CARBON BITES

From the CIBSE ENERGY PERFORMANCE GROUP

Embodied Energy & Building Services

What is embodied energy?

Embodied energy is defined as the commercial energy (fossil fuels, nuclear, etc.) that was used to make a product, bring it to market, and dispose of it. It is an accounting methodology that aims to find the sum total of the energy necessary for an entire product lifecycle. A 'product' could, for example, be a building, a boiler or a lighting system. Embodied carbon is the carbon dioxide (and the equivalent GWP of other gases) emitted as a result of the embodied energy.

In existing buildings, embodied energy is typically equivalent to only a few years of operating energy. It is a 'sunk cost' that cannot subsequently be reduced. In new buildings, the operating energy is lower and so the embodied energy is proportionately higher (but in absolute terms much the same) – perhaps of the order of 15 to 25 years of operating energy.

Building services products are typically constructed of high energy content materials (notably metals) and have shorter life times than buildings (and contribute additional embodied energy each time they are replaced). It has been estimated that over the lifetime of an office building, the building services typically account for ~20% of the embodied energy but not much work has been done on this; for dwellings a figure of ~10% seems probable. It has also been estimated that between 30% and 60% of the embodied energy associated with refurbishment is due to building services.

Key issues

- There are several conventions for calculating embodied energy and carbon (the use of AS 2050 and the ICE materials database – see links below - seem to be de facto UK common practice, but these may not agree with conventions used in EU Eco-design procedures)
- The importance of building services systems is uncertain, as is the degree of influence that designers can have on embodied energy.

Web links

- http://shop.bsigroup.com/en/Browse-by-Sector/Energy--Utilities/PAS-2050/
  Specification for the assessment of the life cycle greenhouse gas emissions of goods and services.
  Free download from BSI. The de facto UK standard but not universally used.

- http://people.bath.ac.uk/cj219/
  Inventory of Carbon and Energy (ICE), a free download from the University of Bath.
  A *de facto* UK standard source of information for materials, but also not universal.

- http://amet.mnsu.edu/UserFilesShared/SolarWall/Benchmarking/Misc/Life-Cycle%20Energy%20Use%20in%20Office%20Buildings.pdf
  "Life-Cycle Energy Use in Office Buildings" by R.J.Cole and P.C.Kernan".
  One of the few analyses that considers building services.

Roger Hitchin, 21 June 2011