1.4.3 The relative sustainability of different systems

There is a widespread assumption that geotextile panels need to be replaced every ten years, whereas plastic containers are assumed to have a lifespan of 50 years. However, the technology of living walls is too new for their actual service life to be confirmed yet, and the first geotextile living wall installed at the Pershing Hall Hotel in 2001 is still extant fifteen years later. In terms of their relative durability, it is logical to assume that plastic containers will be more durable than geotextile mats.

The environmental costs of living walls need to be weighed against their environmental benefits. For example, living walls have been shown to be effective at trapping air pollutants and reducing energy loss through the building fabric (see unit 1.2). However, chemical emissions and energy consumption are involved in all stages of the life of a living wall, from cradle to grave, including raw material extraction, manufacture, waste treatment, transport, construction, replacement of parts and plants, and transport to landfill. The manufacture of fertilizers also involves chemical emissions and energy consumption. An analysis of the emissions during the manufacturing process of different systems showed that a geotextile living wall with a PVC back releases three times more toxic substances into the environment than HDPE (high density polyethylene) plastic container living walls or steel trellis green facade systems. Additionally, the geotextile system would need to function for 23 years in order to balance the emissions involved in its manufacture. As the expected operating life of a geotextile living wall is thought to be only about 10 years, the pollution removal benefit of the felt layer system can potentially never offset the pollution it initially created. The plastic container system and steel trellis facade, on the other hand, could easily balance air pollution with purification, as their life expectancy is estimated to be 50 years. Therefore, the geotextile living wall is the least environmentally friendly, in terms of the air pollution abatement.

In terms of energy consumption, the life cycle of the geotextile living wall requires 11 times more energy than the trellis facade, and 4 times more than the HDPE plastic container system. Furthermore, the geotextile system needs nearly 10 years of energy savings in a Mediterranean climate to balance the energy consumption, which equates with the presumed full operational lifespan of the system, while in a temperate climate, the balance years are 3.6 times longer than the presumed lifespan of the felt layer system. Therefore, the geotextile living wall is the least environmentally friendly, in terms of energy saving performance.

Based on these results, the geotextile system can be classified as environmentally unsustainable, in terms of air cleaning and energy savings. The materials used in the geotextile system – the PVC backing material – are the main reason for its low performance. If other materials, like polyethylene or steel, can be used in geotextile living walls, the number of years needed to balance emissions and energy consumption would be changed significantly. Materials that can be recycled or reused after the lifecycle of a living wall also increase their sustainability.

In some situations, the indoor living walls may have access to natural daylight and air through windows and/or skylights; but in most cases, they are located in a completely enclosed environment and thus special considerations for plant growth and maintenance are needed, such as artificial lighting and irrigation. The operation costs in terms of energy consumption and carbon emissions of indoor living walls are quite large (for lighting, pumps, maintenance, etc.), but are the same regardless of the type of system (planter boxes system, felt layers system, mineral wool system, and foam system). In terms of manufacturing costs, the planter box and mineral wool systems are the most sustainable.

The maintenance requirements of living walls are mostly dependent on the type of plants used. Watering, fertilizing, and replacing plants are the three main maintenance tasks. The service life of plants in the plastic box and geotextile living wall systems are 10 years and 3.5 years respectively, which means a few replacements will be needed during their lifespan, involving emissions during transport. The manufacture of the fertilizer in living wall systems also involves significant chemical emissions. Therefore, plants which can survive with low maintenance and low fertilizer requirements are the most sustainable choice.

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