Creating Smart Communities
A Guide for State Policymakers
Communities Foundation Partnership

The Smart Communities Foundation Partnership was formed in 2018 as a public-private partnership, organized through the NCSL Foundation for State Legislatures. The partnership, through a number of in-person meetings and roundtable discussions, brought together legislators, legislative staff and the private sector to explore the policies and programs that help create smart communities, and the role that states should play in coordinating and encouraging these efforts.

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Introduction

Policymakers across the nation are looking to intelligently implement new technologies with the goal of creating vibrant, livable communities that offer diverse economic opportunities to all citizens while attracting innovative businesses and workers.

Increased reliance on all-online systems for commerce, government operations, health care and education driven by the COVID-19 pandemic, underscores the importance of having robust and “smart” infrastructure to ensure that daily life can continue as seamlessly as possible during times of emergency. The pursuit of such projects can create jobs, drive economic growth and positively impact community members.

The effort to become smarter and more connected requires state and local governments to consider a variety of factors. These include selecting and implementing technologies in a way that best serves the community, determining needs, creating a plan, leveraging opportunities with local businesses and community stakeholders, coordinating technologies across the many interconnected sectors and offices, navigating state and local regulations, and maximizing implementation with limited resources.

As communities plan for technology and infrastructure investments in this new environment, developing a coordinated, cross-government planning approach can greatly enhance efficiency. With the help of state-level entities, and in partnership with experts in the private sector, a coordinated plan can promote the development of a unified vision for how communities will approach the many different decisions that need to be made.

This report explores how state policymakers can support the smart use of technology to create safe, accessible, livable communities that are rich with economic opportunity and prepared to meet any challenge that might arise. It explores the many ways in which telecommunications, energy and transportation technologies can be used to create smart infrastructure and discusses the legitimate data management and cybersecurity concerns that accompany the use of these technologies.
Defining the Smart Community

The meaning of “smart community” varies among stakeholders, organizations and community members. A common theme among these many definitions is that a smart community leverages information, infrastructure, and communication technologies, often in combination with other technologies, to create economic opportunity and improve the quality of life for its citizens. Livability, efficiency, accessibility and sustainability are among the many other characteristics also attributed to smart communities.

The smart community concept is new and evolving as the number of communities using “smart” technologies continues to grow. Although several communities have taken actions to leverage smart technologies—such as installing smart street lighting, traffic or pedestrian sensors, and developing enhanced communications, smart buildings or smart transportation technologies—few have comprehensively adopted smart community concepts across multiple sectors. While communities may not have capacity to holistically implement every smart technology all at once, many have decided to invest in technologies and infrastructure that can lay the groundwork for future smart community growth.

This paper will focus on the intersection between telecommunications, energy and transportation technologies, exploring how these technologies can be managed and implemented to meet the goals of smart communities. The benefits of smart technologies are already being realized in a number of cities. For example, in Seattle the traffic management system uses real time traffic data to ease the flow of traffic through the downtown area.

Communities will likely not have the resources and knowledge to build and manage the many technologies that may be available for reaching smart community goals. The need to quickly respond to COVID-19 has led cities and states across the country to reevaluate budgets, and otherwise rethink how best to invest scarce resources in helping communities and community members recover from the outbreak. This presents another opportunity to leverage expertise in the telecommunications, energy and transportation sectors through public-private partnerships (P3s), which can assist in deploying broadband and wireless communications, as well as smart grid, infrastructure and traffic management technologies. These efforts can enhance efficiency, create cost savings, and deliver better services to residents and businesses.

“Living Lab” in Texas, Smart Neighborhood in Alabama

Dallas has tapped private-sector expertise to create the Dallas Innovation Alliance, a P3 composed of stakeholders who are helping to turn Dallas into a smart community. Partners—including AT&T, Microsoft, IBM and area universities—provide input for the city’s “living lab,” which serves as a testing ground for smart technologies and is located in Dallas’ West End. The first phase of the effort was launched in March 2017 and includes smart parking, smart irrigation, smart water systems, interactive digital kiosks and an open source data platform.

Birmingham, Ala.’s energy-efficient Smart Neighborhood provides another example of a future-focused smart community. The Smart Neighborhood is a collaboration between the city of Birmingham and major utility Alabama Power to develop a microgrid-powered community of high-performance homes, energy efficient systems and appliances and connected devices. This is the first residential microgrid in the Southeast and is powered by solar panels, battery storage and a backup natural gas generator. The homes’ smart systems help make them 35% more efficient than the standard new Alabama home.

It’s not just urban environments that can benefit from smart community concepts. Rural communities, many affected by population loss, driven in part by a lack of economic opportunities that threaten their vibrancy, can use smart community concepts to improve connectivity and create employment opportunities as more job roles move online.
While most of the decisions around smart communities are made at the town, city and county level, state level decision-making will play a major role in enabling communities to best tailor smart technologies to their needs. State legislators can provide resources and support to communities on a range of issues, including data security and management, smart community planning, tax incentives, and policies that encourage and facilitate public-private partnerships.

Smart Telecommunications

The foundation of all smart communities is modern broadband network infrastructure. Broadband enables every smart community service, from smart electric grid offerings, to real-time traffic monitoring, connected vehicles, the Internet of Things (IoT) and a host of other smart technologies. These cutting-edge services depend on real-time data transmission and interaction with end users to serve community residents effectively and efficiently.

Elements of Broadband Connectivity:

- A broadband network includes three main components: the backbone, middle mile and last mile.
- The broadband backbone is comprised of major high-speed transmission lines that run across the country.
- The middle mile refers to the connection between the backbone and the last mile.
- The last mile connects consumers and devices to the internet. For example, the middle mile can refer to the connection between a smaller, rural town to the larger metropolitan area and the major broadband providers.

Broadband is delivered through several types of technology:

- Fiber-optic cable.
- Hybrid Fiber Coax (HFC).
- Copper wire.
- Various kinds of wireless platforms (e.g., fixed and mobile).
- Satellite.
Fiber-optic lines are thin glass threads that carry data on light waves. Cable broadband networks are built on HFC, which uses an evolving standard currently known as DOCSIS 3.1. Like fiber, HFC can deliver multi-gigabit speeds. Digital subscriber line (DSL) is copper-based while fixed wireless, mobile (4G and 5G), satellite and microwave are types of wireless technologies, each of which uses different technologies, network architectures and spectrum bands to deliver service. Wireless systems depend on fiber backbones to move data between antenna locations.

In its 2020 Broadband Deployment Report, the Federal Communications Commission (FCC) reported that the number of Americans lacking a connection of at least 25 Mbps/3 Mbps had dropped from 55 million in 2014 to 18 million by the end of 2018. This means that broadband delivered over a wire (HFC, fiber, etc.) of at least 25/3 Mbps is available to over 94% of the U.S. population. However, gaps in connectivity remain in rural areas and on tribal lands: 22.3% of Americans in rural areas and 27.7% of Americans in tribal lands lack coverage from fixed terrestrial 25/3 Mbps broadband, compared to only 1.5% of Americans in urban areas.

While some advocates take issue with the way the FCC maps and tracks broadband deployment, arguing that the number of people lacking broadband connection is underreported, everyone agrees more work needs to be done to bring broadband to the home.

The Role of Wireline Broadband in Enabling Smart Communities

All broadband connections, including those that are wireless, ultimately rely on a wire for delivery. In the smart community context, fiber and HFC are serving as the foundation for a myriad of services and applications.

Charter Communications, for example, is working with St. Petersburg, Fla., to support local economic development and the deployment of smart community services. In particular, Charter’s broadband network serves as the foundation for an Innovation District, which will be used by local businesses and community members to “develop advanced applications and services that address local needs such as infrastructure, workforce development, public safety, education, and community health.” Among the many innovative programs in the pipeline are a smart lighting project that aims to help the city save money and “an educational program that helps children at the Boys and Girls Club learn more about marine science.”

Comcast has launched several smart community initiatives centered around its high-speed broadband network. MachineQ, for example, helps cities leverage the IoT by allowing for the “transfer of small amounts of data across large distances inexpensively” via a network of sensors and Comcast’s underlying network. To date, MachineQ has been integrated into smart water meters and deployed by municipalities such as Columbus, Ga., and Riverside, Calif. Comcast has also worked with cities such as Detroit to deploy smart camera systems that help enhance public safety.

Over the last few years, Cox Communications has partnered with cities including Las Vegas, Phoenix and San Diego to enable a range of smart city solutions. Cox is currently working with Henderson, Nev., to pilot “new water system control, lighting controls and parking and traffic management solutions.” In addition to leveraging its network to power these services, Cox also “intends to ‘aggregate critical data’ to make actionable decisions on resource management,” highlighting the operational expertise that private entities like Cox can bring to the table.

The Role of Wireless in Enabling Smart Communities

Smart communities can generate an enormous volume of data, so a robust wireless network is needed to facilitate data collection and analysis from the various sensors and devices. The deployment of fifth generation (5G) wireless infrastructure, which is just starting to emerge, will likely ignite smart community efforts because this new wireless technology promises to bring much faster network speeds and greater bandwidth. This will allow more devices to use the network at the same time with lower latency, meaning that devices will take less time to send and receive communications. Proponents believe that 5G wireless networks will be as reliable as the wired broadband internet we currently use. The following graphic shows the evolution of mobile communications.
Five Generations of Wireless Technology

- **1980s** | 1G Analog technology allows the first wireless conversations from across the globe.
- **1990s** | 2G Short Message Service (SMS) brings us text messaging—a new way to chat and a new language to go with it.
- **2000s** | 3G Multimedia Messaging Service (MMS) lets us share more of our lives through photos and other media.
- **2010s** | 4G Live video and wireless broadband brings the world to us in real time on our smart devices no matter where we are.
- **2020s** | 5G By far the fastest wireless technology to date, sure to transform how we live, work and play.

5G deployment depends on small cell technology, wireless transmitters and receivers about the size of a picnic cooler or mini fridge. These small cells can be located on utility poles or on roofs of buildings but will require more transmitters than current 4G cellular since 5G signals travel over shorter distances. 5G uses millimeter waves, which broadcast at frequencies between 30 and 300 GHz. To be effective, these transmitters, or antennas, need low latency backhaul. Due to the shorter range of 5G, bringing 5G to rural areas may be more challenging. Proponents believe 5G will have transfer rates of 10 gigabits per second (Gbps), at least 100 times faster than the current 4G/LTE technology. What does 10 Gbps mean? According to the Consumer Technology Association, a consumer could download a two-hour movie in 3.6 seconds on 5G. On 4G, it would take 6 minutes, while on 3G it would take 26 hours.

Another wireless technology that may help smart communities is low-power wide-area networks (LPWAN or LPWA). Many IoT devices, like sensors powered by batteries, often used in smart community development, need to communicate over large geographic areas, but do not require the same speed and bandwidth as smartphones. Potential applications for smart communities include metering, localization, transportation, and flood monitoring.

AT&T, for example, is working with the city of Atlanta and several other private partners to transform the city’s streetlights into “a sensor-enabled data network,” which is being used to test a range of services, from gunshot detection to parking monitoring. More broadly, AT&T is working with hundreds of localities across the country to build FirstNet, a nationwide public safety wireless network for first responders. San Jose, Calif., the first city to have fully deployed FirstNet, sees that network as another enabler of its smart community vision, assisting it in realizing a range of safety goals.

T-Mobile has deployed a novel suite of services for a broad range of stakeholders in the smart community. Specifically, T-Mobile offers cities, businesses and other entities an energy efficient narrowband IoT solution that can blanket broad swaths of area and leverage sensors and its wireless network to aggregate and transmit large amounts of data in real time.

Smart Rural Communities

Successful smart communities use technology to respond to the needs of their residents who live and work in the communities, without excluding residents based on their location (urban vs. rural), socio-economic standing, disabilities or language barriers.

For rural communities, where the last mile connection for higher-speed broadband can be a challenge, fixed wireless and satellite internet may be options. Using an outdoor antenna and indoor routers, fixed wireless
broadcasts the connection via radio waves from the antenna to the residence, offering higher speeds and lower latency. The connection between the antenna and routers requires direct line of sight and can be affected by weather. Satellite internet can offer quick installation and higher speeds, but due to the distance the data must travel between the satellite and the consumer, satellite internet has the highest latency compared to the other broadband options. Just like fixed wireless, satellite internet requires line of sight and can be affected by weather. In some rural areas, satellite internet may be the only option due to the lack of fiber, cable or DSL infrastructure.

Partnerships with broadband providers can also yield new deployments in rural areas, and those new networks can go a long way toward making those communities “smarter.” In St. Francis, Kan., for example, local officials partnered with Eagle Communications to bring gigabit speeds to the town of 1,300. As a result, according to NCTA—The Internet & Cable Association, “St. Francis has seen 11 new businesses open and nine new commercial ventures have sprung up. A town that once felt left behind was suddenly on its way up. Young people started to move back, because they could now work remotely thanks to Eagle’s high-speed reliable broadband network.”

Bringing Broadband Everywhere So Every Community Can Be Smart

Over the last two decades, states have worked with private entities who have invested almost $2 trillion in building out advanced communications infrastructure. In those areas where robust connectivity is evident, decision-makers have opportunities to forge partnerships in their pursuit of becoming a smart community. As noted above, these partnerships can take many shapes as communities and their partners work to achieve shared goals.

In some instances, electric utilities may aid in expanding broadband by increasing the capacity of fiber cable they install for smart grid technologies. Some states have authorized electric utilities to engage in this arrangement with internet service providers. In the past few years, at least 10 states have enacted legislation regarding electric utilities and broadband deployment. In 2019, Virginia enacted HB 2691 requiring the State Corporation Commission to establish pilot programs under which Dominion Energy and Appalachian Power may submit a petition to provide or make available broadband capacity to nongovernmental internet service providers in areas of the commonwealth that are unserved by broadband. In 2020, Virginia enacted companion bills, HB 831 and SB 794, declaring that it is the policy of the commonwealth that easements for the location and use of electric and communications facilities may be used to provide or expand broadband or other communications services. In its 2020 legislative session, West Virginia enacted HB 4619 establishing the Middle Mile Fiber Broadband Infrastructure Expansion Program and authorizing electric utilities to participate in the program.

As states have authorized electric utilities to participate in middle mile deployment, policymakers work to identify and remove an array of barriers that impede deployment and undermine incentives to invest in certain communities. One barrier in rural areas is the variable nature of fees to attach broadband equipment to utility poles. For example, in its 2020 session, Georgia enacted HB 244, known as the Georgia Broadband Opportunity Act. It grants the state’s Public Service Commission authority to set reasonable, nondiscriminatory and commercially reasonable rates, fees, terms, conditions and specifications in any pole attachment agreement entered into by a communications service provider and an electric membership corporation.

In those areas where broadband remains unavailable, policymakers and advocates continue to try to close a rural digital divide that has persisted for decades. Encouraging broadband providers to expand their networks into these areas continues to be a priority in states across the country.
“Smart transportation” is an Internet of Things vertical application which integrates modern technologies and management strategies in transportation systems. It often includes multi-modal connected transportation systems, traffic sensors, integrated fare systems, advanced traffic signal systems, and automated tolls and fare collection. Elements of such systems influence daily operations across highways, public transportation and on-demand mobility while relying on information systems, new technologies, and automated and connected vehicle systems.

Ultimately, these applications are designed to help make future transportation systems not only “smarter” but also more efficient and accessible and safer. Innovations in “smart transportation” bring important benefits to cities, such as potentially increasing mobility, incentivizing transit ridership, providing mobility to underserved populations, and reducing congestion and air pollution. They also could help communities achieve important safety benefits, such as reducing automobile collisions, promoting driver, passenger and pedestrian safety, and giving drivers safety warnings and assistance. When the U.S. Department of Transportation (DOT) announced its “Smart City Challenge” in 2015 to help cities develop ideas for “smart transportation” systems, the response was overwhelming, with 78 cities submitting proposals. Columbus, Ohio, was chosen as the winner and has undertaken a number of smart transportation initiatives on page 12.

Automated vehicles have the potential to significantly transform transportation systems. These vehicles have on-board sensors, including radar, LiDAR and cameras, which detect activities around the vehicle. Data from the sensors, combined with detailed digital mapping, allows the vehicle to take over some driving functions. There are five levels of automation, ranging from limited control of the forward motion of the vehicle (i.e., adaptive cruise control) to full automation, where a human driver is not needed. Lower levels of automation are available in many new cars today, but full automation is still a number of years away. While automation systems are being designed to operate on today’s infrastructure, automated vehicles will be more effective if agencies improve paint stripes and roadway signage to be tailored to automated vehicles. This could include roadway improvements such as thicker lane markings and standardized signage that does not fade.

Smart transportation relies on telecommunications to allow communication between vehicles, the infrastructure and traffic management agencies, and to facilitate real-time data collection and analytics.

In 1998, Congress enacted the Transportation Equity Act for the 21st Century (TEA-21). This legislation allocated spectrum on a dedicated short-range band, known as the 5.9 GHz band, for Intelligent Transportation Systems (ITS). This dedicated band, often referred to as the “Safety Band,” is used by Dedicated Short Range Communication (DSRC) systems to send and receive vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I)
and vehicle-to-pedestrian (V2P) communications, collectively known as vehicle-to-everything (V2X). These “connected vehicle” (CV) safety applications seek to reduce automobile collisions, promote driver, passenger and pedestrian safety, and save lives by providing safety warnings and assistance to drivers.

Connected vehicle wireless systems generally have a range of about 1,000 feet and do not depend on “line-of-sight” communications to be effective. CV systems are not affected by snow, fog or rain. In essence, the car and its driver can learn things about the transportation environment that generally cannot be seen. This is in contrast to automated vehicles, which gain information from on-board sensors. Automated vehicles will not necessarily be connected, and connected vehicles will not necessarily be automated, but we anticipate that in the future many vehicles will have both systems.

In order for V2I systems to work effectively and communicate with transportation infrastructure such as traffic signals, agencies will need to install wireless communications systems and software along the roadway.

An additional connected vehicle technology has recently emerged: Cellular-V2X (C-V2X). While DSRC is based on communications using Wi-Fi standards, Cellular-V2X (C-V2X) is based on 4G cellular technology. C-V2X is not yet allowed to use the 5.9GHz safety spectrum for regular operations, but the FCC is proposing to allow its use of the spectrum (see page 14).

**DSRC, C-V2X and 5G Systems**

**DSRC** is a short-range wireless communication system, similar to Wi-Fi, that operates on the 5.9 GHz radio spectrum. It was designed specifically to allow vehicles to quickly communicate with each other and with the infrastructure. It enables data and systems to interface by sending and receiving various bits of information without using cellular or other infrastructure.

C-V2X is a 4G cellular-based technology that provides direct communications between vehicles, vehicles and infrastructure, vehicles and other road users, and vehicles and cellular communications providers’ mobile broadband networks. However, the technology is not compatible with DSRC-based operations.

5G, or 5th Generation Wireless, is the newest mobile network for cellular communication. When fully mature it promises a new wireless system that is deployed around the world, offering faster speeds, greater capacity and better reliability compared to previous cellular networks. At some point, it may also provide communication for connected vehicles.

The **Signal Phase and Timing (SPaT) Challenge** (Challenge) was created by the V2I Deployment Coalition, led by the American Association of State Highway and Transportation Officials (AASHTO), the Institute of Transportation Engineers and the Intelligent Transportation Society of America, with the goal of implementing DSRC communications at a minimum of 20 signalized intersections in each state by January 2020. Using the 5.9 GHz band, the Challenge seeks to provide a starting point for deploying DSRC technologies and helping government and industry gain operational experience along the way. The DOT reports that CV deployments are underway in 25 states, from California to New Hampshire. These efforts are driven in part by the SPaT Challenge.

A SPaT message contains information about the status of traffic signal phases, including whether emergency vehicles are preempting the signal or pedestrians have requested to cross. Combined with a message that includes information on intersection geometry and defines the various lanes in the intersection, SPaT is broadcast to connected vehicles. In turn, the vehicle broadcasts a Basic Safety Message (BSM) to the roadside, anonymously indicating various aspects of vehicle behavior, including the speed, direction, braking activity and windshield wiper activity. This information can be used by the vehicle to avoid running a red light or hitting an oncoming vehicle. It can also be used by traffic managers to adjust signal timing without deploying personnel to the field, detect incidents and give safety warnings to drivers about potential hazards. Additionally, SPaT can prioritize extended green lights for certain vehicles such as transit buses and snowplows.
Ohio and Utah are considered leaders in testing and developing CV technologies. Their testing and deployment efforts were studied across transportation modes.

**Ohio**

The Ohio Department of Transportation (ODOT) is leading Ohio’s smart transportation efforts through the state’s DriveOhio initiative created by executive order in 2018 and refined by a subsequent order in 2019. Technologies being deployed involve DSRC systems, vehicle onboard units and unmanned aerial systems (i.e., drones). The ODOT also received a $7.5 million federal grant to help facilitate testing and development of CVs through multi-pronged demonstrations focusing on rural environments, cooperative automation and robust data collection with the goal of helping develop effective and informed smart transportation policies.

- **33 SMART MOBILITY CORRIDOR**

This 35-mile segment on U.S. Route 33 will serve as the proving ground for smart mobility technology, including connected and autonomous vehicle technologies. The ODOT and local governments will equip the highway with high-capacity fiber-optic cable and roadside sensors. The data collected from this project will improve the accuracy and timeliness of traffic counts, weather and surface conditions, and incident management.

- **CONNECTED MARYSVILLE**

A subset of the 33 Smart Mobility Corridor project, the city of Marysville upgraded 27 traffic signals by using DSRC systems to manage signal timing, detect pedestrians and prevent collisions. By installing onboard units in at least 1,200 vehicles, Marysville expects to create a “real-world environment where companies, governmental agencies and academia can develop and test smart technology...” according to the Connected Marysville website. The data will help design new CV technologies and future applications that may help drivers make better decisions behind the wheel.

- **U.S. ROUTE 33: TRAFFIC MONITORING**

A three-year project is underway using drone technology to monitor traffic conditions and flow along a section of U.S. Route 33. Once the project is finished, the results of the study will help inform what may be needed to create a “low-altitude air traffic management system.” The results of this effort will help determine if and how unmanned aircraft can be safely operated.

- **I-90 LAKE EFFECT CORRIDOR**

Sixty miles of I-90, situated on a section of highway with limited visibility caused by adverse “lake-effect” weather conditions, will be equipped with DSRC units and will also test wireless systems designed to send and receive data. From a combination of data collection and variable speed limit signs, the overall management of the roadway can be improved, including a reduction of crashes and fatalities. Additionally, the ODOT will use this information to inform real-time changes when deciding to reduce speed limits due to inclement weather or other high-impact events.

**Utah**

Utah’s Department of Transportation (UDOT) deployed CV technologies to improve the quality and service levels of its bus systems and snow removal operations. Specifically, Transit Signal Priority is being used to hold green lights longer or shorten the timing of red lights. This effort seeks to improve bus flow, mobility and operational efficiency.

- **REDWOOD ROAD CONNECTED VEHICLE PROJECT**

DSRC is deployed at 24 intersections and in 10 buses operated by the Utah Transit Authority. The goals of this project were twofold: 1) to give priority to buses entering intersections that were behind schedule and 2) improve transit schedule reliability. Since November 2017, the results have shown a 6% increase in scheduled bus system reliability and a decrease in the variability of bus arrivals at stops. Following the suc-
cess of this project, a DSRC-based transit signal priority system was installed on the UVX Bus Rapid Transit project in Orem and Provo, Utah, in 2018, and is being planned for two more routes in Salt Lake and Utah Counties.

■ SNOWPLOW PREEMPTION PROJECT

DSRC is deployed at 55 intersections and in 46 snowplows. Given the success shown on buses, the UDOT initiated a project to outfit snowplows with the same DSRC technology. Some stakeholders anticipate that if snowplows receive signal preemption on key routes, then those roads will be cleared of snow and ice sooner. By doing so, this will bring safety benefits such as fewer crashes. Plow efficiency is also improved.

■ PANASONIC “SMART ROADWAYS” PARTNERSHIP

In June 2019, the UDOT announced a five-year partnership with Panasonic to develop the nation’s most advanced network of “smart roadways.” This partnership will allow the UDOT to accelerate development of a statewide system to collect, monitor and share data between vehicles, infrastructure, roadways and traffic managers in real-time environments. This effort will build on the UDOT’s existing framework for CV technologies by enabling insights into critical events such as crashes, inclement weather events and stalled vehicles. Traffic managers will be able to use this information to alert CV drivers in real time with alternate routes, delay times and other helpful information. V2X equipment (DSRC and C-V2X) has already been installed in 69 roadside locations and in 35 UDOT fleet vehicles.

Spotlight: Salt Lake City

Salt Lake City’s smart community effort is aided through its partnerships with Rocky Mountain Power (RMP), Park City, Breathe Utah, Fourth Mobility, Giv Development, Idaho National Laboratory, Maverik, New Flyer, Salt Lake City International Airport, the U.S. Department of Energy, Uber, Utah Clean Cities Coalition, University of Utah, Utah State University and the Utah Transit Authority (UTA).

Salt Lake City’s Goals:

• Promote adoption of electric transportation.
• Enhance access to renewable energy.
• Reduce city emissions.
• Enhance energy efficiency.

What Makes Salt Lake City Smart?

Smart Transportation—Improves safety and mobility, reduces carbon footprint, and provides greater access to services. RMP will use $4 million awarded by the U.S. Department of Energy and $10 million from its Sustainable Transportation and Energy Plan to accelerate the adoption of plug-in electric vehicles in the greater Salt Lake City area by developing electric highway corridors, advancing workplace charging, and incentivizing fleet conversions.

Salt Lake City International Airport will deploy all-electric ground support equipment and infrastructure and install more than 100 electric vehicle charging stations at short- and long-term parking lots as part of a $3 billion expansion.

Salt Lake City is partnering with RMP, UTA and the University of Utah to deploy five electric buses operating between the downtown transit hub and the university.
Mobility on Demand

Mobility on Demand (MOD) is a concept where travelers can access multiple transportation services over a single digital interface. A traveler could book a shared ride (such as Uber or Lyft) to a train station, buy the train ticket and reserve an electric bike at the other end of the train ride in one place. This concept, along with all of the components of Mobility as a Service (MaaS)—shared rides, bike and scooter rentals—are integral to the development of smart communities. These systems all require pervasive access to digital communications systems.

Low-speed, automated vehicle shuttles are being tested in a variety of locations, including California, Colorado, Delaware, Florida, Minnesota, Texas, Utah and Virginia. These vehicles follow fixed routes, providing transportation within senior communities, office parks, shopping complexes and university campuses. They have no human driver but have attendants on board who can take over the driving function if needed. One potential use of these shuttles is to transport people through the first mile or last mile, getting them to and from bus or train stations. Smart communities may include these types of transportation systems to improve mobility options.

While many of the activities associated with smart transportation, including connected, automated and electric vehicles, are being driven by the private sector, state and local actions can support, encourage or inhibit these activities. Tax policies or financial incentives will influence the deployment of electric vehicles. Zoning regulations and transportation planning influence the use of curbs by shared ride services and non-motorized transportation. State regulations will dictate the consistent testing and deployment of automated vehicles and will facilitate the communication systems necessary for connected vehicles.

Transportation and Telecommunications Nexus

In January 2020, the DOT announced another initiative using the 5.9 GHz band for “technologies to improve safety for the traveling public and first responders.” At the time of the announcement, Transportation Secretary Elaine Chao was quoted as saying, “These systems will use the 5.9 Gigahertz Safety Band of spectrum currently allocated for use in transportation systems. We believe it is very important to retain this bandwidth for this purpose, and the Department is actively advocating the FCC to do so.” Specific details about this program, including selection of sites, are still pending.

The DOT announced in May 2020 that there are 23,002 planned and operational vehicle-based DSRC devices, prompting criticism that the number of vehicles with DSRC devices has failed to reach the critical mass necessary to be effective. While General Motors has installed DSRC units on select Cadillac models, Ford announced its intention to install C-V2X equipment on all new vehicles starting in 2022. Other automakers will likely follow suit installing C-V2X equipment. While CV technologies have continued to advance over the last two decades, innovations in broadband and increased demand for Wi-Fi may force DSRC operations to share or move off the 5.9 GHz band entirely.

Over the past few years, the telecommunications industry and other advocates have argued that the 5.9 GHz spectrum, reserved for DSRC and also referred to as the safety spectrum, is being underutilized. In December 2019, the FCC proposed to create sub-bands within the 5.9 GHz band to allow unlicensed operations like Wi-Fi to operate in the lower 45 megahertz of the band (5.850-5.895 GHz) and reserve the upper 30 megahertz of the band (5.895-5.925 GHz) for ITS. The proposal sought comments on allotting space for both DSRC and C-V2X in the upper 30 megahertz of the band. In the rulemaking notice, the FCC noted that DSRC and C-V2X “are mutually
incompatible (and thus cannot both be authorized to operate on a single channel without causing harmful interference).” Uncertainty surrounding the safety spectrum has caused some major automobile manufacturers, including Toyota, to pause their connected vehicle plans.

One concern about reducing the safety spectrum is the potential for wireless interference from non-transportation communications. A preliminary report by the National Highway Traffic Safety Administration (NHTSA) recently concluded that repurposing the 5.9 GHz band for non-transportation purposes may create harmful interference to the point where safety benefits could be reduced or eliminated. Transportation stakeholders—agencies, automakers and suppliers—have been largely united in requesting the FCC to leave the safety spectrum intact. The AASHTO has expressed opposition to using the 5.9 GHz band for non-transportation purposes, arguing both that the current band should be reserved for transportation safety purposes and that DSRC is the only proven technology that will enable the development of a CV environment.

In its filed comments, the NCTA—The Internet & Cable Association argues that “Wi-Fi carries a significant—and growing—percentage of overall traffic online,” particularly as 5G develops. Furthermore, “this ever-increasing demand already threatens to outstrip the nation’s unlicensed spectrum capacity, which would result in significant congestion.” NCTA views the 5.9 GHz band as ideal to help facilitate the development of the next-generation Wi-Fi standard, Wi-Fi 6, and notes that “no automaker has current plans to deploy DSRC radios in new vehicles.” NCTA warns that if the FCC does not repurpose the 5.9 GHz band, “C-V2X cannot deploy in the first place given the technology- and standard-specific rules governing the band.”

The Wi-Fi Alliance filed comments disputing claims that opening up the 5.9 GHz band to Wi-Fi use will create interference for the operation of ITS.

A decision by the FCC is expected in late 2020.

Federal Actions

In 2017, NHTSA announced a proposed rulemaking to mandate all new light-duty vehicles be equipped with V2V technology capable of transmitting over DSRC. These provisions would gradually take effect over three years. At the time, NHTSA projected that the mandate would start at 50% of the new vehicle fleet in 2021, increasing to 75% in 2022 and 100% in 2023. NHTSA studies indicated that these systems would mitigate 83% of non-impaired crashes. However, NHTSA has yet to initiate any next steps and the rulemaking process has halted. In 2015, the DOT announced funding awards for three Connected Vehicle Pilot Deployments in New York City, Tampa, Fla. and Wyoming, respectively. With a $42 million federal investment, these three sites have deployed significant infrastructure elements and developed numerous V2I software applications. The DOT continues to be engaged in these projects, solving deployment issues and sharing lessons learned.

The DOT is also continuing to encourage development of automated vehicle technologies. Specifically, in the fall of 2019, the DOT awarded a number of discretionary grants as part of its Automated Driving Systems (ADS) Demonstration Grant program. As part of these awards, millions of dollars were directed toward projects that focused on the safe integration of ADS into work zones by examining connectivity, visibility and high-definition mapping technologies. In Iowa, the state DOT received a $7 million ADS grant to connect rural, transportation-challenged populations using a mobility-friendly ADS built on a commercially available platform. The University of Iowa will study automated vehicles and conduct various safety demonstrations. The goal of the grant is to help bring safe, driverless transportation services to rural areas in the state.

Additionally, the DOT’s largest discretionary grant program, the Better Utilizing Investments to Leverage Development, or BUILD Transportation Discretionary Grant program, provides federal grants for road, rail, transit and port projects that promise to achieve national objectives. Previously known as Transportation Investment Generating Economic Recovery, or TIGER Discretionary Grants, Congress has dedicated nearly $7.1 billion for 10 rounds of National Infrastructure Investments to fund projects that have a significant local or regional impact.

Recently, a number of BUILD grant awards have funded CV projects. In 2018, the DOT funded three specific projects all with a major focus on CVs. The Colorado Department of Transportation (CDOT) received $20
million, featuring an expansion of deployed CV technology on seven highway segments, consisting of 455 miles, as well as fiber installation on three corridors covering 319 miles. The goal is to improve the safety of drivers and to inform CDOT of crashes or hazards on the roads using Infrastructure-to-Vehicle (I2V) communications to send safety and mobility-critical messages directly to the driver and CDOT.

A second project in Jacksonville, Fla., received $25 million that includes a particular focus on connected traffic signals allowing vehicles to communicate with existing infrastructure, thereby improving traffic flow and mobility. The third project is a $5 million award to Las Vegas, to help the city roll out its automated and connected vehicle service.

In January 2020, the DOT released the fourth version of its automated vehicle guidance, Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0 (AV 4.0). While the document is primarily focused on automation, it also provides a detailed description of federal government efforts to promote use of CVs.

The Smart Energy Grid

A smart electric grid is the backbone of a smart community, providing the reliable and resilient energy system needed to power smart technologies. Smart communities rely on increased electrification to power wireless communication systems, electric vehicles, and sensors that monitor and manage energy use and traffic flows, pedestrian safety, air quality, public lighting and many other systems.

A smart electric grid relies on telecommunications, sensors, smart meters and data analytics to create a reliable, efficient, resilient and affordable energy system that can effectively integrate the distributed energy resources that are becoming a larger component of many communities’ energy portfolios. An intelligent energy grid may include a variety of elements, including smart metering infrastructure, smart buildings, smart street lighting, and distributed energy resources, among others.
A smart energy system is:

- **Reliable** – Modern communities rely on uninterrupted, consistent power supplies to function and thrive. As the number of communities adopting efficient technologies—such as electric heat pump heating and cooling systems and electric vehicles—increases, so does the need for consistent and reliable electricity.

- **Resilient** – Critical operations, such as hospitals, police stations, fire stations, transportation infrastructure, grocery stores and emergency facilities, need resilient power at all times to maintain community well-being. Resilience is defined as the ability to anticipate, prepare for, and adapt to changing conditions and recover rapidly from disruptions to the power sector.

- **Clean and energy efficient** – Communities across the nation are striving for cleaner air and water to protect public health and welfare. A smart, clean and efficient energy system protects the environment and creates a foundation for economic prosperity that can support state and community sustainability efforts.

- **Modular** – The falling costs of distributed generation resources, including solar photovoltaics and energy storage, enable communities to build out cleaner energy sources. Creating a modular grid system that can support critical operations during times of disruption will allow greater resiliency during times of disruption. Modular smart electric grids, known as microgrids, may include local and on-site energy resources, such as rooftop or community solar generation, energy storage, natural gas combined heat and power systems, high levels of energy efficiency, and energy management systems that can monitor system performance and ensure that energy needs are met at all times.

Building smarter energy infrastructure is key to delivering the reliable, resilient and clean energy future that communities want.

**Elements of the Smart Energy System**

**SMART BUILDINGS**

Smart buildings are becoming an increasingly important part of a smart electric grid, as new technologies allow owners to partner with utilities and grid operators in managing the energy system. In addition to optimizing operations with adaptive lighting, heating and cooling systems, these highly efficient buildings reduce energy waste and operational costs, identify operations and maintenance problems, and track building performance. Smart buildings can quickly adjust to changes in grid energy prices or grid stability, acting as “virtual power plants,” that free up energy demand. This capability is driven by demand response, which allows utilities or demand response providers to make small adjustments to building thermostats, water heaters, air conditioning and energy storage systems. If the grid abruptly needs more energy due to a spike in demand or drop in production, utilities can send a signal that discreetly adjusts thermostats, reducing program participants’ energy consumption. This approach lowers emissions and is more cost-effective than generating more power during peak consumption times. Demand response programs are tailored to produce substantial benefits, including reduced system costs, lower emissions and increased system resilience without impacting a participant’s service.

Smart buildings also incorporate on-site battery systems, rooftop or parking lot solar power installations, fuel cells or other energy generation technologies, allowing them to adjust their energy demand as prices change throughout the day and maintain operations during power outages. As buildings become more intelligent and grid-interactive, they will play an increasing role in improving grid reliability and resilience, while lowering building operating costs.

**SMART METER INFRASTRUCTURE**

Smart meters, or advanced meter infrastructure (AMI), enable two-way communication between the utility and the consumer, providing data that can improve grid operations and prevent outages. These devices also allow customers to better manage their energy use. Smart meters, when combined with other energy system sensors, can better connect the electric system’s disparate components, creating real-time system-wide operational awareness.
Smart meters can help customers manage energy use by providing time-based pricing signals, control over electricity consumption, high usage alerts and other money-saving services. Combined with smart devices—like smart thermostats, home energy monitors and smart home sensors—advanced metering greatly increases customer control over energy consumption, as well as energy production for customers that own distributed generation and energy storage.

**Distributed Energy Resources**

Distributed energy resources can be an essential part of a smart grid. They can support communities in meeting their energy goals and, through the integration of other technologies, can provide more control over their energy systems and contribute to increased resiliency and reliability. Additionally, they can help communities meet sustainability targets as well as emissions reduction and air quality goals. These resources include private rooftop and community-scale, solar and wind, natural gas microturbines, fuel cells, electric vehicles, energy storage, and energy management technologies—all connected via a smart grid system. Distributed resources can help create a more nimble, responsive grid while avoiding or delaying construction of more costly power plants, substations and transmission lines.

Shared or community renewable energy resources provide flexibility in siting and facilitate development of medium-sized distributed energy projects in optimal locations on the grid. Community renewable energy programs allow multiple customers to invest in off-site renewable energy and receive a direct benefit from the energy produced. Community energy facilities can be owned by a utility, energy provider or by groups of customers. Shared renewables projects are not limited to rooftops or by property lines so they can be placed in optimal locations, close to where the resource will provide the most benefit on the grid. At least 17 states and Washington, D.C., have enacted legislation authorizing shared renewables.

**Microgrids**

Distributed energy resources also allow for the creation of microgrids, enabling a neighborhood, medical campus, town or building to serve its own energy needs and operate independently of the larger grid as needed. Microgrids are comprised of distributed energy resources, energy storage and advanced controls that balance energy production with energy use and can disconnect from the larger grid to keep the lights on during extreme weather or other disturbances.

In Chicago’s Bronzeville neighborhood, ComEd used grants from the U.S. Department of Energy (DOE) to build the nation’s first interconnected microgrid cluster. The neighborhood is home to critical facilities, including the city’s police headquarters, several fire departments and hospitals, and a university. The Bronzeville microgrid will connect with a microgrid at the Illinois Institute of Technology, enabling the grids to share resources if needed. In addition to supporting critical facilities, the microgrids will serve over 1,000 residential, commercial and small industrial customers by providing them with reliable, resilient power.

More than two dozen microgrid bills were introduced in 2019, with two passing, one of which was vetoed. Virginia enacted SB 1077, requiring licensed assisted living facilities with six or more residents to have backup power on-site. California passed AB 991, which requires the Public Utilities Commission to develop microgrid service standards, methods to reduce barriers for microgrid deployment, and rates and tariffs to support microgrids. Hawaii passed and HB 2110 in 2018 directing state regulators to establish standardized microgrid tariffs to facilitate and encourage development of microgrids. In May 2018, the Puerto Rico Energy Commission created rules to overcome barriers to microgrid development by clarifying the structure, ownership, technology and size of microgrids.

**Smart Streetlights**

In addition to saving energy, lowering costs and reducing maintenance, smart streetlights help communities improve driver and pedestrian safety. Smart streetlights are connected to telecommunications infrastructure and can be equipped with a variety of sensors, capable of identifying and monitoring dangerous intersections, car crashes, traffic jams and accidents, and allowing communities to improve driver and pedestrian safety. Also, because smart streetlights can be adjusted based on the time of day and presence of automobiles or pedestrians, they can improve visibility and help reduce crime, making parking lots and roadways safer.
San Diego has installed sensing streetlights and traffic signals that can communicate with each other and the operator, allowing for adaptive brightness adjustments and saving the city 60% in operational costs over traditional lights. The savings also help pay for the project.

**Electric Vehicles**

Transportation-related pollution—often a leading cause of poor air quality in many communities—can be significantly reduced by switching to electric buses and automobiles. However, the case for electrification goes beyond air quality. Electric vehicles can use cleaner, locally sourced electricity rather than gasoline or diesel, and tend to have much higher reliability and lower operating costs than vehicles with an internal combustion engine. Additionally, fleet electrification at the municipal level can address equity concerns by reducing pollution levels for everyone within a community.

Integrating electric vehicle planning into smart communities efforts requires a number of considerations, including: where will charging stations be located, who will own them and how will they be regulated; where will electric grid infrastructure need to be upgraded to accommodate the additional electricity demands created by transportation electrification; and how will electric utility rate structures be adjusted to help ensure that vehicle charging does not take place during times of peak power consumption on the grid?

**Energy and Telecommunications Nexus**

Communications technology is an essential part of all smart community efforts. As utilities plan their smart grid buildout, they can potentially leverage electricity infrastructure to serve efforts outside of the energy services sector, pending approval by state regulators. For example, if a utility is planning to install fiber optics to increase their ability to interact with customers and monitor grid activity, it can partner with towns, cities or third-party vendors. Those partners may need fiber or broadband communications for smart transportation infrastructure, electric vehicle charging stations, water leak detection, high speed internet, environmental sensors, pedestrian safety and a host of other efforts.

Recently, some electric utilities have been looking at leasing middle mile infrastructure to internet service providers for broadband deployment. As utilities look to expand into broadband, some parties have raised concerns around possible cross-subsidization by utilities. Pole attachment and pole maintenance rates have been raised as a concern. Since there are costs for the poles and their maintenance, utilities charge fees to internet service providers for carrying their telecommunications lines. Cost-sharing mechanisms between electric utilities and internet service providers can be used to address concerns around the appropriate charges for this service. Discussions between stakeholders and regulators to address these challenges can lead to collaboration between energy and telecommunications providers. AT&T and Georgia Power, for example, have worked together on several projects, including the smart city pilot in Atlanta (noted above). Such cross-sector partnerships could enhance efficiencies for communities.

**Spotlight: Denver**

Peña Station Next in Colorado is, according to its promotional web site, “a regional, national, and global showcase for innovation districts, setting the standard for smart, sustainable, connected living.” The Colorado utility, Xcel Energy, will operate the development’s advanced microgrid, and is collaborating with the National Renewable Energy Laboratory and Panasonic to create the nation’s biggest net-zero energy community. Net-zero means that zero-emitting sources—the two large solar arrays combined with energy storage—will provide the community with as much energy as it consumes. This also means that the community can operate as its own microgrid, increasing the resiliency and reliability of its power system. The development will also incorporate emissions free mobility solutions. The effort also highlights the multi-stakeholder process that is necessary to create and coordinate the technologies needed to enable a smart community.
Data Privacy and Security in Smart Communities

Smart communities depend on data and technology to function. During a time when data breaches, ransomware and other cyberattacks are on the rise, smart communities would be wise to address privacy and security considerations during the initial stages and throughout the development process. Failing to secure data or using it inappropriately can have serious and lasting consequences for individuals and can weaken community trust in government and other stakeholders.

Privacy and security considerations are related but not synonymous. Generally, privacy is about controlling who has access to personal information, and security is about protecting that information from unauthorized access. Public and private-sector entities are collecting and sharing increasing amounts of sensitive personal information. When developing smart community programs and applications, policymakers will face questions regarding how to determine what data is needed, what data is being collected and how transparent the policymaking process around data use policy will be. Thoughtfully established and consistent rules, protocols and safeguards can be critical for citizen and private-sector buy-in and successful deployment.

Privacy risks can be significant and can include financial threats, such as identity theft, and fraud, and physical risks such as assault, stalking, theft and domestic violence. Other privacy risks include risks to reputation and dignity; for example, when a person may face bias or discrimination through profiling, facial recognition and other automated systems. Privacy risks may not be obvious, but they can increase as more data are collected and combined. Privacy risk impacts can also vary between populations.

Engaging with a diverse set of stakeholders when developing smart community applications can promote transparency and accountability. Public disclosure on the types of data being collected, guidelines on data ownership and data sharing, and transparency regarding data analysis and usage can combat public mistrust and fears of Big Brother-type surveillance. At its extreme, mistrust could lead citizens to forgo smart government services and technologies, as several cities have moved to ban the use of facial recognition.
As the IoT proliferates and more and more sensors, applications and other equipment are connected to the internet, the need for cybersecurity has increased. A single breached device can become a gateway to the entire smart community’s network. For example, compromised sensors or corrupted data could lead to crashed systems for police, fire and utility departments. Hacking into and manipulation of control systems like traffic signals, autonomous vehicles and other systems could lead to physical destruction, cascading failures and, in the extreme, loss of human life.

Cyberattacks are increasing for all communities. On May 7, 2019, the city of Baltimore was struck with a ransomware attack that crippled city employee email networks and city services, including credit card payment systems and real estate transactions. Hackers demanded that the city pay a ransom in bitcoin, but the city chose not to pay the ransom. The attack will cost the city an estimated $18.2 million in lost revenue and from costs to rebuild and restore networks and computer systems. In 2018, the city of Atlanta was hit with a ransomware attack that cost an estimated $17 million in recovery and restoration costs.

Complicating matters further, smart communities are being built upon existing infrastructure and legacy systems that may be organized in silos, hampering integration and system-wide security management.

While all states have security measures to protect data, at least 32 states statutorily require state government agencies to have security measures in place to ensure the security of the data they hold. Some of these provisions also apply to local governments and third-party agents.

Building and maintaining a secure smart community requires skilled cybersecurity personnel. Acquiring and retaining workers with these skills can be a challenge for state and local governments that must compete with private-sector employers.

In addition to cybersecurity, smart communities may consider incorporating cyber resilience into their infrastructure. Planning for network and technological failures and practicing responses with tabletop exercises can enable a flexible response when cyberattacks or other system failures occur. By building networks and systems that can allow essential services to remain available, even at reduced capacity, smart communities can adapt, recover and bounce back.

Some organizations have created technical frameworks and best practices to assist with the development of smart community infrastructure, networks and systems. The National Institute of Standards and Technology’s NIST Smart Cities and Communities Framework Series (SCCF) provides cities and communities with best practices and technical guidelines for planning, developing and implementing smart solutions. Industry stakeholders and the research community can use the NIST SCCF as a reference to further their innovation and product development goals, and to improve their quality of service. The target audience includes city and community officials, technology innovators, researchers, project planners and managers, and other implementers. The National Telecommunications and Information Administration has created resources regarding security standards for IoT security patching and upgradability.

**Spotlight: Quayside, Toronto**

In 2017, Sidewalk Labs, a project owned by Google’s parent company Alphabet Inc., was awarded the contract to build a model “smart city” on a 12-acre waterfront land parcel known as Quayside in Toronto. In the infrastructure plan, Sidewalk Labs proposed to install a modular pavement system with embedded lights and heating to create safe, welcoming spaces that can adapt to changing conditions. The smart neighborhood’s infrastructure would be anchored by ubiquitous, affordable internet connectivity. The project has generated a large amount of controversy around data collection, privacy concerns and a lack of transparency. Some saw it as an effort to create a surveillance city that commercialized personal data collected in a public space, similar to how Google sells data from internet searches to those who wish to target specific classes of customers. Google ended the project in May 2020 citing “unpredictabilities stemming from the coronavirus pandemic.”
State Policies for Smart Communities

By definition, smart community efforts tend to be local, but many different areas exist where state legislators can act to help communities that wish to adopt smart technologies. A few examples include:

- Creating a task force or advisory group to identify areas where state policy can assist in smart community development.
- Developing a framework to promote interagency coordination on smart communities.
- Establishing guidelines for public-private partnerships (P3s).
- Promoting the expansion of broadband, including fiber networks, through funding and legislation.
- Providing grants and financing options to support community innovation.
- Creating tax incentives to encourage or promote technologies or development.
- Setting data management, usage and cybersecurity standards.
- Streamlining procurement rules to facilitate testing and implementation of evolving technologies.
- Establishing statewide regulations on automated vehicle testing and deployment.
- Ensuring regional coordination so that technology innovation can be coordinated between communities.

An important first step in developing a state smart communities framework is to convene a group of smart communities experts, stakeholders and policymakers to lay out the critical challenges communities face, how smart technology can address these issues, and the role that state level policymaking can play in helping communities overcome these challenges. Each state and each community may have different goals and different problems they are seeking to address. Developing adaptable solutions that allow for a large degree of flexibility among different communities is important.

A strong governance structure is one of the most important elements of a successful smart community. It includes clear roles for executive leadership, a smart communities director who carries out the vision, as well as working groups and advisory committees made up of industry participants, government officials,
citizen groups and other stakeholders. State legislators can promote strong smart community governance through the development of state level guidelines and models that communities, especially those with limited resources, can use to begin the planning process.

Creating and developing smart communities can require substantial budgetary resources for communities balancing multiple funding responsibilities. State legislators can assist local governments in several ways. First, state policymakers could create a formal mechanism to receive bids to execute a project as a P3 to reduce the need for public investment in a smart community project, take advantage of private sector expertise and transfer financial risk. Second, to the extent funding is available, states could explore creating grant programs or financing options to support community innovation. For example, in 2019, California proposed AB 659 that would have established a “Smart City Challenge Grant” program, enabling localities to study emerging transportation technologies that serve transportation system needs. The legislation also would have directed the California Transportation Commission to develop guidelines for the program and manage other related program matters. In 2019, the Florida Legislature appropriated $1 million in the state budget to study innovative transit options, including Smart City innovations, autonomous vehicle services, and hyperloop technology, defined by one study as “a proposed transportation system in which magnetic levitation pods are propelled at very high speeds within a tube, moving directly from origin to destination.” In 2019, Maine’s LD 172 would have sought voter approval to use $15 million in bonding to allow municipalities to invest in smart and connected infrastructure, technology and capacity. Examples of such projects included adaptive traffic control signals, broadband connectivity, and connected sensors and data aggregation platforms.

State procurement regulations have generally been crafted to facilitate equitable acquisition of well-defined and commonly used materials and services. These processes can often take considerable time. Many of the technologies needed for smart community development are less mature, rapidly evolving, and more difficult to define and compare. Policymakers can evaluate procurement regulations and make reasonable accommodations to streamline purchasing of new, innovative technologies for testing, evaluation and deployment. The Minnesota Department of Transportation has instituted the Connected and Automated Vehicle (CAV) Challenge, an open and rolling procurement process that fosters innovation and actively seeks creative ideas.

Third, policymakers can simplify the funding process. Identifying state and local funding for rural broadband and smart technologies can be challenging and local governments may not have the staff resources and expertise available to devote time to identifying and applying for the various funding options. High-speed communications systems are the key to the success of smart technologies deployed by government entities, private business and individual citizens. Regulatory tools that encourage public and private sector expansion of these systems will facilitate many other advancements. Identifying all state programs that could support smart communities and making this information easily accessible can help small, resource-strapped communities that may not have the time, resources or connections necessary to take advantage of state resources.

Any smart community effort will likely include an exploration of P3s, which can provide needed financing and technical knowledge. As these agreements can be complex and may involve the use of data collected in the community, it is important states have guidelines to help communities navigate pros and cons of the many potential options available through these partnerships. Some examples include:

- The city of Philadelphia created a road map for its smart city efforts, which details a few P3s the city entered into for smart city applications, including creating the city’s bikeshare program and installing digital info kiosks.
- In Ohio, the 33 Smart Mobility Corridor includes a partnership between the Ohio DOT, the cities of Columbus and Marysville, and Honda. The automaker is using 200 connected Honda Pilots in the 33 Smart Mobility Corridor, including testing what is being touted as “the world’s most connected intersection” in Marysville.
- LA Metro in California has a mechanism to encourage the private sector to submit creative proposals on how to improve regional mobility. The process—called an “Unsolicited Proposal”—is an alternative approach to leverage a P3 model. Under the agreement, the roles and responsibilities may be shared, or specific modifications built into the system and its operations.
The Utah Department of Transportation has used P3s to share and trade fiber-optic systems. As the state builds fiber corridors, they construct excess capacity, which is then traded to private telecommunications companies for capacity along their corridors. The state also makes highway rights-of-way available, for a trade value, to these private entities. **Through these partnerships,** the state has leveraged 1,000 miles of state-built fiber to access an additional 1,700 miles of private fiber, often to very rural areas of the state, an added value of over $55 million.

Mass-scale data collection is a critical component of a smart community and can help improve safety, efficiency and livability. This data can also be lucrative in the hands of technology companies, which can monetize data from sensors that collect data on weather, pollution patterns and traffic, as well as users' cell phone data and data from microphones and cameras.

State level policies or guidelines can be helpful for communities that may not have the expertise or resources to properly analyze agreements to determine unintended negative consequences. They can also be helpful to larger communities and vendors by harmonizing actions across the state. Clear and transparent data privacy standards, developed with buy-in from a diverse set of stakeholders, could greatly incentivize private investment in smart communities, thereby lowering the financial burden on public-sector partners.

Communities may be eager to gain a smart technology, allowing the vendor to extract and use data in exchange for receiving technology at low or no cost. In many cases communities may do so without seriously assessing the value they are giving up in these agreements. For example, in 2018, **HB 1188** would have authorized the Colorado Department of Transportation to obtain and use information from an electronic device in a motor vehicle. The legislation also would have specified that data could only be used for the purpose of facilitating transportation or managing traffic and limited how personally identifying information could be used.

Since community members have no ability to opt out and decline certain services, it is important to develop policies that address data use, protections for the community at large, data ownership, and how stakeholders and the community will be involved in decision-making.

Guidelines and policies created at the state level, can help set minimum performance standards for data collection, ownership, usage and cybersecurity. Given the range in resources between communities, clear guidelines on data sharing that address when data sharing will be permitted, as well as data ownership guidelines for data collected by both communities and industry partners, can ease the burden on smaller communities.

Some smart technologies, including connected vehicle technology, rely on vehicles being able to freely share anonymous data on vehicle movements and actions. It is important that data regulations and policies not inhibit this data sharing. Having a clear data strategy can be critical since communities may be challenged in developing their own without clear leadership and guidance at the state level.

Several states—including California, Illinois, New Hampshire, Texas and Vermont—have taken action to establish legal standards and clear rules around access, ownership and sharing of utility customer data. California’s **SB 1476,** passed in 2011, clearly prohibits a number of actions regarding electrical customer data, including sharing it with a third party unless the customer has approved selling the data or other personally identifiable information. The **Texas administrative code** establishes that all data belongs to the customer and prohibits the sale, sharing or disclosure of customer information for any other purpose than providing utility service or other customer-approved services.
During the 2019 legislative session, at least 43 states and Puerto Rico considered close to 300 measures that deal significantly with cybersecurity. At least 16 states considered nearly 50 measures intended to address the cybersecurity of the electric grid and other critical infrastructure—a 30% increase over the previous year. Most of these measures do one of four things: establish state-level cybersecurity task forces or committees; establish cybersecurity standards and reporting requirements; expand state open records exemptions to include cyber vulnerabilities; or authorize governors and state agencies to take certain actions to prepare for and respond to cyber emergencies. (To read more on this subject, visit NCSL’s resources, “Privacy and Security Overview” and “Cybersecurity and the Electric Grid”).

At least 38 states, Washington, D.C., and Puerto Rico introduced or considered more than 280 bills or resolutions in the 2020 legislative session that deal significantly with cybersecurity. Some areas seeing the most legislative activity include measures on:

- Requiring government agencies to implement training or specific types of security policies and practices and improving incidence response and preparedness.
- Increasing penalties for computer crime or addressing specific crimes; e.g., ransomware.
- Regulating cybersecurity within the insurance industry or addressing cybersecurity insurance.
- Creating task forces, councils or commissions to study or advise on cybersecurity issues.
- Supporting programs or incentives for cybersecurity training and education.

Successful smart communities focus on improving outcomes for residents by responding to their needs and desires. Smartness is not about the technology and efficiency; it is about using technology and data to improve quality of life. Rather than focusing on where a shiny new smart technology can be used, policymakers and planners can be more effective if they determine the community problem that needs to be solved and then select the technology that best addresses it.

For this reason, transparency and public engagement at multiple levels of the process are important. This includes transparency in decisions around data collection and seeking input regarding whether benefits of new projects outweigh the costs. One option is to require that public officials share how and why smart community projects are selected before the procurement process begins. It is important to have robust public engagement when considering how new technologies will impact a resident’s right to privacy, what safeguards will be in place to protect this right, and how technologies will be accessible by various members of the community.

Policymakers can facilitate the discussion around the trade-offs between personal privacy and the benefits that a technology provides. Communities need to consider very carefully the rights they may be giving up, and receiving, from smart technology solutions.

In addition to addressing privacy and security concerns throughout development, successful smart communities require inclusion and broad public adoption. The digital divide impacts who can access smart community tools and, if not factored into development discussions, could lead to a digital gentrification based on socio-economic status, language, age group and ability.

Chicago’s network of sensors, weather instruments, pollution measurement equipment, cameras and microphones demonstrates how a community can be involved and accept these technologies. Planners did extensive outreach, explaining that the microphones and cameras would be used for recording street noise and traffic and would not record conversations or use facial recognition. They noted that images would be processed and deleted and only aggregate data, without the ability to distinguish individuals, would be collected. Most importantly, a panel of experts would manage the data held at the Argonne National Laboratory. Two years into this “Array of Things” project, data is now accessible to researchers, businesses and advocacy groups.
The rapid pace of technological advancement in communications, transportation and energy provide communities with a vast array of options for improving livability, safety and economic development. With so many choices available and technology changing quickly, communities face increased risks of investing in varied solutions that are not complementary or pursuing technologies that are quick to become outdated. Ultimately, by creating policies that support and guide the smart community planning and development process, state legislators can play an instrumental role in the development of successful smart communities in their states.

Resources

- A Collaboration Playbook for Smart Cities and Electric Companies: An Executive Guide to Partnership Opportunities, Edison Electric Institute, 2019
- Cable Companies and Municipalities: Natural Smart Community Partners, NCTA-The Internet and Television Association, 2018
- City of Philadelphia Smart City Road Map
- Examples of Smart Communities in Action, Edison Electric Institute, 2018
- Funding and Financing Smart Cities, Deloitte, 2017
- The Game Changer for the Internet of Things, T-Mobile, 2019
- How States Are Expanding Broadband Access, Pew Charitable Trusts, 2020
- Trends in Smart City Development, National League of Cities, 2017
- Smart City Overview, Deloitte
- Using Public-Private Partnerships to Advance Smart Cities, Deloitte, 2018
- Wireless Infrastructure as the Foundation of Smart Cities and Communities, Wireless Infrastructure Association, 2018
- Working with Utilities and Smart Communities, Edison Electric Institute, 2019

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- NCSL Smart Communities Foundation Partnership, 2019
- Modernizing the Electric Grid: State Role and Policy Options, 2019
- Privacy and Security Overview, 2020
- Cybersecurity and the Electric Grid, 2020
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