Total cost accounting helps reduce resource use in manufacturing

One way of measuring the sustainability of a product over its entire life cycle is to use a ‘total cost accounting’ approach. A recent study has applied this method to show that copper would be a more sustainable choice of metal to use in transformers than aluminium, primarily because of the high value of recycled copper compared with the price of recycled aluminium.

With natural, abiotic (‘non-living’) resources, such as metals and water, around the world being depleted, product manufacture must become sustainable in the longer term. This implies that a range of materials for products or components should be assessed to see which contribute most to the sustainability of a product.

This study demonstrated the total cost accounting approach to measuring the sustainability of a product over the entire product life cycle. The method assesses all factors that might affect the life cycle of the product, including the intended function of the product over time, the impact of the life cycle production on the environment, and the economic aspects, such as the cost-effectiveness of the product and profitability to the business.

In a case study, the total accounting approach was used to decide whether the design of electrical transformers would be more sustainable if the metal windings coiled around the transformer were made from copper or from aluminium.

For both types of metal, the repeated recycling of the metal windings was essential to making the transformers more sustainable. Copper and aluminium metal is lost during the manufacturing processes, as well as during the use of the transformer and end-of-life processing and recycling of the metals, so it is necessary to add virgin metal to the scrap metal recovered for recycling. However, the study suggests it should be possible to retain 87 per cent of copper and 97 per cent of aluminium in the product life cycle.

Using available environmental and other cost data, the total cost (including life-time labour, materials, energy and waste costs) for copper and aluminium metals were compared. Given the higher, and sharply increasing, prices paid for scrap copper metal compared with aluminium scrap, copper would be a better alternative to aluminium in electrical windings for transformers. The cost recovery in the end-of-life use phase outweighs the costs associated with material and energy use during product processing and use. When the end-of-life phase is not considered, the lower production costs for aluminium would favour the use of this metal over copper.


Contact: bo.carlsson@lnu.se

Theme(s): Resource efficiency, Sustainable consumption and production