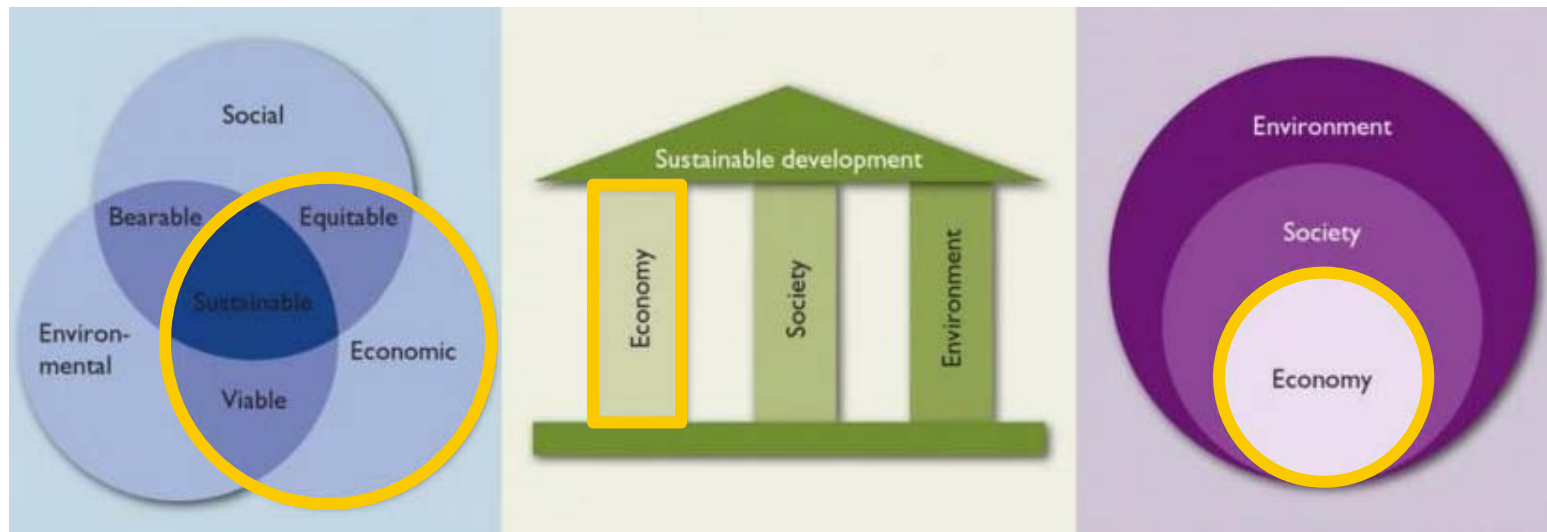


Life cycle approach to construction and refurbishment of the buildings

Kiev, 29.11.2017

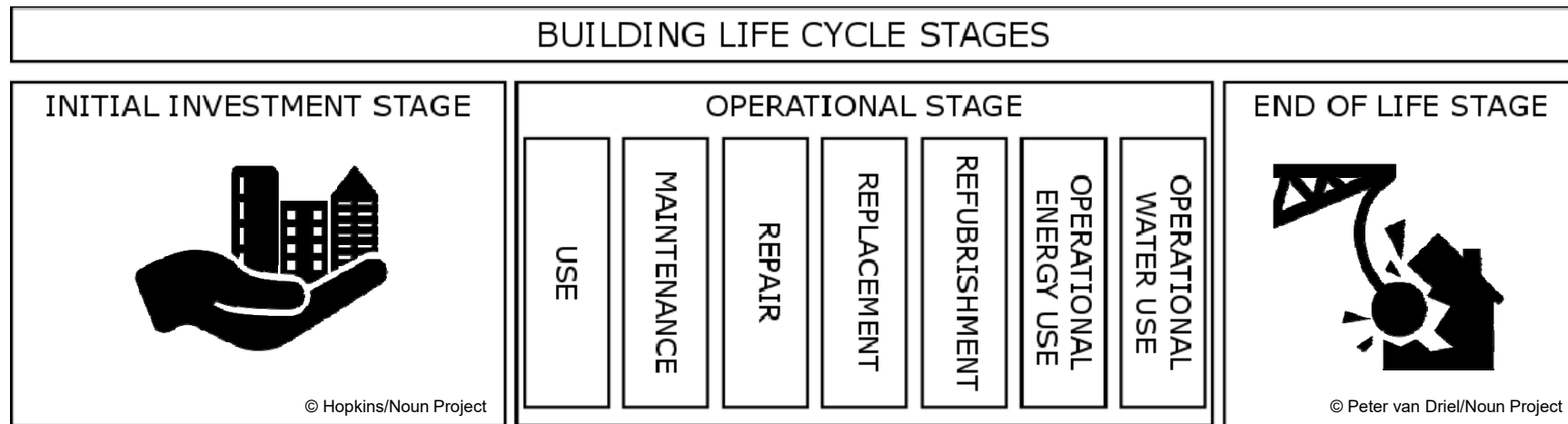
Sustainable development

- › Three dimensions of sustainability form “*interdependent and mutually reinforcing pillars*”:
 - › Economic
 - › Social
 - › Environmental



© E. Barbier/UN/UN

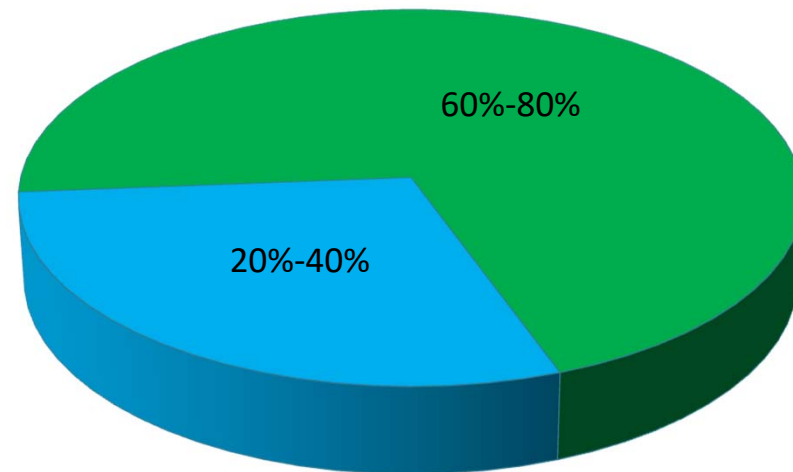
Life cycle of a building



- › Buildings generate costs on every stage of its life cycle;
- › Cost savings at the initial investment stage do not mean reduction of cost during the whole life cycle (operational stage & end of life stage);
- › Cheaper products often lead to lower quality resulting in higher operational stage costs and shorter service life.

Life Cycle Costing

- › Lack of data is the major barrier to implementation of more sustainable solutions
- › LCC allows:
 - › estimation of all present and future costs of a building
 - › compare various scenarios
 - › choose the most feasible one
- › Provides data allowing increase of return of investment (ROI)



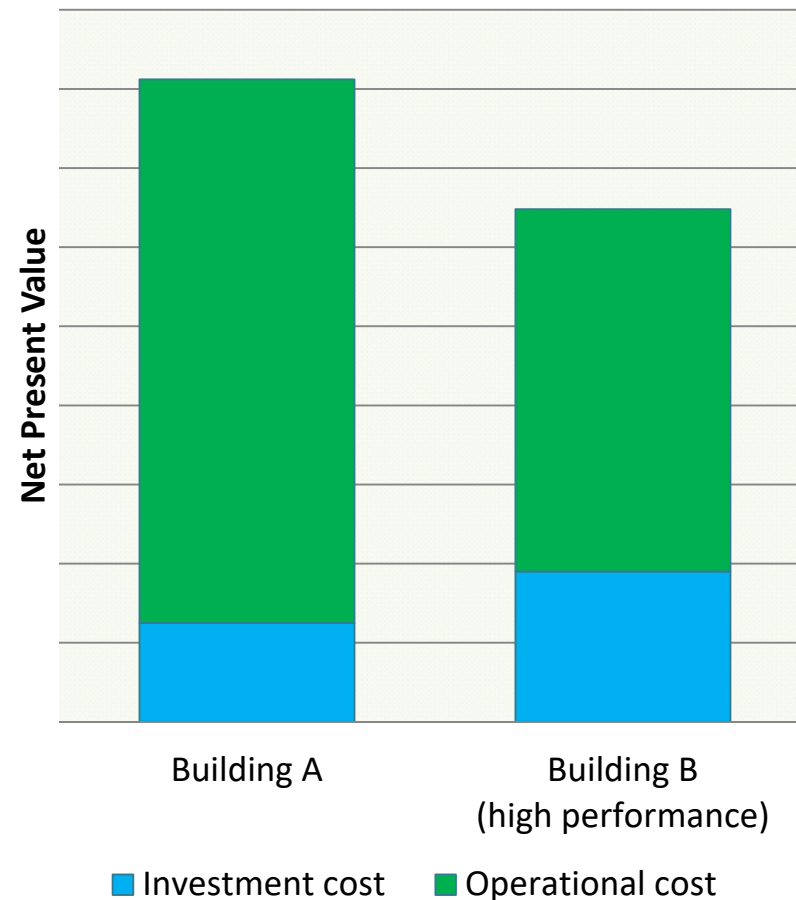
■ Investment cost ■ Operational cost

Life Cycle Costing

- › Life Cycle Costing takes into consideration multiple economic parameters affecting feasibility of an investment, e.g.:
 - › Inflation/deflation rate;
 - › Discount rate;
 - › Growth rate of energy cost;
 - › Growth rate of labour cost;
 - › Growth rate of spare parts;
 - › Loan interest rates.

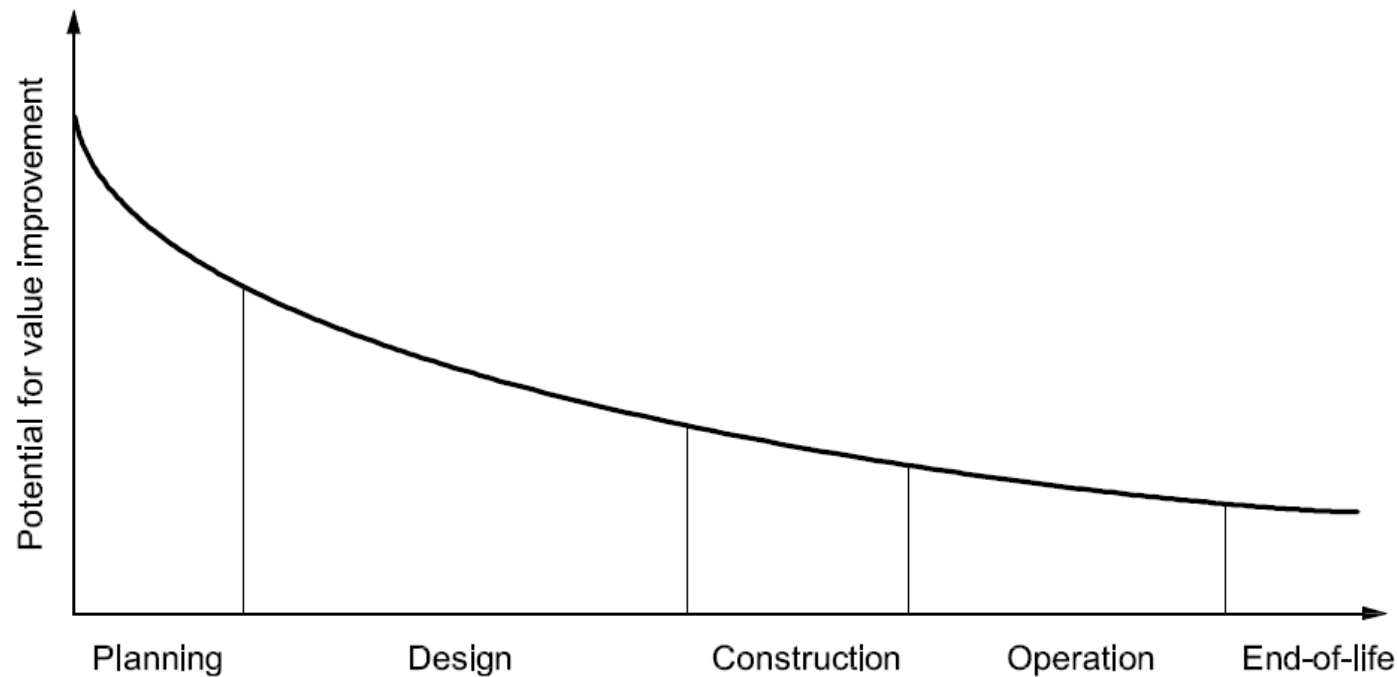
Net Present Value

- › The results (all payments in and out) are discounted to a Net Present Value (NPV);
- › The higher investment cost could be subsidized or/and supported with a preferential loan by a local bank



Decision time frame

- › Up to 80% of the operation, maintenance and replacement cost of a building can be influenced in the first 20% of the design process



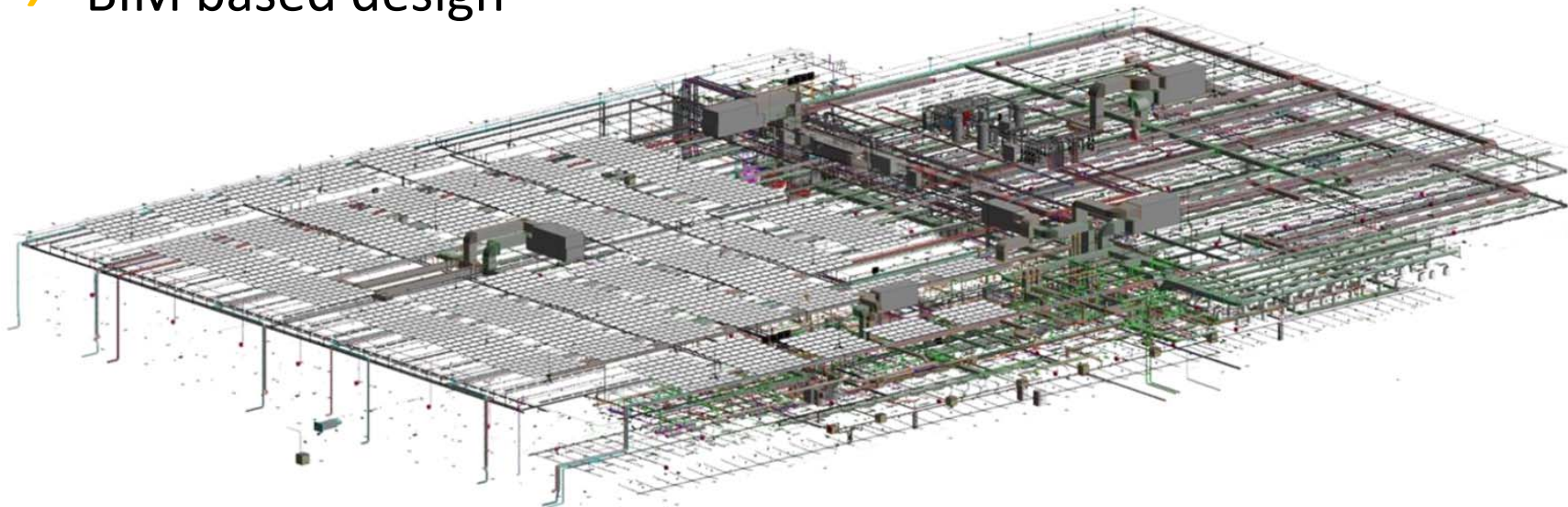
© ISO15686-6

Service life

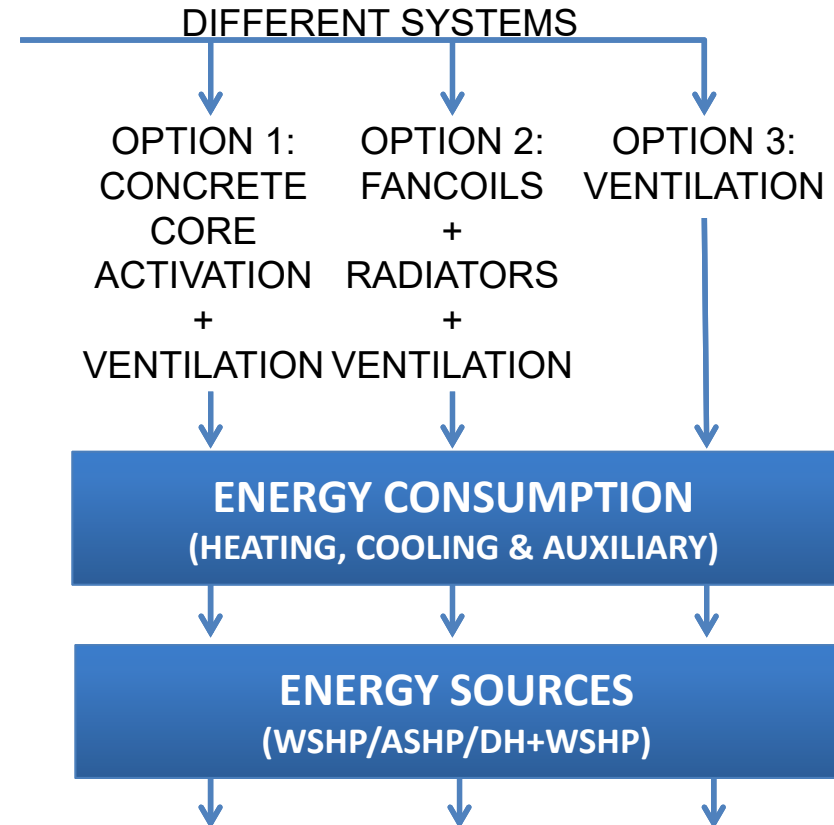
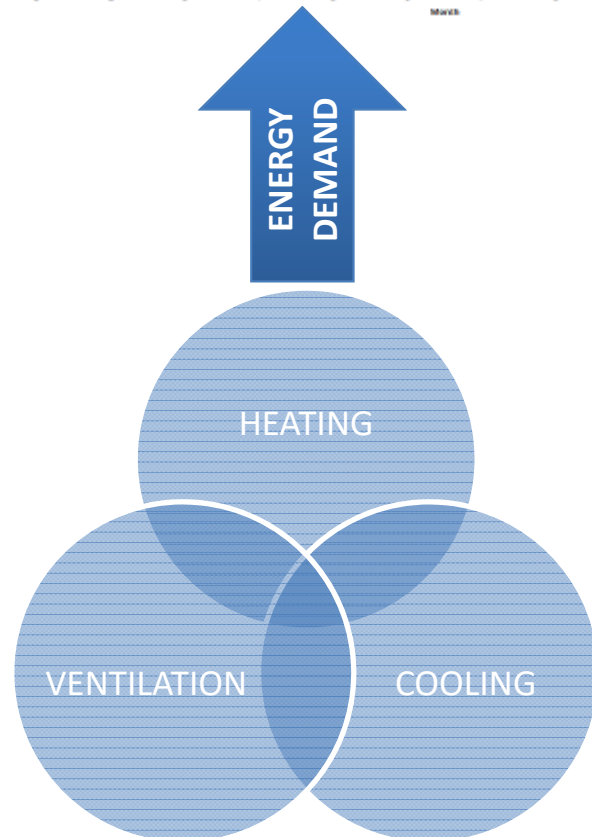
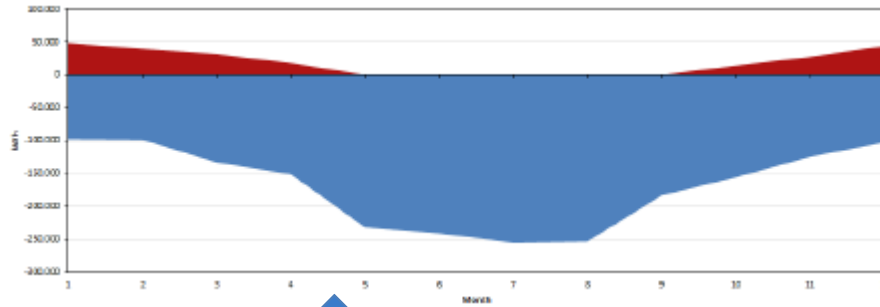
- › Choice of the realistic service life of a building and of the building components is crucial
- › The longer service life of a building the impact of operational stage grows due to necessity of replacement of building components and increase of energy price.
- › The choice of more expensive high quality building components might significantly increase service life of a building and reduce operational costs.

Case study: Shopping/logistic centre

- › Shopping/logistic centre belonging to an international chain
- › Located in Slovenia
- › Area 34.000 m²
- › BIM based design



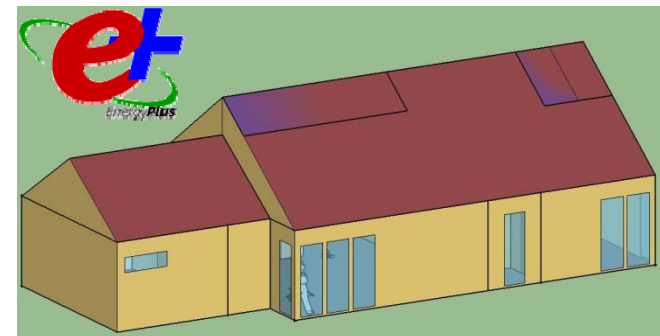
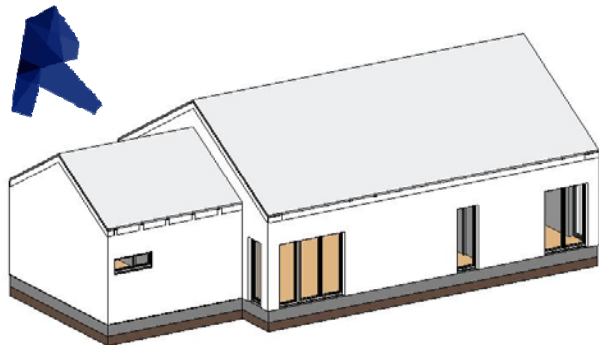
Case study: Shopping/logistic centre



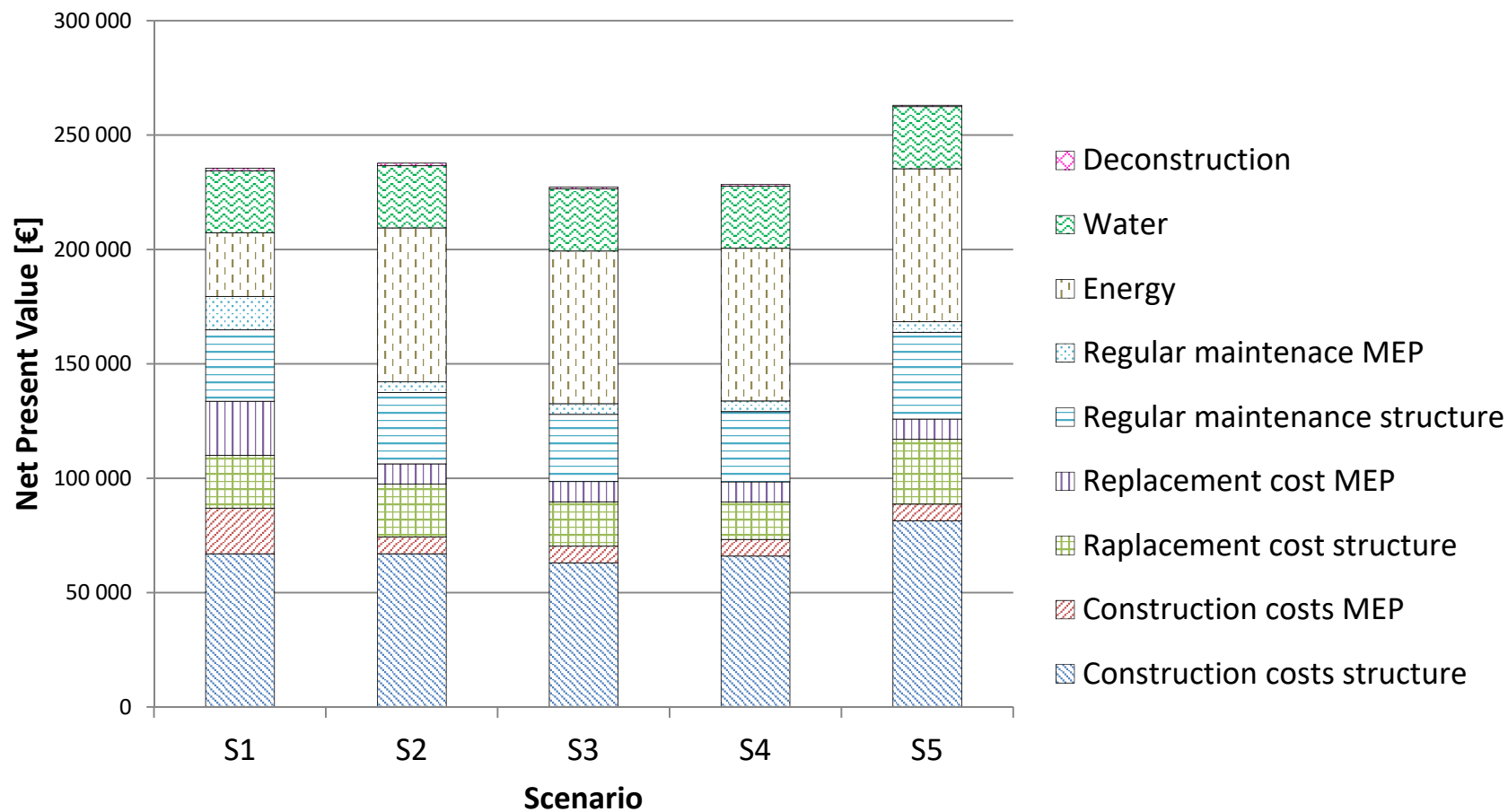
	VARIANT 1 - WATER SOURCE HEAT PUMP			VARIANT 2 - AIR SOURCE HEAT PUMP			VARIANT 3 - DISTRICT HEATING + WATER SOURCE HEAT PUMP		
	OPTION 1	OPTION 2	OPTION 3	OPTION 1	OPTION 2	OPTION 3	OPTION 1	OPTION 2	OPTION 3
ELECTRICAL ENERGY	540.102	873.888	798.864	914.570	972.119	935.510	482.481	777.852	741.243
DISTRICT HEATING	-	-	-	-	-	-	288.108	288.108	288.108
UNDERGROUND WATER	443.951	443.951	443.951	-	-	-	382.213	382.213	382.213
DELIVERED ENERGY	2.444.389	2.501.938	2.465.329	2.444.389	2.501.938	2.465.329	2.444.389	2.501.938	2.465.329
ENERGY COSTS	40.581	64.413	59.057	65.300	69.409	66.795	50.085	71.175	68.561
INVESTMENT COSTS	1.993.200	2.262.000	1.925.000	2.005.200	2.274.000	1.937.000	1.993.200	2.262.000	1.925.000
ANNUAL MAINTENANCE COSTS	72.353	87.313	75.845	72.789	87.776	76.318	72.353	87.313	75.845
TOTAL LCC	3.038.971	3.687.537	3.196.171	3.316.475	3.756.391	3.294.154	3.139.626	3.759.144	3.296.826
RANK	1	7	3	6	8	4	2	9	5

Case study: a single family house (research)

- › Theoretical house located in Poland
- › Useful area of 135 m²
- › 5 scenarios (four construction materials and two HVAC design approaches) were assessed
- › Dynamic energy simulation as a tool for energy demand analysis
- › Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) are indicators of whole life cycle performance



Case study: a single family house



LCC analysis in Green Building certificates



LCC analysis in Green Building certificates



- › Management 02 Life cycle cost and service life planning
 - › 4 credits available split into three parts:
 - › Elemental life cycle cost (2 credits)
 - › Component level life cycle cost (1 credit)
 - › Capital cost reporting (1 credit)
- › Based on “Building and construction assets – Service life planning – Part 5: Life cycle costing” ISO 15686-5:2008

LCC analysis in Green Building certificates



LEED®

- › No points assigned directly for LCC
- › Desirability for an LCC calculation to support decisions taken with respect to sustainability.
- › Taken into consideration indirectly in following credits:
 - › Integrative Project Planning and Design
 - › Optimized Energy Performance (through comparison of energy performance of various building scenarios)

Key findings

- › Total cost of ownership of various scenarios is evaluated over their whole life
- › Total cost of ownership is optimized by balancing investment and operational costs
- › LCC promotes realistic budgeting for operation, maintenance and repair
- › Precision of input parameters (BIM, dynamic energy simulation) increases precision of final LCC
- › LCC encourages discussion about the durability of materials and components from the very beginning
- › LCC makes it more probable that the best value for money solution is implemented

Thank you for attention



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**We are looking forward
to the future.
Wherever!
Whenever!
With you.**



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