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WATER, SOIL AND WASTE

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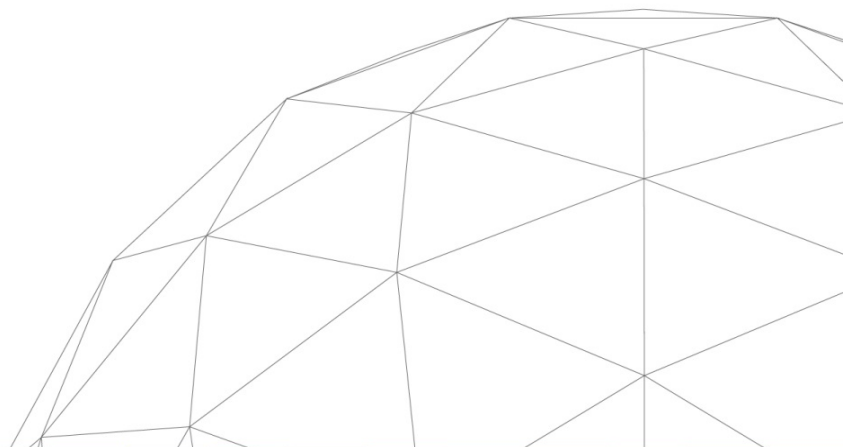
GLOBAL CHANGE
SDGs NEXUS APPROACH

POSITION PAPER – Extended Summary

The Urban Water-Energy Nexus: Drivers and Responses to Global Change in the ‘Urban Century’

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Day 2 | Urbanization



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Summary

The 2015 Dresden Nexus Conference (DNC) features three inter-connected dimensions of global change: 1) climate change, 2) urbanization, and 3) population growth. This position paper defines an *urban water-energy* and discusses its use as a guiding framework to confront these three dimensions of global change. We explore what makes the urban water-energy nexus unique by focusing on infrastructure, institutions, and urban-rural gradients for urbanizing towns, cities, and mega-cities. Our discussion offers lessons for DNC Sessions 8 and 9 and makes special reference to the Sustainable Development Goals. The conclusions address future directions for nexus research, practice, and policy.

The urban water-energy nexus is defined as inter-linked water, energy, infrastructure, and attendant physical resources coupled with the populations relying on these resources as well as the institutions that govern them. Because these inter-linkages shape the future trajectory of cities – their form, function, and footprint – the nexus must be harnessed as a policy tool to build societal and ecosystem resilience to global change. The urban water-energy nexus embodies resource consumption, production, and management tied with social dynamics such as the unequal distribution of wealth, access, and decision-making power. Thus it requires considering social equity, resource access, and political power (the societal components of the water-energy nexus), which we discuss in our analysis. These inter-linkages highlight the emergent properties of the nexus: transformations in resource availability and quality are just as much a result of their development, access, and control as they are questions merely of physical endowment, i.e., location and abundance of resources.

Urbanization poses unique challenges and opportunities for resource-use and institutional dimensions of global change. In the face of multiple global-change uncertainties, cities are experiencing increasing pressures as a result of climate change and economic globalization. Increased population growth primarily in urban environments can lead to increased stress on water and energy resources, particularly in the absence of sound policy and management. Resilience provides a guiding principle for multi-scalar urban planning and management to increase urban adaptive capacity. This principle emphasizes the evolutionary nature of urbanization, manifold social and ecological connections in the urban sphere, and the ability of systems to quickly recover from crisis.

To strengthen urban resilience in the face of global-change uncertainty, we discuss the governance dimensions of nexus frameworks. We draw on the theoretical frameworks of social-ecological systems (SES) and urban metabolism to advance scholarship on the urban water-energy nexus. We next discuss nexus-based opportunities and limitations for adaptation, mitigation, and resilience in the face of climate change in the urban sphere.

The conceptual development is followed by consideration of five case studies drawn from the literature, which highlight both the key themes and diverse nature of the urban water-energy nexus. From this engagement between concepts and case evidence we synthesize lessons learned and identify conceptual gaps with a view towards informing debate on the Sustainable Development Goals in relation to the

urban water-energy nexus. Research gaps and next steps in urban water-energy nexus research and practice are centered on more robust analysis of waste and resource recovery, including the opportunities and limits to efficiency gains.

Our resource-use analysis focuses on water and energy, which anchor the nexus conceptualization of the past two decades. While there are many other factors that influence the nexus and could be included (i.e., environment, climate, and governance) in a ‘comprehensive’ nexus, we maintain that water and energy are the two core resources that are metabolized for urban development and human well-being.

Multiple processes and scales of inter-linkage between society and the environment drive global change, on the one hand, yet offer opportunities for sustainable transitions, on the other. Thus, our view is one of human-environment co-evolution: the complex dynamics of the resource nexus, that is, the interrelation of environmental resources such as water and energy, are shaped by intricate societal and economic processes, which in turn act upon and are deeply influenced by resource use and access, and environmental quality more generally. We follow Esther Boserup’s lead that expanding human populations, provided capacity and flexibility to unleash creativity hold immense promise for innovation and adaptation, and therefore constitute a potent source of positive change. The nexus framework provides a valuable tool to institute positive policy change and promote sustainable development by building societal and ecosystem resilience.



Christopher Scott, Professor of Water Resources Policy and Geography & Development at the University of Arizona, is an interdisciplinary scholar with 200 publications and 9 co-edited books on water resources and policy, the water-energy-food nexus, transboundary water and climate adaptation, water reuse, and global change. His applied research emphasizes the importance of science-policy dialogues with particular attention to ecosystem services, groundwater depletion, and transboundary adaptive management. He completed Ph.D. and M.S. degrees in Hydrology at Cornell University and B.S. and B.A. degrees at Swarthmore College.

Outside the academy, Dr. Scott has worked fifteen years for NGOs, government agencies, and applied-research institutes, contributing to water policy formulation and implementation. He is founding co-director of the AQUASEC Center of Excellence for Water Security, a virtual center and network of researchers and decision-makers, which he established in 2011. From 2001-05 he served as the Regional Director of the International Water Management Institute (IWMI). From 1997-2000 he conducted postdoctoral research in Mexico and headed the IWMI-Mexico program in 2000.