Real-time accounting and simulation of dynamic energy-water-material balances for achieving liveable and sustainable cities of the future

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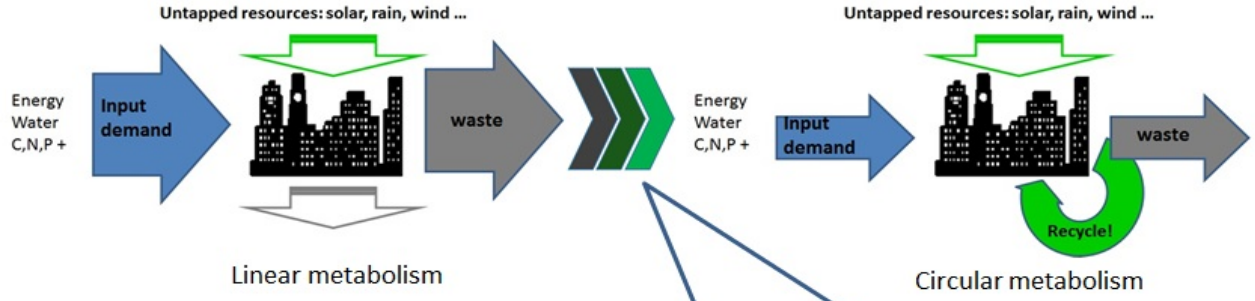
Motivation

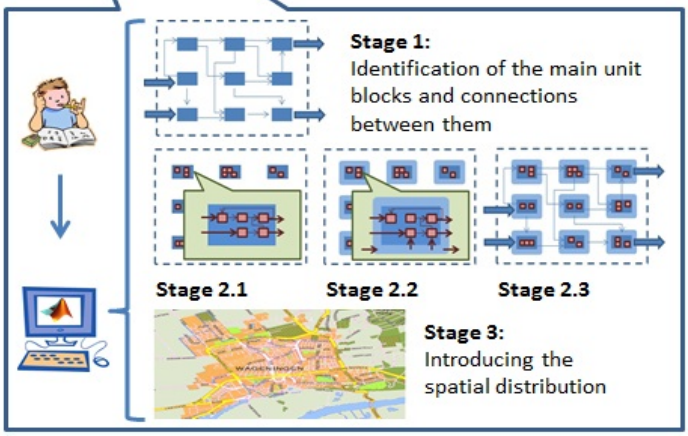
Rapid population growth and industrialization in the last decades resulted in an enormous stress on ecosystems, resources, political systems and economies. In urban areas, these stresses are especially high, since our cities consume large amounts of resources (e.g., water, energy, nutrients) and convert these to low value waste streams (**linear metabolism**). Apart from that, local renewable resources (rain, solar, wind etc.) are often neglected in current supply schemes. Unlike self-sufficient natural systems, which make use of sustainable inputs and recycling mechanisms, cities at the current stage cannot be considered sustainable.

Mimicking natural systems can stimulate a paradigm shift towards a more sustainable and a more **circular metabolism** of cities.
A number of technological and infrastructure concepts to facilitate this shift has been proposed . However, the proposed concepts often focus on optimizing a very narrow part of the system (city) without taking into account other system's elements. Therefore, the combined effect of these concepts on a system can be far from optimal.
Modelling can aid greatly in studying these combined effects. Developing of models that could simulate the conversions of the resources within a city is the objective of the current research.



Technological Challenges

- Complex system: high number of interconnected subsystems, tempo-spatial scales, feedback fluxes;
- Multidisciplinary research: conversions of water, energy and (biodegradable) materials;
- Integration of existing (sub-)models developed in isolation from each other into a single model;
- Reduction of the model complexity without significantly reducing its accuracy.



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