



Towards an urban CLEWs framework – a first iteration assessing water-energy interactions in the City of New York

Rebecka Segerström (1,2), Mark Howells (1), Georgia Destouni (2), Vatsal Bhatt (3), Morgan Bazilian (1), Hans-Holger Rogner (1,4)

(1) Division of Energy System Analysis, KTH Royal Institute of Technology, Stockholm, Sweden, (2) Department of Physical Geography, Stockholm University, Stockholm, Sweden, (3) Brookhaven National Laboratory, Upton, NY, USA, (4) International Institute for Applied Systems Analysis, Laxenburg, Austria

Water and energy systems provide many key services in cities, and although the systems themselves are tightly interlinked they are often planned and operated in silos. This paper presents a prototype urban water-energy-nexus analysis framework. In it, a set of ‘resource efficiency’ and ‘sustainability’ interventions in the residential sector are evaluated from a water and energy perspective simultaneously. Results from this first application show that water-energy interactions from seemingly very different interventions can be graphically represented, quantified and compared. It further shows how interventions commonly motivated by primarily water sector needs could also be cost-competitive from an energy efficiency perspective.

A novel graphical reference resource-to-service system is developed, that connects not only urban energy and water systems but also couples this to the urban services they provide. This design enable analysis of multi-functional urban interventions, whose total cost or benefit could not be fully accounted for in either a separate water or a separate energy system assessment. A framework that centres on urban service provision thereby opens up for fair comparison between, to their nature, very different infrastructure solutions for providing those services.

In an indicative quantitative assessment, comparison of a set of plausible water-energy-system-related interventions in NYC – a shift to water conserving household-appliances and an ambitious installation of extensive green roof – reveals that resource efficiency gains, costs and payback times vary greatly between the compared interventions. Only two out of the four investigated interventions yield results comparable to those of direct energy-efficiency measures. A general recommendation to always seek nexus - or multi-resource - efficiency would therefore be blunt guidance for policy makers trying to make the most of their (likely limited) budget. To consider these urban resource interactions sincerely, sophisticated and systematic quantitative assessments of their coupled effects is needed. A fully developed Climate, Land-, Energy- and Water-use (CLEW*) nexus framework based on the prototype presented here is envisioned to be valuable for such assessments, with capacity to support urban sustainability planning and policy-making, especially for direct comparison of multi-resource benefits of interventions of different nature.

* The term CLEW refers to an integrated resource assessment framework (Howells et al., 2013; IAEA, 2009).