SUSTAINABLE CITIES

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More than half the world's people live in urban areas that use more than 80% of the world's fresh water and fossil energy, and contribute about 80% of the world greenhouse gas (GHG) emissions. As population growth places pressures on water and fossil energy resources, developing resource-efficient and environmentally-friendly cities become imperative. At the same time, the high concentration of people in cities makes them especially vulnerable to a variety of risks ranging from local infrastructure conditions (e.g., lack of sanitation; urban heat island phenomena), fossil energy combustion (e.g., regional pollution from diesel exhaust emissions) and from projected impacts of global climate change, e.g., extreme events (heat, floods, droughts). The year 2010 was reported to be one of the costliest catastrophe years in history. Globally economic losses linked to floods, hurricanes and other disasters, totaled nearly $200bn. Many of these losses were focused in urban areas.

City governments are therefore increasingly taking on the task of both reducing GHG emissions associated with urban infrastructures – i.e., residential and commercial buildings, water, waste disposal, and transport systems - as well as adapting to the multiple public health and climate-related risks emerging in cities. For example, more than 1000 cities worldwide are engaged in climate action plans aimed both at GHG mitigation and climate-adaptation, i.e., increasing their environmental sustainability and adaptive capacity (broadly referred to as sustainability in general). Environmental sustainability is often measured in terms of resource efficiency, waste minimization and reduction in pollution (such as GHGs), while adaptive capacity (of which resiliency is a subset) examines how cities may cope, mitigate risks or ameliorate impacts from various shocks.

So, how can we develop cities that are environmentally sustainable and adaptive? From an engineering stand-point, the design of infrastructures that are efficient, low-polluting and multi-functional can be important in achieving multiple sustainability goals. In the era of the internet, information technologies may provide the tools to deliver the smart and sustainable cities of the future. However, sustainability outcomes in cities do not just depend on technology and design, but on human behavior, market mechanisms, public policy, as well as the natural system (e.g., coastal versus interior cities). Complex interactions between people, urban infrastructures and the natural environment shape both the environmental sustainability and adaptive capacity of cities.

Cross-disciplinary approaches – across architecture, infrastructure engineering, urban planning, public policy, environmental sciences and public health - are important in understanding these interactions to develop sustainable cities of the future. This session features speakers focusing on energy, transport, resourcing and construction in cities using unique cross-disciplinary lenses, e.g., the intersection between human behavior and energy use in buildings, between transportation technologies and policies, and between building efficiency versus resiliency. Conference Session chairs will introduce the

session providing an overview of inter-disciplinary frameworks describing sustainable cities, as well as a review of field efforts toward achieving the goal of sustainable cities using global case study examples.

James Keirstead (Imperial College London) will present on modeling approaches that are commonly applied to urban energy systems, ranging from those focused on individual technologies, through to whole system assessments of both technology and policy will be.

The impact of various land use patterns and travel demand policies (such as congestion pricing, mode subsidies, and parking strategies) on urban system operations, including GHG emissions. Kara Kockelman (University of Texas, Austin) will quantify the potential of plug-in vehicles and other energy-saving technologies, while identifying top tools and challenges for researchers, planners, and policymakers.

Adaptable resourcing is founded on resilience and adaptability as a means to synergistically capitalize on the versatile and complex processes present in urban resources. Whether pressing urban challenges derive from resource scarcity, excess, unpredictability, or various combinations, the equation of how we supply energy, water, and food and process waste must shift. Maria-Paz Gutierrez (University of California, Berkeley) will present on new adaptable resourcing methods based on multifunctional and selective capabilities through a set of case studies concentrated at the infrastructural, building system, and building envelope scales.

Practical application and results of application in buildings of new materials for improved energy efficiency, optimized construction processes, Energy Efficiency and ICT for supporting the whole life cycle will be presented by Jesús Isoird (Acciona, R&D). His talk will also cover the integration of some innovative but commercially-available technologies in a zero-emission residential complex in Spain.