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DISRUPTER SERIES: SMART COMMUNITIES

HEARING

BEFORE THE

SUBCOMMITTEE ON DIGITAL COMMERCE AND CONSUMER PROTECTION

OF THE

COMMITTEE ON ENERGY AND COMMERCE

HOUSE OF REPRESENTATIVES

ONE HUNDRED FIFTEENTH CONGRESS

FIRST SESSION

MARCH 16, 2017

Serial No. 115–14

Printed for the use of the Committee on Energy and Commerce
energycommerce.house.gov

U.S. GOVERNMENT PUBLISHING OFFICE

25–371 PDF WASHINGTON : 2017

For sale by the Superintendent of Documents, U.S. Government Publishing Office
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C O N T E N T S

WITNESSES

SUBMITTED MATERIAL

[1] Ms. Berman did not submit a written statement for the record.

DISRUPTER SERIES: SMART COMMUNITIES

THURSDAY, MARCH 16, 2017

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON DIGITAL COMMERCE AND CONSUMER PROTECTION,
COMMITTEE ON ENERGY AND COMMERCE,
Washington, DC.

The subcommittee met, pursuant to call, at 10:17 a.m., in room 2123 Rayburn House Office Building, Hon. Robert E. Latta (chairman of the subcommittee) presiding.

Members present: Representatives Latta, Harper, Upton, Lance, Bilirakis, Bucshon, Mullin, Walters, Costello, Walden (ex officio), Luján, Clarke, Dingell, Matsui, Welch, Kennedy, Green, and Doyle.

Staff present: Elena Brennan, Legislative Clerk, Oversight and Investigations; Jordan Davis, Director of Policy and External Affairs; Blair Ellis, Press Secretary/Digital Coordinator; Melissa Froelich, Counsel, Digital Commerce and Consumer Protection; Giulia Giannangeli, Legislative Clerk, Digital Commerce and Consumer Protection; Bijan Koohmaraie, Counsel, Digital Commerce and Consumer Protection; Katie McKeough, Press Assistant; Alex Miller, Video Production Aide and Press Assistant; Paul Nagle, Chief Counsel, Digital Commerce and Consumer Protection; Olivia Trusty, Professional Staff Member, Digital Commerce and Consumer Protection; Michelle Ash, Minority Chief Counsel, Digital Commerce and Consumer Protection; Elisa Goldman, Minority Counsel; and Caroline Paris-Behr, Minority Policy Analyst.

Mr. LATTA. Well, good morning. I would like to call the Subcommittee on Digital Commerce and Consumer Protection to order, and the Chair now recognizes himself for 5 minutes for an opening statement.

OPENING STATEMENT OF HON. ROBERT E. LATTA, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OHIO

Good morning, and welcome to our second Disrupter Series hearing this week, and I want to thank our panels for being here to testify today. And we certainly appreciate your flexibility as things moved around due to our full committee markup last week, so we really appreciate that. The topic for today's hearing is smart communities. One of the hallmarks of the Disrupter Series is looking at emerging technologies and platforms to understand how technology is bringing new benefits to the consumer while disrupting traditional markets and regulatory models.

Today we have the opportunity to look at these issues from a slightly different perspective and hear from the experts on the

ground evaluating new technologies in their communities. In some ways, no marketplace is more important than the local government where every service is paid for with hard-earned tax dollars using new technologies at the local level in our hometowns so they may efficiently deliver better services to their constituents.

Many of us sitting on the dais have experience in local government. While many of the challenges and peculiarities are similar if not the same among who we serve, the speed of technology can also be measured by how many of these technologies were available to us years back. Leveraging new technology to provide, measure, and improve service to constituents in our communities is the ultimate goal. There are opportunities to improve education, traffic, and health. We can drastically increase mobility and access to jobs. From safety to sanitation to the environment, communities that wisely invest in technologies can make a real difference in Americans' lives.

While funding is an issue we all face, the first step is identifying the local issues that can truly be transformed by connected and other technologies. I am looking forward to hearing from our witnesses on the panel about their ideas and experiences, solving the most pressing local issues with the new technology.

I would also like to extend a warm welcome to Jennifer Gallagher from Columbus, Ohio, on the panel this morning. As the winner of the Department of Transportation's Smart City Challenge, Columbus has quite a bit of work ahead of them to implement on their goal of reducing infant mortality. If there is one thing I am sure about is the ingenuity and grit of my fellow Ohioans to deliver to our constituents.

I would like to thank you all again for adjusting your plans to be here with us this morning, and I look forward to your testimony.

[The statement of Mr. Latta follows:]

PREPARED STATEMENT OF HON. ROBERT E. LATTA

Good morning and welcome to our second Disrupter Series hearing in two days. Thank you to our panelists for being here to testify. We sincerely appreciate your flexibility as things moved around due to our full committee markup last week. The topic for today's hearing is Smart Communities. One of the hallmarks of the Disrupter Series is looking at emerging technologies and platforms to understand how technology is bringing new benefits to the consumer while disrupting traditional markets and regulatory models.

Today we have the opportunity to look at these issues from a slightly different perspective and hear from the folks on the ground evaluating new technologies in their communities. In some ways no marketplace is more important than the local government, where every service is paid for with hard earned tax dollars. Using new technologies at the local level, in our hometowns, may be able to deliver better services more efficiently.

Many of us sitting on the dais have experience in local government. While many of the challenges and political realities are similar, if not the same, to when we served, the speed of technology can also be measured by how many of these technologies were available to use years ago.

Leveraging new technology to provide, measure, and improve service to constituents in our communities is the ultimate goal. There are opportunities to improve education, traffic and health. We can drastically increase mobility and access to jobs. From safety to sanitation to the environment, communities that wisely invest in technologies can make a real difference in American's lives.

While funding is an issue we all face, the first step is identifying the local issues that could truly be transformed by connected and other technologies. I am looking forward to hearing from the witnesses on the panel about their ideas and experiences solving the most pressing local issues with new technology.

I would like to extend a warm welcome to Jennifer Gallagher from Columbus, Ohio on the panel this morning. As the winner of the Department of Transportation's Smart City Challenge, the city has quite a bit of work ahead of them to implement and deliver on their goal of reducing infant mortality. If there is one thing I am sure about, it is the ingenuity and grit of my fellow Ohioans to deliver for our constituents.

I would like to thank you all again, for adjusting your plans to be here with us this morning and I look forward to your testimony.

Mr. LATTA. And I have some time left on the clock, are there any other members? The Chair recognizes the gentleman, the vice chair from Mississippi.

OPENING STATEMENT OF HON. GREGG HARPER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MISSISSIPPI

Mr. HARPER. Thank you, Mr. Chairman, and thank you for calling this hearing today on Smart Communities, the second hearing this week in our Disrupter Series which provides us the opportunity to examine and better understand how these advancements will affect our daily lives in a rapidly evolving world of interconnectivity.

It is no secret that infrastructure management is a growing problem in the United States. Improving infrastructure management and maximizing investment in roads and bridges and other infrastructures not only improve our quality of life, it also safeguards the flow of commerce, strengthens our economy, and ensures we are competitive both locally and globally.

I am proud to say that a Mississippi company, Camgian Microsystems, headquartered in my district in Starkville, Mississippi, at the home of Mississippi State University, is driving innovations and pioneering efforts to address the problem and help to find cutting edge solutions. Camgian's award-winning product, Egburt, released in October 2014, is a complete internet of things cloud service comprising software, hardware, and communications.

Egburt utilizes proprietary sensing and information processing technology to deliver real time, actionable intelligence designed to be used by commercial and government customers for a broad range of remote monitoring applications ranging from retail operations to infrastructure for both bridges, dams, and other items. By leveraging the experience and success of Egburt's software platform, Camgian engineers, in conjunction with U.S. Army Corps of Engineers, developed the intelligent decision support, or IDS, system to improve the performance and reliability of critical infrastructure.

In May of last year, Camgian engineers completed the installation of the IDS system on the Markland dam bridge and locks system which is 1,395 feet long and a key part of the Ohio River navigation system. It has been successfully operating since that time. As a result of this contract, we could see groundbreaking development in infrastructure, health, and management that could serve as the cornerstone for the design and build of next generation infrastructure management systems.

I am looking forward to hearing from each one of you today, and I appreciate the chairman calling this hearing, and I yield back.

Mr. LATTA. Thank you very much. The gentleman yields back. The Chair now recognizes the acting ranking member of the subcommittee, the gentleman from New Mexico, for 5 minutes.

OPENING STATEMENT OF HON. BEN RAY LUJÁN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW MEXICO

Mr. LUJÁN. Thank you so much, Mr. Chairman. It is a pleasure to sit next to you today for the hearing in the Digital Commerce and Consumer Protection Subcommittee on Smart Communities. I want to thank the ranking members for working together to convene this hearing today, the chairman and the majority, and I thank all the witnesses for their attendance today as well.

Let me begin by noting my appreciation for the title of today's hearing, Smart Communities, because in a State like my home of New Mexico it really is about building smart communities. And as I think today's hearing will show, there are exciting innovations happening everywhere from the assembled cities here in Columbus, Chicago, Pittsburgh, and Portland, including New Mexico where we have two national labs and Intel.

Take what is happening in Santa Fe. In New Mexico, water is a precious resource which is why Santa Fe is deploying cellular smart meters to track consumption and to identify leaks and other problems. These types of advancements improve quality of life, save money, and help policymakers make better decisions. However, there is no reason that these advancements should be reserved for just cities and Silicon Valley. We must act to prevent the development of a new digital divide by helping communities of all sizes adopt smart infrastructure and solutions.

To guarantee that smaller and rural communities aren't left behind, I am working with Senators Maria Cantwell and Congresswoman Suzan DelBene to develop legislation to promote the use of smart technologies while protecting privacy and guarding against cyber attacks.

Our draft legislation seeks to enhance Federal coordination of smart community efforts and provide communities with a resource guide and technical assistance, leverage the expertise of our national laboratories including Los Alamos and Sandia to help communities adopt smarter infrastructure and real solutions, launch regional demonstration efforts to test and advance smart community technologies and systems, and promote the development of a technology-skilled workforce to support the deployment and development of smart communities. We believe this effort will make communities across the country more liveable and sustainable, and there is no reason this effort shouldn't be a bipartisan effort.

I believe that this committee and the Congress has the responsibility to work together to ensure that every corner of America benefits from the infrastructure of tomorrow, which is why critically it isn't enough that we work together to advance the ideas under discussion today, we have to work together to deploy broadband infrastructure that reaches all Americans. I often joked with the previous chairman of the FCC that if we are having a conversation of having broadband at 30,000 feet from Los Angeles to New York,

surely we can be talking about having broadband in all parts of America on the ground.

In the weeks ahead I look forward to working with my colleagues. I want to thank Mr. Latta again for holding this important hearing, and with that I yield to Mr. Doyle of Pennsylvania.

[The statement of Mr. Luján follows:]

PREPARED STATEMENT OF HON. BEN RAY LUJÁN

Thank you, Mr. Chairman. It is a pleasure to sit next to you for today's Digital Commerce and Consumer Protection subcommittee hearing on Smart Communities.

I thank you and the Ranking Members for working together to convene this hearing today and I thank all the witnesses for their attendance.

Let me begin by noting my appreciation for the title of today's hearing: "Smart Communities." Because in a State like my home of New Mexico, it really is about building smart communities and as I think today's hearing will show—there are exciting innovations happening everywhere—from the assembled cities here: Columbus, Chicago, Pittsburgh, and Portland—to New Mexico, where we have with two national labs and Intel.

Take what's happening in Santa Fe. In New Mexico, water is a precious resource, which is why Santa Fe is deploying cellular smart meters to track consumption and to identify leaks and other problems.

These types of advancements improve quality of life, save money, and help policymakers make better decisions. However, there is no reason that these advancements should be reserved just for cities and Silicon Valley. We must act to prevent the development of a new digital divide by helping communities of all sizes adopt smart infrastructure solutions

To guarantee that smaller and rural communities aren't left behind, I am working with Senator Maria Cantwell and Congresswoman Suzan DelBene to develop legislation to promote the use of smart technologies while protecting privacy and guarding against cyber-attacks.

Our draft legislation seeks to:

• Enhance Federal coordination of smart community efforts and provide communities with a resource guide and technical assistance.

• Leverage the expertise of our National Laboratories, including Los Alamos National Laboratory and Sandia in New Mexico, to help communities adopt smart infrastructure solutions.

• Launch regional demonstration efforts to test and advance smart community technologies and systems.

• Promote the development of a technology skilled workforce to support the development of smart communities.

We believe that this effort will make communities across the country more livable and sustainable. And there is no reason this effort shouldn't be a bipartisan effort.

I believe that this committee and this Congress has a responsibility to work together to ensure that every corner of America benefits from the infrastructure of tomorrow.

Which is why, critically, it isn't enough that we work together to advance the ideas under discussion today. We have to work together to deploy broadband infrastructure so that it reaches all Americans.

Mr. DOYLE. Thank you, Mr. Chairman. I want to thank you for hosting this important hearing today on Smart Communities and for featuring my hometown and district, Pittsburgh, and I want to welcome Alex Pazuchanics—we call him Paz, for short—for being here today.

You know, Pittsburgh has changed a lot. You don't have to wipe soot off your car in the morning anymore and the sky isn't full of dust and ash anymore. We have become one of the most liveable and innovative cities in the country. Pittsburgh has deployed a range of technologies and on its smart cities platform and as Alex will point out in his testimony this isn't just sensors and connected infrastructure, it is cloud computing and data analytics on the back end too, taking that data and using it to improve traffic patterns,

reduce vehicle idle time, improve air quality, and make our city more liveable.

Now at the risk of sounding biased, I think Pittsburgh is in many ways a perfect test bed for the city of the future. And as these technologies develop what the city is doing is creating a modular infrastructure that will allow for the rapid deployment of new technologies and capabilities. I know last year was the first round of the Smart City Challenge at the Federal level, but we have been doing this stuff in Pittsburgh for a long time and we are going to continue to do it in Pittsburgh, but we need to continue Federal support. And I want to thank all my colleagues here today for demonstrating the importance of this work at the Federal level and I want to thank all the panelists for your testimony today. And Mr. Luján, thank you for yielding me this time and I will yield back.

Mr. LUJÁN. I yield back, Mr. Chairman.

Mr. LATTA. Thank you very much. The gentleman yields back and the Chair now recognizes the chairman of the full committee, the gentleman from Oregon, 5 minutes. Thank you.

OPENING STATEMENT OF HON. GREG WALDEN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OREGON

Mr. WALDEN. Thank you, Mr. Chairman, and I want to welcome our witnesses. We appreciate your testimony and how our local communities are leading in innovation and great ideas in every sector, because I believe they are laboratories for American innovation and new ideas.

As we will hear today, many communities across our country have adopted technology to improve their citizens' quality of life, but counties, cities, towns, and parishes all face the same question when they evaluate new technology and projects. Many communities are still working to understand how to adopt and when to adopt technology that will improve efficiency, increase accountability, accessibility, and streamline everyday tasks for their citizens.

Several organizations, including the Department of Transportation, have worked to discover what projects local governments were interested in pursuing and hear from residents about the projects they think would be most advantageous in pursuing. In total, 78 cities have submitted applications for DOT's Smart City Challenge, and today I look forward to hearing from some of the finalists about your proposals and I appreciate your testimony, particularly how you have engaged with people in your communities to gather ideas or encourage adoption of them.

The innovation agenda for this subcommittee includes promoting many technologies that have natural applications for local governments, but we must acknowledge the challenges. These ideas may face difficulties with both funding and adoption. There are also important data sharing, cybersecurity, and privacy issues that need to be addressed when government entities are engaging with private companies to provide transportation, energy, or other community services, so my hope is we can explore many of these issues during today's hearing and into the future.

Today we have a chance to hear from several cities and other experts who are on the front lines of finding the value proposition for

deploying smart community technology, and despite my colleague's comments about Pittsburgh which is a wonderful city, it ain't got nothing on Portland.

I would especially like to thank Mr. Chisek from my home State of Oregon and the from the City of Portland. He is here to talk about projects that Portland is working on, as the City of Portland has been a national leader on these issues for a long time. So I want to thank you for making the trek back here, and we appreciate all your innovation.

It is really a fun part of this job, I think, for all of us is to hear what is going on on the ground and how we can help facilitate it and learn from it and take the innovation from our local laboratories, maybe even apply it to the Federal Government. So with that, Mr. Chairman, I yield back the balance of my time and I thank you for your leadership on these issues.

[The statement of Mr. Walden follows:]

PREPARED STATEMENT OF HON. GREG WALDEN

Local communities are the laboratories of American ideas and innovation. As we will hear today, many communities across our country have adopted technology to improve their citizens' quality of life. But counties, cities, towns, and parishes all face the same questions when they evaluate new technology and projects. Many communities are still working to understand how to adopt, and when to adopt, technology that will improve efficiency, increase accessibility, and streamline everyday tasks for their citizens.

Several organizations, including the Department of Transportation, have worked to discover what projects local governments were interested in pursuing and hear from residents about the projects that they think would be most advantageous in pursuing. In total, seventy-eight cities submitted applications for DOT's Smart City Challenge, and today I look forward to hearing from some of the finalists about their proposals. Particularly how they have engaged with folks in their communities to gather ideas or encourage adoption.

The innovation agenda for this subcommittee includes promoting many technologies that have natural applications for local governments, but we must acknowledge the challenges. These ideas may face difficulties with both funding and adoption. There are also important data sharing, cybersecurity, and privacy issues that need to be addressed when government entities are engaging with private companies to provide transportation, energy, or other community services. My hope is that we can explore many of these issues during today's hearing and into the future.

Today, we have the chance to hear from several cities and other experts who are on the front lines of finding the value proposition for deploying smart community technology. I would especially like to thank Mr. Chisek from my home State of Oregon for being here to talk about the projects that Portland is working on, as the City of Portland has been a national leader on these issues. Thank you all for being here.

Mr. LATTA. Well, thank you very much. The gentleman yields back. And at this time, the Chair would recognize the gentleman from Vermont, who is claiming the ranking member's time.

OPENING STATEMENT OF HON. PETER WELCH, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF VERMONT

Mr. WELCH. I thank you very much. Mr. Chairman, as you know, the challenges facing rural America are acute. There is a significant population shift into urban areas. Rural America has enormous challenges. You and I have started a rural caucus and it is because we believe that there has to be a solid future in rural America. That can't happen unless we have solid internet. We have to have the same speed, we have to have the same access and the

same quality in rural America as in urban America and we can't turn our back.

And folks who are here today, including Kurt Gruendling—thank you for coming—from Waitsfield Telecom, are doing the hard practical work to make certain that rural America has the resources they need, the infrastructure they need in order to be viable. So I am delighted that we are having this hearing and that Mr. Gruendling from Waitsfield Telecom is here.

You know, he in addition to being vice president of business developing and marketing, he does all kinds of things in the community. You understand that if you are in rural America you have a job and you have another job and then you have the community service and you have more community service, and that is what you do in addition to raising his twins who are 15 years old. But Waitsfield Telecom is three generations of ownership in the same family; it has been around for 113 years. They serve Mad River in the Champlain Valley areas and it is really crucial to our schools, to our businesses there; it is like 28,000 people.

But how do you deploy and provide service in small rural areas that have mountainous regions and technical challenges? The big carriers don't want to do it because they can't make as much money as they want, but I also think they don't do it because they aren't as smart as the small carriers like Waitsfield Telecom that figure out practical solutions to real problems where they have an ongoing commitment to the people in that community.

So this hearing is very important. Our work on the rural caucus and in this committee is incredibly important. Our chairman of the full committee has a pretty broad rural district, so my hope is that this committee more than any other committee in this Congress is going to stand up for rural America. Thank you.

Mr. LATTA. Thank you very much. The gentleman yields back, and that concludes our member opening statements. The Chair would like to remind members that pursuant to committee rules, all members' opening statements will be made part of the record.

We want to thank all the witnesses again for being with us today and taking the time to testify before the subcommittee. Today's witnesses will have the opportunity to give opening statements followed by a round of questions from the members.

Our witness panel for today's hearing will include Jennifer Gallagher, director of Public Service for the City of Columbus, Ohio; Kyle Chisek, director of Bureau Relations in the office of Mayor Ted Wheeler of the City of Portland, Oregon; Ms. Brenna Berman, commissioner and chief information officer at the Chicago Department of Innovation and Technology; Mr. Kurt Gruendling, vice president of Marketing and Business Development at Waitsfield and Champlain Valley Telecom; Dr. Jennifer Clark, director of Center for Urban Innovation and associate professor of public policy at Georgia Institute of Technology; and maybe I should just go with Paz too—and Mr. Alexander Pazuchanics, the policy advisor at the office of the mayor for the City of Pittsburgh.

We appreciate you all being here today and we look forward to the panel and the discussion today, and with Ms. Gallagher you are now recognized for 5 minutes to give an opening statement. Thanks very much.

STATEMENTS OF JENNIFER GALLAGHER, DIRECTOR OF PUBLIC SERVICE, CITY OF COLUMBUS, OHIO; KYLE CHISEK, DIRECTOR OF BUREAU RELATIONS, OFFICE OF MAYOR TED WHEELER, CITY OF PORTLAND, OREGON; BRENNA BERMAN, COMMISSIONER AND CHIEF INFORMATION OFFICER, CHICAGO DEPARTMENT OF INNOVATION AND TECHNOLOGY; KURT GRUENDLING, VICE PRESIDENT OF MARKETING AND BUSINESS DEVELOPMENT, WAITSFIELD AND CHAMPLAIN VALLEY TELECOM; JENNIFER CLARK, DIRECTOR, CENTER FOR URBAN INNOVATION, AND ASSOCIATE PROFESSOR OF PUBLIC POLICY, GEORGIA INSTITUTE OF TECHNOLOGY; AND ALEXANDER PAZUCHANICS, POLICY COORDINATOR, OFFICE OF THE MAYOR, CITY OF PITTSBURGH, PENNSYLVANIA

STATEMENT OF JENNIFER GALLAGHER

Ms. GALLAGHER. Well, good morning. Again my name is Jennifer Gallagher and I am the director of the Department of Public Service for the City of Columbus, Ohio.

I would like to start my testimony today by thanking Chairman Latta, Vice Chairman Harper, Ranking Member Schakowsky who is unable to be with us, Chairman Walden, and Congressman Luján, and all members of the subcommittee for providing me the opportunity to represent my city and the work we are doing on behalf of Smart Columbus, which is the term coined by our community upon winning the Smart City Challenge. For full details of our Smart Columbus Demonstration Project, please refer to the written testimony that was submitted to your committee.

I appreciate the subcommittee's looking ahead of the curve of disruptive technologies, and I am delighted to have the opportunity to talk about what my community is doing with the collaborative support of our local governments, our research institutions, and our private sector. This hearing is hopefully part of many activities that will help disseminate what works and what doesn't work as communities address these same challenges.

Keep the spotlight on Columbus. We want to make sure that lessons learned in Columbus can empower cost effective, technology enabled solutions across the country, and hopefully inform public policy decisions going into the next decade. Mayor Ginther's vision for Columbus is shared prosperity for all residents. He is working to make the City of Columbus America's Opportunity City. In the mayor's vision, Columbus will be the place where you are more likely to move to the middle class and beyond than anywhere else in the Nation.

We believe access to transportation is a key component of turning this vision into reality. Our application for the U.S. Department of Transportation's Smart City Challenge focused not on how to move people from point A to point B, but how to move people to ladders of opportunity. We believe our focus on opportunity was our key to success in light of rigorous competition from 77 other great American cities.

This Federal grant has changed our city. Cities in the competition, including some represented on the panel, challenged themselves to push for innovation and sustainable solutions in transpor-

tation and energy sectors. Throughout the process, the competing cities learned from one another and we continue to do that today.

I am encouraged that the Congress and the President have been talking about infrastructure. For urban areas, the key to continued growth in the future isn't just about building new highways or adding more lanes to the highways we have, we want to make sure that the discussion provides flexibility and options for disruptive technologies in the cities that want to move in that direction.

Today, Columbus has about 850,000 people. Some estimates have our region growing to three million people by 2050. With this growth we have to be smart in order to be sustainable, which is why what we are doing in Columbus is so important to the future of mobility. What we learn and put into action over the next few years won't just change transportation in Columbus, it will be adaptable and scalable to cities around the country and around the world.

We have learned that technology, indeed disruptive technology, is an enabler, but not an end-all for us to accomplish our goals. As this demonstration project comes to fruition, we look forward to reporting to you and your colleagues on lessons learned and our suggestions for best practices and not best practices moving forward. As your committee considers the development of new standards as these technologies emerge, the City of Columbus looks forward to providing you information on our experience and best practices to better inform you on your decision making process.

Mr. Chairman and other members of the subcommittee, thank you for your time this morning. I am happy to answer any questions now and in the future.

[The prepared statement of Ms. Gallagher follows:]

OFFICE OF THE MAYOR

Good Morning, my name is Jennifer Gallagher and I am the Director of the Department of Public Service for the City of Columbus, Ohio. I want to start out my testimony by thanking Chairman Latta, Vice-Chairman Harper, Ranking Member Schakowsky and all members of the Subcommittee on Digital Commerce and Consumer Protection, on behalf of Mayor Andrew J. Ginther, for providing me the opportunity to represent my city and the work we are doing on behalf of the Smart Columbus Demonstration Project.

I appreciate the Subcommittee's looking ahead of the curve at disruptive technologies and I am delighted to have the opportunity to talk about what my community is doing with the complete and collaborative support of our local governments, research institutions, and the private sector. This hearing is hopefully part of many activities that will help disseminate what works (and even what doesn't) as communities address these same challenges. Keep the spotlight on! We want to make sure that lessons learned in Columbus can empower cost-effective technology enabled solutions across the country. And hopefully inform public policy decisions going into the next decade.

Mayor Ginther's vision for Columbus is for shared prosperity for our residents, he is working to make the City of Columbus "America's Opportunity City." In the Mayor's vision, Columbus will be the place where you're more likely to move from the middle class and beyond than anywhere else in the nation. We believe access to transportation is a key component in turning that vision into a reality.

Our application for the U.S. Department of Transportation's (US DOT) Smart Cities Challenge focused not on how to move people from point A to point B, but instead how to move people onto ladders of opportunity. We believe our focus on opportunity was key to our success, beating out 77 other great American Cities.

This federal grant has changed our city. Cities in the competition, including some represented in this panel, challenged themselves to push for innovative and sustainable solutions in the transportation and energy sectors. Throughout the process, the competing cities learned from one –another and we continue to learn from them today.

Smart Columbus has 3 goals:

Improve access to jobs through expanded mobility options in major job centers.
Connect Columbus residents to safe, reliable transportation that can be accessed by all.
Develop a more sustainable transportation system.

Smart Columbus includes projects across our city. But we do not stop at our city limits, the State of Ohio is making a significant fiber investment along State Route 33, a major trucking corridor, and our suburban neighbor, the City of Dublin will be implementing their new transportation grant surrounding congestion mitigation. All of our technologies will interface with one another, turning central Ohio into a smart mobility hub unseen across our nation.

Within our project, we will be implementing two enabling technologies across 4 project districts.

An Integrated Data Exchange, or IDE, is a dynamic, cloud-based platform that integrates data from multiple sources, including planned smart city technologies, traditional transportation data, and data from other community partners, such as food pantries and medical service providers. This facilitates better decision-making and problem-solving. The IDE is a key component to creating an ecosystem of innovation in Columbus; this ecosystem will be where we engage citizens, businesses, non-profits and visitors to make Columbus America's Opportunity City for all.

Columbus Connected Transportation Network will connect people, vehicles, infrastructure and transportation providers in a safe, secure and seamless manner. Specifics include connected vehicles, smart street lights and a transit-pedestrian collision avoidance system for buses. Congress and DOT have already recognized the need to do more to make these technologies talk to each other, and we're going to demonstrate this at a comprehensive level.

Our Four Districts represent critical population and logistic situations needing next level transportation options and programming. All of our work in these districts will be tested, scalable and replicable:

#1) Residential (Linden): Trip planning and payment options will be integrated into a single application so residents have more convenient access to jobs, school, fresh food and doctor appointments. The Linden neighborhood is facing significant barriers to jobs, health care, fresh foods and where infant mortality is among the highest in the state. We are beginning our work in this neighborhood in an effort to provide a ladder of opportunity to the residents. Transportation to employment centers, well-checks for mothers and their infants, and so much more, will lift the neighborhood and it's residents to a place where they can experience the exact same opportunities our residents in other parts of the city experience.

#2) Commercial (Easton, major job hub): One of the most significant barriers to transportation is something referred to as the "First/Last mile". This is the first mile between someone's home to public transportation and the last mile to their destination from their public transportation stop. We will look to projects such as autonomous transit shuttles and other disruptive transportation. We have created a public/private partnership to enable this demonstration of autonomous vehicles and other transportation technologies to enable this bold project.

#3) Downtown (the heart of the city): An event parking system will allow travelers to plan, reserve and book a parking space for large events. We are home to the All American Quarter Horse Congress, which attracts more than 650,000 people to the Columbus area, The Arnold Sports Festival, which is the largest multi-sport event in the world, attracting competitors from over 80 countries, and other significant events like Ohio State football, in short, we have a lot visitors to our great city who are not necessarily familiar with navigating it. Our parking system will be a partnership with our local tourism office to ensure critical transportation and parking information can be shared with our visitors and residents with up-to-date information to provide some relief to these heavily trafficked times.

#4) Logistics (Rickenbacker Airport and shipping): The Columbus Region ranks first among inland and coastal ports in population concentration within a one-day drive. The region is crossed by eight major Interstate highways. The City of Columbus itself is within a 10-hour drive of 47 percent of the country, and serves as a hub for long-haul trucks. Freight-induced congestion and queuing will be addressed through Truck Platooning and Freight Signal Prioritization. Major incidents at overpasses and narrow streets will be avoided through a comprehensive bridge and street inventory and routing application. Long distance truck parking will be addressed through data integration and information dissemination using a web-enabled device.

Making It Happen

How will we make all of this happen? Through partnerships, government does not hold all the answers, no single sector does. Government, Business, Universities, even local Civic Associations all came together to help us put together this plan and they will be key in executing it. Our Smart Cities grant gives us $40 million from the US DOT and $10 million from Vulcan Inc. Today, our pledges from across sectors have reached an additional $360 million – and counting – these additional partners, are becoming champions of Smart Columbus as well.

Columbus has built an unprecedented culture of collaboration. We are so good at it that the Harvard Business School teaches a course called The Columbus Way. We have

great partners such as Ohio State University, the Columbus Partnership, American Electric Power (AEP), and Battelle Laboratories. For example, AEP recently held a Ride and Share event to help educate drivers about electric vehicles. They brought in electric vehicles from many car makers and allowed people to get the experience of driving an electric car.

We are supported by public funds from Franklin County too because we all know that a strong central Ohio region that does not end at the city limits is best for all of us.

Community engagement is critical. In order to design and implement projects that create the impacts we desire, it is imperative to engage the community along the way.

All urban communities struggle with Air Quality and Congestion Mitigation. Our approach to this is through electrification. This is easier said than done, but we have our local utility (AEP) and its leadership a full partner in this effort.

The city will lead the way to provide base density -- Government fleets will acquire 300 electric vehicles. Specific commitments include City of Columbus, The Ohio State University, City of Dublin and Franklin County.

Smart Columbus will collaborate with private fleets to obtain purchase agreements totaling 450 more electric vehicles. This will allow the initial outlay for grid modernization, electric vehicle adoption and installation of a charging infrastructure achieve economies of scale.

The City of Columbus was named No. 1 among Leading Fleets, an award sponsored by Ford to recognize public fleet operations that demonstrate innovative leadership, operational efficiency, vision for the future and successfully overcoming challenges. We've led the way in compressed natural gas and infrastructure -- and will lead the way in this next sector.

Steps We Have Taken

Our team has established 19 "working groups" that convene on a routine basis to discuss and problem solve some of most significant issues. Some include "Data and Analytics", "Autonomous Vehicles", "Mobility Assistance" and "Connected Travelers, these groups along with others are comprised on both industry experts and government employees to address the question of "How can we make this happen?" not "Can we make this happen?". We will find the solutions we need to grow next level

transportation with the City of Columbus because we are taking the time to bring partners, community members and decision makers to the table so we can move forward together.
Recently we convened our first "Connect Linden" session; hundreds of residents chose to spend their weekend with us providing insight and guidance to us on our project and implementation plans. This information is critical to the overall success of our project with our residents.
We have hosted and attended multiple events and meetings across the nation, topics include Engineering Processing and the development of an Integrated Date Exchange. In addition, our team has hosted the Norwegian Transportation Minister and a delegation from the Netherlands, both looking to our technology goals and offering insights into their advancements.

Moving Forward

New President, new congress – how can they help support the new mobility and infrastructure agenda for America's cities? World class cities – lessons to learn from other global cities?
I am encouraged that Congress and the President have been talking about infrastructure. For urban areas, the key to continued growth in the future isn't just building more highways or adding more lanes to the highways we have. We want to make sure that discussion provides flexibility and options for disruptive technologies and the cities that want to move that direction.

Right now Columbus has about 850,000 people. Some estimates have the region growing to 3 million people by 2050.

We have to be smart in order to be sustainable – which is why what we're doing in Columbus is so important to the future of mobility.
What we learn and put into action over the next few years won't just change transportation in Columbus. It will be adaptable and scalable to cities around the country, around the world.

Technology we have learned, indeed disruptive technology is an enabler, but not the end-all of our efforts to do a few simple important things. As this demonstration project comes into fruition, we look forward to reporting to you and your colleagues our best practices and our pitfalls. As your Committee considers the development of new standards as these technologies emerge, the City of Columbus looks forward to providing you information on our experience and best practices to better inform you on your decision-making process.

OFFICE OF THE MAYOR

Mr. Chairman, Ranking Member Schakowsky, and members of the Subcommittee on Digital Commerce and Consumer Protection, thank you for your time this morning. I am happy to answer any questions you might have.

THE CITY OF
COLUMBUS
ANDREW J. GINTHER, MAYOR

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Ms. GALLAGHER. And we do have a video that we showed during our presentation for the Smart City Challenge, if I may show that now.

[Video shown.]

Mr. LATTA. Well, thank you very much. And the Chair now recognizes for 5 minutes Mr. Chisek for your opening statement. Thank you very much.

STATEMENT OF KYLE CHISEK

Mr. CHISEK. Thank you. Good morning. My name is Kyle Chisek, and I serve as the director of Bureau Relations in the office of Mayor Ted Wheeler. Previous to my role with Mayor Wheeler, I was the project manager for the City of Portland on the Smart City Challenge grant application to the U.S. DOT. The City of Portland appreciates the opportunity to provide feedback to the House Committee on Energy and Commerce as a part of the Smart Communities Disrupter Series.

Portland has been a national leader in Smart City policies specifically as they relate to utilizing innovative technology, improving public health, and supporting energy efficiency. We support Congress' efforts to fund Smart City infrastructure investment and to better understand the challenges and opportunity facing our communities today.

Infrastructure is more than just roads and bridges, and it includes technology to help make the transportation system function better. New technology, big data, innovative partnerships, they all have the ability to change our communities for the better, and in Portland these changes are already happening. Our government and agency partners, our Metro regional government, Multnomah County, the Oregon Department of Transportation, our Port of Portland, and TriMet are all crucial to delivering an innovative transportation system that allows citizens to access information and services quickly and easily.

Whether it is the launch of America's first modern streetcar system or our first statewide road user charge, OreGo, or even our cutting edge academic research on Smart City policy, Oregon is trying to lead the way. Portland State University hosts the National Institute for Transportation and Communities. It is one of five U.S. DOT national university transportation centers and it links the study of transit and transportation, urban planning, housing, and computer science together.

PSU's Business Accelerator has spawned the Smart City startups like Globe Sherpa which is now called Moovel. PSU is also working to design and implement an open data cloud, building on a history of open data and development of open data standards in the Portland region. Portland was one of the first cities to adopt an open data resolution that created an open data portal, CivicApps, back in 2009.

Portland's regional public transit agency, TriMet, has partnered with Google in 2005 to develop a standard for how real time transit schedule information is structured. This standard, the General Transit Feed Specifications, is now used by transit agencies around the world allowing software developers to build transit apps that work consistently across jurisdictional boundaries.

In 2016, TriMet was also awarded the Mobility on Demand Sandbox grant from the Federal Transit Administration. This grant will allow Portland to build on the success of its Hop Fastpass ticketing system to incorporate multimodal and shared use mobility options into its trip planning. So basically this is the goal of allowing Americans to plan, book, and pay for car sharing, bike sharing, public transit, and all from one single application. In fact, it was a common theme through all of the final cities on the Smart City Challenge to be able to do this, so we are very happy to be moving forward on that.

Smart cities must also be safe cities, so Portland is committed to safety through its Vision Zero policy. This policy has been adopted by other American cities and States that no loss of life is acceptable on public streets and that government has an affirmative obligation to eliminate traffic related fatalities and serious injuries. So we are very committed to using Smart City technology to achieve this goal, whether it is deploying speed cameras, gaining data at intersections so the city can address safety issues before crashes occur, or ensuring autonomous or automated vehicles increase safety rather than pose a hazard to our citizens.

There is huge benefits for safety with autonomous vehicles. Ensuring access to opportunity and allowing our transportation network to enhance social mobility is also a key. Transportation is a key to employment and that was one of the focuses in our Smart City Challenge grant application.

Lastly, public-private partnerships provide cities with the alternative and innovative project delivery options. So it is not a replacement for Federal funds, but it is something that can help cities be able to deliver projects better, faster, and quicker. These partners can help fund new infrastructure, and my current boss, Mayor Wheeler, when he was State treasurer, helped create the West Coast Infrastructure Exchange to facilitate these partnerships. He tried to pioneer them and we have a history of doing so.

In conclusion, with increased Federal investment related to Smart City initiatives, the Federal Government will realize significant returns on its investments in the form of energy efficiency gain and leveraging land use patterns to create vibrant cities and strong economic growth. In addition, by testing these in cities, rural communities can benefit from our lessons learned and our mistakes made. Thank you.

[The prepared statement of Mr. Chisek follows:]

STATEMENT

OF

City of Portland

BEFORE THE:

HOUSE COMMITTEE ON ENERGY AND COMMERCE
Subcommittee on Digital Commerce and Consumer Protection

Disrupter Series: Smart Communities

March 16, 2017

PRESENTED BY:

Kyle Chisek
Director of Bureau Relations,
Office of Mayor Ted Wheeler

Chairman Latta, Ranking Member Schakowsky and members of the Digital Commerce and Consumer Protection Subcommittee, my name is Kyle Chisek and I am the Director of Bureau Relations in the Office of Mayor Ted Wheeler of Portland, Oregon. Thank you for the opportunity to provide testimony today on smart city initiatives and how they can reduce energy dependence, harness big data and achieve sustainability goals as well as recount some of the challenges and opportunities relating to the futures of smart cities. As you may know, Portland has been a national leader in transportation through utilizing innovative technology, improving public health, and decreasing reliance on fossil fuels. We were honored to be one of the finalists for the U.S. Department of Transportation's Smart City Challenge in 2016.

We are appreciative of this opportunity to highlight the innovative efforts occurring in Portland and how federal programs and funding focused on prioritizing technology innovation in large urban areas can achieve federal policy objectives.

Transportation Innovation

Portland is a city of innovation and collaboration. Our scale as a "small big city", in combination with the region's economic interdependence and Oregon's strict land use planning framework, means we must collaborate fiercely to compete with larger cities in a global economy – and we have a history of doing it well. In the transportation arena, we have created innovative collaboration structures to bring partners together for critical investments. The Portland Streetcar (TriMet Transit Authority, the City of Portland, and private sector partners) and the Aerial Tram (City of Portland and Oregon Health Sciences University) are examples of collaborative success. Today, the Port of Portland and FedEx are sharing freight data to improve delivery efficiency.

In 2001, Portland led the way with America's first modern streetcar system. Portland's streetcar system is a national model for transit oriented development, public-private partnerships, and reducing energy consumption in our downtown core. For the past two decades, Portland has seen $6.5 billion of new real estate construction value for the city and residents along Streetcar lines; growth like this supports local businesses, new jobs and increased tax revenue.[1] This dense development reduces fossil fuel dependence by contributing to land use patterns that allow for people to walk, bike, or take transit to work.

Our government and agency partners (Metro regional government, Multnomah County, Oregon Department of Transportation, the Port of Portland, and TriMet) are integral to delivering an innovative transportation system that allows citizens to access information and services quickly and easily. We continue to build on a history of collaboration to deliver innovation. ODOT's Road Usage Charge program (OReGO) is a potential partner for our connected vehicle fleet. Portland State University (PSU) hosts the National Institute for Transportation and Communities, one of five USDOT National University Transportation Centers, which links studies of transit, biking, urban planning, housing, and computer science. PSU's Business Accelerator has spawned Smart City startups like Globe Sherpa (now known as Moovel). PSU is also working with the City to design and implement an Open Data Cloud, building on a history of open data and development of open data standards in the Portland region. Portland was one of the first

[1] 2016 Portland Streetcar Annual Report https://storage.googleapis.com/streetcar/files/Portland-Streetcar_Annual-Report_Digital-2016.pdf

cities in the U.S. to adopt an open data resolution and create an open data portal, CivicApps, back in 2009.

Portland's regional public transportation agency, TriMet, partnered with Google in 2005 to develop a standard for how real time transit schedule information is structured. This standard, the Global Transit Feed Specification (GTFS), is now used by transit agencies around the world, allowing software developers to build transit apps that work consistently across jurisdictional boundaries.

In 2016, TriMet, was awarded a mobility-on-demand (MOD) sandbox grant from the Federal Transit Administration[2]. This grant will allow Portland to build on the success of its Hop FastPass ticketing system to incorporate multimodal and shared-use mobility options into its trip planning tool. The goal of allowing Americans to plan, book, and pay for car sharing, bike sharing, and public transit from the convenience of a single app has been the dream of U.S. cities for the past decade. In fact, this was a common theme on almost every finalist proposal to the U.S. Deptartment of Transportation's Smart City Challenge last summer. We expect that the result of TriMet's Mobility On Demand effort will reduce reliance on single occupancy vehicles and fossil fuels.

The City of Portland has also partnered with Waze and Google to better manage the transportation system. Not only is Portland providing Waze with updated information about street closures, Waze is committed to working with Portland on its goals to provide safe routes to schools for children and to help meet the City's Vision Zero goals.

Technology to Improve Traffic Safety

Portland is one of about two dozen large American cities formally committed to reducing traffic fatalities to achieve Vision Zero. Vision Zero is a guiding principle that no amount of loss of life is acceptable on public streets and that government has an affirmative obligation to eliminate traffic-related fatalities and serious injuries. To achieve our Vision Zero goals, we are using technology to make streets safer. This spring Portland launched fixed speed cameras on a few of our high crash corridors which reduced speeds by 90%. Not only does automated enforcement make our streets safer, it saves time for City Police and allows them to focus on other serious crimes.

Portland is excited to identify opportunities for piloting autonomous vehicles and contributing to policy that prioritizes safety. Portland City Council has been supportive of efforts to ensure that autonomous vehicles are helping to solve mobility challenges instead of driving around empty on our already congested streets. We believe the introduction of autonomous vehicles has the ability to significantly change our transportation systems and our cities. Ensuring this change is positive is dependent on local, state, and federal policy that prioritizes safe, shared-use, and electric autonomous vehicles.

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[2] MOD Sandbox grant background: http://news.trimet.org/2016/10/trimet-awarded-678000-federal-grant-to-expand-trip-planning-it-platform/

We suggest that:

- Cities plan for fully automated vehicles and not half measures. Going halfway with partially automated vehicles, instead of fully automated, would require drivers to take over if the vehicle encounters a dangerous situation. In practice, such vehicles have been shown to encourage unsafe driving behavior, with more drivers texting, reading, and engaged in other distracting behaviors.
- Create data sharing requirements for automated vehicles, given the potential to create more useful and cost efficient data than is currently collected through more laborious means.
- Evaluate how congestion pricing options, starting with autonomous vehicles, might cost-effectively reduce congestion by more efficiently using our limited capacity, as well as accelerating smart city investments.

Ladders of Opportunity

Ensuring access to opportunity and allowing our transportation network to enhance social mobility is a key goal for the City of Portland. Toward that end, the Portland Bureau of Transportation (PBOT), has been prioritizing smart city investments in east Portland and historically underinvested neighborhoods. Our goal is to provide our residents with benefits of improved air quality and reduced fossil fuel dependence by investing in access to transit improvements such as enhanced crosswalks.

We are also exploring the opportunity to deploy 20 smart kiosks that provide real time travel information, free public Wi-Fi, and in turn provide data to the City. We believe these tools will increase access to employment opportunities and decrease reliance on fossil fuels. Increased financial assistance from the federal government would allow cities like Portland to expedite and increase the number of informational kiosks thereby resulting in more people choosing to use transit.

One other technology element we are piloting in Portland is air quality sensors near arterials. A growing body of research suggest communities of color and low-income population areas often have more exposure to more toxic chemicals related to fossil fuel pollution.[3] Our pilot project is a partnership between the City, Portland State University and the National Institute of Standards and Technology that will help us better identify the effects of fossil fuel related pollution for people residing and walking near major transportation arterials. This research has the potential to inform transportation, public health, and environmental policies for all levels of government.

Public-Private Partnerships

Public-private partnerships (PPPs) provide cities with alternative and innovative project delivery options, not replacement for traditional federal funding sources. PPPs can make sense for cities when they provide expedited project delivery through management expertise that exceeds public

[3] For more information, see Environmental Protection Agency's Environmental Justice 2020 Action Plan https://www.epa.gov/environmentaljustice/ej-2020-action-agenda-epas-environmental-justice-strategy

options, but not when the partnership requires the privatization of public assets. In fact, Portland is strongly against the privatization of public roads, highways and other transportation assets for the profit of private companies and investors.

For example, design-build PPPs can be more likely to finish projects on time and on budget than public alternatives, especially if the public entity does not have a track record of delivering mega-projects. These partnerships can capitalize on private sector efficiencies in asset management, for instances providing long term maintenance and operations services for a new facility. This traditional type of PPP replaces public delivery mechanisms, but it does not substantially decrease the overall cost of infrastructure to taxpayers.

Another version of PPPs focuses on the private sector technology advantage, a model that Portland has taken advantage of with companies like Waze, and the Multi-Modal App, Hot FastPass and multi-modal app work through MOD sandbox. These agreements with private companies give Portland access to cutting edge technologies needed for smart cities programs.

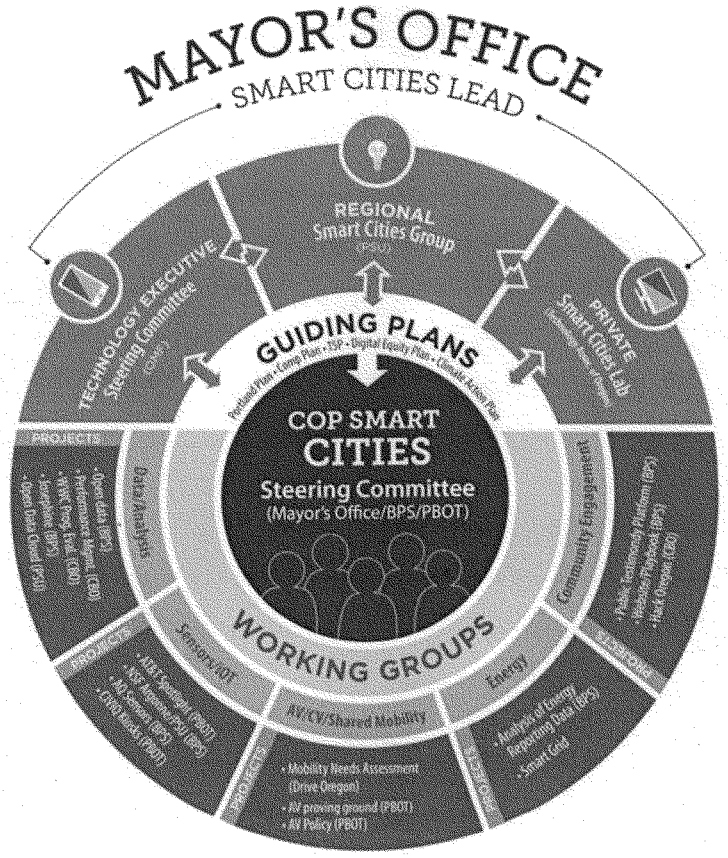
As we have seen with Portland Streetcar and other public-private partnerships, when cities work in tandem with the private sector, it builds community trust and contributes to increased private development near public infrastructure. Many of our public transportation projects also act as economic development projects due to their ability to leverage development and smart growth land use patterns.

Portland is excited about the opportunities that PPPs can provide, especially to further our Smart City agenda. However, we must be clear that PPPs are not an alternative to federal funding and privatization of transportation assets is not a long term plan for smart city infrastructure investment.

Organization

The City of Portland's implementation strategy for smart city initiatives involves an organizational structure developed around three principles. First, the organizational structure must be nimble, responding quickly and efficiently to change while continuing to deliver high performance, and be open to innovation. Second, the City, as the grant recipient, must be accountable and transparent about the expenditure of public funds. Finally, the community must feel a sense of ownership for the project.

The organizational structure has the advantage of having already worked effectively to implement the City's most important infrastructure projects. It is a tried and true model of project delivery when the project is complicated and community support is essential. The proposed implementation structure uses the same model that has been used for major projects in Portland for many years: Portland Streetcar, the OHSU Aerial Tram, and Transit Mall Management. The private non-profit implementation entity provides nimble responsiveness, the board of directors ensures consistent policy leadership, inclusiveness, and focus, and the City Council still retains the bottom-line assets and fiscal authority.



Challenges

Our successes are real, and our city's prosperity is growing. However, Portland's advantages have not been equally shared. Too often, local government implemented policies and made decisions that harmed minority communities. Many transportation and redevelopment projects have caused the displacement of families and communities. Urban renewal and freeway expansion in the 1960s was followed by gentrification because of rising home prices in the 1990s and 2000s. One traditionally African-American neighborhood, for example, experienced a 40% increase in average rent over the past 5 years. As a result, the neighborhoods best served by transit are less accessible to low-income Portlanders.

In addition, Vision Zero safety data reveals that people living in historically underserved neighborhoods suffer the highest number of fatal and serious injury crashes. Pedestrians are especially at risk: someone walking or using a mobility device in east Portland, particularly east of Interstate 205, is 2.3 times more likely to die or be critically injured than a pedestrian in or near the central city. Moving forward, Portland and other cities need to own, understand, and strive to correct these historic inequities. Smart Cities will help us achieve that.

Another challenge with the increased presence of technology includes the concern for safety. Over 40,200 people died in traffic crashes in America in 2016, the highest in nine years.[4] As technology penetrates vehicles and the attention of motorists, the risk to others increases significantly. This poses even greater risk to those walking, biking, and taking transit due to their vulnerability and because this technology may not take into account people who walk without smartphones. Federal funding programs and policy must incentivize and contribute to safer cities.

Other challenges for smart city initiatives include initiatives that often do not fit in neatly to existing federal funding programs due to their overlap between transportation, energy, and commerce. However, over recent years we have realized how critical smart city infrastructure is for Portland and other large urban areas. Smart city investments and infrastructure provide cities with data to better manage traffic, provide residents with more information to enjoy their city, and spur economic growth.

In conclusion, with increased federal investment related to smart city initiatives and multimodal transportation, the federal government will realize significant returns on investment in the form of decreased reliance on fossil fuels and sustainable land use patterns that contribute to vibrant cities and strong economic growth.

We appreciate the opportunity to testify today and I am happy to answer any questions that you might have.

[4] http://nacto.org/2017/02/15/statement-40200-deaths-on-american-streets/

Mr. LATTA. Thank you for your testimony today. And Ms. Berman, you are recognized for 5 minutes for your opening statement. Thank you very much for being here.

STATEMENT OF BRENNA BERMAN

Ms. BERMAN. Thank you, Chairman Latta, Ranking Member Schakowsky who could not be with us here today, and members of the committee, for inviting me to speak today about smart cities. My name is Brenna Berman and I serve as the commissioner for Chicago's Department of Innovation and Technology and CIO for the City.

Chicago, as you know, is the third largest city in the country, a global city with world class architecture, universities, and cultural institutions. As one of the most dynamic cities in the world, we seek to equip our communities with leading edge technology that engages, informs, and empowers. Mayor Emanuel's vision for achieving this is built on a commitment to modern infrastructure, smart communities, and technological innovation.

In Chicago we have applied Smart City tools like open data, predictive analytics, and sensor technology to public health, public safety, and improving our environment, among other public challenges. These tools have helped us to become more responsive to our community, faster and more efficient in our service delivery, and smarter about our investments and policies. Step one for us in becoming a Smart City was examining and changing the way that we collect, share, and use data.

In 2011, Mayor Emanuel launched the city's first-ever open data portal, providing hundreds of city datasets to the public for the first time ranging from business licenses to conditions of our beaches to the largest crime dataset available in the world. One million people visit the data portal annually. These students, journalists, professors, and programmers use the more than 600 datasets available to increase their understanding of the city and produce apps that are useful for others.

We also took a closer look at how we in the city could better use the data we collect to drive decisions or predict issues. We began applying predictive analytics to help the city run more efficiently and effectively. For example, we have been able to devise algorithms to help our Public Health Department forecast food inspection violations 7 days sooner than without the use of data which helps them address threats to public health more quickly.

We have applied predictive analytics to things like rodent baiting, E. coli levels in Lake Michigan, and West Nile virus across the city, just to name a few. But now, data is moving outside of the IT department to become embedded into the physical infrastructure of the city, helping to function in unprecedented new levels of efficiency and effectiveness. This is what everyone means when they talk about the internet of things, new data being collected automatically through sensors telling us what might come next, truly becoming a Smart City, and that for us requires partners.

Chicago is home to some of the leading universities and research institutions in the country, as well as Fortune 500 companies and innovative startups. In 2015, UI Labs, a consortium of Chicago research institutions and corporations, launched a Smart City accel-

erator called City Digital to harness the collective energies of more than 300 organizations to apply cutting edge technology and integrated data solutions to urban infrastructure challenges in Chicago.

With our City Digital partners we can tackle bigger problems like storm management and flooding. While data can tell us what areas in the city are likely to flood, with our partners and new technology we can actually do something about it. For example, recently we combined green infrastructure solutions such as water-retaining plants with sensors and a secure network to actually collect data about their effectiveness and apply a dashboard for the Water Department to manage these solutions. That allows the city to easily see the impact of the solution and make better investment decisions in the future.

Chicago is also committed to efforts that merge our built environment with our digital environment. Right now we are doing this through two projects: the largest Smart Lighting Project so far in the country, and the Array of Things. The Smart Lighting Project will install new LED lights across the city. Not only are these lights more energy efficient, but they will communicate with each other and city systems.

When a streetlight goes out we won't have to rely on a neighbor reporting it, the streetlight itself will alert relevant city departments. We know that simple streetlight outages are associated with small spikes in crime. Being able to respond quickly addresses the need to be able to fix the light and improves public safety.

With funding from the National Science Foundation we are working with the University of Chicago and Argonne National Laboratory on the Array of Things, a first of a kind urban sensing project that consists of a network of interactive, modular sensor boxes installed around the city essentially serving as a fitness tracker to collect real time data on Chicago's environment, infrastructure, and activity for research and public use.

The data generated by the Array of Things will help anticipate floods, traffic safety incidents, and improve air quality. With its data being made open to the public, the initiative supports researchers, policy makers, developers, and residents alike to work together and take specific actions that will make Chicago healthier and more liveable. These initiatives from those at City Digital to the Array of Things, all fall under Chicago's bold and comprehensive vision for being a Smart City. That vision is guided by informed, data-driven decision making, and a collaborative, inclusive process for fostering and promoting innovation.

Indeed, while technology is evolving far more quickly than ever before, the principles of efficiency, sustainability, and a better quality of life for all of our residents still ring true. The city is committed to collaborative urban innovation and to share its insights with the world so that we may all grow together in this process. Thank you very much.

Mr. LATTA. And again, thank you very much for your testimony today. And the committee now recognizes Mr. Gruendling for 5 minutes. Good morning.

STATEMENT OF KURT GRUENDLING

Mr. GRUENDLING. Good morning, Chairman Latta, Ranking Member Schakowsky, Congressman Welch, and members of the subcommittee. Thank you for the opportunity to testify today on Smart Communities. I am here on behalf of Waitsfield and Champlain Valley Telecom and NTCA, the rural broadband association which represents about 850 small, rural telecom providers in the U.S.

As many of the subcommittee members are aware because small telcos serve your districts, we provide broadband and other advanced services to the most rural areas of our country. Broadband helps solve the problem of distance by opening up new education and job opportunities for rural Americans, allowing them to telecommute remotely to companies in urban areas while helping rural businesses tap into global markets, enabling countless possibilities for commerce.

Broadband connects rural veterans and others with healthcare specialists and helps farmers and ranchers use the internet to analyze livestock and crop data. It also provides a convenient means of maintaining strong social connections with friends and relatives, no matter how far away they may be. And when people want to escape the city for a change of scenery and some R&R, broadband is the driver of the tourism economy helping to connect to the ski resorts of rural Vermont and countless other tourist destinations in your home areas.

While Vermont might be best known for its picturesque landscape, world class skiing, and quaint inns, look deeper and you will find a vibrant high-tech business community served by a state-of-the-art telecommunications network that continue to evolve. In our service territory, all schools, many of the larger businesses, and some residential customers are now served by fiber-to-the-home technology offering speeds up to 1 gigabit.

Vitality of any community is dependent on its access to robust economic opportunities, first-rate health care, education, and public safety services. Rural communities in particular face unique challenges to accessing these types of benefits. Smart Rural Community is an initiative of NTCA and for most of the development and deployment of broadband-enabled applications that the community can leverage to improve these vital services.

Smart Rural Community recognizes that broadband access is foundational to community success, but it is just one part of the equation. These communities understand the importance of embracing and relying upon dedicated local leaders and from many fields and industries who work collaboratively to develop broadband-enabled solutions to create and improve opportunities in rural America.

Since 2013, 44 NTCA members have been recognized with the Smart Rural Community Showcase Award for demonstrating excellence in collaborating with other local leaders to improve broadband-enabled services. My company earned this award in 2014 for working with government and business leaders in the Mad River Valley.

After Hurricane Irene hit Vermont hard in September of 2012, the State sought to relocate more than a hundred employees that

worked in the flooded State office complex in Waterbury, Vermont, to a vacant space in the Mad River Valley Business Park. Our company worked closely with State and local economic development officials to quickly wire the building with fiber optics and deploy a state-of-the-art phone system to meet their needs so they could quickly relocate to their new office.

In 2015, our company also secured a Smart Rural Community Collaboration Challenge Grant which matched community funding to provide free Wi-Fi coverage to over a hundred local businesses in tourist areas.

There are many great success stories from the Smart Rural Community initiative. NTCA companies have deployed connected health cards in public schools whose students are challenged by persistent poverty. They have worked with the U.S. border control officials to support critical security functions along our Nation's southern border, and they have enabled local firefighters to view reported fires and locate nearby hydrants before firefighting teams arrive.

To not have access to high-speed internet today should be unimaginable, yet millions of rural Americans have limited or even no access to robust broadband. Smart Rural Community depends upon a mix of private entrepreneurship, public and private capital, and universal service programs. These resources enable not only network deployment, but also the ability to ensure that the services provided over those networks remain robust and affordable and can be upgraded over time.

We have made great progress in deploying broadband, but we still have many locations to reach and upgrade and sustaining such progress is a separate challenge. Recent reforms to the Universal Service High Cost Fund have unfortunately resulted in a budget shortfall that will result in fewer locations being reached, comparatively slower speeds being delivered to locations that are being reached, and higher rural consumer broadband rates.

This budget shortfall hurts small businesses like ours that still need to upgrade portions of our network, and it undermines the ability of those companies to deliver and keep delivering on the promise of broadband that create smart rural communities.

In conclusion, rural telcos have made great progress and are eager to continue deploying infrastructure and delivering services that rural America and, frankly, all of America needs to participate in the global economy. The Smart Rural Community initiative highlights what is possible when consumers, businesses, and other organizations work together to make that a reality. Thank you for the opportunity to testify and I look forward to your questions.

[The prepared statement of Mr. Gruendling follows:]

Statement by

Kurt Gruendling
Vice President of Marketing and Business Development
Waitsfield and Champlain Valley Telecom

On behalf of

NTCA–The Rural Broadband Association

Before the

United States House
Committee on Energy and Commerce
Subcommittee on Digital Commerce and Consumer Protection

"Disrupter Series: Smart Communities"

March 16, 2017

INTRODUCTION

Chairman Latta, Ranking Member Schakowsky, members of the Subcommittee, good morning and thank you for the invitation to participate in today's hearing focused on smart communities.

I am Kurt Gruendling, Vice President of Marketing and Business Development at Waitsfield and Champlain Valley Telecom (WCVT). My remarks today are on behalf of WCVT, as well as NTCA–The Rural Broadband Association, which represents approximately 850 member-owned cooperatives and commercially-owned carriers in 45 states that are largely based in the communities they serve and offer a variety of communications services throughout the rural far reaches of the nation. The small telcos like those in NTCA's membership serve less than five percent of the population of the United States, but cover approximately 37 percent of its landmass.

These companies operate in rural areas left behind by other service providers because the markets were too sparsely populated, too high cost, or just too difficult in terms of terrain. These small broadband providers have been leaders in deploying advanced communications infrastructure that responds to consumer and business demands and connects rural America with the rest of the world. For rural America, such infrastructure enables economic development and job creation not only in agriculture, but for any other industry or enterprise that requires robust connections to operate in the modern world.

Our company is a 113-year old, third-generation, family-owned telecommunications provider servicing the Mad River and Champlain Valley regions of Vermont. Being locally owned allows us to truly understand the telecommunications needs of our customers – our neighbors – and share in a commitment to improving our communities. We provide local and long distance telephone service, cable TV, and high-speed Internet services to more than 16,000 customers. Our service area spans 669 square miles including twenty-four rural communities in parts of three counties with a population of 28,858.

While Vermont might be best known for its picturesque landscape, world-class skiing and quaint inns and Bed and Breakfasts, look deeper and you will find a vibrant high-tech business community served by a state-of-the-art telecommunications network that continues to evolve. Residences and businesses, both large and small, connect to this network and utilize the technology to compete on a global basis. Access to affordable broadband service is a critical component of economic development in rural communities and we are committed to finding ways to make this happen. In our service territory, all schools, many of the larger businesses and some residential customers are now served by fiber-to-the-home technology offering speeds up to 1Gbps.

Our employees are working hard to complete the next evolution of our network to support continued growth in higher speed Internet services and an increased level of reliability and redundancy in the network. This takes an enormous amount of planning, resources and a significant capital investment to make this happen and there is a lot more work and investment that needs to be done. It's a time and money equation.

I recently spoke to Steve Butcher, the owner of VickeryHill, a web development firm located on Lincoln Gap Road in Warren, Vermont. I asked him what high-speed Internet means to him and his business and he replied:

> WCVT's constant efforts to improve the technology backbone in our remote region of Vermont puts our company on an even (and often advantageous) position with our competitors. We get to work from the comfort of paradise at the same speeds and service level as those locked in the skyscrapers of the big city. We can choose to live where we want, in the middle of beautiful nowhere, yet still compete with the big city web developers solely because of the gigabit fiber connection WCVT provides for us. We recently celebrated our 15th year in business and now employ six people and work with clients from St John USVI, Whistler, San Francisco and Boston.

This is just one good example of the types of small businesses that we need to continue to work together to incubate, attract and retain here in Vermont and throughout other areas of rural America.

WHAT IS A SMART RURAL COMMUNITY?

The vitality of a community is dependent on its access to first-rate health care, blue-ribbon education, strong public safety services, and robust economic opportunities. Rural communities in particular face unique challenges to accessing these types of benefits and services, which many times are taken for granted in urban areas. For example, access to healthcare is a critical issue, where the lack of physicians, specialists, and diagnostic tools normally found in urban medical centers creates challenges for both patients and medical staff in rural areas. There is also a shortage of teachers in many areas of rural America and those public-school districts rely on high-speed connectivity to deliver interactive-video instruction for foreign language, science and music classes, amongst others.

Smart Rural Community℠ (SRC) is an initiative of NTCA, and promotes the development and deployment of broadband-enabled applications that the community can leverage to improve these vital community services. SRC recognizes that broadband access is foundational to community success, but

just one part of the equation. These communities understand the importance of embracing and relying upon dedicated local leaders from many fields and industries who work collaboratively to deploy broadband-enabled solutions to create and improve opportunities in rural America. From manufacturers and application developers to telecommunications providers and, ultimately the users who adopt and employ broadband-enabled services, a "smart rural community" reflects a team effort of continuing development and evolution. This collaboration in turn helps with the sustainability of the networks once built, as well as driving greater demand for broadband within the community itself and in other areas as others see the potential applications and uses in practice.

Now entering its fifth year, NTCA's Smart Rural Community initiative supports three major programming components, including rural recognition awards, grants, and educational programming. Since 2013, 44 NTCA members have been recognized with the Smart Rural Community Showcase award for demonstrating excellence in collaborating with other local leaders to incorporate broadband-enabled solutions to support economic development, education, health care, public safety, and other vital community functions. Their applications are reviewed by the Smart Rural Community Advisory Council, which includes representatives from independent organizations with deep stakes in rural America, including the American Farm Bureau Federation, the Rural School and Community Trust, American Library Association, and rural technology experts. These organizations are able to recognize how broadband technology can spark innovation and remarkable achievement across many layers of rural life.

Expanded interest in the SRC program has led to additional ways of acknowledging innovation by small business telecom providers like WCVT. NTCA has awarded SRC Collaboration Challenge grants to support community economic development, job creation and training, K-12 education, computer literacy training for senior citizens, and healthcare. These grants require rural broadband providers to "partner up" and secure matching funds from other rural institutions. This requirement compels and ensures the type of collaboration among rural broadband providers and other local leaders that SRC promotes. Since 2016, nearly $30,000 in grants have been awarded to support rural America.[1]

SRC also produces and hosts educational programming events in Washington and beyond. These programs have addressed smart agriculture, distance education, and telemedicine. SRC has published

[1] "Smart Rural Community Collaboration Challenge Report", NTCA-The Rural Broadband Association (2016): https://www.ntca.org/images/stories/Documents/src%20collaboration%20challenge%20report%20july%202016.pdf

academic papers addressing issues ranging from broadband adoption to social and economic relationships among rural and urban areas, and is set to release on March 29, 2017, a paper that will explore the economic impacts of rural telehealth.

Separately, more than 80 telco members of NTCA have been recognized as Certified Gig-Capable Providers since July of 2015, a designation that highlights how independent telecommunications providers are delivering the Internet of tomorrow – today.[2] These certified providers have demonstrated, through confirmation by an engineering firm or other independent source involved in the company's network planning, deployment or operation, that gigabit technology is currently commercially available with 95 percent of a designated portion of their serving areas, and that such service can be provided without substantial new deployments. The program has been a huge success – a sign of vitality not only for independent telecommunications providers but also for the communities they serve. The SRC web site provides an interactive map of the country highlighting the communities that have GIG-capable certified providers, and SRC Showcase and Collaboration Challenge grant winners.[3]

RURAL BROADBAND COLLABORATION IN ACTION

In 2014, WCVT earned a Smart Rural Community Showcase Award for working collaboratively with government and business leaders in the Mad River Valley (MRV) to promote economic development efforts through broadband access. WCVT had worked extensively with the MRV Chamber of Commerce and the Central Vermont Economic Development Council to deploy the infrastructure required to attract businesses to the MRV Business Park. After hurricane Irene hit Vermont hard in September of 2012, the State of Vermont sought to relocate more than 100 employees that worked in the flooded state office complex in Waterbury. A vacant space in the MRV Business Park was one of the potential options on their list. WCVT worked closely with State and local economic development officials to quickly wire the building with fiber-optics and to deploy a state-of-the-art phone system to meet their needs so they could quickly relocate to vacant space in our service area.

In 2015, WCVT also secured an SRC Collaboration Challenge grant, which matched community funding to provide free Wi-Fi coverage to parts of the MRV. The grant focused initially on two towns

[2] "Become a Certified Gig-Capable Provider", NTCA-The Rural Broadband Association (2017): http://www.ntca.org/awards-recognition-programs/gig-certification.html
[3] "Smart Rural Community Interactive Map", NTCA-The Rural Broadband Association (2016): http://www.smartruralcommunity.com/

in the MRV and has since been deployed to an additional community in the Champlain Valley. We also replicated the MRV deployment in Bristol, Vermont. Our goal was to keep people in the downtown shopping areas. The Warren Store is a quintessential Vermont country store and has an outdoor deck overlooking the river, and if people can grab a sandwich, take a seat on the deck overlooking the river, and get on-line, we suspected they would visit longer. In Waitsfield, we have the Mad River Green, which features a lot of small businesses, including a farmer's market that operates on Saturdays from May through October and sees thousands of visitors weekly.

We now provide free, controlled Wi-Fi connectivity to these highly-visited locations. The area is home to more than 100 businesses and the majority of commercial activity in the MRV (excluding the ski areas). Our Wi-Fi network is an extension of our fiber optic network and allows visitors to gain free Wi-Fi access, while enabling local vendors using Wi-Fi devices to process transactions. It is not intended to replace the wired broadband infrastructure that we have invested heavily in, but instead is designed to extend the value of that service outside of the home and business, and to provide value to both local community members as well as visitors.

We also partner with another key industry – the three Vermont ski resorts located in our service area. We work very closely with Sugarbush, Mad River Glen and Bolton Valley to provide them with the telecommunications infrastructure they need to compete in a highly competitive industry. This includes high-bandwidth fiber-optic circuits for high-speed Internet, business class Wi-Fi, managed phone systems, and video services. The ski areas are a major economic driver and critical to the economic viability of our local economy.

In addition to my company, other SRC broadband providers showcase the many examples of what the availability and sustainability of broadband infrastructure can mean for consumers, business, and communities in rural areas. For example, SRC Showcase companies have worked with U.S. border control officials to support critical security functions along our Nation's southern border; and enabled local firemen to view reported fires and locate nearby hydrants before firefighting teams arrive.

ComSouth Telecommunications in Hawkinsville, Georgia, serves more than 270 square miles with a population of more than 11,500 people with 1 Gbps capability to almost every business in its area, including the Taylor Regional Healthcare System. ComSouth serves an economically challenged area in which many children do not have regular access to physicians. As part of a telehealth initiative, ComSouth supports connected health carts in schools that enable school nurses to connect to and

obtain guidance from remote physicians. This innovative use of health care technology serves students in need.

In Milltown, Wisconsin, an NTCA member serving six villages, 15 townships, and a Native American Reservation community connected six hospitals across two states to enable telemedicine services, including the ability to share critical diagnostic files with a major medical center for life-saving decisions when specialists are not available in the rural areas.

Garden Valley Telephone Company, based in Erskine, Minnesota, provides fiber-to-the-home (FTTH) broadband connections with speeds of up to 1 Gbps to most of its customers in its service area, which spans 3,700 square miles across eight counties. In December 2015, Garden Valley partnered with local school districts to create a dedicated broadcast channel for each school. The company equipped schools with broadcast equipment and training for students and staff, providing opportunities to learn about the broadcast industry and acquire skills.

Rainbow Communications, located in Everest, Kansas, received an SRC Showcase Award in 2015 for highlighting as many as 20 different local organizations and businesses that utilize broadband to enhance growth and innovation. The company hosted an SRC Road Tour to 14 communities, along with ten businesses and organizations, to recognize their contributions.

NTCA's members are fuelling broadband-enabled vitality in rural America. Smart Rural Community recognizes their achievements, supports their collaborative undertakings with other local leaders, and shines a light through its educational programming on how broadband innovations can ensure a strong rural future.

RURAL BROADBAND INVESTMENT IN ACTION: ECONOMIC DEVELOPMENT AND JOB CREATION

NTCA member companies continue to lead the way in deploying high-speed, sustainable broadband that responds to the needs of consumers and businesses in rural America. The broadband infrastructure they deploy enables applications that rural and urban communities can leverage for education, commerce, health care and government services. Broadband-capable networks facilitate greater interconnection of community resources and enable greater participation in the national and global economy.

In April of 2016, the Hudson Institute, in conjunction with the Foundation for Rural Service (FRS), released a report examining the economic benefits of rural broadband infrastructure.[4] It determined that investment by rural broadband companies contributed $24.1 billion to the economies of the states in which they operated in 2015.[5] Of this amount, $17.2 billion was the direct byproduct of the rural broadband companies' own operations while $6.9 billion was attributable to the follow-on impact of their operations.

The Hudson study also confirmed that while small, rural telcos produce a range of telecommunications services in rural areas, much of the benefit goes to the urban areas where the vendors, suppliers, and construction firms that rural telcos use are based. Only $8.2 billion, or 34 percent of the $24.1 billion final economic demand generated by rural telecom companies accrues to rural areas – the other 66 percent or $15.9 billion accrues to the benefit of urban areas.

Additionally, the report found that the rural broadband industry supported nearly 70,000 jobs nationwide in 2015, both through direct employment and indirect employment from the purchases of goods and services generated. Jobs supported by economic activity created by rural broadband companies are shared between rural and urban areas, with 46 percent in rural areas and 54 percent in urban areas.

Other, earlier studies reinforce these findings. For example, the Center for Economic Development and Business Research at Wichita State University found that the total economic impact of Kansas rural telecom companies (in the form of direct wages and induced economic activity) averaged $137.2 million dollars a year between 2011 and 2014.[6] The companies included in the report spent an average of $98 million dollars per year on capital improvements to maintain and expand communication capacity in rural Kansas.

Of course, these referenced studies only look at the direct and indirect economic impact of the investments and operations of the telcos themselves. As the Smart Rural Community program celebrates, the broader socioeconomic benefits of broadband for *users* cannot be ignored. A Cornell University study, for example, found that rural counties with the highest levels of broadband adoption

[4] The Hudson Institute, "The Economic Impact of Rural Broadband," April 2016, ("Hudson Paper"). https://s3.amazonaws.com/media.hudson.org/files/publications/20160419KuttnerTheEconomicImpactofRuralBroadband.pdf
[5] "The Economic Impact of Rural Broadband" (2016), The Hudson Institute, Washington, D.C.
[6] "Economic Impact of Kansas Independent Rural Telephone Companies" (2016), Center for Economic Development and Business Research, W. Frank Barton School of Business, Wichita State University.

have the highest levels of income and education, and lower levels of unemployment and poverty.[7] A recent Pew Study further finds that among those Americans who have looked for work in the last two years, 79 percent utilized online resources in their most recent job search and 34% say these online resources were the most important tool available to them.[8]

PROMOTING POLICIES THAT ENSURE BROADBAND NETWORK DEPLOYMENT AND SUSTAINABILITY

To not have access to high-speed Internet today should be unimaginable, yet millions of rural Americans have limited or even no access to robust broadband. Smart Rural Community depends upon a mix of private entrepreneurship, public and private capital, and universal service programs. These resources enable not only network deployment, but also the ability to ensure that the services provided over those networks remains robust and affordable (and can be upgraded over time) over the decades-long lives of the underlying networks. Recent reforms to the Universal Service High-Cost fund, however, have resulted in a budget shortfall that will result in fewer locations being reached, comparatively lower speeds being delivered to locations that are being reached, and higher rural consumer broadband rates. This budget shortfall cuts support to companies like WCVT that still need to upgrade portions of their network, and it thus undermines the ability of committed companies like WCVT to deliver – and keep delivering – on the promise of broadband that creates Smart Rural Communities.

While it is critical to deliver broadband to the unserved, it is just as critical that those already receiving broadband remain served. There are many places in rural America where networks have been built by committed companies like those in NTCA's membership, but the sustainability of that infrastructure and the affordability of services remain in question. In many parts of rural America, the challenges of distance and density are so great that they cannot sustain even one broadband network. Section 254 of the Communications Act therefore rightly recognizes that our national policy is not merely about deploying infrastructure, but also ensuring that such infrastructure, once deployed, means something for the consumer – that is, "reasonably comparable" services at "reasonably comparable" rates for urban and rural consumers alike. If a network is built but then becomes unsustainable, or if the services offered over it are unaffordable or unreliable or cannot keep pace with increasing consumer

[7] Broadband's Contribution to Economic Health in Rural Areas" (2015), Community& Regional Development Institute, Cornell University.
[8] Searching for Work in the Digital Era" (2015), Pew Research Center, Washington, D.C.

demand, then these outcomes deny rural Americans the benefits of broadband and represent a terrible waste of the resources that help to make broadband infrastructure available in the first instance.

CONCLUSION

It is clear that broadband enables and fosters innovative economic development, commerce, health care, education, and other activities and capabilities that contribute to the success and well-being of communities. Many of these achievements in leveraging broadband infrastructure for the benefits of communities have been highlighted in NTCA's Smart Rural Community program. Small, rural broadband providers are eager to continue deploying infrastructure and delivering services that rural America needs to participate in the modern world. We look forward to working with policymakers and other stakeholders on comprehensive strategies that provide the tools and capabilities needed to achieve our nation's shared broadband goals.

Thank you for the opportunity to testify, and for the Subcommittee's commitment to creating an environment conducive to innovation.

Mr. LATTA. And thank you very much for your testimony this morning. And the Chair now recognizes for 5 minutes for your statement, Dr. Clark. Thanks for being here.

STATEMENT OF JENNIFER CLARK

Dr. CLARK. Good morning and thank you. My name is Jennifer Clark. I am an associate professor of Public Policy at the Georgia Institute of Technology and the director of Georgia Tech's Center for Urban Innovation. I would like to begin by thanking Chairman Latta, and also thanking the members of the subcommittee for making this opportunity available to us to testify to you today.

Smart communities are critical to the future economic competitiveness of the U.S. Over 90 percent of the country's GDP is generated in metropolitan economies that is cities and their suburbs. Smart communities are not just an opportunity to increase economic growth and opportunity, but they present a challenge as well: Does the U.S. invest in intelligent infrastructure to build the 21st century economy and plan for what is beyond? Or does the U.S. miss the moment when targeted investments and integrating information and communications technologies into infrastructure systems could form the foundation of an industry 4.0 level cyber-physical system?

The economic opportunity presented by smart communities is threefold. First, the data produced by intelligent infrastructure promises to increase the reliability of local government services and performance of infrastructure systems. The data paves the way for building interoperable and cross-platform systems that build efficiencies and ultimately allow localities to provide higher quality services at a lower cost. The result is the opportunity to expand services and maintain more reliable and efficient systems ranging from waste management to transportation.

The second opportunity is that smart communities' data systems can enhance and inform the strategic planning capacities of local communities, large and small, with real world data on how infrastructure systems are used by citizens and businesses and how that infrastructure is performing in real time. Further, the sharing of data amongst smart communities partners and participants helps to build networks for diffusing policy strategies and technology models.

These strategic partnerships form the foundation for the third economic opportunity that flows from smart communities: entrepreneurship and market leadership. The data generated by and for smart communities systems and the systems that produce that data form the foundation of new enterprises and new products and services and as a consequence function as platforms for further economic development.

The making of smart communities follows a model of technology diffusion familiar in the private sector context. This, however, is technology diffusion in the public sector context where there is a necessary focus on the broad provisioning of reliable and efficient services and a consideration for building access to data for enterprise development.

In the U.S., the national innovation system largely relies on publicly funded basic research and development conducted within the

network of world class research universities and national labs throughout the country. For decades, these universities and national labs have served as the research and development backbone of U.S. industry as well as of national defense.

Research universities have extensive experience partnering with industry and government on technology diffusion projects. Research universities are built to test new technologies, evaluate alternatives, assess investments, evaluate economic impacts, measure distributional consequences, and certify processes, materials, products, and standards. As with any new enabling technology, research universities can play a role as a neutral third party with specialized technical expertise.

Universities also are embedded in local communities and often have long term working relationships with local and State governments. Research universities also have vested interests in upgrading and maintenance of intelligent infrastructure in the cities and communities in which they are located. World class industry partners, star scientists, and the next generation of entrepreneurs all look for intelligent infrastructure to support their research and commercial enterprises. The absence of this infrastructure makes universities less globally competitive for talent and for capital, and as stated before such absences make local communities less globally competitive as well.

There is a significant amount of research required to move smart communities' technologies from design to development to deployment. There is a growing need for education and training. In research universities like Georgia Tech, we are developing new curriculum to integrate teaching and learning about innovation and communities, technology and cities and regions.

We are also investing in research centers like the Center for Urban Innovation and the Institute for People and Technology that take an interdisciplinary approach to moving innovations in engineering, sciences, and computing into a complex real world context of communities, entrepreneurs, and industries. How to design and deploy intelligent infrastructure to efficiently and effectively support smart communities is one of the central questions going forward for the country as a whole and for local communities in specific.

Building the replicable models and dissemination networks for the broad and sustained implementation of information and communication technologies into the next generation of national infrastructure is the opportunity and the challenge before us.

[The prepared statement of Dr. Clark follows:]

Georgia Tech | Center for Urban Innovation

WRITTEN STATEMENT

Disrupter Series: Smart Communities

A HEARING OF THE

Subcommittee on Digital Commerce and Consumer Protection

US House Energy and Commerce Committee

Submitted By:

Dr. Jennifer Clark

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Disrupter Series: Smart Communities

Summary: Making Smart Communities: Streamlining Research, Development, and Deployment

Smart communities are critical to the future economic competitiveness of the United States. Smart communities are not just an opportunity to increase economic growth but they present a challenge as well: Does the U.S. invest in intelligent infrastructure to build the 21st century economy and plan for what's beyond?

The Federal Government has an important role to play in shaping the scope and scale of intelligent infrastructure investments going forward. In short, the Federal Government will decide the platform on which the national economy is built going forward and whether it meets 20th century standards or sets a new standard for the 21st century economy. Research universities have extensive experience partnering with industry and government on technology diffusion projects like smart communities. Research universities are built to test new technologies, evaluate alternatives, assess investments, evaluate economic impacts, measure distributional consequences, and certify processes, materials, products, and standards. As with any new enabling technology, research universities can play a role as a neutral third party with specialized technical expertise. Further, universities are embedded in local communities and have long-term working relationships with local and state governments and a vested interest in the presence of world class infrastructure in their own communities.

How to design and deploy intelligent infrastructure to efficiently and effectively support smart communities is one of the central questions going forward for the country as a whole and for local communities in specific. Building the replicable models and dissemination networks for the broad and sustained implementation of information and communication technologies into the next generation of national infrastructure is the opportunity and the challenge before us.

Introduction

"Smart communities" have captured the attention of popular audiences and experts alike. The "Smart City" concept promises access and opportunity as well as expanded services and increased efficiencies for local communities. The idea promises simultaneously to generate new revenue via new markets, products, and services and to save money through new efficiencies and systems optimization. Advocates argue that smart communities are more efficient, more sustainable, more profitable, and more inclusive.

Economic geographers have long studied innovation as part of the broader disciplinary project of mapping and analyzing the spatial distribution of economic activities within and across cities, regions, and countries. In recent years technology and innovation have gained privileged positions of prominence in these industry analyses. Researchers particularly focused on processes of technology diffusion and how regional economic ecosystems absorb new technologies and incorporate them into existing complexes of firms, industries, and industrial specializations. In other words, how incumbent systems incorporate new processes, products, materials, and actors.

Smart communities are a challenge and an opportunity for the U.S. The challenge is to proactively engage the declining, incumbent national infrastructure system and not merely repair it, but replace it, with an internationally competitive cyber-physical system which provides not only an opportunity for better services for citizens but a platform for a 21st century, high tech economy and beyond.

Smart Communities and US Economic Competitiveness

Smart communities are critical to the future economic competitiveness of the U.S. Over 90 percent of the country's GDP is generated in metropolitan economies --- in cities and their suburbs.[1] Smart communities are not just an opportunity to increase economic growth and opportunity but they present a challenge as well: Does the U.S. invest in intelligent infrastructure to build the 21st century economy and plan for what's beyond? Or, does the U.S. miss the moment when targeted investment in integrating information and communications technologies (ICT) into infrastructure systems could form the foundation of an "Industry 4.0" level cyber-physical systems. The state of U.S. infrastructure and amount of funding devoted to it undermines U.S. global leadership in smart communities innovation and implementation. The American Society of Civil Engineers' latest report card ranked America's infrastructure at a D+, requiring $3.6 trillion in investment.[2] The question is how can the U.S. plan a smart communities future, and the research and development necessary to support it, when there is such a critical gap in incumbent infrastructure systems?

The economic opportunity presented by smart communities is three-fold. First, the data produced by intelligent infrastructure promises to increase the reliability of local government services and performance of infrastructure systems. The data paves the way for building interoperable and cross platform systems that build efficiencies and ultimately allow localities to provide higher quality services at a lower cost. The result is the opportunity to expand services and maintain more reliable and efficient systems ranging from waste management to transportation.

[1] From the U.S. Metro Economies GMP and Employment Report (2015-17), the United States Conference of Mayors: "Metropolitan areas drove the US economy in 2015. They were home to 85.7% of the nation's population, 87.7% of total employment, 87.9% of total real income, 91.3% of wage income, and 90.8% of GDP."
[2] 2017 Infrastructure Report Card, American Society of Civil Engineers

The second opportunity is that smart communities data systems can enhance and inform the strategic planning capacities of local communities --- large and small --- with real world (continuous and real time) data on how infrastructure and infrastructure systems are used by citizens and businesses and how the infrastructure is performing. Local communities, businesses, and citizens will be able to see how their community is operating rather than model its functions based on past performance.

Further, the sharing of data amongst smart communities partners and participants helps to build networks for diffusing policy strategies and technology models. These strategic partnerships form the foundation for the third economic opportunity that flows from smart communities: entrepreneurship and market leadership. The data generated by and for smart communities systems (and the systems that produce that data) form the foundation of new enterprises and new products and services and, as a consequence, function as platforms for further economic development.

"Intelligent Infrastructure": Next Generation Services and Structures

The promise of "smart" or "intelligent" infrastructure is that it will increase resilience across domains of critical infrastructure systems by expanding capacities and building resiliency through increased interoperability. In other words, by moving from a collection of discrete infrastructure systems to truly interdependent infrastructure ecosystems, the efficient, effective, predictable, and adaptive delivery of services will increase as well.

Across disciplines ranging from engineering to computer science to innovation policy, intelligent infrastructures are increasingly seen as solutions to the "wicked" problems that face local governments.[3]

[3] See Patton, Carl V, David S. Sawicki, and Jennifer J. Clark (2012) Basic Methods of Policy Analysis and Planning. New York: Routledge. 3rd Edition.

These problems include how to respond to both long term and short term threats to resilience: 1) strained resources spread across ever growing urban populations, 2) aging infrastructures and public services systems, 3) competitiveness in the global economy, and 4) acute human and environmental stressors.

In recent years, governments ranging from dense urban environments to rural communities have made significant investments in smart and connected communities (SCCs), leveraging the capacity of information and communication technologies (ICTs) to improve existing operations and develop new services. The resulting "intelligent infrastructure" is dependent on a layer of new technologies to collect and store data, combine data from both fixed and mobile sensing devices, integrate existing data sets, and report the status of the city to user groups including businesses, governments, and communities. These new data streams come from connected, self-reporting, sensing devices (e.g. the Internet of Things, or IoT), citizen contributions (e.g. crowdsourcing), and municipal and official sources (e.g. open government data). These new capacities contribute to an increasingly complex system of users, platforms, interests, and information—with profound implications for systems design and governance.

This infrastructure presents particular challenges because it is integrated both into and across different critical infrastructures. From water and electricity systems and across built, natural, and socio-economic environments, robust intelligent infrastructure is increasingly required for the secure and resilient operations of government services and systems. As a consequence, this infrastructure-of-infrastructures presents a unique problem for critical infrastructure: how to integrate the capabilities and capacities of intelligent infrastructure into incumbent systems while mitigating interruptions, reducing exposure to threats, and ensuring continuity of service? In short, intelligent infrastructure requires attention in its own right as a new critical public infrastructure.

Intelligent infrastructure is quickly becoming central to the operations of critical infrastructure providing services ranging from water, to energy, to multi-modal transportation, to health, to communications. And, economic competitiveness is increasingly tied to the reliability and resilience of these critical infrastructure.[4] Simply put, places without robust intelligent infrastructure systems will be left behind in the global economy because their critical infrastructure systems — utilities, energy, transportation, health, and emergency services — will be not be competitive compared to places who made the investments in cyber-physical systems to support operations.

Intelligent infrastructure directly impacts the management of systems through manual and semi- and fully-autonomous interventions, such as allowing changes to traffic lights during a period of heavy vehicle throughput. Intelligent infrastructure also indirectly impacts existing systems by providing information important to design, maintenance, and decision-making from operations to city planning and administration. The products currently emerging in the context of smart communities are largely service-embedded goods built on a platform of critical infrastructure systems. In other words, smart communities cannot move forward without intelligent infrastructure. Smart communities require: 1) connectivity (reliable, predictable, interoperable, and upgradeable), 2) analytical services (expertise and assets to make data legible and useable), 3) data storage and management services (including security and privacy), and 4) open access to data through platforms and interfaces for citizens, entrepreneurs, and incumbent firms to build enterprises and expand engagement.

[4] See Clark, Jennifer (2013) Working Regions: Reconnecting Innovation and Production in the Knowledge Economy, London: Routledge. See also Clark, Jennifer, Hsin I. Huang, and John P. Walsh (2010) A *Typology of Innovation Districts: What it Means for Regional Resilience*. Cambridge Journal of Regions, Economy and Society. 3 (1): 121-137.

For example, a "smart cities object" — a trash can, a streetcar, a light pole, a traffic light — requires embedded sensors. Those sensors require connectivity (fiber, wireless, etc.). The object requires a service contract to maintain and manage that connectivity. Data analytics are required to manage the resulting data and perform analysis. Interfaces and visualization tools are required to make the data accessible to citizens and businesses. Smart communities are a market-making enterprise and failing to invest in intelligent infrastructure misses the opportunity to provide local communities with globally competitive roads, bridges, and transit but also abdicates the opportunity to build a new industry around the products, services, and systems developed on the platform of intelligent infrastructure.

Making Smart Communities: Streamlining Research, Development, and Deployment

The making of smart communities follows a model of technology diffusion familiar in the private sector context. This, however, is technology diffusion into a public-sector context where there is a necessary focus on the broad provisioning of reliable and efficient services and a consideration for building access to data for enterprise development. There are significant private sector participants in smart communities and some of these firms have created consortiums to offer communities integrated and interoperable packages of hardware, software, and connectivity services.

In the U.S., the national innovation system largely relies of publicly-funded basic research and development conducted within the network of world class research universities throughout the country. For decades, these universities have served as the research and development backbone of U.S. industry and of national

defense.[5] Research indicates that this national innovation has been effective in bringing forward new technologies and in facilitating the commercialization of new products, processes, and materials.

In the smart communities context, research universities are again serving an essential role in the research and development phase of smart communities innovation. At Georgia Tech, we are engaged in developing new policy models for smart communities as well as new technologies including data analytics, sensor networks, and operating systems. Through this research we have identified four key elements in smart communities technology projects: 1) Phased technical deployment to increase opportunities for in-action learning, community engagement and responsiveness, and integration of ongoing technical improvements, while simultaneously reducing the implementation burden on participating organizations, 2) Comprehensive administrative and technical strategies focused on interoperability that account for the necessary current and future need for systems to communicate and foster expansion over time, 3) Programmatic commitments to engaging the community at large, and to integrating concerns originating in everything from planning to technical specifications in meaningful ways and tailored to local conditions, 4) Established policies around open data and open innovation in order to ensure both continued access and local and regional economic development.[6]

Local governments are focused on managing growth and change in their communities and providing services to citizens. Rarely do local governments have internal research specializations. Although some larger local governments have made recent investments in innovation delivery teams, information management teams,

[5] Clark, Jennifer (2014) *Siting "Scientific Spaces" in the US: The Push and Pull of Regional Development Strategies and National Innovation Policies.* Environment and Planning C: Government and Policy. Pp.1-16

[6] For further information see the research project: MAPPD: Multi-Array Phased Participatory Deployment. MAPPD is a technical and strategic smart cities project developing a repeatable approach to scaling up a Smart City sensor network. MAPPD is a city-university partnership between the Georgia Institute of Technology and the City of Atlanta and a featured project of both the MetroLab Network and NIST's Global City Teams Challenge.

and resilience offices, these efforts remain focused on enhanced service delivery to citizens. Further, many of these efforts have been financed by philanthropic investments by leading national foundations interested in improving the quality of life and capacity for service delivery in local communities. In other words, even the exemplar smart communities programs are largely experiments with limited resources, limited timelines, and unclear scalability.

Research universities have extensive experience partnering with industry and government on technology diffusion projects. Research universities are built to test new technologies, evaluate alternatives, assess investments, evaluate economic impacts, measure distributional consequences, and certify processes, materials, products, and standards. As with any new enabling technology (biotechnology, nanotechnology, advanced manufacturing, photonics) research universities can play a role as a neutral third party with specialized technical expertise. Universities are also embedded in local communities and often have long-term working relationships with local and state governments. Research universities also have vested interest in the upgrading and maintenance of intelligent infrastructure in the cities and communities in which they are located. World class industry partners, star scientists, and the next generation of entrepreneurs all look for intelligent infrastructure to support their research and commercial enterprises. The absence of this infrastructure makes universities less globally competitive --- for talent and for capital. And, as stated before, such absences make local communities less globally competitive as well.

Rather than stand up research and development divisions in every local government in the country in order to assess and deploy smart communities technologies, it would be reasonable to again turn to the nation's network of world class universities, like Georgia Tech, to conduct the research and development work of smart communities and thus facilitate the path to deployment by local communities.

Finally, as research universities train the next generation of workers, citizens, and entrepreneurs, it is important to recognize that living and working in smart communities will be distinct from the built environment in which we live now. Whether the changes are immediately disruptive like autonomous vehicles or incremental adjustments to the skills required for living in and navigating the built environment (think automated grocery store check outs, smartphone based parking systems), investments in technical training for new and incumbent workers will be required to take advantage of the value-added these technologies bring to the labor market. Universities again will be critical partners in developing both these technologies and the skilled workforce required to capitalize on their contributions to national and regional growth.

Smart Communities Implementation and the Role of the Federal Government

In 2015 the U.S. Department of Transportation announced a Smart Cities Challenge for cities across the country. The competition was a "winner take all" grant which Columbus, Ohio won. But 77 other communities also applied for the grant. In other words, 77 local communities across the country pulled together strategic plans for implementing intelligent infrastructure systems in their own communities and tailored to their own needs. The Federal Government has long played an essential role in investing in infrastructure and in emerging technologies. Smart Communities combine both these roles. And communities across the country have demonstrated their readiness to move forward.[7]

The Federal Government has several key roles going forward. First, as noted above, smart communities involve technology diffusion into a complex private sector and public sector space --- and that space is also a place, a jurisdiction. The implementation of smart communities involves engaging real people in real places

[7] See the US Department of Transportation summary of the Smart Cities Challenge

in real time. Therefore, flexibility and policy tailoring will be essential to successful implementation. What works in New York City is unlikely to be exactly what works in Columbus or Savannah or Dallas. One size will not fit all.

Although the Federal Government should not set a standardized approach, the Federal Government should consider developing technical standards and platforms for data, connectivity, and integration of hard infrastructure and information and communication technologies to protect citizens and consumers from excessive experimentation. The National Transportation Safety Board's approach to guidance on autonomous vehicles is a good example of signaling to industry, local governments, and researchers about how to shape strategic planning and private investment while protecting consumers and citizens.[8] The National Institute of Standards and Technology's efforts to develop the global cities team challenge and convene industry, local governments, and universities to discuss and develop standards is an important start as well.[9]

Because smart communities technologies cut across domains they also do not fit neatly under a specific federal agency. Many of the efforts to consider and support smart communities have been partial and ad hoc. The recent call for public comments by the Networking and Information Technology Research and Development (NITRD) Program on the "Smart Cities and Communities Federal Strategic Plan: Exploring Innovation Together" is a start at coordinating planning across the Federal Government.[10]

[8] See US Department of Transportation Autonomous Vehicle Policy
[9] See US Department of Commerce, NIST Global Cities Team Challenge
[10] See the Networking and Information Technology Research and Development Program's Smart Cities and Communities Task Force

Georgia Tech and the City of Atlanta are partners in a national network designed for developing smart communities policies and technologies with the scalability of those models to other local governments in mind.[11] The MetroLab Network is a network of 38 cities, 4 counties, and 51 universities, organized into "city (or county) – university partnerships" focused on "research, development, and deployment" (RD&D) projects that offer technologically- and analytically-based solutions for challenges facing communities: mobility, security and opportunity, aging infrastructure, and economic development. One role for the Federal Government is in resourcing and institutionalizing these networked partnerships to support policy diffusion across communities and information exchange about how smart communities investments (programs, projects, and objects) perform as implemented. These networks allow local governments to achieve some economies of scale, build capacity, and avoid replicating mistakes or reinventing the wheel.

The Federal Government has an important role to play in shaping the scope and scale of intelligent infrastructure investments going forward. Simply put, the Federal Government will decide the platform on which the national economy is built going forward and whether it meets 20th century standards or sets the standard for the 21st century. There is a significant amount of basic research required to ascertain how to achieve the promise of smart communities. Some of that research can be resourced through programs like the Smart and Connected Communities program or the Critical Resilient Interdependent Infrastructure Systems and Processes (CRISP) program of the National Science Foundation. However, the current resources are modest investments in basic research and not of a sufficient scale to support the broad, national technology deployments necessary.[12]

[11] For more information about the national MetroLab Network's activities in supporting city and community partnerships please see their website.
[12] See NSF CRISP Program and the NSF SCC Program

There is also a significant amount of applied research required to move smart communities technologies from design to development to deployment. There is a growing need for education and training. In research universities like Georgia Tech we are developing new curriculum to integrate teaching and learning about innovation and communities, technology and cities and regions. We are also investing in research centers, like the Center for Urban Innovation and the Institute for People and Technology, that take an interdisciplinary approach to moving innovations in engineering, sciences, and computing into a complex real world context of communities, entrepreneurs, and industries.[13] How to design and deploy intelligent infrastructure to efficiently and effectively support smart communities is one of the central questions going forward for the country as a whole and for local communities in specific. Building the replicable models and dissemination networks for the broad and sustained implementation of information and communication technologies into the next generation of national infrastructure is the opportunity and the challenge before us.

[13] For more on Georgia Tech's Center for Urban Innovation and Institute for People and Technology's smart cities research and partnerships please see the websites.

Mr. LATTA. Dr. Clark, thank you very much for your testimony this morning, and Mr. Pazuchanics, you are recognized for 5 minutes. Thanks for being here.

STATEMENT OF ALEXANDER PAZUCHANICS

Mr. PAZUCHANICS. Thank you, Chairman Latta, acting Ranking Member Luján, all members of the House Energy and Commerce Subcommittee on Digital Commerce and Consumer Protection. On behalf of Mayor William Peduto and the City of Pittsburgh, I want to start by thanking you for the opportunity to speak with you today about Pittsburgh's emergence as a smart community. It is a pleasure to be here.

The City of Pittsburgh is a resilient city. Investments that were made by philanthropists and industrialists decades ago have helped to position the city to be on the leading edge of revolutions in health care, technology, and advanced manufacturing. A high quality of life and low cost of living attracts new residents from across the country and around the world. For the first time in a long time, we are managing growth instead of managing decline. Given this new opportunity, the City of Pittsburgh is attempting to reshape the way that residents interact with our local government.

An initial challenge of our Smart City work has been defining what it means to Pittsburgh. During the U.S. DOT Smart City Challenge, the definition was provided to us through the twelve Beyond Traffic vision elements including urban automation, connected vehicles, and sensor-based infrastructure. While these applications are vital to the city of the future, they are not goals in and of themselves.

The city has been building a three-part framework for smart cities, collaboratively using technology to measurable improve the quality of life of our residents and visitors, building a data utility for government, industry, and citizens to use, and preparing our systems and our residents for future disruption.

Our Smart City initiatives start with a simple question: what is the challenge we are trying to solve? Instead of letting the latest and greatest technology drive our decisions, we are oriented around real world problem solving. For example, the city has partnered on a number of projects with the Traffic21, Metro21, and newly created Mobility21 institutes at Carnegie Mellon University to use academic research to solve real issues in traffic management, infrastructure preservation, and transportation safety.

An example of a successful implementation of this method can be seen in the city's SURTRAC development. SURTRAC was designed by robotics researchers at Carnegie Mellon to solve system inefficiencies that occur as a result of fixed traffic signal timing. By detecting the volume of traffic at an intersection and providing that information to other signals in the network, the adaptive signals are able to provide more efficient light timings, reduce travel times and stops for vehicles. Future applications include additional capabilities to minimize not just vehicular delay, but also pedestrian wait times and using vehicle-to-infrastructure communications to optimize the flow of heavily occupied mass transit vehicles.

The second pillar of the Smart City strategy is a data infrastructure that allows for the city to operate more efficiently and to allow

the public and private sectors to build on top of our resources. In much the same way that our electric grid, water systems, and roadways and bridges allowed for Pittsburgh's success in the 20th century, our Data Utility will advance Pittsburgh into the 21st.

We have been laying the technical groundwork on this work for several years. The city, county and University of Pittsburgh are partners in the Western Pennsylvania Regional Data Center, a regional effort to make public non-sensitive municipal data. For Pittsburgh, this collaborative structure has been a tremendous success and has brought a number of outside partners to the table to publish their own datasets.

Over 150 datasets provided by local government, public agencies, university partners, and nonprofit organizations help citizens engage with the communities they call home. Trainings, hackathons, and partnerships with local libraries are producing a vibrant ecosystem of civic tech that engages with us, creating a feedback loop.

The final pillar of Pittsburgh's Smart City strategy is the need to build a policy and planning framework around the considerable disruption technology is going to continue to play in the way that we deliver services to residents. Many of the innovations in the Smart City space are in the private sector. Some of them, such as autonomous vehicles and transportation network companies, rely on access to public right of way for their business models to work, and an appropriate and even-handed framework that balances safety with innovation is required for the good of our residents.

Pittsburgh's strong working relationship with the Pennsylvania Department of Transportation and our recent designation as an Autonomous Vehicle Proving Ground will allow us to continue to represent these concerns of our residents on the subject.

The potential for autonomous, connected, electric, and shared vehicles pose significant uncertainty for cities. For example, the City of Pittsburgh receives nearly 15 percent of its general fund revenue from parking tax, a source that could be reduced as a result of autonomous vehicles. Likewise, changes in parking demand have significant effects on the financing of public garages and parking minimums for development. And perhaps most importantly, technological development will create disruptions in employment for the transportation and logistics industry, requiring thought on the future of work and the pathways to advance manufacturing, cybersecurity, and data science jobs of the future.

The City of Pittsburgh is approaching our Smart City deployments by keeping these three concepts in mind. We are trying to harness the promise of new technology to benefit our residents first. We believe these initiatives and others that will come can improve the quality of life of residents by improving safety, reliability, efficiency, and resiliency of our networks. Slowly but surely, we are making the investments and finding the partnerships to advance those goals. Thank you.

[The prepared statement of Mr. Pazuchanics follows:]

United States House of Representatives
COMMITTEE ON ENERGY AND COMMERCE
Subcommittee on Digital Commerce and Consumer Protection

Subcommittee Hearing
Disrupter Series: Smart Communities
Thursday, March 16, 2017

Written Testimony of:
Alexander Pazuchanics
Policy Coordinator, City of Pittsburgh, Pennsylvania

Summary

The City of Pittsburgh is changing rapidly. Investments made by philanthropists and industrialists decades ago have helped position the city to be on the leading edge of revolutions in healthcare, technology, and advanced manufacturing. A high quality of life and low cost of living attracts new residents from across the country and around the world. For the first time in a long time, we are managing growth instead of managing decline. Given this new opportunity, the City of Pittsburgh is attempting to reshape the way that residents interact with our local government.

The City has been building a three part framework for smart cities: Collaboratively using technology to measurably improve the quality of life of our residents and visitors, building a data utility for government, industry, and citizens to use, and preparing our systems and our residents for future disruption. We believe that these initiatives and others that will come can improve the quality of life for residents by improving safety, reliability, efficiency, and resiliency of our networks. And slowly but surely, we are making the investments and finding the partnerships that advance those goals.

Full Testimony

Chairman Latta, Ranking Member Schakowsky, and all members of the House Energy & Commerce Subcommittee on Digital Commerce and Consumer Protection, on behalf of Mayor Peduto and the City of Pittsburgh, I want to start by thanking you for the opportunity to speak with you today about Pittsburgh's emergence as a "smart community." It is a pleasure to be here.

The culture of the City of Pittsburgh is one of innovation. The industrial base that made Western Pennsylvania the engine of the country was not only built on manufacturing, but on research and development. US Steel, Westinghouse, Alcoa, and others produced products and materials, but also inventions and improvements. That history of innovation led to a number of firsts that we still take pride in today: the first commercial radio station, the first polio vaccine, and the first robotics center, among others.

But in Pittsburgh we're also keenly aware of the side-effects those innovations can create. When Pittsburgh was described as "Hell with the lid off", it was not meant to be a compliment. Only through a concerted partnership of the public sector and industry were Pittsburgh's air and water improved.

Disruptions in manufacturing during the 1970s and 1980s posed challenges of a different sort. Depopulation in the region during that time have been eclipsed only by post-Katrina New Orleans. Unemployment in some parts of Western Pennsylvania approached 20%. As a result we are now a city half the size of our peak in the 1960 census. These changes decimated City

government, putting us on the path to seek oversight from the Commonwealth of Pennsylvania's program for distressed municipalities in 2003.

Yet we are a resilient city. Investments made by philanthropists and industrialists decades ago have helped position the city to be on the leading edge of revolutions in healthcare, technology, and advanced manufacturing. A high quality of life and low cost of living attracts new residents from across the country and around the world. For the first time in a long time, we are managing growth instead of managing decline. Given this new opportunity, the City of Pittsburgh is attempting to reshape the way that residents interact with our local government.

An initial challenge in our "smart cities" work has been defining what it means to Pittsburgh. During the USDOT Smart City challenge, the definition was provided to us through the twelve *Beyond Traffic* vision elements including urban automation, connected vehicles, and sensor-based infrastructure. While these applications are vital to the city of the future, they are not goals in and of themselves. They also relate almost exclusively to transportation, which is only one aspect of the broad range of services that local government provides.

The City has been building a three part framework for smart cities: Collaboratively using technology to measurably improve the quality of life of our residents and visitors, building a data utility for government, industry, and citizens to use, and preparing our systems and our residents for future disruption.

Our smart city initiatives start with a simple question: what is the challenge we are trying to solve? Instead of letting the latest and greatest technology drive our decisions, we are oriented around real world problem-solving. For example, the City has partnered on a number of projects with the Traffic21, Metro21, and newly created Mobility 21 Institutes at Carnegie Mellon University to use academic research to solve real issues in traffic management, infrastructure preservation, and transportation safety.

An example of successful implementation of this methodology can be seen in the City's SURTRAC deployment. SURTRAC (Scalable Urban TRAffic Control) was designed by robotics researchers at Carnegie Mellon to solve the system inefficiencies that occur as a result of fixed traffic signal timing. By detecting the volume of traffic at an intersection, and providing that information to other signals in the network, the adaptive signals are able to provide more efficient light timings, reducing travel times and stops for vehicles. Future applications include additional capabilities to minimize not just vehicular delay but also pedestrian wait times, and using vehicle to infrastructure communications to optimize the flow of heavily occupied mass transit vehicles. The success and potential of adaptive traffic signal networks in Pittsburgh led to our successful application to the Advanced Transportation and Congestion Management Technologies Deployment Program application to upgrade dozens of new intersections along "Smart Spines"- the two and four lane roads that are the backbone of transportation through the valleys and across the bridges that make up our City. As we make investments in those corridors, it is a perfect opportunity to layer additional communications, stormwater, and energy infrastructure supported by technology and to improve connections between historically isolated neighborhoods and major centers of employment and educational and healthcare services.

Just last week, Pittsburgh released a request for information focused on smart streetlight technologies, looking for ideas from the community of innovators that will enable and enhance the services we provide. As we plan to replace the entirety of our 40,000 city-owned and operated streetlights, Pittsburgh has the potential to build out a platform for future deployments such as mid-block traffic detection, gunshot detection, air quality monitoring, and public wifi access. We are exploring new models of public-private partnership that can finance these new investments and help us manage the constantly evolving technology risk.

The second pillar of our Smart City strategy is a data infrastructure that allows for the City to operate more effectively, and to allow the public and private sectors to build on top of our resources. In much the same way that our electric grid, water systems, and roadways and bridges allowed for Pittsburgh's success in the 20th century, our Data Utility will advance Pittsburgh into the 21st.

We have been laying the technical groundwork for this work for several years. The City, County, and University of Pittsburgh are partners in the Western Pennsylvania Regional Data Center, a regional effort to make public non-sensitive municipal data. For Pittsburgh, this collaborative structure has been a tremendous success, and has brought a number of outside partners to the table to publish their own data. Over 150 datasets, provided by local governments, public agencies, university partners, and non-profit organizations help citizens engage with the communities they call home. Trainings, hackathons, and partnerships with local libraries are producing a vibrant ecosystem of civic tech that engages with us, creating a feedback loop. In

response to resident concerns, the City recently used the data it publishes on the Data Center to create public-facing information portals where residents can find out about neighborhood building permits, response times for constituent concerns, and tax delinquency.

Our push for innovation is also internal. The smart community must use connected technology and data to enhance city services and increase the efficiency of its own operations. Our Analytics & Strategy team, housed in our Department of Innovation & Performance, works with the city departments to enhance service delivery and ensure data-driven performance. A salient example comes from our Department of Public Works, which is deploying sensors in litter cans to monitor the fill level. By knowing which cans need to be emptied, the City can reduce the time spent on collection by 33%, representing a major increase in efficiency that will save the City money and afford time to focus on other Public Works priorities.

A number of city departments are using custom, interactive maps to view and make decisions based on city data. These maps, cleverly named Burgh's Eye View, allow our fire department to see up-to-date building code violations - to better understand a building before entering it. They allow our police department to monitor 311 requests for city service and see when residents request graffiti removal, note excessive noise, or submit a host of other requests connected to their quality of life. These cases remind us that the smart community isn't just about self-driving cars and sensors, but has mechanisms to learn from itself, and make decisions to improve performance that are based on data.

The final pillar of Pittsburgh's Smart City strategy is the need to build a policy and planning framework for the considerable disruption technology is going to continue to play in the way that we deliver services to residents. Many of the innovations in the Smart City space are in the private sector. Some of these innovations, such as autonomous vehicles and transportation network companies, rely on access to public right of way for their business models to work, and an appropriate and even-handed regulatory framework that balances safety with innovation is required for the good of our residents. Pittsburgh's strong working relationship with the Pennsylvania Department of Transportation and our recent designation as an Autonomous Vehicle Proving Ground will allow us to continue to represent the concerns of our residents on the subject.

The potential for autonomous, connected, electric, and shared vehicles poses significant uncertainty for cities. Depending on advances in technology and cultural adoption rates, large-scale deployment of these innovations could be a matter of decades or a matter of years away. Local governments have operated on a series of assumptions for the last half century which could be substantially upended by these technologies. For example, the City of Pittsburgh receives nearly 15% of its revenue from parking tax, a source that could be eliminated. Likewise change in parking demand could have significant effects on the financing of public garages and parking minimums for development. Competition for precious curb space across different users including rideshares, charging infrastructure, and drone-enhanced deliveries could force a rethinking of land use patterns in the City. The potential for significantly improved efficiency and safety of the transportation network as a result of technology should factor heavily into any decision to debt-finance capacity expansions. And most importantly, technological advancement

will create significant disruptions in employment for the transportation and logistics industry, requiring thought on the future of work and the pathways to the advanced manufacturing, cybersecurity, and data science jobs of the future.

The City of Pittsburgh is approaching our Smart deployments by keeping these three concepts in mind. By focusing on real use cases of need, making data available to the public, and preparing for disruption, we are trying to harness the promise of new technology to benefit our residents. We believe that these initiatives and others that will come can improve the quality of life for residents by improving safety, reliability, efficiency, and resiliency of our networks. And slowly but surely, we are making the investments and finding the partnerships that advance those goals.

The mayor likes to say that Pittsburgh is small enough that you can get all of the right people together to get a project off of the ground, and big enough that when you do, the world takes notice. The lessons we are learning in our urban laboratory can be imparted across the country, and on behalf of the City, we are grateful for the opportunity to share what we have found. Thank you.

Mr. LATTA. Thank you very much for your testimony, and thank you again, all of our witnesses, for the testimony today. And that will conclude the testimony from our witnesses, and we will go into questions from the committee. And I will start off with my questions this morning and this is actually for all of the panel and if you could all maybe give a brief answer.

Safety is regularly mentioned as a benefit of improving local transportation, infrastructure, energy delivery, and health care including emergency services. What improvements in safety have your communities experienced or are trying to achieve with your smart communities initiatives?

And Ms. Gallagher, if we could start with Columbus.

Ms. GALLAGHER. Chairman Latta, thank you for the question. I think on the side of safety for us, we all, most of us here know that 37,000 deaths occur on our Nation's freeways every year, so if you do the quick math that is over a hundred a day. That is unacceptable, and anything we can do to fix that is obviously a positive.

So one of those things are just making cars safer in taking the human element out of it. The second is giving people other options and opportunities to perhaps not have to drive that car themselves. So with our Smart Columbus program, a few of the things that we are doing on the quick end is putting Mobileye on all of the buses in Columbus, where the Mobileye will scan as buses are going up and down the streets and check for pedestrians, bicyclists, other things that maybe you can't see in a COTA bus, all the way to towards the end our demonstration period, the autonomous vehicles, and taking that human error out of the driving experience and all things in between.

Mr. LATTA. Thank you. Mr. Chisek?

Mr. CHISEK. Well, in Portland, one of the things we are looking at, and I alluded to it in my opening statement, was focusing on intersections where we know we have problems and finding out about problems before they result in crashes and fatalities.

So in east Portland you are about three times as more likely to die in a fatal crash than anywhere else in the city, but by focusing on these high crash locations or corridors where we know we have a lot of crashes, with video infrastructure, with other sensors to gather data, we can track near misses and that can tell us ahead of time that oh, there are a lot of near misses with pedestrians and vehicles or bicyclists and vehicles at particular locations, and we can then use our civil engineering groups to create a fix for that before anybody gets seriously injured or killed since we would have the data on that. So that is one of the things we are looking at.

Mr. LATTA. Thank you. Ms. Berman?

Ms. BERMAN. So we are actually doing something similar to Portland because we are part of the Vision Zero project as well. One of the key roles of the Array of Things is to focus on intersection safety. There is a lot of data about actual accidents but there is very little data today about those near misses. And the Array of Things is calibrated to calculate those data, or to calculate data around near misses without actual need of the civil engineers, so it actually creates those calculations so that we can understand better those near misses.

We also actually are using safety cameras across the city to provide safety data and analytics to our police department to help them better understand what is going on across the city to create better safety situations as well.

Mr. LATTA. Thank you. Mr. Gruendling?

Mr. GRUENDLING. So I come at it from the service provider side, so you know we have worked obviously with local and State officials to connect cameras to view road conditions real time. This is certainly very relevant with the snowstorm that we just experienced. You know, when I left Burlington I saw that it was 29.9 inches of snow and over 40 in the mountains.

So there is different locations throughout the State that are set up, including one that we service with fiber optics up on Route 17 that allows people to check real time to see what the road conditions are, and you know that they can deploy resources, snow plows, whatever, using that technology in addition to having all the snow plows now GPS-enabled to see, you know, on a map what has been plowed, where additional resources are needed, et cetera.

Mr. LATTA. Thank you. Dr. Clark?

Dr. CLARK. I can speak to this from the research that we are doing in collaboration with the City of Atlanta. And one of the research projects that we have just started has to do with working with the Safe Routes to School program, which is an existing program, and working with having young people use sensors to help crowdsource, get crowdsource with the information about what the safest route back and forth to school really is for them and their families. And so we can actually then take that information and make recommendations about where improvements to intersections, improvements to sidewalks can also be made.

We also are doing that with bicycle routes so that we are crowdsourcing bicycle routes, so users who are actually telling us, using an app, what the safest routes are, what the more dangerous routes are, and then that information can be fed back to the city in order to make specific infrastructure investment to mitigate those problems.

Mr. LATTA. Thank you. Mr. Pazuchanics?

Mr. PAZUCHANICS. One of the new projects that we are quite excited about is a Smart Belt Coalition of the Departments of Transportation and Turnpike Commissions of Ohio, Michigan, and Pennsylvania. And one of the projects associated with that is to be able to allow for truck platooning among the major interstate corridors of those three States which promotes not just efficiency in the freight system, but also safety delivery, having the vehicles communicate with one another to maintain and safe and healthy distance while being able to move at a speed faster than the humans would be able to provide in and of themselves.

Mr. LATTA. Well, thank you very much, and my time has expired. And the Chair recognizes the gentleman from New Mexico for 5 minutes.

Mr. LUJÁN. Thank you, Mr. Chairman. Two questions for the panel: what should the Federal Government do to assist in development to smart communities? And what have been some of the challenges—maybe three questions. What have been some of the challenges that you have identified with the Federal Government? For

example, Mr. Chisek, in your testimony you talked about the challenges of being able to access different funds because of, you know, telecom energy versus something else, and the ability to be able to combine those funds to be able to deploy a project.

And then I would say the final question is what thoughts do you have with access to existing infrastructure; has that been a critical component to being able to deploy your assets or resources from a Smart City perspective, and specifically pole location on light poles or electrical power lines, existing buildings or infrastructure that are owned by the city, as we talked about even the deployment of 5G now which will present more opportunities with smart cities as well?

Ms. Gallagher?

Ms. GALLAGHER. Thank you for the questions. As far as roles for Federal or State Government, from our point of view it would be helping define those regulations, those policies, those standards as we move forward into this uncharted territory, but yet allowing enough flexibility for locals to use those to be able to solve the problems they are seeing in their communities.

Second question was risk challenges with the Federal Government. I think probably the same thing on just trying to move as quickly as the changes and the technology in the private side is moving and to try to get that legislation, that funding in place to try to keep up with those. It is a challenge at all levels of government.

And then thirdly, as far as infrastructure, and you know we are having some of those dialogues right now in Ohio with some of the utility providers, as far as who has what rights and priorities on and poles and infrastructure and so forth. So that is going to continue to be a challenge as we move forward because there is such a need for that infrastructure and those are conversations that we are going to continue to have, but I think are very, very important.

Mr. LUJÁN. Anything to add, Mr. Chisek?

Mr. CHISEK. Thank you. So I will address the middle question first which was some of the challenges with the Federal Government. I think different agencies have different wants and needs and so the city definitely would, like I said when things are more aligned between the different agencies so we can address it directly rather than in different ways. We also understand that on some of the procurement side of things that the rules and regulations are different for different agencies we are interacting with, so again moving that to that common alignment and trying to problem solve and be more innovative on how we move these things forward.

I think as far as challenges and co-location, we are working with a consortium of private companies and our electric utility on deploying smart sensor technology on our light poles. You know, it does get complicated, but we have good partnerships with these private industries so we are able to work things out. Our private electric utility owns the poles. We own the little arm that comes off of the poles, so we have for a long time have had the ability to work through these issues with them. We are doing the same thing with them on electric vehicle charging stations located in our right of way but owned and maintained by our private electric utility.

Mr. LUJÁN. And as we go to Ms. Berman, for the other witnesses I may not be able to get to I will submit that in writing as well and to get your thoughts in that particular area. Ms. Berman?

Ms. BERMAN. I will try to be very brief. Two supportive roles I think the Federal Government could play, one would be around coordination between the cities. We are all working on very similar problems. You saw one example just a minute ago where we are doing something really similar. The other would be there is a very strong focus on pilots, which is excellent. The challenges do change when you go from a successful pilot to scaling for an entire city and oftentimes the Federal support whether it be a grant or a challenge falls off from pilot to full scale, and so it would be very helpful to see the focus on helping projects go from that pilot to scaling the solution.

Mr. LUJÁN. Do you think there would be, and that is based from a scaling perspective, maybe collaborative efforts even with our national labs?

Ms. BERMAN. Yes. And that is the goal of the Array of Things, actually, is we are scaling a solution citywide there and it is going to multiple cities. So yes, the role of partnering with the national labs is very helpful, absolutely.

Mr. LUJÁN. Thank you. And with that Mr. Chairman, I yield back.

Mr. LATTA. Thank you. The gentleman yields back. The Chair now recognizes the vice chairman of the subcommittee, the gentleman from Mississippi, for 5 minutes.

Mr. HARPER. Thank you, Mr. Chairman, and thanks again to each of you for being here. And you know the technologies and the things that we are seeing already are just, you know, we couldn't even have really pictured this 20 years ago or even 10 years ago, and who knows what we are going to see as this is developed over the next number of years. So I really appreciate your testimony and your insight into what is going as we want to make sure that government is not in the way of innovation. You know, it seems sometimes regulations get a little bit behind that curve that we want to make sure we give folks the ability to be innovative and to come up with these things that are there.

You know, I certainly have an interest in the fact that I have an adult son with special needs who cannot drive. He works. He graduated from a special program called the ACCESS Program at Mississippi State University, one of the first two students to graduate from there almost 3 years ago. He has done a lot of stuff. But as we look at self-driving cars and things like that that could really help those in the disability community, you see some potential that we haven't seen before so we are excited about that.

And Dr. Clark, if I could ask you some questions. Of course our hearing is called, you know, Smart Communities. Do you see opportunities for smaller and rural communities to leverage these technologies that other cities on the panel have discussed, and also how are traditionally underserved communities, including those that are disabled, able to benefit from these technologies?

Dr. CLARK. Thank you very much for the question because I do feel like this is something we need to focus on is how to make that work. Yes, I mean the short answer is yes, I see those opportuni-

ties. I have some concerns about how those opportunities are going to appear. I think we need to plan for them.

One of the things that has been happening in the policy diffusion or the technology diffusion for smart cities rather than smart communities in recent years is that for larger cities vendors have been coming to larger cities and they have been saying we will give you this in kind so we can work out this technology in your city. You don't have to pay us for it, we are going to work it out here. Well, the smaller communities are not going to get that opportunity. They are going to get a price tag on the technology.

And I think this is one of the real challenges is that what is going to end up happening is a very uneven distribution of who has the high-tech technologies built into their infrastructure system and who doesn't. And so I think it absolutely is important for smaller and rural communities to be seen as an important part of this story, not as an add-on later, and also recognizing the fact that they don't have the tax base to pay the same prices.

One of the most interesting, and I will try to make this brief, but one of the most interesting conversations I had recently was I was making a presentation with my colleague from the City of Atlanta to the mayors of the region and you know we have 23 different counties in the Atlanta region, it is a huge region. And the mayors came up to us afterwards and they said, so how do we become part of the smart communities partnership, how do we get access to this technology?

And I thought, I am overwhelmed. I don't know. I don't have a program to direct you to, I don't have a funding source to direct you to, all I can tell you is that we know we need to do this, but I can't give them an answer to when.

Mr. HARPER. Talk to me then for a minute about those that have disabilities, whether they are physical or, you know, we deal a lot with those with intellectual disabilities, so how do we incorporate that for them?

Dr. CLARK. Well, and I think this has a lot to do with the question of standards and thinking about digital inclusion instead of digital divide, right. And so one of the ideas is thinking about, and we have a number of researchers at my own institution who are working on trying to develop the technologies at the beginning so that they are actually someone who had limited eyesight or limited hearing actually could use the technology, because we don't build it for just people who can see in the first instance, instead of again, as I said, coming to that question later and saying oh, how do we retrofit this to be?

We have the technologies to actually build these for quite a broad set of capabilities and opportunities, but we need to design that on the front end and that takes some consideration and planning.

Mr. HARPER. Sure. Well, thank you. And I would encourage each of you in your roles to look at how we can do that and make sure that there is not a catch-up; that it is a bring-along as we go. And so with that I yield back.

Mr. LATTA. Well, thank you very much. The gentleman yields back. The Chair now recognizes the gentlelady from California for 5 minutes.

Ms. MATSUI. Thank you very much, Mr. Chairman, and I want to thank the witnesses. It has been wonderful hearing about what has been happening as far as smart cities and all the innovations that you have utilized. Now very exciting work is happening throughout all the communities across our country to harness the power of technology. In my home district of Sacramento we are also moving forward to embrace these opportunities. We are positioning ourselves as a test bed for, for instance, autonomous vehicles, and encouraging the development of electric vehicle infrastructure.

The City of Sacramento hosts an open data platform which promotes transparency and invites civic innovators to create solutions at the local level. Sacramento was selected as one of the 16 cities to join a partnership with Transportation for America and Sidewalk Labs to pilot new programs and develop best practices for Smart City policies and projects.

All this innovation will rely upon connectivity. This will place new demands not only on our roads and highways, but also on spectrum and infrastructure that powers wireless communications. The most important thing we can do is encourage smart communities is to accelerate the deployment of 5G networks. Verizon recently announced a pilot project to offer 5G in Sacramento and ten other cities. I am glad that Sacramento residents will soon see some of the benefits of super high wireless networks and every American community deserves access to these world class networks.

I am also looking at things like energy efficiency and air quality and I think some of you have brought this up. Cities already consume 75 percent of all energy used worldwide and urbanization is on the rise. These cities of the future as well as all smart communities will need to find innovative and sustainable ways to reduce their energy consumption. Energy efficient technology made possible by smart communities from smart grids to connected light bulbs have the potential to significantly benefit the environment and public health.

Well, all of you who represent cities, what features of your smart systems have that enable your cities to use energy more efficiently and sustainably? Ms. Gallagher, start with you.

Ms. GALLAGHER. Thank you, Congresswoman. So as part of the Smart City Challenge award that we received, $10 million of that came from the Vulcan foundation, and their entire goal is to reduce carbon emissions. So we are partnering with them on basically five different fronts. One is a smart grid which we are very fortunate in Columbus, Ohio, to have the American Electric Power Company headquartered there, so they are doing about a half-billion-dollar program for everything from smart meters up to helping us electrify homes for electric vehicles.

We also, another component of that is fleet, changing our fleet over to electric vehicles. It is consumer adoption of electric vehicles. We are partnering with Columbus Power on many, many ranges for smart grid and we are also looking at just the charging infrastructure in general. So just very quickly those are just some of the highlights that we are hitting for the carbon emissions.

Ms. MATSUI. OK, thank you. Mr. Chisek?

Mr. CHISEK. Thank you. Through the Smart City Challenge, Portland was actually fairly far ahead on the electric side of things. We have been working for quite some time on smart meters. What we want to do is take it to the next level now and move more into, say, port operations and how can we gain efficiency there both with energy usage but also electrification of some of their infrastructure as well.

Ms. MATSUI. OK, thank you. Ms. Berman?

Ms. BERMAN. So two things in Chicago, the first is our smart lighting project which will do an LED retrofit for 420,000 streetlights which will be getting underway later this year, and then we have an active smart buildings program which for buildings that the city owns introduces building control systems for all the city owned buildings, and on the policy side encourages the adoption of similar systems for privately owned buildings across the city to shrink the energy consumption for our building stock.

Ms. MATSUI. Thank you. And Mr. Pazuchanics? Paz?

Mr. PAZUCHANICS. Sure. Two projects, we, similar to the City of Chicago and a number of other cities, are also embarking on a streetlight conversion project for about 40,000 lights, so a bit smaller but that project we expect to realize significant energy savings.

The second piece is through system efficiency. As a result of the adaptive signal network that we are building we are seeing reductions in air quality emissions because the vehicles are spending less idle time in those corridors. Given our topography and the fact that you know everything in Pittsburgh sort of has to run through a valley in between mountains the particulate matter tends to concentrate, and so to the degree that we are able to move vehicles more efficiently and move mass transit more efficiently, we are seeing significant improvements in air quality in those corridors.

Ms. MATSUI. OK. Thank you very much. It looks like I have run out of time. Thank you. I yield back.

Mr. LATTA. Thank you very much. And now the gentleman from Indiana is recognized for 5 minutes.

Mr. BUCSHON. Well, first of all, thank you for being here. Thank you, Mr. Chairman. I don't know. I was in Shanghai a few years ago and all of a sudden at about a certain time of night all the lights went off in the entire city. Has anybody ever experienced that? I am not promoting that but I guess that is how they do energy efficiency. I mean, literally it looks like Vegas and then it is dark. It was the weirdest thing I ever seen in my life.

I want to focus on kind of some practical things and I do want to talk about rural broadband, because my district is primarily rural. And I really consider rural broadband like the electricity or the telephone of our age and especially in rural communities, so what things can we do to get broadband to rural communities? I mean, other than money. I mean, obviously that is important, but there is probably other things too.

Mr. GRUENDLING. Thank you for the question. Yes, I agree. I think rural connectivity is, you know, certainly a critical conversation we all need to have and certainly is a focus and you know it ties right in with economic development. I mean, some of the challenges we have as a local family-owned telecommunications carrier is really just some of the uncertainty in the recovery mechanisms

you know going forward in terms of, you know, we are building the fiber optic network of the future but it takes time and it takes money, and in Vermont we have a limited construction season, right. We have a few months that we can actually put infrastructure in the ground and that is a challenge as well.

But, you know, over the past couple of years at FCC, you know, we have seen reductions in our Universal Service funding, our access revenues, all at a time where we need to be stepping up our infrastructure investment in the fiber optic network of the future.

Mr. BUCSHON. Are there specific regulations that make it difficult and more costly to do these things?

Mr. GRUENDLING. Permitting.

Mr. BUCSHON. OK, so permitting is, I am assuming it is slow?

Mr. GRUENDLING. Absolutely.

Mr. BUCSHON. Yes. And who is that primarily from, what agencies?

Mr. GRUENDLING. It is a mix of local, State, and Federal issues.

Mr. BUCSHON. OK.

Mr. GRUENDLING. You know, including rights-of-way issues and certainly easements you know which can be challenging when dealing with local——

Mr. BUCSHON. Oh yes, I know.

Mr. GRUENDLING [continuing]. Landowners. Especially, I mean, with fiber optics too, you know, we are putting more and more electronics out in the field with splitter cabinets and what not which require easements and you know it takes time.

Mr. BUCSHON. So it is a complicated problem, because I mean I have schools, you know, I mean, if kids can't get fast internet, you know, I mean, how can you have kids out in the rural communities learning when they—I literally have some people that almost essentially have dial-up. I mean they don't have access to the internet, so that is a big problem in our country.

So what I would like to do is if there is any barriers at the Federal level, you know, we need to try to work on those to improve that. And I do think at some point, you know, I have talked to the big carriers also about this and at some point, you know, or I am hopeful that the private sector can solve most of these problems, but there may very well be, like I said it is like the telephone or electricity in my view.

I want to focus on some other practical things. I was interested in what you said about your streetlights because—I went to med school in Chicago, by the way, University of Illinois. My son lives in River North, so I love Chicago.

And one of the most frustrating things of any city, but Chicago is one of those, is when you are driving, you know, it is 10 o'clock at night and you see a ray of red lights and there is nobody coming from the other direction, right. And you are just sitting there idling and then you pass the one and it turns red on you again. What is happening in all of your cities where you can, you know, either pressure sensors or visual sensors or other ways to interact?

The other one is late at night you are traveling through a city, and I am just using Chicago because I lived in Chicago, and you are driving along and you have a green light and all of a sudden out of the corner of your eye you see someone fly through the red

light and you are like, whoa, because they just assume there is nobody coming. So that type of interaction I am interested in too, in technology, infrastructure, vehicle communication.

And I will let you comment first and then take some comments from others about what they might be doing.

Mr. PAZUCHANICS. Sure. So the adaptive signal network that we have tested about 60 intersections right now in the city and we have seen between 15 and 20 percent reductions in the wait times, the number of stops that vehicles are going through those corridors. You know obviously a lot of that benefit is realized at points that are not a.m. or p.m. peak, sort of the off-peak where the signal timing doesn't necessarily make sense.

The city actually received an ATCMTD award from FHWA last year to expand that pilot to another about 150 intersections throughout the city. So I think we are really starting to see the potential for vehicle to infrastructure communication with those signals as well, not just——

Mr. BUCSHON. Is that computer modeling, or how is that?

Mr. PAZUCHANICS. It is a combination of sort of computer modeling and then visualization of the intersection itself, so sort of blocking out vehicles as sort of blocks within the system and then the intersections themselves are talking to the next intersection down the line providing the information. And as I mentioned, you know, we are hopeful that we can then provide information about the load of a bus, how far behind schedule the bus is, factor all of that into whether the bus gets a green light or a red light.

Mr. BUCSHON. I am out of time so the other cities can't comment, but what I would like to say is there is a lot of things. It is not just inconvenience, right, and somebody pointed out idling time in cities and other areas that is leading to more emissions and other things that goes into that is a really important issue. So thank you, I yield back.

Mr. LATTA. Thank you. The gentleman yields back. The Chair now recognizes the gentlelady from New York for 5 minutes.

Ms. CLARKE. Thank you, Mr. Chairman, and I thank our panelists for their testimony here this morning. I want to switch gears just a bit and really focus in on cybersecurity, because of course we are in a time when you know just with some general expertise you could shut down a grid, right. So I would like to have a sense of have any of your smart community systems already been subject to hacking or malicious attacks either attempted or successful?

And I will start with particularly those of you who are operating in cities, so Ms. Gallagher and Mr. Chisek?

Ms. GALLAGHER. Thank you. We have not yet, but of course I think some of the other cities are a little further along than we are, so I will probably pass to them.

Ms. CLARKE. Mr. Chisek? Ms. Berman?

Mr. CHISEK. Thank you. We have not as well, but we have been thinking for quite some time about cybersecurity and those issues are very important to us.

Ms. BERMAN. So I would like to give you a more general answer because I am responsible for cybersecurity for all of the city systems, not just the connected ones we have talked about today but all of our systems. And cybersecurity is a concern across the coun-

try, certainly, and there is not enough funding for everything that cities should be doing in our current budgets or the small amount of grant money that we may be able to pull from the sources that we have today to do everything that we should be doing.

The systems that we have talked about today in Chicago have not been hacked as yet. You never want to say that out loud. To say have they been attacked you actually can't answer that in any definitive way. None of the systems that you have that are monitoring that because to say have they been attacked that means you don't know if they have been successful, right.

So to be very clear you actually don't know if they have been attacked yet, right. You can say that they haven't been hacked because that means they have been successful. You don't know if they have been attacked because everything is under attack all the time. So the City of Chicago and all of our systems are under attack all the time millions of times a day and that is a fact, and that is a fact in all cities across the U.S. every day.

So it should be a focus of the Federal Government to help cities be safer from a cybersecurity perspective. And so I appreciate the question because it is a deep concern of mine and of my peers that are focused on these issues and we take it very seriously, but the support of the Federal Government would be greatly appreciated in that area.

Ms. CLARKE. Mr. Pazuchanics?

Mr. PAZUCHANICS. Sure. The City of Pittsburgh has not experienced an attack at this point, but I will say that a big part of our success thus far has been partnership with the University of Pittsburgh, Chancellor Gallagher, himself an expert in cybersecurity, and a very strong program in cybersecurity that helps provide sort of a feedback loop for us and enables us to, you know, test out our systems, make sure that there is resiliency in those systems, so that city-university partnership is very critical.

Ms. CLARKE. And I am glad that you mentioned that because part of what I would want to suggest because of the rollout of what you are all doing is that where you can get some partnerships going, particularly with the utilities you know that should be a bond that you build. Because you are absolutely correct, Ms. Berman, you are currently under attack right now as we sit here. All you need is for one to penetrate though for there to be catastrophic consequences.

So I want to encourage to that extent some sort of partnering and I will certainly be your advocate here at the Federal level to see what we can do, because as we move into 5G, as we become more expansive in our interconnectedness, you know, the more vulnerable we are going to become.

Just quickly, as the administrators of your community smart systems, have you taken the cyber threats into account when planning for the future and, if so, how have you begun to prepare for them?

Ms. GALLAGHER. We absolutely have. We actually as part of the Smart City Challenge we have put together a working group that is solely focused on this. We have a chief information officer that is leading that. We are very fortunate that we have the Ohio State University on our team.

Another key leader for us is Nationwide Insurance because of course it is very important to them so they have lent us quite a few of their employees to help us in this effort. So you are absolutely right, it is all about partnerships and leaning on that private side and the university side who has already been down this road. So we take it absolutely seriously.

Mr. CHISEK. Thank you. The City of Portland also has been moving forward on this issue. We are creating a chief data officer position just simply because we are going to have sensor equipment spread throughout the city that is vulnerable that is bringing a whole host of data back to our open data platform.

So thinking through that ahead of time has been critical. I think our partnerships with private industry have also helped us quite a bit, because just like we are under attack they are under attack and the more we can do things together, I think the more and better results we get.

Ms. CLARKE. Ms. Berman, did you want to add anything?

Ms. BERMAN. Just quickly that like the other cities we plan for both security and privacy at the beginning of every project and there is someone assigned, a chief information security officer, who has that responsibility on every project.

Ms. CLARKE. Mr. Pazuchanics?

Mr. PAZUCHANICS. Yes, agreed that it is significantly factored into the legal agreements and the structure of our regional data center with that intent and expected purpose in mind. Thank you.

Ms. CLARKE. Thank you. I appreciate your indulgence, Mr. Chairman. I yield back.

Mr. LATTA. Thank you very much. The gentlelady yields back, and the Chair now recognizes for 5 minutes the gentleman from Pennsylvania.

Mr. COSTELLO. Thank you, Mr. Chairman. Mr. Pazuchanics, I had the opportunity to visit CMU within the past year and learn about the autonomous vehicle testing and learned a great deal about how the technology and other types of technology have really contributed to what it means to have a smart community and how it really can create a lot more in the way of efficiency and improvement within not just a public works department but code enforcement and law enforcement, right on down the line.

And I applaud you and everyone in Pittsburgh. It is Congressman Doyle and the other members of Congress from the Pittsburgh area, but in particular those in the city administration who really deserve to be commended. And I would like to ask a couple of questions related to that.

The data utility system that you have, Deloitte report speaking about the impact of wireless connectivity to our communities estimates that adopting a smart grid would create $1.8 trillion in added revenue to the economy, saving the average consumer hundreds of dollars of year in energy costs. What are the biggest barriers that currently exist to deploying a smart energy grid and related to that how does the data utility help advance energy services to provide better resources for the City of Pittsburgh?

Mr. PAZUCHANICS. Sure. I think one of the biggest challenges to a coordinated smart grid and a smart utility management system is the lack of coordination or cooperation among various entities

sort of providing very similar services—natural gas companies, the electric company, the water systems—to the degree that we are able to share resources and solve multiple problems at the same time using similar infrastructure we are going to all be better off and see an economy of scale. So I think that coordination is key across those agencies.

I think, you know, in Pittsburgh we are very fortunate to have Duquesne Light which is a very sophisticated and innovative electric utility that takes that seriously and is moving toward IPv6 infrastructure. But I do think that there is still, you know, a challenge with playing catch-up with some of the other utilities and we could see savings if they were all working together.

Mr. COSTELLO. And is that going to require affirmative steps on the procurement end moving forward?

Mr. PAZUCHANICS. Yes. I think that a major hangup with a number of Smart City initiatives tends to be, or the way that our procurement system is structured now it tends to be sort of more purchase or product oriented rather than solution oriented. And to the degree that we are able to restructure to allow for some of these innovations in procurement to occur we are going to be better off.

Mr. COSTELLO. I would like to ask you about, and I will open this up to the rest of the panelists. Let's talk about health care and a smart community. Smart communities demonstrate real potential for a much needed transformation of health care from reactive and hospital centered to preventive, proactive, evidence based person centered focused on well-being.

How does a smart community, particularly in the municipal administration realm, go about improving a community's health care through its various applications?

Mr. PAZUCHANICS. I think one of the key components of that is providing provision of first and last mile service to critical healthcare assets. You know, one of the major challenges in Pittsburgh given our topography is the fact that first mile or last mile can mean very different things depending on age, ability. The potential of Smart City deployments, particularly shared vehicles, autonomous vehicles, to enhance connection to the major hospitals and university systems that provide that health care, I think, is going to be very important and it is the way that health care and transportation are tied together.

Dr. CLARK. I think the smart and connected health initiatives, research initiatives, actually are a big effort in figuring these questions out. And I also would just point to things like when we are talking about air quality monitoring one of the things we can monitor is for asthma. And so what that allows—and real time. So what that allows families to do is to determine whether or not today is a good day to walk to school or whether today is a good day to drive. So it gives people agency about making decisions about how they navigate the built environment through these sensor systems that can improve their health.

Mr. GRUENDLING. I think telehealth is a great topic when we are talking about smart communities, and I think that access to specialists who might not reside in a rural area for instance, you know, without the need to travel to a big city hospital you know for certain checkups or check-ins. You know, I think with a lot of

smart connected medical devices now you know they report back automatically to a physician or a physicians' group and allow them to monitor a patient in a home type environment. And you know it is the connectivity that is allowing that to happen.

Ms. BERMAN. I would like to build on what Dr. Clark said about the asthma example, because smart cities technologies can allow a city to go beyond just monitoring and changing behavior based on air quality and asthma but actually doing something about it. So taking that information and putting policies and services in place to improve air quality, which also speaks to the equality of health in the city because oftentimes the worse air quality also is where your underserved communities are, so evening that playing field and helping families be healthier as well.

Mr. CHISEK. I agree with everyone. But it could also help better deployment of resources and resources are scarce. So better deployment of these resources, be they health care, be they first responder, is one of the advantages of smart cities.

Ms. GALLAGHER. We have been out talking to especially I would say our lower income neighborhoods as we have been going through this process and just asking them what do they see as their biggest challenge with health care, and what we have heard is transportation is a major barrier. When it will take you an hour and a half to get to your doctor's office by the time you change two or three buses, go to a hub, go to the next place, it is easier just not to go.

So we have got to get them additional solutions. Not only the first and last mile, I a hundred percent agree, but just make it easier so it becomes just another thing to do versus a hindrance and an obstacle you have to overcome.

Mr. COSTELLO. Thank you. I yield back.

Mr. HARPER [presiding]. The gentleman yields back. The Chair now recognizes the gentleman from Florida, Mr. Bilirakis, for 5 minutes.

Mr. BILIRAKIS. Thank you, Mr. Chairman, I appreciate it and I thank the panel for their testimony. For the entire panel a recent report by Deloitte on the impact of wireless connectivity to our communities notes that a 1-minute improvement in response time for emergency medical services could reduce fatalities by 8 percent, which means efforts to better coordinate responses or automatic deployment could save lives.

Are you discussing with your emergency responders how they are utilizing this lifesaving technology? How are you planning to use connected cars to better serve the elderly and disabled populations? Whoever would like to go first, thank you.

Ms. GALLAGHER. We actually do have a lot of conversations with our emergency management. And just a quick example of one thing we are doing is working again, and I think it has been brought up, with the traffic signals and having the traffic signals talk to the vehicles and talk to each other. So whether it is you know an emergency vehicle is coming, you keep the lights green, you stop the other vehicles so they can have quick passage you know that is one example.

Another one perhaps is them specifically talking to each other and you know figuring out who is the closest and that sort of thing

per the cars, they are not having to go through dispatch, and just a variety of things. But we are having those conversations.

Mr. BILIRAKIS. Yes, please.

Mr. CHISEK. It does go back to that deployment of resources issue. So typically we have been sending fire trucks and ambulances to medical calls; by using this technology to triage that and pull the medical calls out we can better deploy our fire resources. We are also deploying some smart cities kiosks that can also be used as gathering points for information for the public in the event of a disaster. We have all heard about the Cascadia Subduction's own earthquake that is supposedly going to hit the West Coast, so that is also one of our strategies around resiliency.

Mr. BILIRAKIS. Very good. Ms. Berman?

Ms. BERMAN. We took a slightly alternative approach to getting emergency resources to where they needed to be. We did an analytics analysis of all of our 911 calls and there are pockets of recurring 911 calls around train stations, et cetera, during commutes, so now we pre-deploy ambulances and have them waiting, so that cuts your response time down quite a bit when the ambulance is already there. So we are doing things like that.

Mr. BILIRAKIS. Very good. Sir?

Mr. GRUENDLING. Thank you. We are definitely having these conversations at both the State and local levels with our first responders. Obviously we are a critical part of that enhanced 911 system in the State of Vermont, so you know those conversations and the technology pieces and components that make that up are certainly ongoing. And you know one of the big initiatives that our State and working with our schools we have been trying to really enhance the location-specific 911 in those schools, which is something you know that is still in process.

Mr. BILIRAKIS. Anyone else? Dr. Clark?

Dr. CLARK. From the research perspective, one of the things we are seeing is that different partners have different data available. So for first responders if they can, particularly when we are talking about events, these natural events like a storm, if they can get information from the utilities about the conditions on the ground they can respond much, much quicker and more safely to an event and help people. And it is building those partnerships and that trust so there is actually data exchanged is one of the things we think there could be a lot of value added.

Mr. BILIRAKIS. Very good. Would you like to——

Mr. PAZUCHANICS. To answer your second question regarding mobility for the elderly and integration of these technologies into elderly populations, one of the key initiatives we have been doing in that regard is building a level of technical sophistication with our elderly population, getting some of these technologies deployed out to our senior centers throughout the city, and enabling residents to understand how the system works so that new technologies such as TMCs and autonomous vehicles are a little bit less unfamiliar to that population.

Mr. BILIRAKIS. Very good. Next question, I know I don't have a lot of time. I understand from a recent Deloitte report on the impact of wireless connectivity to our communities consumers are increasingly more attracted to wireless innovation with their health

care with 70 percent saying that they would be interested in some form of connected healthcare service.

What are your cities doing to help educate older citizens to the positive benefits of this technology? Who would like to go? I know we only have a couple of seconds.

Mr. CHISEK. So we are partnering with community organizations to help explain the technologies and the capabilities to some of our different populations in elderly, minority community as well. So we are using trusted voices in their community that they already have a relationship with to help communicate those things to those populations.

Mr. BILIRAKIS. Very good. Anyone else have any ideas?

Ms. BERMAN. We partner with Microsoft to provide a program called Cyber Seniors in our senior centers and libraries that teaches them basic computer skills if they need that and also how to use those skills to connect with their doctors, hospitals, and also nonmedical resources as well so that they can get the resources they need online and learn those skills.

Mr. BILIRAKIS. How effective has that been?

Ms. BERMAN. We have had actually pretty good uptake. We trained more than a hundred thousand seniors in Chicago last year, and we are seeing increased uptake moving into this year.

Mr. BILIRAKIS. Anyone else? OK, I will yield back. Thank you, Mr. Chairman.

Mr. HARPER. The gentleman yields back. Seeing that there are no further members wishing to ask questions, I would like to thank all of our witnesses again for being here. I am sure when this was scheduled you didn't know you would have a snowstorm to get through, so I hope the travel wasn't too difficult, but we appreciate the effort and your attendance today.

Before we conclude, I would like to include the following documents to be submitted for the record by unanimous consent: a statement from a CA Technologies, a statement from Honda North America, a statement from Panasonic, a statement from ITS America, a joint statement from CompTIA and Technology Councils of North America, a joint statement from ITI, CompTIA, Smart Cities Council and TIA, and a Deloitte report from CTIA for the record as well as a letter from EPIC. And, without objection, those are admitted.

[The information appears at the conclusion of the hearing.]

Mr. HARPER. And pursuant to committee rules, I remind members that they have 10 business days to submit additional questions for the record, and I ask that witnesses submit the response within 10 business days upon receipt of the questions. Without objection, the subcommittee is adjourned.

[Whereupon, at 11:57 a.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

U.S. House Energy and Commerce Sub-committee on Digital Commerce and Consumer Protection

Hearing: "Disrupter Series: Smart Communities"

Statement for the Record:

David J. Bressler, Vice President, API Management Solutions

CA Technologies

March 16, 2017
10:00 a.m.

There's a nuance to the source of the application economy's magic that many overlook. It's not about the app store, not about the ability to easily find and download an app for anything. It's about the creation process.

There are billions of mobile computers in people's pockets. That means there is an army of incredibly talented developers creating experiences. It's into this that smart cities are going to emerge as a platform for creative types to integrate into the mobile economy.

The short-term benefit of automation, or reduced cost of data collection, or more data, is just setting the stage. The real benefit comes when industries are able to do things that are different from the past because of the smartness embedded in the infrastructure. These ideas will not necessarily come from the people who are lighting up the city, but from others who experience the city and want to make it a better place.

In a world of "smart cities" anyone, anywhere in the world, can create an application or "experience" using the world's smart city infrastructure as the starting point.

In New York, some of the subways have sensors and commuters can see how long they have to wait in the station. This kind of information is available elsewhere in the world, like France who are also building a bus tracking system to provide real time information on location and time to arrival of buses in India. What should tracking subways or busses make news? It seems obvious that operators should use GPS to track them, and determine arrival times.

What's interesting isn't just tracking buses. The really exciting angle is the future, when bus data becomes available through secure APIs for people who want to create new commuting experiences.

Individuals who have a multi-hop commute would use schedules, current traffic conditions and expected traffic patterns based on history, and commuters could get an alert of the best bus to catch to minimize the commute across multiple hops and the waits between hops.

The city itself might not create such an app, but the smart-city platform creates the opportunity for the app to be created. Such an app might be best created by the person who experiences the commute (and knows the tricks), rather than someone who sits in an office imagining what such a commute is like.

CA Technologies recommends that communities focus on platforms and security when considering new initiatives to leverage "smart" technologies to unlock innovation.

First, communities should make public information and data accessible through read-write Application Programming Interfaces (APIs).

Healthcare IT provides a useful example. FHIR - Fast Healthcare Interoperability Resources - is an Application Programming Interface (API) standard that uses the JavaScript Object Notation (JSON) standard to represent data. FHIR has captured the imagination of a global pool of developers who see opportunities to innovate in healthcare. This represents a "bottom's up" approach to building a platform for healthcare innovation. A similar approach can be leveraged on behalf of Smart Communities. In

addition, Smart Communities provide an opportunity for overcoming challenges of interoperability, which still face the healthcare IT industry.

Smart-city platforms should follow the model for creating a modern software factory for innovation. This model incorporates security, compliance, and quality and would ensure that the smart-city platform is used "properly." Done well, the people who need to know how it's being used have all the insight they need. They can use what they learn about usage patterns to cultivate it to meaningfully impact people's lives.

Security can't just be a feature, or an afterthought. Rather, security must be a core element on which the Smart City builds trust; without trust, there is no Smart City.

Security of the APIs must be built into the infrastructure when exposing public data for private sector innovation. Many API platforms ignore a platform level of security that would ensure consistent security policy across development teams to protect both data and infrastructure.

When security is part of the platform, security officers own and deploy policies to manage governance, compliance, and security.

Once the infrastructure is secure, we need to ensure three aspects of identity authorization within the smart city framework to ensure accountability and risk management.

Developers must be able to rapidly access security authorization protocols easily, so that security is implemented properly (and not as an afterthought) without presenting a barrier to innovation. Security must ensure that citizens are protected, and also respected. Where possible, the citizen experience should be preserved while providing security; security should not be a barrier to the enjoyment and participation in the smart city experience.

As such, there are three elements to identity and authorization to be considered. At CA we consider these the 'Authentication Triangle™ ' that allows to provide 'Authentication in Depth™ ':

1. **Citizen.** The person. The 'user'. We know how to identify people, even digitally. The technology for mobile identity is catching up, but also fragmenting (between things like mobile phone, smart watches, and various biometrics like voice or facial-recognition that are emerging). Cities need a simple way for developers to leverage the latest user identification technology;
2. **App.** Often activities allowed in one app, are not allowed in another. Learning context of the digital activities being performed from the app, and using that to manage risk and user rights enhances the ability to protect user data and identity;
3. **Device.** The third piece of the Authentication Triangle is the device. Devices must be authenticated so that we can ensure the integrity of data being exchanged between devices, applications, and back-end data systems.

Using these three elements the Smart City can balance security risk centrally, ensure citizen experience when participating in the Smart City offerings, and provide the best possible developer experience for creating secure applications.

Making it real — two broad use cases we are delivering through Latin American cities, where citizen's initial computing experience is often through their mobile device

A mobile, digital ID. Every time the government needs ID multiple identifications are required. The policy is opaque, sometimes hard to follow. It's frustrating for those who trade time for money, because time

taken to prove something as "simple as" identity is time not earning a living. A single digital identity connected to a smart city would streamline every single interaction with the government (and pseudo government organizations like hospitals, utilities, etc.)

Moving paperwork from one department to another is an onerous, time-consuming, and unnecessary process. When citizens need to take paper from one part of the government to another, it's obvious the government is not connected, not focused on the citizen. One example is the need for parents to physically take a child's proof of immunization to their school. In an age of mobile devices that are literally with us at all times, why does one need to have a piece of paper printed at the doctor and delivered to a school?

Citizens face the same obstacle when providing proof of residence for payroll taxes or car insurance. Or for sharing health insurance information with healthcare providers.

Smart Communities provide significant opportunities for reducing costs, enhancing citizen services, and improving quality of life. In many ways, they represent low hanging opportunities we can pick easily to start to build both a platform and the trust necessary to get citizen involvement in Smart Communities innovation.

HONDA

Honda North America, Inc.
1001 G. Street, N.W. Suite 950
Washington, DC 20001
Phone (202) 661-4400

March 16, 2017

The Honorable Robert Latta, Chairman
Subcommittee on Digital Commerce and Consumer Protection
2125 Rayburn House Office Building
Washington, DC 20515

The Honorable Janice Schakowsky, Ranking Member
Subcommittee on Digital Commerce and Consumer Protection
2322A Rayburn House Office Building
Washington, DC 20515

Dear Chairman Latta and Ranking Member Schakowsky,

Thank you for this opportunity to share Honda North America, Inc.'s (Honda) views on the Disrupter Series: Smart Communities hearing. As a supporter of and partner with the City of Columbus in their Smart Columbus project, Honda is pleased that the Subcommittee convened this hearing to showcase all that Columbus and cities across the country are doing to incorporate innovative technology to increase safety, mobility, and efficiency of services for their residents.

Honda has been investing and manufacturing in the U.S. for more than 40 years. This includes $27 billion in purchases of parts and materials from 610 U.S. suppliers in 2016. Honda has made capital investments of $3 billion in its U.S. factories over the past four years alone, and more than $17 billion since we began operations in the U.S. Our 12 manufacturing plants produce vehicles, power equipment, and power sports. The U.S. also hosts the global headquarters for HondaJet. Honda directly employs 30,000 Americans and has never laid off a permanent associate.

In Marysville, Ohio, about 30 miles from the City of Columbus, Honda has two manufacturing plants that produce the Honda Accord Sedan and Coupe, the Acura ILX, the Acura TLX, and the Acura NSX, the only supercar manufactured in the U.S. Marysville is also home to Honda's U.S. manufacturing and research and development headquarters.

Honda shares the City of Columbus' vision for the Smart Columbus project to "implement a holistic vision for how technology can help all residents move more easily and to access opportunity."[1] As Honda strives "to be a company that society wants to exist," we intend to support Columbus' vision by deploying technologies that enhance mobility and road user safety.

Honda plans to work with the City of Columbus on issues related to data integration, autonomous vehicles, connected vehicles, and implementing advanced sensors and cameras at intersections. Honda also intends to make electric and plug-in hybrid vehicles available for the city. The vehicles would include the Fit EV and the Clarity Plug-In Hybrid which is scheduled to be released later this year. Honda

[1] *Smart Columbus*, City of Columbus website (March 14, 2017), https://www.columbus.gov/smartcolumbus/

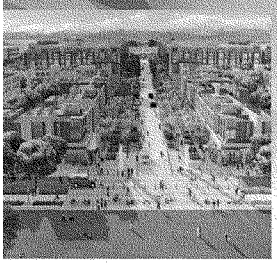
also plans to advise the City of Columbus on electric vehicle charging requirements and the application of vehicle charging and electric utility and renewable generator coordination (Vehicle/Grid Integration).

In addition to working within the City of Columbus, Honda will also launch a comprehensive effort along State Route 33 between Columbus and East Liberty to study traffic congestion mitigation and improve safety for all road users. This route would provide the opportunity to effectively analyze vehicle-to-vehicle and vehicle-to-infrastructure communications technologies.

Honda looks forward to working with the Subcommittee to ensure that these projects enjoy a smooth process to completion, and consumers enjoy the full potential of these life-saving technologies.

Panasonic

A PANASONIC CITYNOW WHITE PAPER



At Peña Station NEXT—a 382-acre transit-oriented development in Denver, Colorado—stakeholders Panasonic, Xcel Energy, Denver International Airport, Younicos, and LC Fulenwider, Inc. have partnered on a unique solar+storage microgrid that deploys the battery energy storage system for five complementary use cases.

Executive Summary

Published: February 2017

Published in partnership with

Xcel Energy®

Younicos

Download the full white paper at
http://bit.ly/PenaMicrogrid

CITY NOW

A Portfolio Microgrid in Denver, Colorado

How a multi-use battery energy storage system provides grid and customer services through a public-private partnership

Introduction

Energy storage technologies have shown great promise as the "Swiss army knife" of the power grid, capable of doing many things for many stakeholders. Battery systems in particular are quickly gaining a larger foothold as flexible, nimble resources that can benefit utilities, customers, and the entire power grid.

As Battery Costs Fall, Deployments and Installation Forecasts Begin Scaling

Regulatory mandates and incentives at the state and federal level, growing opportunities for market participation, and the pure economics of falling storage costs are making battery systems more attractive to customers and to utilities such as Xcel Energy. As storage deployments scale under these favorable conditions, utilities and solutions developers are better learning how to leverage these nimble assets to provide value for the electric utility industry and customers.

Revenue Stacking with Multi-Use Storage Systems Unlock Greater Market Potential

In recent history, battery systems were primarily deployed on the basis of singular use cases serving either a customer or utility and are already providing a financial return in some markets using this model. Trailblazing utilities and project developers are now discovering how revenue stacking with multiple value streams can greatly enhance storage system value.

The battery energy storage project undertaken in partnership by Xcel Energy, Panasonic, Younicos, and Denver International Airport (DEN) at a new transit-oriented development called Peña Station NEXT, in Denver, Colorado, is one of the latest projects to explore the potential of a multi-use battery energy storage system.

Peña Station NEXT Becomes a Proving Ground for Battery and Other Technologies

Peña Station NEXT is a 382-acre transit-oriented development adjacent to the Regional Transportation District's 61st & Peña Station rail stop, located along the University of Colorado A Line train linking downtown Denver with DEN.

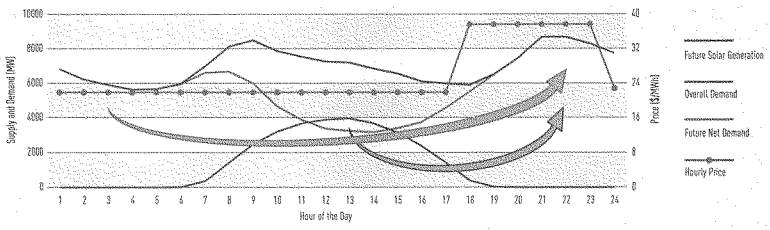
The development is also one of the first major steps toward realizing Colorado's vision of creating a "live, work, play" aerotropolis—or "airport city"—around DEN. It will feature a variety of smart and sustainable solutions including smart street lighting, ultra-fast community Wi-Fi, smart parking, electric vehicle charging stations, a smart bus shelter, environmental sensing, interactive digital signage, and a solar-plus-storage microgrid.

A Public-Private Partnership Yields a Portfolio Microgrid

A recent shift toward multi-stakeholder microgrid models is improving both project economics and growth expectations. At Peña Station NEXT in particular, the public-private partnership approach has resulted in a unique "portfolio microgrid" model.

Panasonic

Solar Time Shifting and Energy Arbitrage Use Cases Move Inexpensive, Off-peak kWh and Solar Generation Into Higher-Price, On-peak Hours



Portfolio of Stakeholders

- **Xcel Energy:** Colorado's major investor-owned utility with an ambitious vision for the state's energy system that includes a modern power grid and renewable energy
- **Younicos:** An expert in MW-scale battery energy storage and storage software applications, including embedded intelligent energy management
- **City and County of Denver (Denver) and Denver International Airport (DEN):** Entities with aggressive sustainability goals and an interest in improving the resilience and sustainability of critical DEN assets to support future growth
- **L.C. Fulenwider, Inc.:** Sustainability-minded master real estate developer in Colorado and for Peña Station NEXT
- **Panasonic:** Peña Station NEXT's anchor corporate tenant, smart and sustainable technologies lead, and invested equity partner

Portfolio of Assets

The battery system project at Peña Station NEXT is a pilot under Xcel Energy's $10.3 million battery demonstration through its Colorado Innovative Clean Technology (ICT) program, comprising five core elements:

- **1.6 MWdc carport solar PV installation:** located over the DEN parking lot
- **259 kWdc rooftop solar PV array:** installed atop Panasonic's corporate office building using Panasonic HIT solar PV modules
- **1 MW / 2 MWh lithium ion battery system:** installed by Younicos at Panasonic's corporate office
- **Panasonic's Denver operations hub building:** will serve as the initial anchor load for the microgrid; a high-tech, energy-efficient office targeting LEED Gold and net-positive energy, with an intelligent building energy management system
- **Switching and control systems:** to operate the battery energy storage system and microgrid functionality

Portfolio of Benefits/Services

The battery system at Peña Station NEXT will be leveraged for five complementary use cases whose services and benefits accrue to different combinations of the core stakeholders:

- **Solar Grid Integration:** Better grid integration of high-penetration solar PV actually comprises two related but distinct use cases:
  - **Ramp Control for Solar Smoothing:** Charge and discharge the battery system to manage rapid fluctuations in solar PV output
  - **Solar Time Shifting:** Store excess energy when solar generation output is high and dispatch that energy later in the day, helping to manage loads on the feeder
- **Grid Peak Demand Reduction:** Reduces peak demand by discharging the battery to offset grid demand based on historical and predictive data sets
- **Energy Arbitrage:** Charge the battery when prices are low and discharge when prices are high, based on energy price signals and low- and high-price thresholds
- **Frequency Regulation:** A fast-responding resource as part of the battery's ancillary services; this use case has broader relevance, not just for grid operations, but also for customers with strict power quality needs, such as data centers and high-tech manufacturers
- **Resilience Through Backup Power:** A portion of the battery's capacity will be reserved to provide an estimated four hours of backup power to Panasonic's facility, including its state-of-the-art network operations center

Conclusion and Looking Forward

Once the microgrid is live in early 2017, Xcel Energy, Panasonic, Younicos, and the other project partners will gather data to review real-world performance and make refinements over time. After completion of the two-year pilot, the project partners will analyze the battery system performance data to determine the optimal settings for the remainder of the battery's estimated 10-year life span.

CITY NOW

ITS AMERICA

ITS America Statement for the Record

"Disrupter Series: Smart Communities" Hearing

House Energy and Commerce Subcommittee on Digital Commerce and Consumer Protection

March 16, 2017

On behalf of the Intelligent Transportation Society of America (ITS America), we appreciate and welcome the Subcommittee's consideration of policy measures that improve and enhance the deployment of smart communities.

ITS America is the nation's leading advocate for the technological modernization of our transportation system by focusing on advancing research and deployment of intelligent transportation systems. Its unique membership brings together all key stakeholders in the intelligent transportation movement —including established and emerging private companies, public agencies, state DOT officials as well as leaders in the academic and research communities.

I. The Importance of Intelligent Transportation

As put forward in our public policy roadmap[1] last month, ITS America seeks to revitalize our infrastructure and modernize our outmoded transportation system. Broadly, we seek to improve the safety and efficiency of our transportation networks and our nation's economy, standard of living, and health and security. Transportation connects communities and is the lifeblood of commerce. It widens job opportunities and is essential to addressing equity, poverty, unemployment, and access to education and health care. 35,092 people died on our roads in 2015[2]—the highest fatality rate since the 1960's. We believe "intelligent transportation" can address the broadest spectrum of challenges and opportunities.

Our objective is to grow our economy and improve our quality of life through innovative technologies that enhance the mobility, safety, security, privacy, sustainability and accessibility of our transportation system in the next decade. Safety, security and privacy in particular are critical and must be addressed by the technology sector along the entire technology lifecycle—in design, development, deployment, and operations. ITS America seeks to grow collaboration within industry and between private and public sectors in these critical areas.

II. Reinvesting in our Communities Through Smart Technology

We are increasingly becoming a more urban and technology centric world. In the United States, more than 85% of the nation's population live in cities and metropolitan areas.[3] The portion of the world's population that lives in cities is projected to grow from 50% to nearly 70% by 2050. To adjust to this

rapid growth, we will need to identify new ways to assist communities in becoming "smarter" and more efficient. Access to jobs, education, healthcare, and public safety services are critical. Changing how we design, develop, and manage the nation's critical infrastructure components will be an essential element for any "Smart Community" of the future. Our public policy roadmap recommends:

Communicating the Benefits and Facilitate Deployment of Smart Community Technologies: To increase support by elected officials and policymakers as well as the general public, show how intelligent transportation systems (ITS) can improve everyday life. Use the narrative to inspire and make the business and economic case for a safer, faster, more equitable, efficient, and sustainable transportation system.

Encouraging Federal Funding Flexibility and New Funding Mechanisms: Advocate for flexible policies regarding Federal/State matching requirements (e.g., 100% Federal funding upfront with a back-end match by Locals/State for continuing operations) and other implementation provisions in the FAST Act and any new infrastructure bill related to the deployment of smart technology for communities. Examine the potential use of a tax overhaul to fund infrastructure investment plans. In any new infrastructure bill, examine requiring that a percentage of all infrastructure funding must be allocated for Smart community/tech-driven mobility. Emphasize performance goals.

Identifying Innovation Champions at the Local Level and Educate Them on the Tools for Experimentation: Encourage communities to allow Chief Technology Officers or other appropriate officials to use Other Transaction Authority, pilot programs, and similar programs to bypass onerous, time-consuming procurement procedures. Encourage the FHWA to enable better flexibility in the States by using performance level conditions measures instead of the traditional measures. Examine Federal restrictions on sole sourcing. Study means to add flexibility to communities (e.g. States, Cities, MPOs, etc.).

Supporting Proposals that Integrate Federal "Smart Communities" Programs and Provide Resources Where Appropriate: Support legislative efforts that would improve coordination of smart community programs across the Federal government. Provide State and Local governments with technical assistance and resources to help foster the deployment of smart community technologies. Support STEM education and training required for the development and operation of smart communities. Support the necessary R&D to enhance the functionality—including cybersecurity and privacy protections—of smart community technologies.

III. Autonomous Vehicles (AVs) and Vehicle-to-Vehicle (V2V) Communications Technologies Are Important Components of Smart Communities

When developing smart communities, intelligent transportation systems (ITS) that transform mobility in those communities will be necessary. Our public policy roadmap recommends:

Establishing the Foundation for the Deployment of Automated Vehicles: Build public confidence by achieving broad industry participation in the NHTSA Automated Vehicles Policy development process.

Revise the guidance where it serves that purpose. Engage with States, safety regulators, and advocates to address their concerns about testing as well as to help them in establishing processes that would help the transition from testing to larger scale deployment. Advocate for changes or clarifications to Federal Motor Vehicle Safety Standards or other authorities to support new technologies (e.g. for automated vehicle, advanced driver assistance systems (ADAS), visibility, lighting, etc.).

Establishing the Foundation for the Deployment of Vehicle-to-X Safety and Mobility Communications: Advance a Federal standard for passenger vehicle V2V and push USDOT guidance on V2I to ensure smooth deployment of Dedicated Short Range Communications (DSRC) by addressing vehicle interoperability, security, and privacy. Advance same standards for trucks and buses. Establish paths for upgrading V2V and V2X standards when next generation wireless systems, such as 5G, are deployed in telecom networks over the long term, addressing same issues as above.

Building Broadband Infrastructure and Secure Spectrum to Support Advanced Vehicle and Transportation Infrastructure Technologies: Include broadband networks in any infrastructure legislation, including broadband funding for rural or otherwise hard-to-serve areas. Support a technology-driven approach to spectrum sharing between Wi-Fi and DSRC that allows Wi-Fi use in the 5 GHz band, but in a way that preserves the safety and utility of DSRC without unduly burdening road users and transportation infrastructure operators.

IV. Conclusion

ITS America would like to thank the Subcommittee for holding this hearing and greatly appreciates the opportunity to submit written testimony. ITS America looks forward to working with you on smart communities and emerging intelligent transportation issues. For more information, please contact: Jason Goldman, VP of External Affairs & Stakeholder Engagement, at 202-721-4212 or via email at jgoldman@itsa.org; or Ron Thaniel, VP of Legislative Affairs, at 202-721-4226 or via email at rthaniel@itsa.org.

[1] *The Road Ahead: The Next Generation of Mobility*, ITS America (rel. Feb. 8, 2017), *available at*: http://itsamerica.org/wp-content/uploads/2017/02/Final-The-Road-Ahead-The-Next-Generation-of-Mobility-Roadmap-020717b.pdf.

[2] *Traffic fatalities up sharply in 2015*, NHTSA (rel. Aug. 29, 2016), *available at:* https://www.nhtsa.gov/press-releases/traffic-fatalities-sharply-2015.

[3] *U.S. Metro Economies GMP and Employment Report: 2015-2017*, The United States Conference of Mayors, 2016.

CompTIA

TECNA
TECHNOLOGY COUNCILS OF NORTH AMERICA

March 15, 2017

The Honorable Robert Latta
Chairman
House Energy & Commerce
Subcommittee on Digital Commerce &
Consumer Protection
Washington, D.C. 20515

The Honorable Janice Schakowsky
Ranking Member
House Energy & Commerce
Subcommittee on Digital Commerce &
Consumer Protection
Washington, D.C. 20515

RE: Support for Smart Cities and Communities Act

Dear Chairman Latta & Ranking Member Schaknowsky:

This week, the House Energy and Commerce Committee will hold the first ever hearing focusing on smart cities. During the hearing, Congressman Ben Ray Lujan (D-NM) will be introducing the ***Smart Cities and Communities Act***, a bill that focuses on enhancing federal coordination and investment in smart city and community programs, providing assistance to communities through workforce training and technology demonstration programs, improving performance and interoperability, and international cooperation and best practices.

A smart city uses information and communications technology (ICT) to enhance its livability, workability and sustainability. It collects information about itself using sensors, devices or other systems, and sends the data to an analytics system to understand what's happening now and what's likely to happen next.

Most cities greater than 750,000 in population have at least one — and usually multiple — smart city projects underway in one sector or another. But few cities have a comprehensive, long-term, integrated plan. In fact, there are only a handful of cities worldwide that are well on their way to a full adoption of smart cities technology in an integrated way across all sectors. And many of the real-world smart city examples are typically much larger or smaller than how we traditionally define cities. They're either occurring on a more regional basis or as small neighborhood-by-neighborhood projects.

There is vast potential to provide smart city benefits to a larger number of citizens and those benefits are immense.

America has the opportunity to capitalize on the use of smart technologies to help drive innovation, stimulate the economy, grow jobs and bolster the country's position as a global technology leader. Whether it is the utilization of high-performance computing, a cloud-first philosophy or the use of cutting-edge data analytics, we are poised to create technological marvels that will be the envy of the world. The "best and brightest" will come to work for our cities, unlocking innovation in the tech petri dishes that will be our smart cities.

CompTIA.

TECNA
TECHNOLOGY COUNCILS OF NORTH AMERICA

We the undersigned support the Act and urge Congress to move forward on this important piece of legislation. We feel strongly that Act will help accelerate job growth and innovation within our communities.

[redacted]

Elizabeth Hyman
Executive Vice President
CompTIA

[redacted]

Skip Newberry
Chairman, Technology Councils of North America
CEO, Technology Association of Oregon

Arizona
Arizona Technology Council (AZTC)
California
California Technology Council (CTC)
CONNECT
OCTANe
Tech San Diego
Colorado
Colorado Technology Association (CTA)
Connecticut
Connecticut Technology Council (CTC)
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New Hampshire High Tech Council (NHHTC)
New Jersey
New Jersey Tech Council (NJTC)
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Texas
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Tech Titans
Utah
Utah Technology Council
Washington
Washington Technology Industry Association (WTIA)
Wisconsin
Wisconsin Technology Council (WTC)

U.S. House of Representatives
Committee on Energy and Commerce
Subcommittee on Digital Commerce and Consumer Protection
"Disrupter Series: Smart Communities" Hearing

March 16, 2017

Statement for the Record

On behalf of the undersigned companies and associations representing the technology sector, we appreciate and welcome the Subcommittee on Digital Commerce and Consumer Protection's consideration of policy measures that improve and enhance the deployment of "smart" technology at the local level.

We believe that strong smart technology policy begins with the inclusion of all stakeholders, both public and private, and aims to improve livability, workability, and sustainability across a broad range of communities, including the most vulnerable. As mentioned in the subcommittee's hearing memo, the technology sector has a history of collaborating with government, academia, and other key stakeholders to innovate and deploy smart technology in communities across the country. [1]

We strongly support investment in the infrastructure that supports the deployment of next generation technologies, namely the internet infrastructure. With 50 billion devices to be connected to the internet by 2020, robust and cutting-edge broadband networks like 5G will be essential to realizing the full potential of smart technology use cases across the transportation, consumer, government and industrial sectors. Ubiquitous, affordable, high-speed broadband connections are critical to enabling the countless smart city benefits and services. Such

[1] Disrupter Series: Smart Communities Hearing Memo. 14 March 2017.

infrastructure investments have "triple bottom line" returns, providing social, financial and environmental benefits.

For example, a recent report by the Smart Cities Council estimates that 12,000 job-years of employment are created for every $1 billion investment in wireless infrastructure[2]. The sustainability benefits from technology innovations in intelligent transportation systems (ITS) and information and communications technology (ICT) is another example, as these solutions offer ways to make our transportation systems more efficient and less costly.

We're encouraged by the existing federal policy that promotes and support efforts by cities and municipalities to improve quality of life for their citizens, like the Department of Transportation's (DOT) Smart Cities Challenge and the National Institute of Standards and Technology (NIST) Global City Teams Challenge. As the subcommittee examines the role of the federal government in supporting smart technology deployment, we support the proposals outlined in the draft Smart Communities Bill. The bill outlines critical priorities, including (1) enhanced federal coordination and investment in smart city and community programs, (2) community assistance, (3) improved performance and interoperability, and (4) promotion of international cooperation and proliferating best practices.

As outlined in the bill, coordination of activities among federal agencies working in smart communities application areas is an important next step. The National Science Technology Council highlighted this importance of bridging existing divisions and silos (see Figure One) in their 2017 *Smart Cities and Communities Federal Strategic Plan.*[3] To address this coordination challenge, the bill directs the Secretary of Commerce, in coordination with the Secretaries of Energy, Transportation, and Housing and Urban Development and the Director of the National Science Foundation (the Secretaries), and other agencies, to develop a strategy for coordinating federal smart communities activities and to promote private sector partnerships and international cooperation.

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[2] Smart Cities Council. *Smart Infrastructure Unlocks Equity and Prosperity for Our Cities and Towns*. September 2016.

[3] National Science and Technology Council. *Smart Cities and Communities Federal Strategic Plan: Exploring Innovation Together*. https://www.nitrd.gov/drafts/SCC_StrategicPlan_Draft.pdf

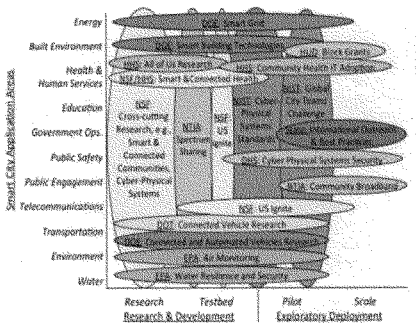


Figure 2: Examples of Federal smart city/community bridging programs. The image depicts examples of smart city/community bridging programs supported by the Federal government by application area (vertical axis) and technology readiness level, from research to exploratory deployment (horizontal axis). Bridging programs are those that cross multiple application areas (vertically-elongated ovals) or span multiple technology readiness levels (horizontally-elongated ovals).

FIGURE 1- SMART CITY APPLICATION AREAS (NATIONAL SCIENCE AND TECHNOLOGY COUNCIL)

Another priority of the Smart Communities Bill that should be considered by the subcommittee is the importance of improved performance and interoperability, which is encouraged in the bill. Systems of intelligent devices must be connected to the network and to each other to maximize the potential of smart communities. To enable broad, scalable adoption of smart communities technologies, and avoid proprietary silos or non-repeatability, attention must be placed on (1) the use of industry-led standards developed by globally relevant standards-setting organizations, and (2) ease of connectivity and interoperability of devices, platforms, software and infrastructure. The bill encourages federal government participation in industry-led smart cities standards development and interoperability.

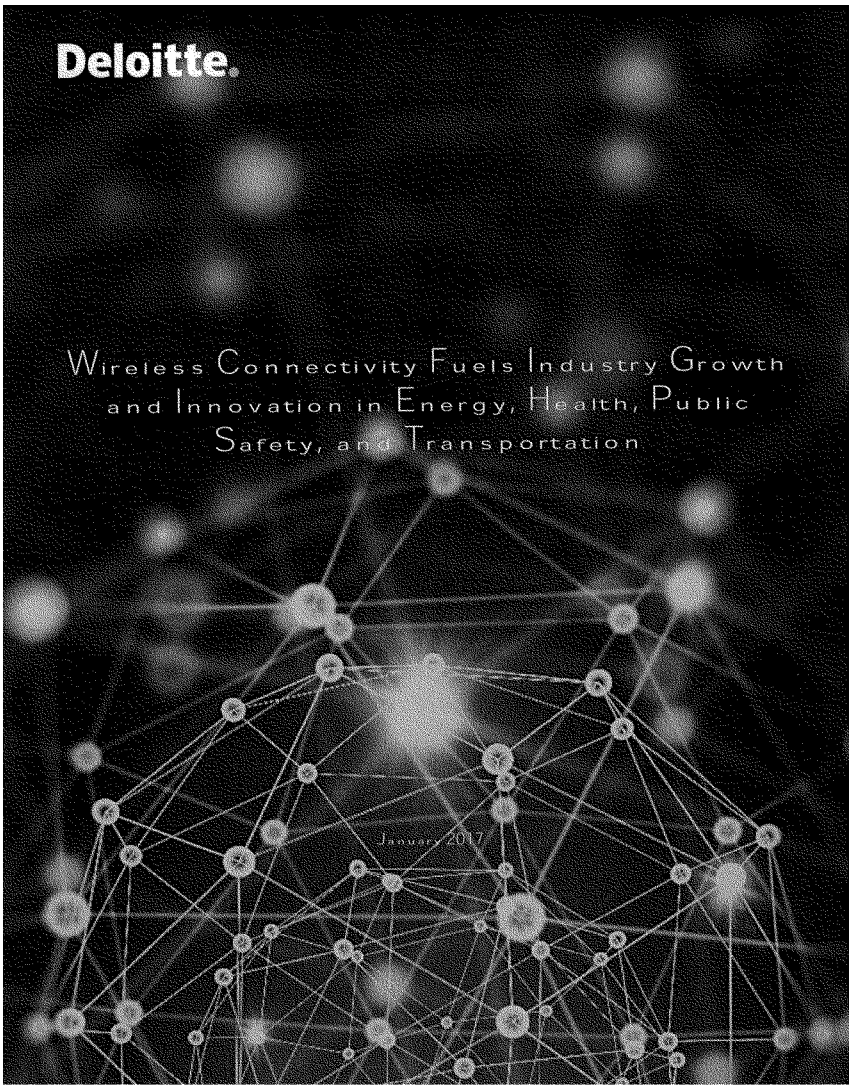
A certain level of standardization will be necessary to drive a successful, nationwide smart community security ecosystem – e.g., to ensure that multiple applications within communities can securely communicate with each other and municipal infrastructure. Industry is in the best position to develop the technological standards and solutions to address the security challenges facing smart communities. The private sector should lead the development of open and voluntary standards that enable interoperability, and partner with the public sector to encourage the sharing of standards and best practices. The federal government should encourage industry/laboratory research and market acceptance, but policymakers should refrain from mandating specific technologies or standards.

With respect to cybersecurity and privacy in smart technology deployment, we strongly encourage integrating privacy and security from the outset, as is done by the companies we represent. To drive smart communities' adoption, applications must evoke trust through hardened privacy and security solutions, looking to widely accepted best practices as well as novel approaches. Most importantly, privacy and security must be designed into smart communities systems at the outset using best-known Privacy-by-Design and privacy engineering

methods, as well as secure development practices, which contemplate the varying objectives and risks for different smart communities' solutions.

Finally, we support the promotion of international cooperation and proliferating best practices. Whereas 54 percent of the world's population now lives in cities, it is estimated that 70 percent of the world's population will live in cities by 2050. The global smart cities market is projected to reach $408 billion by 2020 and U.S. GDP is projected to increase 25-40% due to cyber-physical systems by 2030. The continued cooperation and partnership between the United States and countries around the world with regards to smart U.S. technologies holds the potential to increase U.S. exports and increase job growth in the United States. Furthermore, continued international promotion of U.S. smart technologies in countries around the world holds the potential to advance shared interests, including the adoption of energy and resource saving technologies that can secure the availability of water, food and energy, and improve public health, disease prevention, and pandemic response.

We thank the subcommittee for holding this hearing and allowing us to submit written testimony. We look forward to working with you to coordinate federal efforts on smart communities, and provide federal tools and resources to assist communities across this country as they look to deploy these job-creating and cost saving technologies.


Deloitte.
Wireless Connectivity Fuels Industry Growth and Innovation in Energy, Health, Public Safety, and Transportation
January 2017

Contents

Executive Summary

Wireless connectivity has transformed our world so rapidly that it is sometimes difficult to appreciate how fundamentally it is changing American industry. By fueling economic growth and innovation, these advances yield benefits with far-reaching impacts beyond just the telecommunications sector. Increasingly, industries across our economy are leveraging the wireless platform, charting new paths, becoming more efficient, and creating the potential for extensive economic development and job growth.

Today, 4G wireless technologies and connected devices provide a glimpse into the impact that 5G, the next-generation of wireless connectivity, could have across industry sectors and our economy. This paper explores four major industries, highlighting case studies that demonstrate how wireless connectivity has enabled these industries to grow and evolve. The picture that emerges illustrates the potential of tomorrow's wireless world:

- *Energy:* As estimated by the Electric Power Research Institute, smart grid adoption enabled by wireless connectivity could create $1.8 trillion in additive revenue to the U.S. economy and could save the average consumer hundreds of dollars per year.[1]
- *Health:* Goldman Sachs estimates that connected devices could create $305 billion in annual health system savings from decreased costs and mortality due to chronic illnesses.[2]
- *Public Safety:* Improvements enabled by wireless connectivity have the ability to save lives – a one-minute improvement in response time translates to a reduction of 8% in mortality, as estimated in a study in the Journal of Health Economics – and to reduce crime and the cost of law enforcement.[3]
- *Transportation:* Deloitte estimates that self-driving cars enabled by wireless connectivity could reduce emissions by 40-90%, travel times by nearly 40% and delays by 20%.[4] A 2013 study by the Eno Center for Transportation estimated that self-driving cars could save 21,700 lives and $447 billion per year.[5]

To some extent, the current stage of growth is propelled by improvements in efficiency and other rapid gains. Information that was previously difficult or impossible to acquire is now easily accessible, enabling businesses to better analyze the performance of assets, and more quickly identify opportunities to improve operations.

The next stage of growth will come not just from continued efficiency gains, but also from reductions of failure rates, increased productivity, and new functional capabilities. A fundamental catalyst of this innovation cycle will be the network effects of ubiquitous wireless connectivity brought about primarily by the advancements in wireless technology. Some of these effects are difficult to predict, but their trajectories can be characterized through the use of case examples described in this paper.

Indeed, this next stage of growth will be driven by 5G wireless networks. 5G is expected to provide speeds that are 10x faster than 4G, and with lower latency, which generates significant benefits, particularly in the health industry. 5G will enable the use of numerous devices on the network at once while providing carrier-grade security.[6] 5G will further unlock developments and growth in each of these four industry verticals.

Furthermore, quality of life, economic well-being, safety, and welfare of communities across the country are increasingly tied to wireless technologies. So-called "smart cities" are leveraging faster mobile broadband networks – and the technologies, applications, products, and services they make possible – to more efficiently allocate limited government resources, improve services, and build stronger communities.

It is clear that the communities and industries that offer the most farseeing and flexible platforms and regulatory processes will be the ones that benefit the most from innovation and economic growth. Further, those communities that proactively engage and partner with business will likely be part of shaping this future, helping ensure they also realize the benefits.

Introduction

The following perspectives on the specific industry verticals – energy, health, public safety, and transportation – highlight some of the benefits that have been realized as the result of increased connectivity, speed, improved capacity, and enhanced coverage of wireless networks. These benefits can be categorized in four ways, which are defined below in the context of the industries and use cases studied.

- *Better efficiency:* The increased utilization of assets or time in a business organization.
- *Reduction of failures:* Decreases in 1) the error or failure rate in processes and variability, 2) the asset replacement rate, and 3) the costs of downtime as a result of preventative maintenance.
- *Improved performance*: Leveraging a business or organization's existing assets in ways that ensure new benefits, revenue, or market opportunities.
- *New functionality:* Creation of new devices, assets, or services that may result in 1) expanding customer bases, 2) addressing new markets, and 3) offering new products or services.

	Featured elements	Description	Connectivity enabled uses	Impacts	Types of benefits: Better efficiency	Reduction of failures	Improved performance	New functionality
Energy / utilities	**Generation**	Electricity from fossil fuels, renewable energy, nuclear, oil & gas	• Worker communications • Sensors measuring level of output by renewable sources	• Improves worker safety • Enables smooth conversion to grid from renewable sources	✓	✓		✓
	Transmission	High voltage transmission lines, pipelines, and transformers	• Sensors on substations to report outages • Transmission line supply and demand readings	• Lower maintenance costs through better deployment of technicians • Immediate adjustments to changes in demand/supply	✓	✓	✓	
	Distribution	Lower voltage lines for commercial or residential purposes	• Home smart meters with customer portal • Dynamic pricing and customer billing	• Less demand requiring less capex • Consumers save money	✓	✓	✓	✓
Health	**Hospitals/ clinics**	Tier-1 trauma centers, in- and out-patient treatment centers, and smaller clinics	• Digital/mobile patient charts • Tracking of patients and equipment • Internal staff communications	• Better patient and family experience • Integrated records and management	✓	✓	✓	
	Telemedicine	Remote access to doctors	• Diagnostics • Follow up appointments • Specialist physicians	• Preventative care • Reduced follow up related costs • Expanded patient base	✓	✓	✓	✓
	Patient monitoring	Devices worn to track vitals, including blood sugar, tremors, heart beat, or blood pressure	• Wearables (clinical and non-clinical) • Chronic disease management (heart, diabetes, and asthma)	• Identify symptoms and causes • Avoid major health events or worsening of condition	✓	✓	✓	✓
Public safety	**Law enforcement**	Police officers and community peace officers	• Resource tracking and deployment	• Optimize resource deployment • Crime prevention • Faster criminal case processing	✓	✓	✓	
	Emergency responders	Emergency services, fire, and disaster management	• Instant feedback to centralized hub • System-wide information	• Rapid responses • Saving lives • Identifying crises earlier	✓	✓	✓	
	Public health	Food safety, air quality, and resource management	• Sensors to identify pest infestations • Air quality reports	• Reducing potential public health threats • More efficient inspections	✓	✓	✓	
Transportation	**Personal vehicles**	Individual cars, motorcycles, or bicycles	• Vehicle to vehicle/infrastructure (V2V or V2I) communication • Autonomous vehicles	• Reduced congestion • Increased productivity • Lower emissions • Fewer accidents	✓	✓	✓	✓
	Commercial	Delivery, trucking and train freight Fleets or private transportation	• Semi-autonomous vehicles • Tracking of fleet or vehicles and route optimization • Identifying excess space	• Lower costs • Better fleet management • Prioritization of maintenance expenditures	✓	✓	✓	✓
	Public transportation	Light rail, subway, and buses	• Accurate arrival times • Integrated intermodal system	• Enables more choice • Better and new services • Enables new revenue	✓	✓	✓	

Source: Deloitte analysis

Energy

Wireless connectivity strengthens energy companies' ability to power our nation's homes, businesses, and communities. According to the Electric Power Research Institute, smart grid adoption, which is enabled by wireless connectivity, could create $1.8 trillion in additive revenue to the U.S. economy, saving the average consumer hundreds of dollars per year.[7]

Improving the efficiency, reliability, and security of the nation's power delivery grid impacts nearly every aspect of the U.S. economy. The electric grid covers the entire country and is comprised of the generation of electricity by power plants and other sources, the transmission of electricity, and the distribution of electricity to homes. Wireless connectivity is reshaping the energy landscape with greater access to real-time information. Connectivity helps augment the energy industry's critical role in the economy, electricity utilities in particular, despite ongoing challenges created by aging infrastructure and sheer complexity.[8] Specifically, wireless connectivity fuels the economy as shown through the following case examples of the activities undertaken across the country:

Benefits Consumers, Businesses, and Communities: The benefits to electric utilities stem from the increased asset efficiency and reduced costs, which directly translate into greater reliability and lower costs for consumers and businesses, and opportunities for investment in new capabilities and technologies, such as renewable energy sources. This impact of wireless connectivity can be felt across the economy – as estimated by Electric Power Research Institute (EPRI), a more efficient and reliable energy grid enabled by a smart grid could create $1.8 trillion in additive revenue for the U.S. economy from 2013-2020.[9]

Balances Energy Supply and Demand: Balancing power supply and demand is a critical role for electric utilities, as any miscalculation can cause safety and reliability concerns by oversupplying power to the system. Electricity supply and demand are largely independent, with utilities serving as the matching function to reach a near perfect equilibrium and ensure stability and reliability for the entire grid. Many causes of variability are unpredictable. For instance, weather is estimated to cause 80% of outages and 90% of electricity-related variability.[10]

Furthermore, the addition of renewable energy poses another challenge, as the energy added is often variable due to the availability of solar or wind inputs to generate energy, independent of the consumption or demand of energy. On the supply side, generation is estimated to be the part of the value chain with the largest source of losses in the system, with transmission as the second most significant source, which means improving the capability of the system could reduce power generation needs, costs, and avoidable losses in the system.[11]

Moving from a predictive system to a real-time reporting system that leverages wireless solutions enables electric utilities to better serve a matching function. For example, in 2011, an earthquake in the Washington, DC metropolitan area tripped sensors connected wirelessly to the grid at two nuclear plants in Virginia, shutting down the supply from these plants for 12 seconds. The U.S. Energy Information Administration reported that the other plants on the grid detected the decrease created in those 12 seconds and automatically generated additional output making up the difference to prevent service disruptions.[12]

A smart grid represents the widespread adoption of communications technology in the energy sector and refers to the technology that being used to provide computer-based remote control and automation, utilizing two-way communication technologies and sensors to gather and relay relevant data.

> The Smart Grid Consumer Collaborative estimated that for customers, smart grid adoption could lead to approximate savings of $40 to $100 per year in direct benefits and $50 per year in indirect benefits.[13]

Improves Grid Maintenance and Monitoring: EPRI estimated that the cost of power disturbances due to outages is between $104 billion and $164 billion per year.[14] Outages also cause major disruptions to residential customers and industrial users. Many industrial users are sensitive to any type of outage, which can cause operations to be disrupted and creates the possibility of having to scrap millions of dollars of material in the process. Wirelessly connected sensors allow utilities to monitor the maintenance and status of all of the lines within the system. This real-time monitoring allows electric utilities to accurately deploy technicians to fix and replace equipment due to storm or accidental damage, and provides the basis for optimizing the workforce and capital investments to improve the integrity of the overall system. With wirelessly connected sensors, electric utilities can fix and replace equipment before a critical failure, which potentially translates to further savings of millions of dollars per year.

For example, a report by U.S. Department of Energy (DOE) highlighted the Sacramento Municipal Utility District's (SMUD) implementation of the SmartSacramento project, which involved large-scale deployment of an advanced metering system integrated with existing information technology systems, such as proprietary-based, wireline, and wireless communications technologies. The project utilized a partial deployment of advanced power distribution systems to enable automated grid control and operations. SMUD estimates that this project has reduced outage events by 37% in customer-minutes interrupted from 2009 to 2013.[15]

Protects Workers: Efficiencies can also be obtained across other key components of the grid, including generation and distribution, in addition to reducing energy loss. Many complexities and issues in the energy sector can be alleviated using sensor technology to send information about the status of infrastructure and electricity flows. Nuclear power plants are leveraging next generation wireless connectivity to strengthen on-site communication to monitor equipment, provide redundancies, and address safety concerns. A nuclear facility in South Korea was able to reduce worker radiation doses by 37% through wirelessly enabled radiation sensors and a centralized monitoring system.[16] Similarly, electric utilities are changing how they operate and are moving towards smart automation to improve overall system response time using wireless connectivity.

Reduces Investment Costs: Ubiquitous access to wireless networks allows sensor technology to inexpensively transmit information back to utilities or users on a timely basis. In 2015, a major telecommunications carrier launched a platform for utilities, which uses 4G LTE technology and provides a dedicated wireless backhaul for advanced metering infrastructure. In more than 60% of electric outages, utility companies became aware of the outages from customer notifications, according to industry estimates and stated in the press release announcing the new platform.[17] While most utilities use cellular technologies for aspects of their grid communications, this platform is an example that brings the solution to each smart meter and allows more utilities to undertake smart meters without requiring additional significant communications network investments.

Boosts Generation and Distribution: Bringing electricity into homes and businesses is equally complex, requiring a network of substations, system redundancies, and lower voltage distribution lines. Smart meters provide information for the utilities to dynamically adjust to peaks and demand changes. As of early 2016, more than 50 million smart meters reliant on a wireless connection were installed in approximately 43% of American homes.[18] More recently, these smart meters have been harnessed to provide information about usage to the consumers to directly influence choices to reduce use and cost. This information is accessed through online customer accounts. Some utilities have started to offer in-home meters that convert from kWh to dollars per hour, using the current dynamic price based on aggregate demand.

For example, a DOE report discussed Florida Power & Light's (FPL) project aimed at decreasing losses and demand, using a large-scale deployment of advanced smart meters, distribution automation, an electricity pricing pilot, and advanced monitoring equipment for the utility's transmission system. Advanced metering infrastructure, enabled by cellular technologies, supports a standardized two-way communication link between smart meters, access points on the grid, and distribution automation systems. Over three million of FPL's customers have received smart meters as a part of the project. FPL has achieved 98% of its transmission improvement goals and 50% of its distribution improvement goals, saving some customers $1,200 per household annually in 2012.[19]

Enables Consumer Education: Utilities are also harnessing smart meters to better educate and inform consumers – empowering them to reduce their energy bills. A Washington Post article reported that Oklahoma Gas & Electric (OG&E) installed more than 820,000 smart meters in its service areas through a voluntary enrollment program. Utilities use a combination of cellular and mesh wireless networks, but the backhaul system typically uses the cellular system infrastructure. The program communicated consumption and provided a direct way to monitor energy usage and costs, helping OG&E customers in the program save, on average, $191 per year on their electricity bills.[20]

Health

Wireless connectivity provides for innovations in telemedicine, patient monitoring, and data collection in the health care industry, partially saving the system $305 billion annually from decreased costs and mortality rates from chronic illnesses, according to a Goldman Sachs estimate.[21]

Health care expenditures in the United States rose to $3.2 trillion in 2015, or approximately 18% of the GDP.[22] Health care costs are rising, driven by many factors, including the aging population, severity of illnesses, the inefficiencies and complexities of the system, and lack of transparency or available data. The United States spends nearly twice as much per capita as any other developed nation on health care, but has lower life expectancy and higher levels of chronic diseases.[23]

Wireless connectivity enables remote access and telemedicine, while providing improved care and health outcomes. This increased access reduces unnecessary costs and ensures that time and distance are not barriers to early interventions and preventative care. Goldman Sachs estimates that the total annual savings opportunity for the health system that will be achieved through digital health adoption is $305 billion, with two-thirds from chronic disease management and remote patient monitoring.[24]

Consumers are increasingly attracted to these telehealth and smart monitoring trends, as they empower them to make better choices and access better care. Deloitte's 2016 Survey of U.S. Health Care Consumers shows that nearly 70% of healthcare users are interested in some form of connected healthcare services, 50% of health care users responded positively to the idea of telehealth,[25] and an American Hospital Association's report on telehealth indicates that:

- 74% of U.S. citizens would use telehealth services
- 70% of U.S. citizens would be comfortable communicating their health needs over a device
- 30% of U.S. citizens use computers or smartphones for medical or diagnostic information[26]

Expands Reach of Health Care: Telemedicine requires that both the physician and the patient have a secure, low-latency connection. With ubiquitous cellular coverage, this connection can be realized in rural areas, enabling greater access in all areas of the country.

Telemedicine is being embraced by hospitals around the country; the American Hospital Association's annual survey showed that 52% of hospitals in the United States used some form of telehealth in 2013.[27] Telemedicine is only one part of the picture, as patient monitoring has continued to evolve and grow exponentially. For instance, a Healthcare Information and Management Systems Society (HIMSS) study reported that leading medical professionals from the University of California Davis Health System implemented a program that utilizes clinical telehealth and telemedicine. As of 2016, the program reduced rural to urban transfers by an estimated 31%, saving rural emergency departments an average of $4,662 per hospitalization.[28]

The increased access to specialists and more experienced professionals from remote locations reduces the need for transferring and improves the quality of care offered closest to the patient.

HIMSS published a case study on Dignity Health in San Francisco, an integrated health care organization, which utilizes a telemedicine network that enables physicians to connect with patients at remote care sites through a secure internet connection. The system allows the organization to have a larger customer base beyond San Francisco, and centralized located scheduling services allow for quicker response times and help more patients.[29]

As of 2016, Dignity Health's program was reported to save an estimate of $20,000-$70,000 per bed per year, reduced sepsis shock from 45% to 20%, and halving the average ventilator stay to 1.4 days. Patients were able to get preventative care earlier and identify major issues faster.[30]

Reduces Mortality Rates: In the United States, chronic heart failure impacts nearly 6 million people per year. Telehealth programs have created an estimated 20% decrease in mortality and a 50% reduction in medical costs associated with chronic heart failure.[31] A Brookings report highlighted a program implemented in Massachusetts, the Connected Cardiac Care Program, which uses a combination of remote monitoring, social media, and data management applications to provide telehealth services, including centralized telemonitoring, self-management, and nurse intervention. The program has resulted in a 51% reduction in heart failure readmissions and 44% reduction in non-heart failure readmissions, leading to cost savings of $8,155 per patient. The accrued savings in the six years since its launch is over $10 million.[32]

Helps Manage Chronic Diseases: The Centers for Disease Control estimate that the incidence of diabetes increased fourfold from 1980 to 2014 and now affects approximately 29 million Americans, with 86 million diagnosed with prediabetes.[33] The disease is a significant contributor to rising health costs in the United States. Companies are addressing this trend; in 2015, a major medical device manufacturer

A Brookings report highlighted the State of Mississippi's Diabetes Telehealth Network (DTN), which is aimed at addressing the diabetes epidemic. DTN provides patients with remote care management, resulting in cost savings of $339,184 for 100 patients enrolled in that project and projected Medicaid savings of $189 million annually.[34]

launched a smartphone app for patients using its continuous glucose monitor to receive alerts. Results are uploaded every five minutes to the smartphone app, allowing patients greater control over diabetic episodes.[35]

Advances Medical Research: The wearables and remote patient monitoring market is expected to reach $612 billion by 2024 with expected sales from providers of $50 billion and consumers of $200 billion.[36] The National Institutes of Health (NIH) has created a precision medicine initiative – involving detailed personal medical information retrieved from wearables and implants -- that will enable research for a wide range of diseases to detect correlations between genetic environmental exposures and outcomes.[37]

Specific conditions and illnesses are being addressed through the use of wearables. As reported in a NIH study, the Michael J. Fox Foundation is pioneering work on devices that track the tremors associated with Parkinson's disease.[38] Wearable motion sensors provide reliable data in real time that help doctors determine whether patients are deteriorating and diagnose the root causes of symptoms.[38]

Creates Operational Efficiencies for Hospitals: Hospitals are increasingly using wireless connectivity to provide operational efficiencies. Studies find that more information was documented when a mobile device was used and more diagnoses are captured.[39] In 2015, Mercy Hospital in St. Louis announced that it opened the world's first Virtual Care Center, which houses 330 employees and existing telemedicine efforts, such as SafeWatch. The Virtual Care Center connects medical personnel with patients where they live, at one of Mercy's traditional hospitals, or at another physician's office.[40]

Sparks New Possibilities: With more reliable and faster real-time access, next generation wireless connectivity enables innovations in imaging, diagnostics, data analytics, and treatment. This is made possible through the use of devices, such as clinical wearables and remote sensors, as well as many others that monitor and electronically transmit medical data, such as vital signs, physical activity, personal safety, and medication adherence. For patients suffering from serious or chronic health issues such as cardiovascular disease, diabetes, or cancer, remote monitoring devices can track vital signs and glucose levels and electronically transmit this information to health care providers. For healthy patients seeking information and willing to pay out-of-pocket for devices today, wearables and monitoring technology can provide much needed information to help stay healthy.

Wireless connectivity's role as a catalyst in the health industry is clear in reducing costs across the system, providing incentives to patients to obtain care sooner, empowering patient choice, and providing for new functionality from medtech to hospital integration to patient services.

Public Safety

Wireless connectivity enables public safety personnel and departments to better protect and serve communities. A Journal of Health Economics study on the Salt Lake City EMS services found that a one-minute improvement in response time translates to a reduction of 8% in mortality, which means efforts to better coordinate responses or automatic deployment could save lives.[41] Wireless connectivity can also reduce crime and the cost of law enforcement, as shown through trial deployments of predictive policing programs across the country.

From predictive policing that helps reduce crime to providing real-time alerts giving first responders a more comprehensive understanding of unfolding emergencies, the technological gains of next generation wireless technologies are critical to helping citizens and communities enjoy enhanced public safety.

Wireless technology is enabling police departments to protect more neighborhoods with fewer personnel, improving patrolling techniques, and enhancing community engagement. Enhanced connectivity capabilities, enables public safety to rely on proactive policing techniques and deterrents. Advancements in wireless connectivity have the potential to demonstrably improve public safety by empowering public safety services – emergency responders, law enforcement, and public health – to carry out their missions more safely and effectively.

Advancements in public safety technology have largely focused on addressing declining government budgets and shifts in local tax bases, which have placed additional pressure on communities to do more with less.

Addresses Budgetary Pressures: Scheduling and deploying resources to provide public safety coverage amid budget pressures presents additional problems for many communities. For example, article highlighted that since 2006, the Denver Police Department has received a nine percent increase in emergency calls – responding to more than 500,000 calls in 2015. Compounded with budget cuts and fewer police officers, the Denver Police Department reported that it had postponed purchasing any new police cars.[42] But Denver's advanced wireless camera system, the High Activity Location Observation (HALO), was placed at key locations to extend the reach of the police force. HALO paid for itself in 18 months and allowed for more efficient investigations and capabilities, including the identification of license plates 1.5 blocks away.[43] Next generation communications technologies enable police departments to more efficiently cover the entire city.

Reduces Crime and Improves Officer Safety: The future of policing will take a stronger preventative approach, allowing police to do more with fewer resources and relying directly on data and algorithms to guide the deployment of resources. A predictive policing pilot program deployed by the Los Angeles Police Department (LAPD) builds on efforts in the last decade to focus on common crime hotspots by dynamically predicting new ones.[44]

PredPol estimated that the LAPD's Foothill Division saw a 20% drop in crimes from January 2013 to January 2014 and experienced a day without crime on February 13, 2014, due in part to the adoption of predictive policing analytics. In the Foothill Division, crimes were down 13% in the 4 months following the rollout of predictive policing analytics (while levels in the rest of the city remained flat). With this success, the LAPD expanded the pilot from three to 14 of 21 divisions by October 2015.[45]

The City of Atlanta launched a predictive policing analytics program, which allows police departments to layer data onto the existing wireless camera system feeds to predict when and where crimes may occur, enabling police officers to anticipate problems, preemptively deploy, and prevent future crimes. PredPol estimated that the results of the pilot program – deployed in two zones in July 2013 – showed aggregate crime decreases of 8% to 9%. The Atlanta Police Department has seen aggregate crime rates drop by 19%, attributing a significant portion of the sustained reduction to the deployment of this program.[46]

"The Los Angeles Police Department is leading the design of the next generation police fleet, maximizing the value of next generation wireless communication networks, which will enable the 'connected officer' to send and receive mission critical information timely, reliably, and with almost no latency. These innovations will improve officer safety."

Maggie Goodrich
Chief Information Officer, Los Angeles Police Department

Improves Decision-Making: The Internet of Things (IoT), a key trend in next generation wireless technology, will enable and empower emergency responders to be more responsive and effective. For example, emergency response vehicles can now be connected to the internet wirelessly with enough bandwidth to support high-resolution display monitors and to receive multiple inputs simultaneously. With this improved capability, emergency responders can develop fuller pictures of situations and provide better intelligence to decision makers. Connected sensors within disaster areas can wirelessly relay real-time information to ensure emergency managers make decisions based on the most recent, comprehensive information. A Journal of Health Economics study on the Salt Lake City EMS

system reported that a one-minute improvement in an emergency response translates to an eight percent improvement in mortality one day after the initial incident.[47]

The real-time tracking of emergency responders using IoT enables supervisors to make quicker and better decisions. Uses of IoT include:

- Tracking radio frequency identification (RFID) tags on equipment and GPS location of people and automobiles
- Controlling drones and other video surveillance remotely
- Monitoring integrated real-time weather data and personnel onsite managing the situation on high bandwidth connections

Creates Operational Efficiencies: Public safety professionals can capitalize on operational efficiencies that allow them to better perform their mission and save money. As reported, the Florida Department of Highway Safety and Motor Vehicles (DHSMV) partnered with an equipment manufacturer to install dedicated network antennae for video upload, allowing videos captured in police cars to be collected and used in criminal trials and proceedings. The new antennas reduced upload times from 3 hours to 20 minutes, which was estimated by the manufacturer to save the department $1.1 million in annual overtime.[48]

Integrates Public Health and Safety: Connected devices, reliable connectivity, and the resulting advanced analytics can empower emergency responders as well as public health officials to respond preventatively. For example, the City of Chicago announced that it had partnered with the Argonne National Laboratory and the University of Chicago to launch a city-wide pilot called the "Array of Things" (AoT) in 2016.[49] This initiative consists of 500 lamppost-mounted sensors, enabled by a major telecommunications carrier's network, which monitor air quality and other conditions to:

- Identify potential pest infestations
- Track variables increasing the incidence of asthma attacks
- Detect urban flooding to prevent damage and improve city services
- Provide real-time weather and climate updates
- Recommend the safest and least congested walking routes, depending on the time of day
- Obtain details about factors critical to the health of the city's environment and infrastructure

Once the sensor-based nodes collect the information, the data is transmitted over a secure wireless network to a central database server at the Argonne National Laboratory and then made available to the public.[50] Ultimately, the goal of AoT is to provide real-time, location-based data to detect changes and trends over time to improve the quality of life.

Transportation

Deloitte estimates that self-driving cars, enabled by wireless connectivity, could reduce emissions by 40% to 90%, travel times by nearly 40%, and delays by 20%.[51] A study estimates that self-driving cars could save 21,700 lives and $447 billion per year.[52]

Wireless connectivity improves the speed at which people and goods move along the road safely. An integrated transportation ecosystem is being accelerated by enhanced connectivity, a trend that is expected to continue and will push innovation in the transportation ecosystem. Benefits can be seen across the entire transportation ecosystem and modalities – from public transportation to trucking to individual drivers and riders. Next generation wireless technology is building a platform for widespread adoption of smart roads and infrastructure, while simultaneously recalibrating the transportation value chain, from manufacturers to end users.

While autonomous cars do not require wireless connectivity, being able to communicate to vehicles beyond a short-wave radio range will improve the overall transportation experience.

Reduces Congestion, Travel Time, and Delays: Next generation wireless technology has the potential to further improve these outcomes in the transportation sector by enabling the shift into self-driving cars and vehicle-to-infrastructure communication. Ubiquitous connections, made possible by cellular technologies, will enable software updates to occur automatically and access to networks even in remote locations.

A study estimated that even if only 10% of vehicles were self-driving, U.S. traffic deaths could decrease by 1,100 per year, saving $38 billion per year. If 90% of vehicles were self-driving, traffic deaths could decrease by an estimated 21,700 per year, saving $447 billion per year.[54]

Ford estimates that self-driving vehicles, one of the key innovations generated by next generation wireless technology, can save 37.5% in travel times and reduce delays by 20% for end-customers.[53]

The Atlantic Magazine estimated that the average American commuter spends 38 hours per year in traffic, collectively causing urban Americans to travel 5.5 billion more hours and purchase an extra 2.9 billion gallons of fuel at a cost to the U.S. economy of $121 billion per year.[55] According to the U.S. Department of Transportation (DOT), rural households drive more than urban or suburban households and utilize delivery services to access goods that are often not available locally.[56]

Enables System-Wide Improvements: Greater wireless connectivity pushes transportation services to work more efficiently and allows commuters to make their working and personal lives more productive. The first major benefit to commuters has been in improved efficiency. In the past decade, drivers and riders have been able to access new functionalities and services through their smartphones, examples including:

- Real-time mapping of traffic and road hazards
- Parking reservation services in ramps and on streets
- Urban bike sharing programs
- Ride sharing services
- One-way and day-long car sharing
- Accurate arrival times of public transportation

Deloitte estimated that vehicle emissions will decrease by 40% to 90% annually due to wide-spread adoption of autonomous vehicles, and ride sharing and automation will recover 100 billion hours of productive work that is otherwise used for commuting or driving.[57]

Improves Road Safety: As wireless communications technologies evolve, the transportation ecosystem will benefit by improvements in road safety and traffic efficiency. Augmented and virtual reality applications leveraging on-board sensors from other vehicles can fill blind spots and equip commuters with "see through" capabilities. Reliable identification and localization of vulnerable road users (VRUs) through satellite-based analytics can enhance the decision-making and safety of drivers. Data streams from connected road infrastructure like cameras and sensors can be utilized by on-board applications and algorithms to better plan routes.

Enhances Commercial Trucking: The commercial trucking industry also stands to benefit from enhanced wireless connectivity capabilities. For instance, Scania, a Swedish truck and equipment manufacturer, has partnered with the research and development department of a telecommunications equipment manufacturer to enhance wireless technology for use in the trucking industry. Scania has designed and developed wirelessly connected trucks that use on-board computers to send information to fleet management systems and workshops. This new era of wireless connectivity will enable trucks to be driven in convoys close to one another to improve the flow of traffic, real-time updates provided to the drivers about road blocks, obstacles, weather conditions, and other safety hazards, system-overrides to take over steering and breaking functions, and reduction of air drag leading to lower fuel consumption and exhaust emissions. The new 5G networks will only increase the opportunities available for this type of technology, as more capabilities are introduced to the market.[58]

Builds Platform for Smart Cities: Cities are leveraging wireless connectivity and taking an ecosystem approach to transportation. Recently, DOT announced that Columbus, OH, was selected as the

winner of the DOT Smart City Challenge, which will give the city $40 million in federal grant money and $10 million from private sources, plus the $90 million the city raised from private partners, to upgrade its transportation system.[99] Columbus' approach integrates wireless connectivity in every aspect of its system, including:

- Planning for autonomous cars and fleets
- Facilitating connections on buses and trains to create access for lower-income residents
- Utilizing a mobile phone enabled universal payment system
- Allocating shuttles for those who are in the most need of prenatal care

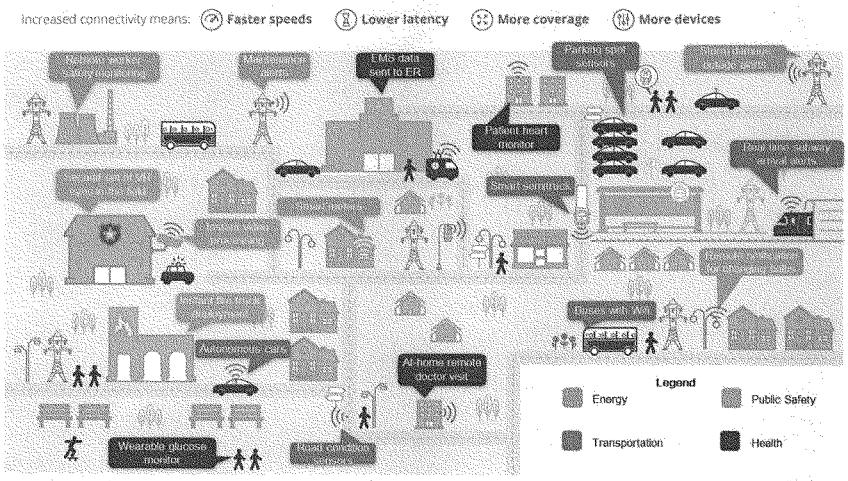
Overall, as further advancements in wireless connectivity continue to impact the transportation ecosystem, industry experts foresee progressively lower costs of transportation, fewer accidents, and new technologies. New business models, like shared ownership of fleets of autonomous vehicles, may emerge as a logical extension of these innovations. Ultimately, these changes could potentially benefit consumers through improved efficiency, better health and safety, and innovative transportation services.

Creates New Emerging Business Models: Business models in transportation will continue to evolve as wireless connectivity changes the very foundation of what transportation offers. New models will incorporate cross-industry cooperation between original equipment manufacturers and telecommunications operators to lower barriers for new sources of data to enter the ecosystem, improving commuter experience through enhanced local dynamic maps. As a result of these emerging business models, opportunities are already being created that deepen engagement with drivers through augmented or virtual reality dashboards.

Case Study

These changes reshaping the energy, public safety, transportation, and health industries – as well as those being felt across almost all sectors of America – are not taking place in disjointed isolation. Rather, they are interconnected and in many respects complementary, with advances in one industry often inspiring or creating demand for advances in other industries. The potential represented by next generation wireless technologies can be seen by envisioning how the four industries studied here could work together in response to a natural disaster, such as the wildfires that devastated portions of eastern Tennessee in late 2016. What follows below are a few examples of how wireless technology could be leveraged by these industries to save lives, property and communities in responding to future wildfires or similar disaster

Figure 3: Ecosystem of Connectivity – Increased connectivity drives innovations across every aspect of our economy



Source: Deloitte analysis

Energy: Energy companies are receiving data that allows them to manage the grid much more efficiently. Small distribution centers, previously unmonitored, now have sensors reporting problems. The grid turns itself off intelligently, detecting outages and downed lines far more precisely, so that power is cut off to a limited area, rather than a larger neighborhood. This data also enables crews to be quickly and efficiently dispatched and power to be more quickly restored after a disaster, allowing the community's recovery to begin.

Health: Ambulances can be routed in real time away from hospitals that have reached capacity or from roads blocked by the fire, and instead sent to hospitals that have the best capabilities to help. The detailed conditions and medical needs of patients are transmitted to hospitals in advance. The emergency room doctors and augmented artificial intelligence medical support are providing real-time support for basic and advanced life support techniques, specifically curated for individual patients through direct links to the patients' medical history. The technology allows for more precise logistics management, including the preparation and shipment of supplies, equipment, and medical personnel to the locations where they are needed most.

Public Safety: Fire commanders are receiving real-time data from firefighters wearing sensors, collecting data about the temperature of the fire, the amount of smoke being generated and localized readings of wind speed and direction. Remote sensors and cameras at ranger stations augment the information, allowing a 360-degree situational view to be stitched together for other respondents and decision makers. The

incident command center has a direct link to data analytics at new National Weather Service ground stations with precise information to conditions and the latest micro-forecasts. Police and other first responders have real-time information about vulnerable residents, including seniors or a recent heart transplant patient living alone in threatened areas, and children at day care centers, allowing for quick evacuation and lives to be saved.

Transportation: Roads with sensors embedded in the pavement detect when a fire is getting too close, sending notification to cars that certain routes are too dangerous, and directing them instead to safer escape routes, without diverting public safety officials to close the road. Cars traveling along various routes relay information about road conditions, congestion, and hazards to trailing cars using vehicle-to-vehicle communication, and trailing vehicles are dynamically rerouted to the nearest evacuation center based on location and prevailing fire conditions.

Conclusions

The Tennessee example is just one of many recent natural disasters for which the preparation and response could have been potentially improved with more ubiquitous coverage, increased adoption of new technologies, and deployment of next generation wireless technologies.

Realizing this future – and the benefits for energy, health, transportation, and public safety industries described above – will require a number of gaps to be addressed in the following ways:

- Making the permitting and regulatory process more efficient. In some cities, for example, small cells are regulated as if they were large cellular towers, with corresponding license requirements, fees and paperwork that inhibit the rollout of innovative wireless technologies
- Establishing public rights-of-way policies that allow the responsible deployment of small cells near consumers in urban areas
- Lowering costs and fees required to install new wireless infrastructure, as many municipalities carry fee structures that deter investment
- Adapting the siting process to provide more flexibility in placing wireless infrastructure, particularly small cells, in urban areas
- Continuing to support innovation in manufacturing and research to development the next generation of devices and equipment

The bottom line is that communities will miss out on opportunities if action is not taken to streamline the deployment of the wireless infrastructure required for 5G and smart cities.

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About the Report

This report was made possible through CTIA's sponsorship, but the contents and analysis of the report were included at the sole discretion of Deloitte. CTIA is an international nonprofit membership organization that has represented the wireless communications industry since 1984. The association's members include wireless carriers, device manufacturers, suppliers as well as apps and content companies.

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March 16, 2017

The Honorable Robert Latta, Chairman
The Honorable Janice Schakowsky, Ranking Member
U.S. House Committee on Energy and Commerce
Subcommittee on Digital Commerce and Consumer Protection
2125 Rayburn House Office Building
Washington, DC 20515

RE: Hearing on "Disrupter Series: Smart Communities"

Dear Chairman Latta and Ranking Member Schakowsky:

We write to you regarding the upcoming Disrupter Series hearing on "Smart Communities" that will be held on March 16, 2017. The implications of Internet of Things ("IoT") for consumer privacy and security are far-reaching. EPIC urges the Committee to consider the substantial privacy and security implications that come with the increased use of connected and "smart" devices. Specifically, core considerations in the development of smart communities should be prioritizing cybersecurity, protecting individual privacy, and minimizing data collection and sharing.

The Electronic Privacy Information Center was established in 1994 to focus public attention on emerging privacy and civil liberties issues. EPIC is a leading advocate for consumer privacy and has appeared before this Committee on several occasions, and has actively participated in the proceedings of the Federal Trade Commission ("FTC") and the Federal Communications Commission ("FCC").[1] EPIC has considerable expertise in the Internet of Things. EPIC has testified before Congress on "the Internet of Cars" and Smart Grid.[2]

[1] *See, e.g.* Marc Rotenberg, EPIC Executive Director, Testimony before the U.S. House Energy & Commerce Subcommittee on Communications and Technology, *Examining the EU Safe Harbor Decision and Impacts for Transatlantic Data Flows* (November 13, 2015), https://epic.org/privacy/intl/schrems/EPIC-EU-SH-Testimony-HCEC-11-3-final.pdf; Marc Rotenberg, EPIC Executive Director, Testimony before the U.S. House Energy & Commerce Subcommittee on Communications and Technology, *Communications Networks and Consumer Privacy: Recent Developments* (April 23, 2009), https://epic.org/privacy/dpi/rotenberg_HouseCom_4-09.pdf; Letter from EPIC to the U.S. House Committee on Energy and Commerce on FCC Privacy Rules (June 13, 2016), https://epic.org/privacy/consumer/EPIC-FCC-Privacy-Rules.pdf; Letter from EPIC to the U.S. Senate Committee on Commerce, Science, and Transportation on FTC Oversight (Sept. 26, 2016), https://epic.org/privacy/consumer/EPIC-Letter-Sen-Comm-CST-FTC-Oversight.pdf.

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The need for strong cybersecurity measure in cities is already evident. Shortly before the 2017 Presidential Inauguration, the Washington Metropolitan Police Department's closed-circuit television cameras were hacked and unable to record for three days.[4] In November, hackers infiltrated San Francisco's public transportation system and threatened to release customer and employee data unless a ransom was paid.[5] Hackers have also targeted police departments across the country by breaching their computer systems, holding files for ransom, and deleting files when they are not paid.[6]

A recent DHS report found that cybersecurity was a top concern in both the public and private sector.[7] That same report also noted that most states acknowledged their lack of understanding of cybersecurity practices.[8] For smart communities to be successful they will need to have support from state governments – and those governments will need to have a strong understanding of how to keep their communities secure from cyber threats. The potential benefits of smart cities will not be achieved if the systems are insecure and cities are subject to hacks that threaten public safety.

Protecting individual privacy must also be a priority in the development of smart communities. As these communities develop, special care must be taken to safeguard data generated by private individuals. For example, several cities have already entered into data disclosure agreements with popular traffic apps that rely on self-reporting.[9] Communities must be transparent with the public about how the data they receive is used and ensure that consumer data is protected.

Transparency is also essential. The public has a right to know if data will be used to determine changes in how first responders operate, especially law enforcement. An increased police presence could lead to the impression that some communities are being treated differently than others and that some individuals are viewed differently because of where they live or who

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[8] *Id.*

[9] Parmy Olson, *Why Google's Waze Is Trading User Data With Local Governments,* Forbes, Jul. 7, 2014, https://www.forbes.com/sites/parmyolson/2014/07/07/why-google-waze-helps-local-governments-track-its-users/; Nick Stockton, *Boston Is Partnering With Waze To Make Its Roads Less Of A Nightmare,* Wired, Feb. 20, 2015, https://www.wired.com/2015/02/boston-partnering-waze-make-roads- less-nightmare/.

they know.[10] Predictive policing tools are already in use throughout the criminal justice system, although little is known about how these tools, which rely on social and personal information, operate. EPIC has filed a Freedom of Information Act suit to obtain documents related to the use of "risk assessment" tools in the criminal justice system.[11] We urge the Committee to question what role, if any, these tools will have in law enforcement and criminal justice in smart communities.

Finally, we would urge the Committee to stress that data collection must be minimized in the development of smart communities. Smart communities should promote Privacy Enhancing Techniques (PETs) that minimize or eliminate the collection of personal information. The collection of personally identifiable information will necessarily require new privacy laws and safeguards. If smart communities fail to minimize data collection and establish strong privacy and security measures to safeguard the data that is collected, they will almost necessarily place their inhabitants at risk of system failure and cyber attacks.

We ask that this letter be entered in the hearing record. EPIC looks forward to working with the Committee on these issues of vital importance to the American public.

Sincerely,

/s/ Marc Rotenberg
Marc Rotenberg
EPIC President

/s/ Caitriona Fitzgerald
Caitriona Fitzgerald
EPIC Policy Director

/s/ Kim Miller
Kim Miller
EPIC Policy Fellow

[10] Matt Stroud, *The Minority Report: Chicago's New Police Computer Predicts Crimes, But Is It Racist?*, The Verge, Feb. 19, 2014, http://www.theverge.com/2014/2/19/5419854/the-minority-report-this-computer- predicts-crime-but-is-it-racist; John Eligon, Timothy Williams, *Police Program Aims to Pinpoint Those Most Likely To Commit Crimes,* New York Times, Sept. 24, 2015, https://www.nytimes.com/2015/09/25/us/police-program-aims-to-pinpoint-those-most-likely-to-commit-crimes.html.

[11] EPIC v. DOJ, No. 17-410, (D.C. Cir. filed Mar. 7, 2017), https://epic.org/foia/doj/criminal-justice-algorithms/EPIC-v-DOJ-criminal-justice-algorithms-complaint.pdf.

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