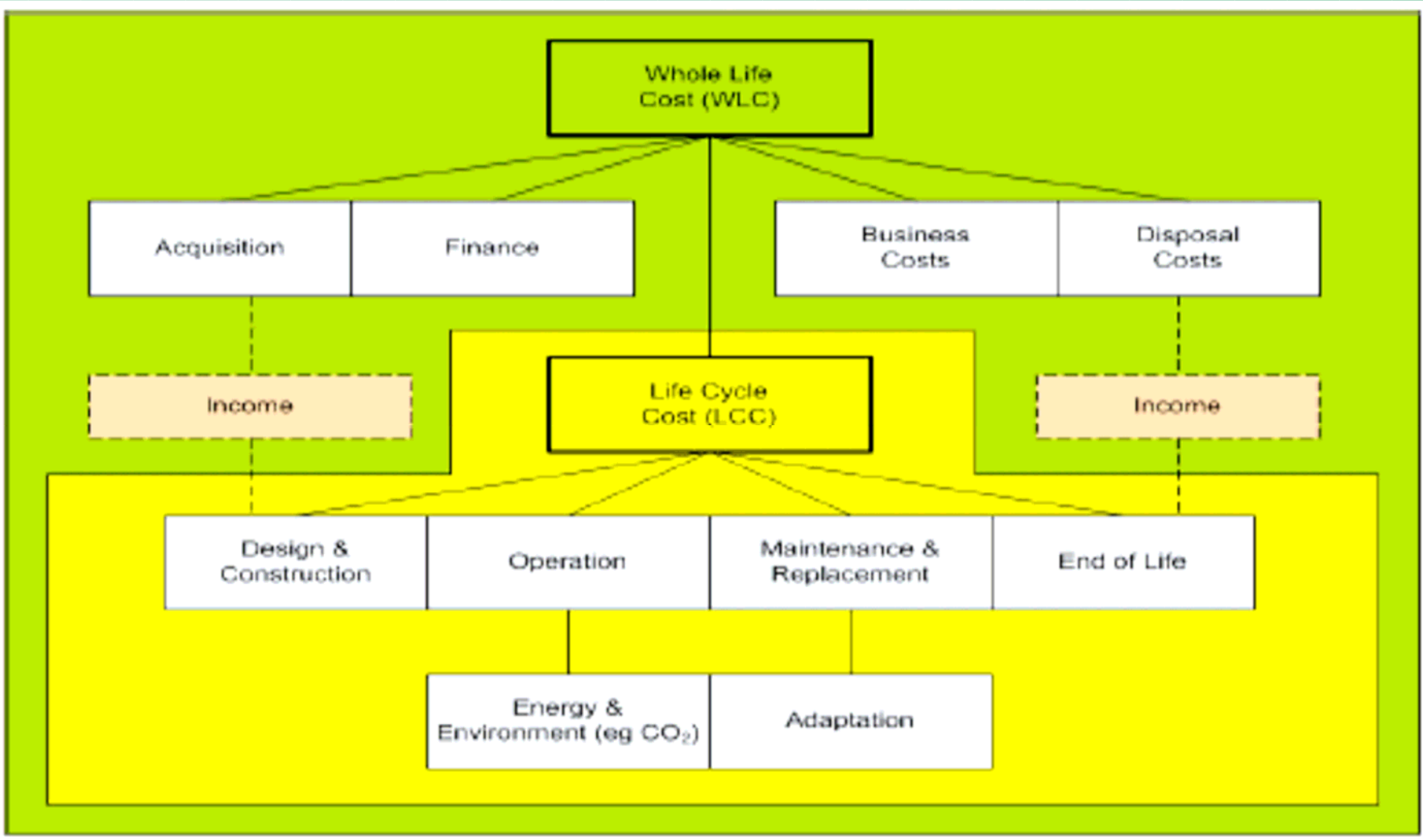
Life Cycle Costing can be used in all levels and phases



Definitions and principles

Life cycle costing (LCC)	Summing up total costs of a product, process or activity discounted over the total lifetime
Life cycle cost assessment (LCCA) consequences	Systematic process for evaluating the life cycle cost of a product or service by identifying environmental consequences and assigning measures of monetary value to those
Whole life costing (WLC)	The systematic consideration of all relevant costs and revenues associated with the acquisition and ownership of an asset

Whole Life Cost – analysis include also income and benefit while Life cycle cost analyses only costs.



Calculation of LCC can be made at various levels:

Coarse level:

Analyses by using average figures for that type of construction (complete building) combined with estimates or predictions of component's performance and maintenance activities.

Detailed level:

Based on proposed design detailing and quantum of individual elements or components of the constructed asset. These are then summed up to produce a life cycle estimate that include consideration of service life planning of the proposed design.

Service life-, Life Cycle- and Design life period

The period of analysis is the length over which an investment is analysed. The period of analysis may be 60 years, but also shorter or longer

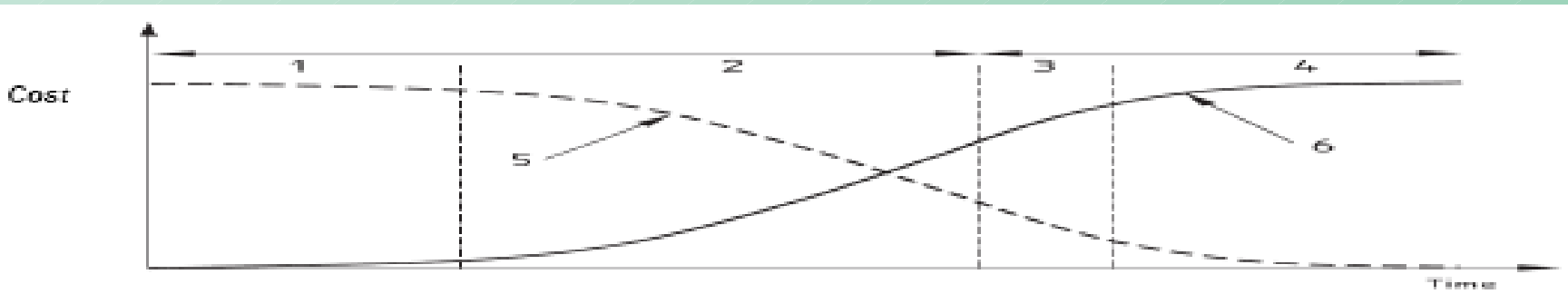
When considering the period of analysis, think also on functional, demographic or aesthetic obsolescence.

Figures about maintenance, repair and replacement will be required to achieve the predicted/ estimated life cycle. Service life replacement dates are important variable input in LCC-calculations.

Use of LCC in the concept-, feasibility- and detail planning phase can influence much on whole life costs.

Up to 80% of the operation-, maintenance- and replacement costs of a building are influenced in the first 20% of the design process.

But decisions, data feedback and continual monitoring and optimisation of LCC must continue through the life of the facility.



Key

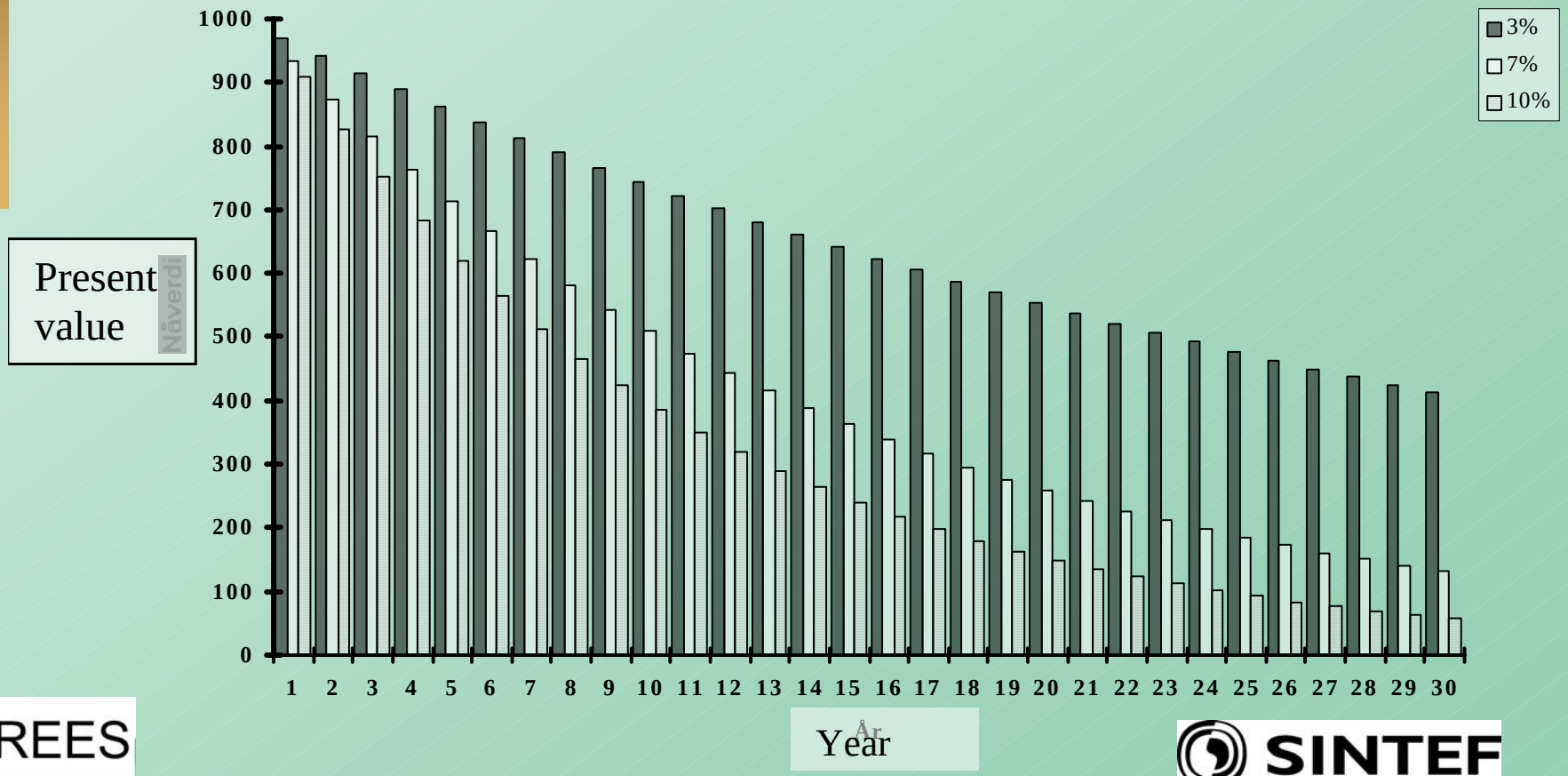
1 Concept	3 Detail Design	5 Potential for cost reduction
2 Feasibility	4 Construction	6 Cost of change

LCC based on Net Present Value (NPV)

- Only costs is taken into account, not revenue or income.
- All costs are converted to net present value by means of a discounting factor and assessed during a service life period.
- LCC is represented by a single figure which take into account of all relevant future expenditure over the period of the analysis.
- The choice of the discount rate have great impact on the net present value: The higher discount rate being calculated , the less will future cost influence on the Net Present Value.

Discount rate in Net Present Value Calculations

The higher discount rate being used , the less the impact of future economic consequences.



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LCC = Discounting of construction- and of future cost

$$LCC = I_0 + \sum_{i=1}^{N} \left[\left((O_i + M_i \cdot (1+r)^{-i} \right) \right] - \left((R \cdot (1+r)^{-N} \right)$$

I_o = Construction cost

r= Discount rate

O = Management and operation cost

M= Maintenance (and refurbishment) cost

i= number of year

N= Length of analysis period

R = Residual value at the end of the analysis period

Challenges with using LCC for buildings.

LCC analysis provides a more secure basis for comparing and selecting material options than the traditional method of judgements based on comparing acquisition costs alone. This particularly applies to situations where the initial costs can influence upon operating and maintenance costs.

Lack of precise databases for investment-, operating-, maintenance and replacement costs can give the tools limited reliability.

Note: The term “LCC” must not be mixed up with the term “Pay back method”

Payback Method is a simple technique to compare large and smalls investments where the alternatives can cause future savings.

Payback- time is a calculation of the time period it takes to regain investments cost.

The calculation shows the number of year elapsed between the initial investment and its subsequent operating cost and the time at which cumulative savings recover the investment.

Simple payback method = Initial cost / Annual savings

Discounted payback method uses present values = Initial cost / Annualized savings

Example of a net present value- metode (NPV)
The Life Cycle Profit model (Norway)

The model is based on the Norwegian Standard NS 3454 (LCC for buildings and civil engineering work).

The model fullfil the principle in ISO/CD 15686-5

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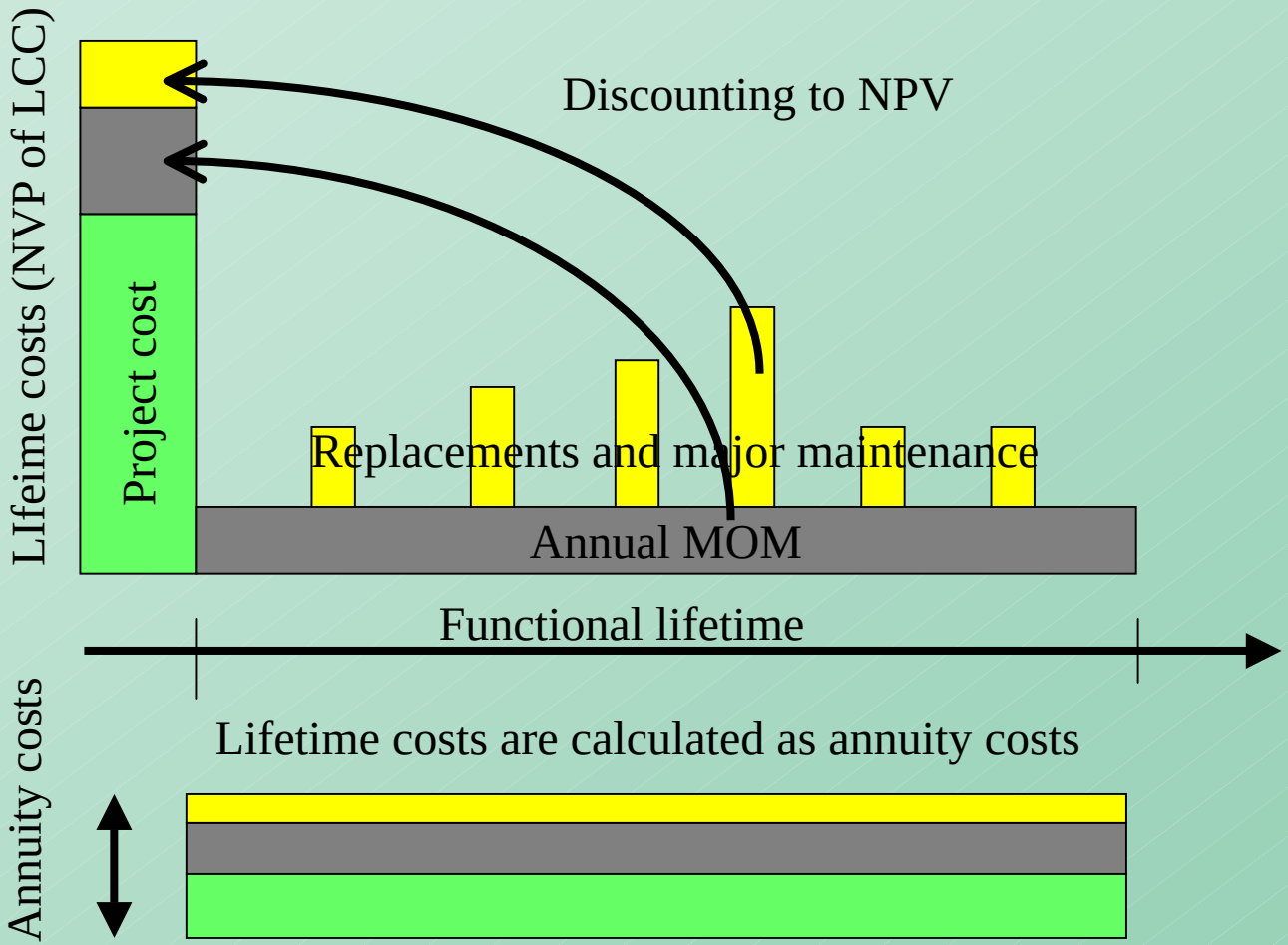
Visualization of the principle of the NPV method



Calculation of NPV of two façade claddings (wood and brick)

Facade claddings:	Predicted replace-ment life (years)	Predicted refurbish-ment intervals (years)	Main-tenance costs (€/m²)	Invest-ment costs	Discount rate %	Dis counted future costs (€/m²)	Net present value (€/m²) Annuity Costs)
Painted wood panel	30	10	0,9	75	3 %	49	4
					7 %	18	6,5
Brick cladding	60	30	0,6	150	3 %	3	5,5
					7 %	1	11

Summary

The LCC analysis involve an economic comparison of different option that meet the functional, maintenance, operational and aesthetic requirements set by the client or decision makers

The usefulness of LCC- oriented tools for making sustainable construction depends much on:

- **Quality of input data in all phases "from cradle to grave"**
- **The exactness of the calculations**
- **The tools must be easy to use**

Some relevant tools for LCC - calculation

LC-Profit **(Norway)**	**www.lcprofit.com**
LEGEP **(Germany)**	**www.legep.de**
BEcost **(Finland)**	**http://virtual.vtt.fi/environ/ohjelmat_e.html**