Sepideh Rabie & Madeline Sjöholm, “Adaptive reuse and circularity potential of ventilation components: A Swedish case study”
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Popular Science Summary

Adaptive reuse is defined as reusing a building for a function different than its original purpose. This research investigated whether the HVAC (heating, ventilation, and air conditioning) components of a building can also be included in the adaptive reuse process. Research on the environmental impact of HVAC components is limited and is often not included in Life Cycle Assessments. However, one study found that the HVAC system of an office building can be 35% of the total embodied carbon emissions, while another report found that the HVAC system can be up to a third of the total building services costs. Embodied carbon is the CO_2 emissions from raw material extraction, production, manufacturing, and transportation. To meet the 2030 climate goals established by the Paris Agreement, scientists and sustainable building advisory groups call on the building industry to reduce embodied carbon emissions by 40 %.

The investigation was conducted in two parts. Firstly, the report determined which elements of an HVAC system had the highest potential for reusability through a literature review and interviews with professionals, concluding that air ducts were the most ideal. The surveys and interviews identified gaps and potential barriers in current adaptive practices and provided possible solutions for future studies. The participants agreed that government regulators would play a key role in incentivising and guiding building owners and manufacturers in the practice of reuse.

Secondly, the financial and environmental benefits of reuse were quantified through Life Cycle Assessment and Life Cycle Costs analysis. The scenarios considered the building's history and future to determine what the building owners could have done with the current office’s ventilation design and what the building owners could do in the future if the office were to be transformed into a residential space. In these scenarios, the air ducts available for the office design and air ducts available for future redesign were examined. The results indicated that reusing air ducts can have financial and economic benefits, with savings of up to 50 % in construction costs and a 98 % reduction in global warming potential. Still, it is influenced by several factors, such as how many air ducts are available for reuse, if the ducts need to be relocated or if they can remain in their position, if the air ducts need to be stored during the renovation period, and many others.

Lastly, the reference points were provided to calculate the potential savings in future adaptive reuse projects based on different duct diameters and mass. Depending on the results, both financially and environmentally, industry practitioners can make the right decision for each project.

The results from this research showed that adaptive reuse of HVAC components can have financial and environmental savings and it has provided a foundation for future research. For example, a real-life application of adaptive reuse of HVAC components is necessary to demonstrate proof of success. This would assist in identifying the technical performance of reused components as well as help to drive the market demand.