Reducing the Life-Cycle Carbon Footprint of your development

In the absence of any specific legislation, the construction industry in Lebanon is slowly warming to various private and NGO incentives to promote energy-efficient building techniques, designed to decrease the CO2 emissions associated with the operation of our buildings –through heating, cooling, lighting and powering them.

As well as promoting the eco-refurbishment of existing stock, bodies such as LCEC, LGBC, and MAJAL rightly put emphasis on designing new energy efficient buildings – but what should be the focus if, one day, the construction of low-carbon or 'zero-carbon' buildings becomes the norm, as aspired to in other countries?

We must begin to assess the environmental impact of a building over its entire life-cycle; that is, in its construction, operation and demolition.

The term 'zero-carbon' applies only to fixed operational emissions, namely heating and cooling a building and supplying its hot water. It considers neither 'embodied' emissions – carbon emitted through the manufacture and transportation of building materials, and their on-site implementation – nor predicted emissions from end-of-life processes.

For example, in the UK, all new homes are expected to be 'zero-carbon' in operation by 2016, and all non-domestic buildings by 2019. Under current UK Building Regulations, around 25% of a building's carbon emissions are embodied within it. Under 2013 regulations, this will increase to around 50%, and by 2016, 100% - if the 'zero-carbon' in operation target is fully met.

At present, it is not mandatory to assess the life-cycle impact of buildings. Global assessment schemes such as BREEAM, LEED and the Estidama Pearl Rating System incorporate categories on the environmental impact of materials specified; however, too often the importance of this category is diminished due to low weightings. Especially with a roadmap to 'zero-carbon' laid out, many commentators suggest material assessment is not rigorous enough. In addition, end-of-life impacts are almost universally ignored.

So what can be done to reduce 'bookend' carbon emissions from our buildings; that is, emissions from their construction and demolition?

Firstly, buildings should be designed for increased durability, to be around for longer, spreading their embodied emissions over an increased lifespan. Too many buildings are erected and deconstructed soon after, especially within the non-domestic sector.

If a building has to be demolished, then its materials should be able to be reused or recycled. When designing buildings, the team should follow the mantra of 'design for deconstruction', where, instead of a building being razed to the ground in a heap of twisted metal and concrete rubble, it would be taken apart piece by piece and its components reused elsewhere. Various materials can be used to ensure materials aren't 'wasted' upon demolition – natural paints for example, timber, and lime mortar within masonry walls.

Materials specification is also important. Naturally, some materials are extremely energy intensive in their manufacture, and others less so. Some materials are even considered to be 'storing' carbon, a process known as carbon sequestration. This mainly applies to timber products, through absorption of CO2 from the atmosphere when in growth; once logged, this carbon is stored until material decomposition. This storage should not be considered a carbon benefit unless the product is from a sustainable source: where as one tree is chopped, another is planted, in theory absorbing the carbon from the eventual release of its predecessor.

The energy intensive processes that are used to manufacture some materials are able to be addressed to make them less so. An example of this is in the 'greening' of concrete. Worldwide, cement manufacture accounts for around 5% of global anthropogenic carbon emissions. In Lebanon, this proportion is higher given the prominence of the industry and the popularity of concrete buildings.

As well as in reaching the extreme temperatures required, CO2 is emitted in the conversion of limestone to lime (or clinker). In order to lessen the embodied carbon of concrete, waste products from other industries, such as Blast Furnace Slag (GGBS), Pulverised Fuel Ash (PFA) and Fly Ash, can be added to the aggregate to reduce its quantity and temperature requirements. Sulphur, a waste product from gas plants in the UAE, is now also being used. These additives have little effect on concrete strength but may increase drying time. Unfortunately, although concrete production is high in Lebanon, the industries that create these waste strands (steel, coal, and gas) are rare.

The sourcing of local materials and products can also reduce carbon emissions associated with construction. Emissions from transportation of materials can be anywhere between 5% and 90% of total embodied emissions depending on the material specification, and even if the most 'eco-friendly' material has to be imported from thousands of miles away, it may be hard to consider it so.

As well as the environmental benefits, there are also advantages for the architect or developer from performance of life-cycle carbon assessment (LCA) in the design stage. Increasingly, the environmental credentials of bids are being scrutinised as an important part of a successful proposal– especially for large projects which require funding approval from international bodies such as the EU, IFC, UN, or World Bank. Bidding companies are constantly attempting to 'outgreen' each other, and life-cycle assessment can contribute to this competition - going beyond legislation measures indicates a real commitment to sustainability.

Although large developers are slowly realising the benefits from undertaking life-cycle assessment (and acting upon results), it is unlikely to be embraced fully by the industry without legislation enforcing its performance. Indeed, many LCA databases and guidance exist, but at present, there is a lack of universally adopted methodology for performing life-cycle assessment, a system that must be in place before it can be enforced through regulation. In some countries, legislation governing construction and demolition emissions may well be imminent, as soon these will be the only emissions associated with a building.

This is unlikely to be the case of Lebanon in the short or medium term, but some local architects and engineers, eager to reduce the environmental impacts of the buildings they design, are starting to take general LCA guidelines on board.

EcoConsulting (www.ecoconsulting.net) is a green building consultancy based in London, UK and Beirut, Lebanon.

Contact us at +961-1-971266 or info@ecoconsulting.net