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LIFE-CYCLE COSTING: A DIFFERENT VIEW ON BUILDING COSTS

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KEY COMPONENTS OF LIFE CYCLE COSTING

Life-Cycle of a Building

The lifespan of a property or a building from its design and development until its disposal:

1. Concept planning
2. Design
3. Construction
4. Operations
5. Replacement or Disposal

Life-Cycle Costs (LCC)

- Initial costs - Purchase, Acquisition, Construction costs
- Fuel Costs
- Operation, Maintenance and Repair Costs
- Replacement Costs
- Residual Values - Resale or Salvage Values or Disposal Costs
- Finance Charges - Loan Interest Payments
- Non-Monetary Benefits or Costs

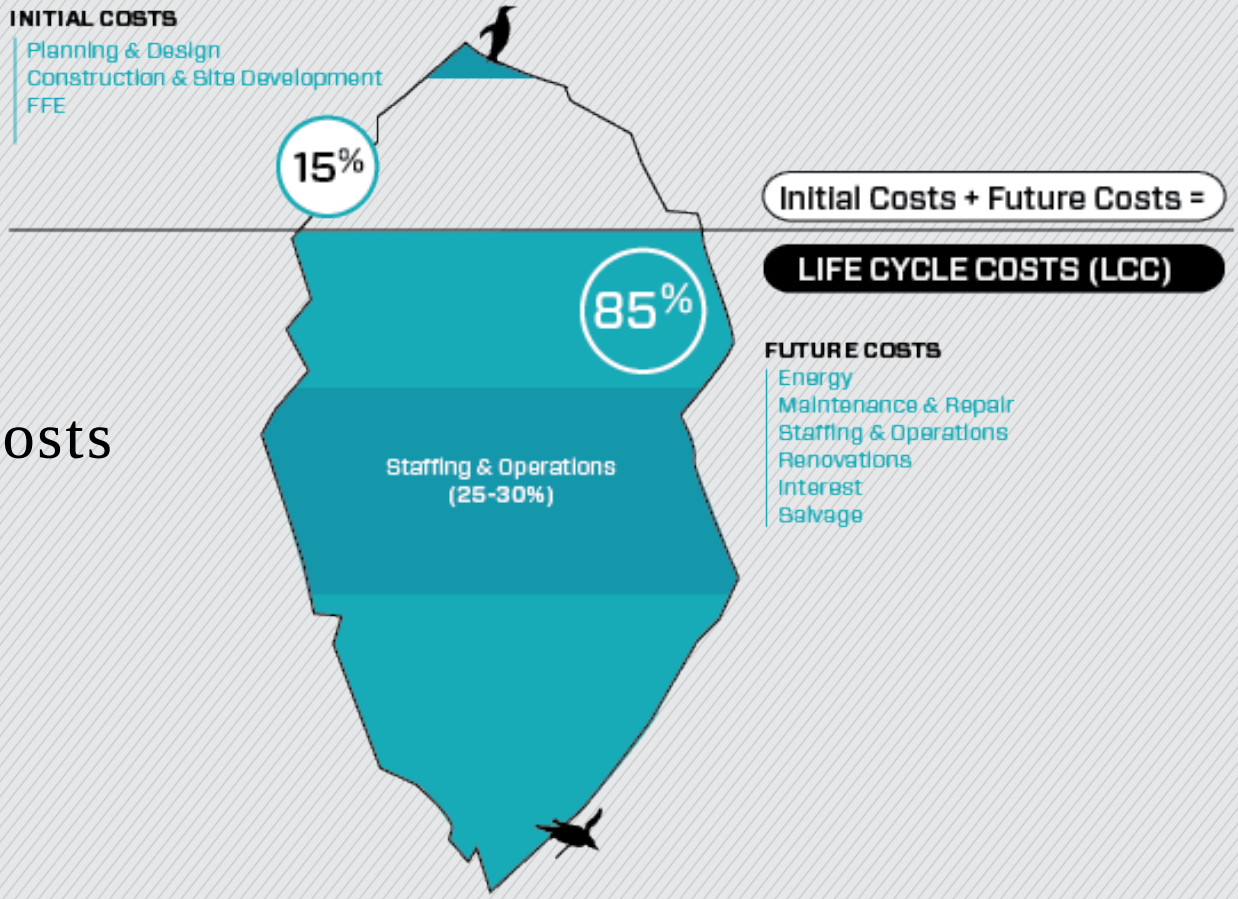
Life-Cycle Cost Analysis (LCCA)

- An economic evaluation method for determining **the most cost-effective option** out of competing alternative.

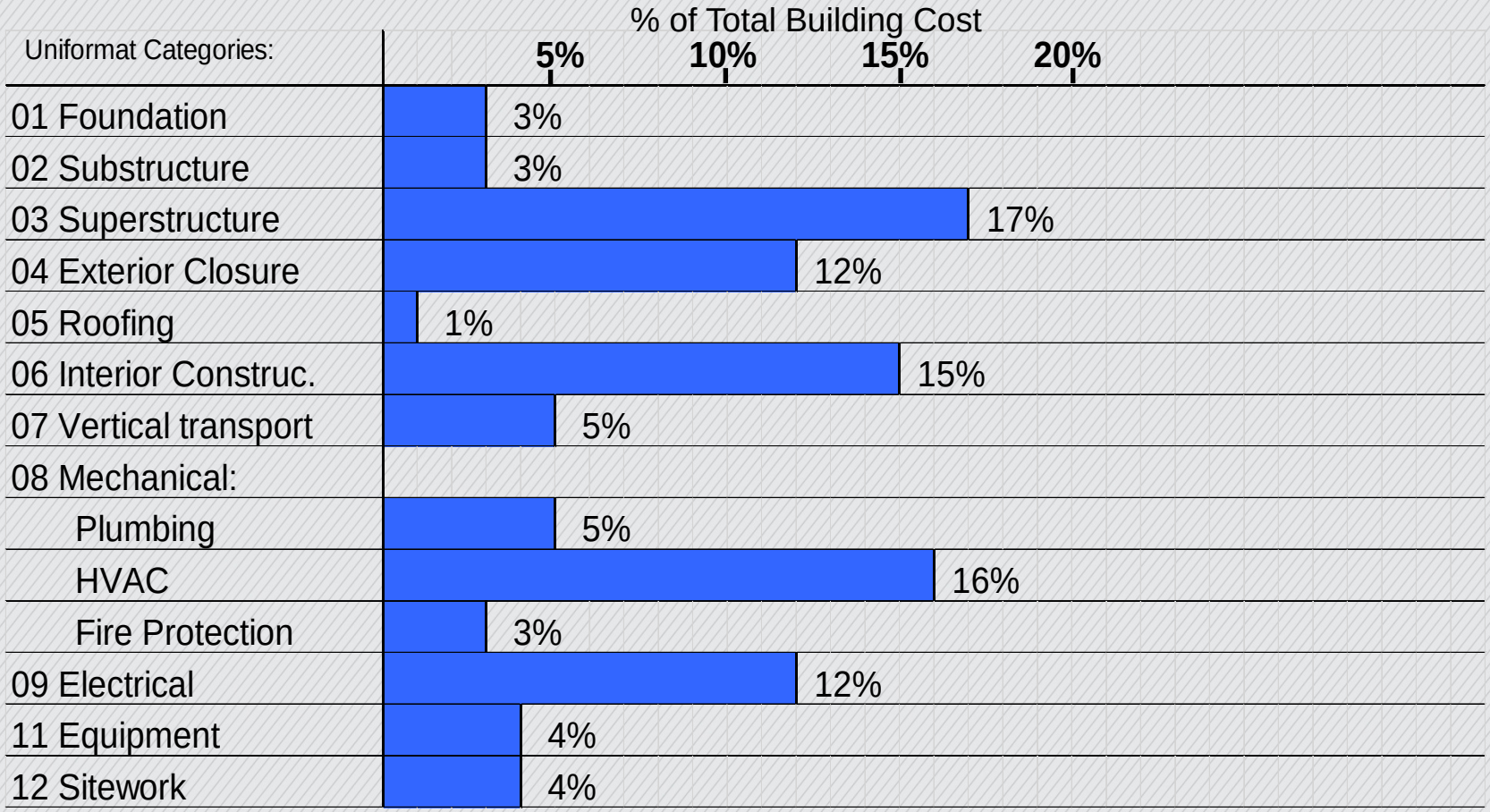
- Sums up, over a given study period, all relevant costs of a building, building system, or building component, in present value (PV) currency.

Data Requirements for LCCA

1. Investment costs
2. OM&R costs
3. Cyclical renewal costs
4. Financial criteria

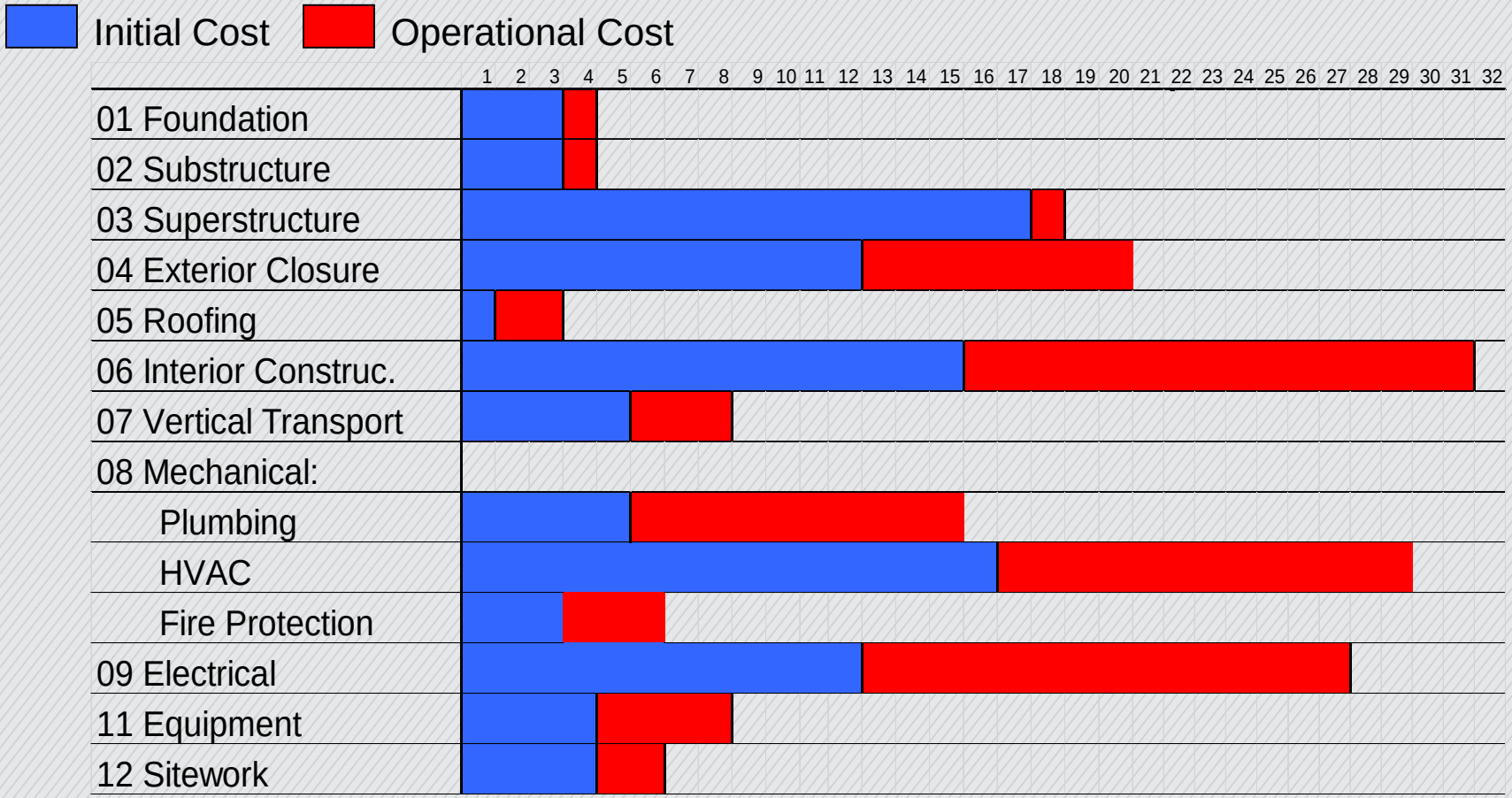


Initial Cost – Office Building



Source: Means Life Cycle Costing For Facilities

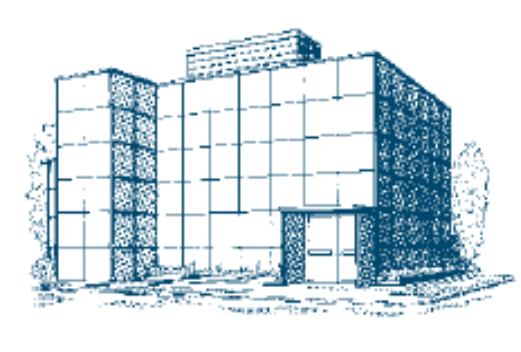
Life Cycle Cost – Office Building



Source: Means Life Cycle Costing For Facilities

CALCULATING LIFE CYCLE COSTS - EXAMPLES -

Example – Low rise office building



OPTION 1:

Standard office building:

- Gas boilers
- Air cooled chillers
- T5 lamps

€ 5.5 million

OPTION 2:

Low energy office building:

- Natural ventilation
- Good daylighting + LED
- Ground Source Heat Pump
- Condensing boiler for peaks
- Cooling tower for free-cooling

€ 6 million

OPTION 3:

Same as Option 2, but only with GSHP:

- Ground Source Heat Pump (GSHP) for all the building heating and cooling

€ 5.85 million

Project specific costs

Unless you are comparing temporary buildings, the replacement cycle for a building would be longer than 25 years.

	Option 1 Name: Standard office building		Option 2 Name: Low energy office building		Option 3 Name: Same as Option 2, but only with GSHP	
Initial capital cost	5,500,000	€	6,000,000	€	5,850,000	€
And then replaced every	80	years	80	years	80	years
with a cost of		€		€		€
and a disposal cost of		€		€		€
Annual servicing and maintenance	10,000	€	11,000	€	10,000	€
Annual cost of consumables and spare parts		€		€		€
Total annual fixed cost:	10,000	€	11,000	€	10,000	€
Annual On - peak electric use	390,000	kWh	150,000	kWh	240,000	kWh
Off - peak electric use	-	kWh	-	kWh	-	kWh
Other electric use	-	kWh	-	kWh	-	kWh
Gas use	540,000	kWh	90,000	kWh		kWh
Other fuel use	-	kWh	-	kWh	-	kWh
annual water use	2,000	m^3	2,800	m^3	2,000	m^3

Project specific costs

As replacement cycles vary for the different building elements, break costs down into annual costs and factor into maintenance.

	Option 1 Name: Standard office building		Name: Low energy office building		Name: Same as Option 2, but only with GSHP	
Initial capital cost	5,500,000	€	6,000,000	€	5,850,000	€
And then replaced every	80	years	80	years	80	years
with a cost of		€		€		€
and a disposal cost of		€		€		€
Annual servicing and maintenance	10,000	€	11,000	€		
Annual cost of consumables and spare parts		€		€		
Total annual fixed cost:	10,000	€	11,000	€		
Annual On - peak electric use	390,000	kWh	150,000	k		
Off - peak electric use	-	kWh		k		
Other electric use	-	kWh	-	k		
Gas use	540,000	kWh	90,000	k		
Other fuel use	-	kWh	-	k		
annual water use	2,000	m^3	2,800	n		

Cost of annual maintenance for specific services installations:

- Mechanical services (Heating, ventilation, air-conditioning)
- Renewable energy installations
- Alarm systems
- And others

Project specific costs

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Initial capital cost	5,500,000	€	6,000,000	€	5,850,000	€
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Other electric use	-	kWh				
Gas use	540,000	kWh	90,000	k		
Other fuel use	-	kWh	-	k		
annual water use	2,000	m^3	2,800	m		

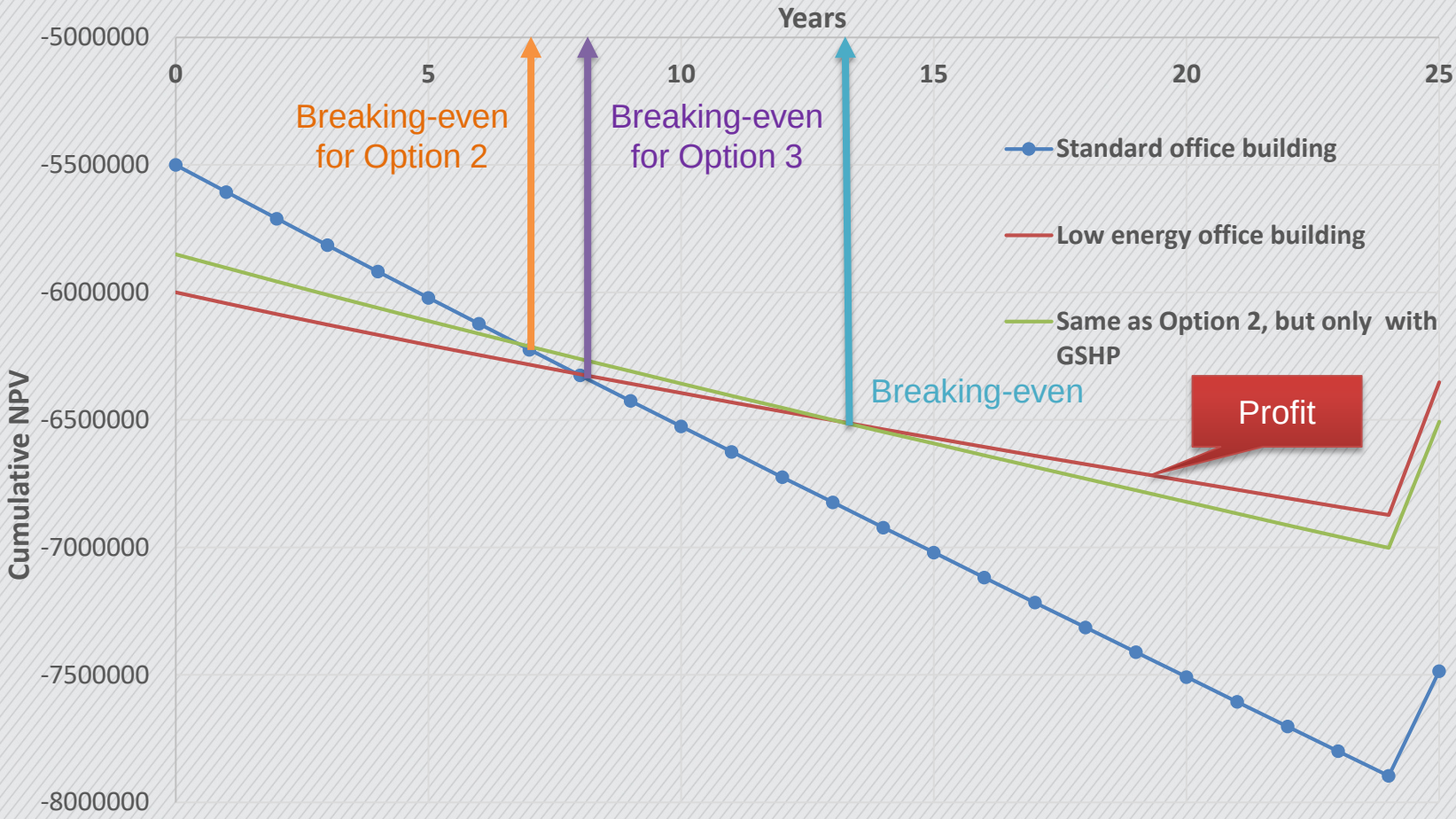
Energy consumption of:

- Mechanical services (Heating, ventilation, air-conditioning)
- Renewable energy installations (=negative consumption)
- Alarm systems
- Lighting
- Fans, pumps, controls
- Catering equipment
- and others, as applicable

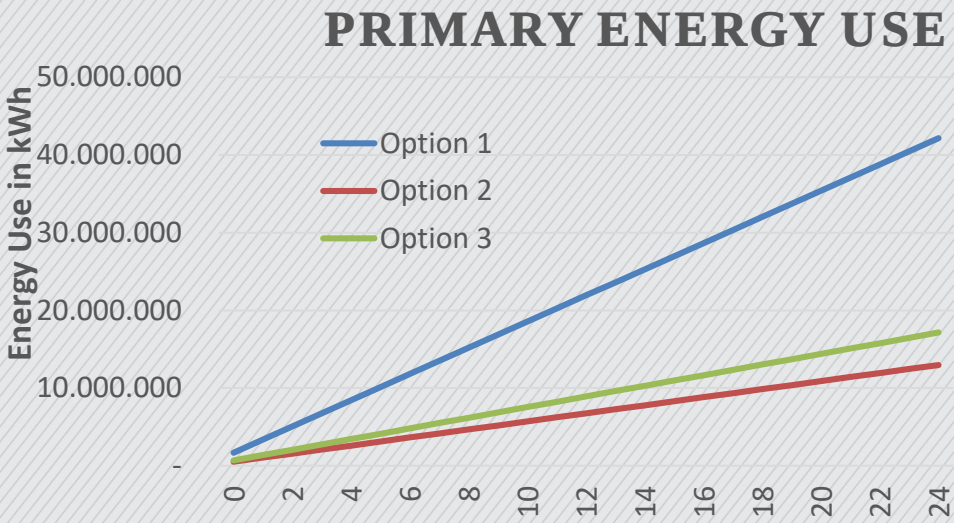
25 years results

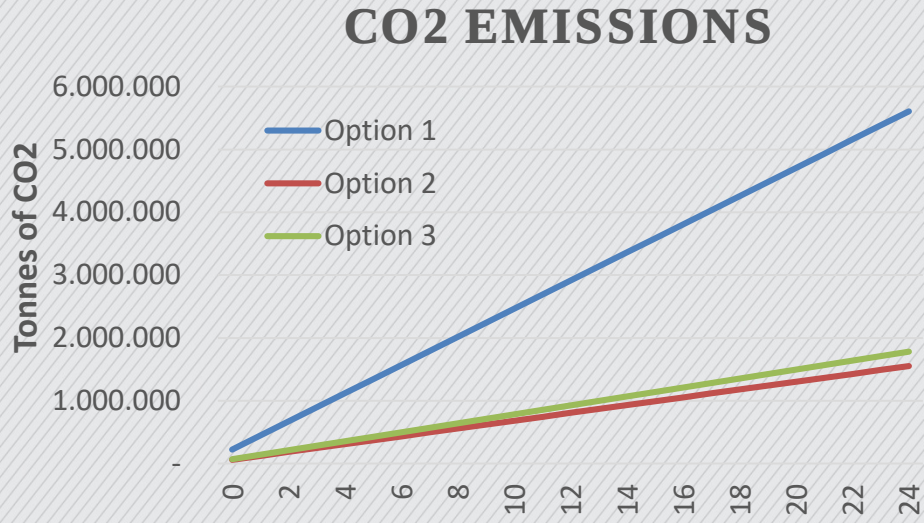
NPV at end of life	**(7,484,993)** €	**(6,351,751)** €	**(6,529,962)** €
Total energy use over life cycle	**42,150,000** kWh	**12,975,000** kWh	**17,150,000** kWh
Total water use in m^3 over life cycle	**50,000** m^3	**70,000** m^3	**50,000** m^3
Total CO_2 emissions over life cycle	**5,605** t CO2	**1,553** t CO2	**1,782** t CO2

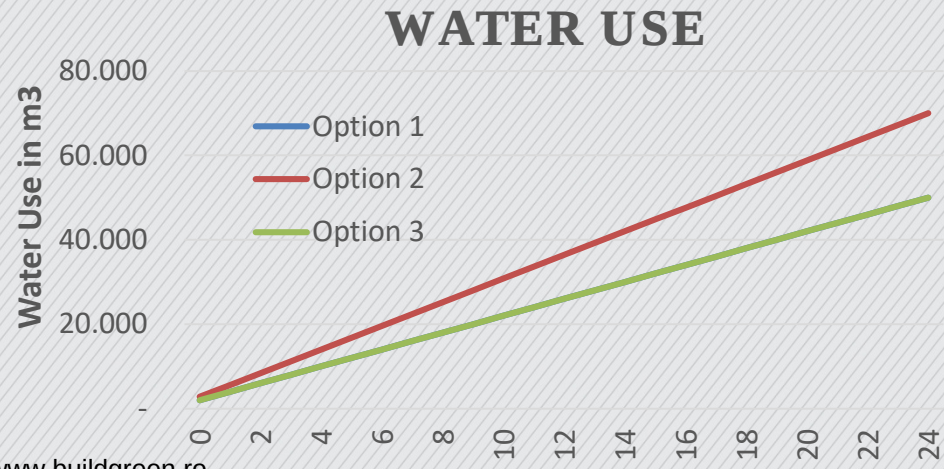
Comparison of Options



Operational energy, CO2, Water



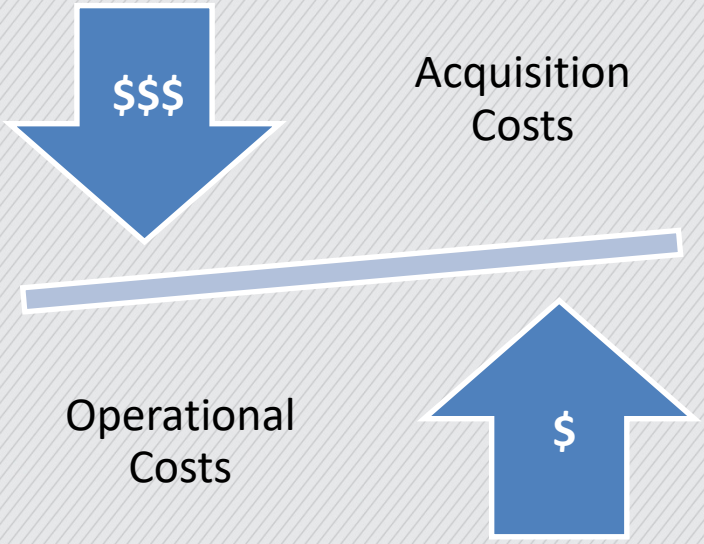




CONCLUSIONS

Life Cycle Costs vs. Initial Construction Costs

Lower acquisition costs could hide higher long-term operational expense. The actual long-term cost of an equipment depends more on operational costs than on initial acquisition expenses.

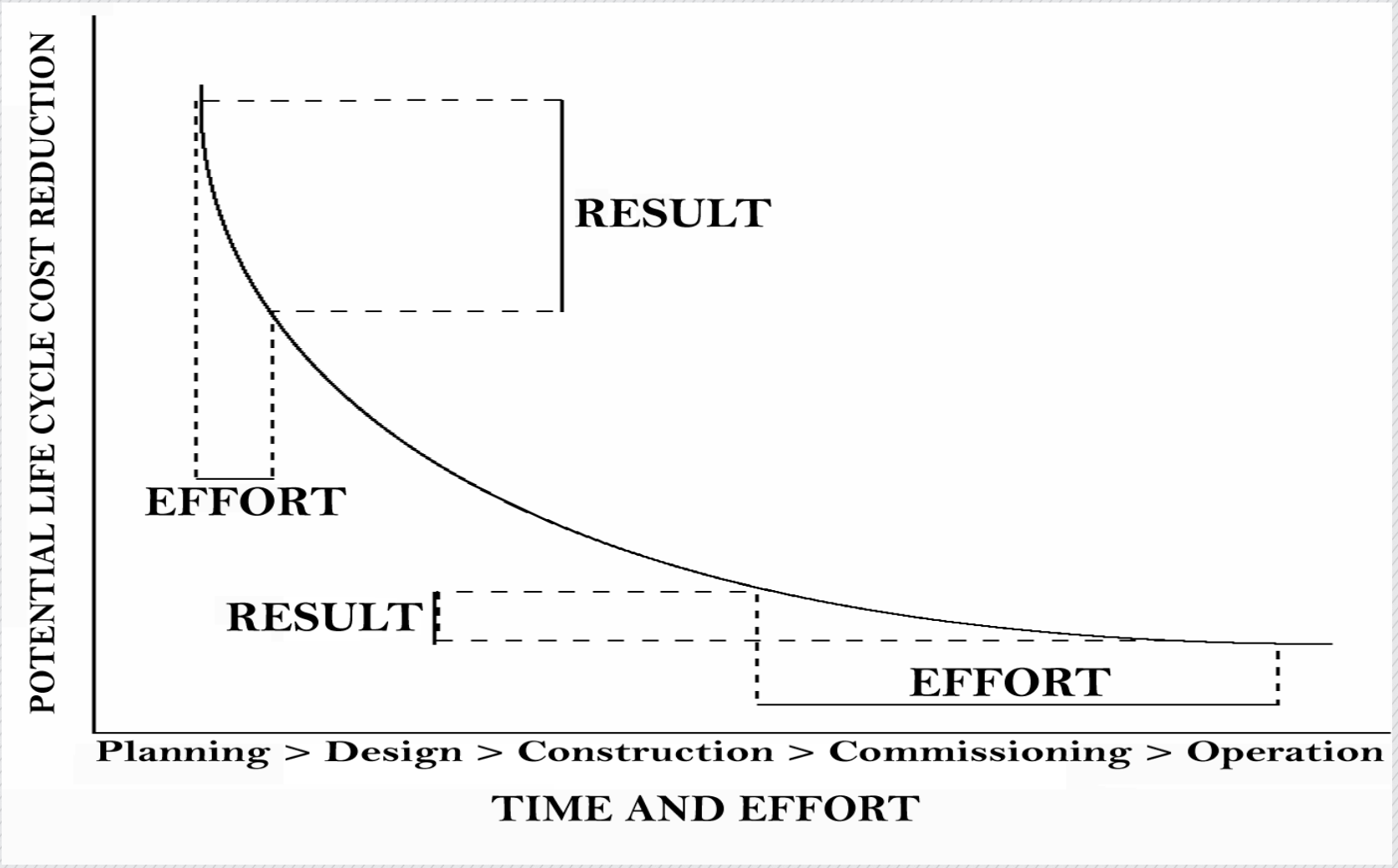


LCCA of Buildings

Referring to Life Cycle Costs vs. Initial Construction Costs

- Compares execution options
  - Technically equally appropriate
  - Different costs
- Takes into account the whole life-cycle of a building
- Implemented early on, during concept planning and design – Radical changes possible
- Main purpose is cost-efficiency, not environmental effects
- Extent of study may vary

Integrating LCC in the Design Process



Part of the solution

An Integrated Design Process with all stakeholders that includes at the Schematic Phase:

- A Baseline Preliminary Project Description (PPD)
- An Elemental Cost Estimate With Analytic Parameters
- An Energy Analysis Simulation Model

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THANK YOU!