Technical Data Sheet 8

Life Cycle Assessment (LCA) and Embodied Energy

New Zealand Steel is committed to continual improvement of environmental performance and the efficient use of natural resources. Our objective is to produce a range of versatile steel building products and steel solutions that are innovative, durable, safe and aesthetically pleasing.

Life Cycle Assessment (LCA)

Life Cycle Assessment (also known as Life Cycle Analysis) is a means of quantifying the impact on the environment of a given product or service throughout its lifespan.

An LCA can be used to compare the environmental performance of products and services so as to choose the one with the least impact.

Determining the 'life cycle' of a product requires an assessment of raw material production, manufacture, distribution, reuse and disposal including all intervening transportation steps.

The discharges caused by usage are also part of the analysis. This includes global warming (greenhouse gases), ozone layer depletion, acidification, waste products and land degradation as well as depletion of minerals and fossil fuels.

An LCA Model can be constructed taking into account all these factors. As can be appreciated this is a complex process and will generally encompass a clear definition of the scope of the model, analysis of extractions and emissions, impact assessment and interpretation. Depending upon the definition of scope, it is possible to generate quite different results for the same product, hence when comparing product life cycles, it is imperative to understand the scope that the LCA is based upon.

LCA of buildings and building products

Life Cycle Assessment has been used to determine the environmental impacts of buildings. The initial impact of a building on the environment results from the energy and other resources consumed in its construction. Thereafter, the building continues to affect the environment directly and indirectly throughout its operation, maintenance, refurbishment and finally demolition.

Life Cycle Assessment has a number of limitations when applied to buildings and building products. However, it is considered to be the only legitimate basis on which to compare the environmental impacts of alternative building designs, components and services. The parameters that are considered in an LCA include energy, water, greenhouse gas emissions, solid waste, land use, biological diversity and soil quality. Just as important are product life, maintenance requirements and the ease with which the materials can be recycled at the end of the building's life.

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…Research into life cycle analysis of various products is continually evolving and indicates that much previously published data is of a general nature and specific circumstances should be taken into consideration. Embodied energy and greenhouse gas emissions should not be used as the only parameters in the decision making process.

Embodied Energy

Embodied energy is the total energy consumed by all of the processes associated with the production of a building. This includes not just direct energy inputs during construction, but also all energy inputs needed to produce components, materials and services from the acquisition of natural resources to product delivery.

Whereas the energy used in operating a building can be readily measured, the embodied energy contained in the structure is difficult to assess. This energy use is often hidden and can only be fully quantified through a complete LCA. All processes necessary for the manufacture of the product must be identified and there are several methods for determining embodied energy content.

Embodied energy content varies greatly with different construction types. In many cases a higher embodied energy level can be justified if it contributes to lower operating energy. Estimates of embodied energy can vary by a factor of up to 10. As a result, figures quoted for embodied energy are broad guidelines only and should not be taken as 'correct'. What is important is to consider the relative relationships and try to use materials that have the lower embodied energy, given the function performed by the material.

The New Zealand Steel Mill, Glenbrook, Franklin, New Zealand.

The single most important factor in reducing the impact of embodied energy is to design long life, durable and adaptable buildings.

Embodied Energy and New Zealand Steel

The embodied energy figures for New Zealand Steel products will follow on from the LCA data work and therefore detailed data is not currently available. In the interim, it is possible to use a reference figure from the www.level.org.nz BRANZ website. However this information comes with the following caveats:

- There is no standard for calculation of embodied energy, the modeller can choose what to include and what to exclude, making direct comparisons difficult.
- The durability of a material is important. If a product with half the embodied energy of an alternative has to be replaced four times during the life of the building compared with no replacement, then selecting the low embodied energy product would not necessarily minimise the impact of the building.
- In the life of a building, the embodied energy in the materials is significantly less than the energy consumed by the occupants of the building. Operational energy must be considered.
- Most figures are quoted for a mass of material, however in buildings square metres or lineal metres are more relevant.

For example: A steel roof is approximately 1/10th the weight of a typical concrete tile roof.

In addition the roof structure can be up to one third the weight of that required for a concrete tile roof, depending upon design.

The way forward for New Zealand Steel

New Zealand Steel is a wholly owned subsidiary of BlueScope Steel Limited. New Zealand Steel supports the wider BlueScope Steel involvement in developing common national LCA methodologies.

Determining an appropriate model for the LCA of products is an extremely complex area. It will take some time to complete however the organisation is making good progress following on from earlier work in this area.