Sustainable Cities: Harnessing Urbanization to Achieve Social and Environmental Goals

Summary

Cities have great advantages. They provide good jobs and are the most efficient form for delivery of services such as waste disposal, power, education, fire protection, and transportation, when compared with rural areas. City dwellers also use less energy than their counterparts in the countryside. Many experts envision that cities of the future will utilize more sustainable water, waste, energy, and transportation infrastructures. But what will drive the innovation needed to create these cities? And what role will government, industry, and NGOs play in bringing about this change? On November 8, 2012, the ELI—Miriam Hamilton Keare Policy Forum hosted a panel of experts to discuss the future of sustainable cities.

Lynn Scarlett, Former Deputy Secretary of the Interior (Moderator)
Shlomo (Solly) Angel, Adjunct Professor of Urban Planning, New York University
Ken Cornelius, Head, Global Center of Competence Americas, Siemens Infrastructure & Cities
Colin Harrison, Distinguished Engineer, Enterprise Initiatives, IBM
Julia Parzen, Coordinator, Urban Sustainability Directors Network
Carter H. Strickland Jr., Commissioner, NYC Department of Environmental Protection
Terry F. Yosie, President & CEO, World Environment Center
John Cruden, President, Environmental Law Institute

John Cruden: Welcome to the annual Keare Forum. I'm John Cruden, president of the Environmental Law Institute, and you're in for a treat. This is the beginning of our focus on cities and in particular, our focus on this enormously important area of sustainable cities.

At the same time we honor cities, we are mindful of the devastation that has occurred recently. We are mindful of the hundred deaths we know right this second in New York, in New Jersey, that those individuals are coming out with resilience and with courage. We honor the leadership in New Jersey and New York in particular. Just for a second, I would like everybody just to take a moment of silence thinking about those great individuals and what they're experiencing right now.

Our moderator today is Lynn Scarlett. For a number of years, she was at the U.S. Department of the Interior, where she served most recently as a Deputy Secretary of the Interior and their Chief Operating Officer. Lynn spearheaded and chaired the Cooperative Conservation Task Force, which established the partnership and collaboration office to strengthen interagency cooperation and conservation partnerships. She is now the co-director of the Center for Management of Ecological Wealth at Resources for the Future in Washington. She's a great environmental analyst and scholar. Her work focuses on landscape-scale conservation, climate change adaptation, greening of businesses, infrastructure, and many other issues. We welcome her as a great friend of ELI.

Solly Angel is a senior research scholar and professor of urban planning at New York University. He holds a doctorate degree of City and Engineering Planning from Berkeley. He has taught urban planning at a number of leading universities across the nation. He has been a senior consultant to the United Nations, to the World Bank, to the Asian Development Bank, and to the Inter-American Development Bank. In September, he published *Planet of Cities*, and he has co-authored the companion volume of *Atlas of Urban Expansion*.

Ken Cornelius is the head of the Global Center of Competence Americas for Siemens. He has been in the position that he now holds since this year. He is responsible for the sales and marketing functions that deepen local relationships across Siemens' important business enterprise. I find it interesting that he is currently on the board of directors of the Georgia Chamber of Commerce, the Metro-Atlanta Chamber of Commerce, and the Georgia Research Alliance. He is the ambassador for Siemens to Atlanta. In that capacity, he is working with leaders on civic, government, and environmental matters across that great city.

Dr. Colin Harrison is the director and distinguished engineer for IBM. Dr. Harrison is the director of the Enterprise Initiative team working on technical coordination of IBM's Smart City offerings. During 2009, he was the principal contributor to establishing a global business

team for Smart Cities and for communicating the technical vision to IBM's clients.

Julia Parzen is the coordinator of the Urban Sustainability Directors Network (USDN). She's had substantial positions in both public and private positions. She is working now to improve sustainability, development, program design, project management, and education. She's been a foundation officer director. She worked in conservation and employment. She's advocated triple bottom-line entrepreneurship. She's been a leader in state government. Her role as coordinator in the USDN is important—that's a group of one hundred members that are actually focusing on the public center sustainability.

Carter Strickland is the Commissioner of the New York Department of Environmental Protection. Carter was appointed the commissioner in New York City in August 2011. Before then, he was the department's deputy commissioner, where he oversaw environmental planning analysis and permitting. He served in the New York Attorney General's Environmental Office and he has lectured and been a professor of law at Rutgers University.

Dr. Terry Yosie is the president and CEO of the World Environmental Center (WEC). Terry works in developing and implementing strategies to advance sustainability throughout the business operation of all the WEC member companies. Prior to the WEC, he was the vice president of the American Chemistry Council. He has also served as the director of the [U.S. Environmental Protection Agency (EPA)] Science Advisory Board, where he advised on the scientific basis of public health and environmental decisionmaking.

Lynn Scarlett: Thank you very much, John. I want to first join John to express my sympathies and condolences and concerns to all those communities that were so affected by the recent hurricane and appreciate the outstanding work that the public servants and the private citizens that helped to recover from that effort. Thank you very much for that.

Over one-half of the world's population now lives in cities, and that trend continues upward and, of course, a central question is, as cities already struggle with many challenges, how does one bring about the three pillars of sustainability: social well-being; environmental well-being; and economic well-being? I'm not going to try and launch this discussion by defining sustainability. I feel like it's a bit like that U.S. Supreme Court decision, you know it when you see it, but we'll hear the various expressions and elements of it through the conversation with the panelists.

City sustainability, though, does require comprehending the linkages between cities and countryside. Sustainability is not simply about cities. Cities are linked, in fact, to the natural world, the rural world, and the agricultural sector. One must think holistically about the interconnections of water, energy, transportation, communication, and other infrastructure, something that we were so acutely aware of in the recent aftermath of Hurricane Sandy. When one system goes down, it affects others and others. And then, of course, there's the constant refrain of how all of that interconnects fundamentally with human well-being.

Now, there are challenges. As we think about these and as we respond to these issues, there are governance challenges. We have interconnected issues, interconnected domains, and yet fragmented institutions, multiple jurisdictions, and different agencies with specific responsibilities. How does one bring those together? How does one achieve coordination so that we can look at the whole while still looking deeply at the parts as well?

Julia will talk to some extent about challenges of innovation; those challenges are multidimensional. They involve the public sector and the private sector. They involve technology, but they also involve institutions and market design. They involve thinking about ways of addressing old needs with new concepts. Into that picture, of course, comes green infrastructure. Some of our panelists have talked about biomimicry, about bringing nature back into cities as we think about increasing city resilience.

There are challenges and questions about the decision setting. Are the regulations, rules, and processes within which cities both here in the United States, but elsewhere across the world, commensurate with the needs of working on a multidisciplinary, multiagency, multijurisdictional way? There are finance challenges. Old infrastructure and needs for new infrastructure. Who pays for what and how?

And then, of course, fundamentally, there are challenges with respect to the well-being of people. This, perhaps, includes questions not only about the ability to have food, to have jobs, and to be educated, but also about fundamental challenges of civic engagement. Part of sustainability, I think, is about that engagement, about ensuring that decision processes engage those who are affected by decisions.

Colin, in your writings, you describe the challenges of meeting the food, water, and energy needs of cities that collectively are growing at a pace of 180,000 people per day. I'd like the panel to think about the characteristics of resilient cities and how these characteristics depart from traditional assumptions about functional cities.

Colin Harrison: Thank you very much, Lynn. The work that we began several years ago in IBM around Smarter Cities probably fits quite well into certain aspects of sustainability. But in the last 12 months, I've personally become very much involved with a group of large enterprises that came together to initially look at the stress nexus. This is the challenge around water, energy, and food that we anticipate from mid-century. The challenge will be driven in part by population growth, but actually it will be driven far more by the emergence of the global middle class. This is what is really going to create demand for resources. From that, this group has started to understand some principles that we might apply to cities, to regions, and to industrial areas.

I think the first principle would be learning: the ability to learn from history. One of the saddest things I came across last year when I was in northern Japan after the

earthquake was that in the valleys going down to the ocean that were inundated by the tsunami, there are stone markers that have been there for 800 years. These markers say: "Do not build below this line," and yet people did. So, first, it is the ability to learn from history.

The second point is to have foresight and to anticipate and understand that there are known threats as well as unknown threats. Consider those threats and mitigate them. Essentially, make sure that you're making an appropriate investment in defenses infrastructure. Japan is perhaps the world's leader in that kind of preparation. Japan has 28,000 kilometers of coastline and 40% of it has a tsunami wall around it. It still wasn't enough, of course.

The third principle that goes to the heart of what IBM would like to bring to this area is around connectedness through the flow of information. We have a concept we call the single version of the truth that we've applied, say, in Rio de Janeiro. In an emergency, this enables all of the responders to have a common vision of the actual situation that is integrated across space, across the dimensions of the city, and also across time. It enables everyone to see what no single person could see.

So, I think those are, for me, probably the most important principles. I'd just make a point that resilience is a little bit different from sustainability in that it's very much about that ability to essentially rebound from a major stress, whether it's an acute stress like a hurricane or an earthquake or events within a long-term stress, such as resource spikes or spikes in prices of resources that can cause challenges to a population.

Lynn Scarlett: Carter, having just come out of a historic hurricane presenting all manner of challenges to the city, how do you think about resilience? And having gone through this experience and rebounded and continuing to rebound, does it cause you to think about that concept any differently? And/or what do you think the city has done well? Where do you think are areas in which further resilience might need to be reconsidered and invested in?

Carter Strickland: Well, I think it was devastating certainly. We had 41 lives lost. The number just went up yesterday unfortunately. Acres and acres of neighborhoods were devastated by a 14-foot storm surge. I think it certainly requires us to think about worst-case scenario planning. The question is how do we do it? There have been a number of planning efforts underway already.

We did learn from past disasters in the city and we now have a very robust Office of Emergency Management, contingency plans, and the like. We were able to order the evacuation of people in low-lying areas certainly averting not every death, but a significant number. That said, many of the planning efforts that were underway will take on new urgency. We have studies underway to measure down to the pump level in our wastewater treatment plants and the elevations of other critical equipment. We've tried to learn something useful from this experience. The infrastructure that I'm directly responsible for weathered the storm fairly well, but we have compared measured impacts with modeled results, and it will be a learning experience. Now, what do you do with that information? It has to affect investment and rebuilding decisions. In fact, the city has had underway for several years an effort, organized in our New York City sustainability office, called the Green Buildings Task Force.

The Task Force came out with recommendations a number of years ago that were enacted into law. As a result, our building code now requires new construction in certain coastal flooding areas to have elevated heating and electrical equipment. Certain critical uses such as new hospitals must have an additional amount of freeboard. For everyone else, including existing buildings, it's optional for the moment, though I understand that FEMA [the Federal Emergency Management Agency] does provide insurance breaks depending on the amount of freeboard we have.

The code approach to achieve resiliency at the building level is something that we will extend. There have been many discussions in our city and elsewhere about city-level structures. I'll have more to say about that later tonight, but I think certainly there are small-scale interventions that we could do right now that can protect our cities.

Lynn Scarlett: Julia, you've done a lot of thought about learning processes and their importance. How is it that cities learn? How is it that they don't fall into the situation described in Japan, where 800-year-old markers discourage building, yet, nonetheless, building had occurred?

Julia Parzen: In 2007, I was the outside program manager for the development of Chicago's Climate Action Plan, which was an adaptation and mitigation plan. At that point, it was kind of anathema to be working on adaptation. It was seen as saying you've given up on mitigation. That has changed over these five years for a combination of good and bad reasons obviously.

But at this point, in the USDN, there are 120 cities, about 50 million in population. New York City is a real leader in this network. It's a peer-to-peer network of cities, and just about everybody is working on adaptation planning at this point. But on learning, let me give you a great example. We have an innovation grant program where groups of cities can come together to collaborate on a problem, so seven of the Mountain West cities came together.

Sometimes, it's hard to talk about climate change and adaptation in their cities, so they decided if they worked on adaptation planning together, they could point to each other and they could also learn from each other. Of course, they have some similar issues around water. So, instead of one city doing a plan, seven cities are together doing a plan. They're getting moral support from each other, but they're also being able to pool resources to study together. They're being able to test ideas, different ideas in different cities and see how they work and compare.

So, this idea of having a region that shares some common issues around, for example, climate change, and being able to learn how to adapt together, is really powerful. I mean, they are very excited about it. We also have a user group of about 30 cities that meets monthly by phone to compare stories on approaches to adaptation. They've sort of dealt systematically with new buildings, with infrastructure, and with sea-level rise.

But the key thing that it comes back to, which is so exciting about this around learning, is this is really in the end as much about process as how you deal with a particular answer. So, what they're talking about is, how do we build the adaptive capacity of our cities? What structures are we going to put into place? A lot of the learning that's going on is, how do you get the crossing?

In Chicago, we actually had a pro bono project from Oliver Wyman. It was an $800,000 project for the city to do a risk assessment for every department in the city. What is the risk around transportation? What is the risk around water? Great to have this study, it was fantastic, but most important were the conversations that took place with all of the different departments around the table, seeing how their work interfaced.

Learning happens at the city level with interconnections, which is partly how you get innovation, at the regional level by going through the process together, and then at the North American level. New York, as they said, has been a real leader in this. It's building policies other cities are looking at and adapting. There is some great work going on in Toronto about insurance risk; other cities are looking at that. So, this is an area where you can model adaptation and learning so well because it's what the topic is really about: how are we going to be ready to change as our environment changes?

Shlomo Angel: Let me start by saying that I really like the term "resilience" because I think it correctly describes our predicament. There are going to be setbacks, and then we will have to come back to where we were before. Repair rather than prevent, which is what people want. They don't want to be bothered—just get it right the first time and we don't want to hear about it. We just experienced a few days with no electricity, no hot water, no Internet, and no telephone in New York City. We just ordered a landline, instead of the Vonage line, and a transistor radio. So, now we can increase a little bit our ability to handle shocks in the system, shocks for which we were not prepared before.

Now, I think that there is an important distinction to be made between rich cities and poor ones. There's a river in Jakarta, for example, that floods every year. There are squatters that build their shacks along the edge of the river, and they get washed out every year. After they get washed out, they build their structures again. So, they're very resilient, and they don't invest a lot of money in these shacks. And the fact that they get carried away is okay.

I think what we're going to face in New York—and I'm sure we're going to face it soon enough—are demands for mitigation. Let's have a big barrier out there in the ocean that's going to take care of everything. We want perfect security. We want to reduce risk. The idea is the opposite. The poorer you are, the more at risk you are. And the way this will work is the more you are one with nature, the more you realize that it's going to be give and take. And that many cities, especially in developing countries, are not going to have the resources for mitigation or for building dikes along 40% of their shoreline. These cities will have to be built for destruction and reconstruction in the future.

Carter Strickland: The Dutch have a good example of that. They obviously have some major surge barriers, but they also have a new concept now, nearly 10 years or so of "living with water." As they contend with water in front of and behind the dikes, they realized, we have to live with this.

Lynn Scarlett: Terry, you've written a lot about system-level interactions across energy, food, telecommunications, and transportation. These interactions, in fact, are described by Colin Harrison in another article. I alluded to them in my opening comments. One of the challenges cities face as they strive to become resilient is that some of the problems actually unfold or transcend jurisdictional boundaries.

In other instances, the problems involve interconnected or at least conceptually interconnected kinds of infrastructure. I remember reading about Albany, New York. I think it was where the wastewater treatment facilities are owned and managed by one entity. The pipes and tunnels are, in fact, managed by yet another entity. The freshwater system is yet another. And that is replicated across this country. The challenge is how one coordinates across these fundamentally interconnected kinds of infrastructure or issued domains.

Terry Yosie: For purposes of this discussion, I would distinguish amongst three different types of governance. Each type is currently being applied. There is that form of governance that most of us are familiar with, which is the top-down, hierarchal form of governance that is characteristic of many government agencies or corporations. Second, there is the network system of governance. A marketplace is a good example where information is available to participants in that marketplace. Buyers and sellers exchange that information for purposes of mutual gain through that common network. Third, there is collaborative governance where discrete groups or institutions find common cause in order to achieve certain specific goals that they're both interested in advancing.

What's interesting today is that all three kinds of governance are being rapidly challenged by advances in technology, where we have an ability to measure and acquire information that sometimes overwhelms the capacity of our formal governance structures to understand and apply it. More fundamentally, what's challenging our system of

governance is that we're used to a situation where we're trying to solve very discrete problems. We're trying to reduce particulate matter in the ambient air. We're trying to reduce toxins in the water supplies. We have very discrete programs and initiatives in order to manage toward these objectives, and we've done reasonably effectively at that task.

What's fundamentally changed though is now we're at the leading edge of a situation where the challenges facing us are more at the system level, where you have the deterioration of many different kinds of infrastructures at the same time, or where you're trying to respond to the connectivity across water, food, and energy, or we're beginning to understand the impacts of climate change. The system of governance that we have is very ill-equipped, ill-designed, ill-prepared to deal with that system level of integration. And since New York and New Jersey are so much in our minds these days—I was reading in the *New York Times* the other day that Gov. Mario Cuomo has already said that he favors a response where New York City would have massive construction of seawalls around the flood-prone areas of Manhattan.

My response at this time is: how would he know the right answer at this point? There are going to be a number of other proposals, such as the modification of building codes, relocation of power generation and storage units, or enhancement of natural systems for floodplain management. I think the challenge that is facing Governor Cuomo, Gov. Chris Christie, Mayor Michael Bloomberg, and every other local official and impacted citizen, is how to arrive at a system-level solution that responds to the very clear, critical, short-term emergencies, where you have to provide people with food, shelter, fuel, and economic livelihood. In the process of making those decisions, how do you leverage the adaptability of those urban areas to persevere, survive, and thrive against those system-level changes?

Fortunately, we have examples of where people are already trying and in some cases have successfully grappled with those issues. As one instance, I would urge you to take a look at what's going on in the management of the Colorado River Basin, a geographic area that is just as large as the area impacted by Hurricane Sandy and one just as complicated with all the politics of water of the West and the interests of environmental groups, water authorities, hydropower, Native Americans, a number of other organizations, consumers, and citizens. They have been successful in designing a governance process whereby they've elevated the level of governance to respond to the system-level challenges that they're facing.

Lynn Scarlett: If you look at the literature on network governance, it actually starts in the private sector, as many companies move from a vertically integrated provision of goods or services, then to a contracting model, and then finally to what might be called a partnered or network model. How do you work with multiple other entities—public and private—to pull together the knowledge to deliver the services that your companies are now delivering?

Colin Harrison: If I can allude to Japan again, one of the things that was a wakeup call for many companies last year was that an earthquake and a tsunami in northern Japan had repercussions in Detroit and Stockholm. That as a result of globalization and the global Internet, we now find ourselves as enterprises connected through our supply chains to disasters on the other side of the planet. I can say for IBM that this has caused us just to do a lot of introspection and development work around the analysis of the total context in which our operations take place.

When the flooding occurred in Thailand last year about this time, for example, our own supply chain people clearly were concerned about the people in Thailand. But IBM has no manufacturing there, so in a sense, we're not affected. But then, it's a short thought from that to realize that, oh, yes, but we buy disk drives from Western Digital, and Western Digital has 40% of its manufacturing capacity in Thailand. So, again, through the integrated ecosystems of industry, we're increasingly connected to disasters wherever they occur on the planet.

Ken Cornelius: I think we've learned in the private industry, and I think you see it in government as well, that everybody is fine with working together as long as they are the one that's in charge. But I think in industry, you can have a plan that there's a clear share of what everybody does. There's a clear split of responsibility. Then there is a clear reward for that investment. I think we're seeing that. It's very easy to look at infrastructure projects that produce revenue or save money because there's a clear financial benefit for that. I think we're seeing that more and more.

One of the things I see as I've gotten more and more into the cities' infrastructure piece, is that we still basically behave and we do things from a process standpoint the way we did 50, maybe even 100 years ago. It's very difficult in a government setting to look at it and say, let's change this structurally, because it means somebody loses power somewhere. The idea of a city and a county combining responsibility and sharing the expenses, reducing the expenses, and sharing the benefit from that—it's almost unheard of. But even the way that we build buildings, though, we do things the way they were 100 or 200 years ago.

Somehow, somebody has to take a stand and try to stand out. The place I see it starting is with mayors of cities because unlike the federal government, the federal government can put things off for a long time. The mayor has to see his constituents every day, so they have to deal with the situation right now. The mayors, I think, are going to lead us out of this, where we are now, into the future where we need to go.

Lynn Scarlett: We're used to governance certainly in this country in which an agency has a set of responsibilities. In many respects, that brings clarity of accountability. When

one shifts to a network or sharing of governance across an attempt to address interconnected issues, challenges of accountability present themselves.

Terry Yosie: I would make three proposals, and not just in the context of Hurricane Sandy. I think it's in the context of a number of other issues related to system-level impacts. The three kinds of governance systems mentioned are top-down governance, network governance, and collaborative governance. I think we're going to need to find a mechanism to integrate all three in order to be sufficiently informed and adaptive to the kinds of challenges that will be confronting us. There is no single institution, there's no global company, there's no unit of government, there's no NGO [nongovernmental organization] that has the ability on its own to solve any of these problems. And so, while human beings as a species are initially stupid and we tend to be defined by or we tend to respond to crises, one of our endearing qualities is that we are ingeniously adaptive over time.

And so, I would make three quick proposals on how to deal with governance going forward. One is that I think we will probably have to create new kinds of special mechanisms to allow that collaboration across jurisdictions, across geographies, across political units, and across the public and private-sector boundaries.

Second, we're going to have to make investments so that as much of our infrastructure as possible becomes a lot smarter. In the future, we have to have an infrastructure such that the power-generation system is able to communicate with the homeowner who needs to recharge his or her electric vehicle, who in turn is linked into the bridges and highways that inform us what better routes we can take so that when we are in an emergency response situation, there's a system that's in place that talks to each other, governed by some rules and protocols. The emergency response people in cities and in states have gotten very good at knowing how to respond and who has what set of responsibilities in an emergency response crisis. We need to extend that kind of behavior, those kinds of responsibilities to a much broader plane. Only, the crisis we're going to be facing isn't just in a scenario of a terrorist attack or something like that; it's going to be in a scenario of an environmental or climate-related situation.

One of the interesting features that I've found about the Colorado River example that I cited was climate scientists are actually at the table informing the mayor of Denver or the mayor of San Diego, because they're able with their more precise understanding of climate science to be able to develop much more accurate scenarios on a much more specific geographic basis. I think we'll need to integrate that other kind of expertise.

One last proposal I'd make in terms of governance: consumers and the public have largely been left out of this debate about how to conduct our planning and how to make our systems more adaptive, yet technology will connect them more and more. Consumers already have the ability to regulate the level of energy they want to use in their homes. They're increasingly able to adjust how much water they're going to consume. Just extend that analogy across a lot of other systems relating to telecoms and things of that nature. So, we're going to have to figure out a way to make consumers much more engaged not only in terms of making positive choices, but also letting the marketplace signal consumers that if you're going to locate your house on a floodplain zone, there are economic consequences to the price you're going to have to pay to adjust for that, because the rest of us are not going to subsidize that behavior either.

Shlomo Angel: I want to make a pitch against coordination and integration. I've been teaching planning, and these are very common words. Every official wants to get everything coordinated. I find this absurd. The reason I find it absurd is if you want anything done, if you want to get anything done, you need to limit the number of voices that are preventing you from getting it done. Just tell me what I need to do and let me move forward. So, for example, I'll use a military analogy. In the military, when you move out, they tell you, you have this place from here to here. Don't go across into the other guy's territory, just keep within your own territory and move forward, and don't coordinate with anybody. My feeling is that it's much more complicated—what Terry said—because what we need is quick and effective interventions, interventions by organizations that have a limited agenda and that are not coordinated.

So, let me give you an example that I like from an environmental perspective. There's the Los Angeles Air Quality Control District. It is governed by the mayors of all the 35 municipalities in Los Angeles. They get together to deal with issues of air quality in the Los Angeles Basin. So, if somebody comes and says, we don't want to use oil paint on the buildings anymore. It pollutes the air. The mayors talk about it. And they vote "no more oil paint." And so that they deal with a single issue—and, yes, I know they can't deal with new emerging issues. In that, I agree. But we need institutional inventions where people are willing to give up their power, a limited amount of power, to create an organization with a limited ability to solve a problem, an organization that can move.

Carter Strickland: I wanted to react to something that Terry said about the collaborative model. If I could use the term integration, I'm trying to integrate those comments with the ones we've just heard, which comes down to the truism that if too many people are working haphazardly on an issue, no significant progress will be achieved. Someone has to be tasked with coordinating the overall effort. We can use the example that we had when the mayor began pulling together key people to create PlaNYC in 2006. Some of the walls that had to be broken down were pretty high. Those, of course, were the walls between agencies who each had a very specific mission, but because they

were doing it fairly well, the synergies between missions were not being exploited.

I think a few things explain New York City's success to date. One is that agencies got together initially to develop this overall strategic plan, but then we were tasked—the people, agencies, commissioners, and everybody else down the line—with getting very specific initiatives accomplished, initiatives that each agency was responsible for reporting out on.

At the Department of Environmental Protection, we are responsible for managing the water quality of the city and its surrounding harbor, and one of our initiatives is green infrastructure. I know it's something that Lynn has worked on. I think it's a great integrating policy that's also very specific. We have been able to get together with our Parks Department—which has gardeners, landscape architects, and a set of skills that we're acquiring but don't quite have yet—to deliver projects. So, it was more of a project-delivery mechanism, but we are providing the funding and reporting, and ultimately we are responsible for getting it done. That is a very specific model that works.

Lynn spoke of how we create space for that to work in the context of being a regulated entity. I think one successful model that we've developed with our state agency in a recent consent order was to create an adaptive management structure. In that consent order, we have certain targets that we have to meet, along with annual reporting requirements. If we don't meet our milestones, this approach builds in space to assess whether there is a slippage or if there is excess. What this approach does is give us space to try to find the best way to get things done, like our collaboration with the Parks Department.

Lynn Scarlett: Among the major challenges that cities face is aging infrastructure. We've all seen various price tags for replacing or upgrading and updating that infrastructure. But worldwide, there are places that have no infrastructure or very, very limited infrastructure, very crude infrastructure. How do the cities of this nation go about investing in infrastructure? Are there creative concepts?

Ken Cornelius: At some point in time, we have to start looking at cities as more like businesses and their citizens as more like customers. I know sometimes we look at all these people moving into cities as a big problem. But actually, it's a big benefit. It's because then you can spread the cost of the infrastructure across more people. But I think what you have to have, obviously, if people are just moving in without jobs, then that's a big problem. But what we're seeing around the world is that while people are coming in, there is innovation.

If you look at Germany, since our company is headquartered in Germany, it's the highest-cost labor of just about anywhere in the world. It's the highest taxes in about anywhere in the world. It's an old country and their economy is the envy of the world. One of the reasons is they take the money and they spend it on things like education and innovation. When you do that and you have a good infrastructure, you encourage businesses to move in, you encourage people to move in. You can have a great, great city. The biggest problem that cities have is not people moving in; it's people moving out. If you look at some of those cities around that are having some real trouble, it's cities where people are moving out.

Not everything has to have an obvious return on investment. Things like safety, I mean, if you think about New York City, they've done one of the greatest jobs of improving the safety of the citizens there. But that's one of the greatest values and that's what brings people in. That's what raises property value. That's what makes it a great place to live and to work.

I think we have to rethink when we think of too many people moving in. We have to think of what is the return going to be for the city and for the people. There are great examples of spending money that make sense. Too many times, the governments get in trouble by spending money for political reasons. Then, that just cascades into the whole mistrust and imbalance of budget and things like that. So again, I think it takes strong leadership.

But most infrastructures in most sustainability investments by nature are going to pay for themselves. By definition, with sustainability, you're using less stuff to do the same thing. So, that's beneficial. That's financially beneficial. I mean, infrastructure is all part of that. Most mass transit systems don't pay for themselves by the ticket sales. And so they say, well, why should we do this because it doesn't pay for itself? But if you look at what you don't have to pay in extra freeway lanes or in time that the citizens save in getting to work, or greenhouse gases produced by more cars on the road, then they almost all pay for themselves. So, I think we have to have a holistic view of the infrastructure investment.

Julia Parzen: Cities, as was pointed out earlier, are very practical; mayors are very practical. Of course, everyone is asking the question right now: how do we do it cheaper? And in a way, I feel like having the sustainability conversation is making sure it's not cheaper but also better. So, what's happening is you take an example like Philadelphia on their green infrastructure. They developed new tools for being able to analyze cost benefits. They decided, we're not just going to look at stormwater, we're going to look at water quality, stormwater, recreation, and clean water all together. And by changing the analyses, they could show that green infrastructure was preferable to another option. If they hadn't had the tools to do that kind of analyses, they couldn't have shown that.

What I see going on in infrastructure among USDN members is really driven in part by needing to find ways to pay for infrastructure, especially as you see less federal funding at a time where there's a lot of infrastructure needing repair. One piece of it is how do we do this at a lower cost, more efficiently, and how do we close leaks.

The other part is innovative finance. I know, for example, there are a number of cities that I work with that are very disappointed at this point with the private-sector involvement on the investment in capital side, especially related to energy efficiency. But more of those partnerships are forming. And then in terms of the innovative finance, a lot of it is around infrastructure banks. It's just talk at this point, but you have great examples. Like in Los Angeles, the mayor really supporting the 30/10 plan to put in 30 years of new transportation infrastructure in 10 years, and the federal government responding with a lot of advocacy to increase the funding available, the transportation, the funding available to do that.

So, one of the big opportunities is that most of these cities that I've worked with have internal change agents now either sustainability directors or chief innovation officers. They are going around as plans are being developed and raising these questions. Can we combine with this other area? And so, I see a huge amount of innovation, but also a tremendous frustration about the difficulty of attracting capital.

Colin Harrison: On the finance question, there are two principal groups there. One, the reinsurance companies in 2011, I think it was the worst year in history for them in terms of losses. I can't remember the exact number, but it's getting close to $400 billion that they had to pay out from insurance losses from major natural disasters. There are opportunities for creativity there. We do through this resilience alliance that I mentioned earlier, and IBM has had a lot of discussion also with Swiss Re, for example. We've also had similar talks with Lloyd's of London, too, about their ability to creatively make investments that will reduce the risk that they're insuring. So, there's a mutual benefit there.

In the case of Hurricane Sandy, I think the actual amount of insured property is relatively small compared to insured property destroyed in Japan last year. I was talking to Swiss Re last week; their view was total insured losses there are probably maybe only $10 billion or so. This is still a big amount of money, I appreciate, and much of it will fall directly on the property owners or state and federal governments.

The other group that is interested to help here, perhaps not so much in the developed countries but in developing countries, I'm thinking particularly, say, of Bangladesh or Vietnam, are the development banks. Their interest is, it would be very hard to bootstrap those economies unless they can mitigate some of the major risks that they face. Why would you make an investment in a plant in Bangladesh if you can guarantee that it will be flooded every year or every couple of years? So, there's a willingness there to make these investments in the understanding that they will enable further economic development, which again is in the interest of the banks.

Lynn Scarlett: Solly, in your book, *Planet of Cities*, you examined city form and discussed the issue of density and the linkage of cities to the periphery. I wonder if you can talk a little bit about your thoughts. Just as you question some of the common wisdom on coordination, you've questioned some of the current wisdom on the value of ever-greater densities.

Shlomo Angel: First of all, we have to put sustainability in a global context. California can be very well-behaved, but if California is well-behaved and India and China and Sub-Saharan Africa are not well-behaved, it's not going to solve the problem. So, when we talk about cities and sustainability, we have to shift the limelight to cities in developing countries for a simple reason. Between now and 2050, the urban populations in developed countries, that is the United States, Europe, and Japan, are going to increase by 160 million people, of which 100 million, by the way, will be in the United States and 60 million in all the other developed countries. At the same time, the urban population in developing countries will grow up by 15 times that, by two-and-one-half billion people. So, for every person that comes to an urban area in a developed country, there will be 15 people coming into a city in a developing country.

So, the problems that developed countries face, of which we heard a lot here, are not the same as the problems that these developing countries will face. They're not the same in many ways. For example, when we graph the rate of urban growth against the rule of law, what we find is that there is an inverse relationship between the two. Namely, the fast-growing cities have weak rule of law. So, ideas that we have about how to combat urban development problems in countries that are growing rapidly cannot be premised on what we're doing here where we have rule of law.

We're used to rule of law. We say, you can't build here, that's the end of it. You can't build here. If you say, you can't build here to somebody in Honduras, they say that's very nice and they build there. So, it's not an option. We need to think about other ways of looking at that.

What is happening? This is what I've written about and what you referred to. What is happening is that when you look at global data, and for the first time we have global data because of satellites, because of the emergence of new statistics and we all know about it, for the first time, we see that urban densities are going down everywhere. So, it's not just America that is sprawling. It's Europe that is sprawling; it's Bangladesh that is sprawling; African countries. Densities are going down so that urban expansion takes place at almost double the rate of population growth.

Let's say if a city doubles in population, it almost quadruples its area. This is happening globally and for a good reason because transportation is cheap, because people are richer. I'll give you an example. In Tianjin, for example, in 1978, when Deng Xiaoping started his reforms, they had 6.5 square meters per person in Tianjin as the average living area per person. Today, they have 25. So, they have four

times the living area than they had before. They have a lot more light and air, too, so that Tianjin has expanded a lot faster than the growth of the population of Tianjin. So, what we have in these countries is urban expansion.

Now, the American response to that is what you were saying, it's a kind of containment. The most famous American city in city planning schools is Portland, Oregon. Why? Because Portland, Oregon, has an urban growth boundary that it adopted in 1979. You can only develop within this boundary. The reason we want that is because we want to preserve the beautiful countryside and the view of the mountain. That is wonderful for the people who live in Portland. It's not so wonderful for the farmers who want to sell their land to developers.

But anyway, we've managed this very nicely. Now, Portland in the last 30 years has grown up by one-half million people. Shenzhen for example has grown up at the same time from 58,000 to 9 million people. So, these cities are expanding. We can't stop their expansion, and that means that the American solution, which is increase density in the name of reducing carbon emissions and energy use, which are all very good ideas, is irrelevant when we get to Bangladesh, because Bangladesh does not use any energy and does not have any carbon emissions. It rather has overcrowded, high-density cities. What they need to do is what you suggested, which is to expand. What they need to expand is infrastructure in order to break out. So, the solutions are very different from here, where we want to protect the agricultural land and revive the inner cities like Ken was talking about, city centers that are losing populations.

When we talk about developing countries, which have exactly the opposite predicament—they need to suburbanize as long as their densities can sustain public transit, for example. We don't want densities to go below 50 people per hectare. But in Atlanta, there are six persons per hectare. There is nothing you can do. You can talk about public transit in Atlanta; it's a joke. If they wanted the same subway system that we have in New York in Atlanta, they need 2,400 stations to get everybody within walking distance of train stations. That's absurd.

So, to talk about city form and sustainability, we have to kind of be realistic in terms of what is the relevant response to the relevant situation. So, in American cities, and I need to start in American cities, things that are keeping densities down are government regulations. For example, if government said, well, you can build another unit in your suburban home, a granny flat in your suburban home, the affordable housing problem in the United States would disappear. There would be enough suburban homes to house everybody. But we don't want that. We want to regulate against that, right? So, we need to re-regulate, not to deregulate but re-regulate in American cities.

Too much talk about the private sector and what the private sector needs to do, and I think we've lost the spirit of public works. We've lost this idea that infrastructure used to be something that the community did together as public works. When you talk about New York City and you ask yourself, how much land is in public use in New York City, the bastion of capitalism? I give it to you as a riddle. Usually, people don't get it right: 50%. So, New York is built with a public spirit, with public land, with the 1811 grid, with Robert Moses and his crazy machinations. But we have 50% of the land in public use. Nowadays, to get land in public use becomes more difficult because people will say, well, the public, we don't trust the public.

Lynn Scarlett: A recent U.S. Department of Energy (DOE) report on infrastructure vulnerability underscores that urban systems and services are vulnerable to cascading effects. This gets back to a theme that we started with interconnections and so forth. Hurricane Sandy did result in devastating damage. The city is doing a yeoman effort to rebound. But nonetheless, those effects reflect in many respects the cascading effects described by the DOE report. The electricity goes down, that affects water pumps. Transportation goes down, that affects the ability of businesses to operate on and on.

So, looking at those vulnerabilities and as our understanding in places like New York and elsewhere deepen, both from experience and from thought, how does this change how cities like New York think about mitigating risk? Really thinking about those cascading effects, does it have an effect on how you think about the future?

Carter Strickland: Well, certainly, and I think that Sandy validated the concept of cascading effects, as if it needed validation. That DOE report, you said is an example. But to give it a little more color, throughout the storm, our drinking water system was fine. Our balancing reservoir is at an elevation of 300 feet, so we can get water up to the sixth floor of buildings by gravity. But many public housing complexes, for example, are higher, and that's why you have the iconic water towers to store pumped water. The severe degradation of the electrical network prevented people from accessing that drinking water, from flushing their toilets, and the like.

So, it's certainly a big issue. The MTA [Metropolitan Transit Authority], which had some flooding issues in subways, was able to empty those tunnels, but was still dependent on the electrical system to come on board. I think it certainly heightens what is sure to be a lively rate case that Con Edison is about to file this fall. We have our comments ready.

But it also begs the question of systematic thinking in the regulatory field that I think this audience is well-attuned to. For example, wastewater treatment plants are required to be energy-independent to some degree, with backup generation. That's great. But there are certain air quality regulatory requirements about how often we can use backup generation that may in fact add to that degradation of the electrical network. For example, if there is about to be a blackout, we can turn on our backup generation. But of course, if we were able to do so proactively, we could prevent a blackout. That would be very helpful. That

kind of system thinking, to bring it back to some of the things that Terry has spoken of, is very important across the regulatory structure.

Lynn Scarlett: I'm going to ask our panelists to give a one- or two-sentence little summary thought of what they'd like to leave the audience with. Then we'll take questions.

Terry Yosie: I think all of the types of changes we're discussing are going to dramatically reshuffle the definition of roles and responsibilities across government, across the private sector, and the NGO sector. Agencies like EPA are seriously going to have to rethink what is the role of regulation of air quality when the next generation of automobiles will probably be based on the hybrid electrification system that don't emit particulate matter. Rethinking roles and responsibilities for adding value to achieve goals that society wants is a major elephant that's in the room.

Julia Parzen: I was talking to the food systems policy coordinator for Portland a few days ago. He said, we want to put the rate, rules, and parameters in place, and then we get out of the way and do everything we can to help. On the flipside, there's so much innovation going on in cities. They need the regulatory framework, the policy framework, the funding framework to get out of the way, but I mean that in the most positive way: to set the performance parameters, to have performance requirements, but then to support the innovation that's already going on.

Ken Cornelius: When we look at doing something new, if we were starting all over again, would we do it that way? Are we doing it because it's an iteration from where we are, because in the private sector, this is how companies go out of business. They keep doing things the way they used to, and they don't take advantage of benefits of innovation, of new thinking, of best practices. Would we really do that again, if we're going to start all over again?

Shlomo Angel: I have two thoughts. The first one is that cities are extremely resilient. They fall apart, and then they come back together. The best example is not Sandy, but the wars. They demolish them, and then they are back up. All the cities that have been destroyed by wars are now back and built up and functioning, so the cities are resilient. We need to make it a bit easier for them to come back. But we need to trust them with their creative abilities to be able to reinvent themselves, and get back to life and do the next thing. I have great trust in cities.

The second thing is that all these innovations that are happening here at a very fast rate are largely irrelevant for where we need innovations and where new sustainability inventions are needed. Because they are needed in cities in the South, and we're inventing them in the wrong places. So, we need some mechanisms for inventing these things elsewhere too.

Colin Harrison: I mentioned earlier three principles: learning, foresight, and connectedness. But there's actually a fourth one, which in the immediate aftermath of the disaster is at least as important as those three. And that is the ability of individual citizens to self-organize and to respond locally to the disaster, instead of waiting until the local or national government comes to help them. Many lives can be saved, much property can be saved by local, self-organizing groups. Nowhere have I seen this so spectacularly as in the coastal towns of Chile after that earthquake and tsunami in 2010 when these towns were cut off from the central government for about one week. There were many heroic acts that came out of local leaders at that time.

Carter Strickland: Success breeds success. We can look to many examples of what we need to do to invest now in lasting infrastructure for, let's say, the 22nd century. Why not? My grandchildren or great-grandchildren might be beneficiaries there. A few weeks ago, I went to the 75th anniversary of one of our wastewater treatment plants, built in 1937, a Works Progress Administration project. We've upgraded it substantially, but the bones are there that we're using now. That significant investment with a view toward the long term has and will benefit future generations.

Audience Member: I'm a little bit surprised. I think that Sandy, in addition to all the misfortune that she caused, seems to have skewed the discussion a little bit in terms of whether we can just sustain the cities that we have, rather than the reason why the terms sprung up in the first place: whether the cities were being generated and operated in a way that was sustainable, not only for the cities, but from the world in which they are created. Because after all, we're talking about a storm that many people who believe in science feel has been contributed to by global warming.

The carbon emissions that are creating global warming are generated overwhelmingly in cities. Fifty percent of energy—I'll leave aside water use and abuse, and materials—is in buildings, most of which are in cities. Twenty five percent is in transport, much of which is in cities, and most of the rest of which is used or misused between cities. And 25% is in industries, most of which, due to no fault of the cities, is in the cities. Those figures are a little bit high because there is 10% for other things. But those are the major energy users, and we didn't really get to the question of how our cities do or don't contribute to solving the problems that we're all causing until we got to urban form. There were a few mentions of things before we got there.

So, I would like the panelists to spend a little bit of our remaining time talking about the things that are being done and can be done, as opposed to all the things that can't be done in Bangladesh and places such as that to try to get a handle on that part of the problem.

Julia Parzen: If you look at the emissions map initially just looking at total emissions, you'll see cities as being the pri-

mary location. But if you look at per capita emissions, I'm talking North America, not globally, the map completely switches around.

So, one comment is, at least with how we're assessing emissions now, it seems as though there are some efficiencies in cities. Although, we are looking at it from a production perspective, and you didn't mention consumption. Most cities haven't done the emissions analyses by consumption, so I'm not going to speak to that. It could be cities look a lot worse, but I think there are a number of studies that show that there are efficiencies around energy use. These maps tell a story around transportation. I don't think that even though cities produce a big share of the emissions, I think, on a per capita basis, there are indications that they have the potential to create a lot of solutions.

Lynn Scarlett: That's an important insight. Cities on a per capita basis may look different. But nonetheless, the questioner is asking, notwithstanding whatever that profile is, what are cities doing, or what can they do to reduce our greenhouse gas footprint?

Colin Harrison: Just one example. We've done work with the City of New York School Districts. Schools account for something like 1,400 buildings in the city. Some of them are relatively modern. Some of them are at least one century old. You can't affordably make the century-old buildings as energy-efficient as the modern ones. But what you can do is identify groups of schools of similar types, similar age and construction, and find out what are the best operating practices for heating or ventilation in that group of buildings. Then you can apply it to all of the schools within that particular group. So, this is a relatively inexpensive way of producing a substantial improvement in the building efficiencies there.

Ken Cornelius: I would just like to add that people in North America use about 30-35% more energy than people in Europe do. London came in; they wanted us to look at the city. It started out as a congestion pricing for downtown initially. Let's just look at things initially to see if there are other things we can do to improve the CO_2 [carbon dioxide] emissions of the city. The number one lever that they had was insulation of buildings, which is very relatively inexpensive and very easy to do very quickly.

There are a lot of things that can be done. The one thing I think cities can do without raising any taxes is—I hate to say it—put in more regulation. But we put more regulation that makes sense to make people do relatively inexpensive but very effective things.

Carter Strickland: One law that we put in place allows building owners to understand their water consumption compared to other buildings with similar features. It is really about harnessing the power of information. The law requires buildings greater than 50,000 square feet to benchmark their water consumption and report out, so they can measure against their neighbors. Building owners will realize many of them are leaving money on the table. And to your point about insulation, New York City is changing the zoning laws now so that you can add up to eight inches of external insulation, which is a lot cheaper than doing it internally and doesn't penalize your floor-area ratio. There's a lot of low-hanging fruit out there to decrease CO_2 emissions.

Audience Member: One of the things that we've been looking at in terms of energy, which would improve sustainability as well as resilience, is moving from a grid top-down structure to what people call a web. For instance, Philadelphia is setting up a charging system—one of the things you were talking about electric cars and using batteries to store alternative energy. Now, moving to that then requires some different model for how we pay for and regulate electricity. How do you see adapting a regulatory framework and structure for electricity to move to this more resilient pattern?

Ken Cornelius: We have a pretty old system, period. Tying everything together is very complex because the sources are very diverse. We call it a smart grid combined with micro grid. It is able to go and look at what's the cheapest source that we have and bring that in at the time. So, it's good from a cost standpoint. It's also good for tying things together. If one area goes down, then another area can pick it up. There's a lot of work being done in that.

But I think one of the things we've talked about earlier is, there's a lot of jurisdictions, there's a lot of governments, there's a lot of different entities, and a lot of them are competing entities. Believe it or not, there are big companies that don't like the idea of people having their own solar power or their own generator. A lot of politics are against it.

One other main thought that I would leave people with is we really need to show leadership in these areas where people start thinking about the good of the whole, as opposed to their little piece of the world.

Audience Member: Lynn started with resilience. There are efforts afoot to substitute resilience for the word sustainability, and there are efforts afoot to replace climate change adaptation with resilience. Resilience is a fine word, appropriate in a lot of contexts, but I just urge caution in how it's applied more generally. And I'd love to hear any further comments on that.

Within the governance piece, Lynn mentions networks and the inadequacy of that by itself. In the academic arena, people tend to talk about networks of networks, nested networks at different levels of scale, so different levels of scale, federal, state, and local coordination would be something else that I would open the door to a conversation on.

I'm sure that if Terry had a couple more minutes, he might have gotten into the reason why we need to change governance approaches moving away from command-and-control regulation and moving away from public-private

dichotomy to multi-stakeholder dynamics and the need for multi-stakeholder processes to fit into governance. If anybody on the panel knows of good examples of that at the urban level, I'd love to hear about it.

Finally, the other word that caught my attention was coordination. While not everybody can participate in every discussion, it's also kind of dangerous to weigh expedience over everything else. And particularly when sustainability calls for multi-stakeholder dynamics, you have to weigh expedience against processes that are fair, equitable, transparent, and democratic. If you wanted to respond to that, that would be great.

Terry Yosie: My western Pennsylvania coal miner origins get the better of me in moments like this when I'm in these very exclusive conversations where we use $25 United Nations words like sustainability and resilience. What I think we always have to remember is that we need to communicate these concepts in ways that consumers and members of the public not only understand but understand why they're going to be better off. It's the quintessential Clintonian approach to governance: you have to be able to communicate why people are going to be better off buying into these concepts that we're all talking about.

So, that's not only a language issue; it's not only a political power issue; it's ultimately a question of legitimacy. I don't think we, who have these conversations, have really come to terms with that yet because in most forums where I engage, the consumer or the taxpayer is still sort of an afterthought. They may be on the receiving end of a lot of decisions that are made in their behalf. But until we find a way to integrate the consumer and the citizen into the core of this decisionmaking process through their own decisions and those whom they elect or allow to make decisions in their behalf, I think we're always going to be the dog chasing the car down the road.

Colin Harrison: I would say we need both. I think sustainability and resilience do different things. They're responding to different challenges, related challenges but different challenges. The reason that this focus on resilience is coming up is that it's clear that as we have to consider not a two-degree world but a four-degree world that will have to confront a lot more instability, instability in natural phenomena, but instability in economic and social systems, too. It's a desire to be prepared for that instability.

I was in a discussion last week with the chief environmental officer of a very large industrial company. He actually reduced a room to silence with the observation that for his company, in a four-degree world, it has no business model. It would have no way of doing the long-term planning that that company needs to do in the face of the levels of instability that they would anticipate.

John Cruden: What a great subject, what great questions, what a wonderful panel talking about something that will now be the theme of the evening. I would be remiss if I did not point out this is the Keare Forum for a reason. And it is because the Keare Forum has generously financed this throughout the years. We have a representative here, Doug Keare, if you would stand up please and be recognized as the individual representing the Keare Forum.

Remember how we started out thinking about cities, thinking about what they're going through right now, but now we're going to gloriously celebrate. One of the great cities of the United States will celebrate PlaNYC. We'll listen to more speakers, more talking about it. But carry the enthusiasm, carry your adrenaline, carry your concern of how we actually move forward this agenda of sustainable cities. Thank you so much.