WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

White Paper

Top Ten Urban Innovations: City of Boston Scorecards

Prepared by the Global Agenda Council on the Future of Cities

April 2016

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Introduction

In late 2015, the World Economic Forum Global Agenda Council on the Future of Cities outlined the Top 10 Emerging Urban Innovations from around the world. From cable cars supporting social integration in Medellin, Colombia, to smart water systems in Queensland, Australia, cities are innovating to accommodate the largest urban migration in history. As a Council, we agreed to look for a city that was willing to allow its progress across these emerging innovation areas to be examined and Boston was a willing hand raiser.

The city's chief architects of innovation generously shared their time with me to convey how Boston's programs map to the Top 10 list. The Scorecard reveals that Boston is planning, implementing, and in some cases has already deployed, initiatives aimed at achieving social integration, spare capacity use, peak-demand mitigation and small-scale innovation. Each initiative is assessed on a 5-point scale:

1 – Not currently under consideration
2 – Programs are under consideration
3 – Programs are in planning stages
4 – Programs are being implemented
5 – Programs are deployed

The City of Boston Innovation Scorecard project allows us to look across departments and functional areas to highlight progress and new thinking. Admittedly, the shortfall of this approach is that the score relates to whether there is an innovation that maps to the Top 10 list – rather than a critique of whether the program is the right one or goes far enough. For argument's sake, one innovation area that could be bolder is Smart Array. While the city is upgrading to LEDs for the city's streetlights (which is common sense) and working toward a mesh network across the system, it would be inspiring to hear a vision that embeds sensing capabilities for pollution, traffic and other data points. This would go hand in hand with the Transportation Department's StreetShare vision and could accelerate progress across the two innovation programs, and dovetails nicely with the city's existing partnership with Waze, impacting yet another Top 10 topic: Mobility on Demand.

Nonetheless, looking at Boston through the lens of the Top 10 list allows us to see the bigger picture of the city's progress, which can sometimes get lost when programs are reported on in silos. It also complements Boston's CityScore, a real-time dashboard that informs city officials – and Bostonians – on the city's performance. Perhaps this overarching view of innovation across the city will further inspire cross-departmental dialogue, which, as the recent Economist piece "How Cities Score" points out, is critical to any city's ability to move beyond bureaucratic silos.

Summary

1) (Digitally) Re-Programmable Space
Public Space Invitational

Boston's Public Space Invitational (PSI) inspired innovative changes to the streetscape and enhanced the way people experience public spaces, whether through a portable library service or repurposing sidewalk obstacles into street furniture. The re-programming of Boston's public space results in a more intuitive and delightful user experience.

2) Waternet: An Internet of Pipes
Stormwater Education and Green Infrastructure

Boston's Water and Sewer Commission and Boston public schools are collaborating on storm water management and green infrastructure (GI) that will be designed to not only mitigate environmental and human health impacts, but also to be an interactive and educational space where curriculum for 5th and 7th graders will be applied in this "living laboratory".

3) Adopt a Tree through Your Social Network

Boston has 29% tree canopy coverage which the city aims to increase to 35% by 2030 to meet greenhouse gas emission reduction goals. Adopt-A-Tree is one strategy to help reach this goal. People can participate in Adopt-A-Tree by choosing a tree to adopt and pledging to care for it, receiving tree care educational tips and tree maintenance materials.

4) Augmented Humans
The Hubway

Boston's bike-share program has annual ridership taking over 1.1 million trips and travelling over 2.5 million miles, burning 110 million calories and offsetting over 1.7 million pounds of CO2.

5) Co-Co-Co: Co-generating, Co-heating, Co-cooling
Boston Community Energy Study

Boston's Climate Action Plan Update recommends expanding the use of on-site combined heat and power, renewable energy technologies and district energy to help meet the city's greenhouse gas reduction and climate change impact commitments. The Boston Community Energy Study laid out solutions that would provide a more resilient energy system, with embedded cost savings and environmental benefits.

6) The Sharing City: Unleashing Spare Capacity
Boston StreetShare

Boston StreetShare envisions a digitally-enabled streetscape that optimizes currently idle curb space, travel lanes or sidewalks and makes them available for public benefit. Currently deployed are dedicated locations for bike and car-share (Hubway and Drive Boston), food trucks and EV charging, as well as exclusive lanes for bikes and buses.

7) Mobility-on-Demand
Keeping Boston Moving in Partnership with Waze

Combining data from city-owned traffic cameras and crowd-sourced data from Waze, real-time information allows for the efficient movement of emergency vehicles as well as mitigation of traffic anomalies. With more partnership potential in the future with additional data providers, IOT and crowd-sourced data will combine to keep Boston moving.

8) Infrastructure for Social Integration
Roxbury Innovation Center

Ensuring that entrepreneurs outside of Boston's well-known start-up hubs have access to resources such as mentors, capital and training, the Roxbury Innovation Center supports neighborhood innovators and business owners through partnerships with The Venture Café, the Massachusetts Technology Collaborative and others.

9) Smart Array: Street Poles as a Platform for Urban Sensing

Upgrades to the city's streetlights will result not only in electricity and cost savings but also in a wireless mesh network that will serve as a platform to support cameras and other enhancements, improving security in public spaces such as parks.

10) Urban Farming

Boston seeks to increase local food production and purchasing to improve the City's food resiliency and security. By reducing permitting burdens and increasing the conversion of non-productive land to agricultural use by 20% over the next 5 years, Boston's partnerships with local farming groups aim to eradicate food deserts and provide equitable access to locally grown produce.

1. (Digitally) Re-Programmable Space

Public Space Invitational

Why

Innovative changes to the streetscape change the way people experience a space. Creating inventive ways to educate the public on the implications of climate change to their neighborhood, transforming unused public space into a place for convening, or re-purposing obstacles on the sidewalk as dual-function street furniture, re-programming Boston's spaces makes them more intuitive and delightful for the user.

What

The Public Space Invitational (PSI) is an open call to architects, designers, artists and engineers to rethink small civic spaces to make them more intuitive and delightful for the users of the city. In 2014, the Mayor's Office of New Urban Mechanics and a half-dozen partners received over 70 submissions and 8 projects were selected for further development. These include a tidal vibraphone installed along a historic channel, a light-activated drywell in a small park, colorful tape applied to stairs to make the inside of City Hall more welcoming, and a portable library service for neighborhoods with less library access.

Potential

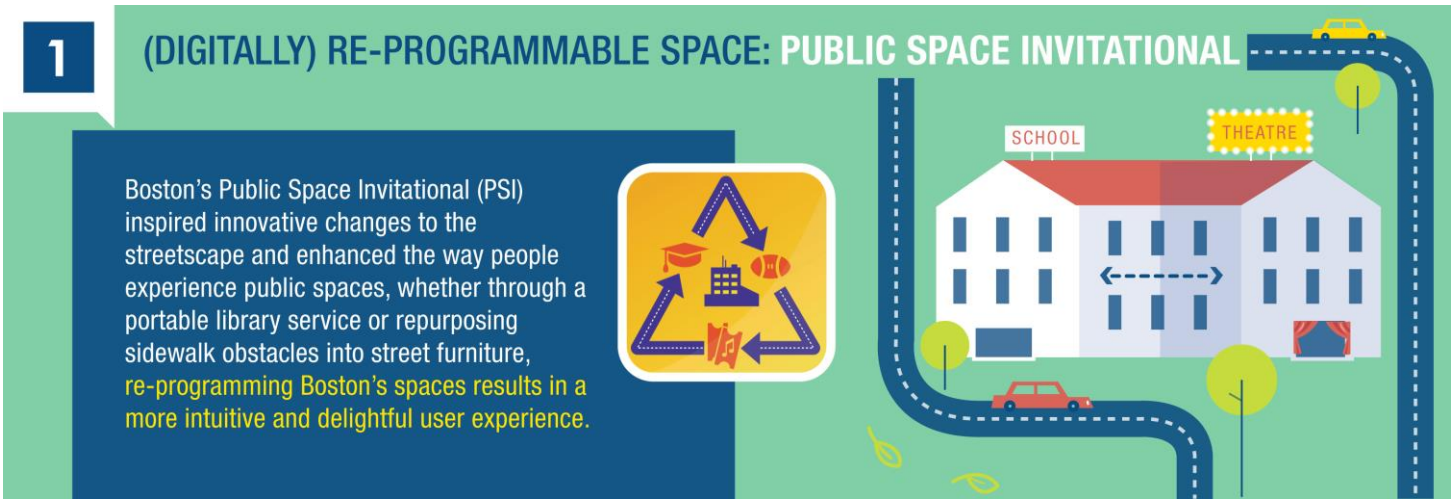
While each of the projects implemented reinterpreted public space in a quick and tactical way for users, the broader impact was the signal sent to potential collaborators and the changes the projects brought about within the government structure. The first PSI signaled to the public an openness to trying new things on our streets, sidewalks, plazas and inside civic buildings. Internally, it forced city departments to collaborate and rethink permit and risk management practices to be more inclusive of small-scale projects and individual designers.

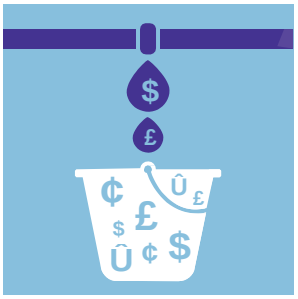
A second call for PSI projects launched in February 2016, this time framed around digital infrastructure for the city, with submissions due in early April. The goal is to engage technologists and designers, as well as to push the City of Boston's thinking on the Internet of People, Places and Things.

Scorecard Rating: 4

Useful links

http://psi2014.newurbanmechanics.org/
http://space.newurbanmechanics.org/
https://www.bostonglobe.com/business/2014/06/04/public-space-invitational-brings-vibraphone-and-rolling-reading-room-boston/puXgJ3VczHdmEtyztyqpWO/story.html





2. Waternet: An Internet of Pipes

Stormwater Education and Green Infrastructure

Why

The Boston Public School ("BPS") system is currently developing a 10-year Master Plan for its 133 facilities, many of which are located within the tributary area for the Charles River, where excess phosphorus must be managed due to environmental and human health impacts. Under a Consent Decree with EPA, the Boston Water and Sewer Commission is using green infrastructure ("GI") to reduce phosphorus loading and meet the total maximum daily load (TMDL) for the Charles River. The Commission is piloting a collaborative project to educate BPS about GI design and construction and to provide BPS with design documents that can be applied or adapted for future facility updates.

What

Five public schools, all located in areas with high phosphorus loading, were selected to participate in the "pilot" project. The Commission is designing and providing funding for construction of GI at each of these schools. GI designs include outdoor classroom spaces so that students, teachers and community members can interact with GI and gain a better understanding of how stormwater is managed in a living laboratory. Fifth and seventh grade teachers will also receive GI curriculum that allows them to better relay complex concepts (i.e. how infiltration removes pollutants from water, the benefits of phytoremediation, etc.) using visual and physical aids

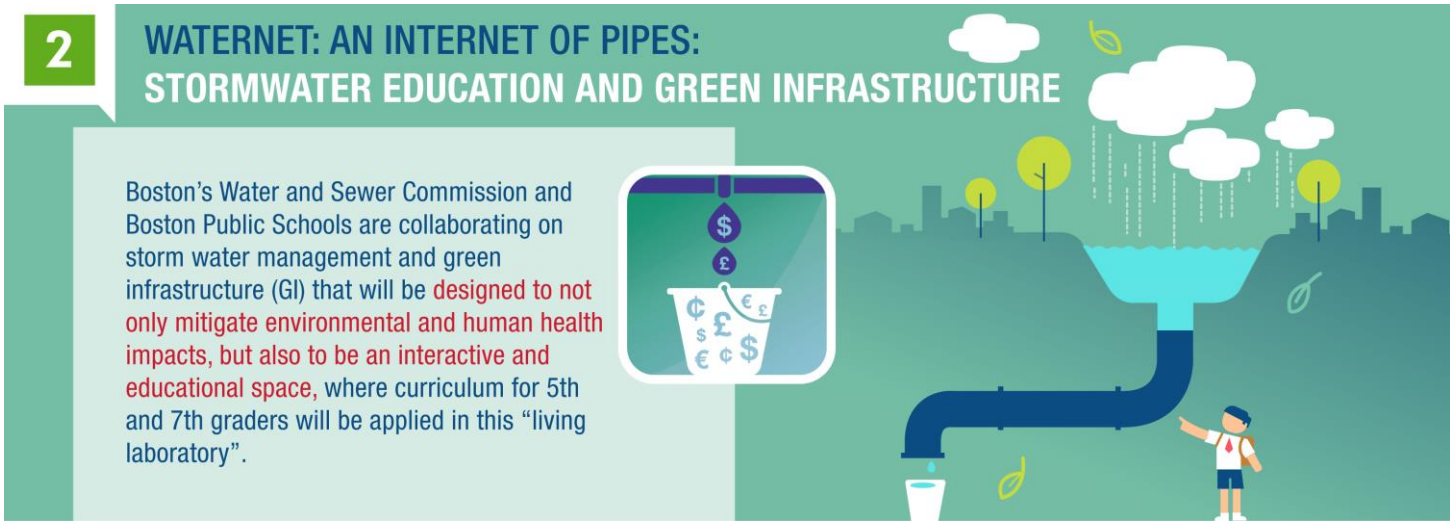
Potential

Upon completion of this project, these new GI features will serve as demonstration projects for future redevelopment and stormwater management improvements at other BPS facilities. BPS will have experience with the GI design/bid/construction process and will have design documents to reference for future projects. Furthermore, the GI curricula have been coordinated with the new Draft Massachusetts Science and Technology/Engineering Standards, so they can be taught in any 5th or 7th grade classroom as GI is constructed at other schools throughout Boston

Scorecard Rating: 3.5
[Will move to 4 in summer 2016]

Useful links

http://www.unep.or.jp/ietc/Publications/Freshwater/FMS7/16.asp



3. Adopt a Tree through Your Social Network

Why

Greenovate Boston's Adopt-A-Tree program aims to increase Boston's urban forest. City trees enrich the lives of all residents by providing many benefits, including: beautifying streets, providing shade, improving air and water quality, and offsetting carbon emissions. Boston plants many new street trees each year, but young trees have a difficult time getting established in a tough urban environment. With help, the young trees have a better chance of survival. People can participate in Adopt-A-Tree by choosing a tree to adopt and pledging to care for it, receiving tree care tips and tree maintenance materials.

What

Residents, businesses and organizations participate in Adopt-A-Tree by pledging to care for a young street tree after it is out of contractor care but before it is firmly established in the urban environment. People locate adoptable trees that are convenient for them to care for on an online map. After signing up to adopt a tree by providing an email address, Greenovate Boston supports volunteers with tree care educational and maintenance materials, including a watering can and a species/caretaker identifying sign.

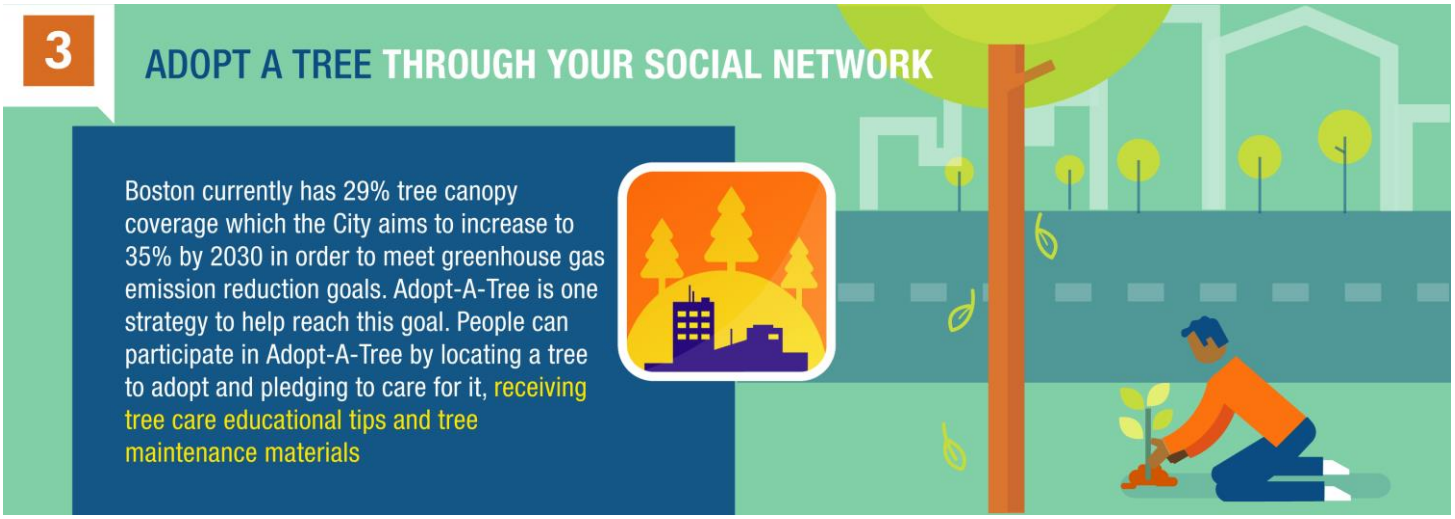
Potential

Boston currently has 29% tree canopy coverage. The city aims to increase Boston's canopy coverage to 35% by 2030 to meet greenhouse gas emission reduction goals. In partnership with the Boston Parks Department, Adopt-A-Tree is one strategy to help reach this goal. Greenovate Boston views the Adopt-A-Tree program as an initiative that elevates neighborhood engagement in local climate action. In collaboration with multiple city agencies and outside organizations, Adopt-A-Tree progresses Climate Action Plan goals and is a creative solution to connect community members to each other and to their environment.

Scorecard rating: 3.5

Useful links

http://adoptatree.greenovateboston.org/



4. Augmented Humans

The Hubway

Why

Urban residents are increasingly multimodal and Bostonians are no exception. Cities evolved primarily around the automobile in the 1900s, but modern-day traffic and congestion and the desire for walkable lifestyles have increased the demand for people-powered transportation. In an effort to get in and around Boston's notoriously tricky one-way streets and aggressive drivers, the city looked for ways to increase access to modes of transportation that are low cost, low or non-polluting, don't impact congestion, and are fun and healthy.

What

The Hubway is the Boston area bike-share program. The bike-share program allows people to easily pick up and drop off bikes at automated stations strategically located throughout the city. Users either pay an annual membership fee or purchase shorter duration passes. Hubway launched in Boston in 2011 with 610 bikes and 60 stations. With coordination by the Metropolitan Area Planning Council, Hubway now serves four adjacent municipalities – Boston, Brookline, Cambridge and Somerville - and has scaled to over 1,600 bikes at 160 stations. To support broad adoption, Hubway has a variety of membership and pricing structures.

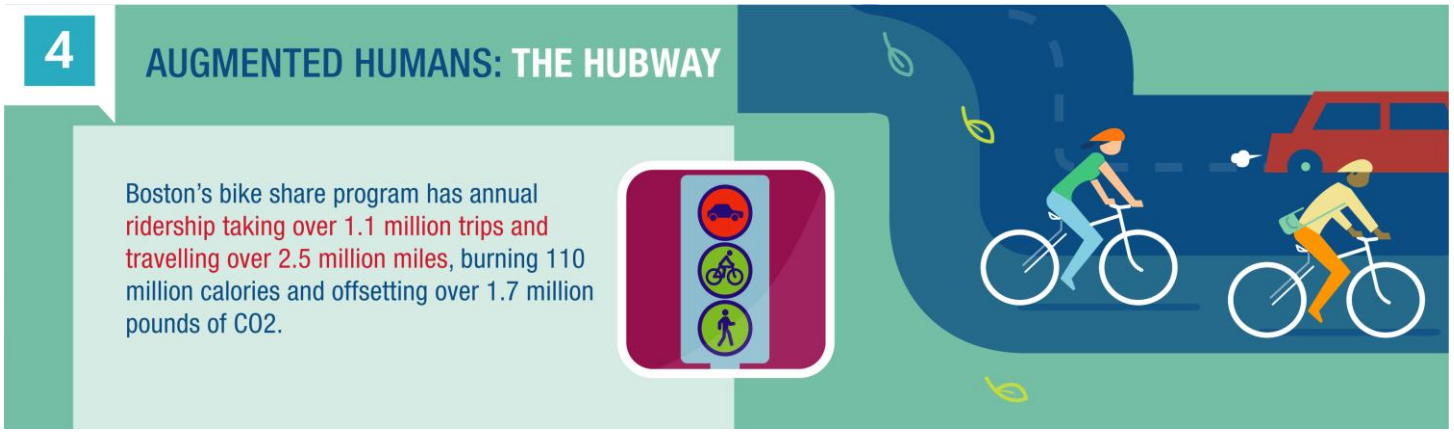
Potential

Hubway has become an integral part of the the region's transportation network, connecting transit corridors and providing residents and tourists with an affordable way to get around town. In 2015, Hubway had 13,248 annual members and 102,445 day passes were purchased. Riders took over 1.1 million trips and traveled over 2.5 million miles across the region – the equivalent of 101 trips around the earth. With 110 million calories burned and a CO2 offset of over 1.7 million pounds, this impact will continue to grow as the program expands into new neighborhoods for the 2016 season.

Scorecard Rating: 4.5

Useful links

https://www.thehubway.com
http://www.cityofboston.gov/bikes/



5. Co-Co-Co: Co-generating, Co-heating, Co-cooling

Boston Community Energy Study

Why

With Boston's Climate Action Plan Update recommending the expanded use of on-site combined heat and power, renewable energy technologies and district energy to help meet Boston's greenhouse gas reduction and climate change impact commitments, the Boston Community Energy Study set out explore solutions. District energy/microgrids are critical during catastrophic events (major storms, flooding and other natural or man-made disasters) to provide backup energy.

What

Using a combination of technologies, including local energy generation, energy storage technologies and resilient infrastructure (such as microgrids and district energy), the Community Energy Study identified opportunities to increase resilience, reduce greenhouse gas emissions and lower energy costs for customers. In partnership with the Boston Redevelopment Authority, the city worked with MIT's Sustainable Design Lab to simulate the energy "heartbeat" of Boston over the course of a year. Building on existing models, such as the energy microgrid in the Longwood Medical Area, the study identified potential locations for other community-based energy solutions.

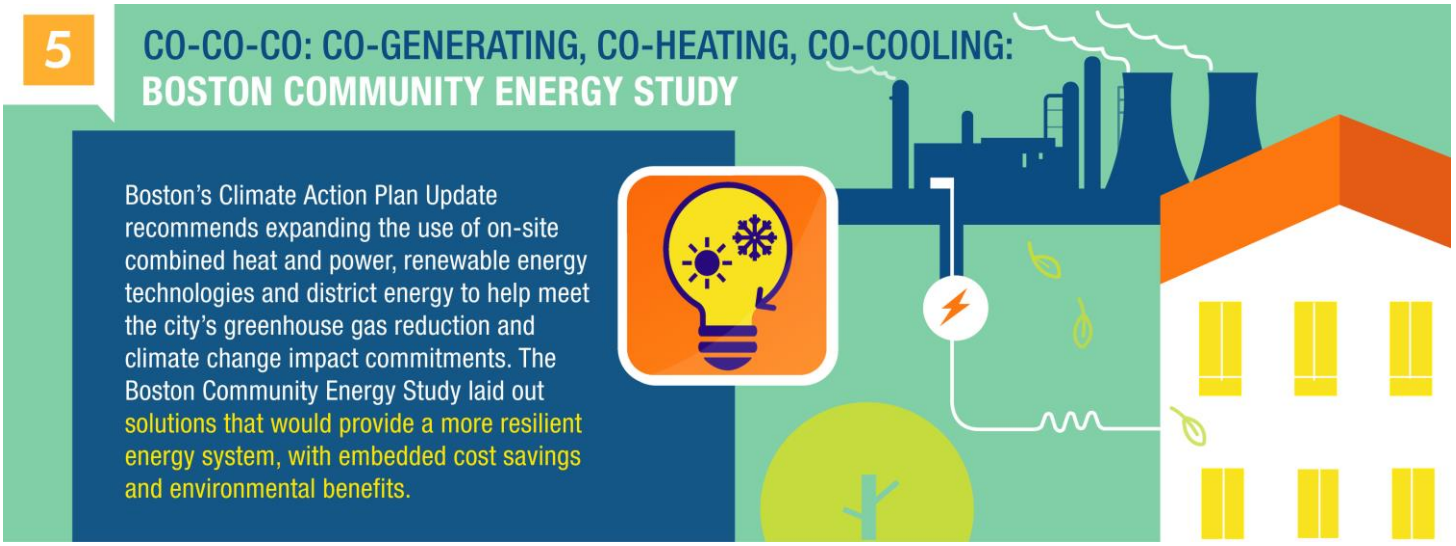
Potential

In addition to providing a more resilient energy system, the report examines cost savings and environmental benefits that point to solutions with triple bottom line impact. Scenarios suggest savings ranging from $600 million to $1.7 billion over 25 years, with the deployment of 10 microgrids in the city by 2022. Boston also looks to its innovative science, technology and business communities to advance solutions that provide cleaner, more affordable and more resilient energy for the city, supporting job growth and advancing energy solutions that can benefit cities around the globe.

The City of Boston, working in partnership with utility providers Eversource, National Grid and Veolia will use these findings to begin the transformation of our energy systems in the city. This partnership approach to energy system planning responds to the needs of Boston businesses and residents for clean, affordable and resilient power systems.

Scorecard Rating: 3

Useful links
Watch the Video [mobile]
Boston Globe article
Press Release
Download the Report



6. The Sharing City: Unleashing Spare Capacity

Boston StreetShare

Why

With the speed of the mobility and digital revolutions, flexibility is a necessary ingredient in managing city streets and sidewalks. Competition for street space is increasing and shifting: cyclists and commuters demand protected lanes, small-goods truck delivery is on the rise and on-demand transportation services – such as Boston-based Zipcar, Bridj and Hubway as well as Lyft, Uber and others – are increasingly the norm. Curb space and travel lanes are often underused, designed to accommodate peak demand, while laying idle for a far greater portion of the day (particularly on weekends) or available solely for private-car parking.

What

Boston StreetShare aims to open up the city's public right-of-way to an ever-increasing diversity of uses by repurposing underused spaces. Much as Airbnb allows home owners to rent out spare bedrooms for financial benefit, Boston seeks to design a system where idle curb space, travel lanes or sidewalks are made available for public benefit. Currently deployed are dedicated locations for bike and car-share (Hubway and Drive Boston), food trucks and EV charging, as well as exclusive lanes for bikes and buses. Boston is exploring several concepts to fully realize the StreetShare vision, including:

StreetShare Exchange Forum (an app that identifies available "shared zones" throughout the city, with the ability to book locations); Dynamic Inventory Data (an open database of every curb space, with the requisite location and regulations, and real-time availability info); Instant Traffic Control (real-time parking regulation and lane use signs, potentially paired with crowd-sourced enforcement).

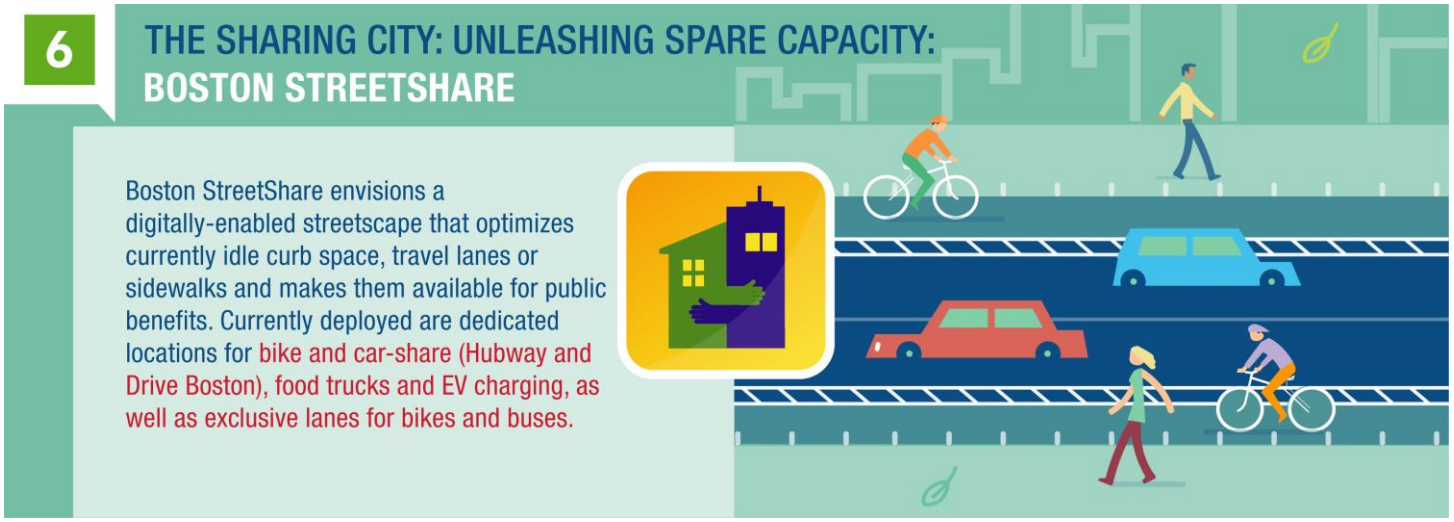
Potential

A fully deployed vision of Boston StreetShare provides a digitally-enabled streetscape, allowing for creative uses and optimized use, evolving beyond embedded and outdated regulations that solved for car-centric lifestyles and peak demand periods. The StreetShare Exchange Forum concept could potentially allow private parking spot owners to make their spaces available for a fee on a real-time basis. Beyond a nice money-making perk for the owner, this has a positive impact on traffic congestion, as drivers avoid circling for parking given increased access to dedicated parking spots. The suite of StreetShare programs further enables city dwellers to live car-free by making other modes of transit safer and more readily accessible.

Scorecard Rating: 3

Useful links

http://www.cityofboston.gov/transportation/driveboston.asp



7. Mobility-on-Demand

Keeping Boston Moving in Partnership with Waze

Why

Real-time information about traffic flow, parking and transit services combine to keep the city moving – with tangible outcomes, such as reduced congestion and improved service delivery in the near-term. Also, the goal of eliminating traffic-related fatalities and serious injuries, partnering with companies and other municipal agencies, is critical. Delivering on-demand service data to the City's emergency and public transportation services allows responders to more immediately address issues and deploy personnel to incident areas. By using data to shape and deploy experiments aimed at improving traffic flow and regulation adherence, novel programs, interventions and tactics can be shaped with statistical confidence in the outcomes.

What

Boston's Citywide Analytics Team partners with Waze, which crowd-sources data from the public, and pairs its data set with that of city-owned traffic cameras, allowing Traffic Management Center engineers to more efficiently remedy incidents and/or guide emergency personnel. By leveraging the combined data sets, the Analytics team can hone in on trends and automatically detect anomalies and take proactive action in the moment. In addition to addressing incidents, the team has also used the data to prove that, even with the removal of a full lane of vehicular traffic, protected bike lanes can demonstrably improve traffic.

Potential

The City of Boston will extend its efforts to collaborate and draw insights from agencies and companies outside of Boston city government, including a deeper partnership with Waze and the MBTA, which operates nearly all transit services in the City. Forging new connections with other providers, integrators and aggregators of mobility-on-demand services, such as SPOT, Inrix, Parkeon, Hubway and others, will help drive the city toward a deep understanding of what levers to pull in order to push Boston toward a multimodal, autonomous, and connected 21st century transportation network.

Scorecard rating: 5

Useful links

http://www.wbur.org/2015/02/13/waze-boston-data-partnership
http://www.wired.com/2015/02/boston-partnering-waze-make-roads-less-nightmare/

8. Infrastructure for Social Integration

Roxbury Innovation Center

Why

Spurring innovation in neighborhoods beyond the Boston area's well-known entrepreneurial clusters – such as Kendall Square, (increasingly) Government Center or Route 128 – is critical to ensuring that all Bostonians have access to resources for budding entrepreneurs. With a focus on businesses that can impact the local community and public education generally, resources for the Roxbury Innovation Center (RIC) are targeted at concepts and entrepreneurs who aim for social and economic impact. A public-private partnership model, the RIC supports economic health through access to advisers, mentors and technical assistance that would otherwise not be possible.

What

The RIC, operated by The Venture Café, in partnership with The SkyLab, Massachusetts Technology Collaborative, Microsoft, Verizon, the Boston Foundation and others, is located in the new headquarters of the Boston Public School (BPS) system. It aims to encourage collaboration, bold thinking and new business development in one of Boston's most economically challenged neighborhoods. With 3,350 square feet of space that includes a creative tech lab, classroom-style training areas as well as flexible event space, the RIC hosts training sessions on web and app design, as well as Excel training for aspiring business owners, amongst a host of other programs.

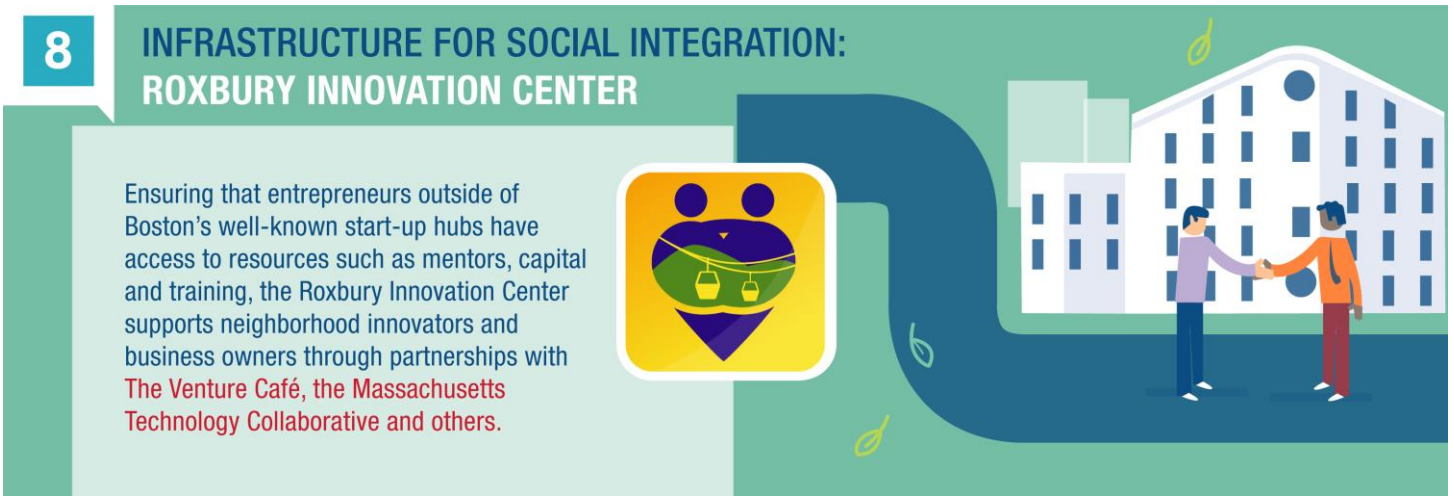
Potential

The RIC acts as a catalyst for economic development that will contribute to the long-term economic health and wealth creation in Roxbury by nurturing local talent and supporting new and existing businesses. By fostering this entrepreneurial enclave, the RIC can act as a bridge to other innovation ecosystems within the greater Boston area and better knit the Roxbury community into those networks. With its location within the BPS headquarters, the environment is ripe for educational innovation and provides fertile ground for evaluating concepts that can impact schools in Boston and public education in general.

Scorecard Rating: 5

Useful links

http://www.cityofboston.gov/news/default.aspx?id=17912
http://roxburyinnovationcenter.org
http://www.bizjournals.com/boston/blog/startups/2015/09/an-inside-look-at-the-newly-opened-roxbury.html#g1
http://www.betaboston.com/news/2015/12/08/with-new-sponsors-roxbury-innovation-center-gets-rolling/
http://bostinno.streetwise.co/2014/12/19/the-venture-cafe-foundation-will-operate-the-roxbury-innovation-center/



9. Smart Array: Intelligent Street Poles as a Platform for Urban Sensing

Why

To reduce aggregate electricity consumption and to provide a greater degree of operational control over the entire street lighting system, the city is currently exploring the addition of wireless controls to its street lights. These controls make it possible to assign an Internet Protocol (IP) address to each street light so that each fixture can be individually controlled. Groups of controlled street lights become part of a larger mesh network to increase the reliability of internet communications throughout the street lighting system.

What

Since 2010, the City of Boston has been engaged in a program to retrofit its 64,000 street lights with LED fixtures and has retrofitted more than 47,000 to date, reducing annual municipal consumption of electricity by 33.7 million kWh. In a pilot program deploying the wireless controls to street lights in Pagel Playground, the city was able to yield an 80% total electricity saving with the combination of LED retrofits and lighting controls. In addition to contributing to a higher rate of saving overall, the lighting controls added an unprecedented level of operational control.

Potential

Lighting controls also result in reduced maintenance costs, which will compound as the program is deployed citywide: controlled LED street lights report if they are “day burning” and can signal the source of a failure, allowing the City's Street Lighting Division to remotely diagnose faults and deploy the proper equipment to the site to facilitate repairs. The wireless mesh network serves as a platform that can be used, among other things, to enhance security in the parks: the network can support devices such as cameras, and can be used to respond to Boston Police Department requests for maximum lighting in areas of the city where criminal activity is a recurring problem.

Scorecard Rating: 4

Useful links

http://www.cityofboston.gov/publicworks/lighting/led.asp

10. Urban Faming

Why

Around the globe, catastrophic climate events and potential terrorist attacks draw stark attention to the need for cities to secure their food systems and to work toward food resilience to ensure that cities can readily and reliably feed their people. With “food miles” averaging 1,500 miles – the distance that food travels from point of production to end consumer – cities are re-thinking how to incorporate agricultural production within city limits to create more resilient systems.

What

In December 2014, Boston’s Office of Food Initiatives (OFI) kicked off the Urban Ag Visioning process to establish a 5-year vision for supporting urban agriculture in Boston, outlining goals, metrics, milestones and strategies. The resulting targets address increasing the amount of land dedicated to food production, improving food production opportunities for all Bostonians, increasing food resilience and security, and promoting health and engagement. Even prior to this visioning exercise, Boston acknowledged the growing urban “ag” movement and revised zoning to reduce barriers to commercial agricultural activity within the city. This paved the way for a local restaurant to install an enclosed vertical farming system under the highway, in previously “dead” space, resulting in nearly 50 pounds of fresh produce weekly.

Potential

By turning non-productive city land over to agricultural use and decreasing permit and site development costs, Boston aims to achieve an increase in local production and purchasing that directly relate to the City’s food resilience and security. Addressing these issues requires significant partnership and stakeholder collaboration – particularly with a 5-year target of a 20% increase in converted land. Training and support, currently underway by (largely non-profit) community-based farming programs such as ReVision, Urban Farming Institute, The Food Project, and Oasis on Ballou can help build local food production knowledge and provide more equitable access to locally grown produce.

Scorecard Rating: 4

Useful links

https://bostonurbanag.files.wordpress.com/2015/11/boston-urban-ag-vision-final.pdf
http://www.icic.org/ee_uploads/pdf/ICIC_INFOG_Food_Access_FINAL.pdf
http://www.cityofboston.gov/images_documents/usersguide_july-1_tcm3-45895.pdf
http://www.citylab.com/navigator/2015/12/freight-farms-two-acres-high-density-urban-farming/420906/

Contributors

Gretchen Effgen is a member of the World Economic Forum Global Agenda Council on the Future of Cities and a Board Member at CivicSmart; a former Zipcar executive, she currently leads business development at coUrbanize, an online platform for city development.

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Global Agenda Council on the Future of Cities

The Global Agenda Councils are a network of invitation-only groups that study the most pressing issues facing the world. Each council is made up of 15-20 experts, who come together to provide interdisciplinary thinking, stimulate dialogue, shape agendas and drive initiatives.

https://www.weforum.org/communities/global-agenda-council-on-the-future-of-cities/

Chair

- Carlo Ratti, Director, SENSEable City Laboratory, MIT - Department of Urban Studies and Planning, Singapore

World Economic Forum

- Alice Charles, Lead, Urban Development, Global Leadership Fellow, World Economic Forum, Switzerland
- Roderick Weller, Project Specialist, Centre for Global Industries, World Economic Forum, Switzerland

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