CITY-LEVEL DECOUPLING

Urban resource flows and the governance of infrastructure transitions

Global economic production is now concentrated in cities. Some 80% of global GDP is produced in cities on just 2% of the land surface, though cities depend on the flow of resources from near and far. Cities have been growing steadily over the past 150 years, and by 2007 over half of the world's 7 billion people lived in urban settlements. By 2050, more than 6 billion people (about 70% of the world's population at that time) are expected to be living in cities, with most growth in developing countries. The key resource flows that support cities are finite, so sustainable economic development will depend on decoupling growth from escalating resource use and ensuring equitable distribution of the resulting benefits. UNEP's International Resource Panel (IRP) has reported that innovation in infrastructure is already improving resource management in many cities, with ample opportunities for wider application.

Treat infrastructure networks as socio-technical systems, adding human dimensions to the physical construction of networks that provide transport, water, food, energy, waste disposal, and other essentials for human wellbeing.

Cities are complex networks of interlocked infrastructures that bring resources in, use the resources to provide services, generate wealth, and dispose of the wastes that are generated by consumption. This flow can be seen as a city's "metabolism". More circular urban metabolism that treats outputs from one use as inputs to another would help cities decouple resource use from the provision of better services and economic opportunities and adapt to a future of resource limitations and climate uncertainty.

The natural environment (such as rivers, watersheds, forests, and coral reefs) can often replace human infrastructure, providing significant savings and other benefits. These benefits are known as "ecosystem services", and systems of payments for such services are ensuring that the benefits can continue to flow. By including ecosystem services into future visions of cities and their infrastructural layout, planners can increase the options for resource decoupling and promote social equity.

The vision for a city should be based on national sustainable urban development policies that support urban infrastructures that reduce environmental impacts (impact decoupling) and improve resource efficiency and productivity (resource decoupling). Urban development should align spatial planning guidelines, infrastructure investment strategies, financial capability, social equity, and long-term sustainability goals.

The social dimension is critical to the health and function of cities and should start with a clear vision of ultimate objectives. A vision to guide the transition to sustainable cities must create equal opportunity for all residents and emerge from interactions among city stakeholders, with each city having its own unique characteristics.

Improve the flow of urban resources through better infrastructures.

Decoupling can be achieved by retrofitting urban infrastructures or building new ones that are more resource-efficient. Increasing investments in urban infrastructures create new opportunities for reconfiguring these infrastructures through better understanding of urban metabolism, for example with the support of methodology called "material flow analysis" (MFA).

The key issue is helping policy makers build urban infrastructures that take into account the long-term flows of strategic resources. This will require linking urban systems to the wider regional flow of ecosystem services and natural resource extraction. It will depend on linking urban systems to their bioregions, based on the principle that sustainable urban systems will restore their bioregions and the ecosystem services they provide.

To assess how initiatives from around the world are contributing to the reconfiguration of cities, infrastructure systems and resource flows, the IRP report grouped innovations according to whether they focus on new construction and new networked infrastructure or on the "retrofitting" of existing infrastructures; and whether they aim at integrated (systemic) change or at a particular category of infrastructure network (such as water or transport).

Four models emerged: "Integrated eco-urbanism" is new development (e.g. an eco-island, new town, cluster development, or eco-village); "urban networked technologies" also include new construction, but the focus is on one particular technology such as water or energy rather than an integrated approach; "systemic urban transitions" are retrofits of existing urban infrastructures using an integrated network approach where new investments in low value environments drive the application of new technologies; and "urban networked infrastructures" are retrofits that focus on a particular technology, such as bus rapid transit systems, rapid urban rail, or major new water efficiency infrastructures.

Each of these four ideal models has variations developed predominantly by environmental or community groups. Examples include the "transition towns" movement, the "global eco-village" movement, and some of the more grassroots-oriented local government initiatives that focus on equity issues.

Make urban infrastructures more sustainable to help drive a "green economy."

An estimated US$41 trillion is required to refurbish the old and build new urban infrastructures over the period 2005–2030: $22.6 trillion for water systems, $9 trillion for energy, $7.8 trillion for road and rail infrastructure, and $1.6 trillion for air- and sea-ports. These investments will ensure the welfare of urban populations and build the foundation for the next generation of great cities.

Sustainability-oriented infrastructures are driven by the economic demand for more viable urban infrastructures and the ecological demand for more sustainable use of natural resources. Retooling the infrastructures of the world's cities for the next long-term development cycle is emerging as a key strategic opportunity for many investors.

While some spontaneous decoupling is already happening, the decoupling needed to achieve sustainability will require deliberate intervention to stimulate systemic changes. A combination of resource productivity improvements, increased use of local renewable resources and ecosystem services, and re-use of waste products can promote decoupling of the resources flowing through cities, and within them. Such material flows are the basis of a green economy.

Design infrastructure to achieve the same level of wellbeing with less resource consumption and environmental impact (resource and impact decoupling, respectively).

Progress toward decoupling can be stimulated by:

Assessing existing research on decoupling in cities, and areas requiring more attention. Studies of urban resource flows using Material Flow Analysis are poorly linked to studies on the social organisation and urban political dynamics of resource flows, but need to be brought together in a more comparative and systematic manner.

Defining the scale of the city and its boundaries. Cities have multiple infrastructures and resource flows that have national and international reach. Better understanding of these flows can inform policies on how they can be managed at the city scale. The diversity of initiatives provides an opportunity to compare different scales and the related impacts of decoupling.

Determining total material requirements and identifying rebound effects. Studies of urban metabolism show that cities depend on material resources imported from within and beyond national boundaries, indicating the environmental impact of cities on other localities. Rebound effects are the unintended outcomes of investments that result in more efficient use of resources but the savings encourage people to buy more goods and services, and thereby defeat decoupling. A key mechanism to counteract rebound effects is to link improvements in efficiency to increased taxes on activities that harm the environment.

Determining how decoupling in cities can be assessed and accelerated in the future. Linking material flows to the institutions, producers, users and intermediaries involved in managing resource flows through infrastructure networks can help city leaders overcome obsolete approaches that may hamper decoupling, or build totally new innovative and sustainable infrastructures.

Establishing targets for desired metabolic flows per capita based on the economic and ecological context of any given city will provide a clear-cut and understandable framework for assessing progress towards more sustainable resource use. Targets for water, energy consumption, and carbon emissions are examples that are being used in some cities already.

Cities in many developing countries can benefit from large-scale investments in new urban infrastructures aimed at poverty alleviation. Investors should promote sustainability-oriented innovations that avoid the obsolete technologies that many developed country cities are seeking to replace, often at great cost.

Cities will be fundamentally restructured over the coming decades in response to many of the macro-dynamics discussed in this report, as well as to the micro-dynamics of changes in consumption, equity, cultural behaviours and technologies. The focus of a practical programme should be on direct and indirect material flows and how urban infrastructures can be reconfigured to improve resource productivity by a factor of at least five.

A summary and the full report as well as a PowerPoint presentation with the main findings can be downloaded at: www.unep.org. For further information, please contact UNEP at: resourcepanel@unep.org