

Evaluation of the environmental impact of air-conditioning systems in the early stage of the design process

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Abstract

Modern office buildings have large cooling loads due to high internal loads. Therefore, air-conditioning systems operate round the year even in Nordic climates, which significantly affects the energy use and hence the environment. Consequently, the environmental performance of air-conditioning systems has become an important design parameter and thus an important part of the design process.

Assessment of the environmental performance is a complex process due to the large number of parameters. The purpose of this study is to develop a methodology for evaluation of the environmental effects from the use of both energy and materials of the system. The methodology is intended for decision-making in the design process of air-conditioning systems.

The method is exemplified in a case study, where an air-and-water system for an office building in Sweden is evaluated. The whole life cycle of the system is considered and the environmental impact assessment is complemented by application of a weighting method. An implementation of the environmental management systems ISO 14001 to the designer's daily work with the environmental assessment is discussed. Moreover, the requirements on energy efficiency and flexibility of the system in relation to the overall environmental impact are studied. The preliminary results show that the energy use of the system dominates the overall environmental impact compared with the use of materials. However, choosing electricity produced by environmentally friendly processes can significantly reduce the effects of energy use.