Can resource-efficiency provide the framework needed for developing a sustainable construction sector, now and over the long term? What is the role of eco-innovation in resource-efficient construction?

The issue

The construction sector is the largest consumer of raw materials in the EU and construction and demolition activities account for about 33% of waste generated annually. The sector contributes around 10% to GDP and 7% to employment, and 2009 was the worst year for construction in the decade. While efforts towards sustainable construction have increased, these have largely covered fragmented segments of the construction industry—i.e. focusing only on energy issues or carbon emissions—thereby omitting the "big picture". We argue that a more comprehensive perspective is needed; one that more fully considers the trade-offs between different types of resources (i.e. materials and energy) and the functionality of the built object (social aspects) over the life-time of a built object.

Share of minerals in the Domestic Material Consumption of European countries in 2007

Source: Eurostat online statistics

Note: While a small proportion of these minerals may not be used in the construction sector, the overwhelming majority are, making it a rough proxy for the material consumption of the construction sector.
Main Trends

Resource-efficient construction is economically relevant. Resource-efficiency leads to lower material costs. Moreover, 60% of residential output is expected to come from renovation in 2013. Could resource-efficiency contribute to a structural shift in the construction industry—towards greater levels of renovation and modernization—leading to a more balanced, less vulnerable sector?

Resource-efficient construction is environmentally relevant. The potential to significantly reduce total consumption levels through eco-innovation in the construction sector is high. There is also great potential to improve re-use, recycling and refining activities. Moreover, with its high impact on the environment, urban land use and expansion deserve special attention not only in the assessment of land cover, but also in the context of sustainable construction and the discussion of new buildings versus renovation.

But, not enough companies are undertaking eco-innovation to the scale needed. Innovation efforts in the construction sector have been largely incremental, according to the EU-wide Eurobarometer survey. In contrast to other sectors surveyed, product (instead of process) eco-innovation was the most popular type of eco-innovation, with around 25% of companies reporting having introduced a new or significantly improved eco-innovative product or service to the market. Of those companies eco-innovating, 3% have declared incredible gains of a more than 40% reduction of material use per unit output as a result of eco-innovation in the last 2 years. However, a third reported less than 5% resource efficiency improvements, meaning there is potential to increase both the amount of eco-innovation happening in the construction sector and the intensity of improvements achieved.

Resource-efficient construction offers a systemic approach to sustainable construction; it goes beyond zero energy, zero emissions, and zero carbon to look at the big picture—how can the existing building stock be (better) used (i.e. through renovation and urban mining) and how can new buildings be built in a more resource-efficient way, i.e. with less resource-intensive materials, new technologies and new approaches to design? It is a systems-wide approach that looks at material and energy flows over the life-time of a building. Resource-efficient construction ultimately means using less material resources to build or renovate homes, buildings and infrastructures while achieving the same or better functionality.

Source: Optigrün, FBB 2010
Green roof

2. Euroconstruct. More information can be found at http://www.euroconstruct.org/
There is a substantial potential to eco-innovate in the construction sector; good practice examples from across the EU display the wide range of eco-innovation happening in different countries—these activities can be enhanced and ramped up throughout the EU. They include, for instance, activities to:

### Reduce the resource intensity of construction materials

**Eco-materials** are less resource-intensive or less polluting than alternative ones. This includes gains made in the production process and the substitution of resource-intensive raw materials. However, the line between what constitutes ‘eco’ and ‘not eco’ is not black and white; one material may even fulfill the criteria for both under different circumstances. Examples include eco-cement, wood, straw, and clay, among others.

**Resource-light construction** refers directly to the appropriated use of construction materials and building techniques, providing the most efficient response to specific needs in a built object.
Use and re-use resources more effectively

**Industrialized construction:** Construction is one of the few industries which has not been converted to an industrialized style of fabrication and production. Whereas resource use on-site is dependent on experience of the tradesman, a pre-fabricated, modular component is produced in a factory with a high-level of precision and the opportunity to better minimize and re-use wastes. Prefabrication enables easier reparation, rebuilding and rearranging of the building. In Japan prefabricated houses can both be bought and traded-in.

**Urban mining** is the extraction of obsolete resources situated in buildings, infrastructure and landfills. In the case of particular metals, for example copper, stocks in the built environment are already of comparable size to "virgin" reserves. The challenge is gaining access to a sufficient quantity of items for recycling, and developing an efficient means of extracting the materials contained in the built environment—eco-innovation is called for.

**Build smarter to ‘save’ energy**

Energy efficiency is also a part of resource-efficiency (lowering the requirement of fossil fuels for instance). The question is, how can buildings be built or remodeled in such a way that they require less energy? For instance, by means of modern technologies in resource efficient cladding the consumption of final energy may be cut by 80%. Green roofs are a way to reduce the need for heating and air conditioning. Another related issue is how to combine the development of smart grids and the design of resource efficient buildings in order to achieve even more radical savings.

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Key messages

- Experts see the impact of the financial and economic crises as the biggest challenge facing the construction sector today, according to the EIO Delphi survey. In 20 years, however, the impacts of climate change, resource constraints and changed demographics are expected to have the strongest impact on the sector.

- The most significant barriers of eco-innovation in the construction sectors relate to the deficiencies of the knowledge base (e.g. lack of knowledge of planners and technicians) and social factors (e.g. risk averse attitudes in the construction sector and the lack of awareness of home owners), according to the experts surveyed. The lack of demand for eco-innovative buildings (user-investor dilemma) followed by the high prices of refurbishing and the high prices of materials for innovative technologies were considered equally critical.

7. The EIO has had undertaken an on-line Delphi survey among construction experts in various European countries from mid-December 2010 until mid-February 2011. The first round of the Delphi received 128 responses. The analysis of this chapter will be largely based on the results of this survey. In the last quarter of 2011, EIO will produce a foresight report on the sustainable construction based on the two rounds of Delphi surveys, scenario development, impact analysis and the roadmapping.
Experts consider a good skills base and strong collaboration between research, experts and business in the construction sector and ambitious regulations, standards and government subsidies and programmes to be the strongest drivers of eco-innovation in the sector. The market drivers are among the relatively weakest determinants of eco-innovation in the construction sector: the prices of building materials and the competition for innovative building components are not currently considered strong incentives to eco-innovate. The relevance of both drivers is expected to slightly grow in the future.

Visions reveal how the construction sector may evolve with the times to shift its primary activities toward renovation and refurbishment, and – to a growing extent – deconstruction of old and reconstruction of new buildings at the same location, while remaining a dynamic, prosperous and forward-looking industry.

In summary, there is substantial potential to eco-innovate in the construction sector, but a candid discussion about the benefits of renovation versus building new, and the political frameworks which favour one over the other is needed. This discussion should happen today, to set the tone for the role of the construction sector tomorrow.

From the Eco-Innovation Observatory:

The EIO Annual Report with analysis of the Eco-Innovation Scoreboard results is at www.eco-innovation.eu/reports

The Eco-Innovation Scoreboard visualization tool is available at http://database.eco-innovation.eu

Detailed analyses of eco-innovation in EU Member States are available www.eco-innovation.eu/countries

From other sources: