Energy*flo*™ Cell : Thermal Performance and Energy Savings

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.

DBB 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.

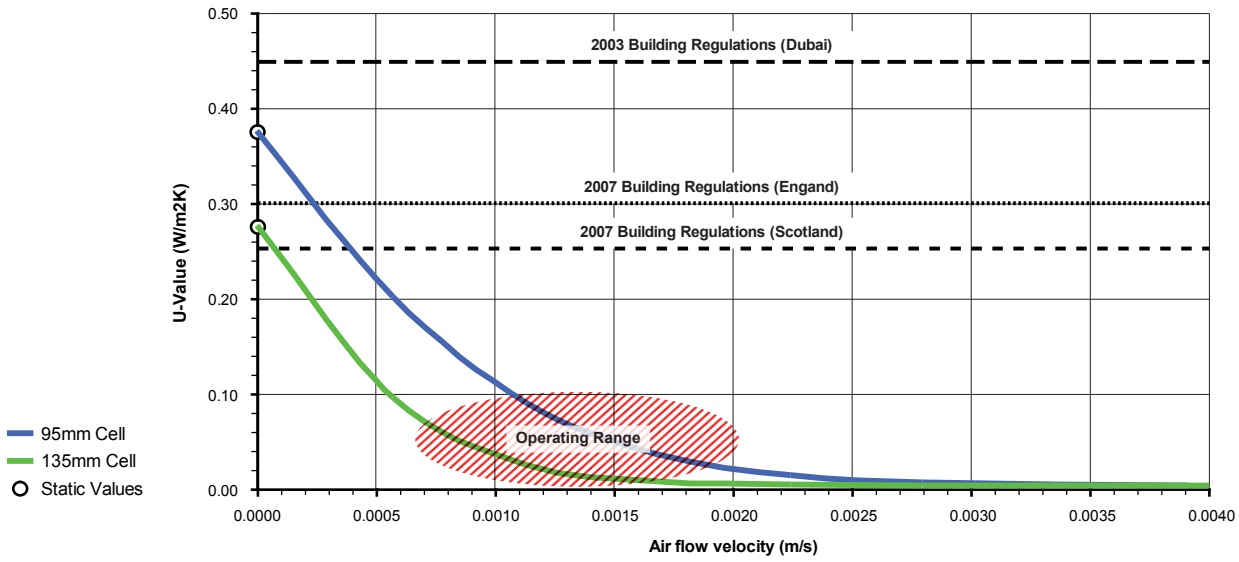
THERMAL RESISTANCE

Insulation manufacturers typically quote thermal conductivity for their products. The **Energy*flo*™** cell combines different materials possessing thermal conductivities that vary dynamically as a function of air flow through the cell. It is thus appropriate to rate the thermal performance of **Energy*flo*™** cells using their thermal resistance contributions. EN ISO 6946:1997 gives the component thermal resistances as 2.0 and 3.0 m²K/W for the 95 and 135mm cells respectively (BBA, Assessment Report No. 2556, 2005). These are 'static' values, with dynamic operation offering much higher thermal resistances.

U-VALVE

The U-Value of a wall incorporating **Energy*flo*™** cells varies dynamically with inward air flow through the cells. A plot of elemental U-Values for traditional brick wall construction using different cell thicknesses is shown in Figure 1 below.

Figure 1. Elemental Dynamic U-Values for typical wall construction



Over time, the thermal performance of the wall will be governed by the 'mix' of static and dynamic U-Values. If the length of time during which the wall defaults to static mode is known, an 'effective' elemental U-Value may be used in energy calculations. For example, if a building that uses 95mm **Energy*flo*™** cells operates statically for 20% of the time ($U\text{-}Value_{static}$ = 0.37 W/m²K) and dynamically for 80% of the time ($U\text{-}Value_{dynamic}$ = 0.1 W/m²K) at 0.001m/s air flow velocity, then the effective U-Value is 0.15 W/m²K.

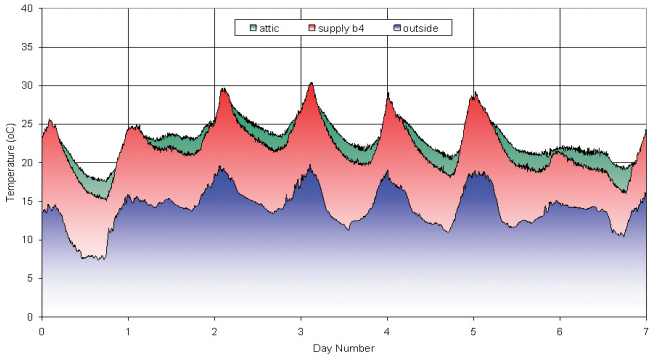
environmental building
partnership limited

Technical Bulletin 02

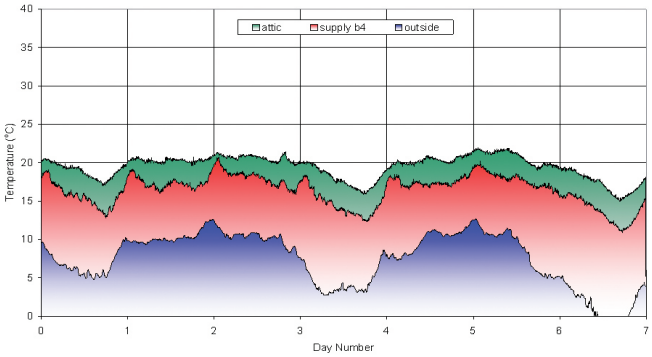
Energy*flo*™ Cell : Thermal Performance and Energy Savings

THERMAL PERFORMANCE

The thermal performance shown by the graphs below was taken from monitored data from our Balerno Exemplar Demonstration Project.



Late summer week (September)



Mild winter week (November / December)

The September week was considered a shoulder period between the non-heating and heating season, whilst the November week was selected as representing a mild winter week. The average temperature up-lift during this week, as a result of the Dynamic Breathing roof system, was 5.6°c.

The November week was selected as representative of an early winter week, which was relatively mild. The average temperature up-lift during this week, as a result of the Dynamic Breathing roof system, was 5.8°c. The temperature rise in the September week is lower as the external temperature is higher and subsequent heat loss lower.

ENERGY PERFORMANCE

The energy savings were computed by comparing the space heating energy demand of the Balerno house with the DBB system fitted in the roof, against an identically proportioned and constructed dwelling built to Scottish Regulations and with an equivalent air change rate. In this case, the house was constructed to 2005 Scottish Building Regulations, with a whole envelope U-Value of 0.45 W/m²K. For the reference weeks chosen, the results were:

- September Week : **Whole Envelope U-Value = 0.23 W/m2K.**
- November Week : **Whole Envelope U-Value = 0.30 W/m2K.**

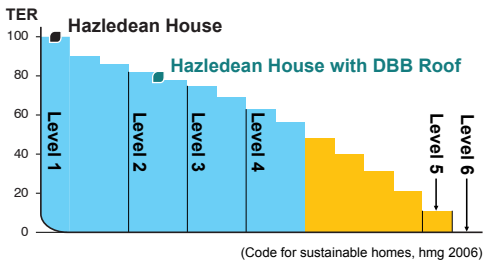
It should be noted that these results were achieved as a consequence of the dynamic roof system that constitutes only 32% of the total building envelope, the balance utilizing a static insulant. Clearly, if walls and floor were dynamically insulated, one would expect to see further reductions in thermal transmittance and consequent energy consumption.

THERMAL EFFICIENCY RATING

Based on our initial analysis of the data, using the two representative weeks described above, we have calculated the effect on the Thermal Emission Rate (TER) as defined in Code for Sustainable Homes; a step change in House Building Practice (DCLG: 2006).

This shows that the effect of the Dynamic Breathing roof, with traditional static insulation in the rest of the building envelope, is to move the TER from Level 1 to Level 2, with no other interventions in the design of the building.

TARGET EMISSIONS RATE (TER)



(Code for sustainable homes, hmg 2006)

CONCLUSIONS

The early results from the Balerno Exemplar Project indicate that the cost and CO_2 emissions associated with the provision of thermal comfort are substantially reduced, both through the minimisation of space heating energy consumption and the mitigation of any possible future cooling needs. **Our findings confirm that our technology has the capability to provide step change improvements efficiency of building fabric thermal performance that will bring potentially huge benefits to the owners and occupiers of buildings.**

The Environmental Building Partnership Limited
Westpoint, 4 Redheughs Rigg, Edinburgh, EH12 9DQ, UK
T +44 (0)131 338 6124 F +44 (0)131 338 6700
E enquiries@environmental-building.com
www.environmental-building.com

CLEAN TECHNOLOGIES FOR THE HIGH QUALITY, LOW CARBON
DYNAMIC BREATHING BUILDINGS OF THE FUTURE

Company Registration Number: 213292 VAT Registration Number: 859 8130 85