4. Resource Demand and Recycling

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The most sustainable solution with which to make insulation materials reduce their ecological imprint is a circular economy that should be implemented in the future.

While today old insulation materials are mainly disposed in waste incineration or cement production plants, the study shows the specific advantages of material recycling: old processed masses from old insulation materials can be further processed into other products or fed back into their original production as raw material. This reduces resource consumption and significantly improves their ecological balance. A prerequisite for such material recycling is that the construction and building materials are suitable, meaning that insulated building components must not consist of mixed materials and inseparable composites. In addition, efficient material recycling methods are required.

The study by ifeu concludes that certain insulating materials made from renewable raw materials are ahead in terms of life cycle assessment but cannot be used for all areas of application. Insulation materials made from mineral or synthetic raw materials have a broader range of applications. In order to achieve a good ecological balance, they will need recycling on a much larger scale in the future in order to enter into a circular economy and thus lessen their considerable ecological footprint.

4.3 Demands on building materials – an architect's perspective

(Kay Künzel)

Anyone working as an architect needs to have a certain degree of resilience. After all, they have to deal with topics that are both complex and diverse. From drawing, constructional details, standards and codes, divergent building materials, right down to overseeing work on the construction site – nuanced questions require competent and fast solutions. Sustainable building also requires detailed expertise in structural physics as well as extensive knowledge of the core topics of ecology and sustainability.

Unlike many other modern professions, an architect's work is geared towards creating something that will endure. An architect creates a structure that will last for decades, something that is functional, aesthetic and should provide a healthy environment for its occupants throughout the life of the building. The question we need to address is this: what kind of expertise can the architect provide in order to cover all aspects of this undertaking, from design to mathematics, from physics to chemistry? Against the backdrop of global challenges in terms of ecology and sustainability, how can we ensure future-proof construction?

As far as ecological and sustainable construction is concerned, the architect faces the task of dealing with issues in the area of building chemistry. The decades-old question of how vapours from chemical building materials affect building occupants and indoor air quality has so far remained unanswered, especially since the adverse interactions between the materials used have largely been unexplored. The disposal of building materials from the 1970s is also still an important issue, and often dismantling is made more difficult by problematic building materials that were previously used widely, such as asbestos or polystyrene.

As the situation currently stands, architects and consumers simply have to trust what manufacturers tell them about their products. However, this trust has already been abused many times, for example, in the case of polycyclic aromatic hydrocarbons (PAH), asbestos, pentachlorophenol or lindane, DDT (dichlorodiphenyltrichloroethane), paints contaminated with tetrachlorethylene, formaldehyde-containing building panels, and insulation materials laden with flame retardants such as HCBD. All the same, this has led to at least one debate currently taking place about recyclability – for instance, about building materials that decompose over the long term, such as mineral fibres.

The debate marks an important step, given that construction requires long-term, future-oriented thinking and planning. However, the problem of the health effects that chemical substances have on the human body and indoor air quality should not be neglected. To put it succinctly, almost all building materials, including furniture and interior fittings, and even the people

A truly sustainable building requires proper design for the whole life cycle of materials already in the planning phase.

themselves have the potential to off-gas chemical substances. In various EU directives and regulations, all emitted vapours are considered in blanket terms, that is, all volatile organic compounds (VOC) are placed in one category.

However, simply lumping everything together is not productive. For example, the vapours emitted from plants may be viewed as active ingredients rather than

pollutants, such as the well-known soporific and antibacterial effect of Swiss pine. Here, the concentration makes all the difference as to whether the substances are beneficial or harmful. Yet, in the latter case, this is usually a temporary problem, as herbal essential oils and their constituents are significantly more unstable than comparable chemically manufactured products. It is well known that SVOC (Semivolatile Organic Compounds) emit substances slowly and continuously over decades, although the consequences for the human body are not known.

The volatile hydrocarbons in construction products based on petroleum, which pollute the air in the room, are particularly problematic. It would be essential to know which building materials emit which substances, how their constituents disperse, and which chemicals release unstable compounds. Additionally, we need to consider and examine interdependencies and reciprocal effects of the materials so that they can be taken into account in architectural planning.

On a positive note, in part because of the current coronavirus pandemic, the topic of indoor air quality has never been more acknowledged. Bacteria can attach themselves to dust particles, for example. The current debate on viruses is also bringing the topics of indoor air quality, electrostatics, dry air and dust into focus.

What does this mean from an architect's point of view?

The architect cannot afford to assess the effect of building materials, how they interact with each other and how they affect human health. An evaluation of this would have to be included in the scope of services provided by the (specialist) planner and accounted for in the remuneration arrangement. However, monitoring of structural environmental protection is explicitly required in state building regulations. If the regulated limit values for indoor air pollution are exceeded and hygiene tests are negative, the architect is jointly and severally liable.

A full disclosure, both for chemical and natural building materials, is extremely important (**see Chapter 4.1**, DGNB standards). Regulations that govern toxicity in other industries (e.g. for cosmetics) should also be possible in the construction sector. The current documentation with supposedly ecological seals is not really meaningful and frequently misleading, especially for consumers. The predominant test methods relate too little to the installed state under real conditions.

The term 'sustainability', originally from forestry, tends to be 'run into the ground' in the construction industry to use a simple carbon footprint assessment for building materials. This simplifies considerations, since the rather than providing more clarity. The calculation methods for assessing environmental impacts are complicated, confusing and not comparable. As part of today's requirements, building materials must be evaluated over their entire life cycle, i.e. from the 'cradle to the grave'.

How is the architect supposed to manage this assessment without the support of the industry? Transparency can only be guaranteed by means of a full declaration of building materials and therefore more detailed than the DGNB standards (**see Chapter 4.1**). An evaluation system is needed that makes it possible, for example, to use a simple carbon footprint assessment for building materials. This simplifies considerations, since the connections between CO_2 pollution and human health are known and have long been regulated. It is also possible to consider further environmental pollution.

According to the KISS principle (Keep It Simple, Stupid), we need a simple and clear declaration for building materials in the form of a traffic light. The "greener" the declaration, the more CO_2-improving the substance is. There should also be a bonus system for particularly "green" building materials. That is more motivating than a regulation based on penalties.

The use of building materials that are as sustainable as possible should be part of any calls for tender as a matter of course. Natural, mineral substances should be given priority over fossil-based substances. The origin of the raw materials plays an important role from a global ecological point of view. The difference between whether carbon is obtained from crude oil or from plants is significant.

Architects must be able to have confidence in the products, including the ingredients, which they use in their projects. Ultimately, this is also what clients and users of the buildings expect; they are becoming increasingly aware of this set of issues and demanding transparency as a result.