Urbanization drives resource use and GHG emissions

More people and changing lifestyles lead to increases in living space, infrastructure for supply and disposal, means of transport and communication. This entails a rise in global resource use in business-as-usual scenarios. In the next three decades alone, about as much infrastructure needs to be built as has been created since the beginning of industrialization. This growth will mainly take place in cities, where more people will be living in 2050 than today all over the world. The challenge will be even greater considering the fact that a significant percentage of the built infrastructure since 1990 will deteriorate prematurely due to the massive use of poor-quality building materials and the severe environmental influences and industrial pollutants.

In addition to that, urban infrastructure development over the last decades failed to keep pace with the rapid urbanization process in many developing countries and emerging economies: Around the world, approx. 750 million people have still no access to adequate sanitation, 150 million are lacking access to clean drinking water, and 850 million city residents live in inadequate housing.

Around the globe, the predominant materials for buildings and infrastructure solutions are steel, sand and cement. Between 1959 and 2010, the global steel production went up by a factor of eight while 25 times more cement was produced. The demand for non-metallic industrial and construction minerals also witnessed over the last 30 years a disproportional increase by more than 240%. This boom has not only spurred demand for raw materials but also increased global CO₂ emissions considerably. The cement industry contributes about 5% to global anthropogenic greenhouse gas emissions, steel industry about 6%.

As infrastructure and buildings have a lifespan of many decades, the choices concerning the design, technologies and materials have a strong impact on the ecological footprint not only during construction but operation as well and therefore can lock societies into GHG-intensive emissions pathways that are difficult or very costly to change.

If the expansion of infrastructure and buildings follow the same raw material and energy intensive patterns as today in industrialized countries, this alone could lead to 350 Gt of CO₂ emissions. This corresponds to around a third of the total available CO₂ budget remaining under a two degrees pathway, limiting global warming to less than 2°C.6

1) WBGU 174
4) Carbon Trust 2016. Breakthrough technology to be demonstrated in Europe to cut carbon from cement and lime sectors. available at: https://www.carbontrust.com
11) https://www.icsi.de
Sand: Seemingly infinitely available

Although sand seems to be available all over the world, sand is not equal to sand. In deserts, for example, sand grains are too strongly rounded due to abrasion by the wind so that such material is not well suited for concrete production. Sand is often mined or dredged from the sea, rivers that are frequently polluted and beaches, which causes serious environmental impacts in the respective ecosystems and endangers biodiversity. Mining sand from sea beaches facilitates erosion leading to land losses, increasing the vulnerability of countries caused by sea level rise due to climate change.

The exponentially growing use of sand and gravel mainly due to the rapid urban growth in emerging economies greatly exceeds natural renewal rates. Nevertheless, the exponentially growing use of sand and gravel mainly due to climate change. Increasing the vulnerability of countries caused by sea level rise due to climate change.

The density of cities allows economies of scale in citizen-oriented services such as collective transport, power, water, and sanitation services, waste management and district heating, reducing commuting distances, air pollution, energy demand, land take and soil destruction. Resource efficient urban planning integrates urban flows and urban sustainability, linking spatial development and planning of infrastructure systems. It minimises the use of resources on the supply and demand side, combining upstream measures as avoidance, prevention, and reduction with downstream action focusing on reusing, recycling, and harvesting e.g. rainwater. This requires more decentralized infrastructure systems and moving away from end-of-pipe utilities. For both, the compactness of cities is key as it contributes to minimising input and output flows. Land recycling like the redevelopment ofbrownfield sites from former industrial areas allows preserving land as a finite resource.

Sustainable Industrial Areas

Industrial areas are drivers of economic development. Nevertheless, they frequently concentrate environmental pollution and ineffec- tive resource use. Sustainable Industrial Areas (SIA) turn these challenges into opportunities. The spatial proximity between different companies facilitates not only pooling of state-of-the-art environmental infrastructure as zero-emissions plants and sharing of services and social infrastructure. Such clusters can also be a breeding ground for industrial symbiosis in which the residues of one company become raw material of another. Having to consider the economic, ecological and social dimension in an integrated manner, such industrial areas require particular management structures, enhancing communication and collaboration.

Synergies with other sectors

Improving resource efficiency in infrastructure and buildings offers multiple co-benefits: It allows achieving important social development goals with less resources: To provide clean water and sanitation (SDG 6), to upgrade infrastructure and retrofit industries (SDG 9) to make cities and communities inclusive, safe, resilient and sustainable (SDG 11). It also reduces pressure on construction materials becoming scarcer and expensive and is an important lever for meeting climate change. Finally, enhancing resource ef- ficiency in construction is an important employment factor as this sector engages about 10% of the global workforce, contributing typically about 10-15% to national GDP.

Recommendations

In view of the rapidly growing demand for infrastructure and buildings not only in emerging countries, tapping the available resource efficiency potentials in construction mate- rials will be key for preserving natural materials and reducing greenhouse gas emissions. This will require not only technical innovations but also favourable framework conditions.

Legal framework

Building codes and standards as well as tender conditions are generally framed for the use of primary raw materials. As long as these do not consider explicitly the use of secondary raw