

# CROSSOVER

URBAN WATER, TRANSPORT,  
AND ENERGY:

Transforming Municipal Services and Urban Infrastructure



Meeting Report by CHRISTINA OLSEN

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# The Transformational Potential of Public-Private Partnerships for Urban Infrastructure

**KEY QUESTION:** Some advocates for new approaches to urban infrastructure think that PPPs in energy, water, and transport are unlikely to succeed because the fundamentals that drive change are not addressed in a PPP format. How and when can a transaction between government and private sector be transformational?

## SETTING OUT KEY ISSUES

From the perspective of investors, infrastructure is not just a facility or system rooted in place that serves a particular community or need and that has a large long-term capital component, but it must also offer a regular or stable cash flow. The current situation regarding infrastructure in the United States is dire: the 2013 Report Card for America's Infrastructure by the American Society of Civil Engineers gives the country a D+ grade for infrastructure investment (with \$3.6 trillion required to improve to a B grade).<sup>1</sup>

expectations; gaps in public perceptions; the need for public sector PPP literacy; and the need to streamline development finance. Opportunities include increasing the role of International Financial Institutions; leveraging (recycling) brownfields; and exploration of innovative user-investor funding models.

## CORE THEMES

There has been a consistent underfunding of infrastructure in the United States over the past few decades. This stands in stark contrast with investments in China and India, as well with previous eras in the United States. The problem illustrates the current unwillingness of American society to pay its own way.

There is also a cognitive dissonance regarding what is wanted and how much should be paid. Figures attributed to perceived “needs” must be approached with caution and backed by data. Challenges such as free riders and lack of trust can sabotage future needs. There is often an imbalance in the return to the private and public sectors for their contributions.

The issue of how much public sector risk financiers are willing to assume must also be considered. Although some risk is acceptable, a certain level of return on investment is required and the public sector needs to take on risk associated with policy decisions. New ways of measuring risk must be developed, particularly in light of climate change.

Formal processes for communication would facilitate dialogue across silos, enhancing communication and building trust between sectors. Although PPPs are often viewed through a strictly transactional lens, attention should also be given to when, where, and how collaboration and engagement between companies and cities happen.

Financial mechanisms can be important levers for transformation. Most companies are not willing to take on tangential projects or indirect business opportunities. Taxpayers and users are often left paying for what is not taken up by the private sector. Tax regimes are not tied to actual usage, so users who do not see direct value are less willing to pay more. As a result, “you get what you pay for.”

Many aspects of PPPs for infrastructure are prohibitively complicated and uncertain. Regulatory frameworks can streamline processes and make permitting less complex. A standardized framework or toolkit would be welcomed, particularly by municipal stakeholders.

Finally, without a clearly defined vision, financing often becomes the objective—instead of the tool—and unnecessary projects continue to be undertaken simply because they can be financed. Creating a common vision based on engagement with citizens and the private sector would allow cities to provide greater context for bids and proposals.

# Governance Frameworks for Urban Sustainability

ing or of criticism compounds delays and paralysis. Communication and engagement, particularly between utilities and city governments that traditionally have limited or strained conversations, are critical to overcoming confrontation and stasis. Using multi-stakeholder dialogue to find common ground opens the possibility for cities and utilities to approach regulators together to request rule changes.

Adding in the voices of technology companies as enablers and citizens as users can further advance dialogue. Innovation labs are another example of public-private sector engagement, such as Boston’s Green Ribbon Commission, which convenes leaders from the city’s leading economic sectors to develop shared strategies for facing climate change, providing advice and counsel on the design and implementation the city’s Climate Action Plan.<sup>4</sup> Education and involvement of public utility companies is necessary. Cleantech San Diego, a non-profit member organi-

<sup>4</sup> See <http://www.greenribboncommission.org/>

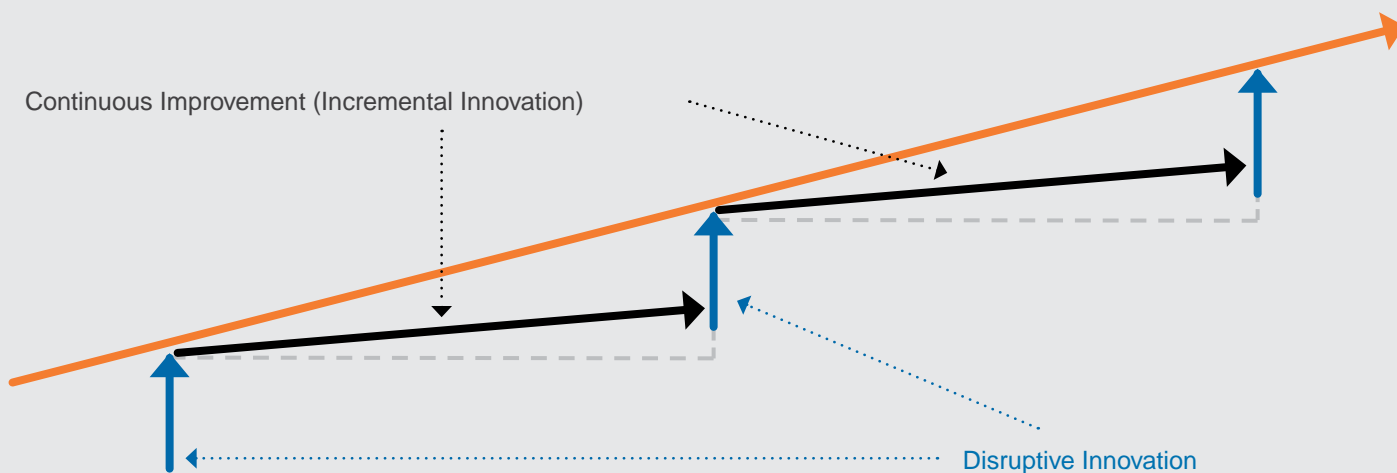
zation, has worked to bring together the private and public sector at a high level before a problem or opportunity has even materialized, involving companies in broader conversations.

There are significant differences in “city”, “urban”, and “metropolitan” areas. Regional coordination is necessary for non-confined organic systems such as energy, water, and air. Examples include elected regional government in Portland and regional coordination on infrastructure in Washington, DC. Another uniting factor could be “disaster-sheds”—regions with shared risk of natural or other disasters (akin to shared water resources in a “watershed”)—which might create less politicized opportunities for chief resilience officers and others working on regional infrastructure.

Issues of social equity are a core concern in thinking about governance frameworks for urban sustainability. Policies for urban adaptation and resilience must put people first.


## CONTINUOUS IMPROVEMENT VS. DISRUPTIVE INNOVATION

Continuous improvement can be transformative if the slope is steep enough and the pace of progress has a high degree of certainty.



Source: Nils Moe, USDN

# Strategies for Flexible Urban Infrastructure

 **KEY QUESTION:** Infrastructure systems are designed to be solid and long-lasting, and investments can require decades. How can utilities adjust to the new realities of the 21st century with flexibility and data-driven decisions to adapt to big shifts such as an altered financial landscape or climate change?

## SETTING OUT KEY ISSUES

The current gap in infrastructure funding means either new investment or less will be done. Although there can be resistance to change and to private sector involvement, PPPs can bring opportunities, particularly for the use of data and innovative technology. Such creative partnerships are a part of the solution to bridge the infrastructure funding gap.

Ken Kirk, Executive Director, National Association of Clean Water Agencies (NACWA), provided an overview of his organization, which was created to ensure that funds committed by Congress to meet water treatment deadlines in the 1970s were directed to large cities. According to Kirk, the Clean Water Act has been successful but it has not addressed the needs of the 21st century, particularly for agriculture and climate change. The Utility of the Future offers a way to explore issues, innovative technologies, and critical actions for utilities to improve resource recovery.<sup>5</sup> While this concept is gaining traction within the sector, the transformation of cities must be approached as a long-term process.

Innovating old high-cost fragmented water infrastructure requires city redesign for integration, but it is an opportunity to change the paradigm in cities, remarked Eileen O'Neill, Executive Director, Water Environment Federation (WEF). Mixing centralized, decentralized, and modular approaches is necessary to avoid “white elephant” projects. Net-energy production treatment plants, effluent reuse, less rigid European permitting that allows innovation, and public amenities designed in conjunction with water facilities are just some examples of success.

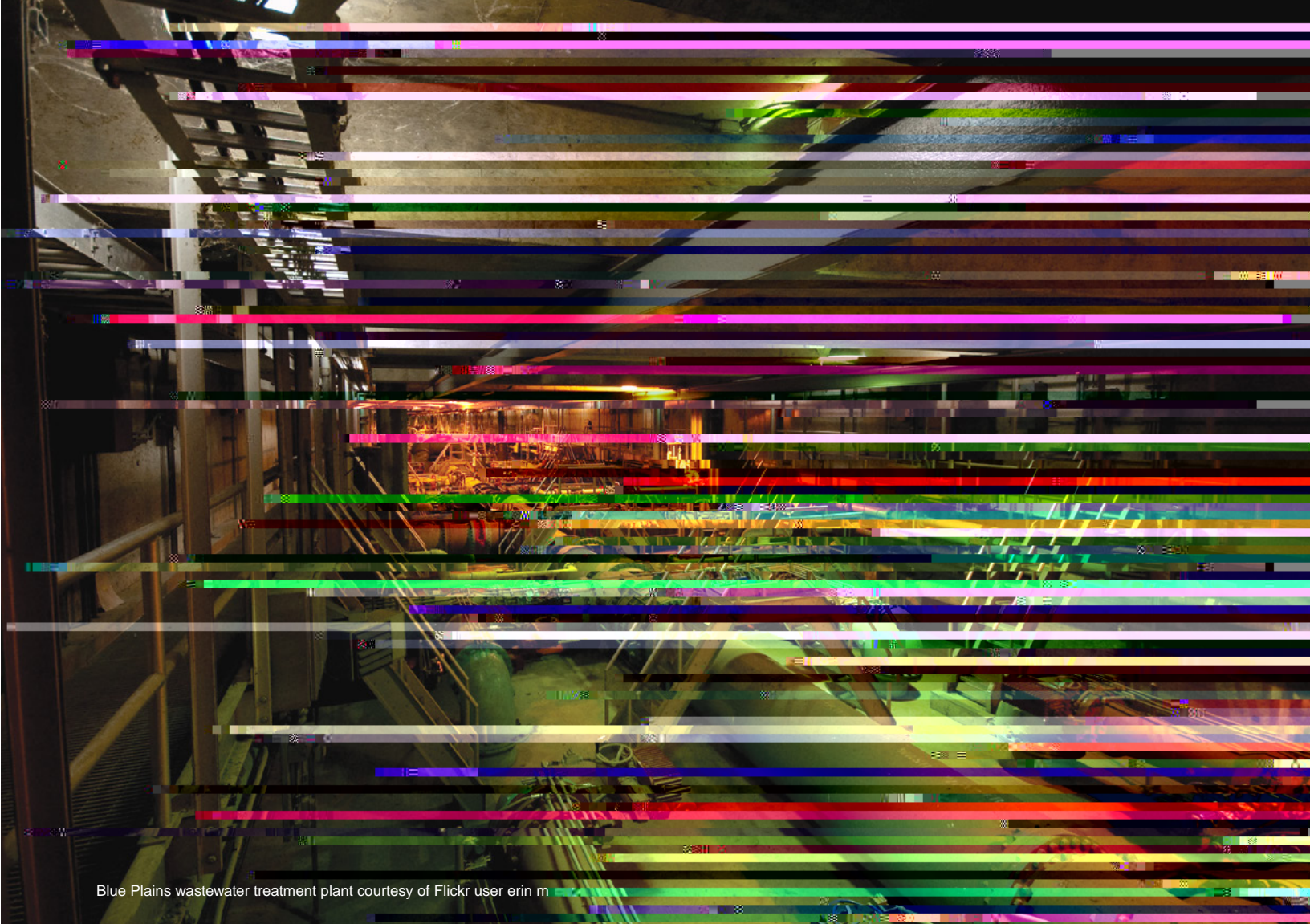
## CORE THEMES

Water is necessary for energy development and delivery, just as energy is required for water delivery. There are parallels between the water and energy sectors, such as the decentralization of distribution and recovery, and issues related to local supply (i.e., rainwater and solar). For both water and energy, changing usage disrupts standard infrastructure and revenue models that have relied on experts at centralized facilities. New forms of data collection are challenging utilities to become more accountable. Mimicry of natural systems is another disruptive innovation—green infrastructure offers new opportunities, particularly for application in the water sector.

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5 See NACWA, WERF, and Water Environment Federation, “The Water Resources Utility of the Future: A Blueprint for Action,” <http://www.nacwa.org/images/stories/public/2013-01-31waterresourcesutilityofthefuture-final.pdf>; NACWA, “Water Resources Utility of the Future: A Call for Federal Action,” <http://www.nacwa.org/utility-of-the-future/files/assets/basic-html/index.html#page1>





Blue Plains wastewater treatment plant courtesy of Flickr user erin m

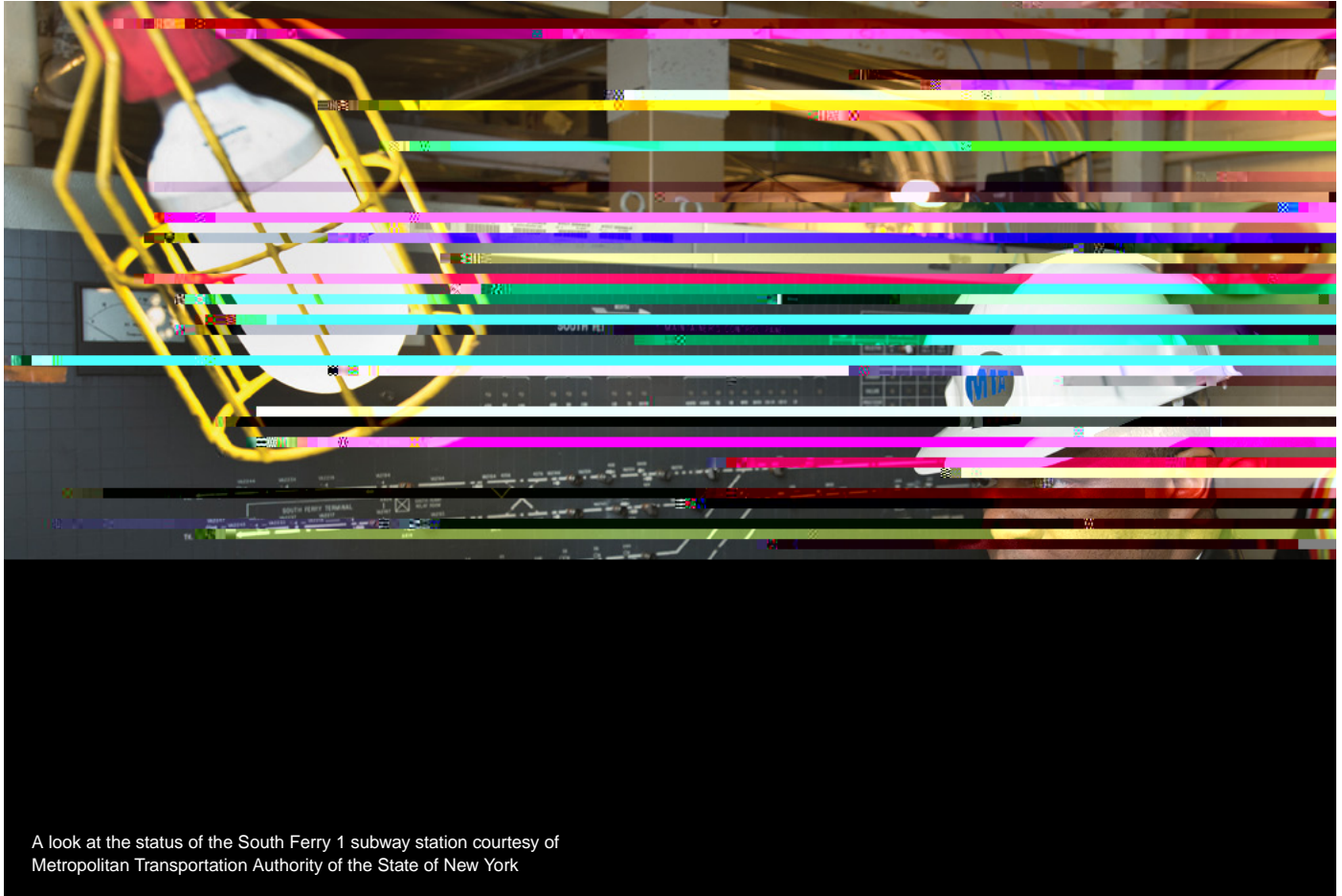
## D.C. WATER

The District of Columbia Water and Sewer Authority (DC Water) is using public-private partnerships and innovative financing mechanisms to upgrade infrastructure while maximizing environmental and financial benefits.

In partnership with the Pepco energy utility, raw sewage at the Blue Plains facility is safely recycled into a nutrient rich fertilizer while using digester gas to produce renewable energy for DC Water's operations. Through another partnership, Veolia Water will implement operational and process improvements at the Washington Aqueduct. DC Water is also a leader on data collection and analytics, for example, using sensor technologies to ensure early notification of problems.

Green infrastructure is being used to reduce combined sewer overflows through the Clean Rivers Project. Recently issued municipal "green" century bonds, to be repaid over 100 years, help finance such initiatives. In 2013, seven teams submitted designs for DC Water's Green Infrastructure Challenge. Winning contracts selected in 2015 went to CH2M for the design of the Kansas Avenue Green Infrastructure Parks Project and to Nitsch Engineering for the Kennedy Street Green Infrastructure Streetscape Project.<sup>6</sup>

<sup>6</sup> See: District of Columbia Water and Sewer Authority, <https://www.dewater.com/greenchallenge>; Water Environment Federation, <http://stormwater.wef.org/2015/06/dc-water-announces-green-infrastructure-agreement-training-program/>; <http://stormwater.wef.org/2015/01/obama-administration-announces-water-finance-center-new-municipal-bond/>



With regard to pricing, there is not a single model to fit all customers. Most water pricing currently operates with fixed charges and a flat fee, based on service size, distributed across the customer base. However, like the energy industry, time of use is being adopted. If water were priced high enough so that the entire cycle worked, it would incentivize the water sector to work with the energy sector to reduce use.


Resiliency planning and post-disaster rebuilding offer important opportunities for rethinking urban infrastructure. Some cities, such as New Orleans after Hurricane Katrina, rebuilt in a different way whereas others, such as New Jersey after Hurricane Sandy and New Zealand after the Christchurch earthquake, faced challenges in creating radically different rebuilds. The multiple small-scale, decentralized systems operated

by Natural Systems Utilities were able to provide service almost immediately after Sandy. In some cases private utilities performed better after Sandy because, in contrast to municipal utilities, they planned beyond their boundaries.

Education and idea sharing, such as work by the Department of Energy on the water-energy nexus and by the U.S. Water Alliance, play a crucial role for advancing holistic approaches for more resilient water and energy systems.

7 U.S. Department of Energy, The Water-Energy Nexus: Challenges and Opportunities, June 2014, <http://www.energy.gov/sites/prod/files/2014/07/f17/Water%20Energy%20Nexus%20Full%20Report%20July%202014.pdf>

# Big Data, Big Benefits?

 **KEY QUESTION:** How are data-powered breakthroughs reshaping the delivery of vital urban services such as energy, water, and transport? Are new opportunities or better outcomes being created for consumers/citizens, utilities, and government regulators?

## SETTING OUT KEY ISSUES

There are many opportunities for technology to drive efficiencies and help cities with their sustainability goals, targets, and policies. However, there are risks related to the safe and secure use of advanced networks. How are appropriate tools being developed to meet needs in the urban context?

Melanie Nutter provided an overview of San Francisco's ambitious carbon reduction goals. The city's carbon profile is similar to other urban centers, with 52% coming from buildings, 43% from transportation, and 5% from waste. The "0-50-100" Climate Action Plan sets out a goal for zero waste, 50% of all trips shifted to non-automobile transportation, and 100% renewable energy. The city's green building program includes mandatory LEED certification and, for the past two years, an ordinance for energy reporting on all existing commercial buildings over 10,000 square feet. According to Nutter, the EPA's Portfolio Manager tool is used because data is difficult to get directly from utilities. Now many other USDN member cities also have disclosure ordinances.

Scott Mauvais, Director of Civic Innovation at Microsoft, provided a synopsis of sensor network architecture as it pertains to the Internet of Things (or Internet of Everything). He outlined three main steps in translating data from things into a usable format: sensors send data; networked aggregators receive data; and finally applications conduct analysis and respond appropriately, such as sending an alert when there is

a fault. He pointed out that as more intelligence gets built into infrastructure, the digital realm becomes physical, requiring increased consideration for security.

Marc Collins, Senior Principal Consultant at Itron Co., continued with an explanation that as we move from a centralized model to distributed resources, new regulation is needed, particularly for managing resources and infrastructure that cannot be digitized and will continue to carry physical risks (i.e., water, electricity, gas). With consideration for security, questions revolve around if and why certain systems should be put into the cloud. We must better understand costs and benefits, the value of data, how technology will be used, and what KPIs need to be created.

## CORE THEMES

In spite of the current infatuation with big data, more is not always better, particularly with regard to consumer behavior change. The focus should instead be on getting the right data. "Fog" computing offers an alternative whereby data transfer occurs at the level near the source to minimize data streaming and localizes certain types of analytics. This might be more appropriate for a water treatment facility or single nodes in a lighting system. Whether data is best moved to the centralized network (cloud) or kept at the edge of the network (fog) depends on the infrastructure and needs. Defining those needs for data must happen before decisions are made about network architecture.



# Engaging Urban Citizens

**KEY QUESTION:** How are urban citizens engaging differently and how are these changes shaping policy making? Are citizens no longer content to remain passive consumers of services? Are larger institutions, such as utilities and government regulators, going to have to relate in new ways to a more activated citizen?

## SETTING OUT KEY ISSUES

At the start of any engagement process, there is a need to develop common context and points of reference. Charles Rutheiser, Senior Associate, Center for Community and Economic Opportunity, Annie E. Casey Foundation, observed that resistance to easy solutions can be traced to the nature of a problem. “Wicked problems” are the unordered or messy social problems that cannot be tackled solely by science and engineering approaches. These problems relate to complex adaptive systems.

Issues related to equity typically carry the hallmark of wicked problems. This means that people are approaching the problem from different frames of reference with asymmetries in access to knowledge and power. Policy is generally approached like a mechanical system in which an action (i.e., “policy lever”) is intended to trigger a predictable outcome. Wicked problems are not this consistent or predictable.

Policy made by private institutions is not subject to public review, which is particularly relevant with the increasing privatization of basic public services. This is compounded by the changing nature of what is considered public, private, and personal. Water, energy, and transport systems are all highly complex. Technology adds another layer to the complexity that can make these systems inaccessible to many people.

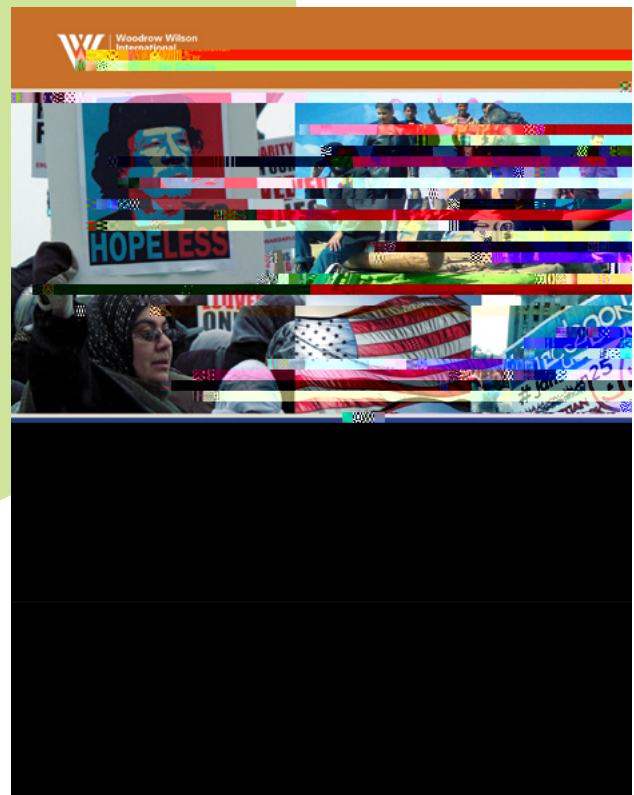
Jim Waring, Chairman of Cleantech San Diego, added a different dimension to the conversation, suggesting that citizens are not actually engaging; however, Waring also made the case that citizen engagement is not essential to the creation of smart cities. Most people are too busy to be expected to engage, while those who do are self-selecting and are not

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inefficiencies and fragmentation. Developing policy, tools, and capacity to drive and maintain efficiency, especially for utilities, can simultaneously enhance citizen engagement. Properly valuing externalities is a key solution to many problems, including

collective decision making about investments in and distribution of resources. Incentivizing desired actions, i.e., pricing water, can be an important tool for policy makers.

A coherent vision or aspirational strategy, such as the “National Strategic Narrative,” enables a systems view—rather than a focus on single interventions—which can be broadly implemented and then translated at the local level.



# Policy Implications and Actionable Ideas

**KEY QUESTION:** What are the policy frameworks that allow for holistic solutions that cut across sectoral and jurisdictional boundaries for prosperous, sustainable, and equitable cities of the future?

## SETTING OUT KEY ISSUES

Mark “Puck” Mykleby, retired Colonel, USMC and Founding Co-director, Strategic Innovation Lab, Case Western Reserve University, introduced sustainability as a grand strategy of the United States for the 21st century. In 2009, Mykleby, together with Captain Wayne Porter, was asked by then-Chairman of the Joint Chiefs of Staff, Admiral Mullen to develop a concept that shifts national focus from threat and risk to opportunity. As development of the strategy progressed, it became evident that the underlying problems in America tied back to global sustainability. To meet this great global challenge “A National Strategic Narrative” was developed, outlining a policy framework to align the country’s economic engine, governing institutions, and foreign policy.<sup>8</sup>

The strategy’s vision included walkable communities, regenerative agriculture, and productivity revolution. This represents a movement toward sectors that generate greater economic benefit per input—such as agriculture, construction, and transportation—rather than investments in sectors such as retail, finance, and information services. An alternative growth scenario outlines key approaches within each sector to create a new economic system based on full spectrum sustainability. The intention is to integrate whole functional systems for key supports such as food, water, and shelter. For example, ecosystem service markets are used for the natural resources sector, distributed

renewables for the electricity sector, and multi-modal mobility systems for transportation.

## CORE THEMES

With the understanding that cities offer tremendous opportunity as effective arenas to catalyze action, attention must turn to identifying points of intervention, engagement, and leverage. Regional, state, and federal support for cities is invaluable. The “National Strategic Narrative” offers an entry point for city level strategy action.

It is easier and more likely for cities to adopt change once one takes the initiative. Trailblazing can be located in large cities, such as New York or Chicago, yet important models can be found in urban areas that have received less national attention and that are less commonly identified with sustainability. For example, Salt Lake City has effectively used sustainability as the logic for the city. Houston and Austin are favorable for sustainability action, located in regions of strategic importance where energy, water, and agriculture come together. Kansas City offers an important smart city model for small and medium-sized cities for its sustainability transition by making the urban center more appealing for densification. Important insights can be drawn from models in cities in other countries around the world, for example the use of PPPs in London and Stockholm. However, any formula needs to be calibrated, socialized, and connected with each city’s identity.

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<sup>8</sup> See Wayne Porter and Mark Mykleby, “A National Strategic Narrative,” (Washington DC: Woodrow Wilson Center, 2011), <http://www.wilsoncenter.org/sites/default/files/A%20National%20Strategic%20Narrative.pdf>

Models for regional, state, and federal level action are also important. Federal agencies can advance integrated approaches to policy, such as the work of the Department of Energy on the water-energy nexus. While the California Environmental Quality Act (CEQA) and the environmental review process are focused on impacts, similar attention should be given to assessing inaction. Monetizing externalities is a critical area for change and creating opportunities. New roles assumed by the U.S. Council of Mayors or city implementation of a carbon tax, such as in Boulder, Colorado, are examples of mayors seeking new mechanisms that enhance and extend their voice, power, and tools to bring about change.

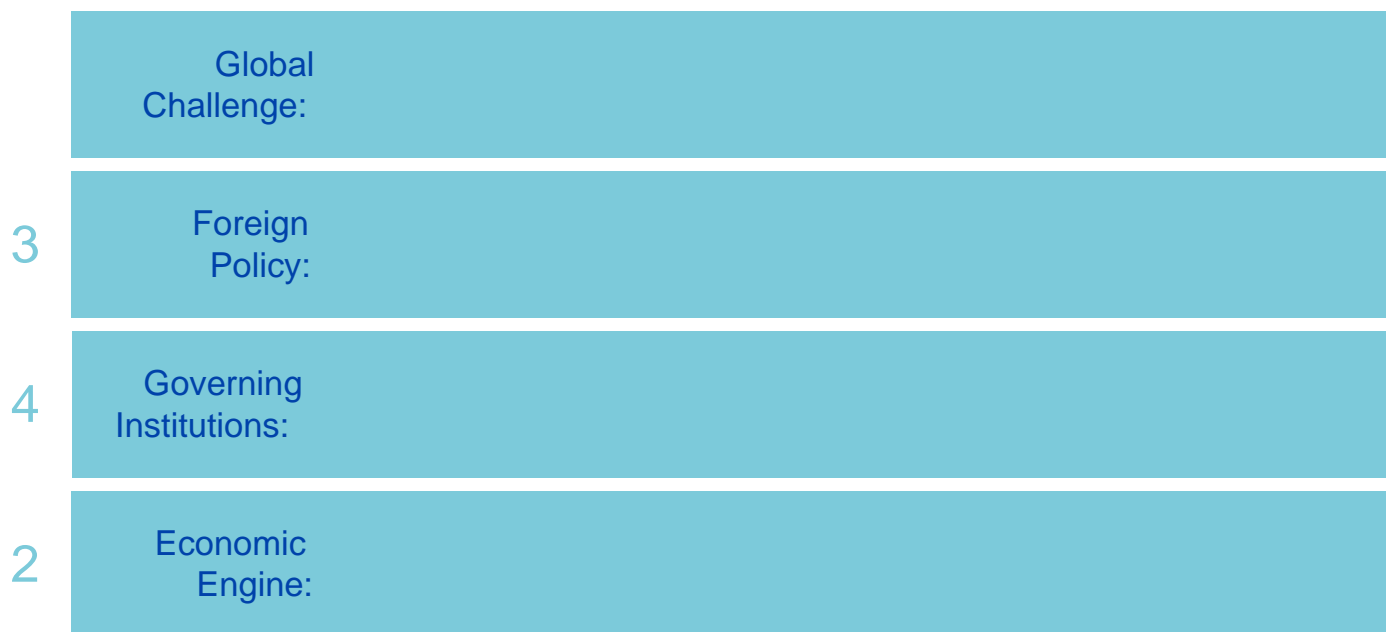
Private sector buy-in and multi-sector coalitions can provide valuable support for the work of cities.

Successful city leaders are engaging with a diverse, full spectrum of stakeholders, including academics, business leaders, and civil society organizations.

It is important to leverage work with the “just below” layer of people in city government and the private sector. This layer includes senior managers, deputy department heads, and others who are catalysts between action and strategy/policy and who can bridge and influence both higher and lower layers of the bureaucracy.

A coherent vision or aspirational strategy, such as the “National Strategic Narrative,” enables a systems view—rather than a focus on single interventions—which can be broadly implemented and then translated at the local level.

## A NEW US GRAND STRATEGY



Source: Mark Mykleby, Strategic Innovation Lab, Case Western Reserve University



# Conclusions

THE CROSSOVER WORKSHOP was an intensive exploration of core issues related to urban energy, water, and transportation. Participants recognized the complex adaptive systems nature of urban sustainability and the need for broad, integrated approaches that work together across space and time. The necessary shift to long-term integrated planning

## WORKSHOP PARTICIPANTS

[Samuel Bockenbauer](#), Energy Policy Fellow, U.S. Department of Energy

[David Bragdon](#), Executive Director, TransitCenter

[Lynn Broaddus](#), President, Broadview Collaborative, Inc.

[Marc Collins](#), Senior Principal Consultant, Itron Co.

[Frank Cutitta](#), Editorial Director, Smart & Resilient Cities

[Roger C. Dower](#), President, Johnson Foundation at Wingspread

[Gordon Feller](#), Director, Office of the Executive Vice President, Cisco Systems; Global Fellow, Wilson Center

[Charles Kiely](#), Assistant General Manager, Customer Care and Operations, District of Columbia Water and Sewer Authority (DC Water)

[Julie Kim](#), Senior Fellow, New Cities Foundation, Global Projects Center, Stanford University

[Ken Kirk](#), Executive Director, National Association of Clean Water Agencies (NACWA)

[Michael Kleeman](#), Senior Fellow, University of California, San Diego

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[Rachel Nguyen](#), Executive Director, Future Lab, Nissan Motor Ltd.

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