

Circular Economy: Shaping the Next Wave of Smart Communities

Smart All Over

BY PREETI SRIVASTAV AND NOAH GOLDSTEIN

The concept of the circular economy has been applied in sustainable manufacturing and shows great promise in creating sustainable communities. In a circular economy, waste streams are up-cycled for greater value and products are designed for disassembly, reuse, and recycling.

A city based on circular economy principles would reframe itself as a closed loop, where production of goods is linked to waste streams, where energy is created locally, and where the cities' people, businesses and governments build on that value to be healthier, more prosperous, with a lower carbon footprint.

An October 2018 report by Navigant and the World Business Council for Sustainable Development, Circular Policy Action Brief, studied the eight materials responsible for twenty percent of global greenhouse gas (GHG) emissions, ninety-five percent of water use, and eighty-eight percent of land use.

All circular economy measures related to these materials can substantially reduce GHG emissions, water use, and land use. The urban fabric of a smart city growing with circular economy principals would enable growth, and services to be right sized to the community needs, accounting for long-term social and economic needs. As we present in this article, the energy sector is an excellent example of implementing these solutions in the near future.

The smart city built on the principles of circular economy is a powerful concept that brings together technology, government, and people within an urban context. Its allure is that technology-enabled solutions will create efficiencies and opportunities to make city living easier, cleaner, and safer.

From an energy perspective, smart cities will use sensor-enabled

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systems in combination with other technologies to effectively predict and manage real-time low carbon energy of all constituents.

Many smart city deployments have been focused on smart street lighting, intelligent roads, and distributed generation. And it is working; cities are creating solutions to reach their low carbon goals, they are devising climate change resilient infrastructure, and they are greening their transit systems.

But the smart city concept – and the technology that comes along with it – will ultimately be more impactful at the human, not the city scale. When deployed, the technology will help cities and communities become more resilient and robust, not just to climate change and natural disasters, and help them grow to become sustainable, benefiting all constituents.

The core of the smart city is data; data about processes, energy, emissions, utility of resources, and behavior. A smart city can use this data to measure, and then act, in a circular way. Without the rich data a smart city delivers, a circular economy could not be implemented.

For example, energy-saving technology advances like low-energy LED grow lamps, vertical farms in cities can raise vegetables using a fraction of the energy and water required by conventional outdoor crops and without necessarily using pesticides or herbicides.

One of the key qualities of a smart resilient city is robustness – that is, that the city is designed to anticipate and respond to potential issues. Vertical farms are one example of robustness, securing space in urban environments for food production. Another example is using historical rainfall data, climate forecasting and streamflow modelling technologies, to estimate future flooding using projected climate data for the region.

**Sustainable Communities:
Enabled by Circular, Smart Cities**

Like smart cities, sustainable communities have no single

definition. The Institute for Sustainable Communities defines sustainable communities as one that, “manages its human, natural, and financial capital to meet current needs while ensuring that adequate resources are available for future generations.”

This definition addresses the nature of capital – that investments of different kinds are needed to support the multifaceted landscape to keep a community thriving. Smart city investments are one such avenue.

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Smart city investments, from the public or business sector (PPP’s) or from private citizens or foundations, are generally targeted at one domain, be it crime (such as ShotSpotter), health (such as air quality sensors), movement (such as carsharing or intelligent traffic) or energy (such as building energy microgrid backup systems).

The challenge for bridging smart cities to sustainable communities is to envision, then deploy, solutions that are integrated by domain and more expansive in solution set. Thinking about those sustainable community solutions as employing circular approaches is impactful. Some examples of those are presented below.

The circular economy concept can provide new, more impactful solutions to the systems that are of focus to smart cities;

Mobility: A circular mobility system would offer more choices and be shared, electrified, autonomous, multimodal. Individualized mobility would be provided as a service. These systems would mean fewer, better-utilized cars, with such positive side effects including less congestion, less land and investment committed to parking and roads, and less air pollution.

Energy: Smart cities and sustainable communities are already careening toward a low carbon future. A core part of that drive is locally derived power. Through renewable power, the emergence

of microgrids, and the community choice aggregation revolution in multiple places, energy is becoming local.

Cities like Madison, Wisconsin are plotting pathways to be a hundred percent renewable. By creating local sources of power, there is greater control of its sources, and greater awareness of its by-products. The drive toward low-carbon energy inadvertently boots circular economy approaches, putting more control in the hands of consumers. There is opportunity for utilities to take advantage of this trend by providing local power solutions, such as renewable power or resilient power backup.

Built environment: Smart city technologies are frequently cited as enabling buildings to develop fully closed water, nutrition, material, and energy loops. A circular city would enable space to be highly utilized, thanks to shared and flexible office spaces and flexible, smart, and modular homes. As much as food and shelter need to be the focus areas of a future smart city, they also fulfil basic needs in society and can therefore not be circumvented. With circular approaches, sustainable communities can be the future of the smart city.

Smart Cities: The Data-Driven Enabler

Even though transformation will happen to a large extent through new business-to-business or business-to-consumer solutions, utility companies can play an important role by looking at circular solutions in smart cities as an exciting new revenue stream.

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In Navigant’s work with European grid operators like Enexis and Gasunie, measuring and managing the GHG impacts of their waste processing and benefits of recycling along the supply chain has been one of the main focus areas. Similarly, European utility companies like Alliander are looking at ambitious goals of carbon neutrality and unpacking principles of smart cities

and circular economy to provide them with the lever to meet their ambitions and tap into new business opportunities. These examples foretell what the North American grid operators will pursue in the next decade, as low-carbon policy and smart grid technology matures.

Transforming a metropolis that has evolved organically for hundreds of years into a smart interconnected ecosystem represents a difficult challenge; at the same time, it presents a significant opportunity for implementing circular economy and

smart city solutions to benefit its citizens.

The circular economy concept can help transform cities into climate-smart hubs to save money, lower emissions, and improve living standards. By deploying smart city technologies, sustainable communities can emerge. Through the deployment of social, financial, and environmental capital, cross-disciplinary and data-rich smart cities will be a positive outcome that enable long-term growth and resilience in communities worldwide. **PUF**

'Smarter States, Smarter Communities'

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we have a collaborative stemming from a rate case that concluded in August. The rate case included a proposal from the company to advance power-sector transformation. One element of National Grid's Power Sector Transformation proposal was to develop a detailed business case for advanced meter infrastructure development.

We are working with several stakeholders in a collaborative, meeting biweekly. And one important component of those conversations for us is: If ratepayers buy a single communications network then let's be sure to use all its value. Can a communications network be used to achieve other things that communities want to?

PUF: A lot of parties besides you and the utilities, such as vendors and community groups are involved. How does that work?

Jonathan Schrag: They're obviously interested, but not a part of the stakeholder conversation. We were aware of some of the technology proposals that vendors have and are thinking through how that conventional meter can be used to meet a range of goals. Really what happens to the revenue stream? There's the technical side to it, but then there's the regulatory treatment of the potential proceeds.

The second area that's of interest is streetlights. Last year the legislature passed a bill that set a uniform price for municipalities to receive compensation for street light utilization. The way street lights can act as a critical piece of real estate to develop into small cell technology for advanced communications is something that Rhode Island is excited about.

The third component that is important is working across state government with the municipalities to make sure that we're leveraging all the assets that exist within state government. For example, our Department of Transportation owns a great amount of fiber-optic cable, which can be used as back haul to increase, or rather to decrease the latency. That will enable applications, for example, autonomous vehicles.

PUF: What's the potential regarding changes citizens will notice and changes in the services that they receive?

Jonathan Schrag: The potential is for a Christmas tree, in which you have some group of entities offering ubiquitous communication services, and it's not yet clear whether it will be the municipalities themselves or an entity of the state or conventional communications providers, the electric, water or gas utilities whom any number of third parties may leverage to offer their applications.

There are a range of needs, whether autonomous vehicles, or storm restoration, or enhanced energy efficiency response services, or more efficient garbage pickup routes. One of the very interesting questions we're asking is the back of the envelope gauge of what is the potential revenue?

PUF: Why is this important to Rhode Island? Why is this priority? You said the Governor is interested.

Jonathan Schrag: Rhode Island is a small state. We have a population that works hard. We're a strong, middle class state. The Governor is creating jobs, and Rhode Island is on top of the wave in recovering from the 2008 recession.

But at the same time, a middle-class Rhode Island wants to make sure that every efficiency and every saving can be gained. We don't have the sizable population that's able to support a large tax base, so we need to be as efficient as we can be. Rhode Island is also close to the 495 and 128 technology loops of Massachusetts.

From the public utilities' perspective, one factor that is unique about Rhode Island is over 95 percent of our citizens are supplied by one electricity company, National Grid, and that company also happens to represent all the gas customers.

While other states must work with several entities and utilities, in Rhode Island it's a relatively straightforward process to bring some of these technologies to commercial innovation.

PUF: It's an advantage that everybody knows each other, so you and the utility, once you have a consensus you can move faster than other places?

Jonathan Schrag: That's what we think, yes. That's what our record shows. **PUF**