02. Definitions

Circular Building Installations: An Introduction

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The concept of 'circular building' is usually associated with either the extensive use of bio-based materials or with the capacity of the building components to be easily demounted. But how about a building's installations? Do we account for circularity when we are making design decisions about electrical systems and indoor climate technology? I am afraid not, or at least, not enough.

Most professionals in the building services industry still make decisions primarily based on 'linear economy' thinking. And yes, architects and electrical and mechanical engineers often still get away with a take-make-waste approach when it comes to designing installations. This is not because they disregard the necessity to minimize environmental effects of the building services systems: energy efficiency is on everybody's mind, especially after witnessing the recent increases in energy prices. The average new or refurbished lighting, cooling or ventilation system nowadays is automatically optimized when it comes to its energy performance.

Nevertheless, this is a bit of an ostrich approach. Although energy use matters, transitioning to more circular practices requires a more comprehensive understanding of materials' use as well. At this moment, *(1.) the majority of our building service systems are still designed, refurbished, maintained and/ or operated with just three things in mind: energy use, comfort requirements and costs* (both initial and operational costs). There is currently no framework in place to account for all the materials service that systems employ.

The issue with building installations is that they are by definition highly 'metal intensive'. In terms of weight, building services components like photovoltaic panels, ventilation ducts or electrical wiring and cable trays might seem insignificant compared to the overall weight of a building. However, *(2.) if one calculates the 'embodied environmental impact' related to the metals used in these systems*, like for instance, steel, chrome, nickel, copper, one finds that sometimes *more than 25% of the total environmental impact of a building can be attributed to its electrical and mechanical systems.*

To make things worse, following the shearing layers principle, *(3.) the average service life of a building installation ranges from 15 to 25 years.* Think for example of the gas furnace or heat pump in your own home: this has a lifespan of a maximum of 20 years. While the lifespan of a building's structural layer can last up to 100 years or longer, the service layer has a much shorter lifespan. On top of that, most of the service layer components will ultimately end up as waste.

The European Commission introduced the

European Circular Economy Action Plan in 2020 with the aim to substantially decrease the use of raw materials, especially metals, and to promote more sustainable product design. This marks a critical time for the building installation sector to act towards the developing of new standards in material use and to consider all the environmental impacts related to mining, transportation and the production of the metals and metal alloys that are used abundantly in building installations.

So, what's stopping us from changing our business-as-usual practices? Why isn't the installation sector at the brink of a major transformation that could finally make the service layer more circular?

Well, it's really complicated! To begin with, building codes and building owners require contractual guarantees that service systems will work properly in the context of safety and comfort. This renders re-using relatively old components or refurbishing installation elements problematic, because these elements run the risk of noncompliance with current standards and that could lead to liability issues. Another aspect that complicates things even further is that newly produced components are likely to be way more energy efficient than older components. This might justify the decision to completely replace a pump of a fan after 15 years instead of refurbishing it.

So, there are no simple solutions on the horizon. And many of the issues at hand ask for more than mere technological fixes; innovation is needed also in terms of business models and new contract types. The good news, however, is that several organisations and companies have already started to explore alternatives. For example, some companies are looking into bio-based ventilation ducts instead of metal ones; others are exploring the potential of refurbishing circulation pumps for heating systems.

To conclude, one should not underestimate the hidden environmental effects of the 'metal intensive' building service systems. When designing or re-designing a building, electrical and mechanical installations must also be considered with circularity in mind.