



UWTSD Glyndŵr Development

Living Wall Life Cycle Cost Analysis

CABAT Consultancy LTD is committed to promoting sustainable development through its policies, strategies and services, thus achieving best value for money in the widest sense. The aim is to build stronger communities, reduce social exclusion, poverty and encourage the development of the local economy.

As such, every aspect of our construction undergoes a life cycle cost analysis. This type of assessment is used to calculate the socio-economic impact made by a product throughout its entire life. Taking into consideration all phases of the process: from the supply of the raw materials, manufacturing, transport, construction, use and end of life (**see Figure 1**).

The Modular Living Wall System (MLWS) will be attached to prefabricated structurally Insulated Panels (SIP's) through retrofitted steel cladding rails. MLWS's are a great way of the Client achieving enough credits for the building to achieve 'BREEAM Excellent' benchmark which demonstrates sustainability performance during planning, design, construction and building operation. Helping to lower running costs, maximise returns through market value and attract and retain tenants with desirable places to live and work

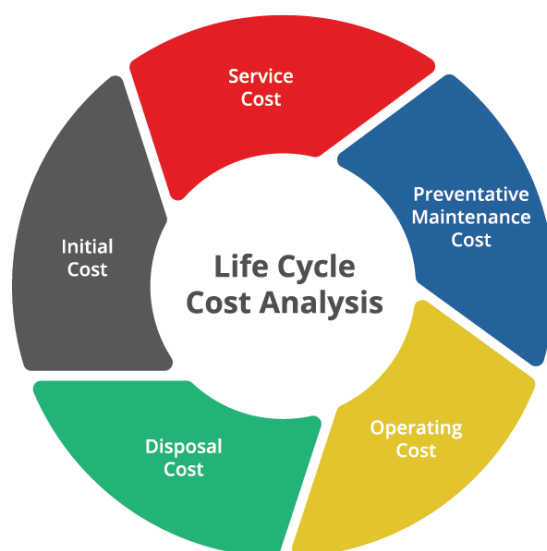


Figure 1: Life cycle cost analysis loop.

Section 1 – Initial Cost

The initial cost for the proposed 100m² Modular Living Wall (MLW) can be calculated through determining the cost of each component of the wall section in addition to the installation costs. A summary of these estimations can be found on **Table 1**.

Table 1: Initial cost estimation summary.

Component	Material	Service Life (Years)	Amount (m ²)	Cost (unit/m ²)	Total Cost (£)
Internal finish	Twin-layer Plasterboard	50.00	100	5.13	205.2
SIP's	Oriented strand board (OSB)	50.00	100		
	Polyurethane core	50.00	100		
	Vapour barrier	50.00	100		
Air cavity	Air (50mm)	-	100	-	-
External masonry	Red clay brick	-	100	2.86	286
MLWS	Cladding rails	-	2500	8	20,000
	Structural bolts	-	-	2,500	2,500
	MLW pannel	25.00	100	200	20,000
Vegetation	H.Helix (flora)	10.00	4500	0.5	2,500
	Irrigation rig	7.00	-	15,000	15,000

The total installation costs of the system amount to £65,000 (650/m²) inclusive of £5,000 installation fees.

Section 2 – Preventive Maintenance Cost

A typical 20 x 20-inch MLW panel includes 45 cells. Each cell holds a plant, so there are 45 plants in each panel. General maintenance duties for the flora include weeding, seeding and pruning. Additionally, general upkeep of the irrigation system is compulsory.

Such maintenance services are tendered out in a maintenance contract where costs can range from £500 - £1,000 per quarterly visit. Appropriate non-intrusive flora for the site of the development are displayed in **Figure 2**.

Figure 2: Proposed flora intended for the UWTSD Glyndŵr building.



Section 3 – Operating Cost

To operate a MLWS only a clean water supply and plant nutrients are required. The irrigation system draws water from the mains, amalgamates with plant nutrients and disperses these fluids evenly through risers across the wall. Approximately, 1L of water is consumed per m² of wall daily – that is a average consumption of 100L/day. Assuming the cost per/L of water is £0.01p, the daily operating cost of the MLW £1 and £365 annually.

Section 4 – Disposal Cost

Disposal costs for all the MLW scrutinised were obtained from product forms and information provided by contractors, therefor the disposal cost of a MLWS this size can be firmly set at £5,000. The disposal costs include the greening systems disposal (removal of plants and structures, transport to landfill, and landfill taxes), and the cladding renewal.

Section 5 – Added Benefits

There is an endless list of benefits regarding the implementation of MLWS's, benefits are mainly related to the socio-economic characteristics of the buildings function or the area in which it is situated. Listed are some of those benefits:

Social

- Climate change (CO2 reduction)
- Air quality improvement (NO2, pm10 & SO2 reduction);
- Flora & fauna (increased biodiversity);
- Urban heat island effect (air temperature reduction);
- Aesthetics (increase of area value).

Economic

- Construction and maintenance (increased cladding durability);
- Energy saving (additional insulation and air conditioning);
- Real estate (increase of property value);
- Incentives and support (tax reduction).

Section 6 – Conclusion

A summary of the total costs and benefits associated with the proposed 100m² are defined below in **Figure 2**.

This proposed vertical greening system is expected to have high installation costs for the pre-vegetated panels and maintenance costs for the whole system (panels to be replaced, plant species, irrigation system). Due to these costs within the life cycle, after the initial costs for the installation, the annual benefits overtake the annual costs (for maintenance) of a tens of pounds, value which is insufficient to pay back the incurred costs.

Table 2: Costs and benefits data input.			
Cost/benefit	Time frame	Year	Value (£/year)
Cost - initial	One time	1 st	65,000
Cost - maintenance	Annual	1 st – 50 th	2,000 – 4,000
Cost - operational	Annual	1 st – 50 th	365
Cost - disposal	One time	50 th	5,000
Benefit - heating	Annual	1 st – 50 th	2,000 (Variable)
Benefit – A/C	Annual	1 st – 50 th	1,900 (Variable)
Benefit – property value	One time	1 st – 50 th	20,000

The MLWS analysed in this study cannot be considered economically sustainable due to high installation and maintenance costs. Although, the socio-economic benefits of vertical greening systems may be seen to make this investment worthwhile. This inference is encapsulated in **Figures 3 & 4**.

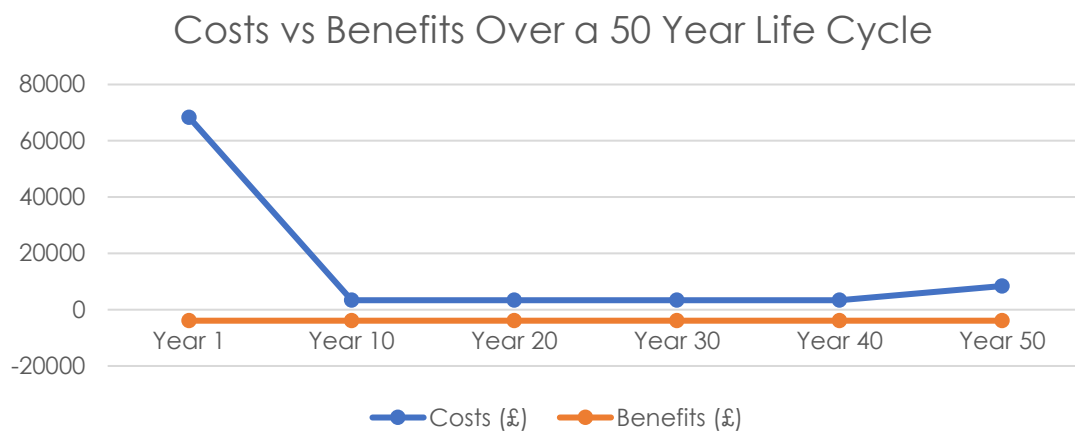


Figure 3: The costs of the MLWS outweigh the cost benefits at all stages of the life cycle.

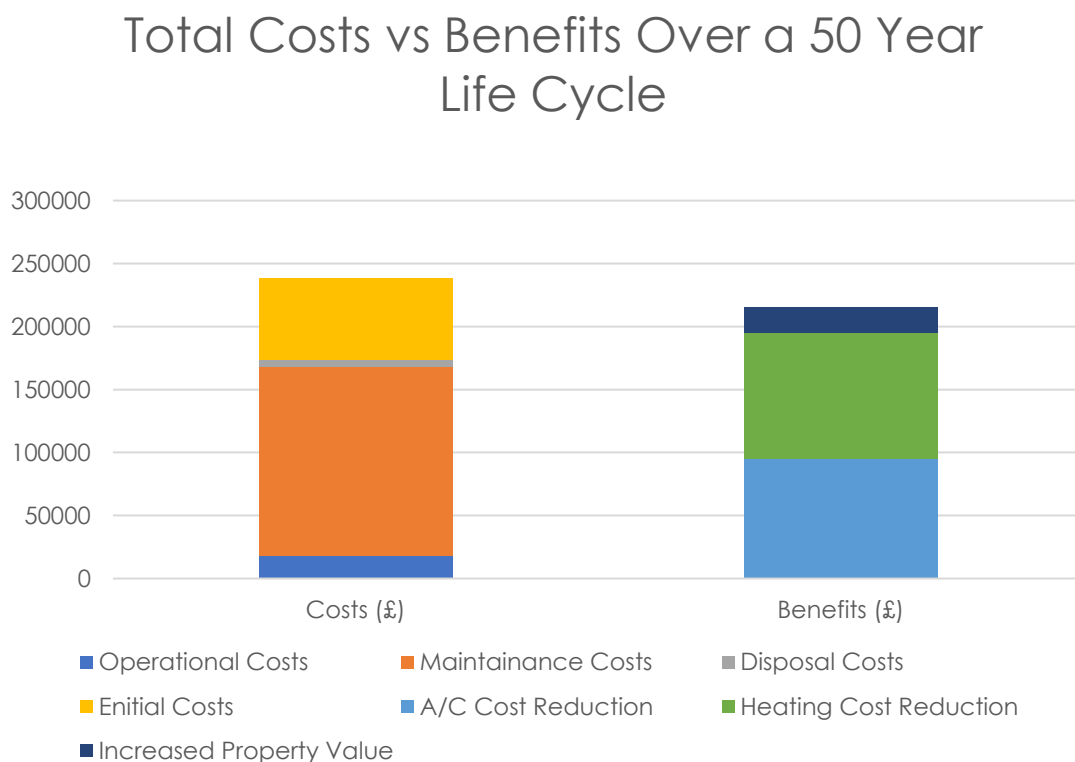


Figure 4: Visual indication of the total difference between the MLW costs, cost benefits and how they weigh.

In conclusion, after analysing the above data sets the total outstanding cost over a full 50 life cycle of the UWTSD Glyndŵr Building is £23,250. The client must decide if this is a fair price for the aesthetic, biodiversity and health & wellbeing benefits the MLWS provides.