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Game Changers Impacting the Global Energy Sector

*Special Edition:
Smart Cities & Communities*

"A Smart City modernizes digital, physical and social infrastructure and integrates all essential services for the benefit of its citizens by harnessing advances in sustainable technology to make delivery of these services more efficient, innovative, equitable, and exciting."

This special edition of Game Changers Impacting the Global Energy Sector follows the launch just a few months ago of the Dentons Smart Cities & Communities Think Tank – an initiative that brings together the resources of the world's largest law firm with leaders of government, businesses, academics, innovators and community stakeholders to help cities and communities leverage existing and emerging technological developments to enable the integration of essential services for the betterment of the lives of their citizens. Together, the Think Tank members share insights and best practices with the aim of crafting innovative legal, economic and policy solutions to societal challenges in an era of accelerating technological change.

This volume represents an initial discussion of some of these issues and challenges by thought leaders who grapple on a daily basis with developing solutions for sustainable and prosperous 21st century cities and communities.

The starting point is a question: what is a smart city? Over recent years, it has become a household expression, yet there is no universal definition or understanding of the term. What it means to tech companies, municipal leaders and regulators, infrastructure developers, social scientists, or the average citizen varies dramatically.

For purposes of approaching smart cities and communities in a systematic manner, the Think Tank has divided the concept into Fourteen Key Pillars for analysis: Government Leadership & Public Policy; Regulation; Technology & Innovation; Telecommunications; Cyber & Physical Security and Privacy; Consumer Engagement & Community Social Infrastructure; NGOs & Universities; Finance, Investment and Economic Development; Transportation; Energy; Water, Wastewater & Waste; Buildings & City Planning; Environment, Health & Safety; and Smart Global Approach.

These Pillars are designed to capture essential city structures, services, and goals and to include all key stakeholder voices. As a global law firm, Dentons also looks beyond national borders for models and best practices. We fully recognize that the integrated nature of smart cities solutions necessarily means that there are no clear lines, and that each pillar will overlap with all of the others at some point. However, we have found it useful in organizing our work so that is will be beneficial to community leaders and, importantly, will help identify the silos that need to be eliminated and the shape of new structures that must be established to ensure optimal and equitable integration of smart technologies and concepts across society.

This edition of Game Changers addresses issues such as: What is the starting point for "smart" initiatives? What is 5G and what does it really mean? Data is the tool for making cities and communities smarter, but how can it be secured? How are community members brought into the smart cities conversation? These questions are truly just a beginning. Over the coming months, the Think Tank will release a series of articles and reports related to each of our Pillars. Please visit our website for more information and to find these reports as they are released: https://www.dentons. com/en/issues-and-opportunities/smart-cities-communities-initiative-and-think-tank

Sincerely,

- Clint Vince & Emma Hand, Co-Chairs
- Jennifer Morrissey & Rudolf Beese, Co-Editors in Chief
- Dentons Smart Cities & Communities Think Tank

Articles

Dentons Smart Cities & Communities Think Tank Pillars for Thought Leadership

Water, Wastewater & Waste

Government Leadership & Public Policy

Cyber and Physical Security & Privacy

Finance, Investment and Economic Development

Consumer & Community Social Infrastructure

Technology & Innovation

NGOs & Universities

Regulation

Telecommunications

Transportation

Smart Global Approach

Environment, Health & Safety

Buildings & City Planning

Energy
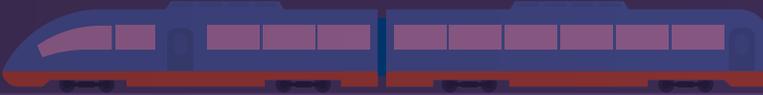
Grid Modernization as the Essential Platform for Integration of Exciting Smart Cities Technologies

By Clinton A. Vince and Jennifer Morrissey

In a decade or so, people may look back on the current time as an era of "smart". We have had "smart" devices for several years – phones, tvs, cars, power grids. Now we are moving toward "Smart Cities." But what does this mean?

The definition of a "Smart City" is elusive. There is tremendous hype in the media, in board rooms, in town halls, even at the dinner table. Conversations about Smart Cities may convey complexity. However, the concept of Smart Cities is relatively simple and elegant. A smart city uses an integrated approach to coordinate all essential services. It modernizes digital, physical and social infrastructure to make delivery of city services more efficient, innovative, equitable and exciting.

The backbone of a Smart City is "the grid" – another elusive term, at least to the average citizen. The grid is a combination of the electric power grid and advanced telecommunications systems interconnected with and supported by a host of sensors and devices that amass and analyze data real-time. Through predictive analytics, machine learning, clean technology and, multidirectional communications, the grid will be used to optimize the efficiency of city operations and services, connect citizens, improve quality of life, and foster sustainability.

While interconnectedness can be achieved almost anywhere, cities (and sizeable communities) are the ideal scale for broad deployment and integration of smart technologies. Over 50 percent of the global population now live in urban areas, and it is projected that by 2050, more than two thirds of the world's population will reside in an urban setting. This growth trajectory means that cities will face increasing challenges in all aspects of their operations and delivery of services. Cities are particularly vulnerable to problems such as social imbalances, traffic congestion, pollution and strain on resources. It is recognized by mayors around the globe that deployment of sustainability strategies and becoming technologically smarter is necessary to improve the quality of life in cities. In addition, it is understood that embracing advanced technologies will enable smart growth strategies which in turn leads to investment attraction and positive growth in cities.

For instance, a recent OECD study identifies a strong correlation between cities' environmental performance and prosperity. As the urban populations grow, so does the adverse effect on the environment, which in turn affects many aspects of daily life. Municipal governments will need to implement strategies for sustainability and, in some regions, adaptation to a changing climate. This requires rapid acceleration towards a cleaner, healthier, and more economically viable city growth through improvements in efficiency, investments in renewable energy technologies, and corresponding regulatory reform. It also requires greening of urban infrastructure, transportation, land-use and development policies. Failure to make this shift will result in increased financial, public health and safety risks.

In addition to sustainability benefits, smart appliances, managed services for telemedicine, crowdsourcing apps, and so forth, can all improve the quality and convenience of daily life. Autonomous vehicles, mass transit made more efficient through data, and automation can connect underserved populations with more jobs and educational opportunities. Applications powered by artificial intelligence and smart streets can offer mobility to people with physical and cognitive disabilities. Smart cities increasingly incorporate computer-enabled networks, sensors, and software into buildings and infrastructure, where citizens and municipalities can control lighting, heating, and air conditioning. Sensor technologies can collect information in real-time to manage traffic flow and

While interconnectedness can be achieved almost anywhere, cities (and sizeable communities) are the ideal scale for broad deployment and integration of smart technologies.

energy use, and critical information can be deployed to do everything from reducing consumption of natural resources to empowering citizens to communicate more readily with first responders and with one another during an emergency.

The possibilities for a connected future are endless. To get there, however, will require breaking down silos to coordinate across technologies, sectors and disciplines. First, Smart Cities are powered by networks. Devices, people, businesses, and governments must all be able to connect securely, reliably, and quickly in order to share data to improve how people live, work, and manage their daily activities. Even while adopting the most current state of the art telecommunications and network technologies, a meaningful "Smart Cities" strategy must also pave the way for the integration of the next generation of wireless networks and services. This will have to occur not only in the telecommunications companies themselves but in all participating sectors of the economy. Additionally, inherent to any interconnected ecosystem, there are security challenges and altered expectations of privacy. A Smart Cities/Communities approach ensures that the increase in smart technology is accompanied by strategies to enhance cyber and physical security.

Much of the smart movement is consumer- and business-driven, but government leadership at all levels is essential. Building smart communities requires public officials to implement cooperative, interdisciplinary solutions for their constituents' most pressing problems. Policy structures must be created that nurture the evolution of Smart Cities/Communities programs. Among other things, this means creating incentives for businesses of all sizes to invest in the deployment and adoption of advanced technologies while ensuring the trust and safety of consumers.

Building broad community support for a Smart Cities & Communities program is a complex process that requires significant collaboration with community anchor institutions, consumers, and other stakeholders. A smart community can only thrive if its members are interacting with and leveraging the resources that make efficiencies and cost savings possible. As part of developing Smart Cities plans, local governments should also engage universities and NGOs to provide intellectual firepower and foster public trust.

Transportation is a key pillar of any "Smart City" as the efficient movement of people and goods is fundamental to any economy. Reliable transportation infrastructure connects people with goods, services, employment opportunities, and with each other. When transportation infrastructure is powered by technology, cities will realize countless benefits such as reduced emissions as a result of widespread use of

electric car shares, enhanced public safety arising from smart monitoring, reporting and routing of emergency responders, and economic development as underserved communities are connected with employers through efficient, data-driven mass transit.

Energy and water are also critical components of "Smart Cities" strategies. "Smart Cities" will incorporate a multi-directional grid and advanced clean energy technology solutions that will include a broad array of distributed energy resources. Smart Cities are electrified cities, so the changes must occur without sacrificing reliability. With respect to municipal water systems, there is increasing demand and higher expectations of reliability and quality of service. Smart technologies can be used to monitor and manage delivery systems.

Finally, implementation of these changes requires financing. Because of the varied benefits that will flow from the "Smart Cities", initiatives do not necessarily fit within the scope of traditional municipal infrastructure projects. An integrated, sustainable planning approach is required to look across sectors. Because of the integrated approach, creativity in financing will also be required. Government, industry, philanthropic, and community-based organizations should all have an interest in making Smart Cities work for their residents and may be poised to invest.

As for cities, specifically, keep an eye on San Antonio and New Orleans – both with interesting Smart Cities initiatives underway that are focused on modernizing the electric grid as a platform that will assist the integration of other services, including advanced telecommunications and transportation along with a number of public safety measures.

Devices, people, businesses, and governments must all be able to connect securely, reliably, and quickly in order to share data to improve how people live, work, and manage their daily activities.

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INSIGHT

How will we know when a city has achieved its Smart City goals, and how long will it take to get there, and what do we have to give up along the way?

Paula Gold Williams, President and CEO at CPS Energy in San Antonia, Co-Chair of the Energy Pillar of the Dentons Smart Cities & Communities Think Tank.

A "Smart City" is one where technology responds to how people want to live. It will be an evolution. In some respects, people may take for granted the way we use electricity today. This evolution is also happening very fast. What our communities look like five to ten years from now will be very different from today. In some ways, the average person is aware of the change because home management and productivity apps are being developed every day. In this respect, there is very noticeable change. But there is a lot happening "behind the scenes". Data is collected and analyzed so services can be optimized to make life easier. We are still trying to figure out some of it which for example, the 5G component, we need to make sure is optimized for all of our citizens and not just certain segments. The pace of all this change will be set by a combination of factors such as the electric companies and telecoms that work to add value, as well as city leaders who help set communities on the right and balanced path forward. We need great communicators to make it work and to let our citizens know about it and how to take advantage of it. Finally, it is important to realize that it will be different for every city, and not everything has to change. A city can maintain its particular historical or cultural identity, and still upgrade infrastructure in a way that helps people live the way they want while still celebrating what makes each community unique.

5G Beyond the Hype:
So Much More than Speed

By Todd Daubert & Lauren Wilson

After years of hype, the debut of 5G in the real world is finally on the horizon. Nationwide carriers are starting to buildout 5G networks in select cities, and several 5G capable devices are scheduled for release in 2019, although widespread availability of true 5G service likely is still years away. And yet, most of the public still does not really understand what 5G is, or how they will benefit from 5G aside from vague claims about faster network speeds. Worse yet, many are concerned about deployment-related disruptions and the installation of additional cell towers based on the false assumption that 5G will lead to large cell towers and antennas blanketing their communities.

The widespread lack of understanding about 5G is discouraging, particularly because the successful deployment of 5G depends upon cooperation among local governments, federal regulators, community leaders, and private companies, which is much harder in the absence of strong public support. For this reason, all stakeholders should focus more on explaining the practical benefits of 5G and dispelling the myths about 5G deployment. Far too often, the benefits of 5G are distilled down to speed: 5G will be much faster than today's network, increasing the potential speeds of our mobile networks to one gigabit per second, which is more than three times the potential speeds of today's fastest networks. To put this into perspective, a high definition ("HD") movie is typically between 2GB and 3GB, which means you could download an HD movie to your mobile device on a 5G network in only a few seconds.

But thinking only in terms of speed really misses the bigger picture. Arguably, the most important benefits of 5G are far lower latency, as well as far better stability and reliability. Reducing latency, which is the amount of delay between sending data from one point to another on the network, and improving stability and reliability is the key to unlocking the types of technologies that we have envisioned since Star Trek, including smart cities, self-driving vehicles, remote robotic surgeries, and all other technologies that require instantaneous and reliable communications. Just as you likely would refuse to accept a ride from a narcoleptic taxi driver (or refuse to be operated on by a narcoleptic brain surgeon), you should refuse to use technologies like self-driving cars or remote robotic surgeries until they are supported by networks that are extremely stable and reliable with very low latency. 5G networks will also have far higher capacity than today's networks, which is critical considering how much data will be generated and needed by tomorrow's technologies that will power smart cities, self-driving vehicles, artificial intelligence and the ever-expanding universe of devices commonly-referred to as the Internet of Things. Finally, 5G networks are far more energy efficient, which is critical not only due to issues like climate change and increasing demand for energy, but also because energy efficient networks are easier to harden and protect during natural disasters.

The combination of greater speeds, lower latency, improved stability and reliability, higher capacity and energy efficiency will, for the first time, allow us all to reap the benefits of smart cities and related technologies.

The combination of greater speeds, lower latency, improved stability and reliability, higher capacity and energy efficiency will, for the first time, allow us all to reap the benefits of smart cities and related technologies. The deployment of the supporting 5G networks can be expedited with effective coordination and cooperation among federal regulators, state regulators, local governments, community leaders and private companies including to facilitate the deployment supporting fiber backhaul, installation of 5G radios and allocation of wireless spectrum. Without public support, deployment will be unnecessarily delayed, and the costs of deployment will skyrocket. Once the facts about 5G are widely known, the majority of the public undoubtedly will support the needed coordination. So, key stakeholders should work together to dispel common myths about 5G deployment and better explain the resulting benefits. Simply put, expediting the deployment of 5G throughout the United States is a bipartisan way to improve the lives of each and every one of our citizens in real and tangible ways.

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INSIGHT

What are city leaders looking for as they evaluate smart technologies?

Neil Harris, Councilmember, City of Gaithersburg MD, and Member of the Government Leadership & Public Policy Pillar of the Dentons Smart Cities & Communities Think Tank

Cities are being presented with many smart technologies, but many of these are not focused on real-world needs. Our city, Gaithersburg, is one of the larger cities in our state, but small compared to New York or Philadelphia. Nevertheless, as a suburb of a rapidly expanding major metropolitan area, we face many of the same challenges as larger cities do in meeting the needs of our residents, but with a very different budget. Here in Gaithersburg, we are looking for ways to make data-driven decisions that enable better services and reduced costs to our taxpayers. Some examples:

We employed a truck with cameras and lasers to gather data on the conditions of our roadways. We can save money and keep our roads in better repair by performing preventive maintenance when roads begin to deteriorate but before their condition becomes critical and much more costly to repair.

We hired a team to inventory our trees. We know the species, age, and condition of every publicly-owned tree, which helps us deal with diseases and understand when mature trees might interfere with other infrastructure. We also can understand the size of our tree canopy, nearly covering 40% of our city, which is one of our state's goals for a healthy environment.

We are compiling locations of below-ground infrastructure including storm water systems and utilities, and we know where there are impervious surfaces that increase the need to manage storm water runoff. We are required by the EPA to improve management of storm water cleanliness before it reaches the Chesapeake Bay, and we are very attuned to the potential destructive abilities of poorly managed storm water systems and committed to proactive measures to ensure public safety.

All these projects and more are compiled into GIS databases that enable us to create more efficient and effective solutions. We can view these individually or collectively as we plan our work and budgets. We embrace technology that enables us to serve our citizens and resolve our specific problems. We are less inclined to consider implementation of technology that, while innovative and interesting, appears to be searching for a problem to solve.

Smart Cities:
Securing Data in a Hyper-Connected Ecosystem

By Pete Tseronis

For cities to be deemed "smart," the critical infrastructure sectors supporting these communities will leverage information and communication technology (ICT) to analyze real-time information. Moreover, if these digital communications are to afford new citizen services, *e.g.* smart grids, intelligent transportation, remote health care, then it is paramount to address cybersecurity and privacy matters without stifling innovation.

The key to building a smart city is the underlying (and hopefully, resilient) infrastructure. In other words, it's the ping, power, and pipe integrated with an Internet of Things (IoT) fabric intended to facilitate secure collaboration, foster knowledge-sharing, and spur economic growth.

CYBER-PHYSICAL SYSTEMS, DIGITAL TRUST, AND IOT

To date, significant public and private sector investment has accelerated the research and development (R&D) necessary for smarter cities/communities to become a reality. Yet, the development and deployment of these innovative approaches will require continuous, multi-disciplinary collaboration across academic, entrepreneurial, and government stakeholders to harness the promise of technology.

To realize the benefits of a distributed network of technologies, cyber-physical systems and machine learning platforms must seamlessly collect, aggregate, and distill information in a manner that leads to improved citizen living while mitigating risk of data breach. In other words, city residents will require that digital trust (keeping information safe and secure) be upheld.

A "smart city" will leverage critical infrastructure computing services such as the cloud, advanced analytics, and artificial intelligence to connect physical and virtual devices. This connectivity requires equal parts broadband, electronics, sensors, software, machine intelligence, and security to strengthen and maintain secure, functioning, and resilient assets vital to our cities and communities

DATA PROTECTION MATTERS

And, as IoT deployments become more ubiquitous, it is crucial that the systems underpinning this infrastructure employ prevention, protection, mitigation, response, and recovery measures, especially given the expected volume, velocity, and variety of data exchange.

So, how do cities plan to balance the promise of enhanced citizen services with concerns related to data protection and personally identifiable information (known as "PII")? After all, the basis for a smart city is maintaining automated infrastructure that communicates with consumer habits, e.g. consumption, movement, and behaviors.

For starters, it is essential that city architects, planners, and technologists emphasize the protection of collected personal data, mitigate unauthorized access to consumer information, and maintain transparency when amassing sensitive customer data.

In addition, while myriad cyber-physical system mechanisms intended to protect customer data exist, a few key techniques that should be incorporated into a smart city framework include encryption, identity management, device authentication, digital certificates, signature, and watermarking, and blockchain.

ASSESSING INNOVATION AND SECURITY

Smart cities/communities exude the concept of "hyper-connectivity" (and increased ICT complexity). The IoT landscape affords always-on access to information and the associated corresponding vulnerabilities, whether malicious or inadvertent. As our sixteen critical infrastructure sectors seek to adopt connected assets within city planning architecture, the threat landscape will exponentially expand.

Moreover, as citizens, we will consume these ICTs in an effort to stay informed, stay connected, and stay smart. To ensure a safe, secure equilibrium of modernization, resilience, and information protection, the public, private, and consumer sectors are proportionately accountable. The over-arching eco-system is as strong (or vulnerable) as its weakest link.

In sum, this digital transformation is clearly being felt within our communities, cities, and countries. However, the infusion of next-generation technologies is outpacing the development of cybersecurity measures intended to protect information assets. Managing and mitigating risk while inventing and innovating is the balancing act. If done effectively, our hyper-connected world will be one that is equally hyper-secure.

About the author

Pete Tseronis is the Founder and CEO of Dots & Bridges LLC, and is a Co-chair of the Technology & Innovation Pillar and Member of the Cyber & Physical Security & Privacy and Telecommunications Pillars of the Dentons Smart Cities & Communities Think Tank. He served in government for 25 years, ending his tenure as the first-appointed Chief Technology Officer for the U.S. Department of Energy, where he served for eight years. An expert in energy, telecom and cyber security issues, with deep reach between government agencies, the nine National Laboratories, and the private sector, Pete was referred to as DOE's "Connective Tissue Officer". He presently advises cities and entities throughout the 16 critical infrastructure sectors, advising on investment opportunities and conducting technology diligence in terms of value, risk, and reward. Visit http://dotsandbridges.com/ to learn more.

INSIGHT

What value do NGOs and universities add to the development of smart cities and communities?

Fenner Stewart, Ph.D, Associate Professor of Law, University of Calgary, Member of the NGOs & Universities Pillar of the Dentons Smart Cities & Communities Think Tank

The field of Smart Cities is populated by many players with a variety of motivations. NGOs and academics are in a position to shape the Smart City environment and manage expectations. Importantly, they fill multiple gaps between Smart City "service providers" and their "clients", educating the public and leveling the playing field within decision-making processes.

Smart City "service providers" are the political, technical, and economic actors, who aspire to define and meet, the demands of urban dwellers. In this way, these service providers are the designers of tomorrow's cities. Smart City "clients" are the urban dwellers, who are threatened by ever-increasing urban density, and in some instances, they also are the municipal governments who acquire services. The clients ultimately will be the beneficiaries – or potential victims – of tomorrow's cities.

Historically, movements in urban planning have been top-down, sometimes without consideration of how city residents interact with their urban environments. Smart City development by its nature is focused on this interaction. It is about optimizing the needs and outcomes of clients to provide improved urban environments. With the tremendous increase in urban populations come trillions of dollars in opportunities to provide services to cities and their dwellers, prompting companies aggressively to vie for their products to be imbedded into the DNA of tomorrow's cities.

Service providers offer new technologies with the promise to revolutionize urban services. Smart City development to date has often been packaged in heroic narratives which suggest a much-improved way-of-life through the power of technology and progress. Such promises, if not properly vetted, may lead to unrealistic client expectations.

NGOs and academics are in a position to assist in managing expectations and in vetting the promise of new technologies. They can mobilize communities along geographic, demographic, or ideological lines to mediate the relationships between governments and companies to ensure a plurality of voices are considered within decision-making processes. Put differently, individual NGOs may not be "neutral" or "objective", but they can create competitive, transparent, and broadly deliberative decision-making processes for issues related to new technologies and community needs. NGOs represent a plurality of voices and – in theory – can perform a valuable role as institutional contrarians, which as a group are at least independent of both governments and special interests. Such voices help to maintain accountability within Smart City governance networks. They also can play a role in smoothing community relations. First, NGOs can facilitate learning and provide platforms for civic engagement between government, industry, and the community. Such functions can lead to faster identification of issues. Second, they can foster knowledge exchanges between service providers and clients, which can enhance decision-making outcomes. Finally, NGOs with technical expertise are able to provide an auditing function, evaluating implementation strategies in practice and reporting on promised return on public investment.

As for academics, they represent expertise in a broad spectrum of fields. Some academics, mainly experts from the fields of the natural and physical sciences, are well-positioned to develop the sort of capital required to develop and translate technology into realizable public goods. Moreover, they have the know-how to identify abuses in research and development of Smart City technologies.

Other academics, who focus on social technologies (*e.g.*, law), are observers of the social processes involved in cultivating Smart City innovation in a manner aligned with the ever-elusive public interest. In theory, academics are morally bound to serve a public education function in society, upholding standards for candor, honesty, and objectivity. In sum, academics provide a "checks and balances mechanism.
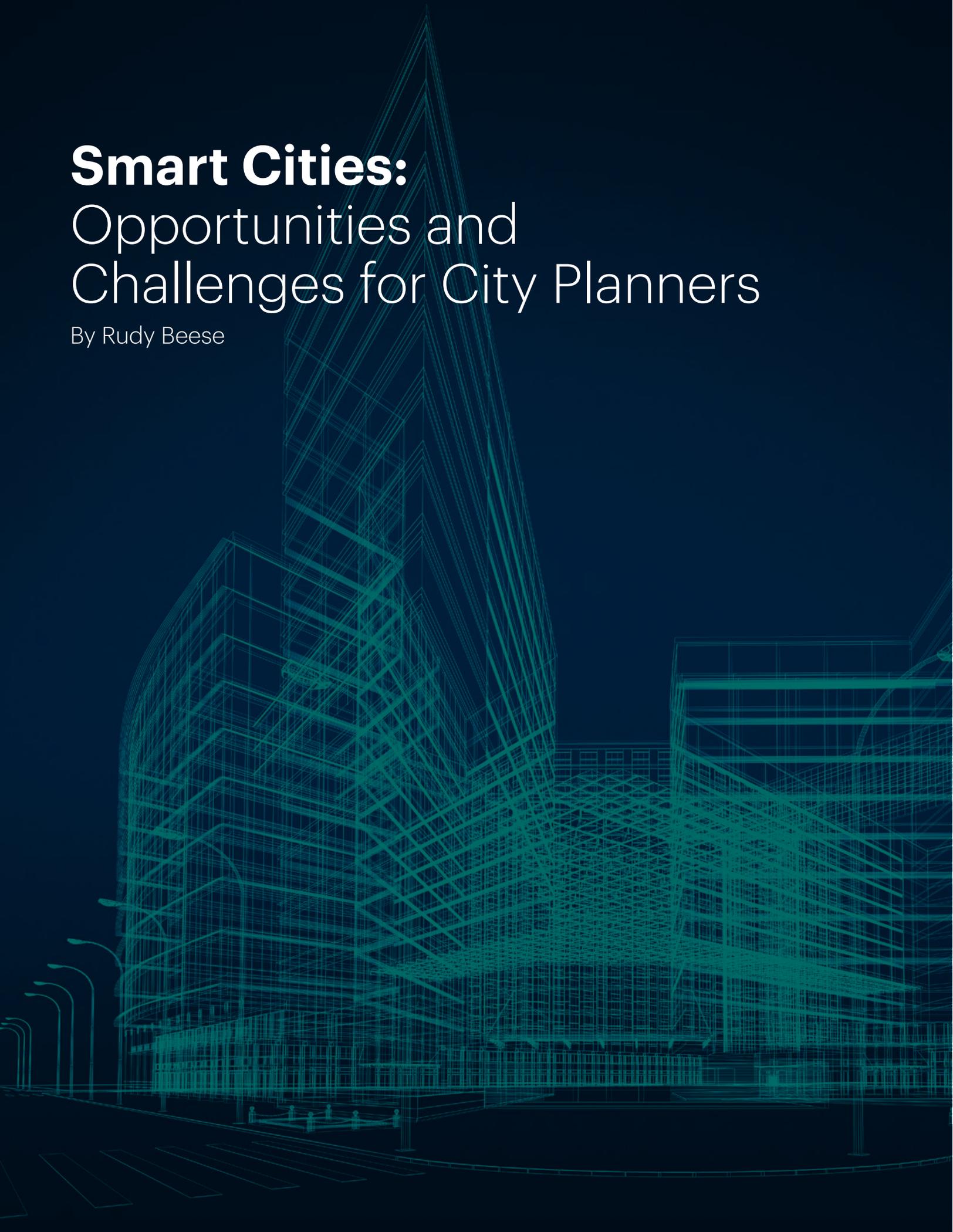
Smart Cities:
Opportunities and Challenges for City Planners

By Rudy Beese

Urban Planning and the Master Planning process will continue to adapt to the challenges and opportunities presented by the evolution we're seeing in the Smart Cities and connected communities initiatives. The challenges presented by the sheer magnitude of technological changes that will occur cannot be understated. Cities in our major metropolitan areas will need to work together to seamlessly accommodate autonomous vehicles, smart metering, 5G, AI and distributed generation, to name but a few, with accompanying infrastructure upgrades can seem daunting. Many communities will need to identify new sources and means of financing or capital in order to make the needed up front investments, suggesting that public-private partnerships of varying types will continue to take center stage as a means of providing the needed capital to fund these large infrastructure projects. This is especially so in communities that may have challenges issuing debt to meet the demand for capital intensive projects.

In many instances, P3 partners may be positioned to bridge the demands needed to effectively upgrade aging infrastructure, incorporate needed technology, and to best position these communities to remain vibrant population centers in the future. Since the likelihood of direct federal funding may remain a challenge, communities will continue to reach out to their partners who can offer strengths in finance, construction, energy, technology and the environment to create these public private partnerships, thereby providing the needed capital and expertise to meet tomorrow's demands. Apart from the P3 model, there are also other well accepted means of engaging with business and industry to attract desired upgrades. In many locales, one means of financing upgrades to infrastructure can be accomplished with special districts, tax increment financing, or the capture and use of other economic activity revenues by State or local governmental authorities. Where existing law may limit or prohibit such initiatives, legislation or referendum can be a means of modifying existing law, enabling long term capital investment in the future of our communities. In each community, and among communities that share geographic region, one key source of vision and guidance in the process are City Planning staff, equipped to anticipate coming change and adapt existing City codes, zoning and infrastructure to accommodate these changes.

We see a crucial need for developers of projects in the areas designated as Opportunity Zones to work with City Planners to adapt the operative Master Plan to make investment in smart-technologies more readily attractive.

At the Federal level, much has been written recently about Opportunity Zones (preferential tax treatments) as a new tool in encouraging investment in economically challenged areas. The anticipated success of this particular approach to urban revitalization has yet to be realized, but remains another tool with the potential for bringing much anticipated new capital into economically challenged areas The most recent guidance provided by the IRS recently still leaves many critical questions about Opportunity Zone investment unanswered. Even so, key milestones for implementation mean that zone investment is likely to result in providing a new source of capital driving investment specifically in economically challenged areas.

Against this backdrop, Opportunity Zone investment may also require that communities rethink their Master Plans in the affected areas. We see a crucial need for developers of projects in the areas designated as Opportunity Zones to work with City Planners to adapt the operative Master Plan to make investment in smart technologies more readily attractive. One way to leverage the imperative of Opportunity Zone investment may be deliberate and forward thinking in terms of adapting current zoning to incentivize investment in smart technologies in return for increased density, building height, and/or a mixture of uses in a way that also incorporates smart technologies, and provides much needed upgrades to technology infrastructure. Another may well be to adapt current parking criteria to anticipate the reduction in the need for on-site parking as the habits of the driving public adapt to ride-sharing and autonomous vehicles. Rewarding the incorporation of such forward thinking technologies with increased density, entitlements or other initiatives could well make such investment more attractive, or yield more attractive public and private spaces, as well as additional amenities. In larger metropolitan areas, internal teams comprised of representatives of planning, zoning, public works, and permitting compliance can make the time needed from project inception to ribbon cutting more efficient, thereby creating value with the very developers that can bring new projects into areas that are in need of redevelopment. Cities can create these cross-discipline teams so as to be specially equipped to swiftly address the challenges and opportunities that arise from incorporating technologies into these proposed projects, some of which are on the bleeding edge of innovation.

All of this is to acknowledge that smart cities and connected communities largely recognize that adapting to tomorrow's technology today is an important, if not key ingredient in assuring that these communities will remain best positioned to be vibrant population centers in the future ideally suited to compete against other communities for jobs creation, capital investment and a sense of place.   Adapting to change is seldom easy, and smart cities of today will continue to adapt in order to remain well positioned for future growth.

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INSIGHT

How can Smart Cities initiatives help with the health and mobility concerns that US cities face as populations increase?

Bruce M. Fried, Partner in the Health Care Practice at Dentons, and Member of the Environment, Health & Safety Pillar of the Dentons Smart Cities & Communities Think Tank

When people talk of "smart" health care, they usually think of telemedicine, which is mostly directed toward remote communities right now. But with the incredibly accelerating trajectory of increased populations, and aging populations, the costs associated with providing healthcare will be a huge strain on the economies of cities. The historical method of hospital facilities and nursing homes is not sustainable. It is inadequate to meet the needs of this population —it is too costly, there is not enough space, and frankly, people want to age at home. Part of the strategy for aging at home will be telehealth. Beyond telemedicine, the ability to connect the clinician and the patient instantly, both when someone is unwell and for monitoring and sharing of information, will be enabled. The next generation of wearable devices—Apple watches or Fitbits will go beyond heartbeat monitors. They will be health sensors, measuring blood pressure, glucose and oxygen levels, and information will be transmitted to the clinician in real time. Integration of smart technologies in daily lives allows us to "skate to the puck." Additionally, robotics will play an important role, especially for those who are not ambulatory but who need assistance, medications, meals, and so on. All this along with improved transportation systems and mobility will be driven in part by a healthcare system with increased demand and costs we are not prepared for.

Community Engagement in Smart City Planning

By Sheri Givens

Smart cities have the ability to connect all infrastructure – electric, gas, water, communications, and transportation. Smart city initiatives may empower consumers to make more thoughtful energy choices. Such choices may offer them energy use and bill management insights, allowing them to prioritize their personal or business goals as they relate to energy efficiency, usage, and savings. These initiatives may also give communities tools to improve health, safety, transportation, and address a host of other particular challenges in their local area.

Building broad community support for a smart cities & communities program is a complex process that requires significant outreach to and collaboration with a community. Communicating specific, tangible benefits of smart technologies, along with being transparent about the costs and investments necessary, must be done early and often in easy-to-understand, plain language. This is crucial to obtaining buy-in for any smart city initiative.

Within a smart city, "innovation" neighborhoods, zones, wards, or districts may allow for piloting and testing of pioneering offerings. Such pilot programs may confirm, or repudiate, consumer openness and interest in new products and services. Engaging in comprehensive community involvement is key. Creating buzz and excitement about such innovations could incent areas within a city to actively compete to be selected. Emphasizing the ability to customize technologies to a community's needs, sharing the benefits technologies may bring to communities, and educating consumers in the necessary and appropriate forums provide the basis for engagement in this context.

Consumer/Community Customization: Smart city technologies can provide for personalized customer offerings based on local demographics, needs, challenges, and lifestyles. These offerings can target the consumer's and community's motivation, whether it is clean energy, cost savings, health, safety, or other. There are numerous advancements in technology, website functionality, text messaging and apps that connect consumers in real time to their electricity providers and numerous new product offerings and rate plans that take advantage of new technologies. Customization may allow for online and application resources allowing communities and consumers access from smart phones, tablets and computers while giving them visibility into their energy usage, enabling them to better manage usage, and providing them with insights into utility and third party offerings. For communities, smart city technology customization may bring health, safety, transportation, connectivity, and other benefits to their residents and businesses.

Consumer/Community Benefits: Examples of smart city technologies bringing societal benefits to consumers may include:

Health

- intelligent hospitals and medical devices, connected ambulances, telehealth services, chatbots, digital health portals, and remote monitoring devices;

- elderly monitoring sensors notifying family members and caregivers of senior's movement and alerting them via text in the event of abnormally long inactivity;

- pollution reduction technologies;

- smart power, gas, and water management allowing for detection of outages and leakages;

- smart waste receptacles with automatic compactors alerting collectors when full to address sanitation challenges; and

- predictive analytics to control rodent or pest populations.

Safety

- smarter policing and emergency response enabling tools;

- smart crime prediction technologies and gunshot sensors allowing for emergency service vehicle prioritization;

- data analytics, wireless, and smart video surveillance to detect criminal activity, strengthen crime fighting, and ensure public safety;

- smart street lighting to reduce greenhouse gas emissions and energy costs while increasing operating efficiency; and

- natural disaster detection sensors assisting in emergency management or consumer notification about dangerous conditions.

Transportation

- intelligent highways, digital signage, and automated car systems;

- smart transportation initiatives including smart traffic systems and sensors, traffic flow optimization and predictive tools, road hazard detectors, traffic cameras, traffic lights and parking to address traffic congestion;

- multi-modal transportation and autonomous vehicles to address urban mobility challenges;

- infrastructure sensors helping with deicing, fracture and vibration signaling; and

- electric vehicle fast-charger stations.

Consumer/Community Education: Going into the community and engaging with the customers on customization options and potential benefits is vital to any smart city initiative. Town hall and neighborhood meetings, city events, county fairs, mobile education units, and other in-person opportunities may prove valuable in gathering insights into what the citizens of a community see as the greatest perceived challenges and opportunities in their locale. Meeting with the community leaders, local legislators, city council members, county officials, local law enforcement, transportation agency, health care community, local utilities (e.g., electric, gas, communications, and water), regulators, industry representatives, and other stakeholders will provide for valuable input about smart city initiatives, technologies, and actions that people, businesses, and industries want to see in their areas.

Providing transparent, straightforward information for consumers seeking an understanding of the value and cost that such initiatives can bring to them personally, and their community collectively, is essential. This transformation of the customer and community relationship will require numerous and frequent in-person discussions to move consumers away from the historical thinking of electricity as a commodity, or something that is always there when they need or want it. Education initiatives will assist communities in both understanding and articulating all that they might be able to achieve with evolving smart city technologies.

About the author

Sheri Givens is Co-Chair of the Consumer and Community Engagement Pillar of the Dentons Smart Cities & Communities Think Tank. She is the former State Utility Consumer Advocate for Texas. In addition to serving as the Governor-appointed executive director of the Texas Office of Public Utility Counsel, Sheri served on the Board of Directors for both the Electric Reliability Council of Texas (ERCOT) and Texas Reliability Entity for four years. She was elected by fellow nationwide advocates to serve on the Executive Committee of the National Association of State Utility Consumer Advocates (NASUCA). Her other experience includes attorney positions with the Public Utility Commission of Texas, Texas Workforce Commission, and Texas Legislature.

Blockchain Applications in Smart Cities

By Alex Kizer
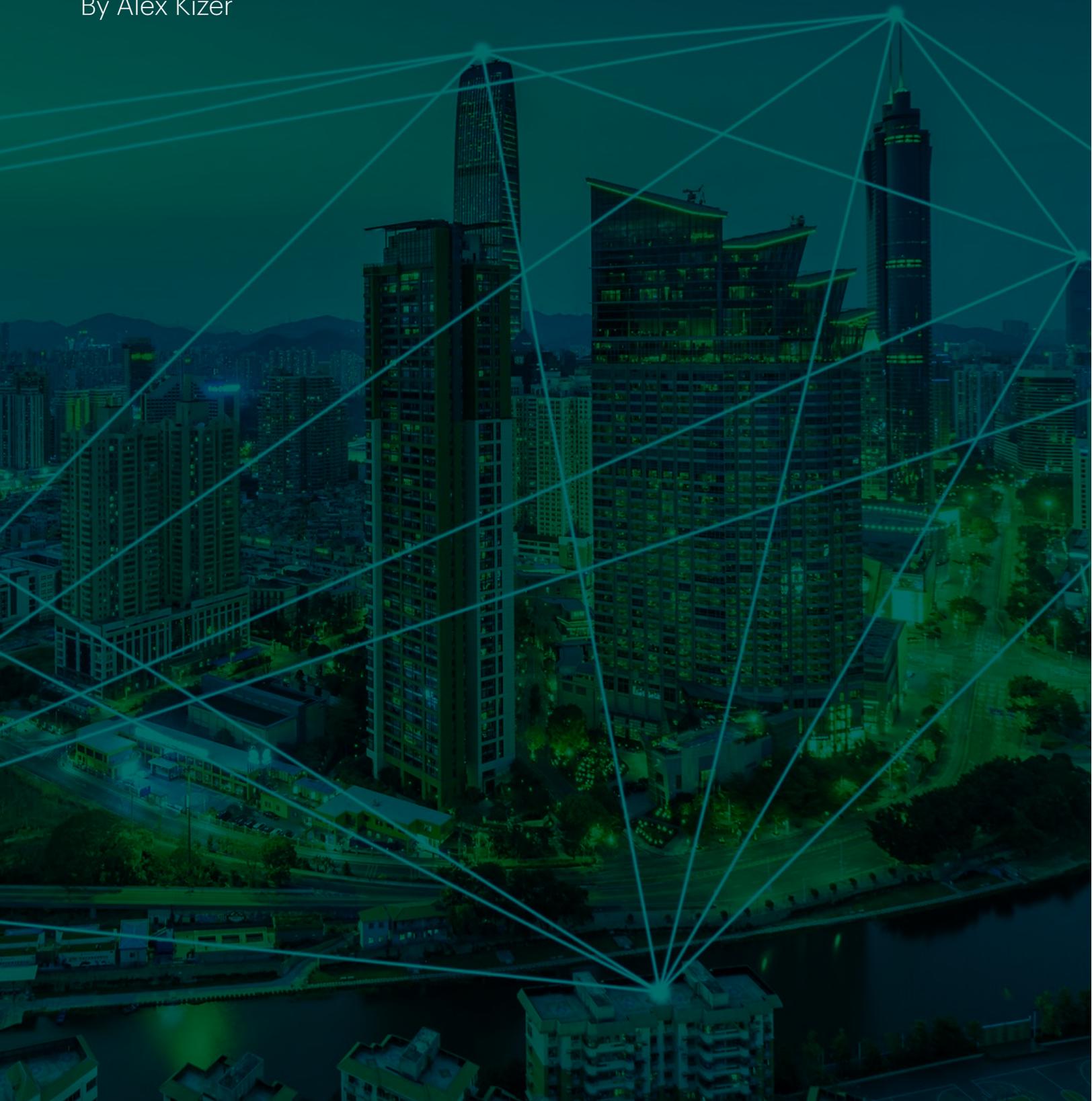
Cities are complex patchworks of infrastructures where both new and legacy systems support many aspects of urban living. These infrastructures include electric grids, natural gas distribution systems, water distribution networks, telecommunications systems, transportation networks, buildings and many more.

These systems are highly interdependent. Water systems, transportation, buildings and telecommunications need electricity, electricity is increasingly digitalized, and telecommunications is growing in importance to all. While they are increasingly integrated, these infrastructures are operated by disparate and often disconnected public and private entities. They are structurally and institutionally isolated, subject to different regulatory regimes and managed by siloed departments and private utilities. This lack of integrated design could produce suboptimal levels of performance.

The objective of the smart or smarter city should be to integrate the goals, operations, and management of these essential functions and infrastructures to improve services, lower costs, and create new opportunities for people, business, and government. While there are many aspects of building a smarter city, including new regulations, policies, and business models, the most critical is the effective integration of the operational technology (OT), such as pipelines and power lines, and information technology (IT), like data sensors and processors. OT comprises the underlying physical systems that govern the performance of a city, while IT is the data network that enables meaningful operation and management, decision-making, prediction, and continuous improvement.

One potential breakthrough technology for improving IT-OT integration is blockchain, the widely-hyped—but potentially disruptive—distributed ledger technology. Blockchain operates as a software for managing large volumes of transactions, settled quickly, securely, and at relatively low cost. This IT-based system can help firms streamline essential business processes and eliminate redundancies and costs of multiple systems – where the digital world can make the physical world operate more efficiently and effectively, enhancing the quality of life for city residents.

Blockchain is not just buzz, it is an existing—and exciting—technology being utilized in real-world operating environments, with applications across the smart city value chain. While it is difficult to find comprehensive data, estimates suggest that to-date, there has been $100-300 million dollars invested in over 100 energy-sector blockchain applications. One project in Europe is using blockchain to create a more efficient energy market with benefits to both the system and the consumers. This blockchain, developed by IBM, offers a mechanism for electric vehicle (EV) owners to market their excess battery power supply to the grid operator, TenneT. In Brooklyn, New York, blockchain is being used to manage and automate energy transactions over a microgrid between 60 energy producers (mostly households with solar PV) and 500 consumers (homes with smart meters) based on energy output levels and electricity prices. Finally, a project called Sharge&Share in Germany is using blockchain to allow the owner of EV charging stations to automate all transactions using smart contracts. More than 1,200 blockchain-based EV charging stations have been deployed throughout the country.

The pairing of smart cities and blockchain enables operations that are greater than the sum of their parts—the ability to make systems more efficient, effective, and reliable, creating cross-cutting ecosystems of information, shared by a range of disparate but connected people, services and businesses. Developing more blockchain tools in smart city environments can help overcome the challenges of IT-OT integration, using blockchain to manage the scale of transactions and as an essential tool for creating the vibrant, livable, affordable, safe and clean cities of the future.

About the author

Alex Kizer is Director of Strategic Research at Energy Futures Initiative, Senior Associate at EJM Associates and Co-chair of the Technology & Innovation Pillar of the Dentons Smart Cities & Communities Think Tank. For more information on the application of blockchain technology to Smart Cities and the energy sector more broadly, see the recent report published by Energy Futures Initiative: "Identifying Promising Blockchain Applications for Energy: Separating the Signal from the Noise," available at https://static1. squarespace.com/static/58ec123cb3db2bd94e057628/t/5b4e59751ae6cf0 86c4450a5/1531861368631/EFI_Blockchain_July2018_FINAL+.pdf

INSIGHT

What role do energy firms play in the Smart Cities transformation?

Rob Wilhite, Managing Director in the Energy Practice at Navigant Consulting, Inc., and Member of the Energy Pillar of the Dentons Smart Cities & Communities Think Tank

A considerable number our nation's municipal and community leaders have stated their commitment to achieving a more sustainable future for their citizens. The Covenant of Mayors, for instance, has secured nearly 7,800 signatories, each of whom are outlining adaptation plans and key actions towards their individual smart city vision. Similar efforts are also being driven by leadership groups such as Climate Mayors, C40 Cities, and We Are Still In, clearly demonstrating that grass roots efforts are well-supported. While distinct, these programs share a common vision for improved social welfare, economic growth, and an improved environment, but with a focus on energy as a core pillar.

Many smart city and community programs include a focus on increased resilience to more frequent and intense climate change impacts (e.g., floods, fires, heatwaves), as well as an increasingly clean, intelligent, mobile, and distributed energy ecosystem.

Smart cities lie at the confluence of major disruptions across multiple industries, including energy, transportation, buildings, and core city services. Energy firms and incumbent utilities have been key partners in many early smart city projects, offering opportunities to develop new business lines and supplier relationships, expand customer choices and optionality, and continue technology innovation.

Additionally, digital technologies are transforming energy infrastructure and adjacent sectors. Smart cities opportunities related to energy are rapidly emerging in areas such as renewable generation, energy storage, electric vehicles, transactive energy, smart street lighting, and building energy management. Successful smart city programs build on these assets to develop a unique smart city vision that is aligned with local needs and goals, turning ambitious energy and emissions targets into reality. These smart city and community programs also demonstrate how energy-related services are foundational to multiple city priorities such as social inclusivity, economic development, and environmental improvement.

A Smarter Future for City Transit

By Eric Tanenblatt and Crawford Schneider

When it comes to transportation infrastructure in our country's largest cities, we all agree that our cash-strapped transit grids are bad, and traffic is worse. In any major city, one need only cast a gaze skyward to the swoop of cranes fashioning a towering, new skyline of glimmering glass and steel to understand that the sea of red that drowns our highways each night, is emblematic of the growing pains at hand—chief among them, worsening road congestion. Sprawling cities are in desperate need of expanded public transportation focused, critically, on equity and accessibility. A city is only truly connected and vibrant when its mass transit system has equal buy-in from the wealthy and financially challenged alike.

On these generic principles, virtually everyone can agree; where consensus shatters is their application. We need more modes of transit at higher frequencies and longer, more diverse routes, but how in this era of penny-pinching? Because every need can't be met, the ordering of our funding priorities must be both intelligent and transformative, otherwise, "sibling rivalry" may pit neighborhood against neighborhood in a mad cash dash.

Some cities or regions are looking at light rail as a solution, but this frequently is not the best bang for the buck. These projects are expensive, often serve only limited communities, take years to construct, and may not alleviate road congestion much, if at all, by the time they are up and running.

Others are focused on squeezing in additional lanes to existing roads, which also is costly and seems merely to invite the addition of more drivers. Instead of spending hundreds of millions on a solution whose utility window is both distant and very narrow, cities could leverage electrified autonomous shuttles almost immediately at a miniscule fraction of the cost.

Astute observers will note that the days of the internal combustion engine are numbered. Across the country car makers and technology companies are piloting futuristic driverless car experiments. There is disagreement among them about which technology is best suited to navigate the external environment, but they all agree that internal combustion engines are too frail and inefficient to power the massive data and analytical requirements of these rolling super computers.

With the inevitability of autonomous electric transit and the inefficiencies of rail in mind, major cities in Europe and Asia are using fixed-route autonomous shuttles to complement larger public transit networks. In Gothenburg, Sweden, Volvo is operating an autonomous shuttle which will be integrated into the city's mass transportation network.

Similarly, the Swiss town of Schaffhausen layered autonomous shuttles into public transit in March to address its first-/last-mile problem.

San Francisco, whose traffic woes are notorious, will launch a driverless shuttle program early next year. Municipal governments are realizing that autonomous shuttles are cost efficient, environmentally friendly, and flexible, three things that commuter rail is not. At their negotiated price, a city can purchase nearly 2,000 self-driving shuttles for the same price of just a few miles of light rail. And unlike light rail, these shuttles, which each hold 12 passengers, could be strategically re-deployed elsewhere for special functions, like a Super Bowl, Olympics or Inauguration festivities.

One significant challenge that autonomous transportation faces is the tension between balancing budgets and innovative policy priorities. Fundamentally, how we operate and pay for transit is changing, but the nation's automotive and mobility laws are stuck in neutral. In some cases, investments in transportation infrastructure are being paid for by eliminating economic incentives designed to spur growth in electric and alternative fuel vehicles.

For example, in 2015, Georgia made a record-breaking $1 billion-a-year investment in the state's transportation system. But as part of that historic legislation, the state did away with its pioneering $5,000 tax credit on the purchase of electric vehicles. Tax credits like Georgia's old model were helping to make it possible for middle-class families to own cleaner, more efficient cars, so the elimination of the credit was devastating for sales of electric vehicles. In fact, just two months after compromise took effect, the number of electric vehicles sold in the state fell from more than 1,200-per-month to fewer than 100.

Luckily, tax breaks and incentives are not the only factor increasing the affordability of electric and autonomous vehicles. Recently, manufacturing costs have begun to decline. Between 1995 and 2010, the manufacturing cost of a lithium ion battery declined by about 14 percent each year. At its peak price point, the battery of the Tesla Model S alone would cost $85,000. Today, after costs have continued to fall, that same battery costs just $8,500. Simultaneously, the price tag for advanced computers, required for autonomous navigation, have plummeted.

Increasing the necessity of intelligent mass transportation is that fact that regardless of the type of engine, personal car ownership is wildly inefficient and costly. The average American family spends $10,000 annually to own a car and uses it just four percent of the time. And because of that idleness, shared use is, on average, 10 times cheaper per mile than personal ownership. It's inevitable, then, that the invisible hand of the market will pivot away from personal ownership and towards shared-use of electric autonomous fleet vehicles.

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Under the "transportation-as-a-service" model, vehicles would log somewhere in the realm of 100,000 miles per year, a rate that inefficient internal combustion engines couldn't sustain for more than two years. Electric vehicle powertrains can last anywhere from 500,000 to 1 million miles. (Just imagine your minivan at 1 million miles.)

What is clear is that public policy does not move at the same pace as technological change. However, those in positions of public power must recognize that the competition to engineer the car (and car service) of the future is fierce, and firms are on the hunt for states and cities whose regulatory environments could give them a leg-up. Thus, it is prudent for policy makers to ask themselves: will investments we make today set us up for success tomorrow? Answering "yes" to that question should be a prerequisite for any significant public investment in transportation. Public policy and technology have never been so interwoven. It is the responsibility of lawmakers to thoughtfully approach mobility with an eye to the not-so-distant autonomous future.

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Smart Cities around the world tailor technologies to their local and global needs

By Ronke Luke

Over 50 percent of the world's population lives in cities today. By 2050, the number is expected to rise to 66 percent. How to respond to current needs while preparing for the future is the most pressing challenge facing city leaders today. What investments not only deliver in-demand services but also set the stage for the future? Smart Cities offers a concept for an integrated approach using digital and physical infrastructure to deliver essential services in a more efficient, useful, innovative and exciting way.

Smart technologies consist of interconnected telecom systems, sensors and devices that amass and analyze data (sometimes in real time) to enable delivery of new or improved services, products and experiences (e.g. power delivery, streaming services). Businesses and consumers are currently driving "smart" applications. But municipal governments play a key role in creating an enabling environment. How cities utilize "smart" technologies should be unique to their needs. What works in New York may not be appropriate for Mexico City. Innovations in Bombay may benefit London. Solutions originally designed for Kenya may find applications worldwide.

Influencers and arbiters are paying close attention to what cities are doing. Every year think tanks, management consultants, etc., churn out rankings of the world's cities to the delight or displeasure of their inhabitants. The rankings tell a story of the place in comparison to its peers. In A.T. Kearney's Global Cities 2017[1] ranking of "*Leaders in a World of Disruptive Innovation*," New York dethrones London, which slips to second, as the top performing city in 2017; San Francisco emerges as the city with the most potential.

But cities are not only "spaces of places" [2] (*i.e.* the physical structures). They are also "spaces of flows" where businesses and people create, exchange and consume information to produce functional activity. Smart cities aim to make these "spaces of flows" more efficient and conducive to creativity. Digging through A.T. Kearney's methodology reveals "spaces of flows" type criteria for current performance and a mix of "places and flows" type criteria to evaluate cities' potential.

Unsurprisingly, cities in North America, Europe and the well know Asian cities (e.g. Beijing, Tokyo, Singapore) dominate the top 25 of A.T. Kearney's 128 evaluated countries. The rest of the world? Rio de Janeiro, the highest-placing city in South America, ranked 52 followed by Johannesburg at 53, the highest performing African city. Lagos came in at 78 in terms of its current performance but dropped to 125 of 128 cities in terms of its potential; probably a disheartening outlook for its inhabitants.

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[1] A.T. KEARNEY, GLOBAL CITIES 2017: LEADERS IN A WORLD OF DISRUPTIVE INNOVATION

[2] CASTELLS, 1996, THE RISE OF THE NETWORK SOCIETY, OXFORD, BLACKWELL.

Yet on the most recent Globalization and World Cities (GaWC) rankings, Lagos, already a mega-city, falls into a category of "cities that are instrumental in linking their region or state into the world economy" and ranks higher than Rio de Janeiro. The importance of Lagos in linking Nigeria and West Africa to the global economy may explain why the city's population, estimated at between 14 and 21 million[3], is growing at an alarming rate. So, are the two ratings of Lagos contradictory? Not really. They tell different stories of the city. A.T. Kearney's ranking of potential, which considers things such as well-being and metrics like infrastructure, articulates the pressure Lagos must alleviate to, at a minimum, maintain its place as a global gateway city. Failure to do so shows that Accra, a city that ranks higher in potential, per A.T. Kearney, is poised to rival Lagos per GaWC. Lagos needs smart solutions, not only to keep it tightly integrated with New York and London, (key trading markets for the city, Nigeria and West Africa), but more urgently, to improve the city's infrastructure and livability for the millions who call it home. For example, Lagos needs technologies that improve electricity reliability and others that enhance transparency in business and governing, etc.

While London and New York—the two most important cities in the world by most rankings—also grapple with infrastructure and livability issues, as rich cities they, arguably, face less pressure than Lagos to deliver basic services today and, hence, focus significant time on the future. But decisions made in London and New York have a great influence, economically and culturally, on what happens in gateway cities like Lagos. Therefore, Lagos must stay attuned to decisions in such global cities. Sifting through which smart solutions to embrace locally and which could have un-intended consequences adds to the complexities that gateway cities face. For example, smart metering of water is beneficial to sustaining services to all Lagos residents, rich and poor. But global streaming services such as Netflix

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[3] LAGOS POPULATION 2018 HTTP://WORLDPOPULATIONREVIEW.COM/WORLD-CITIES/LAGOS-POPULATION/

that broaden entertainment choices, could suppress Lagos' entertainment sector if locals stop watching domestic performers, opting instead for international choices. Nigeria has a vibrant film sector, Nollywood, with many movies shot in Lagos. Censoring international streaming is not the answer, but business and city leaders will have to be vigilant, working on the "spaces of flows" to keep Nollywood robust.

Partnerships will be beneficial to urban settings facing similar challenges or pursuing similar goals. For example, cities in California, East Africa and India may hold answers as Lagos plots its strategies for roof top, off-grid and grid-tied solar. Cairo and Cape Town, also African regional gateway cities, might benefit from Lagos' experiences navigating local and global strategies.

Will smart solutions enhance cities' cultural identity or will they introduce a global uniformity similar to that slowly taking hold in retail? An Apple store looks the same in Los Angeles, London and Shanghai. Clear brand identity is important to corporations, but as globalization sets in, major retail high streets of the dominant 25 cities on A.T. Kearney's world index start to look the same because many of the smart technology vendors are global corporations, scale and standardization may be paramount to them. But preserving and enhancing the innate qualities of their cities while transforming into a smart city is an important role for civic, business and cultural leaders. Improving livability (in terms of infrastructure such as transportation, water and electricity services) should not supersede cultural identity. Tokyo isn't Cape Town. Delhi isn't Barcelona. Smart technologies can be used to preserve, promote and deliver cultural experiences in innovative and exciting ways.

But the imbalances of urban areas today, e.g., poor infrastructure, traffic congestion, pollution, etc., are difficult to address while planning for the future. Retrofitting existing infrastructure is difficult, but is the answer to start again with planned cities built "smart" from the ground up? Some global developers think so. Songdo, opened in 2005, is the first smart city built from scratch by a public-private partnership close to Incheon International

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Airport. First conceived as an international business hub, packed with LEED-certified projects, the city has so far attracted primarily residential occupants. Songdo is, so far, a "space of places" that is still working out "space of flows" inherent to cities. Seoul, classified by GaWC amongst "very important world cities that link major economic regions and states into the world economy" is an hour away. Will Songdo stand on its own – a modern metropolis - or become a vibrant secondary town providing services to Seoul like Reading is to London? The verdict is still out.

As the populations in urban areas swell, civic leaders face new urgency to right existing imbalances and make them livable for all residents. Smart cities – an elegant, simple concept – offers exciting new possibilities for government, business, and civic leaders around the world to partner to solve nagging problems.

About the author

Ronke Luke is a member of the Smart Global Approach Pillar of the Dentons Smart Cities & Communities Think Tank. She is an international cross-sector expert in O&M practices in IT, chemicals, electric power, oil & gas and renewables. A chemical engineer with an MBA, past president of Women's Council on Energy & Environment and a member of the Leadership Foundry Women In Technology, she is recognized as a leader in influencing policy and regulation related to advanced and clean energy technologies (including renewables rollout in Africa). She regularly assists corporate and government executives in the U.S. and in developing countries in finding solutions to complex problems at the intersection of energy, environment and business development, including sustainability, GHG reduction, power sector reforms for private sector, renewables market development and clean energy/tech financing, and energy efficiency and access.

INSIGHT

What are the biggest sources of greenhouse gas (GHG) emissions in cities and what are some strategies for reducing emissions that can be incorporated into a smart cities plan?

Andrew Shaw, Senior Managing Associate in the Public Policy Sector at Dentons, and Member of the Regulation and the Environment, Health & Safety Pillars of the Dentons Smart Cities & Communities Think Tank

GHG emissions from cities constitute two-thirds of the world's emissions; consequently, cities face a moral imperative to reduce GHG emissions, but efforts to address climate change can also create jobs and economic growth, reduce congestion, improve livability of urban areas and mitigate emissions of other non-GHG air pollutants. Bolstering energy efficiency represents one of these opportunities to reduce emissions and also create jobs in urban areas. According to the American Council for an Energy-Efficiency Economy, job growth in the energy efficiency sector grew by three percent in 2017 and the industry now employs 2.25 million people. RetroFit Chicago, a voluntary program that encourages retrofits, has reduced energy use 18 percent at nearly 90 participating buildings.

Cities are also focusing on reducing transportation-related GHG emissions that can provide a variety of non-climate benefits. Investment in mass transit can mitigate GHG emissions, reduce congestion and lower the number of traffic related accidents and casualties. According to the American Public Transit Association, individuals can also save nearly $10,000 annually by using public transportation instead of driving. Electric vehicles also offer an opportunity for cities to lower transportation-related GHG emissions and create jobs through the development and installation of electric vehicle infrastructure in urban areas. Electric vehicle integration also represents a new revenue stream for utilities which are facing lower revenue due to lower energy demand and a more decentralized grid.
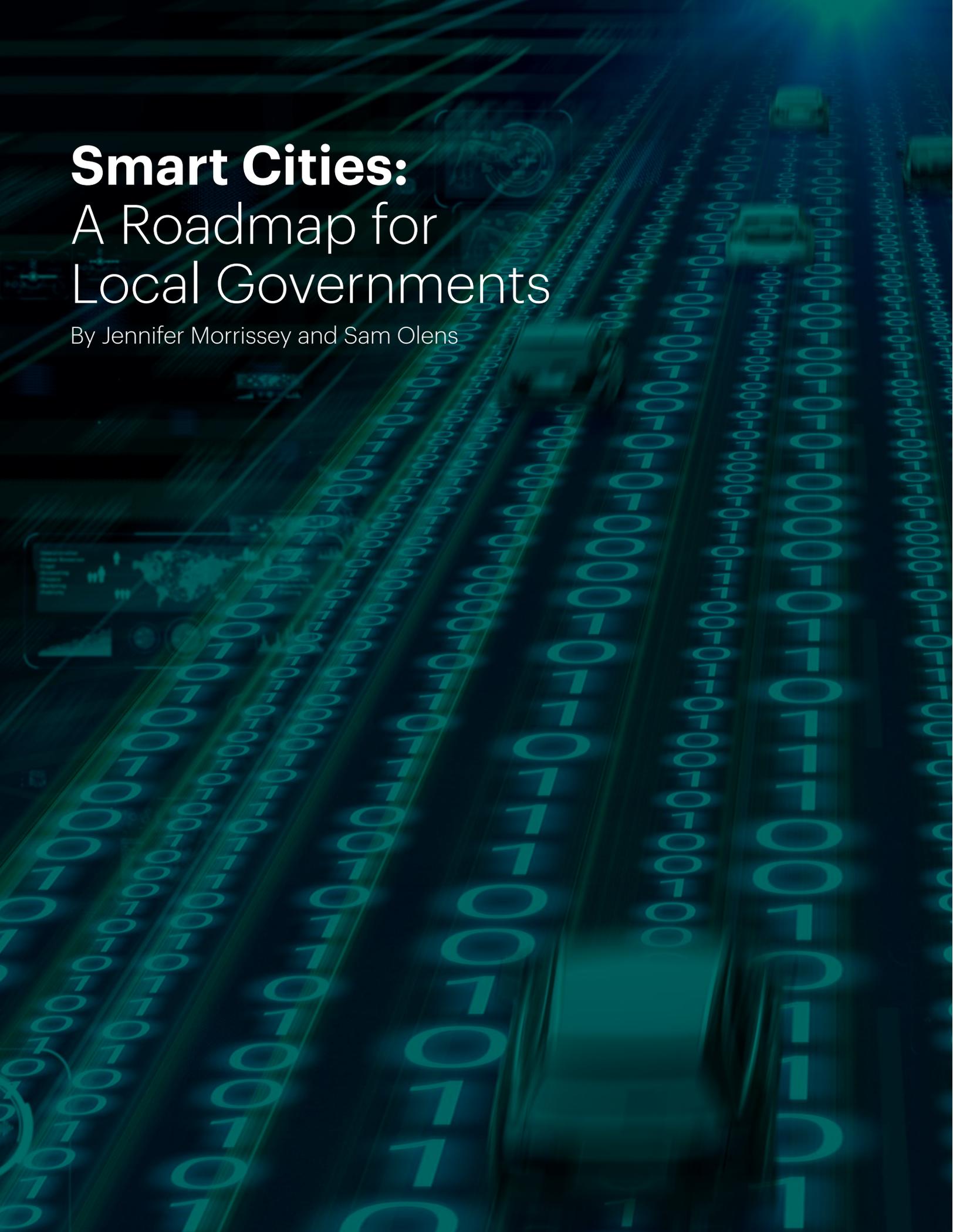
Smart Cities:
A Roadmap for
Local Governments

By Jennifer Morrissey and Sam Olens

It has often been asserted that the primary drivers for economic development and prosperity in society are cities. This is not surprising, nor is it a recent phenomenon. Since the days of Ancient Mesopotamia, cities have been hubs for innovation and advancement, and this is equally true today. From quality education to economic opportunity, from reduced traffic congestion and improved mobility (whether to work or other activities), to lower taxes and reduced crime rates, our cities and communities are the pinnacle of public creativity.

For a city to be influential, its elected officials must vigorously strive to create a unique live, work and play environment. A smart city modernizes the digital, physical and social infrastructure using an integrative approach to coordinate essential and complementary services. Unnecessary redundancies in infrastructure are eliminated or repurposed for more efficient use. Access to services is improved and processes are more transparent. Devices are linked to residents, but innovative cities also will ensure that devices connect to each other. Connectivity and mobility are the new drivers for success.

City governments, more than state or national governments, are in an optimal position to lead the shift to smarter infrastructure. As a republic, our national government was purposely designed to be deliberative, not swift. In today's world of rapid technological advancement, however, a lengthy, intensely deliberative process is often at odds with the pace of change and can lead to increased costs and missed opportunities. Municipal governments are far more agile, and thus are better able to act quickly with targeted focus on the goals and needs of the individual communities they serve.

Nevertheless, cities face certain challenges when it comes to investment in smart infrastructure, particularly when scale and cost of potential projects are significant. As an initial matter, there is an education process that must occur. City leaders need to conduct extensive community engagement to identify present and future needs of residents and businesses. They also need to be conversant enough to be able to sort through the many options offered by tech companies. The goal of the smart city is greater quality of life by finding solutions for concrete problems. It is solution-driven, not tech-driven.

Another challenge, as with any bureaucracy, is a natural tendency away from cooperation and coordination. Responsibilities, and therefore also resources, are siloed. To take full advantage of the potential of new technologies to improve efficiency, increase transparency and reduce costs in the delivery of services, the silos need to be deconstructed.

Incorporating advanced technology systems with real-time data analytics is a process whose path will vary from city to city and will change as innovations emerge over time.

Then, once silos are broken down so that coordination is possible, cities will still face challenges in financing the deployment of smarter infrastructure. Cities and investors may need to approach smart city projects differently than under traditional financing and procurement models.

In short, the challenges are many, but they are not insurmountable with some creative thinking, and the potential rewards for cities and communities are great.

But where does a city begin? City and community leaders do not approach a smart city initiative with a blank slate, at least in the United States. The development of a smart city plan must be undertaken with a clear understanding of existing structures, both physical and social—what they are and how they arose. Because they are close to residents and businesses, municipal leaders will have a deep appreciation of the many-layered tapestry that makes up the community—its culture, its priorities, its problems and successes, its sources of pride and failure. It is against this background that a smart city is constructed.

WHERE TO BEGIN?

Although it may seem obvious, a first step is to craft a set of formal smart city goals. This will help decision-makers focus on solutions first, rather than the technology. General goals might include the following:

- Improve residents' quality of life and civic pride
- Provide greater services in a more efficient manner and with lower or fewer taxes
- Enhance sustainability
- Save energy, water and costs for consumers and government
- Bridge the digital divide
- Provide greater cyber protection

Each of these goals might already be found in a city's strategic plan irrespective of whether the city has a formal "smart" strategy. What a smart city strategy can do, however, is to increase the benefits of achieving these goals by orders of magnitude once they are matched with specific initiatives and projects.

A second step is to obtain an inventory of the city's existing assets and services. Here, the aim is to increase productivity and reduce the cost of services, but a baseline measurement is essential at the outset. Three promising areas of focus that cities and communities are concentrating on are energy/utilities, transportation, and public safety. These can be greatly enhanced to establish economic growth and improved quality of life, but there are many others. Without an assessment of the current status, it will be difficult to know just what needs to be improved and where.

As part of the inventory, the status of "backbone systems" should be assessed. The electric and advanced telecommunications grids are keys to deploying most smart technologies that a city might want to incorporate in its strategic smart city plan. They must be reliable and multi-directional to allow for the integration of advanced technologies, and future-proofed to allow for incorporation of the next generation of technologies that will come.

BECOMING SMARTER

A smart city is in continuous evolution. City leaders do not simply make an investment, see that technology is deployed, and suddenly make a city smart from the ground up. Incorporating advanced technology systems with real time data analytics is a process whose path will vary from city to city and will change as innovations emerge over time. The menu of options available to cities to improve and integrate systems is rich. Not every individual choice will be perceived as "transformative," but what the successful package of options should do is to allow the city to optimize services and operate with more efficiency across sectors and programs. Some initial measures that cities might pursue could include:

Transportation Infrastructure

- Intelligent Transportation Systems (ITS), including sensors to reduce traffic congestion and improve signal control; real-time, quickest route bus traffic controls; congestion pricing; and predictive maintenance

- smart parking systems to reduce congestion and provide mobile parking payments

- improved mobility by linking transit (first and last mile transit) and ridesharing

- charging station buildout for electric vehicles (EVs)

- intelligent commercial vehicle systems

Smart Buildings

- blockchains for added security for Internet of Things (IoT), grids and telecommunication systems

- sensors and LEDs for energy-efficient lighting and power

- sensors to report maintenance issues and malfunctions

- zero energy buildings, green roofs, blue roofs (to store water)

Smart Water

- sensors to report water, storm water and sewage maintenance issues, i.e., leakage detection, management of consumption and non-revenue water

5G Deployment

- incorporation of 5G systems to reduce costs, operate more efficiently and enhance security

Public Health, Social Services & Accessibility

- enhanced mobility for people with physical and cognitive disabilities
- sensors and expanded surveilance networks for faster emergency response (e.g., gun-shot detection, crime locations and crime stats, disaster early warning systems, altered light intensity)
- air quality sensors
- privatized services to include free Wi-Fi (e.g., financed through advertising revenue)
- bike-sharing, ride-sharing and car-sharing programs

Smart Energy

- efficiency measures
- smart streetlights (LED, multi-use structures)
- convert closed coal sites to solar or other uses
- convert waste sludge to energy
- incorporate customer use management technology and distributed energy resources

None of these concepts are revolutionary, and many are already at various stages of implementation in some cities, especially in pilot projects. This list also is by no means exclusive. There are many other initiatives that could be included within a smart cities strategy. And, the menu will change as new technologies are introduced, with applications that are not yet ready to be imagined.

Essential Roles for Local Leaders

The role of local government leaders is critical to the success of a smart city. There is a notion that smart cities are driven by large tech companies with little engagement by citizens. The idea of wide-spread sensors and data collection, whether by government entities or by large corporations, makes many people uncomfortable. But the creation of a smart city is really aimed at making the lives of residents and businesses easier. A city will only be a vibrant, sustainable, inclusive and exciting place to live and work if it is created through engagement with its citizenry.

Before a city can take advantage of advanced technologies, municipal

leaders need to plan extensive community outreach. Even where a plan clearly will enable more services to be delivered for the same tax dollars, cost is not the only consideration. Leaders will need to educate themselves and city residents on financial benefits, efficiency gains, technological benefits, security concerns, and so forth. These discussions should be open, and should frankly showcase both successes and lessons learned from failures.

Municipal leaders will also need to ensure that the entire process is transparent and inclusive, from development of the vision to selection of technologies, consultants and engineers. Even if state laws permit contracting for professional services without a public process, the process should be transparent so as to gain necessary public support.

An additional area where municipal leaders will need to engage the public —and one that is too frequently neglected—is the impact of automation on jobs. While the economic benefits of smart cities initiatives include creation of new kinds of jobs, automation necessarily means eliminating the human component in some areas. Civic leaders will need to ensure that as advanced technologies are integrated, training opportunities are offered in the new sectors to prepare residents and businesses to use the smart systems and take full advantage of services offered. This involves education both to reduce the digital divide to ensure that the communities for whom services are designed are able to use them, and to retrain workers where jobs are likely to be lost.

In terms of financing, adaptive technologies utilizing public-private collaborations offer cities and communities outstanding opportunities to transform their residents' lives by improving public services and converting existing municipal assets to new revenue sources.

Water systems, power utilities and other city enterprises have a dedicated funding source, which can be used as a multiplier effect to take advantage of emerging technologies. Additionally, reduced costs that result from integration of smart technologies, as well as savings that result from streamlining and coordinating processes among departments within municipal government structures, mean that more resources will be available for other purposes.

For example, industry incentives such as streamlined permitting for small cell networks employing 5G wireless technology, prior approval of right of way and telecommunications fee adjustments reduce public costs. Sensors that identify water leaks and power outages, similarly lessen costs and reduce downtime. Adaptive traffic controls reduce traffic congestion and collisions, increase mobility, assist in locating parking, and potentially improve air quality, all resulting in savings to the city and to its residents. Integrated sensors

In terms of financing, adaptive technologies utilizing public-private collaborations offer cities and communities outstanding opportunities to transform their residents' lives by improving public services and converting existing municipal assets to new revenue sources.

Adaptive traffic controls reduce traffic congestion and collisions, increase mobility, assist in locating parking, and potentially improve air quality, all resulting in savings to the city and to its residents.

on smart streetlights turn ubiquitous lighting into IoT digital infrastructure. The lighting is more energy efficient, and the associated power can be used to add numerous public and private applications, partially funding the infrastructure while providing an open yet highly secure cloud connection.

Beyond identifying opportunities and assisting in the formation of strategy, local governments will also need to take the lead in a wide range of activities to maximize the benefits of a smart cities initiative. There may be regulatory structures that need to be changed, from local zoning ordinances and permitting rules to state laws. Leaders will need to keep abreast of available incentives, such as challenge grant opportunities to tax structures and data privacy rules. There also may be a need for managed competition of municipal services. Local leaders should also examine the possibility of agreements between public entities that enhance services with shared costs and greater efficiency, such as cloud-centric integrated investments, shared access, shared data and 5G technology, and privatization of municipal services. And, of course, as elected officials, municipal leaders will need to continue to engage residents throughout the process. One reason is accountability. But perhaps even more important, smart city governments will want to remain at the front of the evolutionary trajectory of the city to be sure that changing needs of the city or community and its residents are accounted for, and to take continuous advantage of innovations that will meet those needs in a smart, efficient, cost-effective manner.

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Dentons Smart Cities & Communities:
Think Tank Organizational Chart

Clint Vince
Chair of Dentons' US Energy Practice and Co-Chair of Dentons Global Energy Sector

Government Leadership & Public Policy	Regulation	Technology & Innovation	Telecommunications	Cyber & Physical Security and Privacy	Consumer Engagement & Community Social Infrastructure	NGOs & Universities
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Justin Driscoll, Executive Vice-President & General Counsel, New York Power Authority

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Karl Hopkins, Dentons Global Security Officer

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Christine Scanlon, President and CEO at Keystone Policy Center

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David Griston, Partner at Dentons

Keith Brandt, Managing Partner at Dentons

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Joseph Rogers, Energy Economist with Legend Consulting

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