Integrated assessment of water flows and urban water networks in smart parks

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Water management is a key issue in the sustainable performance of urban environments. Hence, an integrated approach is required in the eco-design and construction of other sub-systems such as industrial and logistic smart parks. According to the definition presented by Kazemersky and Winters (1999), smart parks are "an innovative model designed to integrate the inflows and outflows of energy, water and waste streams for multiple businesses in a sustainable and synergistic manner". The optimisation and efficiency of the urban water system embedded in smart parks should be taken into account in order to: (1) reduce the demand for water supply systems; (2) improve the environmental performance of the supply and sewer networks, considering both their construction and operation, and (3) manage the potential risks associated with stormwater, e. g., flood events and water scarcity. As a result, different strategies could be adopted so as to reduce the environmental footprint of future smart parks. One of them could be the interconnection of buildings belonging to a certain park in order to share and store the water flows in a closed-loop system. By doing so, there is a bidirectional symbiosis among companies that consume and/or distribute water and the system approaches self-sufficiency. In this case, the aim of the study is to analyse the environmental impacts of constructing different water management scenarios that could be implemented in smart parks.

(A) Basic model: companies harvest rainwater individually and distribute and consume it through an interconnected water network.

(B) Collective model: rainwater storage takes place in a single, centralised tank that supplies all the companies in the smart park.

All strategies will be compared to the environmental impacts of current combined sewer networks and the benefits of reducing the construction of these pipelines and other infrastructures. To that end, Life Cycle Assessment (LCA) and the Plugrisost® model will be used to calculate the environmental impacts and to determine the tank sizing of the rainwater harvesting systems, respectively. These results should guide managers and urban planners in the design, construction and operation of smart parks in the framework of smart cities.