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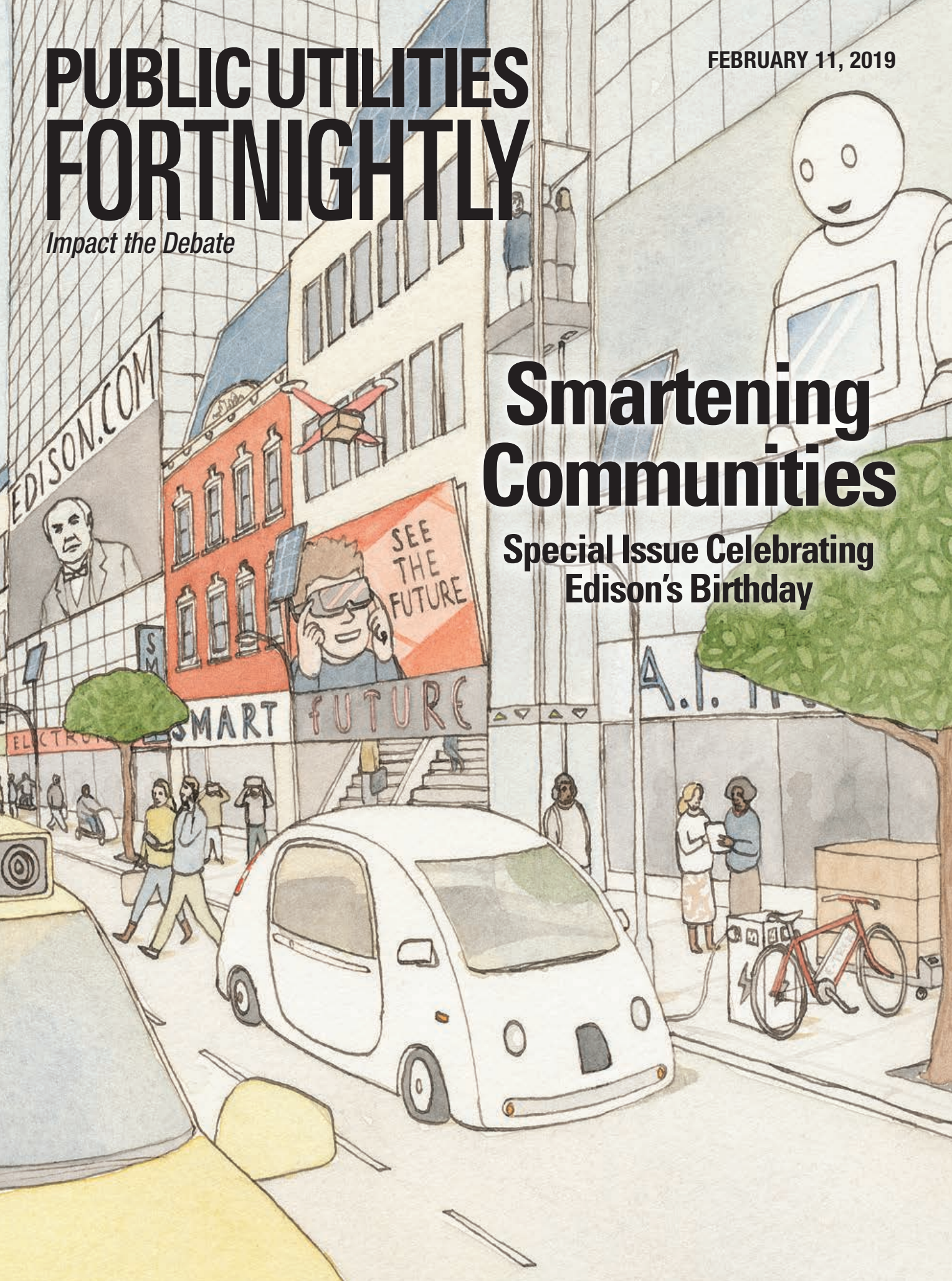
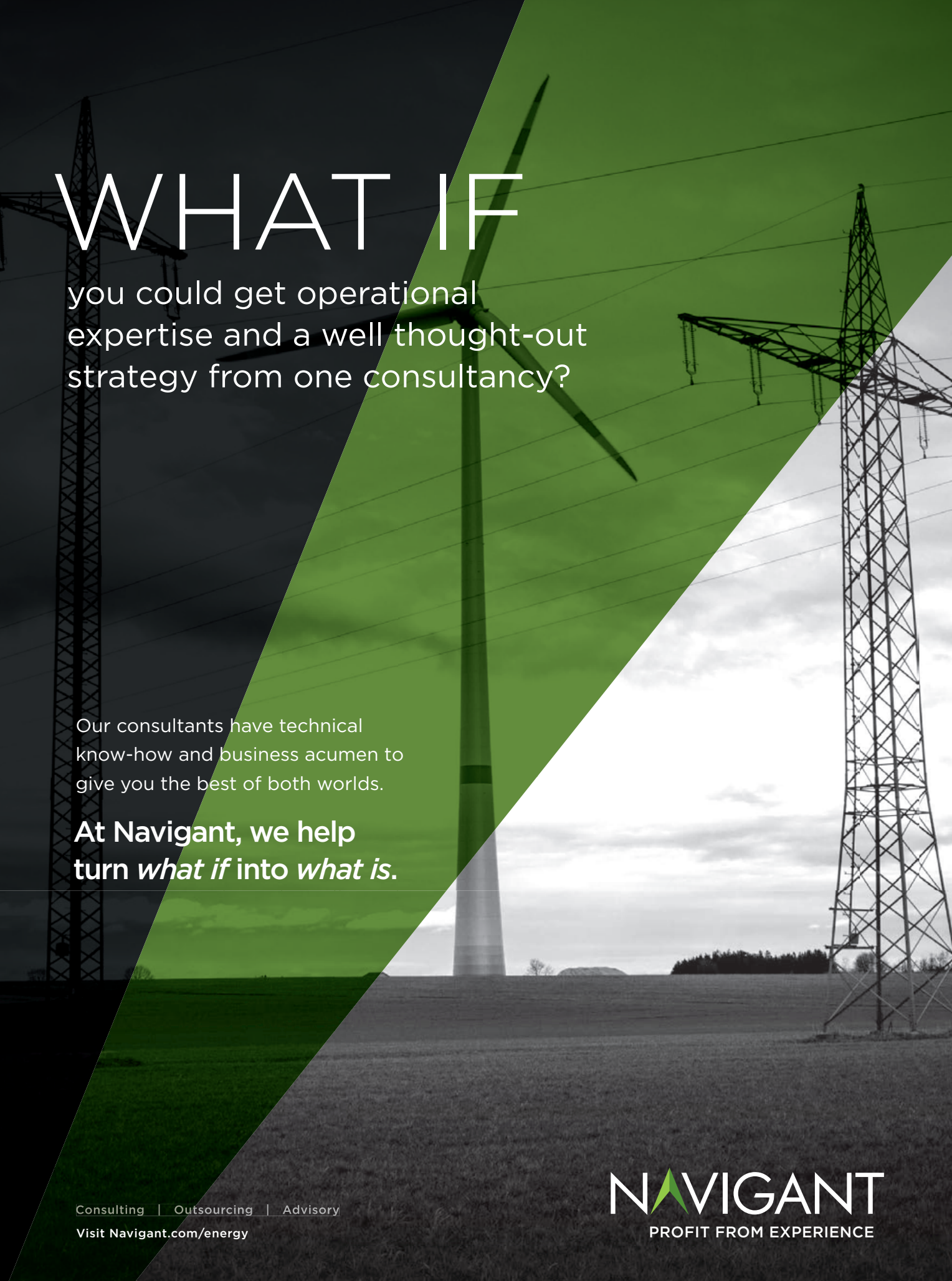
FEBRUARY 11, 2019



Smartening Communities

Special Issue Celebrating Edison's Birthday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PUBLIC UTILITIES FORTNIGHTLY

Impact the Debate

February 11, 2019 • Volume 157, No. 3
(Thomas Edison's Birthday)

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Smarter for All

Where We Are, Where We Need to Go, to Smarten Communities

BY LORI BURKHART, PUF MANAGING EDITOR

Everyone wants to be smart. That goes for communities, cities and states now too. That's why *Public Utilities Fortnightly* is publishing this special issue. To take our readers inside the latest goings-on in this fascinating and flourishing topic.

Yes, the smartening of communities, cities, and states is trending. Inside these pages you will find the latest and greatest information on this topic. Plus, you will get a taste of what is coming.

According to Sue Gander, with the National Governors Association, the smart state movement gained momentum in Illinois. Gander defines a smart state as:

> A state that integrates information and communication technologies and other aspects about agencies, infrastructure and industries to improve the economic viability of residents and businesses.

That's serious business. But it doesn't mean you can't have fun with it. As you read through the interviews, you'll feel the palpable excitement emanating from Duane Schell, North Dakota's chief technology officer, when he talks about drones at Grand Sky Park, sensors for autonomous vehicles, and proudly proclaims, we would love to be the Jetsons! And why not?

Then there's Paula Gold-Williams, CEO of CPS Energy. In her interview, she says she wants San Antonio to be a city of the future. To be a leader in making the technology revolution work for citizens. She adds that the smart cities ethos is that technology should make our lives better, easier and more productive, especially when it comes to city services.

According to Clint Vince, chair, Dentons' US Energy Practice:

> A smart city modernizes the digital, physical, and social infrastructure of a city in an integrated way on behalf of all of its citizens and harnesses sustainable technology in a way that is equitable.

These are striking take-aways. All these great minds working to smarten communities, cities, and states are doing so to benefit all the people. They want to make all our lives better. No one left behind. To coin a phrase, as NGA did, Smarter for All. It's a noble cause to get to work building smarter everything for all of us.

But it won't be easy getting there. Itai Dadon, Itron's global head of smart city product development, and Dan Pfeiffer, Itron's vice president of government affairs, provide an in-depth look at what it will take to create the smart communities of the future. They provide a refreshingly candid take on the obstacles that need to be overcome for the predicted seventy percent of the world's population living in cities by 2050.

These are striking take-aways. No one left behind. It's a noble cause to get to work building smarter everything for all of us.

A consensus is that the digital divide must be conquered. Equitable access to broadband delivery of information is the baseline requirement, according to Virginia's deputy secretary of commerce and trade for technology, Robby Demeria, if we want to move forward with smart communities.

But when we bridge that divide, the real-world applications are mind-boggling. Kim Zentz, CEO, Urbanova,

Lori Burkhart is Managing Editor of *Public Utilities Fortnightly* and has over twenty years of experience in utility regulation in this position and as Legal Editor of Public Utilities Reports.

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a collaborative among Avista, Itron, Spokane, and Washington State University, talks about using air quality sensors to measure air quality from person-to-person or from address-to-address. When someone has a chronic disease affecting breathing, it's vitally important for that person to know what they're breathing at any given time, Zentz points out.

Robert Wilhite, managing director, Navigant, notes that in addition to energy, water is often a big component of smart community programs, both in terms of clean water supply and the safe distribution of water. But also in terms of the treatment of waste water, an important factor.

Information, check. Air, check. Water, check. These are the big-ticket items being grappled with by the great minds aiming at smartening communities, cities and states. Which leads me to the better question than why smarten communities, perhaps, is why not?

So, for those of you just arriving on the smart community scene, not to worry. The American Public Power Association is in these pages to guide you with a checklist for aspiring smart city utilities. Nothing wrong with learning from what already has been tested.

ComEd's Phil Nevels has the amazing title of director, utility of the future. In his interview, Nevels advises that how you build a smart city, and how you build a utility of the future, in both cases, is by starting with customer needs. Nevels says you've got to begin with a vision for what you think the customer needs of the future are. Through that you can identify the key priority use cases.

That is one lesson learned. Smart communities begin and end with the customer. You're going to enjoy this special issue of *PUF* because it's chock full of where we are and where we need to go to smarten communities. There is so much more to do in building them. But the common thread in these pages is making the lives of all of us smarter and better. PUF

Nevels advises that how you build a smart city, and how you build a utility of the future, in both cases, is by starting with customer needs.

Lori Burkhart

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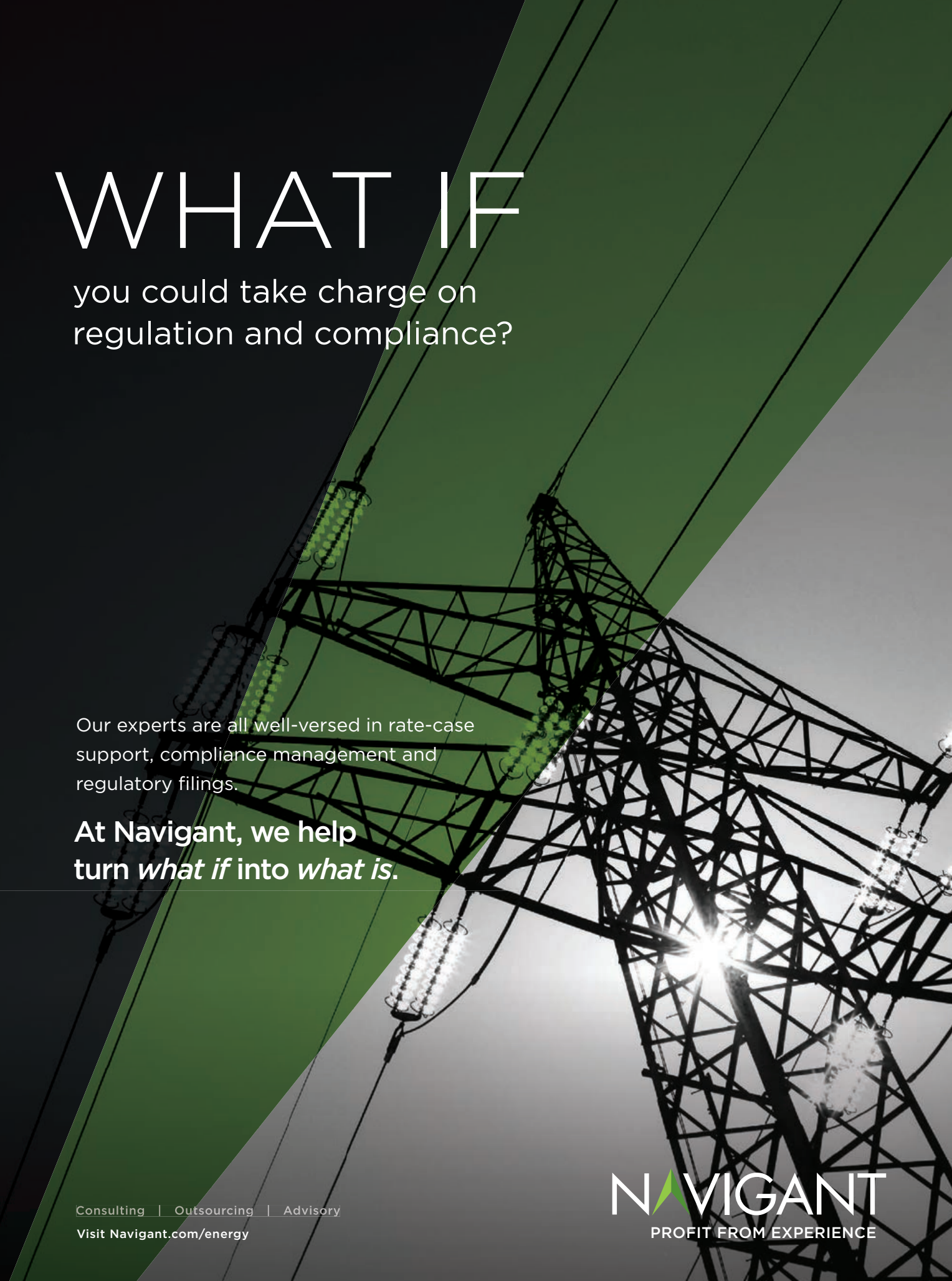
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Nominate a 'Fortnightly Smartest Community'

Tell Us Why It's One of the Smartest in These United States

By Steve Mitnick, PUF Editor-in-Chief

What are the smartest communities in the USA? That's what we want to know, here at *Public Utilities Fortnightly*. That's what we want you to tell us about. Because we want to celebrate these smartest communities this spring.

Come, let's catch a glimpse of the most inspiring visions of our future. By looking at what the most visionary communities are creating today.

Is it your city or county? Is your town one of the strongest growth magnets in the country? When it comes to attracting and retaining the most rapidly expanding companies and the most talented men and women, does your area rank near the top?

Those companies and that talent, when they choose, where do they choose to locate? Is it your area because you all are constructing a twenty-first century infrastructure? Is it your area because it's going to have smart transportation and communications, smart streets and buildings, and smart public safety and sustainability?

Those companies and that talent, you know, don't want to locate in parts of the country that are stuck with twentieth century infrastructure. Those parts that just can't seem to get themselves unstuck.

Companies and talent are instead flocking to efficient and engaging environments that facilitate the livelihoods and lifestyles of the future. We all saw that when Amazon sifted through dozens of communities to find those that are loaded with entrepreneurial, educated, creative and inspired people and a backbone of services to bring and keep them.

In the second quarter of the twenty-first century – don't look now, it'll be here before you know it – this means services that are leveraging tech and data analytics to the max. Services that, with millions of sensors, will hasten your commute, expedite your parking, adjust the lights along your journey, monitor the quality of the air you breathe block by block, and respond in real time to emergencies.

Companies and talent are flocking to efficient and engaging environments that facilitate the livelihoods and lifestyles of the future.

How can you tell a smart community from a – well – another community? It's not hard to tell. A smart community is moving aggressively. It's upgrading wireless communications to the leading edge. It's installing a dense network of sensors. It's developing the analytics and artificial intelligence to convert the tsunami of data that will be coming to practical service improvements to delight the citizenry.

Take a look at the smartest communities. Electric passenger vehicles of varied sizes and shapes are travelling the streets, quietly, without emissions. Microgrids are ensuring the resilience of critical services. LED street lighting is cycling with the traffic. New commercial and residential buildings are minimizing their net energy demands during the day, supplying energy at the day's peak. Students from K to twelve access the Internet at lightening speeds. Increasingly, municipal and utility services are phone apps.

Is one of these smartest communities in your state, if you're at a utility commission. Or if you're at a utility, is one of these smartest communities in your service territory? Well then, here's a golden opportunity to let the world know – at

Steve Mitnick is the Editor-in-Chief of *Public Utilities Fortnightly* and the president of Lines Up, Inc.

least the broad and influential readership of this mag. You can make it happen. You can nominate for this latest competition of *Public Utilities Fortnightly*, the Fortnightly Smartest Communities.

In the June issue of *Public Utilities Fortnightly*, we'll announce and feature the Fortnightly Smartest Communities. Your smart community might make the list. But only if you nominate it by the deadline, which "falls" on March 23rd. That gives you six weeks to send in your nomination.

Why March 23rd you say? That is the anniversary of one of the greatest leaps in history in creating the smart city of today and of tomorrow. It was on March 23, 1857 that the first commercial elevator safely lifted up and returned down.

Three years earlier, Elisha Graves Otis had showed that elevators wouldn't fall, in a dramatic demonstration of his elevator safety brake at the World's Fair in New York's Crystal Palace. Then, at a department store at Broadway and Broome Street, in SoHo, on that pivotal day in March 1857, an elevator carried shoppers up to the floor they chose at forty feet per minute. Before long, the world's cities built so-called skyscrapers equipped with elevators. Pretty smart, for the nineteenth century.

How is it moving aggressively to that Jetsons-like future integrating tech, sensors, data, analytics and artificial intelligence to revolutionize municipal and utility services?

Send your nominations to one of the smart staffers at *Public Utilities Fortnightly*, Alexandra Revel. Alex's e-mail is arevel@fortnightly.com. Tell us the name of the community – city, county, whatever – and tell us why it's one of the smartest in these United States.

How is it moving aggressively to that Jetsons-like future integrating tech, sensors, data, analytics and artificial intelligence to revolutionize municipal and utility services? How are citizens and local businesses already benefitting from these leaps? And how will they benefit even more as its twenty-first infrastructure gets built out in the next few years?

Many communities will naturally hang back, in the inevitable progression to smart communities. Awaiting cost-benefit ratios that certify more certainly that the investment in twenty-first century infrastructure will pay back many times.

But not the smartest communities like the one you're nominating. So on this monumental day, the birthday of one of history's greatest innovators, Thomas Edison, we kick off the Fortnightly Smartest Communities competition. Let the smartest communities prevail. PUF

Edison International CEO Pedro Pizarro speaking at the Electrification 2018 mega-conference hosted by EPRI.

National Governors Association 'Smarter States, Smarter Communities' Initiative

Sue Gander and Dan Lauf, National Governors Association
Sara Bluhm, New Jersey Board of Public Utilities
Robby Demeria, Commonwealth of Virginia
Duane Schell, North Dakota Information Technology Department
Lori Sorenson, State of Illinois Department of Innovation and Technology
Jonathan Schrag, Rhode Island Division of Public Utilities and Carriers

The National Governors Association has been working hard for a couple of years on a smart states initiative that is about to garner national attention with the release of a major report on its initial efforts. But that's getting ahead of all the hard work NGA has done, starting with shadowing the Illinois government and branching out into a cohort of five smart states including Colorado, Nevada, North Dakota, New Jersey and Virginia.

The staff at *PUF* was fortunate that NGA took time from their busy schedules to explain the Smarter States, Smarter Communities Initiative. Next, NGA introduced us to more staff at state governments that are working on making states smarter. These are the personnel that are the vanguard of what boils down to making lives better for all citizens.

Here, *PUF*'s editor-in-chief Steve Mitnick goes behind the scenes with staff from governments in Illinois, New Jersey, North Dakota, Rhode Island and Virginia. You get an in-depth look at how states are becoming smarter. But first, NGA's Sue Gander and Dan Lauf explain the genesis of these amazing programs.

Sue Gander

Director, NGA's Environment, Energy & Transportation Division

Dan Lauf

Program Director, NGA's Environment, Energy & Transportation Division

PUF's Steve Mitnick: Explain the Smarter States, Smarter Communities initiative that's been going on awhile?

Sue Gander: The National Governors Association is very excited about our new effort to help states navigate the emerging world of connected and data-centered technology. The NGA initiative started over two years ago when we were invited by the governor's office in Illinois to begin to shadow them as they developed what was, at the time, the first and arguably only Smart State initiative.

There was already a lot of activity at the local level both in the United States as well as overseas. Illinois was the first to look at a comprehensive program that could be undertaken at the state level. Illinois very much wanted to be the first Smart State, but it didn't want to be the only Smart State.

Illinois asked NGA to work with it to help develop a cohort of Smart States – a group that could share ideas and lessons-learned and raise the awareness of the role of governors and states, alongside cities and the private sector, in deploying smart technologies. Illinois knows that NGA is a place that helps develop and refine policy ideas and helps jointly develop efforts, and we were very pleased to have the chance to work with Illinois.

We spent the following two years on calls with Illinois and participating in their state meetings and stakeholder sessions. We learned a lot. Then, in August of 2017, we pulled together an experts' roundtable with Illinois as well as a half dozen states, some cities and academic folks, federal government officials, industry players, and others.

A Smart State is one that integrates information and communication technologies and the internet of things across agencies, infrastructure and industries to improve the economic viability of its residents and businesses.

– Sue Gander

We asked the question, what next? We've seen Illinois. We've seen some great successes and efforts coming out of that state. What could this mean for other states? Moreover, what could it mean for NGA and our potential role in helping develop additional Smarter States? That discussion helped shape where we are today.

PUF: What's a definition of a Smart State?

Sue Gander: A Smart State is one that integrates information and communication technologies and the internet of things across

agencies, infrastructure and industries to improve the economic viability of its residents and businesses.

We like to emphasize that states are already smart in many ways; this is about becoming smarter. That means enhancing their IT and communications networks, developing data strategies and addressing issues of governance. Being smarter is the means to an end, not about advancing technology for its own sake. When states pursue autonomous vehicles they are looking to address the tens of thousands of lives lost every year to human-caused accidents; when they look at changing street lights to smart, LED technologies, it's about lowering costs, lowering emissions and making streets safer; when they roll out a smarter grid, they are reducing recovery time from natural disasters; when they bring broadband to rural areas they are helping kids do better in school and farmers improve their crop management.

We stress that state efforts are an additive to smart cities and smart communities in that there are a lot of important actions that cities, and larger combinations of cities, can take.

But there are some key actions that states can take to help aggregate the impact of what any one city or region can do. Then there are some important actions that states can take to fill in the gaps in areas outside of cities such as rural communities.

Addressing the urban and rural dimensions is part of our tagline "smarter for all." The other important aspect of smarter for all is addressing issues of equity and access such that all citizens can share in the benefits of a smarter state, including those from low-income communities.

PUF: Are the states enthusiastic?

Dan Lauf: Absolutely. We have seen a lot of interest from the states. It's been interesting working with our first cohort of states and seeing where their interests lie. What we're seeing is a lot of overlap in their areas of interest and some overlap in the approaches they are considering. For example, all the states are exploring data and technology governance structures to drive their work in the long term.

While smart and connected technologies have applications across many sectors, we began by exploring a more focused scope of applications, based in part on the areas of interest states had flagged. This includes the smarter generation, distribution, and use of energy through grid modernization, LED streetlighting, and advanced building technologies.

We're also exploring smarter transportation, whether that's through autonomous vehicles or connected vehicle infrastructure.

And we are looking at smarter public safety, which can include integrated sensor networks for gunshot detection, networked video monitoring and technologies that let emergency responders better share information to make communities safer.

PUF: You said with smart cities what states can do is additive. That makes it seem like some items fall within city or counties, but some are state government functions.

Dan Lauf: Yes, there are areas where states can leverage local success to advance projects further, such as to rural regions. There are other areas where states have regulatory authority or own the assets required to move a project forward.

A prime example is the electric utility sector, where states have regulatory authority and oversee decisions related to developing a smarter electricity grid, transportation electrification, opening data access to third parties, and ensuring data privacy and support of utility cybersecurity efforts.

States are also key players in enabling access to advanced telecommunications networks, particularly in rural areas, which can facilitate other technology services. They also play a critical role in emergency response functions that can be enhanced by smart technologies, plus other functions across transportation, criminal justice, health care, education and more.

Importantly, governors also oversee their own assets and information technology systems. States can, for instance, incorporate submeters to monitor energy use and strategically deploy efficiency measures in state-owned buildings. And there are opportunities to centralize and improve state IT systems, allowing agencies to more easily generate data and securely share information with one another and the public.

This is worth highlighting. States generate and make use of a lot of data. There are opportunities to make sure that data can be securely used and shared across the public sector and even with the private sector to enhance state services or facilitate new projects.

PUF: Where are we going over the next year or two with initiative?

Sue Gander: It's going to be an exciting time in terms of states moving ahead on a smart agenda, particularly as we have 22 new governors taking office this year. In October, NGA sponsored a

learning lab in Illinois, where they were able to demonstrate some great outcomes from their work with our first cohort of five states – Colorado, Nevada, North Dakota, New Jersey and Virginia.

NGA will be hosting a panel on Smarter States for all the governors when they are together in February, for our winter meeting in Washington, D.C. That will be an opportunity for all governors to hear about what's already been taking place. It's going to be a dynamic conversation about the benefits, opportunities and challenges of becoming a smarter state. We will be helping governors learn about actions that they can take as champions and policy leaders.

NGA is taking the lessons that we've learned from our work to date, including the learning lab, and developing a roadmap for governors on smarter states and smarter communities that we will be releasing this spring.

Then we're looking to work with another cohort of states over the course of the following year, to help them develop comprehensive strategies around their Smart States efforts. That will include governors' staff as well as chief data officers and chief information officers who have been critical parts of the teams that we've worked with, as well as state energy, transportation and public safety officials.

We will continue to gather input from an advisory group of experts from the private sector, academia and non-profits. There's a whole ecosystem that needs to come together to make these types of projects a success.

Dan Lauf: We also plan to continue exploring the cross-agency applications of smart technologies. Many state initiatives are deploying smart technologies as stand-alone efforts, but a smarter state initiative gives governors an opportunity to centralize technology governance and plan and deploy technology at a state-wide level, streamlining distinct efforts and cutting across functional areas.

For example, many states already have active grid modernization, vehicle automation, or digital government efforts underway. While those stand-alone efforts are important, a smart community or Smart State initiative will let states implement those siloed data and technology initiatives at a more holistic level, considering overlap and opportunities across state government and the private sector. It will ensure that technology is deployed cross-functionally, interoperably and securely, and is done in a way that benefits all citizens. ❍

Sara Bluhm

Director, Clean Energy Division, New Jersey Board of Public Utilities

PUF: What do you do at the New Jersey BPU?

Sara Bluhm: I'm the director of the clean energy division at the Board of Public Utilities. We are one of the most exciting divisions in the state. We have the pleasure of being able to implement New Jersey's Clean Energy program, as well as the development of our renewable sector for solar and offshore wind. We're also working on cutting-edge technologies like alternative fuel vehicles, and battery storage.

PUF: You have a lot of responsibilities with New Jersey's involvement in clean energy.

Sara Bluhm: Yes. We are at a pivotal point in the industry where there is a lot of change occurring, and there is also a change in how regulators typically work. That's part of what makes this exciting. There is a lot going on, and there are many opportunities both to fulfill Governor Murphy's goals and to be on the cutting edge of different technologies that are impacting the energy sector.

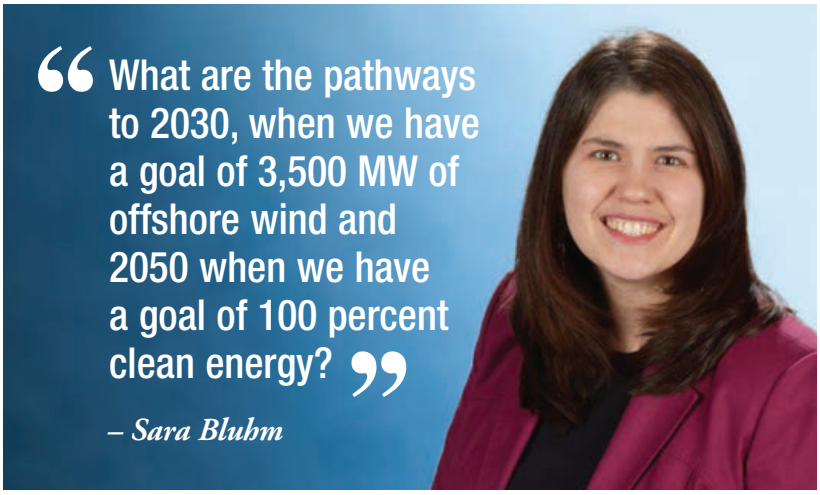
PUF: What's happening in New Jersey in the areas of technology and data in transportation, resilience, micro grids, lighting, street lighting, and public safety?

Sara Bluhm: First and foremost, it all starts with a new administration. That's important to look at and capture. Under Governor Murphy's leadership, we were fortunate to be chosen as one of the five states within the National Governors Association's Smarter

States initiative, and having a fresh administration allows us to do things differently than in the past.

New Jersey wants to be stronger and fairer, and we're also looking at how we can become smarter. We have been a birthplace of innovation, and we continue to position the state so that we are on the cutting edge.

A lot of that is looking at something as simple as working across agencies. We've been able to realize opportunities and plan together. If you look at it this year, our economic development agency was able to release an economic pathway forward for us that took input from other agencies.



If you look within it, we're featured for some of our wind work and the way that we collaborate. The BPU is currently heading up the energy master plan, which is an interagency work group. It's being able to figure out, what are the pathways to 2030, when we have a goal of 3,500 MW of offshore wind and 2050 when we have a goal of 100 percent clean energy?

We are taking a lot of innovative steps within technology, but at the same time sometimes it is something as simple as the agencies coming together to realize those opportunities and advance them quicker.

We've been very fortunate being part of NGA, but also the state has been doing a lot of smart things. For example, we have the most electric vehicles of any state in the PJM region.

We have a charging program for employers and public places within the state. We are looking at ways that we can improve future mobility cross-agency. We're able to look at ways that we can make New Jersey stronger and fairer. That goes back to looking at where we can improve through some of these technological items.

If you look at my agency specifically, under the leadership of President Fiordaliso, we are going through quite a whirlwind of advancement at the moment. We have the largest solicitation for offshore wind in the nation.

We're looking to add energy storage right now.

There is a micro-grid pilot program underway right now. We have a smart meter pilot program going on. There is a lot of collaboration, but we are also looking toward the future and how we position New Jersey in a state of innovation.

PUF: What can we expect in the next three to five years?

Sara Bluhm: We have impressive goals set. While the energy master plan isn't finalized yet, we're on track to release it in June of this year. That is going to have the pathways through 2030, as well as 2050, but you will see some earlier goals related to energy storage.

We have our offshore wind solicitations happening right now, and there are goals for electric vehicle deployment. We also have some pilots going on with our electric bus and transit system that'll be coming online within the next few years.

PUF: How do your vendors and advocates help drive this and accelerate these trends?

Sara Bluhm: We have engaged in a robust stakeholder process. For our energy master plan alone, we've had seven public meetings. We'll be picking up in the spring again, but we've had an active community solar stakeholder process.

One of the goals that the governor has set out is to put us on a pathway to a hundred percent clean energy by 2050. There have been many stakeholder processes around that. Then looking at our regular course of business, we have routine energy efficiency and renewable work.

Anyone is welcome at the table. Our door is always open for best practices and innovative thinking.

PUF: Why are these initiatives valuable for retaining and attracting new businesses and talented citizens who want to be in New Jersey?

Sara Bluhm: One of the things that has come out this past year has been the collaboration of cross-government agencies, and to be able to have a government that is working at its peak and able to deliver to its citizens, hopefully reducing costs at the same time. It's beneficial for everybody.

Being able to align our economic growth strategy, our energy plan, and other policies that are key to the governor's administration is beneficial for everyone. New Jersey is one of the densest states in the country, and we have a talented pool of workers.

We also have a great transportation system. As we're examining how we are able to improve our energy ecosystem, we're going to be able to realize that's for everybody, whether that's better traffic timing or being able to have reduced greenhouse gas emissions because we've got renewables. We're looking at all different sectors of the economy and different ways that we can improve people's lives.

New Jersey is the most improved state in energy efficiency this year, according to ACEEE. That's something that we're continuing to measure against our competitors and are looking at ways that we can improve to be able to show that New Jersey is where things are happening.

We've got the largest solicitation for offshore wind out of any state. We're looking to grow that industry here, but we're not forgetting about other areas. We're looking at how we can bring innovation and be able to remain cutting edge in New Jersey.

Robby Demeria

Virginia Deputy Secretary of Commerce and Trade for Technology

PUF: What is your job for the Commonwealth of Virginia?

Robby Demeria: The best way to describe it is to give a brief history on the secretary positions in Virginia. In the mid '90s, under the Gilmore administration, the Secretary of Technology's office was created.

What's important about that is Virginia was the first state in the union to have a secretary of technology. During this time, technology supported government. It supported business. It was a vertical and having a secretary for technology was the right decision for the state.

Fast forward twenty years, and technology has transformed from being a supporting entity to a driving entity. Technology drives business, government, and innovation. Governor Northam wisely dissolved the technology office and moved IT services over to the Secretary of Administration and moved the forward-thinking, tech-centric economic development, new technologies portfolio to the Secretary of Commerce. In that process, they identified a new Deputy Secretary of Commerce and Trade for Technology and Innovation in the Commerce office and that's the role I'm currently serving.

What's awesome about this experience is, the government was essentially stating that technology is ubiquitous. It's a means, not an end. As a result, I get to work with many secretariats from Workforce Development to Transportation to Agriculture. That's a testament to the fact that technology and innovation should be at the forefront of all our secretaries, and all our agencies rather than siloed in a single office.

PUF: In Smart Cities, what have you been doing so far?

Robby Demeria: We started the Smart Communities Working Group near the end of the last administration. It's been in place for about two-and-a-half years. Broadband is the baseline requirement if we want to move forward with Smart Communities. The governor realized that early on and committed substantially to increasing those resources.

We're in the beginning of our general assembly session, so we'll see how this plays out, but we have proposed forty-six million dollars, in addition to an already appropriated four, so a total of fifty million dollars to assist in getting broadband to the last mile.

It's the largest investment in broadband for rural America to date. We're very proud of the proposal we've made. Additionally, through legislation passed last session, we've hired a Chief Broadband Officer to serve as the state's single point of contact for broadband issues. If you're in Lebanon, Virginia, down in southwest Virginia, or Loudoun County, in northern Virginia, you should have the same access to opportunity afforded by broadband.

The digitally literate workforce – a farmer, a mechanic, a nurse, or software engineer – all require a level of digital literacy, computational thinking, in the new economy.

– Robby Demeria

While that's been taking place, we also, in August of last year, identified our state's first Chief Data Officer, Carlos Rivero. The Chief Data Officer is working to connect state resources, set data use guidelines, and coordinate data sharing among the state's sixty-three agencies. The agencies are working on how to better communicate with each other, share data, and increase services to our constituents through a smarter use of our data.

The Chief Broadband Officer and Chief Data Officer are the two advancements that we have done recently in the Commonwealth that are moving this forward. We've got several community pilot projects that are in the queue or already underway.

The two big ones happening now are a twelve-community fiber ring that's being constructed in Hampton Roads – and if you're not familiar with Virginia's geopolitics, Hampton Roads has a significant one making this project a huge achievement. The other one is the autonomous vehicle explorations that are taking place in northern Virginia.

We've got some exciting work in rural Virginia. In Botetourt County, which is right outside of Roanoke, they're working on leveraging a new work center that has a broadband connectivity for additional remote workers for jobs that sit in northern Virginia.

The City of Fredericksburg is converting legacy data to a completely new data analytics platform that will improve city services. The list goes on, but those are some highlights.

PUF: Where is this headed three to five years from now?

Robby Demeria: For a lot of these pilot projects, they are diverse when it comes to geography. We're piloting in northern Virginia, Richmond, and Hampton Roads, but also in Botetourt County, southwest Virginia, and Southside Virginia.

The idea is that we need to be able to have a proof of concept that can be replicated in other parts of the state. In the next five years we want smart communities to equate to economic growth, but we need that in every region of the state.

When Virginia was named one of the best states for business, it was during a time in which only one or two of our regions had economic growth. All other regions were declining. As we work to get back to the top, and that's where we want to be, we're going to do it with all regions of Virginia, not just a few.

Using some of these Smart Community initiatives will help us get there. Five years from now will be beyond our administration. Our goal is not to get as many wins as we can in the next three years, but to set Virginia up for success for years to come. These pilot projects will prove success and will give us better insight and knowledge on what works and what doesn't.

Five years from now, you'll see several smart communities and cities across the Commonwealth - not just the obvious ones like Arlington. That's a given.

The Governor has a ten-year goal to close the gap on those who are unserved by broadband. The Chief Broadband Officer said recently, that if we achieve our goal on the last day, or the day before the ten-year mark, we'd probably receive a failing grade. We need to close the digital divide as soon as possible, especially as it relates to smart initiatives.

PUF: Why is this important?

Robby Demeria: It's important for the same reasons why we've moved away from a Secretary of Technology, in favor of the idea that technology is in every agency, in every branch of government. The new economy is not going to happen sometime in the future. It's happening right now.

As we move forward, the conversation has shifted from the differences between blue-collar jobs and white-collar jobs, and lately it's been all about the new-collar job. The digitally literate workforce – a farmer, a mechanic, a nurse, or software engineer – all require a level of digital literacy, computational thinking, in the new economy.

It is so integral for our children's future, and the future workforce. You must remind yourself that it's 2019. We're nearly two decades into the 21st century. A digital literate workforce was need yesterday, not tomorrow.

It's why we talk about a lot of your members in the utility industry. We need strong relationships with our utilities to be able to continue to keep Virginia and the nation as an early adopter and at the forefront of new technologies that will grow our economy. So far, it's been a great relationship, and I look forward to continuing to work with a broad cross-section of stakeholders, state agencies, and communities throughout Virginia to achieve these goals. ❍

At the retirement party on January 24 for former Chair Betty Ann Kane of the District of Columbia Public Service Commission, with Liz Stipnieks of the *Public Utilities Fortnightly* team to her left. There was a big crowd to celebrate Betty Ann Kane's retirement, including Commission Staff, but also many luminaries from the District of Columbia government. Betty Ann Kane had a long and distinguished career with many sectors of the District of Columbia government.

Duane Schell

Chief Technology Officer, North Dakota Information Technology Department

PUF: What do you do for the state of North Dakota?

Duane Schell: My title is Chief Technology Officer. From a macro level, I'm responsible for all the technology infrastructure that supports big government, which includes data centers and all the fun things that belong in the data centers, whether they're in our physical data centers or cloud data centers.

I take care of the network. That's an area where we're a bit unique. From a network perspective, we not only serve all of state government, but we also serve local government, and the K through 12 community. It's a bit different than what you typically see in a state government organization.

We are responsible for all the service management initiatives that are going on and we're also working with a team of folks that support our K-12 community. They do some training to help the education community leverage technology in the classroom and support a number of applications that we host on behalf of the education community.

That's a broad view of my official job. Beyond that, I'm getting involved in all kinds of entertaining things. We've got a dynamic and interesting governor and CIO, so it's a great time to be in government in North Dakota when you've got two remarkable leaders.

PUF: What's interesting in North Dakota as far as using new technologies and digitization for lighting, transportation, public safety, energy resilience, and environmental sustainability?

Duane Schell: We've got a lot going on. With a very technology-minded governor and CIO, we're leveraging all kinds of technology. It's not about the technology. It's about the problems that we're trying to solve. Then we'll find the technology that will help us solve that business problem.

From a state government perspective, it's a focus on how to leverage data better, moving into the general government perspective. Over the years, governments went from paper to electronic. We're really trying to push the envelope now to get from electronic to digital.

How do we leverage our data better? A great example is one of the governor's major initiatives that he's calling our Main Street initiative and we've released a Main Street dashboard. That is just a wealth of information that has been, like most governments, buried in a lot of different data bases.

It's all brought together into a single dashboard for community leaders to make decisions on how to grow and evolve their communities. That's something we're excited about. It's an example of how we want to leverage data better.

If you look across governments, they're masters at collecting data, but I would argue governments, as a typical stereotype, aren't very good at leveraging their data. We see that as a theme across a lot of aspects of what we're trying to do. How do we leverage that data to be able to make more meaningful information from it to give decisionmakers and policymakers the right information to make those right decisions?

PUF: People talk about smart lighting, smart streets, using it for public safety, policing and emergency response. What's going on?

Duane Schell: It's a variety of things. It's smart lights and smart streets that communities are implementing, specifically as it relates to public safety. We've been a partner with the local communities on standing up our next-generation 911 solution. We've got the state fully compliant on next-generation 911, including the free text at 911.

We've had that in place for over a year already. We were in the top ten of the country with enabling texts to 911 statewide. We are in the midst of looking at how we can do public safety communications much differently and better in leveraging legacy technology, as well as modern technology, as it relates to what LTD and FirstNet brings to bear.

We see communities doing a lot with body cameras and many other applications to help make data-driven decisions. When it comes to public safety, it's all about situational awareness.

PUF: What about electrification of transportation? How does that fit?

Duane Schell: Some of the larger states are probably looking more at electrification of automobiles more than you see in North Dakota, but it's a part of the ecosystem. We see bills showing up this session to address some of the policy issues in that area and how to approach that.

From an autonomous prospective, we're working closely with our partners at the department of transportation. Highway 83 is a road that goes from Canada all the way to Texas and that road's being positioned as an autonomous vehicle test site. They're taking steps in terms of putting sensors in our roads and being able to be positioned to be ready.

If you look at the UAS-UAV world [drones], real exciting things going on there. At the Grand Sky Park up in Grand Forks North Dakota, sits one of the largest UAS-UAV test sites in the country.

There's more of them that have popped up, but that one brings to bear some interesting items because of what that facility has. It's a partnership between the public-private sector. We've got the Grand Forks air base there.

We've also got the University of North Dakota's Aeronautic School there and multiple private sector parties doing some of the most leading efforts in the country and in the world around what's happening with the UAS-UAV capabilities. It's largely drones.

There's a lot of fascinating work and one of the issues that we're working on that the governor is supportive of is how do we solve the beyond visual line-of-sight challenges that exist in the country from a legal perspective and get people to do that with the FAA?

The obvious issues that people also talk about is how do you do pipeline inspection? How do you do power line inspection and leverage the autonomous vehicles, whether it be the land or air vehicles to be able to improve those practices and leverage that technology? It should be no secret that those are projects that are active and are going on within our research department.

PUF: Where is this going with further integration of these technologies and digitization for the government functions?

Duane Schell: We would love to be the Jetsons. The governor has said more than once, he'd like to see a billion sensors across the state. He's not kidding. It's plausible if you think about energy, and North Dakota is a leader in several areas in energy.

Oil is the one that gets a lot of attention, but we're a major wind producer. We're a major coal producer, so it yields a lot of energy that is generated here.

The egg industry is another one that is great for automation and in sensors. North Dakota is a leader in a dozen egg commodities, energy production and UAS technology and if we're going to remain competitive from an economic perspective, we must find a way to leverage automation, and autonomous sensors.

When you look through the governor's budget recommendations, you see indicators all over that putting a billion sensors across the state of North Dakota is not that far-fetched. When you think about the egg industry, people joke about it, but what are you going to do, put sensors on livestock? The answer is yes. That's being done today.

When you look through the governor's budget recommendations, you see indicators all over that putting a billion sensors across the state of North Dakota is not that far-fetched.

– Duane Schell

There are a couple of test farms that are research farms in the state and they're doing some of the world's leading activities around automation in the egg sector. One in particular is a fully autonomous dairy farm. It's a lot of fun to go and visit.

PUF: It sounds like your governor is using technology to attract and retain talented workers.

Duane Schell: When you look at where we're at, from an economic perspective, workforce is one of our challenges. Our unemployment in the state is low and our workforce is our number one challenge for growth in our economy.

How do we leverage IOT? How do we leverage smart technologies? How do we leverage data to make the right policies?

How do we make the right decisions to incorporate what's needed to attract the workforce that is interested in those types of subjects, but also how do we free up workforce to allow the work on different areas and skills?

It's attracting and repurposing talent. It's part of our education plan to grow a twenty-first century workforce. You see elements of that throughout the governor's plans and strategies as well. You're spot on in that regard. ❍

"In 1950, AT&T had the first PV panel, basically the same technology that we are using today. The cost of that PV panel, maybe $500/KW. It's 50 cents/KW today. So engineering innovation, driven by volume of production, lowering cost, drives that option." Arshad Mansoor, Electric Power Research Institute, Bipartisan Policy Center event, January 24.

Lori Sorenson

Chief Networking Officer, State of Illinois, Department of Innovation & Technology

PUF: What is your role here?

Lori Sorenson: I am responsible for our network operations at the state of Illinois. Our agency is the Department of Innovation & Technology. That is a new agency that pulls all the IT operations from the different state agencies into one single agency with cabinet-level leadership. My responsibility is to provide the network services to not only the state agencies, but we also run a fiber broadband network that serves our K-12, local governments, and higher education.

PUF: What's new in this area, whether it's lighting, mobility or otherwise integrating new technologies, data and analytics into services?

Lori Sorenson: Illinois is one of the first states to put together an enterprise strategy for how to build a smart state. We started about three years ago through listening sessions with local governments, private sector, and industry groups to understand what the need is among the local governments, and what the new opportunities and possibilities are with the new technologies and capabilities.

We looked at what's happening around the world, took all that information and brought that together to develop a strategy on how we could as a state tackle the expansion, growth, development of smart cities, and smart state technology.

After that we put a strategy together, and put a white paper out, and that's public. We've now moved on to ideas and concepts and broken that down into workable strategies. One of those strategies, the one that I worked on directly, has to do with our smart lighting.

Of all the feedback we've heard, smart lighting was one of those key areas, key technologies that will become a foundation for implementing smart city technology.

– Lori Sorenson

Of all the feedback we've heard, smart lighting was one of those key areas, key technologies that will become a foundation for implementing smart city technology. That is because so many governments are challenged now with budgets. You come in and you bring a new idea, or a new capability, and if it costs a lot of money, where is that money going to come from in the budget?

Smart lighting is one of those where you start to see instant payback. By implementing smart lighting, you can reduce your energy costs by over fifty percent or more. If you even are in the marketplace, the vendors and the communities come to the point where they will finance that project with those energy savings, and partner together with the community. So, you're not having to come up with that capital cost.

That was an area we looked to. We talked with local governments. In Illinois, we have the city of Chicago, and other larger communities, but then we're mainly made up of mid-size and smaller communities. Those governments said, we're stuck, we don't know how to start, where to start, what makes up a good smart lighting solution. How do we go out into the marketplace to put together our specifications? What are those requirements, so we end up with a good solution that's reliable, scalable, and sustainable?

That's where we leveraged expertise that we had within the state. We tapped into our universities and brought together some experts. We developed a request for proposal, and put

that out on the street, with the goal of establishing a master contract that could be leveraged by local governments who are looking to implement smart lighting.

We were successful and awarded a contract to three different vendors last year. We began having informational sessions with the local governments and started to connect those vendors with the local governments, to start looking and exploring implementation.

When we held an information session last fall, we had tremendous interest from local governments. We even had to cut off registration when it started to exceed the capacity of our facility. It was a great day.

We had communities there of all sizes and different stages of the smart lighting journey. Some had already put in LED but had not yet installed adaptive controls and were ready to go to that next level. We had some that were getting ready to start.

It was a great conversation to help folks understand how the journey progresses, and how you go about building that value statement and working with your local boards and villages to get those kinds of projects approved.

It was also seeing what are some good fundamentals that you need to follow as you're adapting. What is that value coming from? On LED, what kind of savings do you get when you add the adaptive controls? Then what is the value if you start adding the value-add services, like sensors, cameras, noise detection, those kinds of capabilities, and then build from there.

PUF: Is this all over the state?

Lori Sorenson: We did have full representation of the state, interest from all over, and from various sizes. So that master contract helped the local governments. They do not have to do all that research and put together specifications and go through a lengthy procurement process to enter into a contract with a vendor.

Now they have three vendors. The state has already done that whole procurement process. We have vetted those vendors. They have quality products and solutions, experienced vendors with contract terms and conditions, and now a community can start working with them, and start building to the specific needs of their community, build a plan, a program, a budget, and begin to implement it.

Last fall when we held that session, we had some communities that were ready to roll. They'd already put the lighting in, and they were ready for adaptive controls, which was great. They started reaching out to those vendors and started to get specific about how they could implement adaptive controls.

We heard from some other communities that are ready to start from the beginning. They're starting from scratch, and they're working with those vendors to develop a plan and budget to go LED, adaptive controls, and do a full implementation.

PUF: Were the utilities participating and can they be helpful?

Lori Sorenson: Yes, they can be helpful. In Illinois our two primary providers are ComEd and Ameren. They participated in the workshop with us, talked about their rebate programs, how they worked with the communities depending on who is the provider, and who owns the pole.

That was fabulous. The utilities were great right from the start, have reached out to us, and want to be a part of the solution.

PUF: What's next?

Lori Sorenson: This is a continuum. This is our new norm, as the technologies are going to keep evolving. We've broken our statewide strategy, and our effort, into different areas.

We are working with our Department of Transportation and our Department of Economic Opportunity. They are looking at smart technologies in transportation for safety and efficiency and are looking at how we can leverage state assets.

We have over a thousand miles of state-owned fiber, and most of that runs along our interstate rights-of-way. What can we do with that, to partner with the private sector, to help with the evolution of autonomous vehicles, traffic management, and other technologies? We've got some working groups that are pursuing those efforts, gathering information and looking for the best opportunity and how to move that forward.

We have a group that's working on buildings. One of the first things it did was try to measure what is the utility usage at state-owned facilities? What's the baseline, and what are our energy costs and usage?

Then we're working with the stage agency that manages buildings and facilities, and the agency that does construction of new facilities and buildings. How do we start integrating energy efficiency and smart technologies in those buildings?

Integrating over time as we want to watch and see what that does, and what's our energy consumption, if we integrate some technologies in the legacy buildings.

PUF: How long before the state of Illinois reaches the Jetsons level?

Lori Sorenson: We want that engagement with citizens to be real time, meaningful, and specific. We want to use the technology to drive efficiencies and cost savings in operations. We want to use it to spur and spark economic development, and we want to use it to help address digital equity and digital inclusion in the state.

The last two sometimes get left off technology. For digital equity and inclusion, in order to drive the smart cities, smart technologies, you must have broadband services. So, you're making investments in infrastructure to get the connectivity, and you're building wireless networks.

By doing that, it helps to expand and improve access to broadband services within communities, to the citizens. It helps to lower the costs. It's good to have those kinds of engagements that are helping to build digital skills.

In economic development, if we are a state where we're rolling out smart lighting, and smart building technologies, and are putting in the infrastructure and the capability for smart vehicles and autonomous vehicles, we want to attract companies to come to our state that are building those technologies. We want to be a place where we can test out those technologies, and where they can be deployed and grown. We want to get feedback and build that new business space. PUF

Jonathan Schrag

Deputy Administrator, Rhode Island Division of Public Utilities and Carriers

PUF: In Rhode Island State Government what's your job?

Jonathan Schrag: I'm deputy administrator for the Rhode Island Division of Public Utilities and carriers. We are one of two regulatory bodies that oversee electricity, gas, water, waste water and in the case of the division, we have original jurisdiction over some transportation assets as well, including ferries, transportation network companies (Uber and Lyft), and taxi services.

We are an indispensable party in all cases before the commission. In Rhode Island, the commission acts as the judicial arbiter while the Division presents evidence and enforces Commission orders in a way that may be similar to many advocacy staff in other jurisdictions.

There several areas of utility practice that we have original jurisdiction over or have exclusive jurisdiction over. For example, debt filings of utility companies. It's a very interesting statute in Rhode Island.

PUF: What's going on in Rhode Island's smart communities?

Jonathan Schrag: One of the advantages that Rhode Island has is its relatively small size. Various agencies of state government and various levels of government can work together because most people know each other.

There are a few areas that we're excited about. We're most engaged in working with the electric and gas utilities to consider how the communications for smart cities may evolve. At the center of our thinking is National Grid's efforts to think through the development of their distribution automation and advanced metering proposals. The communications connectivity.

Of course, those could also be leveraged by a range of other users including municipalities.

The opportunity to provide services to municipalities raises the potential for alternative revenue streams and ignites the conversation around how those streams are shared between ratepayers and shareholders of the utility.

PUF: It sounds like the smart meters aren't in yet, but the proposal perhaps will be broader?

Jonathan Schrag: The meters are not in yet. In Rhode Island

(Cont. on page 39)

Smart is Worth the Effort

Facing Headwinds

Itai Dadon, Global Head of Smart City Product Marketing,
and Dan Pfeiffer, Vice President for Government Affairs, Itron

Recently, *Public Utilities Fortnightly*'s editor-in-chief Steve Mitnick sat down and had a talk about smart communities with Itai Dadon, global head of smart city product marketing at Itron, and Dan Pfeiffer, vice president of government affairs at Itron. They had a lot to say about Itron's deep involvement in the hard work required to smarten communities. Here are some excerpts from that conversation.

PUF's Steve Mitnick: What's the business case for smart communities?

Itai Dadon: What we've seen is that the market is not slowed down by technology; it is slowed down by the lack of creative business models and financing. Cities and utilities need more formalized and more clearly defined business cases for each one of the smart city applications available today.

As applications mature and we have access to more data, we better understand the value of these applications, which helps strengthen the business case. With this, it becomes easier to secure financing for new deployments, whether it's from investors, cities, utilities, or another private entity.

The benefits of a smart community application come in three phases. First, there is the direct benefit of the actual application. Typically, the city or utility knows in advance what objectives they want to achieve. For example, when a city puts a parking solution in place, it knows that it wants real-time communication with the citizen on where parking spaces are available in order to reduce traffic in the city and improve the citizen's experience. So, more people park faster, which results in more payments coming in for the city, fewer requirements for parking enforcement, and increased revenue for the city. There are concrete metrics that the city can use in order to verify or validate whether this solution is working or not because it has specific objectives.

However, what we don't know is, what we don't know. It's important to acknowledge that we will discover benefits as well as issues that we cannot necessarily anticipate, and it's true for every application that we put in place.

Figuring out the extra benefits of an application – that is the second step, or type of benefit, that is important to stress. Using smart metering as an example, we knew that the first benefit would be that utilities don't need to send technicians to the meter once a month anymore. Today, we know that smart meters help utilities save energy and optimize operations in ways that we didn't think about before.

Then comes the third step that completes the transformation of smart communities or smart spaces, and that's when data comes together from multiple applications and unlocks new value for the benefit of the citizen.

Such transformation can come in the form of reduction of crime, improved safety on the roads, faster economic acceleration in the city, and much better use of resources, such as water and energy. As an example, making a significant reduction in a community's carbon footprint is an essential metric that we're working with many communities today to achieve.

The UN is predicting that by 2050, we will have almost 70 percent of the world's population living in urban areas. This is happening all around the world, and especially in emerging countries. It's creating a significant impact on traffic, pollution, waste and lack of efficient use of energy and water. At Itron, we are working with the communities and utilities around the world to help reduce those negative impacts of urbanization.

With a P3 model, there's a shared vison, clearly defined roles and responsibilities, clarity on risk and rewards, and most important, net benefits for every stakeholder in the community, especially lower-income ratepayers.

– Dan Pfeiffer

PUF: What are some of the regulatory obstacles you see?

Dan Pfeiffer: We face two primary headwinds when it comes to making smart community projects a reality. I categorize one as the math challenge, and the other as a cultural challenge. The math is related to how communities fund projects and recover costs in a multi-jurisdictional environment, where they're mixing taxpayer money with ratepayer money with potential investor money.

I have no doubt that there is a solution to this challenge, but it takes a shared vision from all stakeholders, especially state commissions. Some commissions have the flexibility to consider value streams that aren't just about adequate, secure, reliable utility service. They can consider public goods like improving air quality or improving public safety. They can consider decarbonization targets. Yet there are some commissions that, by statue, are only empowered to keep utility service reliable and rates as low as possible. All commissions would agree that these value streams are good things. But should those costs be in the utility rate base?

One potential model to deal with smart communities funding or cost recovery challenges is the public-private partnership (P3). With a P3 model, there's a shared vison, clearly defined roles and responsibilities, clarity on risk and rewards, and most important,

net benefits for every stakeholder in the community, especially lower-income ratepayers.

The second challenge I see is cultural. One entity, whether it is the utility or the city, is going to control and run the shared network, while others are going to rent space on the asset. If you're a regulated utility with a rate base, there is some incentive to have that network cost in your rate base and someone can rent that from you.

Utilities have a genuine commitment to service. When I worked at a utility, we took that obligation very seriously. We had to keep the lights on. I imagine that a traffic engineer, the waste management supervisor or any agency that would use a shared network would be equally committed to providing quality services. It's going to take a certain a leap of faith for some entities to farm out part of their obligation to serve with an outside party.

Just like the math challenge, I believe the cultural challenge is solvable with an inclusive planning process that clearly defines roles and responsibilities and how risks and rewards will be allocated. Most stakeholders are going to want to see some cost savings and some upside to using a single, shared network in a metro area, producing more value than if every entity operated their own network. I imagine most would agree that smart communities are a good thing, but when you dig into it, implementation will take a lot of hard work and a shared commitment.

PUF: What can *Public Utilities Fortnightly* readers at the utilities do to accelerate this?

Dan Pfeiffer: Support smart communities initiatives like what the National Governors Association (NGA) is doing. One of the reasons that Itron is sponsoring NGA's initiative is that governors have such broad convening authority to get all the right people all around the same table – commissioners, mayors, utilities, technology companies – to figure out the math.

The smarter states roadmap NGA is developing will offer states a how-to guide on how to use technology to help transform how citizens, businesses and governments interact to provide a better quality of life.

PUF: Is it a matter of divvying up the responsibilities?

Dan Pfeiffer: Yes, especially if you look at public private partnerships as a model; you really need to have a clear understanding of roles and responsibilities. Who's doing what? And how are costs and benefits allocated? It's important to note that in the P3 model, regulated utilities will still need to make a positive business case to their public service commissions, showing how ratepayers will be better off with this shared network than they would be separately.

PUF: How is this going to look in three to five years?

Itai Dadon: You mentioned in the beginning that the technology can be transparent to people, and I truly believe that it's a sign of success when technology is transparent. We need technology that is improving citizen's quality of life intuitively and without any friction.

Technology that's forcing people to change their habits or change the way they live in a way that is going against the natural flow of life is not beneficial. It must help people in a way that is transparent. A great example is how we work with utilities around the world – we bring millions of consumers the benefits of smart metering without them even realizing it in most cases. We are working hard to replicate this success for cities and communities.

The goal is to seamlessly deliver benefits to citizens – like reducing the number of fatalities on the road, decreasing traffic jams, congestion and carbon footprints, and improving air quality – all in a way that happens transparently.

PUF: Who's on the best path to being smartest city, the smartest county, or the smartest state?

Itai Dadon: We have quite a few success stories. Communities that took the initiative and have a lot of public impact. In Charlotte's Uptown, we helped the city improve the use of energy with a nineteen percent reduction in energy used in commercial buildings.

In New York, with Consolidated Edison, we have started deployment of methane gas leak detectors under their AMI network. The detector will sound an alarm if it detects natural gas in the atmosphere where the device is installed. More important, even if people are not at home, the alert will go to the utility and emergency workers, so the fire department can go immediately to that location. We started deploying these detectors at ConEd in October, and they have already detected real leaks that were repaired before any incidents occurred.

This is how we envision smart communities working by creating a triangle of collaboration with the utility, technology provider and community.

At another utility, we are piloting sensors that are attached to poles to help the utility come back to normal operation as quickly as possible after a hurricane. They will detect which poles are still standing, which are leaning, and which just require maintenance.

After the last hurricane, thousands of poles fell down and electric distribution went with it. The problem is that it is extremely difficult for utilities to know where the poles are that went down. They must patrol and identify which poles are down, and then call for additional poles and take the vehicles there.

In this case, the system allows the utility to understand exactly which pole fell and needs immediate attention, and which poles are leaning, meaning they require some maintenance or strengthening, but represent a lower priority. This makes the difference of bringing electricity back on after hours versus after days.

PUF: What else are you working on?

Itai Dadon: We're working with cities and campuses to trial acoustic detection systems. This technology is connected to our network and it's integrated with the police department to provide a real-time, accurate and fully automated alert in the case of a detection of a car crash or gunshot. This is incredible technical innovation, and we didn't develop it, which is also an important point of how we scale our offering for communities.

We have a Developer Program for technical enablement. It's an ecosystem that allows us to bring in innovations from developers and benefit from their expertise in their domain. We integrate and certify their technology to operate on our networks. This is the only way to scale. No single company can claim that they can do everything in smart cities or the Industrial IoT in general. It's impossible.

There are also some revolutions happening in parallel from a technical perspective. For example, Itron Idea Labs is exploring what is possible with technologies such as augmented/mixed reality, advanced sensors, machine learning, and artificial intelligence. Recently at the Consumer Electronics Show (CES), they demonstrated how mixed reality can help cities improve urban planning.

Itron is also helping revolutionize the use of distributed intelligence and edge computing. It's important because of the explosion of the amount of data we need to manage. It's great to have a lot of data, but if you are inundated with it and you're not able to bring an outcome, then you're just overwhelming yourself with data without any benefit.

Bringing in the ability to manage that data at the source and applying analytics in real time not only helps improve reaction times or the latency of the application, it also optimizes the way we deal with the data. We don't need to bring all the data back to one central place.

PUF: Is there something utilities can do to give this a bit of a push?

Dan Pfeiffer: One of the biggest barriers can be securing regulatory approval for cost recovery.

California, Rhode Island, New York, Illinois, Minnesota and Hawaii are all states that have shown some willingness to deviate from the standard cost-of-service model. Performance-based rates is a good example. Once utilities take the leap and come forward with smart projects, with demonstrated benefits to ratepayers, more commissions will be receptive.

Most utilities are fully embedded in their communities. They understand these extra value streams that we talked about. Even though they may not be directly responsible for improving public safety or air quality, they're part of their communities and have a vested interest in improving the lives of their consumers.

PUF: For that state or city, or part of a state that moves this forward, they're going to be perceived as leaders. Won't that be beneficial?

Itai Dadon: Absolutely. We understand that there is an urbanization process and people have the choice, in many cases, of which city they want to live in. They will look at where they can find work and where they can buy a house. Where is a nice school and a park? How does the traffic look?

At Itron, we help communities create an impact in all these areas and more. This makes a city much more attractive from an economic perspective while also improving people's quality of life – and this gives us great satisfaction. PUF

The smart city that The Jetsons lived in was Orbit City. In the iconic futuristic television show of the early 1960's, the year was 2062, notably 43 years from today.

Smart All Over

Navigant on Smart Communities

Interview with Rob Wilhite,
and articles by Peter Asmus, Richelle Elberg, Eric Woods,
H. Christine Richards, Derek Jones, Lon Huber,
John Gartner, Preeti Srivastav and Noah Goldstein,
Navigant

Navigant is deeply involved with the Smart Communities movement. In the pages that follow Navigant takes a comprehensive look at what is needed to build the neighborhoods that we all want to live in. A full range of topics are investigated including transportation, circular economies, resiliency and microgrids, connectivity, safety and much more.

PUF's editor-in-chief Steve Mitnick introduces the wide-ranging observations by talking with Navigant's managing director, Rob Wilhite, an expert on the subject.

PUF's Steve Mitnick: Why are smart communities important?

Rob Wilhite: I like the term smart communities, as opposed to smart cities alone, as the master planning and the execution for these endeavors spans beyond the municipal city limits and often becomes more regionally focused.

For example, two summers ago we had the opportunity at Navigant to work with Jeremy Rifkin and his Third Industrial Revolution team to jointly develop a master plan for the metropolitan region between The Hague and Rotterdam, in the Netherlands.

This included twenty-six municipalities as part of the regional study, for which we contributed the energy pillar of that plan, which ended up being a five-hundred-page document outlining steps that that region should be focused on over the next several decades.

These types of plans go beyond the deployment of technology, they cover circularity, water and waste, agriculture, transportation, but usually with energy underpinning the other pillars.

We've developed similar plans for communities in Europe and in the United States, so that's one way of being involved with these smart city and smart community efforts.

What's also interesting is that I've been asked to be a part of Dentons' Smart Communities Think Tank and, every month, we're bringing in experts to discuss different topics to explore the various pillars that could be involved with smart communities master planning.

I also recently participated on a panel that was associated with smart grid, on how the smart grid becomes foundational to the efforts around the smart community. This is particularly the case when you consider high-speed telecommunications from 5G technology coupled with ubiquitous sensing across power grid networks, and the ability to support distributed energy resources. That's a very interesting component to smart community efforts.

In his role as a Managing Director in Navigant's Energy practice, **Robert Wilhite** leads the global utilities client segment and serves on the Energy practice leadership team. On a global basis, Rob has often advised energy clients in achieving increased efficiency in strategic and master planning, grid automation, and technology strategy and implementation. He is coauthor of the book *Utility of the Future: Directions for Enhancing Sustainability, Reliability and Profitability*, and was recognized as one of the Top 25 Consultants in the U.S. by Consulting Magazine in 2009 and as one of the Networked Grid 100 Movers and Shakers of the Smart Grid by Greentech Media in 2012.

The most successful smart community projects are going to have both top-down and bottoms-up support from the public sector, government, private sector, academia, and private enterprises, all coming together.

PUF: What drives you and smart community development?

Rob Wilhite: There's a couple of factors in play here. We at Navigant are closely observing about three hundred and fifty different smart community projects around the world.

In many cases, those programs focus on either environmental mitigation, energy efficiency, gaining more benefit with fewer human resources and applying circularity or other sustainability components. That's why there is a lot of interest on my part.

Second, they seem to be focused on the well-being of their citizens, whether it's around public safety, enhancement of health, or better social care.

Third, many of these programs are also focused on economic viability. Are we doing things that create innovation and new jobs, and new ways to invest capital to further leverage existing assets, such as street lighting? The dual application of advanced technology and innovation excites me as well.

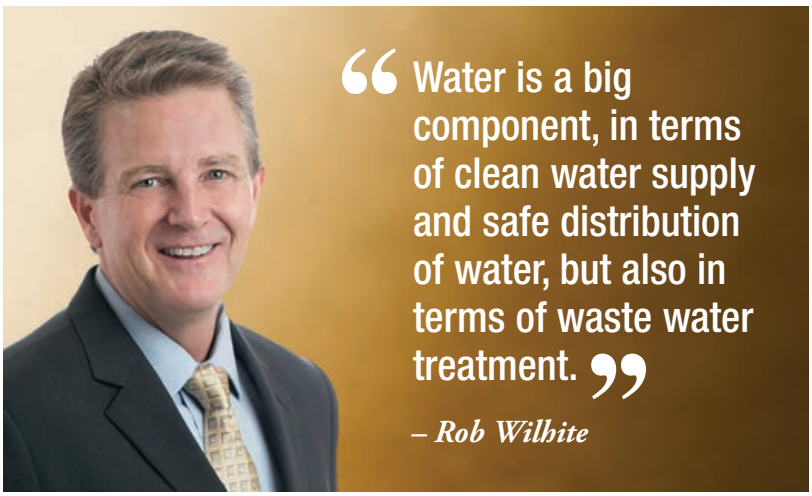
PUF: Give Rob's definition of what's in smart communities, and what's not.

Rob Wilhite: This definition varies considerably from one community to another, but most of the ones I've observed, usually have an energy component. Energy includes electric power, natural gas, and other fuels for transportation. It also can include distributed energy resources and traditional electric and gas utility infrastructure.

In addition to energy, water is often a big component of these programs, both in terms of clean water supply and the safe distribution of water, but also in terms of the treatment of waste water, an important factor in the community.

A third component, very common to many of these smart communities, is transportation. The way that transportation is conducted throughout a community or a city, especially around parking infrastructure, traffic congestion and traffic movement, and redesigning the different modes of transportation.

An exciting component of many smart cities is around making buildings more intelligent, and interconnected to the utility distribution network, so that we can automate a lot of energy optimization functions that may have to take manual intervention today. These buildings are going to be efficient, sustainable, and more responsive to the occupants.



Finally, there's also a smart government aspect. How does the government become a better servant to its communities and their well-being through increased visibility, monitoring, and data analytics that smart technologies can offer?

The most successful smart community projects are going to have both top-down and bottoms-up support from the public sector, government, private sector, academia, and private enterprises, all coming together in focusing on more inclusive programs to serve the community.

PUF: When will citizens start seeing results?

Rob Wilhite: We're starting to see results today, as some of these smart community projects started five or more years ago, even though most were initially focused then on single technology pilots and demonstrations.

Here in Charlotte, North Carolina, Envision Charlotte was started more than eight years ago with a target of reducing energy consumption in downtown buildings by more than twenty percent below a target level.

Now that Envision Charlotte has achieved its energy reduction goal, it has now expanded to achieve more environmental emissions reductions goals. Big successes like these can be capitalized and enable movement toward additional pillars to accomplish something new.

In Columbus, Ohio, public and private leaders have come together to achieve smart community benefits in terms of their infrastructure around smart street lighting, energy efficiency, smart buildings, smart grid, and transportation infrastructure.

And then there are cities like Orlando, San Antonio, and Madison, Wisconsin, and many others that are leading the way here in the United States.

PUF: Project out five years, what do you envision?

Rob Wilhite: What excites me is the progress we could make with autonomous vehicles. Both in terms of moving larger amounts of people through public busing or private vehicles.

Some of the other areas that are interesting are vehicle-to-grid connectivity and leveraging the economic value of stored energy and its capacity in the battery, because it has high value to utilities, especially during peak demand situations. Leveraging this value while your electric vehicle is parked is a win-win situation, for the utility, for the parking garage, as well as creating revenue streams for the vehicle owner.

PUF: What about an economic development component?

Rob Wilhite: It's a big driver. Not only in creating jobs but in keeping investments within a city or community. Also creating a stronger image of being an innovation hub and attracting new talent and new capability into the city limits.

That's what drives a number of these smart city, smart community engagements. Especially those that have the foresight to work with local academia, high-tech centers, or laboratories. Leveraging those assets pays off for many of these communities.

PUF: What's most rewarding for you?

Rob Wilhite: Getting multiple levels of government, different stakeholders, public and private, together in a room and getting their arms around something that is of common interest. That's exciting because you start to see how well they work together.

Another factor that's motivating especially concerns those smart-city efforts that are highly data-driven. They harvest data, make it freely available, and enable others to find new value in that data. They'll find new patterns that others couldn't see before and we are excited to create something that no one else envisioned, as far as the benefit stream or some type of capability from the data that is collected in some of these efforts. ❍

Pathway to Smart City Resiliency: The Microgrid Platform

Smart All Over

By Peter Asmus

Natural disasters – hurricanes, wildfires and earthquakes – have accelerated in recent years, often compromising critical infrastructure, including vital utility systems. The promise embedded in the Internet of Things (IoT) concept that serves as the foundation of any Smart City is resilient and reliable electricity. Microgrids can play a role in keeping smart cities' critical facilities up and running while also supporting the needs of the larger utility distribution network.

What exactly is a microgrid? Here is the definition as provided by the U.S. Department of Energy: A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island mode.

The key distinguishing feature of a microgrid is its ability to island, to keep key smart city components – sensors, artificial intelligence engines, and machine learning data streams – operating, enabling a web of distributed intelligence to help steer traffic, optimize lighting systems and squeeze the most value out of distributed energy resources, whether they are owned and deployed by utilities or not.

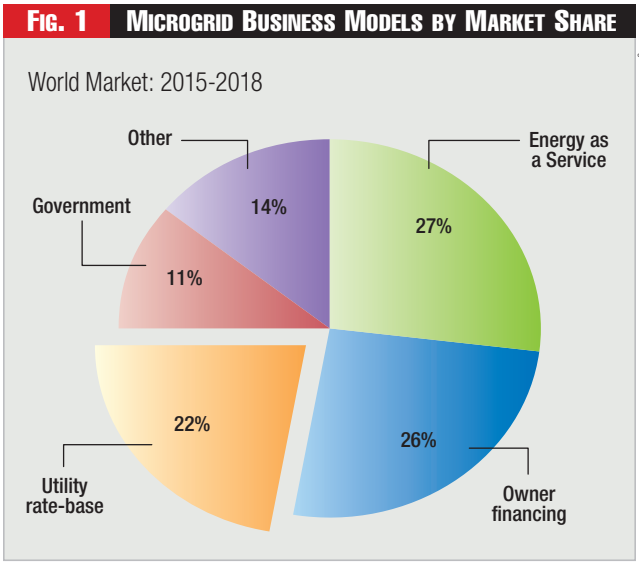
A growing number of utilities view the microgrid they may own and operate – a utility distribution microgrid (UDM) – as the next logical extension of their efforts to deploy grid modernization technologies that dovetail with the needs of smart cities.

It is a networking platform that can be developed incrementally over time, and it enables utilities to both aggregate and optimize DER to help meet multiple smart city goals. Microgrids represent ways for smart cities to increase resilience while also integrating diverse DER – including EVs, thermal energy assets, and building loads – all orchestrated to offer resiliency, economic and environmental benefits to the larger utility distribution grid.

Regulatory Concerns for Utility Distribution Microgrids

Government support for microgrids has been fragmented and often hodge-podge. Among the policy tools available to governments regulators to foster accelerated UDM adoption include the following: Direct government grants for microgrid deployments; Government authorized solicitations for microgrids (often meeting specific state policy criteria); Mandates and targets for DER, renewables, energy storage or carbon reduction; Specific financing vehicles that steer public or private dollars (or both) toward microgrids; Federal and state regulatory reforms addressing existing barriers to utility microgrid deployments; and Streamlined approval of utility rate-basing of microgrids.

Fig. 1 Microgrid Business Models by Market Share



Source: Navigant research

Note that utility rate-basing comes in second (twenty-two percent), reflecting the growing acceptance of utilities being in the driver's seat on microgrid deployments.

According to Navigant Research's *Microgrid Deployment Tracker* 4Q 2018 update, approximately eleven percent rely upon government grants as a primary financing source. These funds are steered most commonly to critical facilities and community

Peter Asmus is an associate director at Navigant and a leading global expert on microgrids and virtual power plants. With twenty-five years of experience, Asmus is the author of four books on energy and environmental issues. He brings additional expertise in the integration of renewable energy to the grid and public policy analysis.

microgrids (most of which include utilities as co-developers, partners or investors.)

See Figure One.

While the most popular business model globally is energy as a service business (twenty-seven percent), note that utility rate-basing comes in second (twenty-two percent), reflecting the growing acceptance of utilities being in the driver's seat on microgrid deployments.

Microgrid Deployments with Smart City Implications

While several utilities have successfully rate-based microgrids – SDG&E's Borrego Springs microgrid being the first successful deployment – many have also struggled. In 2018, however, ComEd ultimately succeeded in gaining approval from the Illinois Commerce Commission to construct a twenty-five-million-dollar front-of-the-meter microgrid supported by a five-million-dollar federal Department of Energy grant.

The utility that has had the most success with regulated investment in microgrids in North America is Duke Energy. In October 2018, the company filed for solar PV system in the Hot Springs community of Madison County in North Carolina to not only benefit the small community but the broader grid.

Along with localized resiliency, the microgrid will provide energy and grid support to all Duke Energy customers while deferring ongoing maintenance of an existing distribution power line that serves the remote town.

Puerto Rico, a U.S. territory, offers the most comprehensive regional microgrid plan, looking at both third-party and UDMs. Historically, the island has relied largely on older oil-fired generation to meet its power needs. This makes the price of power in Puerto Rico among the highest in the United States, second only to Hawaii.

The costliness of electricity on the island contributes to the attractiveness of microgrids that incorporate renewable energy. The island began developing its renewable portfolio with utility-scale wind and solar PV before Hurricane Maria hit. In the aftermath of the storm, islanding capability of generation resources has emerged as an important feature to ensure power reliability.

The Puerto Rico Energy Commission laid out proposed regulations for third-party owned microgrid installations on the island in January 2018. These regulations provide an official path for operators to interconnect their microgrids with the Puerto Rico Electric Power Authority and include a stipulation that microgrids must generate at least seventy-five percent of power from clean energy. These policies have been fine-tuned and project development is gaining important momentum.

For example, Navigant is a program manager for disaster recovery rebuild efforts on a project designed to encompass eight microgrids. One of the proposed microgrids is for the islands of Vieques and Culebra currently under evaluation, and consists of thirty megawatts of solar PV, fourteen megawatts of reciprocating engines, and eighty-eight megawatts per hour of energy storage. Both islands lost their power supply from the main island when undersea cables were no longer able to deliver electricity due to storm-related damage.

Each of these projects highlight how microgrids contribute to smart cities by increasing resilience, optimizing DER portfolios, and keeping critical data management systems online in the advent of an emergency.

They can become components in a broader overarching smart city framework, dividing up sections of any distribution system into resilient building blocks for a more sustainable energy future, while also bolstering overall resiliency of utility distribution systems. Smart city projects will increasingly lean on utilities, requiring these utilities to develop a forward-looking strategy to leverage both existing and new technologies. ❍

> “Solving those economic and environmental problems requires new and creative ways to work with what you’ve got. The good news is that incremental evolutionary change will probably come very quickly to the rescue when some of those technologies diffuse. When we get to battery cost of $50/KWH, there’s not going to be that many questions about whether transportation incentives will be necessary...” Kevin Book, Clearview Energy Partners, Bipartisan Policy Center event, January 24.

The Connected City: A Platform for City Planners, Citizens, and Utilities

Smart All Over

By Richelle Elberg and Eric Woods

Terms like smart grid and smart city have been in use for more than a decade, and impressive productivity and safety applications have become commonplace, if not pervasive, in utility territories and cities worldwide.

Only today, however, are we beginning to see truly progressive projects where the ubiquitous, high-performance connectivity promised by 4G/5G networks, low power wide area (LPWA) solutions and widespread fiber backbones are being leveraged by utilities and cities – often in concert – for revolutionary change.

And though it is still early days – not all 5G standards are finalized yet – city planners and utility managers understand the vision and are looking forward to the time when citywide networks will support new sources of revenue and services for their constituents. In many cases, pilots are being designed with significant local power utility involvement – and rightly so.

In the early days of smart metering, some municipal utilities leveraged Wi-Fi-based networks to offer internet hot spots to their citizens. But the vision embraced by forward-thinking executives today goes far beyond public Wi-Fi.

Pervasive citywide connectivity will support new revenue streams for municipalities. It will also support public safety and traffic management applications, more reliable and resilient power delivery, environmental monitoring, public information services, and more – all of which provide a community with enhanced quality of life and a strong foundation for improved economic growth.

Richelle Elberg is an associate director at Navigant focused on utility communications networks for AMI and distribution/substation automation applications. Elberg has more than twenty years of experience in the telecommunications industry, including an extensive background analyzing and writing on the wired and wireless communications industries.

Eric Woods is an associate director at Navigant, where he covers smart cities, leveraging over twenty years of experience as an analyst and consultant on new technology trends. This includes in-depth research in the areas of IT infrastructure, data analytics, knowledge management, public sector IT, and cleantech innovation.

A multitude of networking technologies can support the connected city. Longer term, however, Navigant believes that high capacity, low latency networks – such as those offered by 4G today (and 5G in coming years) – and fiber networks represent the most forward-thinking options. Combined with Wi-Fi, the possibilities for new business models and revenue sources are virtually unlimited. Below we describe many of the applications in deployment or planning today.

It is important to remember that, built correctly, the citywide network becomes a long-term platform for growth and opportunity. Just as no one could foresee Airbnb or Uber in the 1990s, similarly, today we cannot envision all the ways new services and applications for connected cities will evolve – but evolve they will.

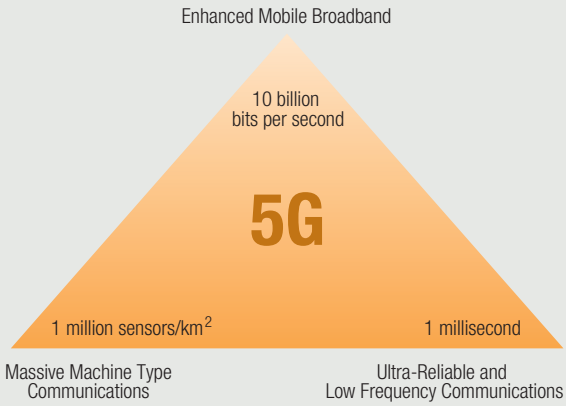
4G/5G, Fiber, and Connected Cities

4G wireless networks are widely available across most mature markets today, and pilots for 5G are underway in the United States, South Korea, Japan, China, and in Europe. At the same time, LPWA networks are increasingly offered by cellular providers and private network developers (such as Sigfox) in many places worldwide.

Finally, more and more fiber is being deployed by both wired and wireless telcos and private enterprises (including utilities) worldwide. It is with the coming convergence of these technologies that the connected city enjoys a true transformation.

Even as the 3G Partnership Project is still putting the final

Fig. 1 Three Legs Of 5G Networks



Source: Navigant research

touches on the standard's specifications, carriers worldwide are testing 5G networks. Importantly, 5G will evolve as an overlay to existing 4G LTE cellular networks, meaning that deployment of private 4G networks today will not preclude eventual upgrade to 5G – in fact, many upgrades will be done over the air as software-based upgrades.

Ultimately, the 5G standard will be composed of three legs, with both mobile and fixed service networks;

Enhanced mobile broadband (eMBB): Will provide significant improvements over existing 4G mobile networks. It promises up to ten billion of bits per second maximum throughput, less than five millisecond latency and will support a hundred times more end users.

Wholesaling fiber capacity, which many utilities are deploying along distribution and transmission lines today, is another potential revenue source for both cities and utilities in the 5G era.

Ultra-reliable low latency communications (uRLLC): Will be used for mission critical applications where guaranteed latency of one millisecond is essential. Examples of uRLLC application include automated vehicles or virtual reality for applications such as remote surgery.

Massive machine type communications (mMTC) networks: Will support the millions of dispersed sensors which will create the Internet of Things. mMTC will offer very long battery life and guaranteed communication at less frequent intervals.

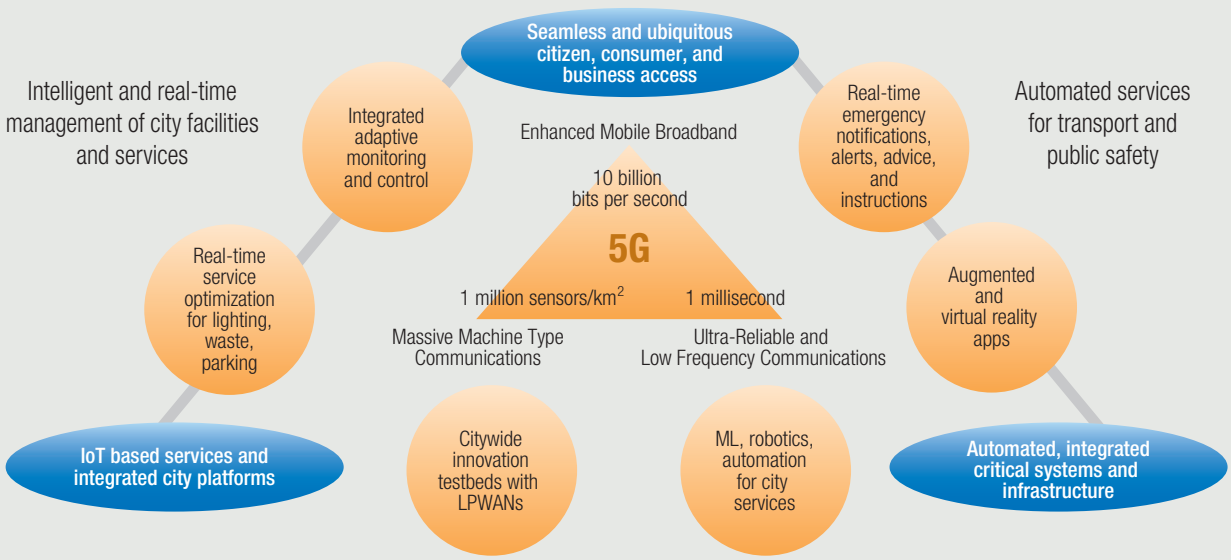
See Figure 1.

5G – Everyone Benefits

With 5G networks, as many as one million connected devices per square kilometer could become a reality. Notably, cities and utilities own street light poles, power poles, and rights of way that will be needed for 5G infrastructure deployment.

Leasing these assets to carriers, along with deployment of multi-use assets such as lighting poles with integrated small cells, represents one area of future city revenue opportunity.

Fig. 2 Three Elements Of 5G Come Together In The Smart City



Source: Navigant research

Integration of diverse city services – supporting more holistic approaches to issues like air quality, health, congestion, public safety, and environment

Wholesaling fiber capacity, which many utilities are deploying along distribution and transmission lines today, is another potential revenue source for both cities and utilities in the 5G era.

A multitude of valuable connected city applications will be made possible by these advanced networks;

Advanced street lighting: At the most basic level, lighting controls provide features such as remote on-off control, dimming, and scheduling functions. More advanced functions include energy monitoring and billing, performance monitoring, color controls, adaptive lighting, and emergency response lighting.

> "With 5G networks, as many as one million connected devices per square kilometer could become a reality."
>
> *– Eric Woods*

Environmental/air quality monitoring: Air quality and noise sensors may be deployed for real-time monitoring citywide.

Traffic monitoring: Traffic sensors can provide more accurate and flexible monitoring of traffic and congestions levels.

Smart parking: Parking sensors may be embedded in parking spaces or video cameras that use vehicle detection software to provide occupancy information may be mounted on smart lighting or power pole infrastructure.

Gunshot detection and location: Gunshot detection systems can use the network to transmit information on detected events. Advanced systems provide precise information on the shooter's location and even integrated video monitoring.

Traffic light controls: Traffic lighting that is adaptive to congestion levels, weather conditions, accidents, and more improve traffic flow, reducing travel times, fuel consumption, and pollution.

Smart waste management: Sensors in trash bins and dumpsters provide data to optimize waste collection and identify overfilling. Waste sensors can relay data to the waste management team to help plan collection routes.

Public messaging/digital signage: Public information networks now span a range of devices, including traffic and parking information panels, public information broadcasts, and dedicated kiosks. Linking public information to real-time urban monitoring systems provides more accurate and timely information and also allows information to be relayed through a broader range of devices including to smartphone or in-car systems.

High definition (HD) video surveillance: Many cities are using closed-circuit TV to provide video monitoring for traffic management and for public safety. The bandwidth requirements for HD video traditionally required a fixed broadband network – but high bandwidth wireless networks such as 4G/5G are increasingly capable of supporting such applications.

In short, the three legs of 5G networks will support all these connected city applications, as shown in Figure 2.

See Figure 2.

Smart city testbeds are integrating smart street lighting and utility smart metering networks into some of the applications described previously. For example, in Atlanta, AT&T and Georgia Power are collaborating with Current to test smart street lighting and applications around traffic congestion, commute times, public safety, and environmental areas in five sections of the city over a combined network.

Looking ahead, the synergies and mutual benefits to be gained between connected cities and utilities are undeniable, and the platform enabled by the latest connectivity technologies will support innumerable applications – including those we have not even dreamed of yet. Cities and utilities should strongly consider partnering to make these networks a reality. ❍

After a *Public Utilities Fortnightly* team meeting, from left to right, Alexandra Revel, Joe Paparello, Liz Stipnieks, Angela Hawkinson, Mike Eacott, Lori Burkhart and Steve Mitnick. The team scheduled the major magazine features for the first half of 2019.

Personal Mobility in Smart Communities: The Role of Utilities and Regulators

Smart All Over

By H. Christine Richards, Derek Jones, Lon Huber, and John Gartner

We are on the verge of upending some of most fundamental building blocks of our communities: energy and transportation. Smart communities bring along an ever-expanding set of transportation options that shifts citizens from personal vehicles to personal mobility – a change that is redefining the role of utilities. New platforms will enable utilities to embrace emerging mobility and transportation-to-grid (T2G) business models, and regulators play a critical role in shaping these opportunities.

Transportation Options Grow

The proliferation of personally owned transportation throughout most of the twentieth century is shifting dramatically in the twenty-first century, as depicted in Figure One.

See Figure One.

The Past: Personal Vehicles Dominated

Over the course of the twentieth century, the personal automobile transformed the way people lived, worked, and played throughout the developed world. Changes – from the rise of urban sprawl to NASCAR – were enabled by the relatively inexpensive and easy to access mobility that enabled individuals to move over greater distances and speeds at will. However, that mobility and the use of personally owned vehicles has come at a tremendous cost in terms of air quality, traffic congestion, health impacts, and road safety.

Emerging: Autonomous, Connected, Electric, and Shared

Improved electric drive performance, ever-increasing computing power, new sensing technologies, mobile apps, and wireless communications are enabling new modes of transportation. The key characteristics of transportation's emerging options can be described as autonomous, connected, electric, and shared – also known as ACES;

Autonomous: Vehicles that can navigate with little to no human interaction.

Connected: Vehicles that can connect and communicate with surrounding vehicles, sensors and infrastructure, such as vehicle-to-home, vehicle-to-building, vehicle-to-infrastructure (V2I), and vehicle-to-grid.

Electric: The electrification of vehicles, primarily to battery

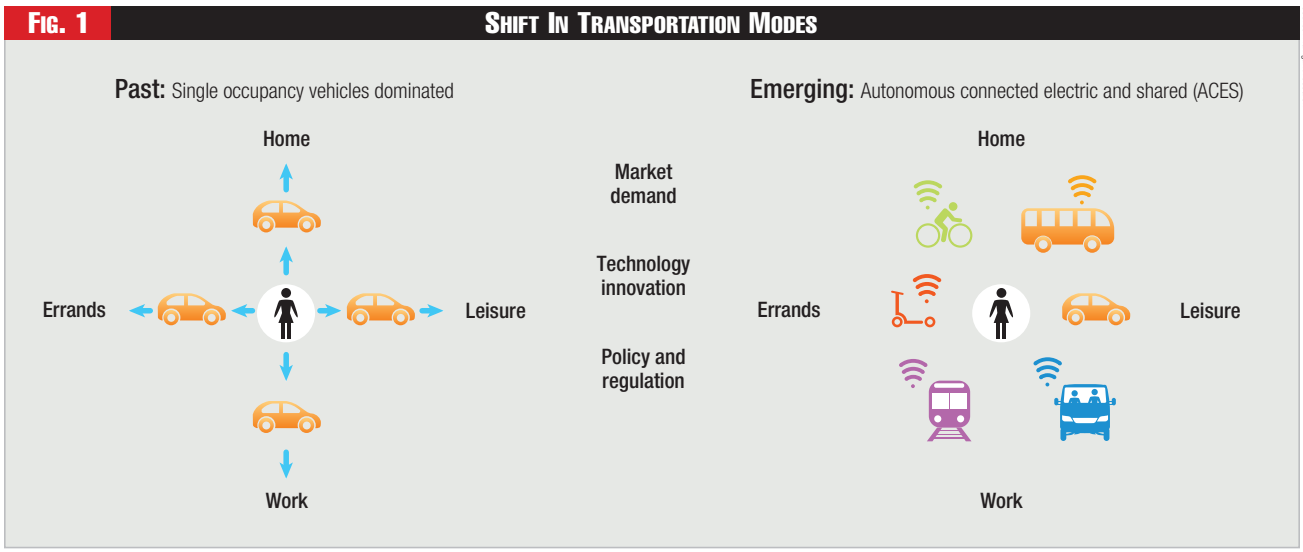
H. Christine Richards is a managing consultant at Navigant, where she is focused on the energy transition's impact on North American utilities. She has worked as a utility industry analyst for well over a decade, studying first the emerging smart grid scene and then the broader digitization, decentralization, and decarbonization of critical infrastructure.

Derek Jones is a director at Navigant, where he leads the transportation consulting group and manages market assessment, adoption forecasting, load research, regulatory strategy, and program implementation. He has more than 14 years of experience in the transportation and energy sectors, along with a deep knowledge of U.S. regulatory and policy environments.

Lon Huber is a director at Navigant, overseeing the Energy segment's North American retail regulatory offering. He provides expert witness testimony, proceeding strategy, and policy solutions on behalf of clients across the energy landscape. Lon is well known for creative data-driven solutions and was named the 2018 Innovator of the Year by Utility Dive.

John Gartner is a director at Navigant and is focused on transportation research and consulting efforts. He has overseen dozens of projects focused on electric vehicles, their local and national impact on utilities, business models for EV charging services, e-mobility, and the expected utilization of of EV charging equipment for both U.S. and international clients.

Fig. 1 **Shift In Transportation Modes**



Source: Navigant research

EVs (BEVs) and plug-in hybrid EVs (PHEVs).

Shared: The shift away from consumer-owned modes of transportation – such as a personal car – toward mobility solutions that are consumed as a service (such as mobility as a service [MaaS] or transportation as a service [TaaS] and often in tandem to provide a multimodal transportation solution between origination and destination points.

Each of these characteristics is evolving at a different pace, but there is evidence of these changes taking place today. Las Vegas, for example, began operating the country's first automated shuttle service on public roads in November 2017. The eight-seat, a hundred percent electric passenger shuttle uses GPS, cameras, and sensors that can communicate with traffic lights through V2I technology. The program will also analyze pedestrian and rider reactions and attitudes toward automated vehicles.

New Market Platforms Emerge

We are transitioning from the well-known model of personally owned vehicles driving on roadways and powered by petroleum products, to a multitude of connected, electric, shared transportation options in smart communities whose paths are still undefined.

New platforms are emerging as a natural outgrowth of this transformation that can enable market players to adapt and grow in this new environment. These platforms – new customer-centric products and services that leverage multimodal, multifuel technologies, and viable business models – include the following;

Infrastructure provider: Provide charging points with different levels of infrastructure management, fleet services, and energy management, including software.

Charging service provider: Sell charging services to EV owners and try to maximize revenues by fixed or flexible tariffs in public and private spaces.

Load orchestrator: Leverage EVs as a fleet of batteries on wheels (or along with stationary second-life batteries) by controlling their charging and discharging to balance load or provide ancillary services as part of a larger energy management service.

Mobility provider: Provide MaaS to customers, either on a narrow (B2C) or wider (B2B and municipalities) scope.

The Role of Regulators

What role will utilities play in these platforms? Much of that is up to regulators as new utility T2G platform opportunities continue to emerge and evolve, yet there is regulatory uncertainty and flux regarding utility participation in the changing transportation landscape. How can regulations keep up with technology and business changes? How will regulation influence new business models and value chains?

Regulators are considering many directions – most of which revolve around the electrification of transportation as the building block for next-generation mobility options. Regulatory strategy

generally falls into three approaches that in many cases will not be mutually exclusive;

Public good: Providing EV charging access to locations not viable for service by private market economics in support of environmental goals, economic development, and disadvantaged communities. For example, while opportunities like fast-charge corridors are more expensive investments for lower utilization than home or workplace charging, these investments unlock key transportation electrification value streams like customer awareness and supply chain readiness, while alleviating key market barriers like range anxiety and equal access to charging services.

Nascent Commercial Market: Leveraging utility access to lower cost capital, bulk hardware procurement economics, and electric system expertise to support EV infrastructure deployment that is better, faster, and cheaper to jolt to nascent markets that need a boost to gain traction. For example, enabling fleet vehicle charging through turnkey services can help optimize system cost impacts from EV infrastructure integration for ratepayers and utilize excess energy supply during overgeneration conditions, such as periods of peak solar PV production.

Ratepayer Protection: Protect ratepayers and support grid resiliency and smarter grid operation by avoiding inefficient or stranded asset investments from utilities to accommodate sub-optimally sited EV chargers. For example, utility-led EV infrastructure planning analyses across North America have optimized for vehicle miles traveled, EV adoption, and other key market trends ahead of selecting host site locations to help mitigate the risk of stranding utility make-ready and behind-the-meter EV supply equipment infrastructure investments and avoid foisting unrecouped costs onto ratepayers.

Subscription Pricing Opportunities

A recent entrant to the ratepayer protection conversation is EV subscription pricing. The industry is starting to earnestly explore the potential value of adapting this pricing trend to the highly regulated energy industry.

The playbook for subscription business models is simple: convert short-term transactions into outcome-based, long-term relationships that create sustained revenue streams. In terms of EVs and EV charging infrastructure, the goal of subscription pricing is to: Recover utilities' fixed costs in a customer-friendly way; Give customers piece of mind through fixed price subscriptions; Mitigate demand charge complexity; Provide stable revenue streams for those investing in EVs and EV infrastructure; and Bundle products and services to make EVs and EV charging experiences seamless.

Pacific Gas and Electric provides an example of subscription pricing as it works to replace demand charges with a new subscription rate plan for customers using commercial EV charging.

The utility submitted its proposal to the California Public Utilities Commission in November 2018 for commercial customers to pay a monthly fee for the amount of power that best fits their needs. PG&E anticipates that this change will help companies find fuel savings through avoiding demand charges that can occur during high powered EV charging.

The Road Ahead

As with the growing number of transportation and mobility options that come with smart communities, there are a growing number of ways that utilities and regulators can support the transition from traditional personal vehicles to transportation that is autonomous, electric, connected, and shared.

A long, but exciting road awaits. Utilities and regulators need to consider frank conversations about the future platforms that will enable utilities to support what comes next for ACES in smart communities. ❍

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

Preeti Srivastav is an associate director at Navigant, leading corporate climate action and advising companies on growth strategies for a low-carbon future. With more than fifteen years of experience in global climate change and sustainability consulting for multinational companies, Srivastav has worked across sectors, regions, and themes of environmental and social impact.

Noah Goldstein is a director at Navigant, focused on cleantech and building technologies innovation. His work centers on strategic engagements related to energy efficiency, building energy management, and applied sustainability. Goldstein has led research on zero energy buildings, energy management systems in commercial buildings, and corporate strategy.

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.

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.

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.

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'

(Cont. from p. 21)

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

Dentons Smart Communities Conversations

Building Bridges

Paula Gold-Williams, CEO, CPS Energy and
Clint Vince, Chair, Dentons' US Energy Practice

PUF's Steve Mitnick: What is your interest in smart cities, communities, and states?

Paula Gold-Williams: We want San Antonio to be a city of the future, to be a leader in making the technology revolution work for our citizens. The smart cities ethos is that technology should make our lives better, easier and more productive, especially when it comes to city services.

We are very fortunate that San Antonio and CPS Energy have been well-served for years by the Dentons law firm under the leadership of Clint Vince and Emma Hand. Dentons is a world leader in the smart city space bringing together a multitalented array of professionals with experience in every aspect of smart city innovations.

We are also fortunate that our city officials – from Mayor Ron Nirenberg and City Manager Sheryl Sculley, to our public-entity CEOs – are excited by the prospects of San Antonio being a smart city leader. This level of enthusiasm and commitment means that we will also be able to incorporate the resources and talents of our water company, led by Robert Puente; our river authority, led by Suzanne Scott; our public transportation authority, led by Jeff Arndt; and CPS Energy, which I have been honored to lead since November, 2015.

Properly marshalled, every city agency and department can contribute to and benefit from the smart city revolution. From that collaborative city foundation, we can methodically incorporate the state and region to create enormous economies of scale, both in the resources available and in the benefits provided. I have already opened a dialogue with the CEO of Austin Energy to imagine the possibility of supporting regional smart city innovations with a corridor of power, the backbone of any Smart City.

PUF: Clint, since you and others on your team have organized this group of leaders focused on smart communities, tell us where this is headed.

Clint Vince: When we first started our smart city think tank, we discovered that there was no standard or universal definition of a smart city, so everyone had a different concept. Electric utilities saw it differently from telecom companies and technology companies saw it differently from transportation companies. That left mayors, city council members and department heads unsure of what they were being asked to support.

That prompted Dentons to ponder a universal definition of smart cities. Our goal was to develop a concise, but comprehensive definition that would not only be universally understood, but universally acceptable.

After some false starts we proposed this definition: "A smart city modernizes the digital, physical, and social infrastructure of a city in an integrated way on behalf of all of its citizens and harnesses sustainable technology in a way that is equitable."

Some cities were doing some of this, but none were doing it all. That's when Paula jumped out front and started animating the definition for her company and for her city. Paula started building the bridges to create the foundation for realizing the full promise of the definition for all of the residents and businesses of San Antonio.

Achieving that full realization requires looking past the narrow focus of any particular company or technology. When tech companies salivate over the internet things, the smart city leaders must ask how will the physical infrastructure of the city accommodate these vaunted goals? How do we build the new infrastructure that will make it all possible? Who pays for that? How will it be accessible to all people and not just those who can afford the most advanced technology? How do we change our social infrastructure to assure that happens?

At the same time, the smart city innovators, whether they are cities, utilities, technology companies or telecom companies, must also pay careful attention to privacy issues.

– Paula Gold-Williams

These questions are not unique to San Antonio. Every aspiring smart city must confront these issues. So, Dentons relied upon the old adage: two heads are better than one. Because Dentons serves as utility legal advisors to the New Orleans City Council, we were able to facilitate a sister city relationship between San Antonio and New Orleans, where smart cities are on the front burner for its Smart and Sustainable City Committee.

Paula and Jason Williams, the chair of that committee, have begun exchanging ideas and aspirations for their respective smart city initiatives. In fact, it was Council Member Williams who is responsible for sensitizing my firm and me to the need to add the concept of equitable to the definition.

We are starting to see the fruits of our labor, done in concert with San Antonio and New Orleans. Our think tank has more than one hundred and seventy thought leaders from China, South America, Canada, the United States, the United Kingdom, Europe, Africa and the Middle East. Everyone everywhere is starting to buy into this definition.

PUF: Paula, how do you effectively bring business partners into this expansive effort?

Paula Gold-Williams: The support of the business community is essential to the success of any smart city initiative. No city can do it all. When you're talking about new products and services and connecting different systems, you've got to have an element of everyone thinking about it in terms of the products themselves; the technology, the information and the data. It cuts across so many platforms and issues that you must identify, invite and incorporate each desirable, if not necessary, business.

For operational reasons, about six, seven years ago, we decided that we were going to change our meter platform from analog to digital. Any city that wants to venture down that road has to think about moving that technology forward so that it becomes a backbone of your system.

We did it. We completed our conversion in the summer of last year. But it took a while for us to change out every meter in our system. Less than one percent of the meters did not convert over to the new technology. But because we were able to do that, and because we've created a backbone system for every single customer that gets electricity and gas, this becomes the foundation to put additional sensors on the system.

From there we can pretty much do anything that is energy enabling including efficient electrification and the ability for us to reduce our carbon consumption by the way that we optimize electricity.

But the kicker is that other companies start to see what we have done and start to imagine the possibilities of connecting their system to our system, with all the additional benefits that can bring to residents and businesses. Bring in the internet service providers and the telecom companies and our backbone becomes the portal for virtually unlimited technology access and twenty-first century services.

At the same time, the smart city innovators, whether they are cities, utilities, technology companies or telecom companies, must also pay careful attention to privacy issues. As exciting as these innovations are, they will be self-defeating and rightfully resisted if they cannot provide sound privacy protection. So, as we innovators incorporate companies who want to offer services in our smart cities, we need to recruit companies who know how to protect privacy.

PUF: Why is the prospect of these great innovations good in terms of economic development, retaining talent in your city, and improving the quality of life?

Clint Vince: The case for the average citizen is that many get access to community services on an equitable basis that they've never received before, like small tower Wi-Fi and 5G wireless.

They get much better access to many more advantages of modern technology like electric vehicle charging and, eventually, autonomous vehicles. All of this leads to much better mobility, traffic control, and public safety. It will also allow for smart buildings that are more convenient and energy efficient. They will also get easy and efficient access to city services, most likely on a mobile app. Every city department and every city service will be accessible on your smart phone.

We also think that these benefits can be regionalized. That's why we call our think tank the Dentons Smart Cities and Communities Think Tank, because we want to reach all kinds of different political subdivisions from densely populated areas initially to more rural areas and communities eventually. All with the hope of eliminating the digital divide.

Of course there is the question of who pays for all of this? One of the flaws we saw among cities was that they didn't have a plan to bring smart city applications and modernizing the digital, physical and social infrastructure swiftly into scale with a practical funding mechanism.

One of the keys is incorporating many of these technologies into the long overdue grid modernization that many cities are starting to undertake. We're moving toward multidirectional grids. If you take that grid modernization, incorporate in telecom, transportation, smart buildings and some of the other concepts we've just mentioned, you can get to scale.

There is a great customer base to support grid modernization. You also have a customer base to support small cell and 5G wireless. Of course, there is a huge customer base for telecom and internet services. All of this creates very attractive opportunities for vibrant public-private partnerships.

Fortunately, Paula and CPS Energy in San Antonio have given us a masterclass in how to reach all of the different government agencies and stakeholders, many of whom would normally be turf fighting, to bring them into the same room and find common

ground to foster cooperation going forward.

PUF: Where will this be in three to five years?

Paula Gold-Williams: I don't think that we'll necessarily be at the Jetsons stage, but we'll start to see a great deal of movement in that direction. We'll see more from people who are experimenting on new forms of energy, with distributed generation moving beyond the systems that you see now. We'll see longer durations of energy storage, which will increase the use of renewables. Transportation will see incredible changes especially with electric vehicles and, maybe within the five years after that, autonomous vehicles being very common.

You'll see a connected system where people will be able to have smart parking and smart access to cars for short-term leasing with the ability for rental companies to have cars that are positioned throughout the city so car ownership might not remain a given. We've already seen some of this happening with bikes and scooters.

People's day-to-day lives should become easier over the next five years. It's like your smart phone. Five years ago, your phone was smaller, had less capability and the apps weren't nearly as amazing as they are today. That product evolution can happen in all aspects of our lives.

PUF: In five years, which are going to be the smartest cities in the country?

Clint Vince: San Antonio and New Orleans are going to be quietly near the top. They have a good scale. They have great leadership on this issue, and they're purposeful right now.

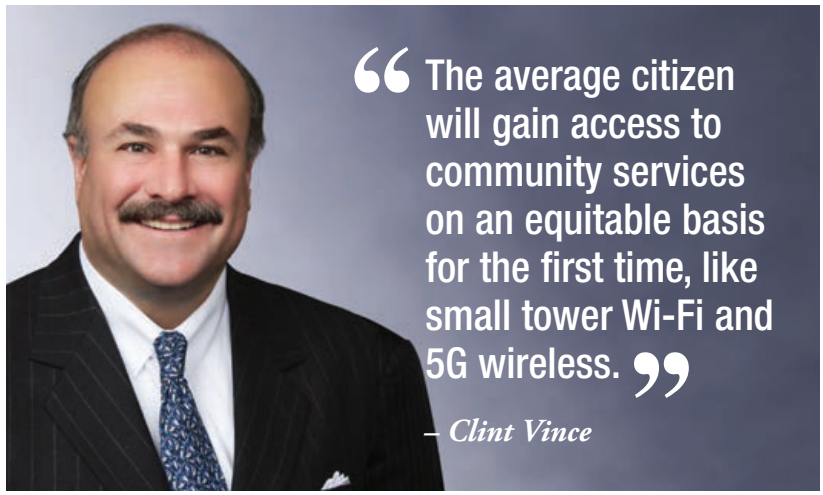
Cities like New York, San Diego, and maybe Chicago are doing some good work. They're larger, and so it's sometimes harder to work at a large scale. What will differentiate San Antonio and New Orleans is that they will be under grid modernization so that customers and their clients are going to be communicating with utilities in a way that saves customers money and reduces carbon emissions.

There is going to be more distributed energy, renewable resources, and mind bending technology in both San Antonio and New Orleans. There will be ubiquitous very high speed Wi-Fi and telecom. The modernized grid will also be the backbone for very effective traffic and crowd control systems. Transportation will be easier to deploy and to access.

5G will change many things, but when done properly with sensor technology and the Internet of Things it's going to make driving in autonomous vehicles more feasible and safer. If you read more about the fourth industrial revolution, we haven't fully imagined what the impact of artificial intelligence and some of this technology that we'll develop incrementally over the next five years will have. I like the scale and the leadership on this subject in both San Antonio and New Orleans. They're going to surprise people at how well they move forward.

PUF: What about other cities, and counties, and communities? What should they be doing to keep up with San Antonio?

Paula Gold-Williams: One of the most important factors that I encourage any community to do is create the relationships, and the outreach, and formalize it. We meet quarterly as a group of people that we talked about earlier through the coordination effort of our owner the City of San Antonio.



We also have valuable connections. One of our biggest customers is the military. We're taking our quarterly meetings down to where the customers, like the military, have needs and activities that can be addressed. Then we're thinking about how we're going to put this information out for public consumption.

We're also figuring out how to create dialogue around these big opportunities. We must move our community along in terms of our energy strategy, in terms of our smart city strategy, in terms of our access to information and the right way to use it. Doing that all starts with talking to stakeholders and affected communities.

Meeting together has helped us create a strong foundation for data-sharing, but as Clint said, we want to do it in a way that protects customer information. We'll share it appropriately among our partners and then see how we can appropriately share it publicly.

How do we approach it so that we are doing what's right? The customer ultimately pays for anything of value, anything that is entertaining or enabling. But to do it, there are choices. I suggest every other community explain to their customers both the value that they get for the dollars that they spend and what the choices are and be able to bring a broad range of potential options back to that community.

Again, in San Antonio, because we already have a strong municipal foundation, we can create those discussions. Clint

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Utility of Several Cities on Smart Futures

Digging Deeper

Phil Nevels, Director, Utility of the Future,
Commonwealth Edison

PUF's Steve Mitnick: What is your role at Exelon?

Phil Nevels: Anne [Pramaggiore, CEO of Exelon Utilities] has put forth a vision for the future and where we want to go. Our group is tasked with looking at that vision, thinking ahead, thinking some few years out, and asking ourselves, what holes exist in this vision?

The hole can be either an opportunity, where there are opportunities that we haven't identified or fleshed out fully, or where are there potential issues that could inhibit or prevent us from executing the vision that Anne has set forth.

Once we've identified those holes, our team is tasked with going deeper and trying to articulate and understand how we can turn an opportunity into action and how we can mitigate a risk. Then the second piece of that is working with the utilities to define projects that help advance our understanding in a particular area or to experiment or test a hypothesis that we might have about an opportunity or risk.

When I use the word projects, I'm using it very broadly. It can be either a pilot or a study. It can be a simulation, a paper, or several items. I'm going straight to pilot, but that's essentially what we do. It's critical for us to be able to interact well with all of our utilities because that's where the magic happens.

We need to find ways to create and build a funnel of projects for the utilities to ensure their livelihood, the strategy where Anne wants to go, to help the utilities design those projects such that they maximize potential earnings on any given topic.

PUF: How does this fit in with the smart communities, smart city, which is very customer centric, too?

Phil Nevels: How do you build a smart city, and how do you build a utility of the future? In both cases, you start with customer needs. You've got to start with a vision for what you think the customer needs of the future are and through that you can identify the key priority use cases, and what is the experience of a citizen or a business or any person living in its borders.

That's another way of saying what problems in the future do we need to solve that the customer needs? It's the same thing as saying, we have solved this problem for a person or a business and that's how we satisfy customer needs. You start there.

Then we start to articulate what roles, responsibilities, and capabilities are required to address those customer needs, and satisfy those customer-use cases. In some cases, the utility is well suited to provide the capability required to satisfy a need.

In some cases, it's other partners. In some cases, it requires a partnership between the utility and others to sufficiently address that customer need. We're working on identifying what capabilities we have today and what capabilities are required to support that.

There are two things I say in terms of why the utility is well positioned to potentially provide capabilities that satisfy the future situation. One, much of what is required for these future-use cases is infrastructure.

Part of what we're trying to do is identify how we take infrastructure today that we're using solely to deliver electrons to customers and start to build a rationale and a case for leveraging some of that infrastructure to provide other services to municipalities and the like. That's the first piece of it.

The fact that there's oversight is a plus. You want to build these items in a deliberate way.

When we look deeper at that, if there are different types of infrastructure, there are poles and wires and items like that, but even more factors that may be more applicable to smart cities are the data and then the connectivity of the connections.

A lot of utilities are focused on that right now, thinking about at the end of the day, a smart city infrastructure, plus sensor, plus communications network, plus data, plus a use of the data, like using the data and aggregating the data in useful ways.

We have sensors in the network. We have technology in place to allow the sensors to communicate with one another. We have lots of data that we generate, and we have mechanisms for handling that data such that it's useful.

Most of what we do today is for our own purposes of delivering electrons. What we're trying to understand is how can we take some of those same assets, some of that same value, and apply it to other useful use cases.

I've got several lists going. I don't know which list is which. We start with use cases. We look at roles and responsibilities and think about what technology needs to take this given a certain capability or role or responsibility. That's when you get into the layer I just mentioned.

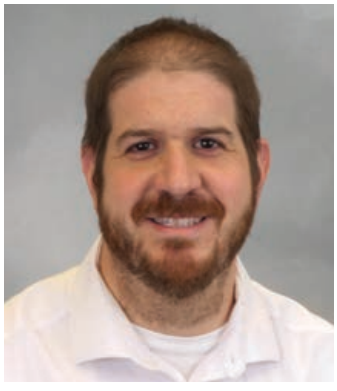
To go further, when we really get to innovate is around business models and policy. That's the icing on the cake. That's how you do all that because we can't stay in the mindset where we can pass everything strictly through a rate-base paradigm. That model could be rate based or not, but we need to put forward other business models that will work, too.

One was the infrastructure. Two is for the common good. When we think about electricity, our mandate, our charter, is

(Cont. on page 52)

Five Questions to Guide Aspiring 'Smart City' Utilities

Public Power Participation



By Paul Zummo, Director, Policy Research and Analysis, APPA
and Juliet Shavit, President, SmartMark Communications

Smart cities have become a buzzing topic in the past few years. There would seem to be a natural fit for public power utilities, which are generally overseen and owned by local governments, to be active participants in smart city initiatives.

Indeed, some public power utilities have undertaken bold smart city plans, though many utilities have taken a wait-and-see approach until now. As the trade association representing public power utilities, the American Public Power Association has offered a roadmap for public power utilities considering getting involved in smart cities. The roadmap lays out key questions utilities need to ask before developing a program and offers a path for utilities to take.

Before looking at the key questions, we must define what we mean by smart city. Today, the definition of smart cities is not universally agreed upon. For example, it can refer to a city that focuses on carbon reduction or is introducing electric vehicles.

It could also refer to a city that has implemented municipal Wi-Fi or integrated solar and distributed energy resources. Many utilities identify smart city initiatives as the next phase of smarter grid efforts, piggybacking on advanced metering infrastructure investments and deployments.

As defined in the roadmap, the Association defines smart as the intersection of digital with intelligence. Smart city, therefore, refers to a city that leverages digital connectivity and data analytics to drive intelligent decision making.

In short, a smart city is a city that betters the lives of residents and businesses through mindful investments and deployments of advanced technologies. Specifically, these efforts can improve energy efficiency, reduce carbon emissions and improve reliability and customer service.

Having identified what a smart city means, the fundamental question the utility must then ask is, will this investment improve the community and the lives of the people in it? Going back to the original definition of smart, it also means asking if each technology decision is an intelligent and meaningful investment for customers and the community.

If the utility answers in the affirmative, then it must begin devising a plan. The roadmap lays out five questions to ponder before establishing a smart city program.

As the trade association representing public power utilities, the American Public Power Association has offered a roadmap for public power utilities considering getting involved in smart cities.

Who is Best to Lead?

There needs to be accountability, and the person in charge of this initiative must have control over people and processes at the utility, possess strong leadership and management skills, and strong communication skills. It doesn't matter if it's the CEO or someone else in the organization, but there must be someone with the vision to lead and follow through.

What Does a Team Look Like?

Once a project lead has been identified, consider who else will be on the team and what roles they will take on. There should be a process lead – someone who will be responsible for developing schedules and core functions and processes. Someone should also manage regulatory and stakeholder communications to ensure these groups are looped into the process. Communications support will be critical in developing public-facing materials and managing public relations.

Who Are the External Stakeholders?

City council and board members, key industrial leaders, and consumer advocates are just a few potential stakeholders who must be engaged. Once these stakeholders have been identified, then the public power utility must determine what the engagement looks like, whether this engagement is formal or informal, how frequently to engage with key stakeholders, and what level of engagement is recommended and when.

(Cont. on page 51)

Paul Zummo is Director of Research and Policy Analysis at American Public Power Association. For over a decade he has been responsible for research on issues such as demand response, time-of-use rates, smart grid, data privacy and distributed generation, and has written white papers on current policy developments affecting the electric utility business as whole and how they impact public power utilities specifically. He produces annual statistical publications and analyzes industry trends and statistics.

Juliet Shavit is the President of SmartMark Communications, LLC and the Founder of SmartEnergy IP. For more than two decades, she has been at the forefront of conversation around technology innovation and the impact of those decisions on industry transformation. She is the founder of the Smart Grid Customer Education Symposium and US Department of Energy Smart Grid Customer Education Working Group.

Planning the Smart City

Collective Collaboration

Photo credit: Avista

Kim Zentz, CEO, Urbanova

PUF's Steve Mitnick: What's Urbanova?

Kim Zentz: Urbanova is an organic collaboration that was instigated in about 2014 by Avista Utilities and Itron. It was initially formed among Avista, Itron, the city of Spokane, and Washington State University.

I was brought on as a facilitator, the person to help write the feasibility study or the strategic plan. We came together and examined the feasibility of leveraging the unique urban advantages of Spokane, Washington as a midsize city on the rise in the smart communities' space.

We have an area of seven hundred and seventy acres adjacent to downtown that is ripe for development, which is our University District. For perspective, seven hundred and seventy acres is about the size of Central Park in New York City.

It is prime real estate, growing in density and provides a great proving ground for all different types of technology and non-technology-based solutions that midsize cities will need to rely upon as they grapple with increasing density and decreasing availability of funds.

We came together around a purpose of finding new ways to make communities better for people.

We're focused on outcomes, very specific outcomes of safer neighborhoods, healthier citizens, smarter infrastructure, a more sustainable environment, and ultimately a stronger economy.

We're taking a systems approach that is keeping everything on the table and not oversimplifying the types of solutions that are necessary. We're focused on identifying what problem we're trying to solve from the perspective of the citizens that are living in the neighborhood.

Toward that end, we've partnered with the Gallup organization to make sure that we are availing ourselves of the best data analytics and behavioral science that is possible to access. Most people think of Gallup as a polling company and, they are. It's an important part of their business, but it's only a small percentage of their portfolio. They are one of the world's leading data analytics companies.

Looking at and evaluating all the different dimensions of challenge that midsize cities will be facing as people continue to move to more urban environments is what we're about. As that urbanization continues, there will be more mega-cities, but mega-cities won't tend to have the same intensity of problems that midsize cities will be facing as the pace of change is so rapid and the availability of resources is subject to competition.

PUF: Working with the City of Spokane, Avista, and Itron to move this forward must be fun.

Kim Zentz: Absolutely. And it's important to note that Washington State University is included, which is our land-grant research university. The reason we call it the University District is because there's a presence of six higher-education institutions in that seven hundred and seventy acres all sharing space, buildings, and urban amenities. That doesn't happen very often.

But even more important, Spokane serves as the medical and medical science center for the Intermountain West, an area that reaches up all the way up into Canada and Montana and the south. That area serves nearly two million people.

Now scale it back to the seven hundred and seventy acres, there are two medical schools. Washington State University just inaugurated its medical school, so it's a startup medical school as of 2015.

We've partnered with the Gallup organization to make sure that we are availing ourselves of the best data analytics and behavioral science that is possible to access.

The University of Washington in partnership with Gonzaga University continues its WWAMI program. WWAMI stands for Washington, Wyoming, Alaska, Montana, and Idaho. It's a collaborative that trains physicians and both medical schools are focused on addressing the physician shortage in less densely populated areas, rural areas and smaller and midsize cities.

PUF: What near-term progress is being made?

Kim Zentz: In developing the feasibility of this vision that we have, we identified and have executed on three proof point projects. One of those is smart and connected street lights in which the first phase was to connect street lights with multifunctional sensors across the seven hundred and seventy acres and of those, three included air quality sensors.

We're now moving into phase two of smart and connected street lights and we have thirty-nine street lights outfitted with sensor packages provided by Itron. We're integrating the data that helps you save energy with LED lights, integrating the traffic data from the city of Spokane, and employing dynamic dimming to improve the business case of saving energy, so that you can have slightly dimmer lights when there is no traffic.


Avista boom truck.


Photo taken by Gravity Drone.

Photo credits: Urbanova (left), Gonzaga University

It's not just on or off. You can have different levels of lighting depending on what the ambient light is and what the traffic is.

We're also examining pedestrian safety in the city. In that way, bringing together the university, the city, the utility and our newest partner, Verizon, to identify how to keep people safer and save money while you do it is one of those use cases.

Let's move from smart and connected street lights into the second proof point project, which is identifying the role of air quality in a healthy city. There's a collaboration within Washington State University between the College of Engineering, where the Laboratory for Atmospheric Research resides, and the College of Medicine, where the physicians and nurses who are addressing public health reside, and together they're pursuing research projects around that idea.

> "The Shared Energy Economy Model Pilot is examining a new wave that will be facing all grid operators, but it's doing so from a mutual benefits point of view."
>
> *– Kim Zentz*


Photo credit: Urbanova

Those three air quality sensors I mentioned earlier were designed and developed at WSU's Laboratory for Atmospheric Research, with the idea to bring air-quality measurements down to the human scale, meaning that typically air quality is measured at the atmospheric scale with very expensive devices and then scientists use sophisticated modeling to scale down and predict or guess what we might be actually breathing.

The idea that we were pursuing was air quality at the very fine grade scale and what we would call the human or personal scale. You can measure air quality from person to person or, more important, from address to address. There are variations. When a person has a chronic disease that affects breathing in any way, it's vitally important for that person to know what they're breathing at any given time. You can't rely on averages or generalities.

The third proof point project is led by Avista called the Shared Energy Economy Model Pilot. It is a large grant, split roughly half and half between the State of Washington's Clean Energy Fund and Avista's investments, for a seven million-dollar, three-year project to develop a micro-transactive grid.

Big words, but what that means is that it's a two-way grid. Conventionally microgrids are applied to campuses and/or facilities that want to be able to operate independently of the major utility grid.

In this case, it's about staying connected to the utility grid so that you can find those optimization use cases among the building information system, and the distributed energy resources that provide benefits back to the operation of the grid and therefore the grid's customers, as well as optimal opportunities to defray the costs of those who might not be a utility and who own solar, or wind, or storage.

The Shared Energy Economy Model Pilot is examining that new wave that will increasingly be facing all grid operators in the future, but it's doing so from a mutual benefits point of view.

PUF: How big can this get in three to five years and how impactful on citizens can it can be?

Kim Zentz: That's a hard question to answer briefly. That's why

we have those five outcomes that we're focused on. The payoff is in measurably healthier citizens and safer neighborhoods.

Smarter infrastructure is implying more efficient and effective operation, meaning lower cost and greater benefits. And then, a more sustainable environment, meaning that we don't want to lose any ground, we, in fact, want to continue to improve the very clean environment we have in Spokane.

Ultimately, when we say a stronger economy, we believe that the opportunity to have a lot of sensors across a finite area to sense anything for any use case that you might imagine will bring some of the best and brightest minds to the universities and to the entrepreneurial ecosystem in the city.

That will help us build a stronger economy by leveraging the ingenuity of our citizens, but also those who have solutions that they want to demonstrate in a real-world environment. We're not the only ones using the term living laboratory, but ours is very large, and it's very physical and we've got a committed, multi-sector stakeholder group in our collaboration. PUF

Dentons Smart Communities

(Cont. from p. 43)

and other members of the think tank come through and work with us on ideas and implementation.

Every community must have a way to build that momentum and discussion; make it transparent, and engaging, and find different ways to punctuate the progress that they have so that the community feels they're part of that movement to be a smart city, a smart community, a smart network, and a smart ecosystem. PUF

Aspiring 'Smart City' Utilities

(Cont. from p. 47)

What Materials Must be Developed?

There are several potential considerations for developing materials. It is advisable to develop a smart city mission statement with goals as identified by the utility that align with enhanced grid infrastructure efforts.

The utility and the city might want to establish clean energy and reduced carbon emission goals, develop an external communications plan to support community buy-in, outline project costs and a funding plan, and identify key milestones and metrics for the next five to ten years. A projected timeline by phases, which is a living document that starts with the utility's operating plan and budget, which then is reviewed by the project management office, would be beneficial as well.

What Are Key Considerations?

From an operations standpoint, the utility should identify concerns and a process for the development of a smart city security plan. The roadmap also suggests identifying key areas of automation that are currently part of smarter grid efforts and any alignments with the smart city model, as well as to identify opportunities to leverage current and future infrastructure for smart city efforts. The utility should also look at the overall goals of the smart city plan to see where the utility can contribute in areas of lifestyle and convenience.

Once a utility has answered these questions, it can develop a clear map to guide the city and the utility on the road to becoming a smart city. PUF

As we drove up to the Kentucky Public Service Commission in Frankfort. Look for "A Day at the Kentucky PSC," the cover article in the March issue of *Public Utilities Fortnightly*. During the day in Frankfort, the PUF team interviewed Chair Michael Schmitt, Vice Chair Robert Cicero, Commissioner Talina Mathews, Executive Director Gwen Pinson, Deputy Executive Director John Lyons, Acting General Counsel JEB Pinney, Director of Financial Analysis Marybeth Purvis, Director of General Administration Stephanie Schweighardt, Director of Communications Andrew Melnykovych, Rosemary Tuft, Manager of Consumer Services, and Assistant General Counsels Quang Nguyen and Nancy Vinsel.

Utility of Several Cities on Smart Futures

(Cont. from p. 45)

to provide the same quality of power to everybody, irrespective of function, income, stature in society.

If you think about it from a smart-city perspective, everybody should have the same access to the benefits of a smart city as everybody else. The utility is naturally poised to be that entity to guarantee that all members of a smart community are able to extract the same benefits from a smart community.

Two hundred years ago, electricity wasn't what it is today, and it wouldn't have been considered necessarily a right, such as a right to life or air or water. It's the same with the internet thirty years ago. Now that's part of our society. If you want to have a job, you need to be connected. If you want to succeed, your family needs to be connected. That's absolutely number two.

Number three is the fact that we're regulated. The fact that there's oversight is a plus. You want to build these items in a deliberate way. Two and three are related, but the fact that we're regulated is a benefit.

PUF: How do you determine what each community needs?

Phil Nevels: What might satisfy the needs of one community may not satisfy the needs of another. In Brownsville, you've probably heard of the microgrids there. What's more interesting is not only are we developing microgrids but we're developing and controlling the microgrids so you start to think about networks of the future and how different microgrids and systems can network and share resources between one another. That is in the network of the future.

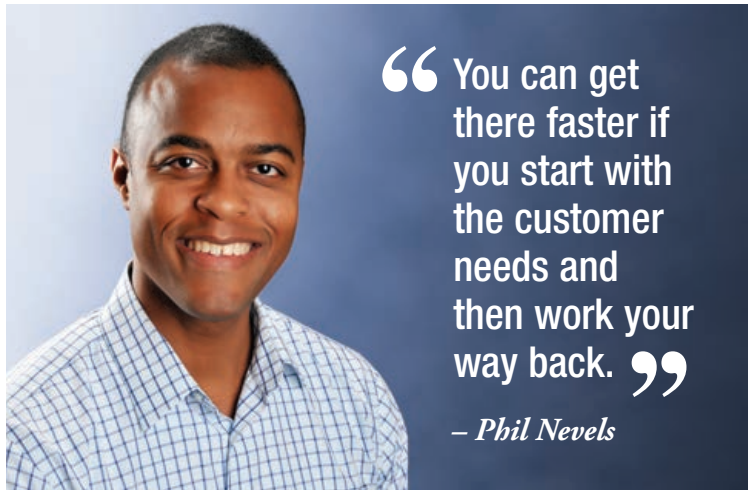
Another interesting item, it's not necessarily super futuristic, but it provides a demonstration of how you can create win/win/win situations for society, and that's in the realm of electric vehicles, which is a no-brainer, triple-win scenario for any use case.

In the Brownsville territory, they've created a ride-share program where they hire individuals from the neighborhood to be the drivers of the vehicles. They're using electric vehicles and they're using those vehicles to help the elderly get from home to public transportation.

In that case it may be more than a triple win, but you've got an economic development win, an environmental win in that you're using an electric vehicle, you've got a societal win, and you've got a transportation win, because you're getting someone from point A to point B. Then you have the utility win because we have more load on the system. That's really four wins. There's probably two or three more.

That's not a futuristic technology, but it demonstrates how we can think about the future. We need to think about the future from a systems approach. One trap we get into, is we get enamored with one technology or another.

We start talking about solar or storage or microgrids or smart substations or AI. It's really more valuable thinking about those as a system and how do all the system components interact with one another. You'll gain a lot more by having some broad, expansive view of the world and not a narrow, technology specific view of the world.



You can get there faster if you start with the customer needs and then work your way back. You'll find that truly some of the customer needs are going to require an aggregation of multiple solutions and technologies. You don't start with a technology and work your way up. You start with their needs and work your way down.

PUF: Why should the industry be excited about this?

Phil Nevels: That's the deal with smart cities. I get excited when you say that term. There are eighty thousand definitions of what it is exactly. In my mind, I boil it down to ten words or less. A smart city is a more efficient city.

You can apply efficiency to every dimension, energy, flow of traffic, or resources. It's about efficiency. A more efficient city is a city that costs less to operate, which means more savings for people.

At the end of the day, people like to talk about electric vehicles. Well, the air is cleaner. We'll have healthier lives. That's a huge part of this, but if you want to talk about people's pocketbooks, that's a big part of it, too.

In a smart city, we can do more with less, put more money in people's pockets, and give them more. It's a higher quality of living at a lower cost. At the end of the day, that's what we're trying to achieve. PUF

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Smart Communities Rap

By Steve Mitnick

Smart communities. They're lands of opportunities.

So our town did a pilot. It was hot. We learned a lot. Now it's time to bear down. Fair? Our chance is rare.

We'll be world-class, high-tech. We'll pass that bottleneck. Then the test was beta. We were stressed. But we came out best.

Now we access the data. And the analytics. It's not a gimmick. The data drives the statistics. You like these lyrics?

Charge that car. The charge isn't large. The electric car's a star. I heard about it on NPR. A miracle, a vehicle, autonomous. A driver, anonymous.

A street light is smart art. Of the solution it's a part. A fresh start. Check the chart.

That light is bright. In the street, no need to fight, or flight, or fright. Outta sight. Our city isn't obsolete, but complete.

We can compete. We're elite. Silicon Valley, take a seat.

Do I have to repeat? In the spreadsheet, we're the athlete, at the track meet. Our town can't be beat. No retreat. Sweet.

The bulb is LED. That's good for you and me. Fits our environment like a T. The power of AC and DC. LED, is almost free. Let it be. Agree?

With 5G, the vision goes 3D. To the nth degree. All the kids get access to the Internet, no matter their address. Bet on the net for their progress, for their success. No sweat. Tell the press.

Good-bye, to no Wi-Fi. High-speed. Like Mom and Apple Pie. It's what we need. The seed, to succeed.

Install a million sensors. Make the network denser. To really communicate. Don't wait, we'll carry our weight. It's our fate, to be great, to rate. Make a date, and to it go straight.

Sustainable, it's attainable. The status quo isn't sufficient. We must become more efficient.

A microgrid too. That's what we did. With the solar panel. Don't change the channel. And a battery. We have a power factory, working every hour. We'll make history. Like we won the lottery.

Our community is going digital. Our problems fixable. The neighborhoods more livable. Businesses and jobs this will attract. It's a fact. Consider the impact.

Smart city, smart community, smart state. It's not too late. But no more debate. It's on our plate. Smart, it's from our heart.

Cartoons by PUF artist Tim Kirby

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