Urban Innovation Labs Scan

Key Innovations Labs Relevant to the Development of Sustainability Solutions for Cities

Prepared by Nutter Consulting and the
Institute of Sustainable Communities for USDN

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What is an Innovation Lab (iLab)?

- "physical or virtual spaces that enable and support the innovation (technological or otherwise) of those who participate in the space"[1]
- Urban Innovation Labs include:
  - Multidisciplinary approaches to research & development
  - Innovation of many types: technology, policy, governance (?)
  - Cross-sector public-private partnerships with cities, academia, industry, and nonprofit organizations
  - Data- and results- driven performance management
  - Focus on scalable solutions developed that can be shared and tested in cities around the world
  - Can be project based
  - Provide a neutral 3rd party platform for collaboration
  - Provides a platform for cross sector allies to align around shared goals

What value do iLabs have for cities?

- Opportunity to learn from others creating and testing new approaches to urban sustainability – another venue for peer to peer exchange
- Access to experts across a variety of fields
- Cross-sector multidisciplinary collaborations that can lead to improvements in other areas
- Saving time & resources by having others pitch in on developing solutions

The Innovation Lab Scan

- 80 ilabs identified internationally
- Assessed non-profit, academic, private sector and government led labs
- Filters for research for this project include:
  - Works directly with cities
  - Includes sustainability projects
- 15 ilabs identified for inclusion in the report
- Desktop research and stakeholder interviews conducted

iLabs relevant to cities

There are many innovation labs working on issues relevant to cities, with more developing all the time. However, the following are most directly relevant to urban sustainability and are those included in this document:

- Envision America
- Metro21
- Silicon Valley Joint Venture
- University of Alabama Sustainable Smart Cities Research
- European Innovation Partnership on Smart Cities
- Leading Cities
- INCENSe
- Intel Ignition Lab
- MIT Senseable Cities Lab
- R2Cities
- RMI
- Smart City Collective
- Synthicity
- The Energy and Resources Institute
- Triangulum Project

NON-PROFIT ILABS

Envision America

Vision / Mission	• Fostering direct collaboration between cities & companies to create & deploy innovative technological solutions that target energy, water, waste and air challenges. • Established 2015 in Charlotte, NC • Website: http://envisionamerica.org/
Stakeholders	• Cities: NYC, Portland, LA, Spokane, San Diego, Milwaukee, Dallas, Cambridge, Greenville, Pittsburgh • Companies: Microsoft, Duke Energy, Accelerated Innovations, GE, Itron, Landis Gyr, Autodesk, Qualcomm, Esri, Thing Worx, Black & Veatch, WellsFargo, SAS • Other: The White House
Projects	• Eco-districts • Traffic light sensors, smart street poles • Data collection & analysis • Transportation
Engagement Activities	• Annual workshop (starting Jan 2016) • Social media platform • Technical assistance from companies • News & publications

Envision America

Key Lessons

- 6hr workshop format worked well for city & company collaboration
- Cities need ongoing technical assistance, governance & strategy
- City-to-city communication & networking of great interest to cities

Tech Used

- Project dependent
- Could include streetlight sensors, new energy efficiency retrofits, software applications, GPS tracking, dashboards

Metrics & Data

- Will be project dependent
- Work shopped solutions to be deployed in 2016
- Solutions will provide tangible results for cities

Success Stories

- Jan 2016 kick-off
- Success to come as cities implement their plans throughout the year

Metro 21

Vision / Mission

- Established in 2014 by Carnegie Mellon University as a test bed for 21st century innovation
- Research, design, deploy and evaluate solutions to challenges affecting the economy and quality of life in metro areas
- Website: http://metro21.heinz.cmu.edu/

Stakeholders

- City of Pittsburgh, PA
- Carnegie Mellon University
- Remaking Cities Institute
- Non-profit, private, and governmental agencies

Projects

- Mapping and data collection for street repairs
- Traffic21: real time adaptive traffic control

Engagement Activities

- Project planning & design with external partners
- Forums, surveys, and targeted deliberate forums
- MOU with mayor (who then committed to "innovative Pittsburgh" initiative)
- Partnership outreach to other universities and metros through Metro Lab network

Metro 21

Key Lessons

- The university cannot respond to every city challenge and vice versa
- Important to find a clear intersection where the university can help (i.e. research + data analysis)
- Assignment of a key city official is critical for success

Tech Used

- Sensors
- Smart streetlights
- Maps

Metrics & Data

- Project dependent (TBD)
- R&D will lead to solutions for deployment and then commercialization
- Enhanced reputation of CMU and home metro by project will be one area of success measurement

Success Stories

- Traffic light intersection coordination to determine current (real-time) and future (predicted) traffic patterns and have a system of responsive networked traffic lights communicate and adapt to changing conditions.
- Low or no-cost pothole & street mapping & repair
- Helped to launch Metro Lab Network

Silicon Valley Joint Venture

Vision / Mission

- Established in 1993 in Silicon Valley, CA
- Build a framework for regional thought, analysis and action by assembling Silicon Valley's leaders in business, government, labor and the nonprofit sector to assess challenges, reach consensus on best strategies for response, and work together on solutions.
- Website: http://www.jointventure.org/

Stakeholders

- Silicon Valley cities and counties
- Universities and non-profits: Stanford, David & Lucile Packard Foundation
- Private sector: Adobe, Bank of America, Google
- Planning agencies: SamTrans, Caltrans

Projects

- Initiative areas include Climate Prosperity, Economic Development, Grand Boulevard, Surplus Harvest and Wireless Communications
- Climate Prosperity projects include Smart Energy Enterprise Development Zone, Public Sector Climate Task Force, Renewable Energy Procurement Project
- Mobility as a Service

Engagement Activities

- Planning & design with partners through project task forces
- Membership, board, and foundation investors
- Webinars
- Annual conference
- Surveys

Silicon Valley Joint Venture

Key Lessons

- Private-public sector communication
- There is not always an area of collaboration on projects
- Keep annual meeting participation prices low so public can access it
- A body like SJV has value in providing an unbiased framework for regional projects

Tech Used

- Project dependent (TBD)
- Eg. wireless communication initiative with new technologies and start-up companies

Metrics & Data

- Project dependent
- Overall SJV measures success in terms of community, network growth, funding growth, and number of people & companies participating
- Research arm of SJV puts out a Silicon Valley Index with various measures (eg. health, salary, housing affordability)

Success Stories

- Hunger & poverty amelioration in Silicon Valley: Collaboration with the non-profit organization Urban Harvester on a collaborative regional framework using software that matches surplus food to authorized agencies
- Sustainable Buildings Objective: assessment of green building programs & implementation challenges. Retrofit of 10 million square feet of property with wireless thermostats and lighting management technology

Leading Cities

Vision / Mission	• Unite university leaders (faculty & students), policy innovators, city officials, and business leaders from a select set of cities around the world to create sustainable social change through research, policy development, economic development and implementation of best practice solutions to common urban challenges • Website: Leadingcities.org
Stakeholders	• Cities: Boston, Barcelona, Hamburg, Zapopan, Vancouver, Haifa, Lisbon, Lyon, Dublin • A university partner from each of the cities
Projects	• Exchange Missions featuring business, academic, and civic leaders traveling to partner cities • Online workshops
Engagement Activities	• Online platforms • Exchange missions • Webinars & workshops • Surveys • News & publications

Leading Cities

Key Lessons

- Access to talent and development of a talent pipeline is critical for sustainable growth.
- Publicizing successes, inventions, and achievements attracts talent to companies involved and drives innovation.

Tech Used

- Renewable energy projects
- Smart grid
- Smart manufacturing technologies

Metrics & Data

- Utilize data, statistical analysis, social indicators, and proven implementation models to share knowledge

Success Stories

- In 2012 officials from the ports of Boston and Lisbon met and signed a cooperation agreement to share information and resources
- In 2013 exchange mission delegates and local partners had a private dinner with Irish Prime Minister Enda Kenny and discussed the country's economic recovery and development strategy

Rocky Mountain Institute (RMI)

Vision / Mission	• Established in 2012 in Colorado • To facilitate cross-sector collaboration for scalable, market-based solutions that facilitate the efficient and restorative use of natural resources, specifically in the electricity system. • Website: http://www.rmi.org/
Stakeholders	• Renewable, grid, and distributed resource providers • Utilities, regulators, and grid operators • Experts & advocates • Customers & investors • Lab Core Team
Projects	• elab Accelerator: 4-day project focused bootcamp for electricity innovation
Engagement Activities	• Convening meetings • 3 workshop meetings a year • Several other programs

Rocky Mountain Institute (RMI)

Key Lessons

- No one can solve these problems by themselves
- There needs to be ownership of a project for it to succeed
- Sometimes it's better to start with a problem or opportunity that can't be ignored, creating an opportunity to come up with a new solution

Tech Used

- Worked with cities served by an investor utility looking at microgrid deployment
- Technology to measure resilience or energy innovation within the community and help navigate partnerships

Metrics & Data

- Use of data to understand and effectively communicate the costs and benefits of distributed resources as part of the electric grid
- Use of data to harmonize business models of utilities and distributed resource developers
- Use of data to accelerate the pace of distributed resource adoption

Success Stories

- The accelerator worked with a team involving Ithaca, Cornell, and Iberdrola (utility); plan developed on utility resiliency program; multi-stakeholder demonstration project leveraged funding

The Energy and Resources Institute (TERI)

Vision / Mission

- Established 1974 in New Delhi, India
- Initial focus on documentation and information dissemination to propel the process of sustainable development
- Website: http://www.teriin.org/

Stakeholders

- TERI employees
- Project partners
- Communities in regional centers throughout India (eg. Mumbai, Goa)
- Affiliate Institutes around the world (London, UK; Washington, DC; Japan, Malaysia; and the UAE)

Projects

- Himalayan Adaptation: : Water and Resilience initiative
- Water-Energy-Food nexus research
- Business models for off-grid electricity supply

Engagement Activities

- Activities grouped into divisions and coordinated by an Area Convener
- Engagement supported by division Directors/Associate Directors as well as over 1200 employees

The Energy and Resources Institute (TERI)

Key Lessons

- Necessary transformation requires investments in infrastructure, reduction in reliance on fossil fuels, and innovation in policies.
- Innovation at every level has to be ushered in to seize the opportunities ahead.

Tech Used

- Microbial biotechnology
- Mechanical and chemical engineering techniques
- Customization of PV technology
- Other technologies to reduce the ecological footprint of development

Metrics & Data

- Water audits to inform decisions around water efficiency, system optimization, conservation, and sustainable management
- GRIHA: a co-developed building rating system

Success Stories

- Back-to-Earth: sensitizing children on the impact of waste through educational and outreach components such as books, educational kits, learning material, brainstorming sessions, and practical experience.

ACADEMIC ILABS

University of Alabama: Sustainable Smart Cities Research

Vision / Mission

- Established in 2013 as collaboration between UAB and the City of Birmingham
- To foster cross-disciplinary research, training, and outreach for developing innovative solutions for sustainable smart cities at the scientific, economic, and human levels
- Website: https://www.uab.edu/smartcities/

Stakeholders

- City of Birmingham
- University of Alabama
- Private partners

Projects

- Sustainable Cities Youth Champions Program
- Smart Cities Hackathon

Engagement Activities

- Training, research, and ongoing outreach to community to engage & educate citizens about smart cities
- RFP pilot research funding
- Smart Cities Challenge
- Smart Cities Hackathon
- Conferences and symposiums

University of Alabama: Sustainable Smart Cities Research

Key Lessons

- Higher-quality living conditions that are affordable across a wide range of incomes requires the creation of business and job opportunities for a diverse, balanced community.
- To maintain such a healthy environment and long-term growth, a balance of resource-consumption and supply is necessary.

Tech Used

- Software applications
- Sensors
- Info communication technologies
- Smart transportation

Metrics & Data

- Government data converter tool to facilitate computer data interpretation and analysis
- Trail system monitoring to improve usage and safety

Success Stories

- Hydrogen Fuel Cell Bus: UAB and MAX bus fleet of Birmingham-Jefferson County Transit Authority added a fuel cell bus that produces no tailpipe emissions.
- The first hydrogen fuel cell bus and fueling station in the Southeast.

MIT Senseable Cities Lab

Vision / Mission	• Founded in 2004 in Cambridge, MA • A research initiative to study the changes due to technology and hand-held electronics on the build environment • Website: http://senseable.mit.edu/
Stakeholders	• Cities and corporate partners through an academic platform called Senseable City Consortium • Past city partnerships have included New York, Rome, Copenhagen, Boston, and Singapore
Projects	• Hubcab: interactive visualization that allows users to explore taxi trips in New York City and how they can be shared
Engagement Activities	• All partners meet in person once a year at the Forum on Future Cities conference • Smaller convenings throughout the year, either over the phone or in person

MIT Senseable Cities Lab

Key Lessons

- Collaboration across disciplines and industries is crucial for research on technology and city development
- Collecting and measuring big data plays a crucial role to success

Tech Used

- Hand-held electronics
- Sensors to track real-time city data

Metrics & Data

- Big data is being measured in projects to understand cities and plan for transformation, as well as make data available to citizens

Success Stories

- Future Food District: digital supermarket that contains real-time nutrition information about food in the market and the grocery store itself

European Innovation Partnership (EIP) in Smart Cities

Vision / Mission

- EIP for Smart Cities and Communities combines ICT, energy management, and transport management to develop innovative solutions to major environmental, societal, and health challenges facing European cities.
- Website: http://ec.europa.eu/eip/smartcities/

Stakeholders

- 332 cities from across Europe
- Private sector: Siemens, Philips Lighting, SAP
- High Level Group: Bratislava, London, Warsaw, Almere, Funchal, Country of Austria, Alcalde de Barcleona

Projects

- Sustainable Urban Mobility
- Positive Energy Blocks
- Humble Lamppost

Engagement Activities

- Smart Cities Stakeholder Platform
- Planning & design with partners through Action Clusters
- Partnership General Assembly
- Webinars, surveys, forums

European Innovation Partnership in Smart Cities

Key Lessons

- Collaboration is needed (it is no longer 'us' vs 'them') to drive smart mobility solutions.
- If the fight against climate change is to be won in cities, smart cities are a part of the answer.

Tech Used

- Smart electric mobility solutions
- Smart lamp post technologies and LED lights

Metrics & Data

- Open platforms and data allow public and private service providers to develop and test innovative transportation solutions regarding information, ticketing, and trip planning

Success Stories

- Several projects launched in Dec 2015/Jan 2016: lamp technologies, mobility/transportation, and 'positive energy blocks'.

INCENSe

Vision / Mission

- Foster innovation and high tech employment in the European energy sector through an acceleration program dedicated to energy efficiency and cleantech start-ups
- Participants from any of the 28 EU countries and 13 FP7 Associated countries such as Turkey and Serbia may apply
- Website: http://www.incense-accelerator.com/

Stakeholders

- Energy companies: Enel & Endesa
- Accelerator: Accelerace using public funding platform (Funding box)
- Cities not directly involved but may benefit from the start-up technologies that are incubated

Projects

- Over 250 start-ups incubated covering:
  - Energy storage
  - Energy efficiency and home automation
  - Renewable energy
  - Smart grids
  - E-mobility

Engagement Activities

- Includes two open call sessions per year aimed at selecting up to 42 start-ups for incubation

INCENSe

Key Lessons

- The accelerator was created to support entrepreneurs and capture the opportunities coming from a new wave of digitalization and the internet economy – lessons yet to come

Tech Used

- FIWARE Technologies:
  - Internet open cloud infrastructure
  - Openstack-based cloud environment
  - Open APIs that make it easy to connect to the Internet of Things (IoT)

Metrics & Data

- Survival rates of start-ups
- Rate of companies that raised capital
- Rate of follow-up rounds after Accelerace participation
- Companies that make a profit
- Number of new jobs created at the start ups

Success Stories

- Vatia: energy sequence combines data, software expertise, and building science to deliver energy information
- Zenup: clamp-on smart gas meter used to reduce gas consumption

PRIVATE SECTOR ILABS

Intel Ignition Lab

Vision / Mission	• First labs opened May 2014 in the UK, Germany, Sweden, Israel, and Turkey • To enable the fast creation of scalable, standardized solutions and building blocks. • Website: http://www.intel.com/content/www/us/en/internet-of-things/iot-ignition-labs.html
Stakeholders	• Intel • Host cities in the UK, Germany, Sweden, Israel, Turkey, Ireland, UAE and Russia
Projects	• Agriculture, transportation, energy, retail • Smart homes and buildings • Smart Cities • Communication infrastructure
Engagement Activities	• Each of the 8 labs runs training workshops covering a diverse array of subjects (eg. agriculture, smart homes) • In-person showcase areas feature demos and developer kits • Labs used as venues for networking events

Intel Ignition Lab

Key Lessons

- The real power is the solution at the end
- Data allows the creation of analytics capabilities to make better decisions

Tech Used

- Internet of Things (IoT) platform
- Sensors and apps
- Distributed computing
- Machine-to-machine communication
- Partners with large companies (Kingspan, Keenans) on IoT projects

Metrics & Data

- Intel uses gateways to aggregate data from sensors and crunch data through the backend systems. Eg. tracking CO2 levels from Intel's API Management Platform and charging a "congestion charge" when CO2 levels are at its highest

Success Stories

- Ersules: an integration of the Intel Internet of Things Gateway with smart controls and dashboard application that collects and monitors data, resulting in up to 90% energy savings through smart lighting technologies

Smart City Collective

Vision / Mission

- The Smart City Collective connects entrepreneurs, knowledge institutes, universities, and governments across the globe to further sustainable urbanization
- Active in the USA, Japan, Taiwan, Indonesia, Europe, and South Africa
- Website: http://smartcitycollective.com/

Stakeholders

- 20 connected cities across the U.S., South Africa, Colombia, Asia, and Europe
- Service companies, living labs, and incubators/accelerators: Philips, East Coast Electric, the European Network of Living Labs, and the Austin Technology Incubator

Projects

- Events & innovation/trade missions: organized visits to other countries for groups of city representatives, scientists, and business executives - sometimes organized around summits or expos, or sometimes planned around a city's objectives.

Engagement Activities

- Private sector, cities, and other entities are equal participants at round tables – recent suggested topics include: Business Models, Policy & Regulation, Citizen Participation, Internet of Things, Cyber Security & Privacy, Standardization, & Integrated Planning

Smart City Collective

Key Lessons

- Cities are at the heart of climate change
- Cooperation and transfer of best practices is a key element to further sustainable urbanization.

Tech Used

- Test beds and Living labs
- Technology start-ups
- Incubators and Accelerators
- Chemical and high tech systems and materials

Metrics & Data

- Data collection related to: health; big data; air pollution; food security; clean & secure energy; safe & secure public environment; resource efficient industries; water, waste & resource efficiency; transportation & logistics; efficient use of land & subsoil; energy efficient buildings

Success Stories

- Amsterdam Smart City objectives to lower CO2 emissions to a target level, support the economic development of the Amsterdam area, and collaborate closely with Austin and Antwerp Smart Cities to share and strengthen expertise and innovation.

Synthicity

Vision / Mission	• Established in Berkeley, CA • To create a new way to engage communities in decisions about urban development through the creation and use of easy-to-use tools. • Website: http://www.synthicity.com/
Stakeholders	• Autodesk (currently owns Synthicity) • Planners, designers, and architects • Developers and investors • Community residents
Projects	• GeoCanvas: large volumes of geographic data to easily create 3D visualizations • UrbanSim: platform used to simulate metropolitan real estate markets and the impact of land use and transportation plans for urban planning
Engagement Activities	• The platform provides new ways to propose and visualize projects in 3D, evaluate financial feasibility, and share them with the community

Synthicity

Key Lessons

- Synthicity has excelled by combining powerful analytics for urban planning with intuitive visualizations of the city.
- GeoCanvas, a GIS tool, needs to be streamlined, to be more intuitive and eliminate the complexity of traditional GIS systems

Tech Used

- Toolkit: open source platform designed to integrate various pieces that enable a diverse set of data processing workflows. It largely utilizes Python programming and is open source on Github

Metrics & Data

- Data used to create 3D visualizations that help communicate data in a clearer way

Success Stories

- Urban Canvas next-generation 3D visualization of massive urban datasets that helps communicate the impacts of decisions in its context and throughout the planning stages of a project

GOVERNMENT FUNDED ILABS

R2 Cities

Vision / Mission

- The R2Cities Lab runs from 2013-2017 throughout 23 cities in Europe with main demo sites in Valladolid, Spain; Genoa, Italy; and Kartal, Turkey
- To develop and demonstrate replicable strategies for designing, constructing and managing large scale district renovation projects for achieving zero energy cities
- Website: http://r2cities.eu/

Stakeholders

- European Union, This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement
- 8 industrial partners, such as ACCIONA, ABB, and ONYX
- 3 research institutions: University of Genoa, Technical University of Istanbul, and Cartif Technology Centre
- Technology companies: Steinbeis, Europa Zentrum and youris.com

Projects

- Develop and demonstrate replicable strategies for designing, constructing and managing large scale district renovation projects for achieving nearly zero energy cities
- My Smart City District Network: Three smart city projects (R2CITIES, EUGUGLE, and ZenN) have partnered to share and promote energy efficient renovation solutions for cities across the EU

Engagement Activities

- Project Consortium: coalition of 17 partners from 5 different European countries, including 3 cities, 3 universities, 8 industrial partners, and 3 other technical and communication organizations.

R2 Cities - government

Key Lessons

- Substantial greenhouse gas reductions require an emphasis on renovating existing buildings.
- Conducting replicable large scale district renovation projects will help achieve nearly zero energy cities.

Tech Used

- Information and communication technologies
- Efficient lighting systems
- Building Management System to directly link energetic performance to financial impact

Metrics & Data

- Using data for technology payback analysis: evaluation of the financial sustainability of each technology and then using the data as a basis for presenting renovation projects or making energy saving intervention plans

Success Stories

- Interventions implemented in Genoa, Italy to improve energy efficiency of buildings: replacement of steel windows & boiler for energy efficiency; internal satellites installed for users to directly manage their heat; rooftop to be replaced with a PV plant to power the lifts and lighting, etc.

Triangulum Project

Vision / Mission	• Founded in 2014 and located in cities all over Europe • To find viable solutions to make cities sustainable, smart, and livable in the future with a focus on sustainable energy supply, mobility, and information technology. • Website: http://www.triangulum-project.eu/
Stakeholders	• 22 private sector organizations, such as Siemens and KPN Telecom • Project managers: Fraunhofer, University of Stuttgart, Steinbeis-Europa-Zentrum • Participating cities in Europe: Manchester, Eindhoven, Stavanger
Projects	• Integrated urban solutions around sustainable mobility, energy, crosscutting ICT, and smart business opportunities
Engagement Activities	• Cities were pre-selected for the projects, and each project must co-involve 2-3 follower cities (ie. cities willing to replicate the solutions found)

Triangulum Project

Key Lessons

- The project is meaningful as far as the consortium can show the benefits it brings through joint ownership, a smarter way of working, the implementation of innovative energy saving technologies, a boost in data infrastructure, civic engagement processes, sustainable transformation of public space, and an uptake of smart solutions

Tech Used

- Instruments for modeling costs that yield 3D visualizations
- Hardware and software to monitor street lighting, mobility, houses, offices, and other aspects of the smart city

Metrics & Data

- Footprint calculation methodology (esp. for energy saving, CO2 reductions, financial savings, jobs created, and environmental impact).
- Cities develop an integrated protocol for monitoring energy, infrastructure, mobility, and governance practices to allow for documentation of improved performance.

Success Stories

- The city of Eindhoven, Netherlands will be transformed into sustainable living environments through a district-wide ICT solution that will allow residents to access infrastructure to book electric vehicles from a car sharing system.

Key Takeaways and Trends

- Any one organization cannot respond to or solve every challenge; multi-stakeholder cross-sector collaboration is critical
- Sustainability challenges are linked so inter-disciplinary approaches are necessary
- The cooperation and transfer of best practices is a key element to further sustainability
- Strategic focus is necessary to work on problems & solutions that can be best approached by particular innovation labs and their stakeholders (not all problems have the same chance of success)
- Sometimes it's better to start with a problem or opportunity that a community can't ignore, therefore creating an opportunity to come up with a new solution
- Innovation at every level has to be ushered in to seize the opportunities ahead.
- Necessary transformation requires investments in infrastructure, reduction in reliance on fossil fuels, and innovation in policies.
- Cities are at the heart of climate change.
- Cities need support in technology, governance, and strategy
- Direct learning and collaboration (ie. through city-to-city learning, exchanges, workshops, etc) provide opportunities for innovation
- Regional representation & frameworks can be useful to link local initiatives or interests
- Business and job opportunities are necessary for a diverse, balanced community.
- A balance of resource consumption and resource supply is necessary for sustainability
- Access to talent and development of a talent pipeline is critical for sustainable growth.
- Substantial greenhouse gas reductions require an emphasis on renovating existing buildings.
- Conducting replicable large scale district renovation projects will help achieve nearly zero energy cities.
- Data collection and analytics offer big opportunities for decision improvement
- Assignment of a key point-person or official is important for ownership of initiatives
- Keep projects and events accessible (eg. low entry prices) so the public and all relevant stakeholders can participate in some way.

Thank you

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