THE INFLUENCE OF FIXED ASSETS ON LIFE CYCLE ASSESSMENTS

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(1) Overview

For evaluating ecological sustainability of products, the accounting of *fixed assets* in *life cycle assessments* is not adequately analyzed. Fixed assets represent machinery, equipment and constructions, which are utilized in the life cycle of products to enable their production and use. Subject matter of this paper is the set-up of an *input-output model* to implement these fixed assets, followed by a methodological analysis of the approach and structural analysis of the determined coefficients.

(2) Methods

The Study is based on an input-output model with *hybrid units*, which measures energetic transactions in energetic units and other transactions in monetary units. A total of 73 sectors are accounted for, of which nine are energy sectors. The model is *environmentally extended* to take renewable energies as well as greenhouse gases and air pollutants into account. Specific *cumulative energy demands* and potential environmental impacts are calculated for the products produced in the sectors. The *impact categories* climate change, eutrophication, acidification and photo-oxidant formation are investigated. By *endogenizing* the *consumption of fixed capital* by the *augmentation method* on the one hand and the *matrix flow method* on the other hand, the fixed assets are implemented and an comparative analysis is performed.

(3) Results

A general result is, that the products of the basic industry – in contrast to the service sector – show a high cumulative energy demand as well as energy related environmental impact. Extensive additional environmental impacts are attributed to process related emissions. The energetic and ecologic coefficients rise 20 to 30 % on average, if fixed assets are considered. In particular, the energy demand and emissions for fixed assets in the service sector are large. Usually, machinery and transport equipment show a twice as high proportion as buildings and structures. Directly used fixed assets constitute only a fractional amount of the total energetic demands for fixed assets, whereas indirect inputs of the upstream process stages generate the principal part. A monetary model – comparable to the developed hybrid unit model – shows an underestimation of energetic coefficients by 6 %. Adopting the coefficients for fixed assets to a life cycle assessment of an offshore wind farm indicates, that about 12 % additional cumulative energy demand and up to 20 % higher values for the impact categories are calculated.

(4) Conclusions

The input-output analysis constitutes an adequate methodology to account for fixed assets in life cycle assessments. Subsequent modeling should also follow the hybrid unit approach and assure homogeneous energy sectors, especially with respect to electrical energy. Accounting for fixed assets leads to significant additional energetic expenses and emissions – especially for services. To assure an objective conclusion of a life cycle assessment, fixed assets have to be considered. For the model developed in this study, the augmentation method is easier to implement than the matrix flow method. The energetic coefficients determined by the augmentation method do not significantly differ from the coefficients determined by the matrix flow method.

References

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