

Title:

Urban Metabolism: History, Insights and Applications

Authors & affiliations:

*Christopher A. Kennedy
Department of Civil Engineering
University of Toronto*

Abstract:

The concept of the urban metabolism, conceived by Wolman in 1965, provides an integrated, holistic view of the physiology of cities, which has evolved to become germane to the contemporary analysis and design of sustainable cities. The first metabolism studies of real cities were conducted in the 1970s by chemical engineers in Tokyo, ecologists in Brussels and civil engineers in Hong Kong. Around this time, systems ecologists primarily under Odum, also began describing metabolism in terms of solar energy equivalents. Most metabolism studies, however, tend to follow Baccini and Brunner, expressing flows of water, material and nutrients as mass fluxes, with just energy flows in joules.

In studying how the metabolism of cities has been changing, Kennedy et al. provided insights into mechanisms that threaten the sustainability of cities. Beyond concerns over the sheer magnitudes of resource flows into cities, there are more subtle imbalances and feedbacks that threaten sustainable urban development. In particular, accumulation processes such as water in urban aquifers, toxic materials in the building stock, heat stored in rooftops and pavements, and nutrients deposited in soils or waste sites, need to be appropriately understood and managed.

With an increasing number of studies being undertaken, different applications of urban metabolism are developing. These include: i) sustainability indicators for state of the environment reporting; ii) inputs to city greenhouse gas emissions inventories; iii) mathematical models of urban metabolism to support policy analysis; iv) as a tool used in sustainable urban design.