Dynamic Breathing Buildings Sustainability Overview

INTRODUCTION

The Environmental Building Partnership Ltd (EBP) is an innovative clean technology company, specialising in the development of Dynamic Breathing Building (DBB) systems for use in environmentally friendly, sustainable buildings of all types.

Dynamic Breathing Building systems utilize a dynamically insulated building envelope that acts as a ventilation source, heat exchanger and filter of environmental pollution. The heat or coolth that normally flows out of the building and is lost to the environment is brought back in the form of pre-heated or pre-cooled ventilation air. As a result the energy required for space heating and cooling is reduced. At the same time, the air entering the building is filtered to a high standard, significantly improving overall comfort levels for users of the building.

EBP has developed the **Energy*flo*™** cell, the world's first commercially available Dynamic Insulation product, forming the core component of a range of DBB Systems that will significantly reduce the carbon footprint and improve the indoor air quality of the built environment.

SUSTAINABILITY OF A DBB SYSTEM

The principal sustainability benefits from adapting this technology can be summarised thus;

- Ventilation air is pre-warmed using building envelope conduction heat loss, thus reducing space heat demand to maintain comfort levels for occupiers.
- Ventilation air is pre-cooled by using coolth flow, thus reducing or eliminating the need for space cooling with a consequential reduction in energy demand.
- Indoor air quality is improved through dynamic filtration effects, and as a consequence of ventilation conductance being de-coupled from space heating energy use.
- Building floor plate efficiency is improved as a result of lower thermal mass.
- Less construction material is required to satisfy legislative drivers.
- The amount of heating, cooling and ventilation plant required to deliver thermal comfort requirements is reduced.
- Dynamic Breathing Building systems deliver both mitigation and adaptation strategies.

SUTAINABILITY EVALUATION OF THE Energy*flo*™ CELL

In considering the sustainability of the **Energy*flo*™** cell, like for like comparisons of individual construction products can be problematic, due to the incremental benefits arising from the Dynamic Breathing Building approach.

However, the following factors have been taken into consideration in our evaluation of the sustainability of the **Energy*flo*™** cell and the associated Dynamic Breathing Building systems.

Embodied Carbon

Through correct specification, using **Energy*flo*™** cells means it is possible to achieve near zero u-values in the active (i.e. Dynamic Insulation) elements of the building envelope. Producing embodied carbon calculations on a DBB system, and then comparing it to a static construction that would nominally achieve comparable performance, is therefore elusive as many 100's of mm of conventional static insulation would be required to achieve u-values below say 0.05W/m^{2}K.

One approach to considering embodied carbon is to simply consider the **Energy*flo*™** cell as part of a static system and compare it to the conventional insulation it would otherwise replace. If we consider the EnergyfloTM cell for instance as part of a timber frame construction, then the 95mm cell will produce a wall with a u-value of 0.321 W/m^{2}K. The thickness of conventional insulation required in the same construction to produce the same u-value was calculated.

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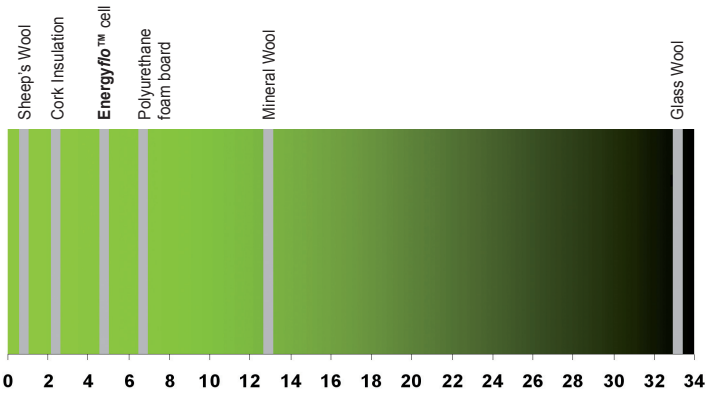
Embodied Carbon Cont.

Using data extracted from the Inventory of Carbon and Energy (ICE) model from the University of Bath (Hammond and Jones 2006) the embodied carbon of the insulation material only was calculated (Figure 1). Natural materials such as cork and sheep's wool have lower embodied energy than the **Energy*flo*™** cell which in turn has lower embodied carbon than conventional, high volume insulation materials. It is worth re-iterating that this assessment does not consider the dynamic performance of the **Energy*flo*™** cell.



Construction Methods

The **Energy*flo*™** cell is intended for both manual and automated installation across all building environments. The modular design, utilizing an inter-locking method that requires no fixing agents; a light yet rigid construction that promotes safe and efficient handling; a size and shape consistent with existing standards for rigid insulation; and a construction that ensure rapid fitting around voids in the envelope, all contribute to fast, efficient and cost effective use in all building construction methods.

Supply Chain

The base material, which must conform to all relevant Building Safety requirements, has been specifically selected to ensure low supply chain costs. The pervasive nature of the production process, with manufacturing facilities available in every major market, means that production of the **Energy*flo*™** cell will take place close to the point of consumption. It is our objective that as new markets are developed, local manufacturers will be appointed to ensure that, wherever practical, production is no more that 100 to 150Km away from the point of use. In addition, sustainability practices will form a key consideration in the selection and approval for new manufacturing sites.

Manufacturing Process

The manufacturing process utilizes two elements - water in the form of steam, and electricity. The steam used in the production process is produced by a gas fired boiler. After use in the moulding process the steam is captured and condensed before being recycled back into the process. This is a closed process, and as such around 90-95% of all water used is recycled repeatedly. The process does require relatively high levels of electricity, but this is mitigated by design of the pressing tool to ensure multiple impressions from each cycle. It should be noted however, that the use of energy in the production cycle has bee taken into account in the comparisons produced by ICE model described earlier.

Recycling

The EPS material that forms the base for both the active and static **Energy*flo*™** cells has an established recycling path into the production process for any EPS based products. The material is re-ground using a mechanical process, and up to 15% of the base material used in each cell can be recycled In this manner. Thus cells recovered from refurbishment or demolition sites can be returned to the EPS manufacturer for recycling.

CONCLUSIONS

The **Energy*flo*™** cell, as a Dynamic Insulation product, stands up well in comparison with other more traditional static insulation products in like for like comparisons. When combined into a Dynamic Breathing Building system however, the comparative sustainability performance improves dramatically when the energy savings associated with the positive impact on construction methods and operational costs over the life-cycle of the buildings are taken into account.

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