

BUILDING RESILIENT NETWORKS

HEARING

BEFORE THE

SUBCOMMITTEE ON COMMUNICATIONS, MEDIA,
AND BROADBAND

OF THE

COMMITTEE ON COMMERCE,
SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE

ONE HUNDRED SEVENTEENTH CONGRESS

FIRST SESSION

JUNE 22, 2021

Printed for the use of the Committee on Commerce, Science, and Transportation



Available online: <http://www.govinfo.gov>

U.S. GOVERNMENT PUBLISHING OFFICE

54-372 PDF

WASHINGTON : 2023

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED SEVENTEENTH CONGRESS

FIRST SESSION

MARIA CANTWELL, Washington, *Chair*

AMY KLOBUCHAR, Minnesota	ROGER WICKER, Mississippi, <i>Ranking</i>
RICHARD BLUMENTHAL, Connecticut	JOHN THUNE, South Dakota
BRIAN SCHATZ, Hawaii	ROY BLUNT, Missouri
EDWARD MARKEY, Massachusetts	TED CRUZ, Texas
GARY PETERS, Michigan	DEB FISCHER, Nebraska
TAMMY BALDWIN, Wisconsin	JERRY MORAN, Kansas
TAMMY DUCKWORTH, Illinois	DAN SULLIVAN, Alaska
JON TESTER, Montana	MARSHA BLACKBURN, Tennessee
KYRSTEN SINEMA, Arizona	TODD YOUNG, Indiana
JACKY ROSEN, Nevada	MIKE LEE, Utah
BEN RAY LUJÁN, New Mexico	RON JOHNSON, Wisconsin
JOHN HICKENLOOPER, Colorado	SHELLEY MOORE CAPITO, West Virginia
RAPHAEL WARNOCK, Georgia	RICK SCOTT, Florida
	CYNTHIA LUMMIS, Wyoming

DAVID STRICKLAND, *Staff Director*

MELISSA PORTER, *Deputy Staff Director*

GEORGE GREENWELL, *Policy Coordinator and Security Manager*

JOHN KEAST, *Republican Staff Director*

CRYSTAL TULLY, *Republican Deputy Staff Director*

STEVEN WALL, *General Counsel*

SUBCOMMITTEE ON COMMUNICATIONS, MEDIA, AND BROADBAND

BEN RAY LUJÁN, New Mexico, <i>Chair</i>	JOHN THUNE, South Dakota, <i>Ranking</i>
AMY KLOBUCHAR, Minnesota	ROY BLUNT, Missouri
RICHARD BLUMENTHAL, Connecticut	TED CRUZ, Texas
BRIAN SCHATZ, Hawaii	DEB FISCHER, Nebraska
EDWARD MARKEY, Massachusetts	JERRY MORAN, Kansas
GARY PETERS, Michigan	DAN SULLIVAN, Alaska
TAMMY BALDWIN, Wisconsin	MARSHA BLACKBURN, Tennessee
TAMMY DUCKWORTH, Illinois	TODD YOUNG, Indiana
JON TESTER, Montana	MIKE LEE, Utah
KYRSTEN SINEMA, Arizona	RON JOHNSON, Wisconsin
JACKY ROSEN, Nevada	SHELLEY MOORE CAPITO, West Virginia
JOHN HICKENLOOPER, Colorado	RICK SCOTT, Florida
RAPHAEL WARNOCK, Georgia	CYNTHIA LUMMIS, Wyoming

CONTENTS

Hearing held on June 22, 2021	Page 1
Statement of Senator Luján	1
Statement of Senator Thune	3
Statement of Senator Klobuchar	46
Statement of Senator Fischer	48
Statement of Senator Markey	51
Statement of Senator Moran	53
Statement of Senator Peters	55
Statement of Senator Blackburn	57
Statement of Senator Rosen	59
Statement of Senator Capito	61
Statement of Senator Young	64

WITNESSES

Chief Jeffrey D. Johnson, Chief Executive, Western Fire Chiefs Association	5
Prepared statement	6
Jonathan Adelstein, President and Chief Executive Officer, Wireless Infrastructure Association	10
Prepared statement	12
Denny Law, Chief Executive Officer, Golden West Telecommunications Cooperative, Inc.	24
Prepared statement	25
Harold Feld, Senior Vice President, Public Knowledge	32
Prepared statement	33

APPENDIX

Letter dated June 17, 2021 to Hon. Ben Ray Luján and Hon. John Thune from Joseph Torres, Lep Fitzpatrick, and Carmen Scurato, Free Press	75
Letter dated June 21, 2021 to Senator Ben Ray Luján and Senator John Thune from Tony DeTora, VP, Government Affairs, Lynk Global, Inc.	119
Letter dated June 22, 2021 to Hon. Ben Ray Luján and Hon. John Thune from Steven K. Berry, President & CEO, Competitive Carriers Association ..	120
Response to written question submitted to Jeffrey D. Johnson by:	
Hon. Raphael Warnock	121
Response to written questions submitted to Jonathan Adelstein by:	
Hon. Ben Ray Luján	122
Hon. Raphael Warnock	124
Response to written question submitted to Denny Law by:	
Hon. Raphael Warnock	125
Response to written questions submitted to Harold Feld by:	
Hon. Ben Ray Luján	125
Hon. Raphael Warnock	128

BUILDING RESILIENT NETWORKS

TUESDAY, JUNE 22, 2021

U.S. SENATE,
SUBCOMMITTEE ON COMMUNICATIONS, MEDIA, AND BROADBAND,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Committee met, pursuant to notice, at 2:40 p.m., in room SR-253, Russell Senate Office Building, Hon. Ben Ray Luján, Chairman of the Subcommittee, presiding.

Present: Senators Luján [presiding], Klobuchar, Blumenthal, Markey, Peters, Rosen, Warnock, Thune, Fischer, Moran, Blackburn, Young, Capito, and Scott.

OPENING STATEMENT OF HON. BEN RAY LUJÁN, U.S. SENATOR FROM NEW MEXICO

Senator LUJÁN. Appreciate everyone giving us a little bit of time this afternoon, as we are coming from a vote off the Senate floor. And our colleagues will be joining us here shortly, as well. So, thank you again for being with us today on this important hearing on Building Resilient Networks.

In today's world, broadband is essential and telecommunications, including voice and Internet are basic and critical services that every American deserves. During the COVID-19 pandemic, broadband kept students in school and learning. The Internet kept us connected to our friends and loved ones that we could not be together with in person. For many of these networks connected us to our jobs and our livelihood. For so many, just access to basic healthcare.

Just as important, these networks support how we communicate in times of emergency. When disaster strikes, these services connect us to someone who can help—firefighters, police officers, EMTs. In these vulnerable moments, we rely on these networks with our lives. Unfortunately, in times of emergency, too many Americans are not able to connect to someone who can get help. They get a busy signal. They get dead air. Connection does not work.

Native, Hispanic and other communities of color are most at risk. In the fallout from Hurricane Maria, millions of Americans in Puerto Rico experienced telecommunication outages that lasted for months and left them stranded without vital services.

Wildfires across the West caused cell phone services to go dark for more than 3 million people. They were left without access to 911 or emergency alerts, while wildfires raged.

These are the stories that made the headlines, but similar stories are all too common across the country. In my home state of New Mexico, there was an incident in Sierra County where broadband outages caused a disruption on medical services. Hospitals were forced to transfer patients that they could no longer care for, because the hospital lost access to the network.

Another outage impacted our Rail Runner, which is our public transportation train that runs through the center of the state—our main commuter line between Santa Fe and Albuquerque, where a network outage brought the train to a crawl. The outage shut down systems designed to prevent collisions.

There are too many stories where 911 call centers lost access for up to a week, due to service outages.

New Mexicans and all Americans deserve better than this. We need to remember that some of the worst outages are not even tied to natural disasters. In 2018, CenturyLink, now Lumen, experienced a 37-hour nationwide outage that disrupted 911 service for millions of Americans. The cause? Faulty equipment and a configuration error. Thirty-seven-hour outage due to faulty equipment. It is unacceptable.

And the U.S. Government has committed tens of billions of dollars to get Americans connected and telecommunication services are recording massive profits. It is time for these companies to step up. Reaching 100 percent connectivity, it is essential, but we must do more.

It is time that these companies reinvest those profits toward ensuring that their users have access to resilient, redundant, and secure networks. Our connections must be resilient. They must be built to standards that correspond to the investment the Federal Government and states have made. When a natural disaster strikes, and we dial 911, the sound we hear should be someone ready to help.

Our connections must be redundant. A single piece of faulty equipment or a burst gas main, should not disrupt telecommunication service, let alone national service across multiple carriers. Networks should have built in redundancies and consumers should have multiple options for providers in times of crisis.

And finally, our connections must be secure. Malicious actors continue to target communication networks. Just this year, nationwide energy and health infrastructure have been held hostage. On Christmas Day last year, a bombing in Nashville caused a network outage that reached across three states. Planes were grounded and doctors were unable to reach electronic health records. Just imagine the consequences of future outages in a world where an interconnected, smart, electrical grid and autonomous vehicles, that rely on mobile broadband for communication.

Our networks must be built to prevent and be resilient against these threats. The priorities I listed—resilient, redundant, and secure—are fundamental principles we must consider, as we look at existing infrastructure and as we build the next generation of networks.

And I am grateful to Senator Thune and his work on this hearing. I know he recognizes the importance of reliable and resilient infrastructure. And I thank our witnesses for being here. They each

represent critical perspectives in this issue—public interest, emergency services, local carriers, and wireless infrastructure. I look forward to continuing our work together to make progress on this issue, for all Americans and all my fellow brothers and sisters, the people of New Mexico.

And with that, I recognize the Ranking Member for his opening statement.

**STATEMENT OF HON. JOHN THUNE,
U.S. SENATOR FROM SOUTH DAKOTA**

Senator THUNE. Thank you, Chairman Luján, and welcome to our panelists today. Expanding reliable and resilient broadband access in rural areas has long been a priority of mine, here in the Senate. So, I appreciate you holding this important hearing today.

Reliable and resilient networks across all parts of the United States have never been more critical. The COVID-19 pandemic changed the way we live, work, and in some places, educate our kids, which led to the most significant real-world test to date, of the resiliency of our broadband networks. Overnight, our networks faced new demands, as consumer and business usage of fixed and mobile broadband networks soared.

As the Nation locked down, demand for reliable Internet connectivity shot up. Some reports have found that fixed broadband went up by 40 percent. Mobile data traffic shot up by over 20 percent. Voice traffic, on wireless networks, increased in some cases by nearly 40 percent.

While networks in Europe and elsewhere reduced streaming quality in order to minimize the stress on their networks, U.S. broadband networks were able to accommodate this increased traffic and exceed expectations. This is largely because of the United States light touch regulatory approach to broadband policy, which has led to sustained investment by telecommunications companies, who have made network reliability and resiliency a priority.

Even though our networks performed very well during the pandemic, I think we can all agree there is still more work to be done. Far too many times, however, Congress has attempted to spur broadband deployment by providing large sums of funding, with little to show. A 2009 stimulus package provided more than \$7 billion to support broadband, but due to the lack of coordination and mapping, and a host of other factors, multiple agencies squandered away the funding, resulting in just a fraction of the access to connectivity that was promised.

Today, as Congress considers a larger infrastructure package, this committee has an opportunity before it, to support the deployment of reliable and resilient networks and it is imperative that we get it right. Which is why I believe we should make smart investments, while maintaining a regulatory regime that allows companies to make the kind of choices in investments that have resulted in strong and resilient U.S. networks.

We must remove the regulatory and permitting hurdles that delay the build out of networks, particularly to more rural areas. I will continue to advocate for updated regulatory measures, like the Streamline Small Cell Deployment Act, which would update current law to better reflect emerging technology and speed up per-

mitting, while respecting the role of State and local governments, in making deployment decisions.

Additional funding should also be targeted to unserved areas and not used to overbuild existing networks. In the last year alone, Congress, acting in a bipartisan manner, provided a significant amount of funding for broadband services, through the CARES Act and the year-end Coronavirus Relief Package.

USDA's Connect—ReConnect Program received \$735 million and NTIA was provided \$1 billion to build networks in Tribal areas, and another \$300 million to support broadband infrastructure in more rural areas. At the same time, Congress was appropriating additional broadband funding, the FCC, under the Rural Digital Opportunity Fund—or the RDOT Fund—has committed over \$9 billion to support broadband services over the next 10 years and another \$11.2 billion, through that program's second phase. Additionally, the FCC is expected to distribute up to \$9 billion, over the next 10 years, to bring voice and mobile broadband services, under the 5G Fund for Rural America.

The bipartisan Broadband DATA Act, signed into law last March, also requires the FCC to produce new maps. Having new, accurate maps is critically important to ensure that this funding, most of which is largely unspent, goes to truly unserved areas.

At the same time, I believe it is equally important that this committee conduct oversight of the FCC's development of the new maps. And I hope that the Committee will hold an FCC oversight hearing so members can discuss this important issue.

Recognizing the significant amount of funding already made available, finding common sense ways to efficiently deliver reliable broadband services in a technology neutral manner, like the framework under the bipartisan Rural Connectivity Advancement Program Act, should be part of any infrastructure conversation.

We also need to be mindful that the deployment of reliable and resilient networks does not happen overnight. It takes time and it requires providers to have sustainable and predictable funding.

States like my home state of South Dakota, have short build seasons, which leads me to my last point. Having a sufficient workforce and resilient supply chain in place, will be critical to keep networks up and running in times of emergencies, support the build out of broadband networks, meet the demands of 5G deployment, and perform maintenance and upgrades on the networks in the future. Which is why I hope the full Senate will soon pass the Telecommunications Skilled Workforce Act legislation that would increase the number of workers enrolled in telecommunications training programs.

And before I close, I would like to reiterate a point I made earlier. The committee, which has jurisdiction over telecommunications policy, has a real opportunity to support efforts to close the digital divide. And if we work together in a bipartisan manner, we can ensure Americans have access to these important services.

I appreciate all the witnesses for being here today. I look forward to hearing from them about how we can support resilient networks and ensure that any additional efforts focus on the areas that need it the most.

So, Mr. Chairman, I am delighted that on our panel today, we have not one but two South Dakota witnesses. Jonathan Adelstein hails from South Dakota. And of course, Denny Law, who this committee has heard from before, who runs Golden West Telecommunications out of Wall, South Dakota, is someone who brings great knowledge and expertise to these issues, and I look forward, as always, to hearing from him. And he has with him today his son, Andrew, who is a State champion hurdler, both the 100s and the 300 hurdlers—hurdles, I should say. So, he has won the State Championship in the State of South Dakota, which is a pretty—a pretty big deal.

So, anyway, delighted to have them here and look forward to hearing from all our panelists and to engage in a discussion about what we can do better, where we can make improvements, and continue to build out networks that serve people everywhere across this country.

Thank you, Mr. Chairman.

Senator LUJÁN. Appreciate that, Mr. Thune, and I join you in welcoming our panelists, and also, future generations of leaders who join them, as well. It is good to see them joining family today.

In addition to both Mr. Law and Former Commissioner Adelstein, as well, we are also joined by Mr. Feld, who is the Senior Vice President of Public Knowledge, here from Washington, D.C.. And the first panelist that we will hear from today is Chief Jeffrey Johnson, who is the Chief Executive of the Western Fire Chiefs Association, out of Sisters, Oregon.

Chief, you are recognized for 5 minutes.

**STATEMENT OF CHIEF JEFFREY D. JOHNSON,
CHIEF EXECUTIVE, WESTERN FIRE CHIEFS ASSOCIATION**

Mr. JOHNSON. Thank you, Chairman Luján, Ranking Member Thune, and distinguished Senators of this committee. Thank you for the opportunity to appear in front of this committee and discuss such an important topic.

My name is Jeff Johnson, as mentioned, and I serve as a Chief Executive for the Western Fire Chiefs. We serve from Guam and Saipan to Colorado's border, and from Alaska to the border with Mexico. Two of our top priorities at the Western Fire Chiefs are wildfire, technology, and the intersection of wildfire and technology.

The chiefs of the West serve some of the most wildfire prone, challenging terrain, and extreme fire conditions in the United States. In 2020 alone, 10.1 million acres burned, and 9,248 structures were lost, which drew assistance from fire departments across the United States. We know factually that the fuels are dryer, the fires come earlier and last later in the year, and they are burning with previously unwitnessed intensity, which undermines our fire attack efforts.

In my home state of Oregon, megafires last year simultaneously burned in the Clackamas, Santiam, Umpqua, and Rogue River drainages, destroying entire communities, homes, businesses, valuable timber assets, and critical communications infrastructure. Other Western States had similar experiences, in terms of the frequency and scale of the fires. For example, California saw its first

ever gigafire, which burned over one million acres, and had its worst year on record since the Big Burn of 1910.

As an Incident Commander, I know firsthand the value of communications to an effective operation. Unfortunately, fire of this magnitude often destroy back haul, burn over mountaintop antennas, and level buildings critical to network operations. To make matters worse, the communications infrastructure is critical, not only to responders, but to the civilians to whom we are trying to evacuate ahead of the flame front.

Additionally, our challenges are often exacerbated by an unreliable power grid and public safety power shutoffs, which take down communicationsites that do not have adequate backup power to outlast the interruption. The Western Fire Chiefs have been working with our Member State Fire Chiefs Association to improve permitting and regulations processes for placement of backup power generation at communicationsites, and to inform communication providers and lawmakers of public safety's needs.

As public safety and the public at large become increasingly reliant on our communications infrastructure, the need for reliable and expanded communications has never been more important to us. FirstNet, as the Nationwide Public Safety Broadband Network, has greatly enhanced communications availability, resilience, and reliability for first responders with dedicated spectrum for public safety and the ability for first responders to have access to portable cell towers that provide wireless connectivity during emergency events. As we approach the 20th anniversary of the 9/11 terrorist attacks, I would like to thank this committee for having played such a key role in advancing FirstNet, enacting law.

Last, given the vast stretches of land in the West, that are publicly owned, passing law or regulation that ease and speed the placement of communication infrastructure on Federal lands, would be beneficial. By way of illustration, Oregon is 60.4 percent public lands, California 52 percent, Washington 41.9 percent, Alaska 95.8 percent, and Nevada at 87.8 percent, contrasted to Iowa at 2.8 percent public lands. As you can tell by this illustration, having expedited processes for placement of public—or communications infrastructure on public lands, would in fact be helpful.

Because communications are so important to an effective fire attack, assistance by Congress to remove barriers and improve communications would be meaningful to incident commanders.

Thank you and I look forward to your questions and comments.
[The prepared statement of Mr. Johnson follows:]

PREPARED STATEMENT OF CHIEF JEFFREY D. JOHNSON, CHIEF EXECUTIVE,
WESTERN FIRE CHIEFS ASSOCIATION

I am Jeffrey Johnson, Executive Chief for the Western Fire Chiefs Association (WFCA). I previously served as president of the International Association of Fire Chiefs (IAFC) and a chief fire officer of the Tualatin Valley Fire and Rescue Department in Beaverton, Oregon where I served as chief of the department for 15 years before retiring in 2010 after a 32-year career. The WFCA serves fire chiefs in the 11 western states, including Oregon, Washington, California, Idaho, Nevada, Utah, Montana, Arizona, Alaska, Hawaii, as well as Guam/Saipan.

I thank Chairman Ben Ray Lujan and Ranking Member John Thune, as well as the other esteemed members of the subcommittee, for convening this hearing to examine ways the Federal government can support “resilient, redundant, and secure broadband and telecommunications infrastructure” and review lessons learned to

improve our Nation's resiliency and reliability. It is an honor to join you, and I thank you for requesting guidance and input from the WFCA. The WFCA's membership includes the career and volunteer leaders of fire related emergency service organizations throughout the WFCA member states and the Western Pacific Islands.

Prevention, Preparedness and Response to the Growing Threat of Wildfires. The WFCA's membership provides critical protection of people, critical infrastructure, and the environment from the occurrence and outcomes of fires and other natural, technological, and manmade emergencies. Over the past year, our membership and their departments have answered the call to support our country's response to the COVID-19 pandemic, while simultaneously responding to yet another unprecedented fire season in 2020. The 2021 fire season is already upon us and we are preparing for another record year, with fires that have already ignited this year and dry conditions and unseasonably high temperatures across much of the Midwest and West. After consecutive years of devastating fire seasons, it has become clear that the major wildfires in the West are not one-off anomalies, but becoming a pattern and creating a new normal.

History has taught us that planning and preparedness are key to mitigating risk and bolstering our readiness to achieve the best possible outcomes. Preparedness includes evacuation planning and drills, fuel management, hardening of structures against the threat of wildfire, and increasing the response resources that are available to respond to wildland fires through codified agreements. Once a fire has started, the goal is to contain the fire to the smallest area possible and minimize the amount of damage to our communities, critical infrastructure, and natural resources, which involves the notification and evacuation of all persons who are at risk, resource requests, and dispatching and coordinating with inter-and intra-state responders. Following a fire incident, the focus shifts to recovery and learning from the events that transpired during the emergency.

Criticality of Broadband Communications for Public Safety and Emergency Response. Modern technology and broadband have provided new tools for citizens, emergency response personnel, and state and Federal forestry managers, including "smart" tools using drones and unmanned aerial systems/vehicles for land management and to detect small fires before they become large forest fires using broadband connectivity. Advanced technology solutions are equipping public safety with new capabilities to communicate and coordinate during emergencies. For example, an incident commander can enhance how resources are dispatched and deployed to emergencies. The ability to access information and situational awareness is also essential because the location, mapping, weather, terrain, and predictive fire behavior intelligence can help to inform the response and coordination during the fire event.

In order for first responders to actually utilize these advanced solutions, they need to be able to count on the technology and underlying network performing in operationally critical situations. It is essential for emergency response personnel to have reliable access to broadband and the correspondingly essential resilient commercial power grid and backup power sources. Additionally, mobile wireless applications serving public safety should be built in accordance with commonly accepted standards, such as the 3GPP international wireless industry standards, to enhance their quality performance, interoperability, and reliable operation.

While I expect there will be many compelling proposals discussed during today's hearing, I also want to recognize the tremendous progress that's been made - thanks to the U.S. Congress enacting legislation to establish the Nationwide Public Safety Broadband Network-to address the communications challenges that historically hindered emergency response. Before FirstNet, field-based first responders, such as wildland firefighters, were hesitant to adopt new technology solutions because they couldn't count on it working when they needed it most. Now that we have FirstNet, first responders have priority and preemption, dedicated 700 MHz public safety spectrum that has been built out across the country (with aggressive rural coverage build benchmarks—an important priority for the WFCA), and the ability to request portable cell towers (Colts and Cows) to make sure first responders have connectivity, such as in the event infrastructure has been damaged by a fire or when a command post is staged in a remote mountainous area. I had the opportunity to appear before the Senate Commerce Committee in 2010 during a hearing to discuss the 9/11 Commission Report's recommendation to build a nationwide, public safety, wireless, interoperable, broadband network. As we approach the 20th anniversary of the 9/11 terrorist attacks, this committee and your colleagues in the House of Representatives and Senate can be proud of the successful fruit that's resulted from your legislative action. Thank you for working with the public safety community to make our vision become a reality.

Enhancing Network Resiliency and Reliability: Cannot Be Achieved in a Silo. Our country won't be able to tackle the pressing issue of broadband and telecommuni-

cations network resiliency in a silo. I have seen firsthand the devastation caused by massive conflagrations, such as the deadly and destructive Camp Fire in Paradise, CA in 2018. While resiliency practices, like burying fiber underground can certainly improve resiliency, the reality is that above-ground communication and power infrastructure in the path of a catastrophic fire will have difficulty withstanding the heat, wind and conditions of these massive fire events—even if built to the highest possible level of physical resiliency. As a country, we must properly invest in fire mitigation activities, land management, community readiness, and ensure there are the necessary resources to support fire suppression. We are entering a new age of wildland firefighting, and state and local budgets and the workforce in the fire service are becoming strained as wildfire season becomes increasingly long, frequent, dangerous, and destructive.

Commercial Power Grid. It is also important to recognize the need for improved power resiliency. Access to reliable commercial power isn't only important for the communications industry, but also for health care, first responders, citizens, and virtually every other facet of our economy. The recent and significant power failure events in California and Texas call into question the resiliency of the commercial power grid. As a result of the COVID-19 pandemic, society has transitioned to "remote-everything," which further reinforces the critical need for a robust and resilient commercial power grid.

Temporary and Fixed Backup Power. The placement of backup power generators at communications facilities can help enhance resiliency and power redundancy. The need for backup power has been evident during the public safety power shutdown (PSPS) in California. The WFCAs has collaborated with local lawmakers and other stakeholders in California to streamline the process for siting backup power facilities. Local and state siting rules, environmental, and other regulations governing the placement of backup power generators can make it exceedingly difficult to get this equipment installed at communication towers. This is not unique to California and is an issue that hinders backup generator placement at sites in jurisdictions across the country. The Federal government could consider preemptive siting and environmental streamlining rules to make it easier for these backup power facilities to be installed.

Streamlining the Process to Deploy Broadband Infrastructure. Especially in the case of wireless networks, greater reliability can be achieved from the number of cell towers in an area. This functions as a form of redundancy. As such, Congress should consider ways to expedite the process to deploy broadband infrastructure. Streamlining the deployment of both wireline and wireless broadband will also help to narrow the digital divide, boost the capacity and speeds available for broadband users, and expand available fiber backhaul-diversity. In response to the COVID-19 pandemic, Congress approved record levels of Federal stimulus that can be used to support the deployment of broadband and telecommunications infrastructure. While this is an important step forward, we should not stop there. Action should also be taken to streamline the process to make it easier, faster, and less costly to deploy wireless and wireline broadband across the federal, state, tribal, and local levels. With the passage of the American Rescue Plan Act of 2021 and current efforts underway to advance bipartisan infrastructure legislation, the time is now to move forward with broadband streamlining legislation or (at a minimum) approve a temporary window for expedited state, local, tribal, and Federal review and approvals while communities across America work to harness this opportunity to expand access to broadband.

Difficulty and Delay Deploying Broadband Infrastructure on Federal Lands. The WFCAs membership is regularly called upon to support fire suppression efforts on Federal lands to protect people, property, and some of America's most beloved landscapes. We also respond to other emergency situations on Federal lands to support and protect Federal government employees, local residents, and visitors, such as when first responders support a search and rescue for a missing person in a National Park or respond to a medical issue for an injured hiker at a U.S. National Forest. There is a critical public safety need for more robust and available broadband communications on Federal lands. Especially along major roadways, areas commonly used as incident command posts or other emergency staging grounds, and in recreation areas attracting large numbers of residents and visitors, the inability to have reliable and available wireless communications on Federal lands is no longer a mere inconvenience, it is a serious public safety issue. Congress should take action to overhaul, expedite, and streamline the Federal leasing, easement, appraisal, review, and approval processes for broadband projects on lands managed by the Federal government.

The Federal government maintains a significant presence in rural areas and across the western United States. As Congress and the Biden-Harris Administration

endeavor to close the digital divide and bolster network resiliency, I am concerned this mission could be hampered unless there is a fundamental change in how many Federal agencies approach their responsibility to review and approve broadband infrastructure projects. Aesthetic, historical, and cultural considerations on Federal lands should not wholly outweigh or supersede concerns about the life and safety of first responders and the public visiting, working, and living on or near Federal lands. The ability to communicate should be recognized as critically important, and I'm hopeful the Federal government can find ways to make it easier for this critical infrastructure to be deployed.

Cybersecurity and the Evolving Threat Landscape. Cybersecurity is another important pillar that must be included in our Nation's efforts to enhance our resiliency. Particularly given the recent high-profile ransomware attacks impacting the meat processing and energy sectors, the growing cyber threat landscape underscores the need for the Federal government to ensure the security of government infrastructure and systems. Additionally, Congress could consider proposals to help federal, state, tribal, local, and territorial governments modernize and update their security capabilities, including providing support for education and training to expand the available cybersecurity workforce. Voluntary cybersecurity grant funding could also be considered for other critical infrastructure sectors, including the communications industry.

Next Generation 9-1-1: An Important National Priority. When discussing resiliency, reliability, and redundancy for the communications sector, we must not overlook the critical need to reform and invest in Next Generation (NG) 9-1-1. Federal funding for NG 9-1-1 implementation will equip public safety answering points (PSAPs) and emergency communications centers (ECCs) with the ability to modernize their operations. This will bolster redundancy by allowing a 911 center to load-share with other PSAPs/ECCs. It will also allow PSAPs/ECCs to receive rich Internet protocol (IP)-based data and information in the form of video, photos, and multimedia from the public, and then send this critical and life-saving information directly to field-based first responders, including those using FirstNet. Transitioning our country's existing patchwork of 9-1-1 jurisdictions (many still using legacy systems) to NG 9-1-1 is critical for our Nation's communications resiliency. As bipartisan infrastructure legislation is considered by Congress, I urge this committee and your colleagues in the House and Senate to include the NG 9-1-1 reform and funding bill. We must ensure 9-1-1 centers regardless of state or jurisdiction—can receive IP-based data and information, which will better inform emergency response, reduce response times, and improve outcomes.

Public Safety Communications Priorities at the FCC. Finally, on behalf of the public safety community, I would like to take this opportunity to commend the Acting Chairwoman of the Federal Communications Commission and express my appreciation for her leadership and steadfast commitment to public safety communications. Acting Chairwoman Jessica Rosenworcel has been a longstanding champion for first responders. On behalf of the WFCOA, we are hopeful the Biden-Harris Administration will nominate her to serve as Chair. Should this happen, I urge this committee to advance her nomination.

Throughout her career, Ms. Rosenworcel has meaningfully contributed to bipartisan legislative and regulatory efforts to modernize emergency communications for first responders in America. For example, as a senior congressional aid for this committee, Ms. Rosenworcel helped to author the bipartisan legislation that created the Federal First Responder Network Authority and set aside 20 MHz of Band 14 spectrum for public safety's use. In her role as Acting Chairwoman, she has continued to listen to the needs of public safety and recently helped lead bipartisan action to stay¹ the reallocation of 4.9 GHz spectrum, which would have taken away this vital spectrum resource from public safety. The public safety community now has the opportunity to work with the FCC and other stakeholders to help shape the future use of the 4.9 GHz spectrum. With changes in broadband technology, public safety's communications resilience can be strengthened by preserving the spectrum for public safety's use, including facilitating the introduction of new 5G capabilities into the public safety communications ecosystem and meeting the urgent need for dedicated nationwide 5G spectrum for the public safety community.

Thank you. Thank you for inviting me to testify. I appreciate your efforts to bolster our Nation's communications resiliency, reliability, security, and redundancy. On behalf of the WFCOA, thank you for allowing us to share public safety's views on these topics. I am available to respond to any questions you may have.

¹<https://www.fcc.gov/document/fcc-adopts-49-ghz-stay-order>

Senator LUJÁN. Chief Johnson, thank you so very much. Next we will hear from the Honorable Jonathan Adelstein, the President and Chief Executive Officer of the Wireless Infrastructure Association. The floor is yours, sir, for 5 minutes.

**STATEMENT OF JONATHAN ADELSTEIN,
PRESIDENT AND CHIEF EXECUTIVE OFFICER,
WIRELESS INFRASTRUCTURE ASSOCIATION**

Mr. ADELSTEIN. Thank you, Chairman Luján, and Ranking Member Thune for holding this hearing and for getting the perspective of the wireless industry on providing resilient and reliable and redundant networks. Your priority on this is well-founded because people's lives are at stake here.

In the infrastructure package you are considering, I think is the biggest opportunity in decades to build more resilient networks that save Americans lives. Resiliency is a real priority, and you make it real priority by, not limiting funding to single, potentially less resilient, technology. That will be the way that you enable Congress to maximize the disaster prevention response and recovery we have been talking about. And it will help you to harness strengths in redundancies of multiple technologies. A flexible "all of the above" approach deploying fiber, mobile and fixed wireless, will be the best way to achieve all of Congress' both broadband and climate change goals.

Now, when I ran RUS, during the Recovery Act, then Vice-President Biden called me into his office, and I will never forget what he said. He said, "Give yourselves freaking flexibility". And that is a quote, not a PG version. I will never forget it because we made that our watch word at RUS. We were trying to get the money out the door and flexibility, I think, should be Congress' watch word, as well, when you try to get this money out the door. It would be unprecedented to direct all funding to a single technology, excluding others that may provide more resiliency.

An investment of this magnitude is a dangerous time to experiment with putting all your eggs in the single wireline basket. Data speeds, both upload and download, are important to consumers. Congress can make them a priority. Yet cementing law of static level data speeds, as a gating eligibility factor—you are not even eligible if you do not meet those—you could be hamstringing your ability to advance other goals that you care about. Seize this moment to promote all of your goals—resiliency, speeding broadband service to your constituents, providing them mobility, serving public safety, like Chief Johnson here, promoting affordability and fighting climate change.

This committee's long-standing approach has enabled the U.S. to build the world's strongest telecommunications networks. And as Senator Thune noted, we rose to the occasion during this pandemic. We saved the entire economy. You set goals, traditionally, and priorities for Federal agencies to execute. You do not cement, in law, narrow technological standards, like specific data speeds.

Congress should, again, direct agencies to execute your priorities. Let all technologies that promote your goals compete for funding, including fixed and mobile 5G services. On resiliency, wireless networks have real advantages. They tend to go out less often in dis-

asters and they tend to get restored more quickly—much more quickly, in some cases, than wireline networks.

Rather than exclude wireless, Congress can make resiliency a priority funding factor. Reward applicants with the most resilient solutions. Let multiple technologies compete and let the best ones win. And get people who do not have access to the Internet connected as quickly as possible. Wireless networks get up and running much quicker than fiber. Your constituents need broadband now. Do not make consumers wait for a decade, or that long, by limiting the range of eligible providers. Future proof should not mean deployed far into the future. Connectivity delayed is connectivity denied.

And excluding mobile solutions could inadvertently grow a rural mobility digital divide. Do not tether rural residents to the Internet through a wire to the home or to the farmhouse. Rural Americans need mobile networks for their daily lives, for precision ag, and for rural economic development. Prioritize public safety. First responders, like Jeff Johnson, do not have a fiber line trailing his fire truck. They go into harm's way to protect us all. Let us make sure the solutions meet their needs.

And to combat climate change, which is causing so much trouble, right now, in your state, Chairman. 5G networks can help reduce carbon emissions by up to 15 percent—one-third of the 50 percent reduction required by 2030 by funding always a challenge for climate change solutions. Target your broadband dollars, which we think we can get, to prioritize projects that contribute the most to reducing carbon emissions. Do not eliminate options like 5G that are best documented to combat climate change and mitigate future disasters.

Make affordability a priority. One in five Americans, many in our state of South Dakota, are smartphone only. Many are low-income, rural residents who will not give up their phone, their smartphone. But funding only wireline solutions means they have to purchase a costly new fiber service.

So, inviting multiple technologies is the best way to attract qualified applicants in every service area, give agencies the flexibility to consider providers for each location. Otherwise, the hardest to reach areas by phone disrepair never get service. Congress has valued all these, many priorities. You do not have to choose one at the expense of the others.

If rigid eligibility requirements are locked in statute, like symmetrical speeds that most consumers do not use, it precludes the technological flexibility to address other priorities, like resiliency and it can leave many people unserved.

Thank you for holding this hearing and thank for the opportunity to testify.

[The prepared statement of Mr. Adelstein follows:]

EXECUTIVE SUMMARY, JONATHAN ADELSTEIN, PRESIDENT AND CEO OF WIA

By making resiliency a priority in the infrastructure plan, rather than limiting funding to a single, potentially less resilient, broadband technology, Congress can maximize disaster prevention, response, and recovery. A flexible all-of-the-above strategy, including fiber, fixed and mobile wireless improves redundancy and best employs this historic opportunity to achieve all Congressional broadband and climate change goals, not just one.

Congress should set agencies' funding goals, not set technological gating factors that preclude other priorities. Otherwise, Congress may tie agencies down with limited flexibility, preventing consideration of innovative and geographically appropriate provider applications that address many essential consumer needs beyond data speeds. Rather than cement specific broadband speeds in statute, Congress should set a checklist of priority factors including:

Resiliency: Congress can instruct agencies to consider resiliency as a primary factor for funding. Applicants that provide resilient solutions are rewarded with priority consideration.

Higher download and upload speeds: Download and upload speeds are valued by consumers. Faster offerings deserve priority. In terms of symmetrical speeds, data show consumers use over ten times the downstream bandwidth compared to upstream. To make the primary gating criteria for eligibility a service most consumers do not require would foreclose providers from even applying that could better address many Congressional priorities and more urgent rural consumer needs.

Mobility: If wireless broadband is excluded, Congress could inadvertently grow a rural mobility digital divide. Many unserved residents would be tethered to accessing the Internet through a wired connection at the home or farmhouse. Fixed wireless supports 5G mobile broadband that is indispensable for rural Americans' daily needs, precision ag, and rural economic development.

Speed of deployment: Given the urgent need for broadband in rural areas, prioritize connecting consumers as quickly as possible provide flexibility to expert agencies to consider applicants that get networks up and running. Don't make consumers wait for many years by limiting the range of eligible providers. Future proof should not mean deployed far in the future.

Public safety and first responders: First responders rely on mobile networks as they go into harm's way to protect the public. Service to those who serve us all should be a priority goal.

Battling climate change: Congress can set as a priority factor for agencies the degree to which proposed projects will contribute to the reduction of carbon emissions. If only one technology is allowed, Congress would eliminate options like 5G that can best achieve this clear priority. Let the best technology win.

Targeting unserved areas: Congress should target funds to truly unserved areas. Define "unserved" areas as those lacking service through either wired or wireless technology. Accurate maps are needed to identify truly unserved areas with already committed build plans to target support.

Affordability: Limiting funding to wireline providers saddles smartphone-only consumers with the need to purchase costly new fiber service or require large ongoing Federal subsidies. Few rural consumers are willing to give up mobility.

Cost efficiency: Technological flexibility provides consumers with the most megabits for the taxpayer dollar. No single technology is likely to garner a qualified applicant in every unserved area. Allow agencies flexibility to consider providers with the most appropriate solution for the given deployment. Ensure every awardee can cover its costs to remain viable so service and quality is maintained. Otherwise, the hardest areas to reach will fall into disrepair or remain unserved.

Congress has long expressed the value of each of these factors—and should not choose one as a gating criterion at the expense of all others. If rigid requirements, such as symmetrical speeds, are locked in statute, it precludes the flexibility to consider providers that address other key priorities including resiliency, an evolving mix of speeds, mobility, quicker deployment, public safety, climate change, and affordability for rural consumers. Lack of flexibility may leave many areas unserved.

PREPARED STATEMENT OF JONATHAN ADELSTEIN, PRESIDENT AND CEO,
WIRELESS INFRASTRUCTURE ASSOCIATION

Chairman Luján, Ranking Member Thune, and members of the Subcommittee, thank you for holding this important hearing and for the opportunity to testify. I am the President and CEO of the Wireless Infrastructure Association (WIA), representing the companies that build, develop, own, and operate the Nation's wireless facilities. Our members include infrastructure providers, wireless carriers, equipment manufacturers, and professional services firms. WIA advocates for the wide-

spread, responsible deployment of wireless infrastructure to enable mobile and fixed wireless broadband access for communities everywhere.

The wireless infrastructure industry is committed to making next-generation communications technology widely available to every corner of America. The importance of connectivity is dramatically underscored by the increased reliance on broadband during this unprecedented COVID-19 pandemic. WIA and our members are grateful for the leadership of your Subcommittee in promoting our shared goal of closing the digital divide with ubiquitous, reliable, resilient, and redundant broadband networks.

The Importance of Resilient and Redundant Networks During Pandemic

The focus of this hearing is on building resilient and redundant broadband networks. COVID-19 brought forth new challenges and new opportunities for broadband deployment. The pandemic created an even deeper recognition of how essential reliable broadband connectivity is to every household and to every business. The wireless industry's network investments enabled the entire economy to sustain itself during the pandemic. We helped businesses to stay afloat, children to continue learning, and first responders and health care providers to offer critical care.

Dramatic consumer usage changes, including work-from-home, remote learning, and telehealth, generated an unprecedented demand for wireless connectivity anchored by the need for wireless infrastructure. Wireless networks rose to the challenge and performed magnificently. U.S. networks' performance during the pandemic continues to demonstrate why our networks are the envy of the world. COVID-19 drove mobile traffic up 20 percent, essentially overnight. Yet, mobile data speeds kept pace. This was not the case in other countries. According to an Ookla report, China's mobile download speeds saw speed decreases of up to 40 percent during their peak COVID-19 restrictions, while Italy saw decreases of up to 23 percent, and Spain saw decreases up to 15 percent.¹ Over two-thirds of European countries experienced mobile speed decreases of up to 30 percent in late March, according to OpenSignal.²

The wireless success story is not accidental. Thanks to the wireless industry's innovation, the nearly \$30 billion invested every year by the wireless industry,³ a timely supply of spectrum due to the leadership of this Subcommittee and the FCC, and a regulatory framework that promotes investment in responsible wireless infrastructure, the U.S. was in a better position than the rest of the world during the pandemic.

The pandemic was only the most dramatic and recent example of the need for reliable and resilient broadband networks. I was honored to be appointed by the Federal Communications Commission as the Vice-Chair of its Broadband Deployment Advisory Committee (BDAC) Disaster Response and Recovery Working Group (DRRWG). Our group delivered a unanimous, consensus report that outlined the challenges and solutions to ensure that reliable, resilient broadband was available before, during, and after natural disasters.⁴

The single greatest legislative opportunity for Congress to enhance the reliability and redundancy of broadband networks is in the transformative infrastructure package now under consideration and proposed in President Biden's American Jobs Plan. That is why one of the most important recommendations of the BDAC's DRRWG was for Congress to make major investments to expand the availability of broadband access. The expert group concluded that resiliency and deployment go hand in hand. The report stated, "the most obvious and immediate means of infusing the necessary capital to address these availability challenges is for Congress to appropriate the additional funds needed to deploy broadband in unserved areas in a timely manner."⁵

¹*Tracking COVID-19's Impact on Global Internet Performance*, Ookla, <https://www.speedtest.net/insights/blog/tracking-covid-19-impact-global-internet-performance/#/United%20States> (last updated July 20, 2020).

²Francesco Rizzato, Sam Fenwick, & Ian Fogg, *Mobile Experience During the COVID-19 Pandemic: 4G Download Speed*, OPENSIGNAL (Apr. 08, 2020), <https://www.opensignal.com/2020/04/08/mobile-experience-during-the-covid-19-pandemic-4g-download-speed>.

³See 2020 Annual Survey Highlights, CTIA at 3 (Aug. 25, 2020), <https://api.ctia.org/wp-content/uploads/2020/08/2020-Annual-Survey-final.pdf> (noting industry investment was \$29.1 billion in 2019).

⁴*Report and Recommendations: COVID-19 Response*, FED. COMM'NS COMM'N BROADBAND DEP. ADVIS. COMM. DISASTER RESPONSE & RECOVERY WORKING GRP., (Oct. 29, 2020), <https://www.fcc.gov/sites/default/files/bdac-disaster-response-recovery-approved-rec-10292020.pdf> [hereinafter *BDAC DRRWG Report*].

⁵*Id.* at 33.

The Need for Multiple Technologies to Address Broadband Reliability and Redundancy

Wireless broadband serves as a key lifeline during storms, natural disasters, and other emergencies. Providing that lifeline is the industry's goal every day. Wireless providers and builders have invested significant resources to strengthen and harden networks and improve network resiliency and planning.⁶ In 2017, Hurricane Harvey's unprecedented floodwaters affected only 5 percent of the thousands of wireless facilities in the affected areas of Texas and Louisiana.⁷ In the wake of Hurricane Katrina, 1.75 million telecommunications lines were downed while only 1,000 cellular transmission towers were affected.⁸ Six months after the storm, 130,000 lines remained out while cellular service was fully operational.⁹ After the catastrophic events of 9/11, many point-to-point wireless links were established to supplement the loss of a main switching station housed in the World Trade Center. These links were installed in a matter of days, and many remain as a source of permanent backup.¹⁰

Once disasters occur, the availability of multiple providers and networks can help consumers and businesses stay connected to critical services and information. Fiber is a state-of-the-art network architecture that provides outstanding bandwidth and broadband service and is an essential element of any national broadband buildout effort but comes with its own tradeoffs. WIA members own and operate most of the fiber in the U.S. Regarding its resiliency, like other wireline infrastructure, we are aware that fiber can be vulnerable to damage from natural forces.¹¹ In rural areas, fiber is usually deployed aerially on utility poles. Aerially deployed networks may be subject to interruptions from environmental events such as wind, ice loading, trees falling, snow and storms, fire, and hurricanes.¹²

Fiber buried underground is still subject to fiber cuts and other disruption often caused by excavations, and while it can be more resilient than aerial, it can also be far more costly, time consuming to deploy and repair, and sometimes impractical depending on the soil and topography.¹³ Wireless networks help to ensure that multiple providers and networks are available when disaster strikes. Through overlapping site coverage, diverse deployment of fiber backhaul, and extensive investments in deployable assets, wireless providers can mitigate the impact of disasters on their networks and often restore service more quickly than wireline fiber.

As climate change continues to increase the severity of weather events, fiber and other wireline infrastructure will face increased exposure to risk. It is estimated that over 1,000 miles of long-haul fiber conduit and almost 2,500 miles of metro fiber conduit will be underwater by 2032.¹⁴ Unfortunately, these trends are not improving. Extreme heat waves and large storms are predicted to become more common.¹⁵ Wireline infrastructure will continue to face vulnerabilities that are different than wireless options.¹⁶

⁶ See 2019 Annual Survey Highlights, CTIA at 5 (June 20, 2019), <https://api.ctia.org/wp-content/uploads/2019/06/2019-Annual-Survey-Highlights-FINAL.pdf> (stating that the wireless industry invested over \$253 billion between 2010 and 2019).

⁷ Nick Ludlum, *The Wireless Industry Responds to a Historic Hurricane Season*, CTIA (Sept. 26, 2017), <https://www.ctia.org/news/the-wireless-industry-responds-to-a-historic-hurricane-season>.

⁸ Paula Rhea, *Hurricane Katrina: Telecom Infrastructure Impacts, Solutions, and Opportunities*, VERIZONBUSINESS (Feb. 12–16, 2006), <https://archive.nanog.org/meetings/nanog36/presentations/rhea.pdf>.

⁹ *Id.*

¹⁰ Zayan EL Khaled & Hamid Mcheick, *Case Studies of Communications Systems During Harsh Environments: A Review of Approaches, Weaknesses, and Limitations to Improve Quality of Service*, 15 INT'L J. DISTRIB. SENS. NETS. (Feb. 24, 2019), <https://doi.org/10.1177%2F1550147719829960>.

¹¹ See, e.g., *The Real Cost of Fiber Cuts: How to solve using Gigabit Wireless*, GIGABIT WIRELESS (Mar. 15, 2016) (noting, among common reasons for outage such as tornadoes and hurricanes, squirrels accounted for 28 percent of damages to fiber lines in 2010).

¹² See THE COMPLETE GUIDE TO FIBER TO THE PREMISES DEPLOYMENT, PPC at 8 (2020), <https://www.ppc-online.com/fiber-to-the-premises-ebook>.

¹³ See *Cost Efficiency* *infra* pp.15–16 and related discussion.

¹⁴ Ramakrishnan Durairajan *et al.*, *Lights Out: Climate Change Risk to Internet Infrastructure*, In Proceedings of the Applied Networking Research Workshop 2018 (July 16, 2018).

¹⁵ See *Climate Change Indicators: Weather and Climate*, ENVIRON. PROT. AGEN., <https://www.epa.gov/climate-indicators/weather-climate> (last visited June 16, 2021).

¹⁶ Anthony Townsend & Mitchell Moss, *Telecommunication Infrastructure in Disasters: Preparing for Crisis Communications*, N.Y.U. CTR. FOR CATASTROPHE PREP. AND RESP. at 8 (April 2005) (“Wireless links, whose links are constructed out of intangible electromagnetic radiation, reduce some of the vulnerability of wired networks”); see also David Theodore, *A Climate-Proof Internet is Here and Critical Infrastructure Needs it Yesterday*, CLIMATE RESILIENT INTERNET

Loss of electrical power can create outages of telecommunications service for wired and wireless networks. Telecommunications providers of both fiber and wireless broadband are equally and deeply committed to serving their customers' needs in emergencies. Yet, each is subject—in differing degrees—to the lack of a reliable electric grid. Fiber-to-the-premise (FTTP) networks face the more intractable problem of loss of power to the premise in addition to the network. Most in-home fiber includes a battery backup that lasts twenty-four hours.¹⁷ After those twenty-four hours, services including telephone and 9–1–1 services are lost. Power is often lost in rural areas for weeks even in regularly occurring ice storms and even longer in the wake of disasters. Restoring electrical service to all the homes in the wide areas often affected by these larger natural disasters is a lengthy process. Wireless connectivity requires the difficult, but far less onerous, challenge of providing power only to the transmission site such as a tower to serve all the households in the service area regardless of if they have power on their premises. And consumers can often find alternative locations to re-charge their devices, including in their cars.

Wireless assets, such as cell on wheels (“COWs”), can be quickly rolled in to provide temporary network capacity—including backhaul when a fiber connection is lost—and restore connectivity. This speed of response is simply not always possible in primarily wireline networks that much reach many affected premises. Wireless networks also can be rerouted and optimized during and after a disaster. If one cell site is offline, the network can use capacity from another site to maintain connectivity.¹⁸

Wireless networks also have unparalleled self-healing capabilities that are being enhanced with 5G technology. Fiber networks in rural areas, particularly aerial fiber that is damaged by storms, tend to take longer to restore. Restoring one tower can quickly provide service to an entire area, versus having to repair numerous fiber breaks or entire areas of poles washed, burned, or blown away. A resilient network is a redundant network. Resiliency is a key factor Congress should consider in prioritizing funding for broadband buildout.

Public Safety and First Responders Rely on Mobile Wireless Networks

In terms of disaster response and resiliency, first responders also need universal coverage. First responders rely on wireless broadband as they rush to the front lines for fires, crime scenes, and disasters and need mobile connectivity on site to protect themselves and the public. In many rural areas, the closest hospital can be an hour or more away. Wireless broadband like 5G can turn an ambulance into a mobile emergency room during that “golden hour,” saving lives and preventing disabilities.¹⁹

Many current and potential applications for public safety officials are powered by wireless broadband. A combination of wearables, sensors, cameras, and other Internet-connected technologies are being used by public safety departments to enhance their efforts in a variety of settings. For example, FirstNet, the dedicated network that Congress established to support first responders, has nearly eighty deployable assets available at no cost to subscriber agencies, utilizing Band 14 for best public safety experience.²⁰ In Chicago and Miami, for example, police departments are utilizing technology that uses an array of smart acoustic sensors to identify gunshots and isolate their location.²¹ In Sea Isle City, New Jersey, cameras and sensors are

(Feb. 6, 2020) (suggesting a wireless alternative using point-to-point millimeter wave links as a fail safe for when fiber lines are downed).

¹⁷See Public Notice, *Public Safety and Homeland Security Bureau Reminds Providers of Facilities-Based Residential Voice Services That are Not Line-Powered of Upcoming Requirement to Offer Subscribers 24 Hours of Backup Power for Customer Premises Equipment*, FED. COMM'NS COMM'N DA 18–1205 (rel. Nov. 27, 2018), <https://docs.fcc.gov/public/attachments/DA-18-1205A1.pdf>.

¹⁸*How Wireless Kept Americans Connected During COVID–19*, CTIA at 3 (June 23, 2020), <https://api.ctia.org/wp-content/uploads/2020/06/How-Wireless-Kept-Americans-Connected-During-COVID-19-2.pdf>.

¹⁹Sanjay Joshi, *5G and Me: And the Golden Hour*, DELL TECHNOLOGIES (Nov. 19, 2019), <https://www.delltechnologies.com/en-us/blog/5g-me-and-golden-hour/>.

²⁰*Understanding the FirstNet Deployable Program: High-Impact Solutions for Public Safety Operations*, FIRSTNET AUTH., [https://firstnet.gov/system/tdf/Deployables factsheet 2021.pdf?file=1&type=node&id=1342&force=0](https://firstnet.gov/system/tdf/Deployables%20factsheet%2021.pdf?file=1&type=node&id=1342&force=0).

²¹*Smaller Cities Increasingly Turn to Gunshot Detection Technology to Prevent and Reduce Gun Violence*, INTRADO GLOBE NEWSWIRE (Dec. 22, 2020), <https://www.globenewswire.com/en/news-release/2020/12/22/2149702/0/en/Smaller-Cities-Increasingly-Turn-to-Gunshot-Detection-Technology-to-Prevent-and-Reduce-Gun-Violence.html>.

being used to monitor flood risk.²² Electronic flashing road signs are automatically activated to alert drivers when the flood risk is high.

Unmanned Aerial Vehicles, often referred to as “drones”, can get information to first responders faster in an emergency. Drones equipped with cameras are increasingly being used in search and rescue situations to scour areas that may be difficult for people to access. In January 2019, a search and rescue team in Utah used a drone to locate a 60-year-old hiker stranded on a ledge.²³ During the Camp Fire, sixteen Northern California emergency responder agencies worked together using a team of drones to map and track the fire, helping them develop and implement their containment strategies.²⁴

Advances in wireless technology have helped spur the development of tools utilized by public safety officials. As next-generation wireless devices and networks roll out across America, 5G will enable a whole new generation of public safety innovations. Public safety and disaster response is another key factor Congress should prioritize for funding broadband infrastructure.

Wireless Networks are Vital to Addressing Climate Change

Reliable and redundant telecommunications networks have the unique ability to help prevent and to mitigate the destruction of disasters before they occur, as well as providing the means to respond to them. Scientific reports indicate that climate change is a major factor spurring the increasing number and severity of natural disasters—and one that humans can address.²⁵ Studies have shown how dramatically the latest advances in broadband, wireless broadband, and particularly 5G networks, can help reduce greenhouse gas emissions. The Global e-Sustainability Initiative documented that Internet-enabled solutions could reduce greenhouse gas emissions by 16.5 percent.²⁶

The characteristics of wireless networks’ wide area coverage, mobility, and speed of deployment offer unique benefits that address every policy goal of President Biden’s American Jobs Plan. In fact, every element of the President’s plan will rely on rapid deployment of wireless connectivity, including energy and smart grid, transportation and connected cars, agriculture, water and land use, building efficiency, and advanced manufacturing. The World Economic Forum documents that the digital technology sector, relying on 5G connectivity, “is probably the world’s most powerful influencer to accelerate action to stabilize global temperatures well below 2°C.”²⁷ Indeed, “digital technologies could already help *reduce global carbon emissions by up to 15 percent—or one-third of the 50 percent reduction required by 2030.*”²⁸

To ensure that Federal broadband infrastructure investments effectively target climate change, Congress should keep in mind the most important applications that accomplish the goal. Each of the most fundamental green technologies enabled by broadband requires wide-area and ideally universal and mobile coverage of rural America. These include smart grid, smart transportation and autonomous vehicles, precision agriculture, and water conservation.

Wireless networks provide additional benefits to emerging technologies that will rely on resilient networks. Smart transportation, such as self-driving and electric vehicles, rely on advanced mobile networks to provide instantaneous connectivity for

²² *Tech Help With Floods Begins with Sea Isle City Alert System*, PRESS OF ATLANTIC CITY (June 10, 2019), https://pressofatlanticcity.com/opinion/editorials/tech-help-with-floods-begins-with-sea-isle-city-alert-system/article_58d476e4-1feb-5644-a7c8-a91a5bb19e71.html.

²³ Zacc Dukowitz, *Drones in Search and Rescue: 5 Stories Showcasing Ways Search and Rescue Uses Drones to Save Lives*, UAV COACH (Jan. 18, 2019), <https://uavcoach.com/search-and-rescue-drones/>.

²⁴ Joe Rosato Jr., *How a Squadron of Drones Mapped the Entire Paradise Camp Fire Zone in Two Days*, NBC BAY AREA, <https://www.nbcbayarea.com/news/local/how-a-squadron-of-drones-mapped-the-entire-paradise-camp-fire-zone-in-two-days/201896/> (last updated Nov. 29, 2018).

²⁵ See, e.g., *Climate Change Indicators: Weather and Climate*, ENVTL. PROT. AGEN., <https://www.epa.gov/climate-indicators/weather-climate> (last visited June 16, 2021) (noting heat waves and large storms are likely to become more frequent); *The Effects of Climate Change*, NAT’L AERO. AND SPACE ADMIN., <https://climate.nasa.gov/effects/> (last visited June 17, 2021) (“Effects that scientists had predicted in the past would result from global climate change are now occurring: loss of sea ice, accelerated sea level rise and longer, more intense heat waves.”).

²⁶ *GeSI Smarter 2020: The Role of ICT in Driving a Sustainable Future*, GLOBAL E-SUSTAINABILITY INITIATIVE AND BOSTON CONS. GRP. at 9 (Dec. 2012), https://www.telenor.com/wp-content/uploads/2014/04/SMARTer-2020-The-Role-of-ICT-in-Driving-a-Sustainable-Future-Decem-ber-2012_2.pdf.

²⁷ Börje Ekholm & Johan Rockström, *Digital technology can cut global emissions by 15 percent. Here’s how*, WORLD ECON. FORUM (Jan. 15, 2019), <https://www.weforum.org/agenda/2019/01/why-digitalization-is-the-key-to-exponential-climate-action/>.

²⁸ *Id.* (emphasis added).

numerous operations, especially safety sensors. Vehicle traffic congestion is a major source of emissions. It is estimated that cars are responsible for about 30 percent of CO₂ emissions.²⁹ Deloitte estimates that self-driving cars, which rely on wireless connectivity, could reduce emissions by 40 percent to 90 percent, cut travel times by nearly 40 percent, and reduce delays by 20 percent.³⁰ In addition, smart city and smart building technologies could result in \$20 billion in savings if the energy efficiency of buildings is increased by just 10 percent.³¹

5G networks will increase manufacturing efficiency and sustainability goals. 5G can enable more efficient compressors that waste less energy, increase boiler efficiency to reduce air waste energy, and improve motor voltage imbalances to reduce energy consumption.³² Furthermore, 5G will reduce greenhouse gas emissions in numerous ways, such as making smarter electric grids that are more efficient and resilient.³³

For example, WIA member Anterix is working with utilities to deploy utility-grade private networks, providing capabilities, features, functions, and equipment for reliable and resilient connections for essential services. These new networks enable a range of new use cases, such as the Falling Conductor Protection capability developed by San Diego Gas & Electric and Schweitzer Engineering Laboratories. It relies on the low latency of LTE—the same technology used in our phones—to enable broken power lines to be de-powered in the interval between breakage and hitting the ground, which reduces their likelihood to ignite wildfires that have recently plagued so much of the country and contributed to global warming.³⁴

Internet of Things (“IoT”) technologies in appliances, buildings, factories, and homes employ sensors that rely on 5G as they monitor and analyze energy usage. These technologies alone could cut carbon emissions 15 percent by 2030.³⁵ Smart energy grids also employ 5G. The Pacific Northwest National Laboratory found that it could directly reduce energy usage and carbon impact by 12 percent and indirectly by 6 percent.³⁶ Having resilient electrical grids has become increasingly important during destructive wildfire seasons. As electrical grid operators aim to enhance their networks for greater reliability and resiliency, sensors and analytics enabled by 5G applications are increasingly critical, “allowing for timely diagnosis, prediction, and prescription of all system variables and assets during normal and extreme-event conditions.”³⁷

Water conservation and efficient farming is another benefit of wireless broadband. Agriculture accounts for 80 percent of water use in the U.S.³⁸ Agricultural IoT technologies, like precision agriculture, monitors, soil property and yield mapping, and satellite imagery, can help to reduce agricultural water consumption by as much as 15 percent per year.³⁹

For the telecommunications industry itself, 5G networks are estimated to be 40 percent more energy efficient due to technological evolution, which has dramatically

²⁹ *Digital Transformation of Industries: Automotive Industry*, WORLD ECON. FORUM at 4 (Jan. 2016), <https://reports.weforum.org/digital-transformation/wp-content/blogs.dir/94/mp/files/pages/files/wef-dti-automotivewhitepaper-final-january-2016.v1.pdf>.

³⁰ *Wireless Connectivity Fuels Industry Growth and Innovation in Energy, Health, Public Safety, and Transportation*, CTIA (Jan. 19, 2017), <https://www.ctia.org/news/deloitte-wireless-connectivity-fuels-industry-growth-and-innovation>.

³¹ Darrell M. West, *Achieving Sustainability in a 5G World*, BROOKINGS at 4 (Dec. 2016), https://www.brookings.edu/wp-content/uploads/2016/11/gs_20161201_smartcities_paper.pdf.

³² See generally *id.* (describing ways that 5G technology will enable resource management and sustainability).

³³ See, e.g., Sofana Reka ET AL., *FUTURE GENERATION 5G WIRELESS NETWORKS FOR SMART GRID: A COMPREHENSIVE REVIEW*, 12 ENERGIES 2140 at 2145–49 (June 4, 2019) (detailing several benefits 5G will provide to electrical systems including real time demand response).

³⁴ *Wildfire Safety Innovation: Cutting off Power to a Broken Power Line Before it Hits the Ground!*, SAN DIEGO GAS AND ENERGY (Mar. 20, 2019), <https://sdgenews.com/article/wildfire-safety-innovation-cutting-power-broken-power-line-it-hits-ground>.

³⁵ Renee Cho, *The Coming 5G Revolution: How Will it Affect the Environment?*, COLUM. CLIMATE SCHOOL (Aug. 13, 2020), <https://news.climate.columbia.edu/2020/08/13/coming-5g-revolution-will-affect-environment/>.

³⁶ R. Pratt, ET AL., *The Smart Grid: An Estimation of the Energy and CO₂ Benefits*, PACIFIC NW. NAT’L LAB. (Jan. 2010); see also Bruce Weindelt, *Digital Transformation of Industries: Automotive Industry*, WORLD ECON. FORUM at 4 (Jan. 2016).

³⁷ Louis Brasington, *Digital Smart Grid Resilience: Wildfire Mitigation and Reliability*, CLEANTECH GRP. (Oct. 22, 2020), <https://www.cleantech.com/digital-smart-grid-resilience-wildfire-mitigation-and-reliability/>.

³⁸ Darrell M. West, *Achieving Sustainability in a 5G World*, BROOKINGS at 2 (Dec. 2016), https://www.brookings.edu/wp-content/uploads/2016/11/gs_20161201_smartcities_paper.pdf.

³⁹ E.J. Sadler et al., *OPPORTUNITIES FOR CONSERVATION WITH PRECISION IRRIGATION*, 60 J. OF SOIL AND WATER CONSERV. 374, 377 (Oct. 27, 2015).

increased energy efficiency, particularly in chipsets.⁴⁰ 5G processors and radios are tightly designed together, which promotes smart, integrated, energy saving features.

There is much debate in Congress today about the level of resources the infrastructure plan should dedicate to combatting climate change. Yet, there seems to be wide agreement on the need for broadband deployment funding. Congress should target resources to deploy broadband infrastructure to maximize the beneficial impact on climate change. No broadband technology is better documented to achieve climate change goals than wireless broadband. If even a fraction of the 15 percent reduction in carbon emissions estimated by WEF is achieved, it would be a monumental contribution toward saving the planet. Excluding wireless broadband would miss an urgently needed opportunity to combat global warming and to prevent untold disasters from occurring in our lifetimes and those of generations to come.

Lessons from the Recovery Act and then Vice-President Biden: The Need for Flexibility

My experience overseeing the Broadband Initiatives Program as Administrator of the Rural Utilities Service at the Department of Agriculture (“USDA”) for the Obama-Biden Administration can provide useful lessons as this Committee deliberates on how best to accomplish its broadband deployment objectives. It turns out that this can be much more complicated in practice than it might appear.

I am very familiar with financing FTTP projects: the RUS under the Recovery Act ultimately approved 221 fiber wireline projects, 60 wireless projects and 28 combined wireless/wireline.⁴¹ Given the severity of the economic downturn, we strove to move as quickly as possible seeking “shovel ready projects.” These were fewer and farther between than hoped. I was confirmed by the U.S. Senate in June 2009 after the policy was already established for the first round Notice of Funding Availability (NOFA). Of the roughly \$3.5 billion ultimately awarded, the first round awarded \$1.067 billion for 68 broadband projects.

However, funding was going out the door more slowly than the White House wanted to see. As we were devising the rules for the second and final NOFA, I was first called into the office of Chief of Staff Rahm Emmanuel, who admonished RUS to speed up the process. Shortly thereafter, I was called into the office of then-Vice President Biden, who had been charged by President Obama with overseeing the Recovery Act. Needless to say, this second meeting was more pleasant.

The guidance Vice President Biden shared was as clear as it was sound: “Give yourselves more freaking flexibility.” I will never forget those words—which is a direct quote, not a PG-rated version—because they became our motto as we made policy cuts in the second NOFA. When deliberating on decisions, I often called for more “freaking flexibility.”

Vice President Biden’s advice proved as wise as it was piquant. We made major changes in the second NOFA, including the mix of grants and loans, that were critical to the success of the program.⁴² It is a heretofore unreported fact that RUS had almost more funding than it had qualified projects. RUS received \$28.965 billion in total applications for grants and loans that resulted in \$3.529 billion RUS ultimately awarded. Yet, in the final process, almost every award that passed both our financial feasibility and our technical feasibility screens won funding—with only a handful that could have met those screens left at the end of the process. In other words, only about one in eight projects penciled out as technically and financially feasible.

The lesson of the Recovery Act is that Congress cannot assume that if it provides funding with narrow strictures that its vision can be achieved—even if funding levels are very large as to appear sufficient. From the perspective of an Administrator, the agency does not choose who applies and which private or municipal actors are willing to step up. The agencies to which Congress allocates funding can only rely upon and consider what comes in through their doors. Agencies are limited to those operators that are prepared to offer the service specified. Even more fundamentally, implementing agencies can and should only fund those operators among them—whether for-profit, non-profit or municipal—that are not only willing, but able to demonstrate a plan that is both financially and technically feasible. The way telecommunications networks are structured geographically, typically only providers already serving an area or with existing infrastructure in the region are interested in or capable of expanding to the most hard-to-reach areas.

⁴⁰ *GeSI Smarter 2020: The Role of ICT in Driving a Sustainable Future*, *supra* note 7 at 209.

⁴¹ DISTRIBUTION OF BROADBAND STIMULUS GRANTS AND LOANS, CONG. RESEARCH SERV. at 6 (January 4, 2011).

⁴² MARK A. ABRAMSON AND PAUL R. LAWRENCE, PATHS TO MAKING A DIFFERENCE, LEADING IN GOVERNMENT ch. 4 (revised ed. 2012).

Clearly, we learned that finding feasible projects is difficult. The more rural and less densely populated the area, the more difficult it becomes. The essential limiting factor is often whether—even if Congress pays for 100 percent of the capital expenses—the ongoing revenues from end users cover the operating expenses. Again, the less densely populated the service area (those Congress most seeks to reach) the more difficult this long-term business case becomes.

I am concerned that if Congress does not provide implementing agencies with needed flexibility, it will find that for many areas, no qualified applications will come in the door and areas will remain unserved. Worse, if financially infeasible projects are nevertheless approved, the networks will be unsustainable, and consumers will lose the quality of service or end up having no service at all. For example, as noted above, fiber cuts in areas with long fiber runs (such as through rural, wooded areas) are expensive to repair, particularly considering that few customers are providing the revenue to cover those costs. If overly prescriptive technological parameters are sealed in statute, it may be too late for Congress to change course, as we did at RUS in the second NOFA.

The lesson is that applications are very provider specific and geographically specific. The unique history of network investment in a particular service area dictates feasibility along with the financial and technical strength of the operator proposing to provide service. Two areas similar in geography and density may not have similarly strong providers or existing networks from which to extend further into rural areas. For example, there may be an area in West Virginia that is similarly rugged and sparsely populated to one in Montana. However, one might have a local cooperative that has long invested in building out fiber connectivity, with a solid balance sheet girded by years of RUS and Universal Service funding, while the other has not benefited from similar investments in infrastructure or have a similarly strong local provider. One might offer a feasible project proposal while the other does not—or one area may not even get a qualified application to serve it. If Congress does not provide the funding agencies flexibility to take in the door a wider variety of proposals, one area may go unserved—or worse, become unserved when the provider is unable to cover its costs due to limited ongoing customer revenues after it is built at taxpayer expense.

Solution: Congress Establishes Priority Goals, not Limiting Technology Decisions about How to Achieve Them

Congress should set funding agencies' goals and not set technological gating factors. Otherwise, Congress may tie funding agencies down with limited flexibility to even consider innovative, cost-effective, and geographically appropriate provider applications that would have likely met Congressional priorities or have met them sooner.

In the history of this distinguished Committee, the Communications Act is a model of setting goals and priorities rather than specific technological solutions that may or may not be sustainable or even meet all of Congress's objectives.

Rather than cementing specific broadband speeds in statute, Congress can set a checklist of priority factors, including the following based on Congressional and Administration priorities:

- Resiliency of networks: both vulnerabilities and the speed of restoration;
- Higher broadband speeds;
- Mobility, highly valued by consumers in rural and other areas, which is also an added benefit of fixed wireless broadband investment;
- Speed of deployment and infrastructure siting;
- Public safety: the needs of first responders and emergency response;
- Contribution to reducing carbon emissions and thus preventing future natural disasters;
- Target unserved areas;
- Affordability to consumers;
- Cost efficiency;
- Workforce development.

Congress has long expressed the value of each of these factors and should not choose one at the expense of all others, which would happen if certain priorities were locked in as gating factors that preclude the consideration of other factors. Consider each in turn:

Resiliency: As indicated by this hearing, the resiliency of telecommunications networks is a priority for the Committee. American lives and property depend upon it, as we have seen in the pandemic. All telecommunications technologies, including

wireless broadband, have their own vulnerabilities. As noted above, for obvious reasons, long stretches of aerially deployed fiber optic cable, or for that matter any wireline service deployed overhead, are exposed to many natural forces, and can take long periods to restore. Moreover, FTTH is dependent on electrical service at the home, which is often disrupted for long stretches. Whether one agrees with this analysis or not, Congress should not tie agencies' hands to one technology that may be more exposed to risk. It can charge funding agencies with considering resiliency as a factor in "future-proofing" funding choices. Agencies can ask applicants to identify the level of resiliency for its proposed broadband delivery mechanism—and make them prove their capability to meet their promises, both technically and financially. They can ask: how vulnerable is your technology to outages? What steps are you taking to ensure resiliency? How long will it take to restore service and what will it cost? Is your network financially sustainable considering those costs and the likelihood of disruptions in the proposed service territory?

Resilient networks mean sustainable networks. Real "future proofing" requires that the companies that are provided funding to build networks will remain in business to provide service to customers into the future. Resiliency is key because ongoing operating costs must be covered by the revenue stream, or the networks will fall into disrepair and will not remain open consistently, provide adequate customer service or quick outage restoration, or could become inoperable.

Higher speeds: Members of Congress have expressed an interest in prioritizing symmetrical speeds. Consumers clearly separately value both download and upload speeds, and it makes sense for agencies to prioritize them independently. The gap between downstream and upstream traffic has consistently grown over the last ten years. Recently, the ratio of downstream consumption to upstream is fourteen to one.⁴³ Current consumer trends demonstrate significant increases in downstream consumption while upstream increases at a fraction of the rate.⁴⁴ Today's consumers do not utilize upstream bandwidth at the same rate they use downstream and speak to it with their dollars and usage. Video streaming makes up over 80 percent of all Internet traffic, two thirds of which is traffic from downloads.⁴⁵ Even popular applications that utilize relatively high upload bandwidth, such as two-way video conferencing, do not require anything near symmetrical speeds. Studies have shown video conferencing requires approximately one third of the upstream bandwidth compared to downstream.⁴⁶

Networks are optimized based on consumer use patterns. The telecommunications industry has responded by engineering networks to favor downloads to meet their customers' demand. It is possible that consumers will reverse long-term trends favoring download speeds; however, even if upload speeds demand doubles, it will remain far below download speed demand. The speculative prediction that upload speed demand will dramatically rise can justify making it a priority, but it is not a good basis to make symmetrical speeds the sole eligibility requirement for an entire planned investment of this magnitude—to the exclusion of other priorities.

To make symmetrical upload the primary gating criterion for funding would short-change addressing resiliency, climate change and disaster prevention, the speed of getting service to rural Americans, mobility, public safety, affordability and other key factors we know consumers value now and urgent crises Congress seeks to address.

⁴³ See John Ulm & Tom Cloonan, *The Broadband Network Evolution Continues*, COMMSCOPE 9 (2019), <https://www.nctatechnicalpapers.com/Paper/2019/2019-the-broadband-network-evolution-continues>; see also *The Asymmetric Nature of Internet Traffic*, NCTA (Mar. 22, 2021), <https://www.ncta.com/whats-new/the-asymmetric-nature-of-internet-traffic> (stating that the downstream to upstream traffic ration was sixteen to one at the end of 2020. *But see, e.g.*, Peter Rysavy, *The Folly of Attempting to Future-Proof Broadband*, LIGHT READING (June 15, 2021), <https://www.lightreading.com/opticalip/the-folly-of-attempting-to-future-proof-broadband/a/d-id/770204> (noting a reverse in the trend that the gap between downstream and upstream grows every year due to increased use of video learning, telemedicine, and telelearning bringing the ratio down to ten to one).

⁴⁴ See *id.* at fig. 3, 4 (demonstrating a 37.8 percent average growth rate over five years for downstream while upstream has a 18.8 percent growth rate for the same time).

⁴⁵ *The Global Internet Phenomena Report*, SANDVINE at 6 (Sept. 2019), https://www.sandvine.com/hubfs/Sandvine_Redesign_2019/Downloads/Internet%20Phenomena/Internet%20Phenomena%20Report%20Q32019%2020I90910.pdf; see also *Distribution of Global Downstream Internet Traffic as of October 2018, By Category*, STATISTA (Feb 13, 2018), <https://www.statista.com/statistics/271735/internet-traffic-share-by-category-worldwide/>.

⁴⁶ Jay Zhu ET AL., *Testing Bandwidth Usage of Popular Video Conferencing Applications*, CABLE LABS (Nov. 5, 2020), <https://www.cablelabs.com/testing-bandwidth-usage-of-popular-video-conferencing-applications> (studying various video conferencing applications utilization of upstream and downstream bandwidth).

Mobility: We know for certain that Americans value mobility. Rural Americans traverse longer distances and rely on mobility even more heavily. If wireless technology to serve fixed or in-home or mobile broadband is excluded from an infrastructure plan, Congress could inadvertently grow a rural mobility digital divide in which many unserved residents would be limited to accessing the Internet through a wired connection in the home or farmhouse. All broadband technologies, including wireless broadband, are needed to provide communities with robust connectivity. And if Congress gives wireless broadband technology a fair chance to compete for the same funding, including for the in-home market, consumers will benefit from mobility that is provided by all wireless broadband investments including fixed wireless that supports 5G.

This rural mobility divide would preclude rural Americans from access to similar interconnected solutions that are available to their urban counterparts. Rural residents should not be tethered to the relatively short leash of ethernet or a Wi-Fi signal when they need a high-speed connection. Further, many applications, such as precision agriculture, require wireless broadband to blanket vast acres of farmland to be useful. The larger properties and distance between houses that many Americans seek out by living in rural areas require larger areas of service. For children doing homework on hour-long bus rides in rural areas, for example, waiting until they get back home to go online is not a good option. In terms of a priority, you might ask your rural constituents what they value more: greater broadband mobility on the road and across their farm fields—or upload speeds at home. For those like me who have lived in rural America, I expect you can guess the answer.

Speed of deployment, infrastructure siting and workforce needs: Fiber can take months to years to deploy even in easy geography, but more complex deployments can take many years. Wireless broadband links can be installed and ready for operation in a matter of days in a variety of scenarios.⁴⁷ According to a study by the Fiber Broadband Association, it would take 10 years and an additional \$70 billion to pass 90 percent of U.S. households—before even reaching the last 10 percent which are of greatest concern for rural access.⁴⁸ To connect that 90 percent would require an additional \$15 billion.⁴⁹

Given rural consumers' urgent need for broadband, especially in rural and unserved areas, the focus should be on utilizing all technologies to connect all communities as quickly as possible. And wireless broadband can be deployed quickly. WIA members report that, on average, it can take about six months for a wireless collocation and about eighteen months for a new tower to be built.

Future proof should not mean deployed far in the future. Rural consumers should not have to wait in the back of a long line for many years to finally get the broadband Congress promised. Connectivity delayed is connectivity denied. Speed to market should be a priority Congress charges funding agencies to consider. In terms of keeping up with consumer needs—real future proofing—wireless networks are upgraded constantly. 5G is the most readily upgradeable generation of wireless broadband. Once deployed, it is easier to upgrade networks to handle varying demands and ultimately to upgrade to the next generation of wireless broadband. To achieve Congressional goals, placing a priority on getting networks up and running will meet rural Americans' urgent needs. Speeding deployment will require working to encourage providers to offer plans customized to different communities—not one-size-fits all. Congress should provide priority and flexibility for expert funding agencies to evaluate how quickly providers can deliver.

Public safety and first responders: As noted above, first responders rely on mobile networks as they go in harm's way to protect the public. Fiber to the premise will not help them as they race to put out fires, deliver health care in ambulances that can become a mobile emergency room with 5G, or protect the public from crimes in progress. Public safety has always and will always rely on mobile networks. Service to those who serve us should be a priority goal established by Congress for funding agencies.

Battling climate change: As noted above, broadband and digital technologies can contribute to solving the crisis of climate change. Wireless broadband and 5G solutions play a particularly strong role given the need for wide-area coverage, mobility and distributed IoT applications. Congress can set as a priority factor that funding agencies consider the degree to which the proposed project will contribute to the re-

⁴⁷ Dori Erann, *Fiber VS Wireless-The Greatest Debate of the Decade*, CERAGON (Mar. 18, 2021), <https://www.ceragon.com/blog/fiber-vs-wireless-the-greatest-debate-of-the-decade>.

⁴⁸ *FTTH Study 2019*, CARTESIAN at 2 (June 4, 2019), <https://optics.fiberbroadband.org/Portals/0/Cartesian%202019%20FTTH%20Study%20Summary%20Findings%2020190604%20SENT.pdf> at 2.

⁴⁹ *Id.* at 4.

duction of carbon emissions. Again, if only wireline technology can be considered, Congress could tie agencies' hands in terms of considering the full range of options to achieve this clear priority. Let the best technology win. *Target unserved areas:* Congress should target funds to truly unserved areas as defined by the FCC as lacking broadband service. To close the broadband gap, define "unserved" as those locations lacking service delivered through either wired or wireless technology. Accurate broadband maps are needed that take into consideration areas with already committed build plans so that support is targeted where it is needed.

Congress can also reduce barriers to deployment by creating incentives for local jurisdictions who are able to demonstrate 5G and broadband readiness through siting-friendly rules such as the adoption of efficient, simplified processes, and cost-based access to the right of way. WIA supports a priority for funding to communities that demonstrate 5G and broadband readiness by implementing streamlined and cost-based access to the rights-of-way. Importantly, Congress can maximize the value of broadband investments, address concerns of city leaders about aesthetics and disruption to communities, reduce environmental impact, and speed deployment by prioritizing the use of existing infrastructure. Policies, like those Congress approved in Sec. 6409 of the Middle Class Tax Relief and Job Creation Act of 2012 to prioritize the use of existing infrastructure, and dig once policies that are widely supported for fiber deployment, are prime examples. This ensures that networks can be deployed expeditiously while recipients are held accountable for outcomes.

Affordability: As the technological capabilities of mobile devices continue to grow to rival traditional computers, many users have decided to prioritize their mobile connections over fixed.⁵⁰ This choice is most clear among rural and low-income Americans, the majority of individuals who identify as "smartphone only users."⁵¹ In rural America, nearly one in five residents has decided to rely solely on their wireless devices for broadband, while over one in four Americans who make less than thirty thousand dollars a year have made the switch to smartphone only; the same is true for those that have a high school degree or less.⁵² All of these groups, and all Americans, would benefit from an upgrade to 5G to support their choice. If FTTH is the only choice, millions of rural Americans would need to spend an additional \$75 a month, or more, for a wireline connection that they already decided they do not want or cannot afford.

Congress should build on steps it has taken in the Consolidated Appropriations Act of 2021 that established an Emergency Broadband Connectivity Fund of \$3.2 billion to help Americans afford Internet service during the pandemic. It should fund a permanent affordability support program with sufficient subsidies to ensure low-income families obtain quality broadband. Saddling consumers with the need to purchase a new wireline service on top of their smartphone connection could unnecessarily add to the burden of large ongoing Federal subsidies because few low-income consumers are willing to give up their smartphone and the mobility it provides.

Cost efficiency: Technological flexibility can also provide consumers with the most megabits for the taxpayer dollar. The wireless industry is committed to closing the digital divide and has an indispensable role to play. Fiber is critical, yet it is one of many tools for closing the digital divide. The last mile—or last 10 miles in some cases in rural America—is most costly to provide with fiber, when simply connecting fiber to a tower for mobile or fixed wireless can cover many premises for a fraction of the cost and in a much shorter time. To provide connectivity to all communities, every broadband technology can contribute based on a community's specific needs and the capabilities of existing providers.

Wireless broadband is an economically efficient solution that must be considered as part of the plan. When considering barriers to deployment, including the capital expenditure required to reach each new subscriber, time to market, and physical limitations of deploying infrastructure across diverse terrains, wireless service that covers long distances in some cases makes more sense than a home-by-home approach.

Underground fiber deployments must consider a myriad of factors to ensure the longevity of the deployment, all of which add to cost and time for completion of a

⁵⁰ Monica Anderson, *Mobile Technology and Home Broadband 2019*, PEW RESEARCH CTR. (June 13, 2019), <https://www.pewresearch.org/internet/2019/06/13/mobile-technology-and-home-broadband-2019/> (stating 45 percent of non-broadband users said they do not have a connection at home because their smartphone meets all of their online needs).

⁵¹ Andrew Perrin, *Mobile Technology and Home Broadband 2021*, PEW RESEARCH CTR. (June 3, 2021), <https://www.pewresearch.org/internet/2021/06/03/mobile-technology-and-home-broadband-2021/> (providing a demographic breakdown of smartphone only users).

⁵² *Id.*

project. In coastal cities and areas prone to flooding, deployments must work around the water table often digging deeper to avoid water damage. In some of our hardest states, including Alaska, Minnesota, Wisconsin, and the Dakotas, frost lines can require deployments to bury conduit six feet underground or deeper.⁵³ Soil and buried obstacles also play a role in determining speed and cost. For example, clay is harder to excavate than other soils and may contain rocky particles that can impinge on conduit, requiring additional hardening.⁵⁴ Unexpected tree roots and boulders are also sources of significant delays.⁵⁵ While insulated from some weather patterns and physical disruption, underground deployments are simply not technologically or economically feasible in all situations.

Workforce development: Another source of broadband deployment delay is the lack of a sufficient skilled workforce. To help ensure a diverse pipeline of job-ready workers ready for these jobs, Congress should take bold action to invest in registered apprenticeships and evidence-based job training and support.

Today, registered apprenticeship in the broadband industry is new and would quickly need resources to scale to the level needed to support the level of funding contemplated by Congress and the Biden Administration. To solve this “good problem” from creating high-wage, high-skilled jobs, and to increase the efficiency, equity, and success of a broadband infrastructure investment, a corresponding initiative is needed to develop and diversify the broadband workforce through additional support for registered apprenticeships and the educational and training system. An immediate expansion of education and skills training will create a pipeline for broadband infrastructure jobs in a growing industry of the future.

Conclusion

Every community, regardless of size, location, or geography deserves broadband service. Congress has an extraordinary opportunity to expand digital inclusion and take dramatic steps to bridge the digital divide. Industry and the government must step up to meet this moment. This is no small task and will take every tool available. We must ensure the rapid deployment of networks that can meet consumer demands. We must ensure that these networks work in all scenarios from natural disasters to pandemics.

While no technology alone will meet all these needs, wireless broadband is a key component of a resilient broadband network. With its distributed architecture, wireless broadband is inherently resistant to disruption; if one node goes down, traffic is rerouted to nearby antennas. Further, during times of disaster, we turn to wireless assets to help supplement telecommunications and broadband services, keeping people informed, allowing them to contact emergency services, and allowing first responders to coordinate efforts. Beyond today, wireless technology, particularly 5G, will allow for revolutionary, and life-saving applications in disaster preparedness and response. These applications will directly contribute to U.S. commitments to mitigate climate change through increasing energy efficiency and will mitigate the frequency and severity of future disasters. Deploying this technology will also create millions of jobs across the country, many of which will not require a college degree. These jobs will elevate individuals as they build their own communities, providing opportunities and services that will benefit everyone. Congress can maximize this potential with support for registered apprenticeships and training for the telecommunications workforce.

Realizing these benefits and bridging the digital divide will take continued, dedicated efforts by the entire telecommunications industry and the Federal government. WIA and its members stand ready to deliver.

Wireless broadband helps to drive America’s innovation economy and fuels the Nation’s economic future. The U.S. has always been the global leader in wireless innovation. Broadband infrastructure legislation offers a unique opportunity to increase network resiliency if Congress designs the program with sufficient flexibility to address it and other Congressional priorities such as combatting climate change.

That is why the leadership of this Subcommittee is so critical. WIA appreciates the opportunity to partner with the Subcommittee in addressing these important issues. We are deeply grateful for the bipartisan recognition of the importance of infrastructure by this Subcommittee, by Congress, by the FCC, and the Biden Ad-

⁵³ *Frost Line by State 2021*, WORLD POPULATION REVIEW, <https://worldpopulationreview.com/state-rankings/frost-lines-by-state> (last visited June 17, 2021).

⁵⁴ *The Complete Guide to Fiber to the Premises Deployment*, PPC at 8 (2020), <https://www.ppc-online.com/fiber-to-the-premises-ebook>.

⁵⁵ See Joe Byrne, *Key Factors When Choosing Between Buried and Aerial Fiber Deployments*, PPC <https://www.ppc-online.com/blog/key-factors-when-choosing-between-buried-and-aerial-fiber-deployments> (last visited June 17, 2021).

ministration. All have implemented policies to promote wireless broadband deployment, and all are working to build on recent successes.

Thank you again, Chairman Lujan and Ranking Member Thune, for holding this hearing and inviting me to testify. I look forward to continuing to work with you and the rest of the Subcommittee to make real progress on these very important issues.

Senator LUJÁN. Thank you so very much, Mr. Adelstein. Next, we are going to hear from Mr. Denny Law, the Chief Executive Officer and General Manager, from Golden West Telecommunications from Wall, South Dakota. The floor is yours for five minutes, sir.

**STATEMENT OF DENNY LAW, CHIEF EXECUTIVE OFFICER,
GOLDEN WEST TELECOMMUNICATIONS COOPERATIVE, INC.**

Mr. LAW. Thank you, Chairman Luján, Ranking Member Thune, members of the Subcommittee. Thank you for this opportunity to participate in today's hearing on network resiliency.

For over a century, Golden West has provided communications services to rural South Dakota. Today, we have more than 30,000 accounts, located across a geographic area, the size of Maryland, New Jersey, Connecticut, and Delaware combined. That is fewer than 2 customers per square mile. In addition to robust service for consumers and businesses within our territory, we serve several Tribal reservations, numerous anchor institutions, including schools and hospitals, VA facilities, and five Public Safety Answering Points.

Golden 111—The Rural Broadband Association, which represents approximately 850 rural, community-based carriers like Golden West that offer advanced communications services throughout the most sparsely populated areas of the Nation. We operate in deeply rural markets where the cost of deploying and operating networks is high and a tailored approach to managing risk and resiliency, as necessary, to create sustainable networks.

The first step to achieving resilient and reliable communications services begins with the network infrastructure. Golden West technology infrastructure is designed with resiliency in mind, including the construction of hardened buildings to withstand extreme weather conditions, large banks of redundant batteries in every network office, that are also backed up by standby generators.

Golden West has also invested in physically diverse fiber routes, connecting to each of our network offices, coupled with redundant electronics with multiple connections to prevent large numbers of customers from being isolated from Golden West's local networks. We have also established connections to statewide fiber networks that provide middle mile transport and added redundant connections to separate Internet points of presence where possible.

To mitigate the cost of purchasing this capacity from larger regional or national carriers, SDN Communications—an entity owned by Golden West—and a number of other small community-based providers in South Dakota enables connectivity between rural South Dakota and the rest of the world. SDN was created 30 years ago to connect rural markets to better long distance telephone service. And today, it is because of SDN's 50,000-mile fiber network, that Golden West customers do not get isolated from the world in the event of a fiber cut, or a single network disruption.

Deployment of cheaper technologies than fiber, often sounds attractive in rural markets. But it comes at a different kind of cost. Technology that causes connectivity to be spotty when it rains or snows, suffers from degradation or complete shutdown in extreme temperatures, and counters line of sight issues with seasonal foliage growth, or have network components exposed to the elements, may be less expensive to install initially.

But those technologies often come with a higher operating cost over time, and lack the kind of reliability for essential functions, which could leave consumers without the ability to dial 911 during a hurricane, because the underlying network does not perform reliably in the rain.

Another leading threat to network resiliency involves security. Each day, our networks can face the same security threats and denial of service attacks as the larger national broadband providers. To help mitigate those risks, Golden West, again, partnered with SDN to collectively deploy distributed denial of service protection across our networks.

Knowing where to monitor, or take steps to manage risk on a network, can be the hardest part for many smaller providers. To support those efforts, NTCA created Cybershare which, among other things, is an information sharing center that provides access to daily threat indicators and a weekly technical analysis for small broadband providers, like Golden West.

Finally, while high cost is the most imposing obstacle to deploying and maintaining reliable broadband in rural areas, other barriers can affect the ability to achieve resiliency, redundancy, and security objectives, including permitting delays or other access issues, like crossing railroads, supply chain shortages for critical communications equipment such as fiber or customer premise equipment, and shortages of skilled telecommunications workers, that help all providers deploy or repair networks.

Mr. Chairman, Ranking Member Thune, thank you for this opportunity to testify today and I look forward to your questions later.

[The prepared statement of Mr. Law follows:]

PREPARED STATEMENT OF DENNY LAW, CHIEF EXECUTIVE OFFICER, GOLDEN WEST
TELECOMMUNICATIONS COOPERATIVE, INC.

Chairman Luján, Ranking Member Thune, and members of the Subcommittee, thank you for the opportunity to participate in today's hearing focused on building resilient networks.

I am Denny Law, Chief Executive Officer of Golden West Telecommunications Cooperative, Inc. in Wall, South Dakota. For over a century, Golden West and its subsidiaries have provided communications services to rural South Dakota, starting in 1916 with the stringing of a telephone line along fence posts. Today, Golden West has more than 30,000 accounts, including 29,000 broadband subscribers and nearly 9,000 cable television customers. Our customers are located across 24,500 square miles—an area approximately the size of Maryland, New Jersey, Connecticut, and Delaware combined—which equates to fewer than 2 customers per square mile. In addition to robust service for consumers and businesses within our territory, we serve numerous anchor institutions, including 73 K–12 schools, 62 health clinics and hospitals, 20 libraries, five Veterans Administration facilities, and five Public Safety Answering Points (PSAPs).

Golden West is a member of NTCA—The Rural Broadband Association (NTCA), which represents approximately 850 rural, community-based carriers like Golden West that offer advanced communications services throughout the most sparsely populated areas of the Nation. All NTCA members are fixed voice and broadband

providers, and many members also provide mobile, video, and other communications-related services in their communities. Operators like those in NTCA's membership serve less than five percent of the population of the United States but cover about one third of its landmass. We operate in rural areas left behind decades ago when networks were first being built out by other service providers because the markets were too sparsely populated, too high cost, or just too difficult to serve in terms of terrain. In the vast majority of these rural areas, companies like Golden West are the only full-service fixed communications networks available.

Despite the challenges of distance and density, Golden West and its fellow small broadband providers have led the charge in deploying advanced communications infrastructure that responds to consumer and business demands and connects rural America with the rest of the world. In rural America, broadband infrastructure enables economic development and job creation not only in agriculture, but for any other industry or enterprise that requires advanced connections to operate in today's economy. Yet those networks need to keep pace with consumer demand and provide reliable connections that deliver consistent performance for users when they depend on those services the most. Throughout the pandemic, as Americans worked and learned from home, consumers drove up network bandwidth usage and demand. Golden West and other small rural operators were able to meet those demands thanks to years of network investments and upgrades in robust and reliable networks.

Yet, for all our progress to date, we still have more work to do in deploying and operating this critical infrastructure, as too many rural consumers still lack sufficient connectivity altogether. And, even where networks exist, operators face the challenges of: (1) sustaining and upgrading them to keep pace with consumer demand; (2) delivering affordable services that can be relied upon both for everyday functions that have become increasingly important during the pandemic; (3) ensuring users have access to them in the face of emergencies that may range from extreme heat or cold to wildfires, earthquakes, or other natural disasters; and (4) taking reasonable steps to manage risk and promote the security of networks from intrusions of all kinds.

In short, network deployment is an essential goal and a condition precedent to achieving national connectivity objectives, which includes making sure that these networks are there for consumers in their times of greatest need. But the job is not done when the network is built, as community-based providers like Golden West and other smaller rural broadband providers know all too well. Living in the communities we serve, we can see firsthand how the decisions we make and the measures we implement affect our neighbors, friends, and family, and we therefore have substantial incentive to do what we can to make sure they have access to the best possible communications services. At the same time, however, the fact is that we operate in deeply rural markets where the costs of deploying and operating networks can be higher, and a tailored approach to managing risk, resiliency, and redundancy is necessary to create sustainable networks that provide services customers can afford. In this testimony I will provide examples of the kinds of measures we take—starting with network architecture and deployment and continuing through ongoing operations—to promote the availability of robust and reliable communications services for our users.

Network Resiliency Starts with Smart Network Investment

As an initial matter, networks must address the rising demand of consumers' bandwidth needs and be easily scalable to meet that demand. The COVID-19 pandemic has underscored the essential nature of high-speed download and upload connectivity for every American, whether at work or at home. For years, small rural community-based providers like Golden West have seen that high-speed broadband facilitates so much more than just downstream applications like streaming video entertainment, and the value of these other uses (and a network capable of supporting them) have been recognized and realized more widely now during the pandemic. Indeed, many Americans now realize the importance of robust broadband in connecting with a doctor without traveling to the medical office or hospital and for students to continue their education even when the classroom is hundreds of miles away or just right down the street but closed. A high-capacity network capable of handling significant upload speeds is also critical for people to continue receiving paychecks by working remotely using secure and bandwidth-intensive virtual private networks. Additionally higher upload speeds enable better two-way capability and network performance that not only allows us to video conference during the work day, but to maintain social interactions with friends, family, and other loved ones.

A robust network is also important of course to accommodate the needs of public safety—and the public served by first responders and other professionals in the case of emergencies. Deployment of cheaper technologies often sounds attractive in rural markets, but it comes at a different kind of cost. Connectivity that is spotty when it rains, unreliable when it snows, suffers from degradation or complete shutdown in higher or lower temperatures, encounters line-of-sight issues when foliage grows back on trees, or has network components exposed to the elements may be less expensive to install initially, but these technologies often come with higher operating costs over time, are often unable to keep pace with ever-escalating consumer demand, and lack the kind of reliability that one wants for the conduct of everyday life such as telework, remote learning, or telemedicine, and especially in the case of an emergency. In short, no one wants to be in the position of being unable to access 911 in the event of a hurricane because the underlying network does not perform reliably in the rain.

Golden West and other small rural broadband providers have used a variety of methods over the years to deploy service and, as a result, have gained first-hand experience with the differing capabilities and shortcomings of certain technologies. As we look to future needs of our customers and our communities, we have taken aggressive steps to focus on anticipated increases in usage and make network choices that will give our communities that they can rely upon for essential functions such as working or learning from home—and to reach public safety or others in the event of emergencies. Put plainly, we are investing in more and more fiber technology to meet that demand. Golden West has invested in physically-diverse fiber routes connecting to each Golden West network office, coupled with redundant electronics with multiple connections to the network to prevent large numbers of customers from being isolated from Golden West's local network.

In addition to continuing to deploy “last mile” fiber as fast as we can where we can, we have taken measures to establish robust and reliable connections to statewide fiber networks that provide “middle mile transport” between our local communities and the rest of the world, and by adding redundant connections to separate Internet points-of-presence where possible. SDN Communications, an entity owned by Golden West and a number of other small community-based providers in South Dakota, was created 30 years ago to help connect rural markets to better long distance telephone service and today it has a 50,000-mile fiber network that enables more robust broadband data connectivity between rural South Dakota and the rest of the world. In partnership with SDN, Golden West maintains multiple connections to the Internet backbone to ensure Golden West customers do not get isolated from the world in the event of a fiber cut or single network disruption.

Efforts to deploy more robust and resilient networks, however, come at a cost. Whether we are talking about wired or wireless networks, building redundancy and greater resiliency into networks—especially in rural areas where distances are great and densities are low—can be a challenge. For example, redundancy in a wireless network translates to placement of more antennas or towers and more backhaul capacity such as fiber. Similarly, burying fiber provides relatively greater resiliency and security for both wired connections themselves and for the wireless services that depend upon that fiber foundation. Indeed, one must not overlook how critical a fiber foundation is to *every* kind of communications technology—wired or wireless. Fiber not only offers the most efficient and economical means of meeting consumer demand well into the future,¹ but it also is essential to our Nation's 5G future. As the Wireless Infrastructure Association aptly captured in a report last year, “The buzz around 5G focuses on the wireless aspect of the technology. However, the connectivity it advances is only made possible by extremely dense fiber networks.”²

But burying wires to fulfill the needs of users for better and more reliable wired and wireless connections alike can often be more costly than if one were to string aerial fiber on poles—and in certain parts of the country, it is difficult to impossible at this point to bury fiber for a variety of logistical, environmental, and economic reasons. Similarly, procuring redundant connections to distant peering points hundreds if not thousands of miles away for Internet connectivity is expensive, and it is a cost that is not entirely under our control as many smaller providers must purchase such capacity from larger regional or national operators. In a number of rural states, smaller operators have taken steps to mitigate such costs by banding to-

¹ See BROADBAND TODAY: Rural America's Critical Connection, Foundation for Rural Service (Mar. 8, 2021) (“BROADBAND TODAY”), available at: <https://www.ntca.org/sites/default/files/documents/2021-02/Rural%20America%27s%20Critical%20Connection%20-%20FRS%20White%20Paper.pdf>.

² Fiber, An Essential Facet of the Connected Community, WIA Innovation & Technology Council (Jul. 22, 2020), p. 4, available at: <https://wia.org/wp-content/uploads/Fiber-v3-1.pdf>.

gether to form statewide fiber networks; as noted above, and Golden West is proud to be a member of SDN Communications one of the earliest such statewide collaborative ventures that today provides robust connections to multiple Tier 1 Internet backbone providers. Nonetheless, even as we have taken these great strides to become more efficient while putting into place such redundancy and promoting the reliability of our connections to the rest of the world, we still are forced to rely upon—and pay—the Tier 1 operators.

Local providers like Golden West are well-positioned to assess the balance needed in investment strategies and have sound incentives to do all they reasonably can to ensure the communities they serve have services they can depend upon. Our commitment can be seen in the efforts we have made to deploy the best possible networks. Indeed, as NTCA’s annual broadband survey confirms year after year, small community-based providers like Golden West have consistently led the charge in rural broadband deployment, with the most recent report indicating that nearly two-thirds of NTCA members’ rural customers have access to fiber-to-the-premises connectivity and speeds in excess of 100 Mbps. Golden West is in the midst of a multi-year upgrade to replace our decades-old copper network with fiber optics. With more than 14,000 network route miles within South Dakota, at the end of 2021 we will have successfully completed 70 percent of the copper network replacement with fiber optic service. This is the kind of connectivity that provides a reliable foundation for users when emergencies strike and a platform for community development and sustainability in rural areas that face many other challenges as well.

Nonetheless, because of the higher costs of operating in rural areas, there is a need for governmental support to make the business case work and ultimately to support the kinds of networks that will provide greater resiliency, reliability, redundancy, and capability for rural users. Smaller rural telecom providers like Golden West have long leveraged support from the High-Cost Universal Service Fund (USF) overseen by the Federal Communications Commission (FCC) and Rural Utilities Service (RUS) loans through the Department of Agriculture in concert to deploy advanced telecommunications services in the most rural areas of the United States. Many smaller providers have successfully leveraged a mix of funds from these programs and private investment to deploy robust broadband to millions of homes, businesses, farms, and anchor institutions including public safety entities. While RUS lending programs have helped to finance the substantial upfront costs of network deployment, the USF High-Cost Fund helps make the business case for construction and sustains ongoing operations at affordable rates. More specifically, USF by law aims to ensure “reasonably comparable” services are available at “reasonably comparable” rates.

Both the RUS loan programs and the FCC’s USF programs are therefore critical to the deployment of the best possible networks in rural areas that meet the objectives of this Subcommittee and other policymakers when it comes to network performance and reliability. It is worth noting, however, that these programs are limited in their resources. Indeed, at times over the past decade, we have seen caps and even cuts in support enacted to the FCC programs in particular that have undermined, rather than furthered, the goal of deploying more robust and reliable networks more deeply into rural areas. In fact, we even saw for a time some policies that encouraged providers *not* to invest in network deployment as rapidly or that penalized perceived “gold-plating” of networks that would be more robust and reliable—these caps and constraints certainly did not place value on the notion of redundant connections or help in spurring their deployment. In recent years, however, steps have been taken to enhance and address such concerns in these programs, but the fundamental point remains—rural broadband is not easy, it faces challenges of distance and density that make it higher cost than deploying and operating networks in an urban or suburban area, and without sufficient and predictable support, the goal of promoting resilient and redundant networks in rural American will be far more difficult to achieve.

Ongoing Efforts to Promote Resilient, Reliable, and More Secure Networks

Often, the primary focus in national broadband discussions is on the one-time act of building networks while insufficient attention is paid to what comes next. Once built, networks must be maintained, upgraded, and made useful over their entire lives, or those investment could be wasted or ultimately become incapable of meeting consumer demands whether in everyday life or in the context of an emergency. Services must be delivered over that infrastructure on an ongoing basis, at rates that are affordable enough for consumers to make good use of them and at consistent and reliable levels of performance. Maintenance must be performed, customer calls must be answered, “middle mile” capacity to reach distant Internet points of presence must be procured, and upgrades must be made to facilities and

electronics to enable services to keep pace with consumer demand and business needs. Constant concerns arise too in the form of bad weather, natural disasters, and third-party risks that make it important both to make sound choices in what kinds of networks to deploy in the first instance and then how those networks will be managed over time.

All of this bears witness to the fact that as policymakers consider how best to promote broadband access going forward, we need to consider not only current demand, but also reliability and future projections for performance. When being built—or being funded—networks must account for potential surges or shifts in utilization and how demands on networks continue to increase at astounding rates. The pandemic has certainly highlighted the need for such advance planning and forethought, with a recent report indicating that broadband providers saw a 40 percent increase in broadband usage between the end of 2019 and 2020 and estimating that around 30 percent of the modern workforce could be working from home multiple days a week by as soon as the end of 2021, creating a permanent demand for higher speeds and upload capacity.³ Similarly, OpenVault has found that upstream broadband that upstream broadband traffic increased by 63 percent from December 2019 to December 2020,⁴ underscoring the shifts in network utilization and the need for reliable networks that will deliver consistent performance for those working, learning, or seeking medical assistance from home. Golden West's network usage during the pandemic experienced dramatic changes. In the span of just 90 days from January 2020 to April 2020, Golden West's overall network usage increased by 25 percent, and the bandwidth usage for upstream alone increased by 41 percent in that time. Golden West's network was able to withstand the sudden and unpredicted increase in usage and our customers were able to seamlessly transition to their remote work and education activities.

Fortunately, networks like those built by Golden West, SDN, and other providers based in rural America were architected to meet such demands brought on by shifting consumer and business usage. Indeed, as NTCA's annual broadband survey confirms year after year, NTCA members have led the charge in rural broadband deployment, with the most recent report indicating that nearly two-thirds of their rural customers have access to fiber-to-the-premises connectivity and speeds in excess of 100 Mbps. Throughout the pandemic, NTCA members reported that their networks performed as designed, without congestion or disruption despite unprecedented increases in demand.

Continued growth in demand is expected to increase significantly in coming years, such that peak demand for a family of four is projected to exceed 400 Mbps symmetric in just seven years, with bandwidth needs accelerating in the years after that.⁵ These imminent increases are anticipated due to an array of new technologies that hold substantial promise for consumers and businesses alike, such as greatly improved virtual education, telemedicine, agriculture, business, security, and entertainment. Golden West submits that federally funded broadband programs should therefore focus on the consumer experience and the long-term implications for rural communities by requiring the deployment of networks that in a decade or more will still deliver reliable and resilient services that consumers can depend upon. More specifically, we believe that fiber represents the best choice of network technologies to promote reliability in meeting these demands and ensuring that users have reliable access to public safety and other essential services as well. We also support an increase in the minimum broadband deployment performance benchmark to at least a symmetrical speed of 100 Mbps/100 Mbps to ensure that federally supported networks will meet the future needs of consumers. Any funding programs going forward should generally aim to ensure that new deployments perform at least at this speed threshold.

The same reasoning with respect to “planning ahead” and not treating the job as done once the network is built in the first instance follows with respect to promoting network reliability, resiliency, and security. Achieving these objectives in more rural areas turns not just upon the kind of network built—although that is certainly an important factor for the reasons discussed above—but also on the efforts made to operate and upgrade that network over time. Golden West's technology infrastructure is designed with resiliency in mind, including the construction of hardened buildings to withstand extreme weather conditions and large banks of redundant

³ BROADBAND TODAY, pp. 2, 15.

⁴ Dan O'Shea, *Pandemic Drove Upstream Broadband Traffic Boom: OpenVault*, Fierce Telecom (April 1, 2021, 12:46 PM), <https://www.fiercetelecom.com/telecom/pandemic-drove-upstream-broadband-traffic-boom-openvault>.

⁵ See Comments of The Fiber Broadband Association, GN Docket No. 20–269 (fil. Sep. 18, 2020), pp. 9–10.

batteries in every network office that are also backed up by standby generators. For all of our customers that are served directly by fiber optics, Golden West installs UPS batteries at customer's homes and businesses to ensure performance during limited power interruptions.

Golden West and smaller broadband providers also take seriously network security. On a daily basis, our networks can face the same security threats of intrusion and denial of service attacks as the larger, nationally known broadband providers. As one example of the measures we take to help mitigate these risks, Golden West has partnered with SDN Communications and its other members to collectively deploy Distributed Denial of Service (DDoS) protection across our respective networks. More broadly, smaller rural network owners again have sound incentives to take reasonable steps to secure their operations and manage risks given that any threats to their networks affect the communities in which they live and work—any incidents can affect their own homes and their friends, family, and neighbors. The hardest part for many smaller providers can simply be monitoring threats and taking reasonable steps to manage risk. To enable and empower such efforts, NTCA has worked with a number of members and collaborated with other stakeholders in a variety of ways to raise awareness of cybersecurity issues and to provide tools and actionable information to members regarding cyber risks. Such efforts include participation on the Executive Committee of the Communications Sector Coordinating Council and co-chairing of the Small and Medium-Size Business Working Group organized under the Information and Communications Technology Supply Chain Risk Management Task Force. NTCA also hosts an annual Cyber Summit for members and other small broadband providers that often includes presenters from key agencies such as the Cybersecurity and Infrastructure Security Agency. Finally, NTCA created CyberShare: The Small Broadband Provider Information Sharing and Analysis Center, a member of the National Council of Information Sharing and Analysis Centers, that among other things provides access to daily threat indicators curated for smaller operators' needs along with weekly technical analysis and bi-monthly calls in which providers can share experiences and resources.

It is worth noting again, however, that these efforts do not come at a small cost in rural America. As noted earlier, Golden West's serving area is 24,500 square miles—roughly equal in scale to Maryland, New Jersey, Connecticut, and Delaware combined. Dispatching technicians to address network resiliency or redundancy needs across such a wide swath of rural America is not easy, and recovering the costs of doing so from 30,000 customers stretched across this vast terrain would render services unaffordable. For this reason, I must emphasize again the significance of predictable and sufficient ongoing USF support for smaller operators—without such resources, efforts to promote greater resiliency, redundancy, and security in rural networks will run headfirst into the economic realities of operating in areas where there are at most a handful of customers per square mile.

Other Considerations

While high costs are perhaps the most imposing obstacle to deploying and maintaining reliable broadband in rural areas, other barriers can affect the ability to achieve resiliency, redundancy, and security objectives. Several of these are discussed below.

Permitting Delays

Infrastructure investment depends on prompt acquisition or receipt of permissions to build networks. Roadblocks, delays, and increased costs associated with permitting and approval processes are particularly problematic for Golden West and other NTCA members, each of which is a small business that operates only in rural areas where construction projects are undertaken over wide swaths of land. The time involved in obtaining construction permits can take substantial amounts of time, undermining the ability to plan for and deploy broadband infrastructure—especially in those areas of the country with shorter construction seasons due to winter temperatures that freeze the soil and prevent any excavation for burying fiber. Additionally, in some areas of the country, obtaining reasonable terms and conditions for attaching network facilities to poles that are owned and operated by other entities or for installing fiber near or under railroad crossings can result in long delays and costly fees charged to providers seeking to build out networks to rural communities lacking service. These can all affect both the timing for and economics of deploying resilient networks, and redundant facilities in particular.

Navigating complicated application and review processes within individual Federal land-managing and property-managing agencies can be burdensome for any network provider, but particularly the smaller network operators that serve the most rural portions of the country. The lack of coordination and standardization in

application and approval processes across Federal agencies further complicates the deployment of broadband infrastructure. Congress should look to implement the recommendations of the FCC's Broadband Deployment Advisory Committee's Streamlining Federal Siting Working Group final report issued in January 2018.⁶ NTCA participated in the development of these recommendations, which address streamlining of environmental and historical reviews and application review periods, among other pertinent recommendations in removing further regulatory barriers to broadband deployment. Such measures will be critical to the deployment and sustainability of wired and wireless networks alike, all of which rely in many rural areas upon robust fiber backbones that must often traverse Federal lands.

Addressing Supply Chain Concerns

In recent years, Congress has provided significant funding through several agencies to deploy broadband infrastructure with the goal of bridging the digital divide. However, as broadband providers construct these networks, it is important to monitor the status of the communications supply chain. Many have been rightly focused on supply chain *security* in recent years—but there is a looming concern about supply chain *resiliency* as well, and this has the potential to undermine national objectives to deploy the best possible networks to as many Americans as possible in the coming years.

Specifically, NTCA members are beginning to report significant backlogs for critical communications equipment like fiber, routers, antennas, network terminals, and customer premise equipment—ranging from several weeks to more than one year. As an example, Golden West is now finalizing our 2022 network and fiber optic buildout plans. As recently as last week, our fiber optic suppliers have indicated the delivery date for fiber-optics is 42 to 65 weeks out. Delays in production of necessary equipment appear to be related to both increased demand for broadband investment as well as ongoing effects of the pandemic. To ensure that existing and new infrastructure initiatives are as successful as possible in responding to consumer needs and demands, we believe it is important that the Federal government work closely and directly with manufacturers, distributors, and other suppliers to avoid disruptions in the communications supply chain. For these reasons, while there has been a great deal of focus on the *security* of our supply chains, we strongly encourage Congress to consider supply chain *resiliency* as a key component of delivering on national broadband objectives.

Workforce Development

We also recommend Congress help in the development of a skilled telecommunications workforce that can help providers of all sizes deploy robust networks and help to keep them resilient and more secure. Earlier this year, NTCA and a number of other telecommunications associations sent a letter to the White House regarding how the United States currently faces a shortfall of skilled workers needed to ensure the deployment of robust fiber, mobile, and fixed wireless networks. A concerted effort by industry and government will likely be needed to develop a skilled workforce able to deploy next generation wired and wireless networks. To develop the telecommunications jobs needed, Congress could help by bolstering the capabilities of institutions of higher education and other institutions and providing support for employers to expand registered apprenticeships and associated technical instruction and certification costs. Several legislative proposals, including Senator Thune's Telecommunications Skilled Workforce Act, which would establish an interagency working group to develop telecommunications industry workforce solutions, or Senators Wicker and Sinema's Improving Minority Participation and Careers in Telecommunications Act to address this need by awarding grants to Historically Black Colleges and Universities and Tribal Colleges and Universities for workforce training, could go a long way in achieving this goal. We cannot build the networks of tomorrow without a skilled and diverse workforce today.

Conclusion

Community-based providers like Golden West are deeply committed to the customers we serve and, given our experience and success in serving the most rural areas, we are critical components of any strategy seeking to achieve the Nation's broadband goals. We look forward to working with policymakers and other stakeholders to ensure that all Americans have access to sustainable and affordable net-

⁶Broadband Deployment Advisory Committee, Streamlining Federal Siting Working Group, Final Report, Federal Communications Commission, (Jan. 23–24, 2018), available at: <https://www.fcc.gov/sites/default/files/bdac-federalsiting-01232018.pdf>.

works that successfully manage risk, resiliency, and redundancy, so that those services are available when needed the most.

Thank you for the opportunity to testify, and for the Subcommittee's commitment to broadband infrastructure investment in rural America.

Senator LUJÁN. Thank you, Mr. Law, and it is very impressive what you all have built out there, as well. And again, thank you so much for being with us today.

Next, we are going to hear from Mr. Harold Feld, who is the Senior Vice President with Public Knowledge, here in Washington, DC. You are recognized for 5 minutes.

**STATEMENT OF HAROLD FELD, SENIOR VICE PRESIDENT,
PUBLIC KNOWLEDGE**

Mr. FELD. Thank you, Chairman Luján, Ranking Member Thune. Thank you for inviting me to testify today on this important subject.

As our economy and society have gone digital, our dependence on our communications networks has increased exponentially. Some of us may remember a time growing up, when the whole family shared a single telephone line. Today, nearly all of us have cell phones, sometimes more than one. And our digital communication does not stop there. At any given time, parents may be working remotely, while their children attend different virtual classrooms. Even our houses and devices may depend on constant connection with the Internet to function properly.

But as our dependence on constant connectivity has grown, our networks have become more fragile. Those who grew up with the one telephone line to the home, will remember that it worked regularly and reliably, every time you called someone. Even in a blackout, as long as the copper lines remained connected, you could call family to make sure everyone was all right, call 911 if you had an emergency, and call the power company to ask how long until the power came back on.

Today, we can wake up on a sunny day to discover that a cut fiber cable, or misconfigured router, has cutoff everything from our phone service to our video streams. An electric blackout, caused by a brutal heatwave, can now knock out communications when people desperately need to reach 911. A hurricane or wildfire can shut down phone and Internet in a geographic region for weeks, or even months. This is especially true for island communities and other geographically isolate communities, as we saw not only after Maria, but also after Sandy and Katrina.

How did this happen? Briefly, our rules have not kept pace with changes in technology. The traditional copper network was reliable because we chose to make it reliable. We have not made this choice for our current IP based and mobile networks. To the contrary, our aggressive regulation has left us increasingly unable to address the threat of our fragile network ecosystem.

The FCC has systemically divested itself of its authority to take the necessary leadership role by refusing to clarify the regulatory status of interconnected voiceover IP carriers, and by reclassifying broadband as a Title I information service. The FCC has rolled back its cybersecurity initiatives, at times claiming that it lacks authority to even consider cybersecurity.

As a GAO report published last April 29 found, the FCC's role in restoring telecommunications networks remains unclear. This can create confusion in post-disaster situations over how to allocate resources, such as generators and fuel.

Congress alone can resolve this confusion by creating clear priorities and clear lines of authority. None of this means returning to the days of monopoly network. To the contrary, competition among networks creates much needed redundancy. In small and rural markets that cannot support competition, we should be willing to invest public money to create the needed level of redundancy.

Congress has a tremendous opportunity to resolve these issues and restore resilience and reliability to our critical communications infrastructure. Both our wireline and wireless networks are undergoing significant upgrades. Legacy carriers are retiring their copper networks. Wireless providers are shutting off their 3G networks and deploying 5G.

States and Congress are currently debating how to close the digital divide and bring affordable high-speed broadband to all Americans. Legislation providing the necessary reliability framework and resources can ensure that these new networks will be resilient, reliable, redundant, and sustainable.

My written testimony includes multiple recommendations for Congressional action. To highlight the most important here—first, require the FCC to make outage data publicly available and to publish report after every major outage. Both markets and policy-makers need information and, right now, there is a dearth of that in the market.

Clearly empower and require the FCC, State governments, and Tribal governments to make rules and set standards for communications network reliability, including onsite power backup, and backup power in the home. Prioritize restoration of communications networks and establish agreed upon metrics to measure reliability.

Fund network upgrades to improve reliability and permit governments to make communications assets, such as fiber inspection available to avert outages and to assist network recovery.

To conclude, network resilience does not happen on its own. When something is everyone's general responsibility, it is no one's actual responsibility. We must upgrade our rules as we upgrade our networks to provide to all Americans, communications networks that will be there whenever we need them, whatever the emergency.

Thank you and I am happy to take any questions, at this time.
[The prepared statement of Mr. Feld follows:]

PREPARED STATEMENT OF HAROLD FELD, SENIOR VICE PRESIDENT,
PUBLIC KNOWLEDGE

Chairman Lujan, Ranking Member Thune: Thank you for inviting me to testify on this important topic. My name is Harold Feld and I am the Senior Vice President of Public Knowledge, an organization that is celebrating its 20th anniversary this year, and is dedicated to promoting freedom of expression, an open internet, and access to affordable communications tools and creative works.

Consumers and businesses expect a reliable communications network. In fact, our economy depends on it. But our very *lives* depend on reaching emergency responders every time we call 911. In disasters, the ability of first responders to communicate instantly with the public and with each other can mean the difference between life

and death.¹ In theory, upgrading our Nation's communications networks to Internet protocol (IP) should enhance resiliency because the protocol allows information to be broken up into packets, transmitted across multiple networks using different physical media (such as fiber and wireless), and reassembled at the endpoint. The protocol also establishes and confirms that packets are sent and received, and provides mechanisms for adjusting to congestion.

Instead of proving more resilient, our networks have grown increasingly fragile. A 2018 report by the Government Accountability Office (GAO) noted that "from 2009 to 2016, about one third of all wireless outages reported to [the] FCC (6,002 of 18,325) were attributed to physical incidents."² These outages have also grown longer in duration, especially when they are the result of a natural disaster or involve a concurrent failure of the electric grid.³ In addition to outages caused by natural disasters such as wildfires and hurricanes, outages can occur when telephone infrastructure is targeted in physical attacks, or from cybersecurity attacks.⁴

Unfortunately, outages can occur as a consequence of technical issues and carrier neglect, as well as from external events. In 2014, a "preventable coding error" in a single router in Washington State resulted in a 911 failure covering more than 11 million people.⁵ In 2020, a server failure in Georgia resulted in a multi-state blackout of T-Mobile's network.⁶ In other places, carriers have allowed legacy infrastructure to rot.⁷ In too many rural areas and small towns in America, people cannot reliably reach 911 on a good day, let alone in the wake of a catastrophe. In the 20th century, our telecommunications infrastructure was the envy of the world. We reached 98 percent of the population with reliable, affordable voice service. Today, we have communities that lack basic phone service, and those who have access to modern networks can wake even on a sunny day to find themselves cut off from vital services for no apparent reason—and for an unknown time.

In addition to these nationwide problems, specific geographic areas and Tribal lands may face unique challenges. As we saw in the aftermath of Hurricane Maria, restoring service to islands presents a set of challenges not shared by mainland communities. This includes reliance on undersea cables, which may be damaged in a disaster, and the high cost of transporting equipment and supplies to the impacted area. Extreme temperatures in desert Tribal lands can range in excess of 59 degrees in a day.⁸ The stress these temperature swings put on networks creates challenges for maintaining connectivity and requires additional hardening to withstand these

¹ Lisa Krieger, 911 Failure During California Wildfire Prompt Changes, *The Mercury News*, June 2019 ("When lives are at risk, communication is critical, said Christina Taft, 25, a business student at CSU Chico who lost her mother, Victoria, in the fire. She and her mom received no emergency warnings. And she was unable to get help for her mother after repeatedly calling 911. She is researching new approaches to emergency communications—calling the proposed platform "Victoria" after her mother—so others don't suffer the same fate.").

² GAO, Telecommunications: FCC Should Improve Monitoring of Industry Efforts to Strengthen Wireless Network Resiliency at 10 (2018), available at <https://www.gao.gov/assets/690/688927.pdf>. Accidents accounted for 75 percent of outages; natural disasters accounted for 24 percent and manmade incidents accounted for 1 percent of outages during the period of 2009–2016. *Id.* at 12.

³ *Id.* at 14–15 (From 2009 to 2016, the annual median duration of wireless outages attributed to accidents ranged from 8 hours to 16 hours, compared to natural disasters, which ranged from 19 to 36 hours.)

⁴ *Id.* at 10. See also Mariah Timms, *AT&T Outage: Internet, 911 Disrupted, Planes Grounded, After Nashville Explosion*, *Nashville Tennessean* (January 5, 2021).

⁵ April 2014 Multi-State 911 Outage: Cause and Impact, *Report and Recommendations*, PS Docket No. 14–72 (Pub. Safety Bur. 2014), 29 FCC Rcd 9327 (2014). Bishr Tabbaa, *Busy Signal: Behind CenturyLink's 911 Service Outage of 2014*, *Medium*, April 2019 ("On the early morning of April 9 2014, more than 6000 calls to 911 failed to reach call centers during a system outage that lasted more than six hours and affected a population of 11 million U.S. residents living in 60 counties across seven states including Washington, North Carolina, South Carolina, Minnesota, California, Florida, and Pennsylvania. Networks owned by CenturyLink, Verizon, and others were involved with the outage, and the root cause of the failure was related to a software defect in the call routing service of Intrado, a 3rd party contractor used by the telecommunications providers.")

⁶ Jon Brodtkin, T-Mobile Screwups Cause Nationwide Outage, but FCC isn't Punishing Carrier, *ArsTechnica*, Oct. 23, 2020.

⁷ Kristina Panos, *DSL is Hanging on the Line as Telcos Stop Selling New Service*, *Hackaday*, Oct. 29, 2020. In re Technology Transitions, Policies and Rules Governing Retirement of Copper Loops by Incumbent Local Exchange Carriers, Special Access for Price Cap Local Exchange Carriers AT&T Corporation Petition for Rulemaking to Reform Regulation of Incumbent Local Exchange Carrier Rates for Interstate Special Access Services, WC Docket No. 05–25, GN Docket No. 13–5 RM–11358 RM–10593, *Report and Order, Further Notice of Proposed Rulemaking, and Order on Reconsideration*, 30 FCC Rcd 9372 (2015) at ¶¶ 90–92.

⁸ *Weather and Climate Inventory National Park Service Sonoran Desert Network*, National Park Service Sonoran Desert Network at 10 (2007).

ranges. Additionally, challenges exist in communities where terrain such as mountains or forests may hamper post-disaster restoration efforts, or in sparsely populated rural areas. In urban areas, it is imperative that providers and local governments invest equally in traditionally marginalized communities such as minority and low-income neighborhoods. Tribal authorities need to be empowered and resourced to restore communications on Tribal lands and to coordinate as equals with state and Federal authorities.

Only Congress can remedy this situation. For reasons I will discuss in greater detail below, it is unrealistic to expect the market to solve this on its own. Public safety has always been regarded as a classic case of “market failure,” because market forces alone cannot ensure the optimal result. Widespread deregulation of IP-based services at the state level and by the Federal Communications Commission (FCC) has had the unintended consequence of muddying the overall authority of the agency and the states to ensure network reliability as they traditionally did for the analog phone network.

Additionally, post-disaster restoration of modern communications networks requires coordination across multiple industries, Federal agencies, and local authorities, further diluting the ability of a single agency such as the FCC to address these resiliency problems without new Congressional authority. A GAO report released this month found that the failure of the Department of Homeland Security (DHS) to clarify the FCC’s role in network restoration post-disaster significantly impeded the restoration of communications networks in Puerto Rico.⁹ Disaster relief has not traditionally prioritized restoration of communications. Federal and state agencies have not uniformly recognized the vital importance of restoring communications to the overall disaster recovery. Restoring communications to the public, not merely to first responders, is critically important to modern public safety and disaster response. The Wireless Emergency Alert System (WEAS) and the Integrated Public Alert Warning System (IPAWS) are the most obvious examples of the need to restore communications to the public as well as maintain communications for first responders. But the flow of communications in an emergency is two-way, especially as telemedicine becomes more integrated into our healthcare system and emergency response. Restoring communications to everyone needs to be fully integrated with disaster response efforts in the same way restoring power or clean water is prioritized. Only a clear mandate from Congress can make this happen across federal, state, and local authorities.

Happily, the current transition of our national wireline networks to all-IP systems, and our deployment of 5G wireless networks, provides an ideal opportunity for Congress to act. As we upgrade to an all-IP framework, retire legacy copper networks, and build out 5G, we can upgrade our resiliency standards to take advantage of the new technical capacities of these networks. In the days of the AT&T monopoly, we could require the network be hardened to 99.999 percent (“five 9s”) reliability and incorporate the added cost into the regulated rate. That approach is simply not viable today. We enjoy the fruits of competition enabled by IP-based services. We welcome the ability to break up functions and aggregate functions in ways that were impossible using older technologies, because, when done correctly, doing so enables providers to offer better service more efficiently. IP-based services can allow local providers to offer their communities the same level of service as in larger markets at an affordable cost, taking advantage of the economies of scale from a world-wide market in IP-based and mobile equipment.

At the same time, we must recognize the inherent weaknesses of IP-based and mobile technologies. First and foremost, these systems need power. Not merely power to cell phone towers and network operating centers, but power in the home. The traditional copper landline system was self-powered. It could operate even when the electric grid went down. Modern IP-based landlines and mobile networks are not self-powered. Mandatory back-up power requirements must include mandatory back-up power in people’s homes as well as to cellular towers.

Moreover, the traditional landline network had clear lines of responsibility for maintaining reliable communications. Modern systems may be distributed among numerous vendors and network operators without a clear understanding of the architecture. As a result, it can take hours for a network operator to become aware of the scope and extent of an outage, and even more time to find the source of the outage. Cheap off-the-shelf equipment dramatically lowers cost, but may not be as reliable as custom-built equipment.

⁹GAO, Telecommunications: FCC Assisted in Hurricane Maria Network Restoration, but a Clarified Disaster Response Role and Enhanced Communication Are Needed, available at <https://www.gao.gov/assets/gao-21-297.pdf> (Apr. 2021).

Finally, for competition to work, markets need information. If we want carriers to prioritize resilience and reliability, we must make it possible for them to reap the rewards of these efforts. The current reporting requirements treat network outage information as confidential business information. Publicly available information, such as the Disaster Information Reporting System (DIRS), suffers from being voluntary and from homogenizing the information to prevent comparison in performance between carriers. As a result, subscribers who wish to prioritize reliability over cost savings have no information on which to make that choice. Investment in reliability will produce no reward, and failure to invest in reliability will have no lasting consequence. Carriers are therefore disincentivized from investing in resilience and reliability.

Public Knowledge has several specific recommendations that address these factors, which I provide at the end of my testimony.

I. Why Congress Must Act

In the days of traditional landline networks, Congress typically left issues of reliability to the states, with broad support from the FCC under Section 1 and Section 214 of the Communications Act.¹⁰ This approach made sense at a time when the primary communications providers were closely regulated monopolies with self-powered networks. But today's universe is radically different. Some of these differences reflect changes in technology. Some differences reflect the increased centrality of communications in all aspects of our lives, including disaster recovery. Some differences are the result of deliberate policy choices that have allowed our communications infrastructure to grow increasingly fragile. Only Congress can provide the necessary guidance, authority, and resources to ensure that our national communications infrastructure can reliably meet our needs—whether in times of crisis or in our daily lives.

It is worth noting that Congress has, in the past, stepped in where necessary to create national policy and provide funding for implementation. For example, as part of the 1996 Act, Congress established the 911 system as our national emergency number, creating needed uniformity.¹¹ In 2008, Congress required all providers of public safety access points (PSAPs) to interconnect with providers of advanced communications services regardless of regulatory classification.¹² Congress has provided funding for the national first responder network, FirstNet, as well as funding for E911.¹³ While the scope of the challenge here is significantly greater, it is not unprecedented.

A. Moving From a Single, Regulated Monopoly Network to Multiple, Competing Networks Has Fundamentally Altered the Communications Landscape

To appreciate why our communications networks have gone from robust and resilient to fragile and unreliable, we must briefly review how our modern network ecosystem evolved. In the 1990s, two technologies began mass deployment: mobile networks and the internet. These technologies were in their infancy and therefore we expected only “best efforts” service. To be clear, “best efforts” does not mean that the providers are cavalier about the quality of their service. Best efforts means that customers are not entitled as a matter of right to a particular quality of service. Instead, all the provider promises is to make best efforts to deliver the message. For the vast majority of uses in life, “best efforts” is good enough. This is particularly true because IP-based technologies are designed to deal with the lack of reliability in best efforts networks. Packets are broken up and can move along multiple pathways and multiple networks. Wireless networks must move from tower to tower without dropping the call, and between networks for roaming when the carrier lacks sufficient capacity.

This inherent flexibility not only produced cheaper service but also allowed new, competitive offerings. It enabled carriers to break up functions that traditionally had to be done in the “core” of the network and allowed these functions to take place at the edge. For example, in the traditional network, the local incumbent telephone network maintained the local PSAP networks. As networks evolved, new companies emerged capable of managing PSAPs on multiple networks. Packet switching allowed carriers to employ multiple routes for the same transmission instead of rely-

¹⁰ 47 U.S.C. §§ 151, 214.

¹¹ Codified at 47 U.S.C. § 251(e)(3).

¹² *New and Emerging Technologies 911 Improvement Act of 2008*, Pub. L. No. 110–283, 122 Stat. 2620 (2008) (NET 911 Act) (amending Wireless Communications and Public Safety Act of 1999, Pub. L. No. 106–81, 113 Stat. 1286 (1999) (Wireless 911 Act)).

¹³ *Middle Class Tax Relief and Job Creation Act of 2012*, Pub. L. No. 112–96, Title VI (Spectrum Act of 2012), § 6409(a), 126 Stat. 156, 232–33 (Feb. 22, 2012) (codified at 47 U.S.C. § 1455(a)).

ing on and using a single circuit for each call. It also allowed them to outsource routing to specialized companies that could find the most efficient and least expensive routes. New services, such as video and geolocation, were easy and cheap to support when compared to the traditional regulated public switched telephone network (PSTN). Best efforts allowed these technologies to grow and proliferate.

These advantages also gave rise to significant issues. First, packet-switched technologies and mobile technologies are not self-powered. When the power goes out, communications stop. But as recently as 2019, the Senior Director of Emergency Preparedness for California's electric utility PG&E advised people to use landlines to communicate during power blackouts without any apparent awareness that modern landlines are not self-powered.¹⁴ Networks have grown so complex that *even the companies themselves* cannot predict how a failure in one part of the network impacts another part of the network. Nor is it clear whether a service is being provided by the carrier itself or by a contractor. This can make it difficult to trace the source of an outage, or take the needed steps to resolve the outage.¹⁵

As long as self-powered traditional copper networks provided a reliable service alternative, the policy of treating competing networks as best efforts was manageable from a public safety perspective. Any traffic too important for best efforts went over the telephone networks. The failure of a dial-up Internet service provider might be an inconvenience, but hardly a matter of life and death. As long as people kept a traditional copper landline, they could guarantee themselves reliable access to 911 and to communications even during a power outage.

Today, however, mobile networks and IP-based networks have long displaced traditional copper as the primary communications networks for the majority of the public.¹⁶ Indeed, it has become our national policy to sunset the traditional PSTN and transition to an all IP-based communications network. Additionally, the services that used to be considered secondary to voice, such as video communications and data transmission, have now become critically important. In 2002, when a peering dispute between Cogent and America Online caused a severe slowdown of Internet traffic in the D.C. region, it was an inconvenience.¹⁷ Today, a comparable slowdown of Internet traffic to the D.C. region would result in severe impacts on schools, businesses, and government operations.

B. Deregulation and Preemption Have Eliminated Needed Oversight By the FCC and the States

Clearly we can no longer afford to treat these networks as best efforts. But neither Federal nor state policy has kept pace with these changes. Despite debate over the growing use of voice-over-IP technologies and their potential to displace the traditional telephone network as early as 1998,¹⁸ and a study of the impact on resilience from the phase out of the PSTN by the FCC's Technical Advisory Committee in 2013,¹⁹ the FCC and the states have moved in the opposite direction. The FCC has imposed no reliability obligations on providers of broadband service—not even outage reporting requirements. Most states have divested themselves of authority over IP-based services.²⁰ Even where states have retained (or reclaimed) authority

¹⁴Jonathan J. Cooper and Juliet Williams, *Anger Grows as Utility Struggles to Get Its Blackouts Right*, Associated Press (Oct. 31, 2019) (quoting PG&E Senior Vice President for Disaster Recovery as urging people to get blackout information “the old fashioned way, through calling on a landline”).

¹⁵See Tali Arbel, *Over 12,000 Calls to 911 Failed in AT&T Outage*, Baltimore Sun (March 23, 2017) (network configuration error); *December 27, 2018 CenturyLink Network Outage Report* (single server generating malformed packets disabled the entire network); April 2014 Outage Report *supra* note 5 (“preventable coding error” in contractor’s router created multi-state 911 outage).

¹⁶Federal Communications Commission, Communications Marketplace Report, GN Docket No. 20–60, 35 FCC Rcd 13188 at para. 147, Dec. 2020 (“as of December 2019, residential fixed voice connections were about 30 percent switched access and 70 percent interconnected VoIP, with residential switched access connections comprising only 14.4 percent of all fixed retail voice connections.”).

¹⁷‘Peering’ Dispute With AOL Slows Cogent Customer Access, *The Washington Post*, July 2012.

¹⁸*Federal-State Joint Board on Universal Service*, CC Docket No. 96–45, Report to Congress, 13 FCC Rcd 11501(1998) (Stevens Report).

¹⁹Post-PSTN Public Network Resiliency: FCC Technological Advisory Council: Communications Resiliency Working Group, Dec. 2013.

²⁰*Telecommunications Oversight 2017: A State Perspective*, National Regulatory Research Institute (2018) (“As of December 2017, 35 states had passed legislation limiting direct oversight of the retail wireline telecommunications services provided by the large incumbent price cap service providers. In addition, Iowa, Pennsylvania, New Jersey, and Rhode Island had reduced

over reliability requirements for voice service, the FCC has repeatedly acted to broadly preempt state authority to regulate either IP-based voice services or mobile voice services.²¹

The FCC has imposed certain limited obligations on interconnected VOIP providers and mobile voice providers (but not on their data or text messaging services). Mobile voice providers and interconnected VOIP providers must comply with the FCC's discontinuance notification rules under Section 214 of the Communications Act. In theory, this requires providers to demonstrate that discontinuing or impairing service to the community will not harm the public interest.²² Streamlined discontinuance processes, however, allow discontinuances to be granted with little review. Interconnected VOIP and mobile voice providers are obligated to participate in the FCC outage reporting system.²³ As with all participants in the NORS and DIRS systems, these reports are kept confidential, preventing subscribers from making provider choices based on reliability.

Additional problems have emerged as providers of copper networks continue to discontinue these networks. In 2017 and 2018, the FCC relieved carriers of the bulk of their obligations to provide notice to customers when discontinuing networks. The FCC also eliminated the requirement to provide a comparable replacement network. Carriers may now discontinue all legacy copper service by asserting the presence of a broadband provider with sufficient capacity to support a VOIP product regardless of whether the broadband provider offers facilities-based VOIP.²⁴ The FCC also eliminated customers' ability to file complaints when carriers simply allow facilities to rot or fail to replace facilities after a disaster. As a consequence, customers currently served by legacy copper have no enforceable right to continued service, let alone reliable and resilient continued service.

Unfortunately, the FCC is not alone in deregulating even the legacy telephone network. The majority of the states have broadly deregulated their legacy telephone networks as well as IP-based networks. Those states that have investigated after deregulation have found that legacy networks have fallen into widespread disrepair—particularly in rural areas.²⁵ Many of these rural areas lack cable systems or wireless networks; when the legacy copper stops working, communications in these regions simply *stops*. As a consequence of permitting legacy carriers to abandon, or constructively abandon, their networks, we now have communities in the United States that lack even basic 20th century communications infrastructure.

Finally, the FCC has taken affirmative steps to limit its own authority over communications networks. The FCC reclassified broadband service (fixed and mobile) as a Title I service in 2017, abandoning the agency's traditional authority to require network resilience and reliability. Given the 2017 Order's elimination of Section 706 (47 U.S.C. 1302) as an alternative source of authority over broadband, and general determination that it lacks significant ancillary authority over broadband, it is unclear whether the FCC could even require broadband networks to provide mandatory outage reports.

It is also uncertain to what extent the FCC will retain authority over interconnected VOIP providers or mobile providers. The FCC has declined to classify interconnected VOIP. In the Orders imposing outage reporting requirements on interconnected VOIP providers, the FCC has relied on both its Title II authority (in the event interconnected VOIP is Title II) and its "ancillary authority" as ancillary to Title II. When the legacy copper network is retired, however, any existing ancillary authority will disappear. In other words, if the Commission's efforts to sunset the PSTN in the next few years are successful, the Commission will have effectively terminated its authority over the landline communications network.

A similar fate awaits the FCC's authority over mobile networks. Section 332(d) defines Commercial Mobile Radio Networks (CMRS) as mobile networks that pro-

oversight in either all or part of the state after a formal commission examination and review proceeding.").

²¹ See *Charter Advanced Services, LLC v. Lange*, 903 F.3d 715 (8th Cir. 2018); *MN PUC v. FCC*, 483 F.3d 570 (8th Cir. 2007).

²² 47 U.S.C. § 214.

²³ See FCC Network Outage Reporting System (NORS) and Disaster Information Reporting System (DIRS).

²⁴ Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment, *Report and Order, Declaratory Ruling, and Further Notice of Rulemaking*, WC Docket No. 17–84, 32 FCC Rcd 11128 (2017); Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment, *Second Report and Order*, WC Docket No. 17–84, 33 FCC Rcd 5660 (2018).

²⁵ In re Commission Inquiry into the Service Quality, Customer Service, and Billing Practices of Frontier Communications, P407, 405/CI–18–122 (2019); see generally *Telecommunications Service Carriers' Service Quality Report*.

vide service to the public when interconnected with the “public switched network.”²⁶ The 2017 “Restoring Internet Freedom Order” explicitly defined the “public switched network” as consisting of the traditional legacy phone network.²⁷ Once the existing legacy phone network is retired, CMRS will cease to exist as a legal category. All mobile services will be “Private Mobile Radio Service” (PMRS).

While the Commission will arguably retain its Title III authority over mobile providers, it is unclear how much that authority allows it to regulate in the name of reliability and resilience. When the FCC attempted to impose a backup power obligation on licensees following Hurricane Katrina, the rule was challenged in the D.C. Circuit.²⁸ Because the case was rendered moot by the FCC withdrawing the relevant regulation,²⁹ the question of the FCC’s Title III authority to impose reliability and resiliency regulations remains unresolved.

Finally, the Trump FCC consistently refused to acknowledge any authority to address issues of cybersecurity. The United States is thus the only developed nation whose telecommunications regulatory affirmatively avoids any consideration of cybersecurity as part of its deliberations. For the last four years, the FCC has assiduously avoided any hint of leadership or oversight in securing our critical communications infrastructure from cyber threats. This leaves, and will continue to leave until remedied, a giant and exploitable hole in our defenses. It is ironic indeed that the Federal Energy Regulatory Commission and Department of Energy have a mandate from Congress to consider cybersecurity threats to the electric grid and energy infrastructure, and meanwhile the Department of Transportation considers cybersecurity concerns to our transportation infrastructure, but the Federal Communications Commission is considered unsuited to protect the Internet from cybersecurity threats. The humor of this delightful irony will, alas, be of small comfort in the event our communications infrastructure is subverted by state-sponsored hackers or criminals seeking ransomware.

II. Unregulated Markets Are Not Capable of Adequately Protecting Resiliency

Carriers and proponents of deregulation have justified the risk to public safety by arguing that carrier’s have sufficient financial incentive to invest in resilience and reliability.³⁰ There are several problems with this. First, empirical evidence clearly contradicts this hypothesis. As noted above, the number of outages and the length of outages have both *increased* with deregulation—not decreased. Rural communities have seen legacy networks degrade and disappear without replacement by the promised advanced networks. Even setting this empirical evidence aside, classic economic theory demonstrates why public safety concerns such as network resiliency have traditionally been considered a case of market failure requiring regulatory intervention to achieve the desired result.

First, as noted above, networks have become far too complicated for carriers to assess what is required to maintain resiliency. This is why “sunny day” outages keep occurring. Fragility in the network from equipment failure or routing errors only becomes apparent after the fact. Nor can carriers force electric utilities to cooperate with them and agree to prioritize services. Carriers cannot prevent third parties from cutting fiber lines. While carriers can—and should—do more to improve their own networks, they cannot address the entire problem. Only the Federal government can do that.

Second, while carriers have incentive to avoid outages, they also have substantial incentive to cut costs—especially where investment does not yield back immediate short-term profit. This makes carriers especially subject to what is called the “optimism fallacy.” Carriers believe that their preparations are sufficient because they take an optimistic view of likely outcomes (even when preparing for the worst). While economics likes to conceptualize corporations as rational actors immune to wishful thinking, corporations are managed by human beings. We should therefore expect that while those closest to the problem have valuable expertise, they may also have their own difficulty in remaining objective.

²⁶ 47 U.S.C. § 332(d).

²⁷ *Restoring Internet Freedom*, Declaratory Ruling, Order, Report and Order, WC Docket No. 17–108, 33 FCC Rcd 311, 355 para.75 (2017).

²⁸ RCR Wireless, *Appeals Court Questions FCC Authority on Backup Power Rule*, May 9, 2008.

²⁹ Matthew Lasar, *FCC: Back to Square One on Cell Phone Tower Backup*, *Ars Technica* (Dec. 8, 2008).

³⁰ *Technology Transitions; USTelecom Petition for Declaratory Ruling That Incumbent Local Exchange Carriers Are Non-Dominant in the Provision of Switched Access Services*, GN Docket No. 13–5, WC Docket No. 13–3, RM–11358, Declaratory Ruling, Second Report and Order and Order on Reconsideration, 31 FCC Rcd 8283 (2017).

Third, even putting that aside, carriers that invest in reliability cannot expect to be rewarded for their efforts in the market. Because the FCC keeps reliability data confidential, customers cannot make purchasing choices based on reliability. Certainly carriers can (and do) claim to have the “most reliable network,” but why should consumers believe these advertising claims? And even a network that is “most reliable” on average nationwide may not be particularly reliable in a specific county or recover quickly after a natural disaster.

By contrast, carriers will generally escape consumer backlash after a disaster-based outage because consumers blame the storm for the damage. Even when service is particularly bad by a specific carrier, outages are rare enough that consumer memory fades over time. Additionally, consumers face the uncertainty over whether the carrier they switch to will be a significant enough improvement in reliability to justify the cost and aggravation of switching. Finally, if mandatory network sharing agreements are in effect (which they should be), carriers that invest in more reliable networks face a free-rider problem. Other networks that chose to invest less in reliability will still remain operational by leveraging the responsible carrier’s investments in resiliency. Because the public has no way of knowing that these networks are only operational as a consequence of the “prudent carrier’s” investment, the prudent carrier will receive no recognition or marketplace reward for prioritizing network resiliency. Instead, the investment will reward the rival who failed to adequately prepare.

Finally, we must recognize that most of the costs we are concerned about do not fall directly on the carrier. Loss of business revenue, or even loss of life, from a communications outage is not charged to the carrier, whereas the cost of making reliability investments is. It is rational for carriers to discount the external costs. This is also why the Federal and state governments should not only require carriers to meet standards of reliability, but also invest public money. While it is appropriate to have communications carriers serve the public interest as well as their private interests, it is equally appropriate for public money to be spent for broad societal benefits.

III. Recommendations

Public Knowledge notes that Senators Markey and Wyden have introduced a bill that would address many of the problems of network resilience, and provide incentives to do so in an environmentally sustainable manner. Public Knowledge is pleased to support the Generating Resilient and Energy Efficient Network (GREEN) Communications Act as an important step forward. In addition, Public Knowledge endorsed the RESILIENT Act introduced last Congress in the House by Chairman Palone and Representative McNerny. These two bills are examples of Congressional action that would help to restore reliability to our critical communications infrastructure.

Public Knowledge makes the following recommendations for Congressional action. While some of these are reflected in the GREEN Communications Act, or were reflected in the RESILIENT Act, others were not. We hope you consider including these recommendations in any future legislation:

1. *Provide the information necessary for proper planning and for the market to reward investment.* Direct the FCC to combine the National Outage Reporting System (NORS) and the Disaster Information Reporting Service (DIRS) into a single, publicly available database that permits the public to identify carrier performance on a granular level. Direct the FCC to conduct a full report after every significant outage.
2. *Provide clear authority to the FCC and the States.* Clearly empower the FCC and states to create necessary rules for network reliability, cybersecurity, and cooperation among relevant stakeholders. Congress should direct DHS to fully integrate the FCC into its disaster response in line with the GAO recommendations. Additionally, Congress should require the FCC and the Department of Energy to develop enforceable guidelines for cooperation between power companies and communications providers.
3. *Create metrics necessary to set standards and promote accountability.* Require the FCC, National Telecommunications Information Administration (NTIA), National Institute of Standards (NIST), and the Department of Homeland Security (DHS) to develop suitable metrics to measure reliability and resiliency for wireline, fixed wireless, mobile terrestrial wireless, and satellite networks.
4. *Promote sustainability and avoid environmental degradation.* Require further study to create recommendations for environmentally friendly and sustainable solutions, and to reduce existing practices that risk degrading the environment.

5. *Make Federal and state assets available in disaster recovery.* Permit and encourage the Federal government and state governments to make available in an emergency communications resources such as fiber, spectrum, operating government networks, or other assets to communications providers to restore communications to the general public.
6. *Fund network upgrades that promote reliability.* Provide Federal money to pay for necessary upgrades to communications networks to enhance reliability. In particular, provide funding to replace aging copper networks with modern fiber networks built to modern resiliency standards. Where legacy carriers wish to retire their copper networks without replacement, create incentives to sell these networks to alternative providers (including state or local governments, community anchor institutions, and cooperatives) willing to provide wireline service. Additionally, Federal grant programs that fund deployment should include mandatory reliability metrics.
7. *FCC studies that address the specialized needs of specific communities.* Require the FCC to report to Congress on the special needs of island communities, geographically isolated communities, Tribal lands, low-income and traditionally marginalized communities of color, and communities in environmentally sensitive areas. The report should include steps the FCC will take under its existing authority to address identified special needs, and recommendations to Congress for any other necessary action.

Thank you. I am pleased to answer any questions you may have.

Senator LUJÁN. Thank you very much, Mr. Feld. I will now recognize members for questions, as well. I will recognize myself for 5 minutes.

Mr. Feld, resilient, redundant, secure broadband is a core focus of today's hearing. However, before we can really address this problem, we need to understand the current state of broadband resiliency in the United States. In your testimony, you state that the FCC currently does not have broadband resiliency requirements. Does the FCC presently enforce broadband network resiliency standards, yes or no?

Mr. FELD. No, it does not.

Senator LUJÁN. Mr. Feld, in times of a disaster, when Americans lose access to broadband services, are there currently any nationwide requirements for reporting those outages as they are occurring, yes or no?

Mr. FELD. No, there are not.

Senator LUJÁN. Mr. Feld, are there any requirements for reporting broadband outages, after they have occurred, so consumers can make informed decisions between carriers, yes or no?

Mr. FELD. No, there are not.

Senator LUJÁN. This is unacceptable, and Americans deserve to know the reliability of the critical infrastructure. And I think this is an area that we can find some common ground and legislate on.

Mr. Law, thank you for being here today. South Dakota and New Mexico are similar in many ways when it comes to broadband build out. Both are highly rural, and each has one unique challenge in laying fiber across the Federal, State, and Tribal land. Mr. Thune touched on it. It is getting all of that approved, and the topography that we face, and the challenges are significant. So, thank you so much for your testimony and your perspective.

I want to highlight one part of your written statement. You "operate in deeply rural markets, where the cost of deploying and operating networks can be higher, and a tailored approach to managing risk, resiliency, and redundancy is necessary to create sustainable networks that provide services customers can afford". Mr.

Law, how has your decision to deploy fiber led to more sustainable, resilient, and affordable networks?

Mr. LAW. Thank you, Mr. Chair. I think the first way is both the resiliency, in terms of its durability and performance characteristics. There is nothing superior to it on the market as it relates to, I will say, technology performance, whether it be broadband, voice, or whatever application you choose to put on it.

The second item is its scalability. And so, we still use fiber that was—was deployed in the 1990s, in the early 2000s to 2010s. Throughout all of that, fiber has proven to be a very resilient medium to deploy, upgrade, and scale throughout those times and we have not needed to replace it, in some cases going on 30+ years. So, fiber has been a great benefit for rural customers, such as those served by Golden West.

Senator LUJÁN. Can Congress support providers like yours in constructing future-proof networks that meet the highest standards of resiliency by passing an infrastructure package that would allow more investment in these areas?

Mr. LAW. I think, certainly, an infrastructure package would be a great start, in terms of continuing to expand and deploy broadband into rural and underserved areas. I think that is only one act, though, Mr. Chair, in terms of, that is a great first step, but you also have to consider, as part of that, both the sustainability of that network going forward—it is one thing to build it. Anybody with enough money can build a network. However, I have learned it is more challenging to actually operate a network, over a long period of time and you can spend a lot of money doing that, if it is not done properly.

Senator LUJÁN. Appreciate that reminder, Mr. Law. Mr. Adelstein, in your testimony you state, “Loss of electrical power can create outages of telecommunication service for wired and wireless networks”. And certainly, I agree with the statement that many energy grids are in desperate need of maintenance and repair. However, effective disaster response requires redundancy. It is important to anticipate failures and prepare accordingly. Do you believe the FCC states should regularly—I am sorry. Do you believe the FCC and states should regularly evaluate whether essential telecommunication networks are sufficiently resilient, to continue providing essential communication services during catastrophic events?

Mr. ADELSTEIN. Yes, I think it is very important that the regulators keep a close eye on the resiliency and redundancy networks. When it comes to redundancy, more network deployment leads to more resiliency, to your earlier question. That is what the BDAC actually concluded at the FCC.

I think it is important that, when you think about, you know, resilient networks that, you know, in the case of wireless networks, if one node goes out, it can be rerouted traffic to another. And we try to build, now, overlapping densified networks that can—essentially, if there is a problem in one area, they can be rerouted to another. And so, when you have redundancy, in terms of coverage like that, it actually increases resiliency and ability to survive when there is an outage of any kind.

Senator LUJÁN. If the FCC or a state finds essential networks are not adequately resilient, should they engage in rulemaking on the subject?

Mr. ADELSTEIN. Well, I mean, you know, there have been rulemakings on this. The FCC has done rulemakings on this and they have concluded, and the industry has risen up to a voluntary agreement, basically, that is, I think, dramatically improved resiliency. We have seen really wonderful performance, not only during the pandemic, but during recent disasters, especially with regard to wireless networks. We have seen, while often cases the wireline network is gone for weeks and months at a time—often no fault of their own, as a result of the electric going down—we have seen wireless networks quickly restored, in the case of recent hurricanes and fires. And people then depend upon their wireless device.

So, I think, when you are looking about spending an unprecedented sum of funding on a new infrastructure package, you have got to think about the resiliency of different types of technologies, as well as improving resiliency within those technologies. We can make wireless networks more resilient. We can make fiber more resilient. But both of them have different characteristics. And this kind of redundancy, and having multiplicity of technologies, makes it more likely that you will have the emergency services when people's lives actually depend upon them.

Senator LUJÁN. So, just to clarify, when a state or the FCC finds that essential networks are not adequately resilient, you do support them engaging in rulemaking on the subject?

Mr. ADELSTEIN. Well, I mean, rulemaking proceeding. I am not sure what rulemaking, in the end, they would need to do. I mean, right now, what we have found is, it is very hard to do a one size fits all approach on regulation. What works in New Mexico might now work in South Dakota, depending on the ability, for example, to get backup generators in place. You know we try to get them to as many sites as we can, but some sites do not have room. Sometimes it is a sacred national monument, where we cannot get, you know, certain types of devices in.

I mean, it is important that the regulators really stay on top of this and make sure that they are—that the public is protected. But the industry, I think, is working very hard. And we will work hand in hand with regulators to make sure that all of the resiliency needs of our customers are met.

Senator LUJÁN. I will explore that a little bit more later. Appreciate your time today.

I will now recognize Mr. Thune for five minutes.

Senator THUNE. Thank you, Mr. Chairman. Mr. Law, as you know, ensuring there are reliable and resilient broadband networks in rural America means not just having Federal resources to deploy these networks, but also having the Federal support available to maintain them over the lifetime of the network.

Over the years, the FCC's Universal Service Fund High-Cost Program has provided the reliable support needed to sustain these networks. However, the USF contribution factor is now above 30 percent for the first time, which puts at risk the ability of the USF to ensure predictable and sufficient support, as required by law. It is for that reason that I introduced the Rural Connectivity Ad-

vancement Program Act, which would help strengthen connectivity in rural areas by providing funding for both the build out of networks, and to support the sustainability of those networks.

Can you speak to the importance of the USF continuing to provide reliable support for companies, like Golden West, over the long run? And if that funding went away, what effect would that have on your customers?

Mr. LAW. Thank you, Ranking Member Thune. Absolutely. Universal Service Funding has been foundational to the broadband build out in much of rural America. I can specifically speak for the entirety of Golden West service territory, which I mentioned is about the size of Maryland, New Jersey, Connecticut, and Delaware combined. Quite frankly, we could not have built out the broadband network that we have to date, and will continue to build, without the support of Universal Service funding, now and in the future. Both in terms of affordability, but as well as sustainability for networks.

I applaud your efforts, as it relates to putting the Universal Service Funding on a sound financial footing, because that is in question. When you start seeing contribution to rates to fund something in the 30 percent territory, I think your draft legislation would do a lot, in terms of providing additional funding that would, perhaps, take the pressure off of the primary funding over periods of time, depending on the needs of the Universal Service Fund.

But I absolutely think, regardless of infrastructure packages that are being discussed, or that have already been approved, you cannot have those discussions without having a similar discussion of, how do we keep Universal Service funding on firm support, both now and in the future.

Senator THUNE. And you, sort of, answered it, but just to reiterate the point, the bill I mentioned, RCAP or Rural Connectivity Advancement Program Act, would help the USF program over the long term.

Mr. LAW. Absolutely.

Senator THUNE. Yes, thank you. Mr. Adelstein, ensuring that our Nation's broadband networks are resilient to natural disasters and able to handle increases in network traffic requires technology to be deployed to all parts of the country. What can Congress do to ease the regulatory permitting burdens that slow down the deployment of redundant and resilient networks, particularly on federally owned lands?

Mr. ADELSTEIN. Well, you know, Federal lands, there are enormous obstacles in getting wireless infrastructure placed. And those areas require these networks for emergency response. I mean, you have fires. You know, we see what is happening right now and what happened in Black Hills recently. We have got to have access to those lands and the FCC—I chaired a working group that came up with an entire report. For many years we have been trying to get these things implemented. Administration after administration, we have not been able to get it done.

So, I think, you know, it is time for legislation to require Federal agencies to, basically, treat wireless on Federal lands like they would, you know, in the—like we would in the private sector, where we can get long term leases, where we can get access, where

we can get these things expedited. Because it not only protects the public, but it protects Federal—Federal workers, as well.

And when it comes to, you know, citing for resiliency, we need to be able to get things like generators placed. A lot of places do not even allow us to do that. We talked about backup power but, you know, if you are going to put funding into this bill, maybe you could require that there be streamlined types of approaches for things like that.

And some of the progress that the FCC has made on allowing quick access for colocation to existing facilities, no allowing small cells to be cited in the rights of way, within certain limits. Making sure those do not get rolled back and making sure that, you know, funding goes to communities that have met model standards.

Senator THUNE. Very good. Mr. Law, any regulatory barriers that you face, in this respect?

Mr. LAW. We have certainly faced the challenges of accessing Federal lands, whether they be National Park, National Forest, BLM, lands administered by BIA, in certain cases. I would echo my colleague Mr. Adelstein's comments. I also would strongly urge there be a streamlining of the permitting process for access of Federal lands, both in terms of the processing, the forms, and also, I will tell you, in terms of the visibility into the process.

I will tell you, Golden West has several projects ongoing, across various Federal lands this year. And when you make those applications for rights of way, each agency, A, handles them differently, B, there is no way for a provider to have any idea, short of repeated phone calls or e-mails that may or may not get answered, about what is the status of our application. In South Dakota, for example, with a 5-month construction window, if we do not have an answer in a April-May-June territory, receiving an answer that we can do it in November does us no good, nor will it do customers any good.

So, I would—I would echo those comments that, absolutely, the recommendations from the FCC's BDAC committee a couple of years ago. Absolutely, whether it is by statute, order, or some other decree, I would wholly support.

Senator THUNE. So—and this I would direct, again, to either or both of you. And I will try to make this quick, Mr. Chairman. My time has run out.

Multiple agencies are dispersing broadband funds, which could ultimately lead to duplication of broadband services. So, as Congress considers additional broadband funding, do you believe having funding go through one agency reduces the risk of overbuilding? And if so, which agency do you think is best suited to handle the disbursement of funds?

Mr. LAW. I would start by saying, I think—I think very clearly, the Federal Communications Commission is the preferred agency for the distribution of these types of funds, both in terms of their agency expertise and knowledge of networks, deployment, availability, affordability, sustainability—all of those items. But also, more importantly, beyond just the fact of getting these networks built, there has to be some level of monitoring and commitment capabilities that are done following up what are, to me, staggering amounts of money for broadband deployment. Great, but staggering

amounts. There has to be follow up. The FCC is equipped to do that. I do not believe there are other Federal agencies that are adequately equipped, in the broadband field, to have that capability.

Mr. ADELSTEIN. And I would certainly agree that, if we are going to have multiple agencies having funding, you have got to make sure you avoid overbuilding. You have to have some kind of—if Congress is going to provide funding to multiple agencies, that there be some kind of a coordinating mechanism that is made within the legislation itself, to ensure that there is proper coordination and that there is not any overbuilding, particularly over other fellow programs, but certainly over existing networks. Limited resources need to go to truly unserved areas and there have to be good maps in place to get that done.

Senator THUNE. Thank you. Thank you, Mr. Chairman.

Senator LUJÁN. Thank you, Mr. Thune. Senator Klobuchar, you are recognized for five minutes.

**STATEMENT OF HON. AMY KLOBUCHAR,
U.S. SENATOR FROM MINNESOTA**

Senator KLOBUCHAR. Well, thank you very much, Mr. Chairman, and thank you to you and Senator Thune for this important hearing.

As we consider major investments, and this could not be more timely, this hearing, in infrastructure, we want to make sure that our networks are, what we call, future proof and that they also, as the focus here today, are better able to respond to emergencies. And the bill that Representative Clyburn and I are leading would make major investments in broadband infrastructure.

Mr. Law, in your testimony, you highlighted the importance of capacity in broadband speeds, particularly for responding to emergencies. Can you elaborate on that about, particularly, for rural communities?

Mr. LAW. Thank you, Senator Klobuchar. Yes, I think one of the most important characteristics is not simply what is a network currently capable of delivering, but what is it able to capably deliver in the future, or in the event of a specific situation.

I will use the pandemic as an example, from Golden West's perspective. In the span of 90 days, from January 2020 to April 2020, Golden West's network usage, overall, increased 25 percent. Our upstream usage increased 40 percent in 90 days. Our network was able and capable of handling that type of capacity change, I will say, somewhat at a moment's notice. Ninety days, in a network operator's world, is indeed a moment's notice, with no warning.

So, I think it is absolutely critical that any future broadband funding that is discussed as part of an infrastructure bill or otherwise, begin the discussion about what type of network do we wish to have, what do we wish to accomplish with those networks—not just today, but tomorrow. Because if you only view the speed capabilities by the applications that you use today, it will be outdated by the time this money gets out the door.

I have been in this industry a number of years and I have watched policy discussions in the last 10 years go from 4 by 1 to 10 by 1 to 25 by 3, in the last 10 years. I will ask, you know, how

many times do we wish to have this discussion, as we talk about these types of investments?

Senator KLOBUCHAR. Yes, I think that is a good rate and yes and I think it is time for action.

Chief Johnson, Mr. Adelstein, good to see you again. The Next Generation 911 Bill that I have with Senator Cortez Masto, that would create a Federal grant program to help states and local communities upgrade their 911 infrastructure. And I actually got interested in this, in part, with interoperability issues and we had a—someone was killed, and the murderer was out, and they were trying to find them. And we had something like seven different systems that could not hook up, as police officers were frantically trying to find this perpetrator. And it was a memorable moment in our state. And this was in the metro area, much less what happens in the rural area.

Chief Johnson, in your testimony you emphasize the need to invest in the next-generation 911. As the former Vice Chair of FirstNet, what lessons can we learn from FirstNet? And then, I would ask you, Mr. Adelstein, a recent study found that 240 million 911 calls are made every year. Talk about upgrading 911. I will start with you, Chief Johnson.

Mr. JOHNSON. Thank you, Senator Klobuchar. Yes, it is true. All emergencies start at a public safety answering point and it is next-generation 911 that will drive the capability of those centers into the future. Unfortunately, we are a bit behind in that area.

So, public safety community would urge Congress to support the Next Generation 911 legislation and update these important centers. Again, that is where all emergencies start.

Senator KLOBUCHAR. Thank you.

Mr. ADELSTEIN. And I would agree. I think it is very important that we do invest in that. I am particularly concerned about states that divert E911 funding to non-E911 purposes, which is happening across the country. Those funds that are being raised for that purpose, should be used for that purpose.

When it comes to future proofing—I just want to go back to the earlier question, I mean, we have to be careful about investing in networks that only have one type of capability. For example, aerial fiber is particularly exposed to the elements. And what can happen, in the case of a fire or wind or storm or hurricane, even ice storms, those networks can go down. That is not future proof. You put all your eggs in the basket of one type of technology that is very exposed, and not have multiple technologies be allowed to be considered, I do not think you are going to have networks up and running when you need it.

When it comes to operational expenses that Mr. Law was talking about, if there is not enough customers, basically, to sustain that project going forward, and there is an ice storm, there is fiber cuts, in a fiber line that is going over long aerial distances, serving a very few number of customers, there is not the wherewithal to do that. And those networks will not be around for the long haul. They will not be there to provide decent service to customers. Or if they survive at all, they will not be there to provide service.

So, when it comes to future proofing, we better make sure that we are only giving funding to well-run organizations like Mr. Law's

in Golden West. And we better make sure that it is being distributed widely to a number of technologies that can be a sustainable network, with a multiplicity of options.

Senator KLOBUCHAR. Thank you. Mr. Feld, just one last question. You note that natural disasters accounted for 24 percent of outages. Our country has the second-highest number of natural disasters in the world. In your view, what key measures should we consider to ensure our networks are less vulnerable to the natural disaster outages? Mr. Feld?

Mr. FELD. We need to prioritize backup power, not merely onsite, which a number of folks have pointed out, but also, in people's homes. Communications is, in public safety and emergency, two-way now, not simply one-way. And so, we need to make sure that we have reliable backup power everywhere in the network.

We need to have more public information, so that consumers can choose the most reliable networks. Reward those companies that choose to invest in reliability. And ensure that policymakers have access to appropriate information, and develop standardized metrics, so that we can hold those carriers who are not investing sufficient resources in reliability accountable.

Senator KLOBUCHAR. Thank you very much.

Senator LUJÁN. Thank you, Senator Klobuchar. Senator Fischer, you are recognized for five minutes.

**STATEMENT OF HON. DEB FISCHER,
U.S. SENATOR FROM NEBRASKA**

Senator FISCHER. Thank you, Senator Luján. I appreciate the witnesses here today, as we discuss network resiliency.

Mr. Law, as you might know, the FCC updated its rules for recording for major network outages among the FCC states and Federal agencies in March. Information sharing is critical for managing threats to network infrastructure and restoring services. Do you feel that there is enough communication between the FCC and states to quickly respond to these network outages?

Mr. LAW. Thank you, Senator Fischer. I think there could be more that could be done, in terms of the, I will say, both the channels of the communication, as well as the substance of information as it relates to the NORS, Network Outage Reporting, as well as, potentially, the DIRS, Disaster Information Reporting System. I think there could be improvement. Do I think they are necessarily bad? No, but I am confident they could be improved to provide better visibility to states, as well as consumers.

Senator FISCHER. Thank you. For farmers and ranchers, having a fast broadband connection to their homes is important. But that may fall short when they cannot get access to those connections when they are on a tractor or working cattle, a mile or more from their house. It is essential that America's producers have reliable connectivity to control and power precision agriculture technologies.

Mr. Adelstein, is wireless or satellite broadband service more likely to provide our producers with high-speed Internet connections where they need it?

Mr. ADELSTEIN. Absolutely. I think, you know, when it comes to precision agriculture, it is required that the entire field be covered,

not just the farmhouse. So, if you limit funding only to fiber that goes to one location, you do not cover the entire field.

And you—not only do you lose the agricultural production advantages, but you lose the reduction in use of water. And right now, we are seeing vast droughts in the West. And they are really damaging, you know, the ecosystem for years to come. And the President's plan talks about trying to deal with this water crisis. Let us use the broadband funding to do that. The way you do that is by allowing coverage of the entire farm field, so that we can use precision agriculture to save water resources, especially at a time when we are seeing these droughts, and the disasters as a result, I think personally, of global warming. We need to address that.

And you know, if you just go to the farmhouse, and the farmer has to run back to the farmhouse, it does not do him any good when he is trying to control his use of water, he is trying to increase crop yields. Make that, I think, a priority in funding so that there is a reward for that. There might be a little bit more—

Senator FISCHER. Yes, you know, we have so many new great technologies, especially when it comes to water conservation through irrigation practices, where that can be monitored, but you have to have that connectivity to do it.

Mr. ADELSTEIN. That is right. There are sensors throughout the field and there is also algorithms they put in, in terms of where they need to have the water.

Senator FISCHER. And on irrigation systems, as well.

Mr. ADELSTEIN. Yes, absolutely. Irrigation systems are now being used with extensive data sensors that rely on wireless connectivity throughout the field.

Senator FISCHER. Right, thank you. I am going to zoom out a little bit here. But a fundamental consideration for our conversation here today is knowing the actual scope and reach of our fixed and mobile broadband networks. I know it gets mentioned a lot in this committee's hearings, but broadband mapping and ensuring the FCC uses the most accurate data available affects many of these related issues.

Mr. Law, could you touch on the importance of broadband mapping and the timing of updating those maps at the FCC, as it relates to building resilient networks, and beyond? Should we not have the most up to date, reliable information before we start putting money out there to deploy broadband?

Mr. LAW. I absolutely agree, Senator Fischer, that it is highly important that we know both where broadband services is available and what it is capable of? And more importantly, where is it not and where are the places that we need to fill in?

Maps are always an interesting exercise. They are a snapshot in time. It is hard to make them dynamic, however, I am hopeful that the FCC continues to improve its process to develop, generate, and deploy those maps. And as a small rural provider, we certainly have tried to do our part to provide the FCC with timely information to reflect that.

Senator FISCHER. Right. Thank you. We have seen many different suggestions for what the current definition of broadband should be updated to. We hear about 25 megabytes per second

download speeds is not enough for a family with high Internet usage and that demand is growing for upload speeds.

Mr. Law and Mr. Adelstein, from your perspective, what makes more sense for future broadband build out? And how do we ensure that areas that currently do not have access to broadband, meeting the FCC definition of 25/3, that they do not slip through the cracks, as we—as we move forward on that well intended pursuit in building out?

Mr. ADELSTEIN. Well, first, we certainly, you know, need to target unserved areas and under, you know, 25/3 would be a good place—would be a good place to start. Generally speaking, Congress does not set these standards and statutes. They leave it to the agencies. Because, as the Universal Service Law says, it is an evolving standard of technology. Today's gigabit speed is, you know, yesterday's telegraph.

We need to let the agencies continue to upgrade it, but right now, consumers are using 10 times more download than upload. And that is the way the entire system is networked. So, to go to asymmetrical speeds is something that is not often used. There might be a handful of customers that use it, but generally speaking, the average user does not get anywhere—anywhere near that.

So, to engineer an entire system, and basically, in the case of wireless, they cannot always reach that. So, if you do say that you need a symmetrical speed, you basically cut out wireless from the entire bill, in today's marketplace. And you have cut out the ability to deal with precision agriculture. You cut out the ability to deal with the global warming, that actually causes some of the issues that we are talking about. You are dealing with resiliency of wireless networks. All that is cut out and you are putting everything into one technology because it meets this speed.

Now, if people want to value those speeds, I think we could do that. You could make that a priority. Say we want higher upload; we want higher download. Just do not make it a gating factor, in law, that is set forever in this kind of cement that cannot be visited, that is inflexible, and suddenly find out, after you set that in law, that it cannot be revisited.

That is why, traditionally, this committee and this Congress, in the Telecommunications Act that Senator Markey helped to pioneer, set standards, like an evolving definition of telecommunications service, that allows the continued evolution. And some day it will be more than 100/100, but today, that would, I think, artificially move the networks toward one single solution that does not meet your other goals including, what you mentioned, precision agriculture.

Senator FISCHER. Thank you. My time is up. Mr. Law, if you would like to answer that for the record, I would appreciate it. Thank you.

Mr. LAW. Thank you, Senator Fischer.

Senator LUJÁN. Senator Fischer and Mr. Markey—Senator Markey, you are recognized for 5 minutes, sir.

**STATEMENT OF HON. EDWARD MARKEY,
U.S. SENATOR FROM MASSACHUSETTS**

Senator MARKEY. Thank you, Mr. Chairman, very much. So, as we assemble the broadband components of the next infrastructure bill, I believe that we must address issues at the intersection of climate change and telecommunications policy.

Scientists have projected that sea level rise will submerge more than 4,000 miles of fiber optic cables within the next 15 years. Increasing extreme weather events, like hurricanes and wildfires also raise the likelihood of severe outages in our communications networks. And at the same time, studies estimate that our digital technologies and the Internet account for nearly 4 percent of global greenhouse gas emissions, a number that is only expected to rise as broadband adoption continues to grow.

So, it is crystal clear that climate change is a threat to our networks, while our communications infrastructure is, itself, fueling this ever-growing crisis. So, that is why Senator Wyden and I have introduced legislation to tackle both ends of the problem, the Generating Resilient and Energy Efficient Network Communications Act, or the GREEN Communications Act. Our legislation will create a new \$5 billion program at the NTIA, which will fund projects to increase network resiliency, as well as initiatives to reduce the environmental footprint of communications technologies.

Mr. Adelstein, do you agree that we need to invest in both network resiliency and carbon reducing technologies, as part of any broadband infrastructure package?

Mr. ADELSTEIN. Absolutely. I think, you know, our industry has certainly stepped up to deal with and reduce the carbon footprint of every one of our—my major members. You know, you look at our own footprint and what we have done to reduce it, and I can put in for the record those numbers, which are impressive. But I think the bigger picture is that Internet enabled solutions can reduce greenhouse gas emissions by 16.5 percent, according to independent experts. That is one-third of the way, by 2030, to the goal of 50 percent that we are shooting for. This is an enormous contribution. I do not know of any other technology that is more important.

And 5G, of all the technologies, is the most important of those to get us to that goal. Because smart transportation—the biggest problem with emissions is transportation and smart cars and autonomous vehicles can contribute dramatically by 40–90 percent reduced emissions. So, if we get 5G into this bill, you have got, suddenly, the ability to reduce greenhouse gas emissions enormously. But if we limit it to one type of technology—and all telecom does help—but mobility is the most important because you have sensors in factories, you have the water we talked about.

I mean, we are willing to do more than just reduce the footprint within our own industry, we are in a position, as an industry, to contribute to the reduction of greenhouse gas emissions in a dramatic fashion. But if you take the \$65 billion—we all read the same articles in the paper where we see there is pressure on the funding for climate change. Here you have got \$65 billion, potentially, you want to target every one of those dollars to try to maximize the reduction in greenhouse gas emissions.

So, why not make it eligible to all technologies and let the agencies rate them? Say, which one of these—which one of these projects that you are proposing does the most to reduce greenhouse gas emissions? And the wireless industry thinks we will be first in line, but we will see. Let the agencies decide. We think our technology can do more to save the planet than almost any other technology, besides renewable energy.

Senator MARKEY. Love it. Mr. Feld, I would like to ask you two questions, if I could. One is just following up on Mr. Adelstein, it is explaining why, in addition to robust funding, we also need strong resiliency rules on the books, to require better preparedness before and after the inevitable disasters strike us.

But also, if you would, just ruminate for a second, as well, on municipalities and this broadband industry march to state to state to prohibit municipalities from even deploying broadbands. What would you recommend that we do, in both of those areas?

Mr. FELD. Well, we need this to be a fully integrated and fully coordinated at every level of government. I have recommended, in my testimony, that the Federal legislation preempt these State laws and not simply in the case of building out municipal networks, which are critical, but also that networks can—State and local government, as well as the Federal Government, can make assets available in time of emergency, as backup.

There is often time, plenty of fiber in the ground to provide backhaul, or plenty of spectrum that is going fallow, that is held by Federal agencies or by State and local governments, and they should be encouraged to put those to productive use, particularly in times of crisis.

Senator MARKEY. Are we in a paradoxical situation where many of these municipalities might have acted themselves and there is a State law that the broadband companies have that prohibit them from acting on their own? And now, we are passing Federal legislation to provide funding that the broadband companies want to use in order to go in to solve a problem that the municipalities were saying they were willing to solve in the first place?

Mr. FELD. Yes. This is a—it rates four out of five Morrisette's on the irony scale, as I like to say.

[Laughter.]

Mr. FELD. The local governments are closest to their citizens. They often have a much greater awareness of what the particular risks are, in the community. In addition, we have problems of communities that have traditionally been marginalized or underfunded, such as on Tribal lands, or in communities of color. These communities are uniquely situated to contribute and yet, in many states, they are prohibited from doing so. This is now trying to take on a problem where we need to focus everything in saying, well, instead, why do we not put a bucket of cement on your right foot and tie your hand behind your back, and now go out and fix the problem. But give the money to the people who put the cement on your foot and tied your hand behind your back.

Senator MARKEY. Oh, you are definitely winning the metaphor contest today in the Commerce Committee. But I love each one of them because they are accurate, in terms of where we are. And I guess, all I would say is, if you can in 10 seconds say, do you be-

lieve we need strong rules on resiliency, to make sure that it gets done?

Mr. FELD. We absolutely need rules on resiliency. It is not going to happen on its own, and we have 10 years of evidence—20 years of evidence now to prove it.

Senator MARKEY. Beautiful, thank you.

Senator LUJÁN. Thank you so much, Senator Markey. Senator Moran, you are recognized for 5 minutes.

**STATEMENT OF HON. JERRY MORAN,
U.S. SENATOR FROM KANSAS**

Senator MORAN. Chairman, thank you. Let me begin with, thank you all for being here. And then, let me begin with Commissioner Adelstein. I am part of this group working on infrastructure. One of the common denominators, even though we have had a debate as to what infrastructure—how it should be defined—one of the things that has been defined, from every iteration of this infrastructure plan, or plans that I have seen, is broadband. So, it has won the hearts, minds, and souls of Members of Congress and the public. We recognize its importance. And should we pass a bipartisan, or—infrastructure plan, I think that it, or whatever might come from infrastructure, will include broadband.

So, what does that mean? The number, generally, has been \$65 billion that is in nearly every plan. And what is your advice on how best that money should be spent? And let me give you this caveat. It seems to me that we elected officials, have the habit of creating a new program every time we decide we want to provide better services in broadband for our constituents. And then, I struggle to explain what the programs are that are available at the FCC, or the Department of Agricultural Rural Utility Services.

What is it that we could do, perhaps even with an existing program, that would provide the depth and speed and the coverage that we are looking for, across the country, in regard to broadband?

Mr. ADELSTEIN. Well, it is a great question. It is not really one size fits all solution. I mean, you need to give the broad guidance to the agencies as to what you want. You know, if speed is a factor, you make that a priority factor. If you want resiliency, you want these networks to be up, make sure that you put that in.

We talk about regulations, etc. You have got the biggest carrot here, to feed resilience that you have ever had, if you are talking about \$65 billion. Make sure those networks say that they can be up and running. But do not just pick one technology or come up with some standard that is a gating factor, that just says one technology, that may or may not be more resilient. If you want resilience, let the agencies decide, you know, which applications come in the door.

You know, what I learned at RUS is, you cannot really decide who is going to apply or who is going to offer to provide service. You never know who is going to come in the door. And if you have, you know, hurricanes and—I am sorry, tornadoes in your part of the country that would wipe out aerial fiber and leave everybody with no service, I would kind of wonder, why did Congress only pay for, you know, aerial fiber in my district, when we could have had, you know, a wireless network that we would have had to replace

one spot? We would replace the tower, get the power there, and we would have everybody covered, as opposed to having to go back and clean up all of the many fiber lines that got wiped out by a tornado.

I mean, so, if that is a factor, make that a factor. But give some flexibility to the agencies to follow the goals of Congress. Today we are talking about resilience. We are talking about redundancy. But other goals that you have include precision agriculture, of course, we talked about before today. Mobility—rural customers want mobility more than anything else. And if you do not make that a factor that rewards it, you say, we are only going to do some gating factor that precludes wireless and fixed wireless, we will never get mobility.

Senator MORAN. Are there programs that exist today, at any Federal agency, that we could add the resources to, without creating a new program?

Mr. ADELSTEIN. Well, the Rural Utility Service runs an outstanding program. You know, NTIA has done things, never on this scale before. The Federal Communications Commission ran the RDOF and has reverse auction mechanisms in place that could be used. Those are the three existing mechanisms. None of them have dealt with funding on this level. So, you have a bit of a challenge there.

I think it is very important to give the agencies administrative funding, frankly, to be able to really kick the tires of these proposals. You know, you have got to make sure that they are there for the long haul. We talked about future proofing. Make sure you do not give money to programs that will not be around for years to come. Like, Denny will be there, but you give it to some new company that is a startup, it will not be around to provide service.

Senator MORAN. That is good point about the personnel and resources to manage the program. I am also an appropriator for both the Department of Agriculture and the FCC. The \$65 billion may need to include some capabilities of those agencies to manage the program. I appreciate that.

Mr. LAW, anything that I ought to know, in regard to, like, the practical application? If we wanted to improve broadband, is there something that stands out to you that is most in need of attention? I know today's hearing is on resiliency, but I give you the license to talk beyond that.

Mr. LAW. Thank you, Senator Moran. I will say a couple of things. One is, while I agree with my colleague that the—that the technology that deploys has to have certain capabilities, I would caution Congress against setting the bar too low. It is easy to give talk about applications that are in use today, when you are talking about a generational investment, quite frankly. And I would not want to focus on the applications that any of us may use in our home today as those of the applications tomorrow. Because 3 years ago, there are applications we were not using then that we are using now. And that is just getting more rapid, not less.

The second part it is, resiliency and redundancy, I think, is a great topic. I thoroughly enjoy talking about it. It is not cheap. And so, do you want the cheapest network? Do you want the best net-

work? Or do you want something in between? And I think there is a possibility for both Congress, as well as the Agency, to define those items. But I will caution you, you cannot have both. You cannot ask for the cheapest network, but it has to be the most resilient, the most redundant, and perform in all capabilities because that will not be the cheapest network, and understandably so. Occasionally, that has been lost in earlier programs.

And I would advocate, Senator, that from my perspective, the FCC is, indeed, the best agency to administer some type of significant broadband funding program.

Senator MORAN. I felt that way when there were two Kansans on the commission. Less so today.

[Laughing.]

Senator MORAN. I do not what the clock says, but I will try one more question. I will ask you it, Mr. Law. You mentioned in your testimony, the ongoing support for Universal Service. It is important to resiliency and rural broadband, I think, was your testimony. Why is the stability of USF important for small, rural broadband providers and their consumers, particularly when it comes to the resiliency of the network?

Mr. LAW. So, when you look at what companies, such as Golden West, or those in Kansas—a Nex-Tech or a Pioneer or some of the other quality providers in Kansas, Universal Service Funding has been foundational for the platform and the network topologies that they have built. And they have built reliable networks and they have built quality networks that scale. We all have to operate those over long periods of time with low customer numbers and low density and the sustainability, which is key for Universal Service Funding.

The sustainability of a company like a Golden West or a Pioneer being available to offer those services in 2021, 2031, or 2041—it is great to talk about \$65 billion investment in broadband. But I will tell you, from my perspective, the Universal Service Fund will be the underpinning that will allow Golden West to be able to continue to provide whatever technologies are necessary in those years.

Senator MORAN. I assume you could have a caveat, if we make the Universal Service Fund more stable.

Mr. LAW. Thank you for that. I wish I had added that myself and concur entirely.

Senator MORAN. Thank you. Thank you, Chairman.

Senator LUJÁN. Thank you, Senator Moran. Senator Peters, you are recognized for 5 minutes.

**STATEMENT OF HON. GARY PETERS,
U.S. SENATOR FROM MICHIGAN**

Senator PETERS. Thank you, Mr. Chairman. And to our witnesses, thank you for your testimony here today.

I am—I serve as Chairman of the Homeland Security Committee, here in the Senate and I am certainly focused every day on ensuring that America's critical infrastructure is resilient to attacks, as well as national disasters.

At DHS, the Office of Infrastructure Protection's Infrastructure, Development, and Recovery, IDR Program, works, with both Fed-

eral, State, local, Tribal, and territorial governmental officials, and infrastructure owners and operators, to plan, design, implement solutions that are going to enhance security and resilience of critical infrastructure against the whole gambit of threats that they face.

Mr. Feld, my question is for you. What are the ways the Federal Government can better coordinate recovery of telecommunication networks, during outages caused by either a natural disaster and also, improve network resilience against other types of attacks against this critical infrastructure?

Mr. FELD. It is critically important that we clarify and expand the role of the Federal Communications Commission, in terms of priority in restoring communications when it is down. Our—the GAO report that I mentioned in my testimony, shows that there is a tremendous amount of confusion about the right role of the FCC that needs to be clarified. There needs to be greater coordination, particularly between energy providers, the power companies, and the telecommunications providers, which can only be provided by leadership at the Federal level.

With regard to cybersecurity, we have to get the FCC off the bench. We are talking about the agency that supervises the physical infrastructure of the Internet and it has, essentially, been benched for the last 4 years, on cybersecurity. The FCC is in the best position to monitor network providers, to ensure that they are taking appropriate precautions, to, as license conditions require that they show that they are taking cybersecurity responsible and seriously. And without the FCC involved, we have a giant and exploitable hole in our Federal response to cybersecurity threats.

Senator PETERS. Well, you mentioned several items. Are there some priorities that just jump right out at you, in terms of the FCC's oversight?

Mr. FELD. Well, one of the key issues is the FCC's overall authority, which is in jeopardy at the moment, because of the failure to classify voiceover IP as a Title II service, and the classification of broadband as a Title II service. We are on track to see the FCC's oversight of wireline communications in this country completely disappear within the next five to 10 years, as traditional copper networks are retired. That needs to be corrected.

Senator PETERS. Again, Mr. Feld, participation in the Disaster Information Reporting System, as you know, is voluntary for providers. It only collects data about outages at certain times and certain criteria that have to be met. The Network Outage Reporting System only requires reporting of longer outages, impacting a certain number of people, as well. And while participation in NORS is mandatory for voice providers, it is not mandatory for broadband providers. Plus, the information is not available to the public.

My question to you is, how can regular collection of data, about a broader array of both sunny day and disaster outages prevent future outages? And what should we do, in Congress, to ensure the FCC is getting consistent, reliable data for all outages?

Mr. FELD. Well, the FCC must be provided with appropriate data to make important decisions and policymakers need information about frequency of outages, where these outages are occurring, what factors are going into these. The single most important thing that Congress can do, is to provide clear authority for the FCC, to

mandate the collection of this information, and funding to allow the FCC and carriers to provide this information.

We can imbed, in every network, automatic outage reporting requirements. We can replicate what the FCC has done on speed testing, with regard to reliability testing, where we have carriers place the devices and software within their network, so that the FCC can track these things while respecting trade secrets and privacy. This does not have to be hard. And it does not have to impose significant long-term burdens, if we do this properly and fund it properly, so that we can deploy it now, when we need it.

Senator PETERS. And I say, sunny time outages, too. I have complaints I hear from constituents that their broadband is out consistently. Not for—it may not fit any of the criteria that I mentioned here, but it is a persistent problem and clearly, the resilience is not in the network. You think what you are discussing would help us address that? Or should we do even more?

Mr. FELD. Well, I think what I am suggesting is a good first step. And it is important to recognize that repeated short outages can be as crippling as a long-term outage. The network must be reliable. It means that I have to be able—if I am saying we are going to do distance education, then that has to work for the school day. It cannot be something that works, kind of-sort of, during the school day and tomorrow it might not work, or it might work in the morning, but I might have to—there are just too many problems going on in our networks.

We need—but the critical need, right now, is to establish the authority of the FCC to act, to mandate that the FCC act, and to provide the means to collect all this information. Because right now, we do not even have the metrics to say what is a reliable network. But I am also confident, as a consumer and as somebody who talks to consumers, that if we made information available, that consumers could trust, as to which networks were the most reliable, that network would be rewarded for its investment. But we must make that information available.

Senator PETERS. Thank you. Thank you, Mr. Chairman.

Senator LUJÁN. Thank you, Senator Peters. Senator Blackburn, you are recognized for 5 minutes.

**STATEMENT OF HON. MARSHA BLACKBURN,
U.S. SENATOR FROM TENNESSEE**

Senator BLACKBURN. Thank you so much, Mr. Chairman. And do our witnesses, we appreciate you all being with us.

I represent Tennessee and in 2020, Tennesseans really came to appreciate the resiliency of their networks. In 2020, we had tornadoes, we had storms, we had floods, we had other natural disasters, and then, on Christmas Day, we had the bombing—a car bomb was detonated outside the AT&T downtown building in Nashville. And that is where the switching capabilities for much of the Southeast is located. And at that point, we had people in several states who were affected by that Christmas Day bombing.

And during my work here in Congress, whether in the House or here in the Senate, working on broadband infrastructure resiliency is something that has taken a good bit of my efforts. And we have the Internet Exchange Act, which recently passed the Senate as

part of a larger package and will help in building these resilient and redundant networks. And right now, in Tennessee, what we know is that we have 400,000 Tennesseans that are living in a census block that has no provider for service that hits that 25/3 mark. And the average cost of streaming that fiber is \$30,000–40,000 per mile. And then, to trench that fiber, it is \$50,000–70,000 per mile. So, the costs add up quickly.

Tennesseans realize this and they are very concerned. We have heard from some of our—our Tennesseans about Congress considering this 100 by 100 standard for broadband, when they really have not been able to get the 25/3 FCC minimum.

So, Mr. Law, I would like for you to talk about what this would do. If you had the 100/100 standard, what that would do to rural communities that are still trying to get the 25/3?

Mr. LAW. Thank you, Senator Blackburn, for your question. I totally agree that, in terms of broadband availability and capability, the focus of any infrastructure program has to begin with focusing those dollars, targeted on those who do not have service today.

And if the standard is, indeed, 100 megs symmetrical, that does not mean that somebody who has 75 meg or 100 by 10, or some other thing, has, you know, insufficient broadband. They may have adequate broadband. But I think any funding program would need to begin—let us begin with the hardest first. And the ones you just described, in Tennessee, I think would meet my definition of what is the hardest first.

Then, the second part is, to make it available. The second part is, what are the capabilities that we want to have associated with that, along with both the affordability, and then, finally, the sustainability. So, it would really be, kind of, a four-part process—availability, capability, affordability, and sustainability. But I would propose you begin with how do you solve for the 25/3 customers first.

Senator BLACKBURN. Thank you for that. Mr. Adelstein, let me ask you this. And this is an area we have talked about in the past. Should we stay technologically neutral when we are distributing broadband funding and looking at broadband access?

Mr. ADELSTEIN. Well, absolutely. I think, you know, your point, fiber costs 10 times more than wireless to deploy, according to the Carmel Group's study that I have seen. Capital outlays, per individual, are much, much higher. And you actually may not get the service that you ultimately want. I mean, you have got a lot of resiliency issues that could come with, particularly, aerial fiber and, as you mentioned, it is much more expensive if you bury it. And Denny was mentioning the—it gets more expensive the more resilient it is.

The beauty of not doing 100/100 but being technologically neutral is that you can then pick more resilient technologies that might actually be less expensive in this case. Because instead of having to restore service at \$30,000 a mile to \$60,000 a mile, you only have to restore service to one site—to a tower, to a water tower, wherever the facility might be. Get the back haul to that. Get the power to that, when the power goes down.

If you have a fiber network that you spent all this money on, all of a sudden, there is no power. Nobody can get broadband in their

home, because those require—fiber to the home requires power in the house. Getting power to the tower, getting power to the wireless transmission facility is a lot easier to do. So, not only is it more expensive to put in, but if you ever have a problem, you have got to restore it, it is more expensive to restore, and where is the money going to come to pay for that, once Congress has opened up its wallet for this enormous amount, on a non-resilient network, potentially?

So, when you are spending these money—these moneys, make sure you target the most efficient technologies, ones that are the most resilient. You can reward these things. Now, getting higher upload speeds is wonderful. Make that a priority, too. But do not make that a gating factor, where you cut out all other technologies. You cut out fixed wireless, you cut out mobile wireless, you cut out other options that can do it cheaper, that can actually do it better, and that can be more resilient. That is why Congress, traditionally, has always been technologically flexible and has not set standards and statute that lock it down.

Admirable though the standard might be, whatever—you know, 100/100 is what we all want. Someday that is going to be very low, even for wireless networks. But today, you could end up using those fundings—those funds to architect a network that is not what you had in mind. And in fact, you will not reach many unserved customers because you spent so much on inefficient, expensive technology that, in the end, you do not get everywhere you need to go.

Senator BLACKBURN. Thank you. Thanks, Mr. Chairman.

Senator LUJÁN. Thank you so much, Senator Blackburn. Senator Rosen, you are recognized for five minutes.

**STATEMENT OF HON. JACKY ROSEN,
U.S. SENATOR FROM NEVADA**

Senator ROSEN. Thank you, Chairman Luján, really appreciate you holding this important hearing. Witnesses, I really appreciate you being here.

I just want to say a little something, building on what Senator Peters said about—and everyone is talking about network resilience. But I just want to add my few cents about wildfires and network resilience to address wildfires. As the Chair knows all too well, wildfires, unfortunately, have become an ever-present threat to the Southwest. And 95 percent of the West Coast is under extreme drought, all across California, Oregon, Nevada, New Mexico, Arizona. Lake Mead, in Nevada, has hit its lowest water level on record last week, since the inception, I believe, of the dam. Forty-six percent of my state are living in elevated risk of wildfires.

So, it is imperative that communities, in my state, all across the West, but really, all across the country, have access to reliable and resilient communications network. I am not going to go on about that because other witnesses have, but I just wanted to put that out there. Resilience is really, really important.

But I would like to talk a little bit about, what we are calling, the middle mile. In some of the most rural and underserved parts of Nevada and across the country, the lack of basic fiber infrastructure remains a barrier to bringing broadband service to many

homes and businesses. Small Internet providers, in particular, often lack resources to invest in extensive networks. But by partnering with middle mile network providers, it can reduce their capital expenditures that often serve as a barrier to rural deployment.

And so, Mr. Adelstein, how does the lack of middle mile infrastructure hinder the ability of ISPs, particularly in rural areas, to provide sufficient broadband service by either wireline, wireless, or both? And what do you think Congress can do to fill in the middle mile gap?

Mr. ADELSTEIN. It is a great question. Getting fiber deeper in the network is essential to meet the needs of people in Nevada and every other rural city in the country. The question is where do you terminate that? Do you take it all the way to the home? Or do you take it to an antenna? And sometimes, it is appropriate to take it to the home. Denny Law, in his territory, is somebody I would trust to do that. He has already built a very strong foundation and he just needs to finish out some exchanges that are not fiber to the home, yet.

You might have areas of Nevada where, if you can get close to those end users, they are very widely dispersed once you get to the end of that line. So, you get the middle mile out there. And it may be that you want to take fiber to the end user, but you may want to use a wireless solution that will get out to those hard-to-reach Nevadans and get to them much cheaper and get to them much quicker.

I mean, I know that people in Nevada need broadband now. It could take years to get fiber networks built out to the very farthest reaches, or you can put up a single tower, or co-locate on an existing tower, and almost, you know, within 6 months get service to an entire area. Whereas, one estimate is, it could take 10 years to even get to 90 percent fiber penetration in the United States.

Senator ROSEN. Wow, thank you. I want to talk a—ask Mr. Feld, too, a little bit more about the middle mile. Because, as we have discussed, smaller ISPs, they lack the capital expenditure to expand their footprint to high-cost areas, to meet the needs of rural communities—maybe even underserved communities. But in order to make it feasible for these smaller ISPs to deliver broadband service to underserved communities, should we consider, here in Congress, ensuring middle mile infrastructure as eligible for Federal resources, especially when partnered with an ISP that is committed to providing the middle mile and helping potentiate for those last mile connections?

Mr. FELD. Middle mile is absolutely critical to rural America. It is absolutely critical to the deployment of 5G. I would highly recommend making these available for—eligible for grants, particularly if we are talking about open infrastructure, where we have public dollars go to pay to lay down fiber that will be open to multiple competitors, so that we can get the biggest bang for the buck.

I have heard some people denigrate the BTOP program from 10 years ago. But one of the most important things it did was to fund middle mile in a number of rural areas. In Maine, they, in particular, have something called the Three Ring Binder Fiber Backbone, which is, even now, paying dividends to rural communities in

Maine. We can do this here, as part of build out and, indeed, we must, if we want to make sure that rural America has access to high-speed, reliable broadband.

Senator ROSEN. Thank you. I really appreciate everyone being here today and I look forward to having a little bit more robust discussion on middle mile access. Thank you, Mr. Chair.

Senator LUJÁN. Thank you, Senator Rosen. Senator Capito, you are recognized for 5 minutes.

**STATEMENT OF HON. SHELLEY MOORE CAPITO,
U.S. SENATOR FROM WEST VIRGINIA**

Senator CAPITO. Thank you, Mr. Chairman. And thank you, gentlemen, for being here today. I am from West Virginia. We have some of the lowest broadband deployment in the country, unfortunately. We also are subject to flooding, flash flooding in particular. And actually, I think about today on a day—tomorrow will be the 5-year anniversary of a very devastating flood we had in Southern and, sort of, middle West Virginia.

But I wanted to ask Chief Johnson this question about FirstNet. I was able to go to Kingwood, West Virginia, where we dedicated a FirstNet facility and tower sites, built in West Virginia. But in your testimony, you mentioned that, for resiliency, the importance of backup power generators. So, is that a—is that a frequent thing for first responders in the Western part of the United States, where people have backup generators for first response, to keep their systems up and running?

Mr. JOHNSON. Thank you—excuse me. Thank you, Senator. It is a frequent issue in the West. It has been exacerbated by public safety power shutoffs, which are deenergizing the electrical grid, to avoid starting fires. So, when you take down the power grid, intentionally, to avoid starting a fire, it is only a matter of time until the towers, the facilities, etc., their backup power expires.

So, that is why we are working with the California Fire Chiefs Association, etc., to work with the State legislature to speed the process by which we get permits and get backup power generation to these towers. That is what maintains our wireless connectivity.

Senator CAPITO. Thank you. That reminds me, and you brought this up about the permitting. I know that some of these—well, I look at permitting major lines in West Virginia. You have to go under streams, or you try to get the right of way, or you want to work with the power company.

I do not know, Mr. Law, if you have the same kind of issue in your home. What could we do to speed up the permitting? Because it is time and money. We are going to have the money. We just need to make sure we shorten the time to get to those last places.

Mr. LAW. Thank you, Senator Capito. I have two suggestions, I think, that could be implemented relatively simply. There were recommendations from the FCC's BDAC committee, Broadband Deployment Advisor Committee, which Mr. Adelstein was involved in, that had some excellent recommendations to streamline the application process for crossing Federal lands, particularly, which I know was also an issue in West Virginia.

Senator CAPITO. Poor—poor service, yes.

Mr. LAW. Yep. Any—for us—for Golden West, my organization, for our service, BLM, just a whole—national parks, all sorts of things. Again, I do not think it is anything that the Federal agencies are doing intentionally, but obviously, their primary jobs are not to manage the rights of way on their—on their lands.

Senator CAPITO. Right.

Mr. LAW. However, once you make an application for right of way, I will tell you it is a deep dark whole, it feels like, that goes in and you do not see it come to light until 2 years later. And you have no visibility into the part of the process and that has to be changed. That is one suggestion.

The second suggestion is, you need to be cognizant of environmental and all of those items. So, I am not suggesting otherwise. However, when you are in particularly road right of way, that has been disturbed, they use that to build the road, yet still being required to do all, and then some, of the environmental reviews, when you are in the road right of way. It seems a little bit redundant to me.

I understand if I am going cross country across, what I would term to be, virgin territory. There should be environmental reviews. There should be a higher standard set for that. But when I am in a disturbed road right of way, some of the permitting and application processes for that—which is our—I will say our main trunking and backbone lines—that has to be speeded up and I would think we could do that.

Senator CAPITO. Yes, and we are trying to build that into the Surface Transportation Act. I know a lot of states have tried to do that, that dig once prospect, and I think that makes a whole lot of sense.

Mr. Adelstein, let me ask you a question. You mentioned BTOP—or not BTOP. You mentioned RDOF and Rural USDA and Department of Commerce. We have ARC in West Virginia, Appalachian Regional Commission, which has a broadband component to it. What we are finding is, for instance, if we have auctioned off the census track in the rural auction, but it may be surrounded by something that the ARC is going to work, and you have to go through one to get to the other. These agencies just fight one another, rather than try to work with one another. Let us just say the ARC could build it quicker, could the FCC work with them to make that happen, why does that not happen? It makes too—does it make too much sense?

Mr. ADELSTEIN. Well, you know, when I was running Rural Utility Service, we used to get called to the White House—I told a story earlier about Vice President Biden calling me in to try and coordinate and make sure the agencies were working together. What I really learned, from the perspective of somebody who is on the receiving end of applications, people saying, I want to serve your area. What is really important, I think, in West Virginia, in particular, is that we did not get to choose who came in and applied. We did not say, we want fiber here. We want wireless there. It depended on who came in the door.

Senator CAPITO. Right.

Mr. ADELSTEIN. And when you are in a state like yours—and I worked with your predecessor, Senator Rockefeller and Senator

Byrd on this—you know, we—you do not have really a great history. You have really pretty, you know, second-rate infrastructure in some ways, because of the history. Nothing to do with the senators, nothing to do with the providers. It is just that they did not have the rural co-ops that, for years, were getting RUS funding, USF funding. And so, when you are thinking, in West Virginia, about who is going to come in the door to serve us, it is—you cannot get some company just—that is newer, that does not have good infrastructure nearby, that is going to come in and do it. You have got to give flexibility, I think, to the agencies that you are giving it to.

Make sure they are coordinated. Maybe, put in place in the statute, actually, if you are to go to more than one—and you can decide if they put it all through RDOF or something else—but have a coordinating function, within the law itself so that they are required to coordinate. But then, watch out, because you have got to make sure that whoever comes in the door is in a position to actually serve West Virginia, and kick the tires of what comes through.

Senator CAPITO. Well, I have got a real problem with one of the providers that is going to walk out with several hundred million dollars in the RDOF, in the State of West Virginia. And they have a terrible track record. They have not lived up to their obligations in the past. And yet—and yet, they were awarded—they are still in Process 2. Now, they did not get all of it, but they got a big bunch of it. And my understanding is, if they do not move forward, well, in 5 years, the only thing they have to do is pay a fine. And then, you have got 5 years of people who are not served, or underserved, and—well, you can tell. Very frustrating with me.

Last question, Mr. Law. One of the things the Administration, I think, wants to do with the funding—and you mentioned that you thought the FCC was the best place for the increased funding—they are really high on municipal networks. We have had a couple municipalities in our state that have tried them. A couple that have failed. But could you talk about municipal networks and, you know, without disparaging a municipality?

Mr. LAW. Sure. And—and I would say, in general terms—and I would stress that my comments are in general terms—I do not necessarily think municipal networks are the preferred method for delivering broadband. And there are a couple of reasons for that. I do not think there is a great track record of success of governmental entities, whether they be communities or otherwise, competing with a private business. Even if that private business is lousy, for lack of a better word, communities competing, governmental entities competing is historically not beneficial. That is item one.

The second item is, you are still going to have a large number of constituents that are haves and have nots. Because whatever governmental entity you pick—so, let us pick towns municipalities. That border of that municipality ends somewhere. Or, if you want to go counties, that county boundary ends somewhere. Or go beyond that to whatever district you wish, I guarantee you there will be a broadband subscriber 30 feet the other side of that boundary that says, I do not have service.

And so, for those reasons—again, in general terms—I do not—Do I think there should be laws banning it? Not necessarily. But at the same time, do I think that the funding should be specifically directed toward municipalities? No.

Senator CAPITO. Yes, and I have a question, too, on the ability to maintain. They may be able to stand them up and they may be able to get them moving, but you are talking about over a long period of time, to have the expertise and the longevity to be able to maintain and adapt to the technology. Thank you.

Senator LUJÁN. Thank you, Senator Capito. We have Senator Young. Senator Young, you are recognized for your 5 minutes.

**STATEMENT OF HON. TODD YOUNG,
U.S. SENATOR FROM INDIANA**

Senator YOUNG. Thank you, Mr. Chairman. This—I am going to direct several questions to Mr. Adelstein. And I thank you for your appearance here today.

Sir, I believe we need an all-of-the-above technology approach to close the digital divide. No single technology is, by my lights, going to be the right solution for every household's needs. There is a role to be played by multiple proven technologies, including fixed, mobile, satellite, wired, wireless, licensed, unlicensed, and others, to deliver connectivity throughout America's vast geography and diverse economy.

Mr. Adelstein, in your testimony you talk about the importance of technological flexibility for resilient broadband networks. Can you tell us, why is technological flexibility so important? And what role does technological flexibility play in ensuring resilient networks?

Mr. ADELSTEIN. Great question. You know, technological flexibility is important because—you know, one-size-fits-all is an over-used term, but what I was just saying to the Senator was that you do not know what is going to come in the door. It depends on the particular geography. It depends on the history of network investment in that particular geography.

Sometimes, like in Denny's territory, fiber to his remaining exchanges makes perfect sense and it goes right to the end user. But another area that does not have that fiber that he has built, and he does not have a provider that comes in the door with a solid balance sheet, like he has, cannot be able to provide that and stay in business because it is not a very profitable area. There is a reason these areas are unserved.

So, you want to find solid applicants and Congress does not get to pick them. Ultimately, it has got to be whatever comes in the door it is going to be—businesses decide they can serve that area. Let the best technology win that meets a number of concerns that Congress has.

If you have a gating criteria, for example symmetrical speed service, then you are taking one priority, whether you think it is important or not, or the upload speed, and saying that is more important than mobility. You are saying upload speed is more important than getting consumers broadband quickly. Sometimes wireless can be deployed much more quickly.

And you asked about resiliency. When it comes to resiliency, if you are talking about only fiber networks, they can be very exposed to damage and they require power in the home to work. Whereas, a fiber system, could more quickly be restored because you only have to get power to the transmission site and you only have to get back haul to that versus getting fiber back up to, literally, you know, thousands and thousands of homes that may be wiped out, and hundreds of fiber cuts. So, you know—but in some places, that actually might make more sense.

Particularly, in terms of resiliency, it is not even one-size-fits-all within a category. Denny was talking about buried fiber versus aerial. Buried is more resilient, but it is a lot more expensive. So, you know, that is a tradeoff. And if you sit here and——

Senator YOUNG. So, this——

Mr. ADELSTEIN. Go ahead.

Senator YOUNG. I am sorry, sir. So, in short, or in summary, this all-of-the-above approach that gives you technological flexibility, you might call it, there is a straight line from that approach to enticing your private carriers and your not for profits and others into service provision and in closing the digital divide. Is that accurate?

Mr. ADELSTEIN. Yes, if you—yes, it is exactly right. Because if you pick one technology, you are not going to close the digital divide, because you are not necessarily going to find a provider of that technology that is in a good position to serve that area. Depending on the nature of that area, whether it is mountainous, whether it is flat, whether they had invested in fiber, whether they have not yet, whether there is a nice tower there, whether there is not.

Senator YOUNG. Yes.

Mr. ADELSTEIN. I mean, you cannot, as a Congress, say we are going to pick one standard and nobody gets in unless you can do big, fat upload speeds. And that only allows one technology and, by the way, not many people actually use upload speeds. But guess what? They all use mobility. They want resiliency. They want those networks to be there.

Senator YOUNG. Yes.

Mr. ADELSTEIN. Why do you not let the agencies have the flexibility to consider other factors, besides just upload speed and cutting out everybody that cannot do certain upload speeds?

Senator YOUNG. I can tell this is an area of passion for you. And it is a really important area, as we contemplate how to best use taxpayer dollars, and in closing the digital divide. So, thank you for that answer.

I am going to ask you another question. One of my areas of focus is ensuring that the United States is positioned to lead the world in innovation and the development of new technologies. As we think about advancing our international competitiveness and leading the world in wireless innovation, does it concern you that neither the Administration's budget blueprint, nor its broadband plan seem to speak at all to the need to win the race to deploy 5G?

Mr. ADELSTEIN. I would like to see it mentioned. You know, all the objectives of the President's American Jobs Plan requires 5G and relies on 5G. From water to advanced manufacturing to, of course, the broadband, but the jobs—we are talking about creating

4.5 million jobs with 5G, which is more than the entire American Jobs Plan. I think it might make sense that it should be included, since the green future that the President is committed to, really is going to rely on mobile connectivity. Smart transportation, which is the big focus, electric vehicles, reducing emissions all require 5G, all of them.

So, I think, yes, it should be mentioned, and I think it should be a part of the plan. If we want to meet the President's objectives, it is going to have to be funded. And to say that we are only going to fund wireline networks, when everything else the President wants to see, from reducing climate change to smart transportation to electric cars, autonomous vehicles, is going to require wireless connectivity.

Why would you take these funds that you have and use them to achieve all of these goals, instead of saying we only have one goal, and by the way, that goal is upload speed? That is it. You cannot make the upload speed; we are not going to worry about global warming. We are not going to worry about electric vehicles. We are not going to worry about autonomous vehicles. We are not going to worry about mobility. That is what would happen if you put a narrow technological standard in statute, and you do not allow the flexibility for the agencies to consider other Congressional priorities, other Administration priorities.

Senator YOUNG. Thanks so much for that answer. Let it be known to my constituents and colleagues that, ensuring the U.S. wins the race to deploy 5G is a priority of their senator.

Mr. ADELSTEIN. Well, we appreciate that very much.

Senator LUJÁN. Thank you, Senator Young. Chief Johnson, the threat of wildfires has become a constant factor in states like New Mexico. Just last week, New Mexico communities, like those in much of the West, we experienced, for the most part, record-breaking, triple degree heat earlier than we have experienced it in some time, even before Summer officially even really began.

The increasing threat of wildfires to communication networks, has prompted states to act. The California Public Utilities Commission issued orders to require wireless and wireline providers, in the areas most prone to wildfire, to equip cell towers with 72 hours of backup power.

Chief Johnson, can you discuss the role backup power sources play for emergency response during wildfire?

Mr. JOHNSON. Thank you, Senator. Well, I think the most important thing is that those networks work, and the wireless capacity is adequate, and that they sustain long enough so that the—so that the operational period is sustained, with that wireless infrastructure.

That cost has currently been borne by the wireless carriers themselves, or by the people that own the towers and the infrastructure associated with it. That is currently who is funding that. So, anything that the Federal Government can do—can do that would be a dollar in from the government or a dollar in from industry—anything that speeds deployment of backup power, we think is a wise choice.

Senator LUJÁN. And Chief Johnson, should cell towers in areas susceptible to wildfires be equipped with backup power sources, when technically feasible?

Mr. JOHNSON. We believe that wireless towers should be equipped with backup power. Now, that does not mean, necessarily, that every tower for every purpose needs backup power. A lot of that depends on the architecture of the network. What we would encourage, and you have heard it here by some of the witnesses today, is to provide the agencies the flexibility to take a look at the network architecture and achieve the goal and measure the goal. But we believe they do require backup power when it is a key site and that will only be determined by the architecture itself.

Senator LUJÁN. Appreciate that. And Chief Johnson, the next question I am asking is, because I have heard this from critics and folks that have been pushing back against getting redundant power and backup power. How do you ensure that the backup power itself does not become a risk? No one wants anyone to be hauling diesel fuel through what is, effectively, dry timber. What are your thoughts there?

Mr. JOHNSON. Thank you, Senator. Well, you know, as a firefighter, I do not see hauling diesel, or diesel's presence in a wildfire environment as a risk. These wildfires are moving commonly at a mile a minute. They are moving ahead of the fire front, five and six miles at a time. If the ember cast component to wildfires is the risk, the intensity of these wildfires is consuming everything on the top of a mountaintop or the infrastructure. Adding a few hundred gallons of diesel will not materially affect the size, scope, and scale of that fire.

So, to us, the most important thing is that those towers and facilities are operating for as long as possible. And you can deal with the combustibility and the survivability of those sites, through the size of the compounds, by making sure that the setbacks of the vegetation are such that we can do retardant drops ahead of the fire and that we can actually deploy resources in there to protect those sites. It is a priority operationally to protect those sites. That said, you can protect three or four sites and lose an aerial back haul fiber line and lose the whole thing.

So, you do have to look at this systemically, Senator.

Senator LUJÁN. I appreciate your clarification. Now, it is no secret that this hearing is taking place in the middle of ongoing negotiations of what could be historic Federal funding for broadband infrastructure. Now is the time to get Federal investment in broadband right and that means investing in resilient, redundant, secure broadband networks.

Just a couple questions that I have left. When a single community has access to multiple broadband providers, does that benefit the community's resilience to communications outages? Chief Johnson, yes or no?

Mr. JOHNSON. Yes, in general.

Senator LUJÁN. I will come back to you.

Mr. JOHNSON. Thank you.

Senator LUJÁN. Mr. Law, yes or no?

Mr. LAW. Not necessarily, no.

Senator LUJÁN. Mr. Adelstein?

Mr. ADELSTEIN. Yes.

Senator LUJÁN. Mr. Feld?

Mr. FELD. Absolutely.

Senator LUJÁN. Appreciate that. Chief Johnson, you want to expand on that?

Mr. JOHNSON. Thank you, Senator. When market conditions exist that would allow for the presence of multiple providers, then I think adding redundancy to any network adds survivability of the network. And I operate from that assumption.

Senator LUJÁN. Mr. Law, do you have a quick response, sir?

Mr. LAW. To clarify a little further, Mr. Chair, two items. As it relates to who are the second network providers, or the additional network providers connected to? So, you may have situations where there may be a second provider in town. They came in, quite frankly, they provided service to the five largest customers in Wall, South Dakota, where I grew up, and they go out the other side of town, and away they go. I do not find a large material amount of value to that, from a resiliency and a redundancy perspective, as it relates to those small, you know, situations of competitors picking and choosing who they may serve, but say, you know, providing these large community benefits.

So, that is a reason for my not necessarily answer. It depends if there is another provider that is committing to serve all those institutions, residential, not redlining neighborhoods and other items, then, yes, that would be the case.

Senator LUJÁN. Appreciate that. Mr. Feld, we have seen a lot of different responses, including from Federal agencies like the FCC, when it comes to natural disasters and full recovery, delaying families, schools, and businesses trying to rebuild. How did the responses to Hurricane Maria differ from FCC responses to other disasters, such as Hurricane Katrina, Superstorm Sandy, and Hurricane Michael? Commissioner and Acting Chair Rosenworcel has said, for example, "It's time for the FCC to develop a consistent and reliable approach to ensuring the resiliency of networks in disaster".

Mr. FELD. Yes, the response to Maria was highly unusual. In the case of Katrina and Sandy both, the FCC, number one, engaged in significant on the ground activity. I participated in a conference call that was hosted by then FCC Chair Kevin Martin, in the immediate aftermath of Katrina, where all stakeholders were brought together to solve the problem of, what can we do in this catastrophe.

During Katrina, the FCC, the Chair of the Relevant Bureau, David Turetsky, and Chairman Genachowski were constantly keeping the public informed, bringing together stakeholders to ensure that there was activity. And in both of those cases, they convened taskforce to conduct an investigation. Hundreds of pages of testimony that culminated in Commission reports with significant recommendations and many rule changes that have put in place and have benefited resilient networks to this day.

None of this was done in response to Hurricane Maria. The public inquiry that the FCC conducted afterwards was grudging and handled at an extremely low level of the bureau. I find it unfortunate that, whereas after both Katrina and Sandy there were full

Commission hearings in the devastation zone. After Maria, there were a few press junkets by the Chair to Puerto Rico. But it was—frankly, the FCC's response was inadequate and disgraceful.

And yes, we need to have standardized responses to disaster. And Congress should include a mandatory reporting requirement, investigation requirement to ensure that the FCC takes appropriate steps following a disaster, particularly one of that magnitude.

Senator LUJÁN. I appreciate that. What happened with Maria is just simply unacceptable. People were left without access to anything, including lack of a timely response with getting connected.

Mr. Adelstein, after hearing from Chief Johnson and Mr. Feld and the question that I asked around Hurricane Maria, do you support FCC regulation that requires a certain level of resiliency in communication infrastructure and mandates the restoration of services in a timely fashion?

Mr. ADELSTEIN. Well, you know, Maria is a good example. I mean, there was—it was devastating in Puerto Rico what happened. I mean, it was unbelievable devastation. And you look at the response from my industry—and I can only speak for my industry—80 percent of the citizens of Puerto Rico were restored service by wireless.

Now, this is something, when we go to resiliency, it is different for different technologies in different areas. Within 2 weeks we had cells on light trucks, providing 2,800 calls an hour. The wireless industry can respond very quickly and did respond very quickly. And it is not the fault, or lack of commitment by wireline providers that they could not respond more quickly. When you have devastation to every—to every pole in the state of—in the territory of Puerto Rico, what can they do? You know, you cannot restore it.

But when you think about resiliency, one size really does not fit all. And the industry did look at that and said, what can we do. As a matter of fact, we buried back haul after Maria—one of our providers, one of my members said, we cannot have our back haul up there on aerial anymore. And we talked about being more expensive, well, now we are learning lessons from that. And I think one of the great lessons that we learned is that wireless service was restored much more quickly than wireline service.

And this is not just in that situation. In Florida, I mean, I could give example after example. I would like to put in record examples of how quickly we have restored wireless service. And it is not because we care more than fiber providers. They care equally. We are all committed. We understand we are in an industry that people rely on for life and death. But the question is, we have a technology that if we can just get one transmission site up, we can cover vast areas. And when you have a technology that is, for example, fiber to the home, where you have—you have wires out to every single home, you have got to restore, potentially hundreds or thousands—in the case of, you know, Puerto Rico, hundreds of thousands of connections that you have to restore.

And that is why, when you think about resiliency, I think it is important to think about having multiple technologies. The advantages of each one—and it is very hard—as a former regulator myself, I think regulators do need to be vigilant. I think Harold is

right that, the fact that they really rode hard after Sandy, we have made major improvements. The fact that they really ride on the industry and say, you know, tell us what you did. Tell us how you can improve. Let us work together. The industry has come together in consortia. They have come together working with electrical companies, because so much of it relies on the electric grid. We have done much better, and I think we can continue to do better. And I do not think that regulators ought to let up.

But I am not sure—and, you know, we are willing to engage in these rulemakings—that there is one rule that we could put in place that fits for all these different circumstances. And certainly, it is a very different circumstance for wireline and wireless.

So, when you have got, as you mentioned, this enormous pot of money—you have the biggest carrot you have ever had to feed resiliency, instead of regulations—saying do it this way, do it that way—say, we are going to reward those applications that are more resilient. Make us prove that we are going to be able to get service restored quickly. Say, you are not getting the funding unless you can reliably—and we will kick the tires to make sure you can really do it—get service restored quickly to all the customers, or to a certain percentage of them.

And you know, I think that if you do that, you will find out that mobile networks actually can—and wireless, fixed wireless, as well—can respond really quite quickly, and more quickly, in some cases, than wireline. In other cases, wireline can be very reliable. You know, within each technology—buried fiber can be more some resilient, in some cases, than aerial fiber. And buried fiber might not be resilient in an area where there is—it is flood prone, like in—in the south of the country, along the coast.

So, you know, it is hard to come up with a regulation that fits for everybody. But it is very, I think, easy for Congress to say, we have all this money. What are we going to do with it? What are we going to prioritize? Do not tie agencies' hands and say you can only consider one type of application. You can only consider wireline, without thinking about, does that limit the flexibility to have more resilient networks that can respond like they did in Puerto Rico.

Senator LUJÁN. So, would you say that is a yes or no to supporting the FCC regulation that—or supporting the FCC regulation that requires a certain level of resiliency and communication infrastructure and mandates the restoration of services in a timely fashion?

Mr. ADELSTEIN. Well, it depends what it says. I would say—I would say maybe. And we will certainly work with the FCC and I think we might be able to come behind it. There is a resilient act that you have—

Senator LUJÁN. Maybe is OK. So, you would be—you feel comfortable representing the organization that you are doing, that is substantial, to participate with the FCC and with your expertise as a former FCC Commissioner and rulemaking, around this.

Mr. ADELSTEIN. We would certainly work with them in a rulemaking and see if we could come up with something that deals with all of the many different categories. But, you know, narrow requirements and mandates, I think, ultimately—

Senator LUJÁN. I will take yes or no here.

Mr. ADELSTEIN. OK.

Senator LUJÁN. Because you went on a little longer and I did not gavel you down. But that—that is—I appreciate that. And anything else, please submit it to the record on that one, Mr. Adelstein.

There has been a lot of chatter about rural areas, and I very much appreciate the attention to modernization, when it comes to precision agriculture. Mr. Law, as discussed, precision agriculture, its critical application. In 2019, the USDA published a report that stated, “As technology advances, and the volumes of data to manage agriculture production grow, higher speeds will likely be necessary, requiring more symmetric data flows”. Should there be a minimum standard required for both up and down connections, to prepare the network for precision agriculture?

Mr. LAW. I think there should be, Senator—or Chairman, for a couple of reasons. One is, in terms of, again, the applications and the usage of the network, both today and for tomorrow, I will say connected ag is a great example, in terms of the gigabytes of data that is generated from the connected ag environment. Whether it is in live time, or in a stored basis that is later uploaded to the—I will say, to the cloud, for lack of a better phrase, I do think that there should be minimum standards.

And I think that is also a cautionary tale, in terms of understanding the need between deploying the technology and things that technology—current technologies are capable of doing versus deploying technology that will meet the needs of broadband subscribers, not just today, not just tomorrow, but generations in the future. That is the question I think Congress will have to answer with that. But yes.

Senator LUJÁN. I appreciate that. Mr. Adelstein, I am going to ask you the same question I asked Mr. O’Rielly, former FCC Commissioner. What broadband speed do you have at home?

Mr. ADELSTEIN. It is about 80—I happen to have Fios. I do have fiber to the home spot—80 down and similar up, a little less than 100.

Senator LUJÁN. That is pretty good, really good. I will share with you what I shared with Mr. O’Rielly is, that is all that I am asking for people to be able to get. Whether they live in a city or they live out in the country. You know, we can have a conversation, a debate about this, but what I am looking at is, what is it going to take for us to live up to the commitment, to make sure that we have equitable speeds in rural, as well as urban? And it is my understanding that most people that live in urban settings and in cities, they have a choice between a cable company or a fiber line that they can get up to gigabit connection. That is just not something that is available in rural areas.

Our national commitments in this area has always been to make sure that rural and underserved communities be on that equal playing field. And what I am looking at is for an investment with public funds to ensure that kind of equal opportunity.

And the reason I am raising this with you is because of the back and forth with looking at wireless versus wireline. It should not be seen that way. Wireless depends on fiber, too, as we all know. We need to be making investments that will help us achieve those

same opportunities in rural America and in the frontier communities, as we have in cities.

And so, as a matter of engineering and technology and economics, would you say that wireless performs and scales the same as fiber?

Mr. ADELSTEIN. Not in terms of upload speeds. As a matter of fact, the way the networks are engineered, that is why upload speed is, kind of, being used as something that can block mobile service.

Senator LUJÁN. Appreciate—I appreciate—that is—I agree with that. Now, the last question that I have is, it surprised me when I read this, which I think goes to a big part of the conversation we are having today. I believe that we need to have the inclusion of a comprehensive network solution in America. While I joined many of my colleagues in asking for Chairman Pai to delay the RDOF auctions, because of the concerns that were shared today by Senator Capito, we are now finding that areas that have the highest Internet connection speeds in the country qualify as areas that will benefit from the RDOF auction. I do not think that was the intent. And it is why we all should be looking at this.

Now, with that being said, recently, AT&T, the Senior EVP and CFO, Mr. Desroches said that he thinks, I quote, “Fiber is the only product out there that delivers the performance necessary for telehealth, online education, remote work—”. He even goes on to talk about the importance of demand for symmetrical speeds over time.

If AT&T, who is one of the most significant wireless providers today is now saying—and this was from January—sorry, June 18, 2021—that that is where they are going, what do I read into that?

Mr. ADELSTEIN. Well, AT&T is a member of mine and my understanding is that they seek flexibility, as well. I mean, we all think fiber is wonderful if it makes sense for a particular area, like it would in Mr. Law’s territory. I think that Congress has to think about getting good wireless and wireline service. It is not fiber versus wireless—fiber and wireless.

We have talked before about how many people are frustrated that there is not wireless service in certain areas. And even in my, you know, neighborhood sometimes this thing, it does not work as well as I might want but, you know, we want to make that comparable, too. And so, the question is, what gets the consumer what they need? And consumers really—

Senator LUJÁN. Can I ask you a follow up in that space?

Mr. ADELSTEIN. Yes.

Senator LUJÁN. Does wireless substitute for wireline connectivity?

Mr. ADELSTEIN. It absolutely does. It is doing it today.

Senator LUJÁN. It does?

Mr. ADELSTEIN. It does. You have got 20 percent of the population today—

Senator LUJÁN. So, what I—and I am going to push back a little bit here. When I asked the question about the engineering, your response to me was no, that in fact, what I stated, which is that the engineering and technology and economies that wireless performs and scales the same as fiber, the answer to that question is no, it is not.

So, it is hard for me to not push back in saying that it does replace wireline. There is a reason why you and I both have a wireline connection where we live, not a wireless connection that is providing us the up and down speeds that we need to communicate with our constituents, with consumers, and with members.

So, I agree that they should—we should be working to look at a comprehensive approach here. But you would still argue that, in fact, wireless can replace wireline and get the same architecture that I just laid out, with the foundation of that question, is that from an engineering and technological and economic perspective, wireless performs and scales the same as fiber?

Mr. ADELSTEIN. Not only can it, it is. One in five Americans are using their smartphone as their only broadband connection. You can put this into a laptop and get 100—in 5G you can get—and even 4G, get 100 megabit download speed. Consumers, our customers, are not using upload, 1 to 10, using one-tenth the amount of upload they are download. So, your question was can they do equal to upload? And I said, you know, really they cannot, because these things—the power coming out of this is not the same as the power coming out of the tower.

So, an advantage of fiber is it has better upload. That should not be used as something to not allow rural consumers the choice to use this, and 1 in 5 consumers have, as their connection to the internet. It is absolutely substitutable. If you get fixed wireless into the home, you can get even better levels of service, and you can do it more quickly. Instead of waiting, potentially, 10 years, as the Fiber Broadband Association studies showed, you can get it done within months, or a year or two.

I mean, there is a lot of tradeoffs. But if upload speed is the only thing you want, I would say, yes, fiber is going to give you bigger upload speeds, due to the nature of the architecture. But if you are saying what do consumers need, they are using 1 to 10. Even if it doubles, 1 in 5, you are not going to need fiber to meet the vast bulk of consumers' applications. And for precision ag, it does not need that level of upload.

Senator LUJÁN. So, would you support eliminating data caps from wireless companies?

Mr. ADELSTEIN. Well, when you go to a fixed wireless, there are no data caps, generally speaking. You can get a service that has no data caps. Now, if you are doing mobile——

Senator LUJÁN. Would you support eliminating data caps from wireless plans in America?

Mr. ADELSTEIN. No, I mean, it is up to the—to the company to decide if they—what they want to do. And it is up to the customers to decide what they want to buy. If the customer wants to buy an unlimited plan, they can. And fixed wireless, which is the best substitute——

Senator LUJÁN. Let me push back on you there, Mr. Adelstein. And I know I have to close this hearing. If someone—you said, if someone wants to get an unlimited plan, they can. No, they cannot. Not if they cannot afford it. When there is a 16-year—16-year-old little girl from New Mexico, her name is Helene Archuleta, that lives on the Navajo Nation. She was my special guest for President Biden's Joint Address to the Congress earlier this year. Because we

did it remotely, she could not watch it because her and her mom cannot afford an unlimited plan. She can barely do her homework.

And using the example that, if 5G in wireless is the answer here, there cannot be data caps on these families. It is a thing of the past. That is an old technology. It is like long distance calling. People should not be charged for long distance calling anymore, I believe. Because, if you have a wireless phone in your house—I do this with my mom all the time. When she is going to call a family member that lives out of state and she picks up her landline, I say, “Wait a minute, Mom, you are going to pay for that one”. She goes, “Oh, yes, yes”, and she pulls out her wireless phone and then, she makes the call, and it does not charge her that extra fee.

And then, you know, we talk about funding USF and—that is not a responsible way for us to be looking at funding Lifeline or USF. We have got to modernize there. And so, I just want to make sure that when we are making these investments, and I completely agree with the goals here to find ways to make investments that we are going to reduce emissions in America. In the biggest cities, yes. Precision farming, those tractors are going to work. They communicate both ways.

How do we make sure we get those speeds? Wireless is going to be a solution, but it is going to take long. It is going to take intense back haul when it comes to the fiber, as well.

But I want rural customers to be able to have those speeds, as well. I want my firefighters to be equipped. When they have technology on them, that becomes their eyes and ears, so that a camera can be on their back and on their front and you have someone at the command center saying, be careful. There is something coming right at you or something behind you. Or if someone goes down because of an accident or inhalation, you can get them out of there. That is what 5G is going to help deliver.

I want us all to work together but not diminish another while we are trying to promote another here. And so, this has been an important hearing for me. I think it has been an important hearing for our colleagues. And I very much appreciate the perspective of each and every one of the witnesses today.

Now, with that, if I do not close this hearing correctly, I am going to get into some trouble. So, I want to thank all of the witnesses for their productive discussion today. And the hearing record will remain open for two weeks, until July 6, 2021. Any senators that would like to submit questions for the record for the witnesses, should do so by that date. And we ask that your responses be returned to the Committee by July 20 of 2021.

That concludes today’s hearing and again, I thank everyone for their time today. Thanks so much.

[Whereupon, at 4:54 p.m., the Committee was adjourned.]

A P P E N D I X

WASHINGTON
1025 Connecticut Ave NW
Suite 1110
Washington, DC 20036
tel. 202.295.1400



June 17, 2021

The Honorable Chairman Ben Ray Luján
The Honorable Ranking Member John Thune
U.S. Senate Subcommittee on Communications, Media, and Broadband

Re: Hearing on Building Resilient Networks

Dear Chairman Luján & Ranking Member Thune:

Free Press Action applauds the efforts of the Subcommittee to explore the urgent need for more resilient communications infrastructure — including an examination of the impact of Hurricane Maria on Puerto Rico’s communications infrastructure — and respectfully submits, for the record and appended to this letter, three items for consideration by the Subcommittee:

- A 2019 report by Free Press, titled “Connecting the Dots: The Telecommunications Crisis in Puerto Rico,” focusing on the Federal Communications Commission’s response to the prolonged communications outage and disruption in Puerto Rico following Hurricane Maria;
- A 2020 study by Professors Luis Rosario-Albert & Bruno Takahashi, titled “Emergency communications policies in Puerto Rico: Interaction between regulatory institutions and telecommunications companies during Hurricane Maria,” examining the emergency communications experiences of territorial authorities and regulated entities during extreme infrastructure collapse in Puerto Rico following Hurricanes Irma and Maria;
- A 2021 blog post by Free Press analyzing the recently released U.S. Government Accountability Office’s report on the Federal Communications Commission’s activities during and after Hurricane Maria in Puerto Rico.

The people in this country require access to affordable, resilient, and open communications infrastructure — especially in Black and Indigenous communities, and communities of color who have long been denied equitable access on account of racism and colonial status — and we thank the Subcommittee for considering these items and for undertaking this important work.

Respectfully Submitted,

/s/ Joseph Torres

Joseph Torres
Leo Fitzpatrick
Carmen Scurato

CONNECTING THE DOTS



photo credit: Dr. Michael Ezzard-Carroll

The Telecommunications Crisis in Puerto Rico

FP Free
Press
MAY 2019

Table of Contents

Introduction

The Perfect Storm: Colonialism and Government Apathy Meet Hurricanes Irma and Maria

Just Reconstruction Efforts Must Include Just Access to Communications

The Voices of Puerto Ricans Must Be Heard

What Congress and the FCC Must Do to Help Puerto Rico Build a Resilient Communications System

Timeline of Events and Related Oversight Questions

Next Steps

Appendix: Puerto Ricans Share Their Stories on How Puerto Rico's Communications Crisis Impacted Their Lives After Hurricane Maria

"Communication was down for weeks, making it hard for everyone to stay sane, calm, and collected. Thus... our mental health decreased, worse than what it already was."

—Patricia in Bayamón, Puerto Rico (Jan. 31, 2018)

Acknowledgements

REPORT AUTHORS

Leo Fitzpatrick, Carmen Scurato and Joseph Torres

The Free Press Puerto Rico working group made this report possible. Members include Teresa Basilio Gaztambide, Lucia Martínez, Nilda Muhr, Yesenia Perez-Algarin and Misty Perez Truedson.

"For me, not having any cellphone connection or access to internet in the immediate aftermath of the storm was worse than not having electricity or water service. We had little idea what had happened in the rest of the country."

—Maritza Stanchich in San Juan, Puerto Rico (Jan. 31, 2018)

Introduction

The ability to communicate during and after a disaster is a life-and-death matter. And few disasters better exemplify this need than Hurricanes Irma and Maria, which devastated Puerto Rico in September 2017.

Hurricane Irma struck on Sept. 6 and left more than a million people without power while weakening Puerto Rico's already fragile infrastructure. Then on Sept. 20, Hurricane Maria—a Category 4 storm—destroyed the islands' infrastructure. It left nearly the entire population without power and knocked out Puerto Rico's communications networks.

Between 3,000–5,000 people died, making Maria one of the deadliest disasters in U.S. history.¹ And the inability of Puerto Ricans to make calls or access life-saving information contributed to the death toll.

Nazario Lugo, president of Puerto Rico's Association of Emergency Managers, captured the crisis in an interview with the Associated Press in March 2019: "The biggest crisis after Maria was communication . . . that unleashed an endless number of problems."²

The tragedy that continues to unfold in Puerto Rico isn't just the result of the storm. The word "natural"—often used to describe a disaster like Hurricane Maria—should be removed from any descriptions of what happened on the islands.

The disaster can't be separated from the history of more than 100 years of U.S. colonialism in Puerto Rico, a history of wealth extraction, systemic racism and economic exploitation that left the islands' critical infrastructure—including the communications networks—fragile and vulnerable.

Colonialism has also led to the willful neglect of Puerto Ricans' basic needs. This has been the case in the wake of Hurricanes Irma and Maria, where the focus has been on debt repayment and austerity measures to "reduce costs" rather than on rebuilding and ensuring access to critical services. Meanwhile, the Federal Emergency Management Agency and other government entities—including the Federal Communications Commission—have failed to respond adequately to the disasters that unfolded.

The FCC, the government agency responsible for ensuring that the media and telecom companies it regulates serve the public interest, has yet to conduct a vigorous investigation into the failure of the islands' communications infrastructure, which was a major factor in the death toll.

This report's goal is to call attention to the critical need to examine and investigate all of the causes for the collapse of the communications networks. There are dozens of key questions posed throughout this document that Congress must demand answers to if we are to ensure a crisis like this isn't repeated.

It's deeply troubling how little interest the FCC has shown in analyzing what went wrong and using this information to shape its policies on communication rights and public safety.

So far, the FCC has failed to:

- Convene an independent commission—as it did after Hurricane Katrina—tasked with thoroughly investigating the communications blackout.
- Directly engage with the affected communities in Puerto Rico through field hearings to inform the agency's policies.
- Be forthcoming and transparent with information regarding its work to restore communications after the 2017 hurricanes.
- Adequately respond to the gravity of the communications crisis in Puerto Rico as it has to crises in other parts of the United States.
- Abandon its efforts to dismantle the Lifeline program, which would directly undermine Puerto Ricans' ability to afford telephone and broadband services.
- Hold telecom companies accountable for the amount of time they took to restore services.
- Implement sufficient measures to identify potential misuse of the Federal funds the FCC set aside for recovery work.
- Take necessary steps to ensure that telecom companies deliver on promises to accelerate reconstruction.
- Provide access to Spanish-language translations for all Puerto Rico-related material.

This is why we're calling on Congress to ensure the FCC adopts policies that address the underlying causes of the prolonged outage in Puerto Rico. Affected communities should be part of the design and governance of their local communications infrastructure and funds should be allocated to support self-sustaining and resilient communities.

"We did not have electricity at our house in San Juan until January 11. Therefore, our access to our landline telephone service was limited."

—Sheila Ward in San Juan, Puerto Rico (Jan. 31, 2018)

The Perfect Storm: Colonialism and Government Apathy Meet Hurricanes Irma and Maria

Understanding the history of colonialism in Puerto Rico is essential to creating policies that will address the economic, political, social and racial inequities shaping

the islands' reconstruction efforts. These inequities played a central role in the tragedy of Hurricanes Irma and Maria. And they're why the fight for a just reconstruction of Puerto Rico is a critical racial-justice issue.

Puerto Rico has been a colonial possession of the United States for more than a century. During this time, the Federal government has imposed predatory economic policies that have allowed U.S. companies to extract enormous profits from the islands at the expense of Puerto Ricans and Puerto Rico itself.

That legacy of colonialism continues to this day. In 2016, Congress passed legislation that created an unelected fiscal-oversight board tasked with restructuring Puerto Rico's debt, which had ballooned to \$120 billion after Federal tax breaks³ for U.S. companies operating in Puerto Rico ended in 2006.

Unlike other cities in the United States, Puerto Rico doesn't have the legal recourse to declare bankruptcy. The islands lost that right in 1984 due to an amendment inserted into a bankruptcy bill.⁴ Now, the fiscal-oversight board is implementing punitive austerity measures that will further punish Puerto Ricans trying to recover from a historic tragedy.

The U.S. government has failed to provide the kind of economic support needed for the recovery and reconstruction of the islands. Puerto Rico has received less Federal relief in the wake of Hurricanes Irma and Maria than other parts of the United States that suffered significant hurricane-related damages in 2017.

In addition, President Donald Trump reportedly told congressional leaders that Puerto Rico should not receive further Federal assistance for programs like food stamps.⁵

Trump has also repeatedly lied about how much Federal assistance Puerto Rico has received and has made racist statements about Puerto Ricans.⁶ His message is clear: Puerto Ricans don't deserve help, an attitude that's reflected in his administration's failure to respond adequately to the disaster on the islands.⁷

This refusal to respond appropriately extends to the FCC.

Just Reconstruction Efforts Must Include Just Access to Communications

The FCC has failed to conduct a comprehensive investigation that examines all of the factors that led to the collapse of the islands' communications networks—or to hold telecom providers accountable for the slow pace of service restoration.

While the FCC has allocated more than \$100 million in new Federal funding to restore communications services and build more resilient networks on the islands, the Commission has failed to put in place an adequate oversight process to ensure that the telecom companies receiving this funding spend the money for its intended purposes.

The FCC has a history of investigating communication failures and holding public hearings following disasters. It's historically done so to inform its policymaking and prevent such failures from happening again. For example, this is what the FCC did after Hurricane Katrina devastated communications in Louisiana and other Gulf states.

Chairman Ajit Pai's indifference to the communications crisis in Puerto Rico speaks volumes about the islands' colonial status. When Pai visited Puerto Rico, he met with telecom-company officials but failed to hold a single public hearing.

By contrast, consider Pai's urgent response in October 2018 after Hurricane Michael struck the Florida Panhandle. Pai immediately ordered his agency to investigate the failure of telecommunications providers to quickly restore service. The chairman's decisive action came just weeks before Election Day, which saw Republican candidates in that region running in close gubernatorial and senatorial races.

Chairman Pai has failed to show the same urgency with Puerto Rico. This is unacceptable.

Over the past year, Free Press has called on the FCC to appoint an independent commission to investigate the causes of the islands' communications failure. And last November, we submitted Freedom of Information Act requests to both the FCC and FEMA to learn more about how our government agencies responded to the islands' communications crises. FEMA is as critical as the FCC to rebuilding the communications networks due to the agency's central role in coordinating disaster-recovery efforts.

To date, only the FCC has provided documents, with an initial production of 52 consumer complaints received on April 30, 2019. The agency has claimed it will take years to provide all of the complaints it has received, and this delay is further evidence of how it's failing to prioritize Puerto Ricans' essential communication needs.

“People in Puerto Rico pay a lot for cellphone and internet. They are US Citizens, they deserve to be treated the same way [as] the people that live in the US mainland.”

—Sonia Acevedo in Alexandria, Virginia (Feb. 12, 2018)

The Voices of Puerto Ricans Must Be Heard

It’s crucial that we hold the FCC accountable so we understand why communications networks in Puerto Rico collapsed and how that breakdown has impacted the lives of the people on the islands. Congress has an essential role to play in ensuring the FCC fulfills its responsibilities in this regard.

Since Hurricane Maria hit, Free Press has worked to ensure the voices of Puerto Ricans are heard and prioritized when it comes to policies adopted to restore and rebuild Puerto Rico’s telecommunications infrastructure. This is a personal issue for many Free Press staffers who are Puerto Rican and have family living on the islands.

Last year, we submitted comments to the FCC that included heartbreaking stories that Puerto Ricans shared with us on how the islands’ communications crisis prevented them from learning whether their loved ones were alive or able to access the help they desperately needed (*see appendix*).

Free Press and Resilient Just Technologies also traveled to Puerto Rico and held story circles—intimate community gatherings—to allow participants to share their stories on how the loss of communications affected their lives. Residents of Comerio and Vieques discussed how the communications blackout limited their mobility, their ability to find food, water and medical care, and their capacity to seek out their loved ones.⁸



What Congress and the FCC Must Do to Help Puerto Rico Build a Resilient Communications System

As U.S. government actions—and inactions—have worsened a massive humanitarian crisis, it’s the FCC’s duty to investigate what went wrong and to adopt policies that prevent the islands’ communications networks from collapsing in the future.

In this report, Free Press shares essential actions Congress should compel the FCC to take in Puerto Rico and offers key policy suggestions that can be applied to future disasters anywhere in the country:

- *The FCC, in coordination with other Federal agencies or Congress, must form an independent commission* to conduct a comprehensive and expedited investigation of every major or prolonged communications outage, regardless of where it occurs in the country. The Commission must produce a detailed report for each discrete outage that includes a critical assessment of agency actions, or inactions, and provides clear, actionable recommendations or proposed regulations to prevent the recurrence of such outages.
- *he FCC must immediately and directly engage with affected communities*, hold public field hearings in such communities, and provide access to potentially life-saving information in languages appropriate for these communities.
- *The FCC must apply its expertise and promulgate regulations*, including recommending actions or regulations for other federal, state or territorial agencies, to a) address the known underlying causes of prolonged outages and b) engage in a longer-term examination and rulemaking to strengthen resilient-network infrastructure.
- *The FCC must be more transparent*, provide clear and measurable requirements for funds allocated to network-recovery work, and hold telecom providers accountable for unreasonable delays to ensure recovery efforts accelerate the restoration of services and increase network resiliency.

“In the beginning of the hurricane the hospital my mom worked at was filled with people who were on the floor crying over the fact that their homes were more than likely destroyed and that their families were still in their homes and [they had] no way of being able to contact them.”

—Hector Santana in Carolina, Puerto Rico (Jan. 31, 2018)

Timeline of Events and Related Oversight Questions

As Congress works to address Puerto Rico’s urgent and unmet needs, Free Press offers the following timeline of events along with key questions for lawmakers to ask the FCC about rebuilding resilient communications networks for the islands.

2017

SEPTEMBER. Hurricane Irma unleashes tropical storm-force winds in Puerto Rico, knocking out electricity for 1.1 million people. Two weeks later, Hurricane Maria makes landfall as a Category 4 storm. As a result, Puerto Rico experiences one of the most extensive and lengthy communication blackouts in modern U.S. history.⁹ Right away 95 percent of cell sites are knocked out of service; two days after landfall, 97 percent of radio stations remain off the air, and not a single TV station is broadcasting.¹⁰ *Subsequent reports indicate that the lack of power and accessible communications contributed to the 3,000–5,000 lives lost and hindered recovery work.*¹¹ The FCC activates the Disaster Information Reporting System (DIRS), a web-based system launched in 2007 in response to Hurricane Katrina that telecom carriers use to report communications-infrastructure status and situational-awareness information during a disaster to coordinating agencies and first responders. DIRS functions on an entirely voluntary basis.

OCTOBER. Free Press joins a letter commending the FCC for advancing \$76.9 million to restore communications services and urges the implementation of additional measures to swiftly restore communications.¹² The agency forms an internal Hurricane Recovery Task Force to: coordinate across bureaus and offices throughout the FCC; support the restoration of communications services following the 2017 hurricane season; and focus on the “challenges facing Puerto Rico and the U.S. Virgin Islands.”¹³

Then-Ranking Member Frank Pallone Jr. of the House Energy and Commerce Committee calls for a “Commission level review” to strengthen the Wireless Resiliency Cooperative Framework based on his own constituents’ experiences following Superstorm Sandy (2017 Pallone Wireless Framework Letter).¹⁴ The framework is an industry-led, self-policing and voluntary guidance that defines the actions wireless providers agree to take following a disaster.

NOVEMBER. FCC Chairman Pai visits the islands to survey the damage and meets with government officials coordinating recovery efforts. He also meets with various representatives from communications entities, including AT&T, Claro, Liberty, Open Mobile, T-Mobile and Verizon—but fails to hold a single public hearing.¹⁵

DECEMBER. The pace of recovery is excruciatingly slow: Less than 5 percent of TV stations are back on the air; 66 percent of radio stations are still out; and cable and landline phone services are, in the FCC’s own words, “generally nonexistent.”¹⁶

These are the questions that remain unanswered:

- *How effective and accurate was the information the FCC collected through DIRS and does that information hold insights on how each telecom provider restored services?*
- *Did inaccuracies or lack of access to information slow down or impede subsequent recovery efforts? How can the FCC remedy the way it addresses such obstacles?*
- *Should DIRS, and another arrangement with industry discussed below, continue to be entirely voluntary?*
- *How did Puerto Ricans rely on these aggregated DIRS reports to make decisions for their families? Considering that publicly available DIRS information provides only the percentage of cell sites operating in a given area, how would the public and on-the-ground first responders benefit from having access to more accurate coverage maps and outage information?*

DECEMBER. The FCC’s Public Safety and Homeland Security Bureau opens an inquiry into the “resiliency of the communications infrastructure, the effectiveness of emergency communications, and government and industry responses to the 2017 hurricane season.”¹⁷

These are the questions that remain unanswered:

- *Why has the FCC refused to assemble an independent panel like the one it convened after Hurricane Katrina?*
- *Why has the agency failed to examine whether stakeholders actually applied the lessons learned from past investigations?*
- *What is the composition of the agency’s Hurricane Recovery Task Force? How often does it meet and what activities is it undertaking? What is the task force’s role in responding to the 2017 Atlantic hurricane season?*

2018

JANUARY. The Government Accountability Office releases a report on the industry-led Wireless Resiliency Cooperative Framework.

In response to extensive network outages following Superstorm Sandy, the FCC opened a rulemaking proceeding in 2013 to “promote transparency to consumers as to how mobile wireless networks compare in maintaining operations during major emergencies” to spur providers into improving network resiliency.¹⁸ After a fierce backlash from providers, the agency closed the 2013 proceeding and adopted the industry-proposed framework in place of regulations protecting the public.

The GAO report on the framework finds the FCC doesn’t have a means to evaluate the progress of the initial implementation of the framework; the FCC and industry’s broad goals for the framework don’t have any specific metrics to assess progress toward these goals; and the FCC didn’t have plans to communicate information about the framework to public-safety officials and other stakeholders.¹⁹ The report recommends “[m]ore robust measures and a better plan to monitor the framework [to] help [the] FCC collect information on the framework and evaluate its effectiveness.”²⁰

The FCC agrees with the GAO’s recommendations.

MARCH. Chairman Pai again visits the islands with unidentified members of his internal Hurricane Recovery Task Force. The related press release and subsequent mentions of the visit include no information on the makeup or activities of the group.²¹ FCC Commissioner Jessica Rosenworcel also visits Puerto Rico and speaks with members of communities most impacted by the hurricane.²²

These are the questions that remain unanswered:

- *Why has the FCC publicized the chairman's visits to Puerto Rico but withheld important details about the task force's policy priorities, or even its membership?*
- *Who serves on the task force, what has it done, and who has it interacted with in government and industry?*

The FCC proposes a \$954-million plan for rebuilding telecom networks in Puerto Rico and the U.S. Virgin Islands.

Hurricane Maria's severity forces the agency to track and publish DIRS outage reports for 182 days—the longest, by a wide margin, for any U.S. disaster-recovery effort since DIRS' creation.

APRIL. Free Press and the National Hispanic Media Coalition (NHMC) file joint comments in the FCC's inquiry, highlighting stories from Puerto Rico and the Puerto Rican diaspora and demanding that the agency fully engage with Puerto Ricans by holding field hearings on the islands, publishing key documents in Spanish, and giving the public information on the task force.

Free Press and NHMC also call on the FCC to consider how its plan to gut the Lifeline program would disconnect many Puerto Ricans—who participate in the subsidy program at *twice the national average*.²³

These are the questions that remain unanswered:

- *Why did the FCC largely ignore the reasonable requests issued by Free Press and NHMC?*
- *Why didn't the FCC and FEMA have the Spanish-language expertise to communicate critical public-safety information?*
- *Why is the FCC still considering its 2017 proposed changes to Lifeline—a program expanded under President George W. Bush in response to the displacement Hurricane Katrina caused—given that this plan would directly undermine families in Puerto Rico who are still living under precarious conditions?*

The FCC's Public Safety Bureau holds a single public workshop on its inquiry—in Washington, D.C.—to “identify communications information needs of government and consumers to improve preparation and response efforts during crises.” The FCC invites federal, state, local and territorial government representatives to attend and includes a panel of consumer groups—but excludes industry stakeholders, the very carriers the agency is supposed to regulate.²⁴

This exclusion insulates the providers from exposure to public scrutiny. As a result, there's no opportunity to learn about the conversations these carriers had with the FCC on restoring and rebuilding the islands' communications networks. Excluding these providers also allows the FCC to avoid public discussion of potential regulation that could hold the carriers accountable.

For example, during the event, the FCC presses the consumer panel to discuss one tangible “improvement” for a *crowdsourced* disaster-information application. Such thinking reveals how the FCC may consider shifting responsibility for disaster readiness and situational awareness from the FCC and industry to members of the public, despite the enormous quantity of actionable information already in the hands of these actors during disasters.

At the workshop, Jarrett Devine, the regional emergency communications coordinator for FEMA Region I, provides an important observation:

We've heard a lot of things today. Folks saying “voluntary.” Folks saying “trend analysis” . . . This is life-safety equipment. We have to do better. Post-disaster, we have an extremely fragile environment with a vulnerable population. This “voluntary” word needs to go away. We have commercial entities selling themselves as public-safety grade. If you are going to make a profit saying you are serving the community with public-safety grade communications, then you need to be able to prepare an answer and response as to where your communications are available. Specifically post-disaster response events.²⁵

These are the questions that remain unanswered:

- *Why did the FCC shield these regulated entities from public questioning and take the industry's assertions at face value?*
- *How has Chairman Pai's myopic deregulatory agenda allowed industry to ceaselessly avoid regulatory scrutiny, even on public-safety matters?*
- *Why has the FCC resisted shifting from the voluntary approach of DIRS and the Wireless Resiliency Cooperative Framework (see June below) to one that mandates first-responder access to communications services during and after a disaster, consumer information on outages and service-restoration estimates, and improving telecom-network resiliency?*

JUNE. Rep. Nydia Velazquez of New York introduces the National Commission of the Federal Response to Natural Disasters in Puerto Rico Act of 2018, which would convene a commission to consider a broad array of factors that impacted the disaster response, including the adequacy of the islands' telecom networks. The bill remains in committee through the conclusion of the legislative session.

The FCC opens a proceeding for comments on the creation of the \$954-million *Uniendo a Puerto Rico* Fund and the *Connect USVI* Fund, which plans to divvy out hundreds of millions of dollars over 10 years to accelerate telecom recovery in Puerto Rico and the U.S. Virgin Islands.²⁶ The FCC forgives the earlier \$76.9-million advance in funds to Puerto Rico and the U.S. Virgin Islands announced in October and allocates approximately another \$100 million for Puerto Rico.

Notably, the bulk of the total simply renames existing commitments from long-standing Universal Service Fund programs that predate the hurricanes. These programs support buildout of telecom infrastructure to areas that are otherwise too expensive to serve. Barring any pending changes from the FCC, the programs will continue to use a methodology that's independent of Hurricane Maria specifically or disaster relief generally.

In addition, the FCC doesn't include any coordinated oversight measures, metrics or requirements to ensure funds are used to *accelerate* recovery of telecommunications.

The Public Safety Bureau opens a proceeding seeking comments on the effectiveness of the Wireless Resiliency Cooperative Framework. Even though the unique devastation of the 2017 hurricane season revealed the vulnerability of Puerto Rico's communications infrastructure—and first responders and consumers alike advocated for more resilient networks—the FCC is only now considering whether the voluntary framework is appropriate or effective.

However, the inquiry stops short of asking whether the voluntary framework should be replaced with a mandatory one.

JULY. FEMA releases a report noting that the loss of communications in Puerto Rico impeded the agency's response and recovery efforts: "FEMA and supporting Federal agencies struggled to gain situational awareness and assess the status of critical infrastructure, in part due to communications outages across Puerto Rico."²⁷

These are the questions that remain unanswered:

- *Why did the FCC—the expert agency on telecom matters—fail to recognize and address the clear threat to first responders' ability to communicate during and after a disaster?*
- *Why did FEMA's assessment fail to further explore the causes of the communications outage and its effect on recovery work?*
- *Why did the FCC fail to conduct a similar self-critique?*

Free Press submits a letter on the proceeding on the *Uniendo a Puerto Rico* Fund that expresses concern that without more robust accountability measures, money will be used to offset already planned deployments or simply end up in shareholders' pockets.²⁸ Free Press also flags an investor call in which a telecom CEO expresses skepticism about the company's ability to fully restore its network in Puerto Rico.

The FCC suggests no meaningful changes to the Wireless Resiliency Cooperative Framework (aside from suggesting that other entities, such as backhaul providers, be enveloped into this voluntary framework).

AUGUST. The FCC releases an initial round of \$64.2 million from the *Uniendo* Fund to telecom providers that serve Puerto Rico. To date, the agency has not disclosed what accountability processes, resiliency requirements or measures will be used to determine how the funds will accelerate recovery and promote network resiliency.

These are the questions that remain unanswered:

- *Is the FCC keeping track of how the additional funds are spent? If so, how has the money contributed to network resiliency?*
- *What measures are in place to ensure that these funds are being used to expedite recovery?*

The FCC's Public Safety Bureau concludes the 2017 hurricane-response inquiry by releasing a paltry 36-page report (the "2017 Hurricane Season Report").²⁹ *The report fails to reflect the gravity of one of the most catastrophic communications crises and deadliest hurricanes in U.S. history.* The report also fails to determine whether any FCC-regulated entity should be held accountable for the slow restoration of service and includes only information that was already publicly available.

These are the questions that remain unanswered:

- *Why did the FCC fail to conduct a self-critical review as it did after prior disasters?*
- *Did the FCC's Public Safety Bureau have sufficient staff and resources to conduct a comprehensive examination on par with the staff and resources involved in the Hurricane Katrina investigation?*
- *Did FCC staff in the Public Safety Bureau provide an honest critique of FEMA or their own agency's response to the hurricanes, or are such insights best captured through an independent commission?*
- *Why didn't the existing internal Hurricane Recovery Task Force prepare the 2017 Hurricane Season Report, as it was well-situated to discuss its own activities and to note how the various agency bureaus and offices coordinated their hurricane response? If task-force members contributed in unacknowledged ways, how did they do so?*
- *Why didn't the 2017 Hurricane Season Report provide any useful details about the task force's activities?*

SEPTEMBER. The Government Accountability Office releases a report revealing how woefully unprepared FEMA was in responding to the disaster in Puerto Rico.³⁰

On the first anniversary of Hurricane Maria, Free Press joins a coalition of Puerto Rican advocates, racial- and social-justice organizations, and media and telecom experts to urge Chairman Pai to convene an independent commission to conduct a comprehensive investigation of the communications crisis in Puerto Rico.³¹ Alongside allies, Free Press hosts a Facebook Live discussion on Maria's impact and the future of communications.³²

Free Press files comments calling on the FCC to gather more complete and accurate data to better coordinate the work needed to build resilient networks and disburse recovery funds effectively. We urge the FCC to conduct a deep and thorough analysis of its current policies to address the resiliency of communications networks.³³

OCTOBER. Free Press teams up with Resilient Just Technologies, the Center for Embodied Pedagogy & Action and other organizations in Puerto Rico to host small-group discussions in Comerío and Vieques to hear Puerto Ricans talk about how the loss of communications has impacted them. Residents discuss how the loss of communications limited their mobility as well as their ability to find food or water or medical care or seek out their loved ones.³⁴

In the wake of Hurricane Michael, Chairman Pai admonishes telecom providers for their slow response to the week-and-a-half-long telecom outage in the Florida Panhandle and demands that the Public Safety Bureau investigate the matter. Free Press criticizes Pai for failing to show the same urgency in response to Hurricane Maria. Pai is more critical of telecom providers in Florida than he is about the communications crisis that continues to affect Puerto Rico more than a year after the storm made landfall.³⁵ Wireline and wireless service remains spotty and in some parts of the islands not all services are restored to the level available prior to Hurricane Maria.

A year after then-Ranking Member Pallone of the House Energy and Commerce Committee first wrote to the FCC on the matter (see 2017 Pallone Wireless Framework Letter above), he requests a rulemaking to expand and make enforceable the Wireless Resiliency Cooperative Framework (2018 Pallone Wireless Framework Letter).³⁶

These are the questions that remain unanswered:

- *Why was the FCC's response to Hurricane Michael so different from its response to Hurricane Maria?*
- *Why did it take several letters from Congress starting in 2017—and several massive disasters—to prompt Chairman Pai to move toward engaging in his agency's public-safety charge against carriers and the Wireless Resiliency Cooperative Framework?*³⁷

NOVEMBER. The FCC relaunches an examination of the Wireless Resiliency Cooperative Framework after Hurricane Michael and long after allowing its related June inquiry to sit dormant. This time, the agency demands information from telecom providers on how they responded to both the 2017 and 2018 hurricane seasons. While such an inquiry is welcome, it comes more than 400 days after Hurricane Maria's landfall, and 74 days after the FCC closed its inquiry into the 2017 season.

Various providers' responses are cursory or heavily redacted. The information the providers offer is general in nature and doesn't allow the public, or advocates acting on its behalf, to assess the resiliency and restoration of carriers' networks or to com-

pare variations in disaster response from one state or territory to the next or over time from one hurricane to the next.

These are the questions that remain unanswered:

- *Why didn't the FCC conduct this review earlier, and why didn't the agency demand the carriers provide more comprehensive information on its response to the 2017 and 2018 hurricane seasons?*
- *What prompted the FCC to conduct this review after Hurricane Michael but not after Maria?*³⁸
- *Why was it necessary for the FCC to re-launch an inquiry that was already open and allowed to sit dormant following one of the most destructive disasters?*

Free Press files Freedom of Information Act requests with the FCC and FEMA, seeking a clearer understanding of each agency's role in response to Hurricane Maria and ensuing recovery efforts. The FCC should have completed this type of inquiry on its own initiative by convening an independent commission when the 115th Congress was in session, ideally in coordination with congressional investigations.³⁹ Free Press requests consumer complaints in the aftermath of the 2017 and 2018 seasons and records of the FCC's actions—with a particular focus on the task force's work.

The FCC later tells Free Press that the requested information will take years to produce.

These are the questions that remain unanswered:

- *Why didn't the FCC request this kind of information after receiving either Rep. Pallone's 2017 or 2018 Wireless Framework letters, and why wasn't the information Free Press requested included as part of the FCC's 2017 hurricane report in the first place?*
- *Why hasn't the FCC proactively analyzed the consumer complaints that came from hurricane-stricken Puerto Rico? Why did the FCC fail to cite the Hurricane Maria-related consumer complaints in its 2017 hurricane report or relevant dockets?*

DECEMBER. The FCC expands its inquiry on the Wireless Resiliency Cooperative Framework to include the role of backhaul and power companies in promoting resilient telecom systems. The FCC fails to assess how telecom providers performed during the 2017 and 2018 hurricane seasons or implement new requirements to improve network-infrastructure resiliency.

While we welcome the FCC's newfound desire to more comprehensively analyze the problem of network resiliency, the fact that the agency expanded the inquiry to entities it doesn't regulate while asking nothing more from the entities it does regulate is telling.

Essentially, this act shifts attention elsewhere and sidesteps any accountability from telecom providers for failing to mitigate the long delay in restoring communications in Puerto Rico. Instead, this inquiry represents a continuation of the agency's belated examination of telecom issues directly impacting public health and safety in Puerto Rico.

These are the questions that remain unanswered:

- *Why has the FCC gone to great lengths to excuse the telecom providers for any responsibility in the months-long telecommunications blackout in Puerto Rico?*
- *Given the Trump administration's widespread efforts to obscure its role in the excruciatingly slow recovery efforts in Puerto Rico, how can rigorous congressional oversight produce more information on the telecom aspect of the recovery efforts?*

2019

FEBRUARY. House Energy and Commerce Chairman Pallone submits a letter demanding a status update from the FCC on its current workload and backlog, including FOIA requests. On the same day, the agency contacts Free Press regarding our pending FOIA request.⁴⁰

APRIL. Almost six months after filing its FOIA request, Free Press receives the initial production, which is comprised of 52 consumer complaints from Puerto Rico for a period after Hurricane Maria. The FCC doesn't provide carriers' responses to these complaints.

The comments from consumers offer a small window into a much larger problem: *Providers promised automatic refunds and relief for the extensive loss of services but failed to deliver.*

These are the questions that remain unanswered:

- *Why has the FCC failed to cite or acknowledge these consumer issues publicly, including in its 2017 Hurricane Season Report?*
- *Why did the FCC fail to launch a more skeptical investigation of the carriers when it began receiving these complaints?*

MAY. The FCC releases a report on its investigation into communications providers' preparation for and response to Hurricane Michael.⁴¹ The investigation criticizes the lack of coordination among wireless and landline service providers, power crews and municipalities in restoring communications in the wake of the storm.

Furthermore, the Public Safety Bureau identifies a credibility issue: "the effusive praise given by [Wireless Resiliency Cooperative] Framework signatories that commented in this docket *simply does not ring true*, in light of the lengthy wireless outages in Bay and Gulf Counties. . . . At least tens of thousands [of] wireless customers had to wait days, unnecessarily, for their mobile phone service to be restored while their provider held off entering into roaming arrangements" (emphasis added).⁴²

While the report doesn't go far enough, it nonetheless reveals the FCC's ability to provide a critical analysis of telecom companies' conduct. Such analysis was woefully absent from the agency's report on the 2017 hurricane season. The agency's condemnation of *days-long* outages in Florida contrasts its lack of outrage over the *months-long* outages millions of Puerto Ricans experienced.

These are the questions that remain unanswered:

- *Given how the FCC raised concerns in the Hurricane Michael report over the carriers' failures in Florida, will the agency revisit the conduct of carriers operating in Puerto Rico—and approach it with greater skepticism?*
- *Why was the tone of the FCC's 2019 Hurricane Michael report so different from the tone of its 2017 Hurricane Season report? And why did the FCC provide a critical analysis of the effects of Hurricane Michael and no critical analysis of the impact of Hurricane Maria?*

Next Steps

Puerto Rico needs a comprehensive and community-governed plan to build a resilient communications system. To create such a plan, the FCC needs to first conduct a full independent investigation of the communications crisis in Puerto Rico.

Free Press recommends the following actions:

- *The FCC should promulgate regulations—and recommend related actions or rules for other federal, state and territorial agencies—to address the underlying causes of the prolonged outage in Puerto Rico.*
- *The FCC must engage in a long-term examination and rulemaking to strengthen the resiliency-network infrastructure not just in Puerto Rico but throughout the United States.*
- *Congress and the FCC should provide more funding for restoration efforts and offer coordination and oversight to ensure those funds accelerate restoration and incorporate network resiliency. Lawmakers and agency officials should mandate that affected communities are part of the design and governance of their local infrastructure and that funds are allocated to support self-sustaining and resilient communities.*
- *Congress should hold hearings to provide robust and regular oversight of the FCC's response to Hurricane Maria and recovery efforts in Puerto Rico.*
- *Congress should launch an investigation focused on what happened in Puerto Rico and should mandate the creation of an independent FCC commission to examine the roots of the communications crisis.*
- *Congress should use its subpoena power to ensure the prompt delivery of all requested documents from the FCC and FEMA in response to FOIA requests from Free Press and existing congressional-information requests.*
- *Lawmakers should request reports from both the Government Accountability Office and the Congressional Research Service on the history of telecom in Puerto Rico. These reports should analyze how the islands' colonial status contributed to the 2017 disaster.*
- *The FCC should abandon its Lifeline proposals, which would directly harm Puerto Ricans and other disaster survivors.*
- *Lawmakers should hold industry accountable by requiring regular reports to Congress, clear and public guidance and monitoring from the FCC, and publicly available data for advocates to a) identify potential misuse of the funds set*

aside for recovery work and b) ensure that telecom companies deliver on their promises to accelerate reconstruction.

- *The FCC and other relevant agencies must provide Spanish-language translations of all Puerto Rico-related material, and the FCC should create a Spanish-language consumer-complaint portal.*

Puerto Ricans Share Their Stories on How Puerto Rico's Communications Crisis Impacted Their Lives After Hurricane Maria

In the absence of adequate FCC outreach, Free Press and the National Hispanic Media Coalition invited their members and the public to share their experiences of losing communications during and after Hurricane Maria through a public comment-collection tool on the Free Press website.

Beginning on Jan. 29, 2018, Free Press reached out to its members and asked: "What's your story about the impact Hurricane Maria has had on Puerto Ricans' ability to access communications services?"⁴³ Despite the extreme hardships that many Puerto Ricans faced—and despite the lack of access to basic necessities, including communications services—many people sent feedback via this tool with the hope that the FCC would hear them and heed their concerns.

For instance, Sandralis Rivera of Woodland Park, New Jersey, said on Jan. 31, 2018:

My grandfather died 4 days after the hurricane hit [Puerto Rico]. . . . We weren't able to find out about his death until 3 days later in a brief 3 min. phone call. The lack of service had us extremely concern[ed] over the welfare of my grandmother who was in an elderly home without any power nor access to cell service. It took at least 3 weeks before I was able to speak to my in-laws and my cousins. Up until last week, when I visited [Puerto Rico], I experienced several dropped calls and no internet[.]

This tragic story is all too common and is an important piece of the larger story of the communications crisis—a story the FCC failed to hear due to its indifference and subpar outreach. Many commenters noted in January 2018 that providers had only recently restored reliable communications services—more than four months after Hurricane Maria struck.

Many stories of uncertainty and heart-wrenching silence from loved ones came to the fore as power and service were slowly restored and some survivors were finally able to speak for themselves by submitting their stories through Free Press' comment tool. One commenter noted the difficulty caused by the timing and conduct of the FCC's proceeding:

How can the FCC possibly ask for comments regarding the impact of Hurricane Maria on Puerto Rico when many of [the] citizens of the island still remain without power or internet[?]. Is the FCC actually going [to] the . . . island and knocking on doors? Is the FCC going to drop fliers on the island that citizens can mail back to them?⁴⁴

Such outreach does not relieve the Commission of the obligation to do more and learn from the people it serves. But the comments we collected tell a powerful narrative about the hardships suffered by people disconnected from their communication services and from each other in the wake of the storms.

- *Patricia in Bayamón, Puerto Rico (Jan. 31, 2018):*

Communication was down for weeks, making it hard for everyone to stay sane, calm, and collected. Thus . . . our mental health decreased, worse than what it already was. . . . My boyfriend's family still does not have home Internet access thanks to the hurricane. Many areas that provide Internet (theirs being Claro, the telephone company) were severely damaged thanks to water coming in the central buildings.

- *Michael Slayder in Luquillo, Puerto Rico (Jan. 29, 2018):*

Ever since the Hurricane hit us I wasn't able to contact my friends for about two weeks before my parents took a very long trip to the center of the island which was crowded with cars and people where a few stores had signal for everyone to communicate with, I got in contact with my friends from the U.S. but I haven't heard anything from the ones here in Puerto Rico due to school being closed and me not knowing where they live.

- *Luis Lugo in Adjuntas, Puerto Rico (Feb. 12, 2018):*

As of today, the AT&T tower has not been replaced or rebuilt, leaving us with a mediocre service. *However, last weekend there was a service outage with one*

of Claro's fiber-optic cable, leaving all Claro customers in Adjuntas without phone or Internet service until today. I feel that the telecommunication companies have left the people in the mountain area behind. My parents had AT&T postpaid accounts. One of the numbers was transferred to Claro and the other was not paid because of the lack of service from AT&T, who refused to give us a fourth month of credit (emphases added).

- *Hector Santana in Carolina, Puerto Rico (Jan. 31, 2018):*

In the beginning of the hurricane the hospital my mom worked at was filled with people who were on the floor crying over the fact that their homes were more than likely destroyed and that their families were still in their homes and [they had] no way of being able to contact them.

- *Maria Colon in San Juan, Puerto Rico (Feb. 2, 2018):*

I live in the San Juan metropolitan area. My mother lives on the west side of the island. I was not able to communicate with her for 5 days. I couldn't access any reception and her land line was completely out of service. Due to lack of gas and road obstructions I couldn't get to her. I [must] say *those were the most difficult days since she is elderly and depends on the phone to let her needs known*. Finally, I was able to go see her in person (emphasis added).

When I go visit her, as of today, the communications are difficult and at times I need to go out of my community to get reception. *It is extremely urgent and important that the FCC investigates and reassure[s] the Puerto Ricans, USA citizens, that this will never happen again* (emphasis added).

- *Otoniel Cajigas in Aguada, Puerto Rico (Jan. 29, 2018):*

On September 19, 2017 my family [and] I were about to go sleep knowing that early in the mornings we will begin to feel the impact of the hurricane Maria at our home in Bo Espinal, Aguada, PR. To our surprise before any wind or rain began there was a power outage (which later we lived [through] for 75 straight days), which caused that around 2 or 3 am we end up without any broadband Internet access at our home (ISP Liberty Cable), but at least we still had the cellphone. . . . [H]owever around 4:30 [or] 5:00 am we also [lost] any cellular signal from our provider (AT&T and Tmobile). At this point we decided to try capturing local channels, however none [were] available, therefore we tried the radio . . . [no] FM radio was available in the spectrum, so we switched to AM. *[F]inally we were able to locate one local radio station: 1340AM. Unfortunately, even while they were trying to provide information to the audience, they were blind as well. [N]o information was received from any government agency, neither status of the Hurricane and how much additional time we should expect to receive [the] impact* (emphasis added).

[A]t around 7:00AM [on] September 21st we wake up to our new reality, no running water, no electricity, but worse than that No communications at all . . . basically it passed 1 week before we heard that the communications provider Claro had part of their cell towers working, therefore we looked for people with their service to load a cell phone in order to communicate with our family members out in U.S. mainland. AT&T cellular signal took almost a month to begin working for calls and SMS, however . . . data service wasn't available until 6 weeks, but very unstable and extremely slow (emphasis added).

3 months later the service [stabilized] and was near to normal, however broadband service for home wasn't available. Finally, on day 75 our neighborhood was re-energized, therefore *I began contacting Liberty to get estimates on when should I get the service back, but there weren't any estimates given*. Finally, last week, January 23, 2018 the [fiber] cable was installed at the neighborhood, however my coax cable from the fiber to my home was cut, so I contacted Liberty to get it replaced. *I have contacted them more than 5 times and thru all possible channels however I'm still without the service and they aren't even providing any installation date*. So this is a summary of our story so far . . . (emphases added).

- *Sheila Ward in San Juan, Puerto Rico (Jan. 31, 2018):*

We did not have electricity at our house in San Juan until January 11. Therefore, our access to our landline telephone service was limited. Concerning the cell phone, it was about 10 days before I could talk well with my husband. I was off island and he was in PR for Hurricane Maria.

- *Maritza Stanchich in San Juan, Puerto Rico (Jan. 31, 2018):*

For me, not having any cell phone connection or access to Internet in the immediate aftermath of the storm was worse than not having electricity or water service. We had little idea what had happened in the rest of the country, as only one radio station was left operating (WAPA).

Once I managed to get hold of a newspaper (by driving about half an hour to the newspaper with a friend), I learned that the mayors and authorities of five municipalities of the country's southwest had achieved no contact with the governor or emergency officials, this [was] five-six days after the storm.

In addition, I knew personally of someone living nearby who contracted potentially life-threatening leptospirosis but could not seek medical attention from the hospital military ship in port because doing so required a referral, yet there was no way to call or reach his doctors for one.

- *Gerardo Talavera in Brookline, Massachusetts (Jan. 29, 2018):*

It was me and my uncle putting our phones outside, against anything we thought could work as an antenna. No service for days, no reliable service for weeks. It was an absolute nightmare to let everyone know we were OK. *Communication was at such a premium that when PREPA offered an Internet 'oasis' it was flooded with people trying to get on WiFi. Such things should never happen again* (emphasis added).

The communications blackout also harmed people on the U.S. mainland who had friends and family in Puerto Rico. Here are some of their comments:

- *Sonia Acevedo in Alexandria, Virginia (Feb. 12, 2018):*

Most of my family lives in the . . . southeast of the Island, to be exact in the town next to where the hurricane Maria landfall. It wasn't until 12 days after Maria . . . that I was able to talk with my mom. She had to drive at least 30–40 min far from my town, park in the shoulder of a highway to be able to talk with me and my sister. The 10 min or so that . . . the call [lasted] it was very difficult to understand what she was saying because the signal was bad. It wasn't until a week later that I was able to talk with her again. I went to the Island [in the beginning] of November and I had no signal all the time. Almost 5 months after the hurricane communications still bad. I used to talk with my parents almost every day. Now if we are lucky, we talk twice a week. *People in Puerto Rico pay a lot for cellphone and internet. They are U.S. Citizens, they deserve to be treated the same way [as] the people that live in the U.S. mainland* (emphasis added).

- *Ahmad Moradi in Fort Lauderdale, Florida (Jan. 30, 2018):*

As an Expat who lives in PR, communication is vital to our business operation. We cannot conduct business when struggle continues with lack of power, Internet, and other related services.

- *N. L. in Long Grove, Illinois (Jan. 30, 2018):*

Six months following Hurricane Maria and we still are not able to directly communicate with our friends in parts of the mainland and Vieques[.]

- *Magdaliz Figueroa in Silver Spring, Maryland (Feb. 11, 2018):*

My immediate family, my parents, my mom and sister had phone signal on and off during the whole ordeal they live in Bayam[ó]n . . . and I am more than thankful for that because I will have gone crazy if I wouldn't have listen from them for 14 or 20 days like it happened to so many of my friends here.. . .

My friend decided to go stay with her parents in her hometown of Cidra[.] They didn't have any radio or cellphone signal [and] didn't know what was happening. . . . *[W]ith no communications they couldn't know if the hurricane passed or if it was still there* (emphasis added).

[T]he death toll of the aftermath of the hurricane is more [than] 1,000 people[.] [T]he mayor of Orocovis walked for a day or more with a corpse just to be able to get signal on a cellphone [for the corpse to] be pick[ed] up. There are thousands of stories like the ones I just wrote here. Still to this day there're people without power, water and phone signal[.] [I]t's been 5 months, and all I can think is that the 2018 hurricane season will start in a few months.

- *Sandra Wilkes in Perth Amboy, New Jersey (Jan. 29, 2018):*

It took two whole weeks to try to communicate with my parents. Those two weeks were heart wrenching not knowing if my parents were safe as [images] of devastation were spreading. They couldn't use their cellphone because the cell towers were down and landlines were destroyed.

- *Clarinda Low in New York City (Feb. 2, 2018):*

For several people I know, even in San Juan, Internet services have been very spotty at best. Because phone service is even worse, this has interrupted every aspect of life. *Professors are unable to communicate with students, parents [are] unable to communicate with their children[s] schools, information flow in general has come to a standstill* (emphasis added).

- *Marta Landrieu in New York City (Jan. 30, 2018):*

My family, sister, cousins [and] other close relatives live in Patillas and Guayama areas [most devastated] by Maria. Today, months after Maria most are still without electricity and no access [to] the internet. . . . One cousin, [struggling with] multiple cancers, was unable to reach anyone nor use the Internet to receive updated information/news as to her town's condition and for information on the distribution of needed water, food that would reach her remote area. FEMA irresponsibly was/is asking folks to file their claims on the Internet and was closing its doors to those who were unable to do so.

Endnotes

¹See *New England Journal of Medicine*, "Mortality in Puerto Rico after Hurricane Maria," July 12, 2018: <https://www.nejm.org/doi/full/10.1056/NEJMsa1803972>; *GW Today*, "GW Researchers: 29,75 Excess Deaths Linked to Hurricane Maria," August 29, 2018: <https://gwtoday.gwu.edu/gw-researchers-2975-excess-deaths-linked-hurricane-maria>.

²Danica Coto, "Puerto Rico Lures Tech Developers as Hurricane Season Looms," Associated Press, March 20, 2019: <https://www.apnews.com/36ad55904ab6459db6a0521d92490b90>.

³Puerto Rico and possession-tax credit, 26 U.S.C. § 936 (fully repealed 2006).

⁴See Juan González, "Puerto Rico's \$123 Billion Bankruptcy Is The Cost Of U.S. Colonialism," *The Intercept*, May 9, 2017: <https://theintercept.com/2017/05/09/puerto-ricos-123-billion-bankruptcy-is-the-cost-of-u-s-colonialism/>.

⁵See Gabriela Martinez, "Why This Disaster Relief Bill Is Stuck on a Debate over Puerto Rico Food Stamps," *PBS NewsHour*, March 28, 2019: <https://www.pbs.org/newshour/politics/why-this-disaster-relief-bill-is-stuck-on-a-debate-over-puerto-rico-food-stamps>.

⁶See, e.g., Annie Karni & Patricia Mazzei, "Trump Lashes Out Again at Puerto Rico, Bewildering the Island," *The New York Times*, April 2, 2019: <https://www.nytimes.com/2019/04/02/us/trump-puerto-rico.html>; Aaron Rupar, "Trump's Latest Outburst Against Puerto Rico, Explained," *Vox*, April 2, 2019: <https://www.vox.com/2019/4/2/18291975/trump-puerto-rico-disaster-relief-funding-bill-explained>.

⁷See Amy Sherman, "Donald Trump Falsely Tweets That Puerto Rico Got \$91 Billion in Hurricane Aid," *Politifact Florida*, April 3, 2019: <https://www.politifact.com/florida/statements/2019/apr/03/donald-trump/trumps-false-tweet-puerto-rico-got-91-billion-hurr>.

⁸See Joseph Torres, "Puerto Ricans Speak Out About Islands' Communications Crisis," *Free Press*, Oct. 18, 2018: <https://www.freepress.net/our-response/advocacy-organizing/stories-field/puerto-ricans-speak-out-about-islands-communications>.

⁹See Trevor Houser & Peter Marsters, "The World's Second Largest Blackout," *Rhodium Group*, April 12, 2018: <https://rhg.com/research/puerto-rico-hurricane-maria-worlds-second-largest-blackout/> ("What was already the largest blackout in American history has now likely become . . . the second largest blackout in the world"); see also Alexia Fernández Campbell, "It Took 11 Months to Restore Power to Puerto Rico After Hurricane Maria. A Similar Crisis Could Happen Again," *Vox*, Aug. 15, 2018: <https://www.vox.com/identities/2018/8/15/17692414/puerto-rico-power-electricity-restored-hurricane-maria> (reporting the restoration of "power to the last neighborhood that lost electricity after Hurricane Maria—328 days after the Category 4 storm hit the island").

¹⁰See FCC, "Communications Status Report for Areas Impacted by Hurricane Maria," released Sept. 23, 2017: <https://docs.fcc.gov/public/attachments/DOC-346860A1.pdf>.

¹¹See Milken Institute School of Public Health, George Washington University, Ascertainment of the Estimated Excess Mortality from Hurricane Maria in Puerto Rico (2018); Nishant Kishore et al., "Mortality in Puerto Rico After Hurricane Maria," 379 *New England Journal of Medicine* 162, 162–170 (2018); see also Nidhi Prakash, "A New Study Says Nearly 6,000 Died In Puerto Rico After Hurricane Maria. The Government Still Says 64 People Died," *BuzzFeed News*, May 29, 2018 (noting that the collapse of the cell networks "prevented many people from seeking help if they were unwell," and those "who relied on home oxygen and dialysis machines or refrigeration for diabetes medication were left vulnerable, cut off from medical professionals and unable to call for help"); Danica Coto, "Puerto Rico Unveils New Emergency Preparations After Maria," Associated Press, Sept. 11, 2018 (noting the recent installation of direct emergency lines to nursing homes to address the fact that many of the people who died as a result of Maria were elderly), <https://www.apnews.com/b6651a23cc51481497f7f64eafc4bf78>.

¹²See Letter from the Center for Media Justice, Color Of Change, Free Press, the National Hispanic Media Coalition and Public Knowledge to FCC Chairman Ajit Pai, Oct. 6, 2017: <http://www.nhmc.org/fcc-must-aid-puerto-rico>.

¹³FCC, “FCC Chair Announces Hurricane Recovery Task Force,” released Oct. 6, 2017: <https://www.fcc.gov/document/fcc-chairman-announces-hurricane-recovery-task-force>

¹⁴See Letter from Rep. Frank Pallone Jr. to FCC Chairman Ajit Pai, OL 17–18, Oct. 6, 2017: <https://docs.fcc.gov/public/attachments/DOC-347575A2.pdf>.

¹⁵See FCC, “Chairman Pai Meets with Officials in Puerto Rico,” Nov. 7, 2017: <https://www.fcc.gov/document/fcc-chairman-pai-meets-officials-puerto-rico>

¹⁶See FCC, “Communications Status Report for Areas Impacted by Hurricane Maria,” released Dec. 6, 2017.

¹⁷See “Public Safety and Homeland Security Bureau Seeks Comment on Response Efforts Undertaken During 2017 Hurricane Season,” PS Docket No. 17–344, Public Notice, 32 FCC Rcd 10245 (Dec. 7, 2017).

¹⁸“Improving the Resiliency of Mobile Wireless Communications Networks: Reliability and Continuity of Communications Networks, Including Broadband Technologies,” PS Docket Nos. 13–239 & 11–60, Notice of Proposed Rulemaking, 28 FCC Rcd 14373, 14373–74 ¶¶ 1, 3 (2013).

¹⁹See GAO, “FCC Should Improve Monitoring of Industry Efforts to Strengthen Wireless Network Resiliency,” December 2017 <https://www.gao.gov/assets/690/688927.pdf>.

²⁰*Id.*

²¹See FCC press release, “FCC Chairman Announces Visit to Puerto Rico & U.S. Virgin Islands in March,” Feb. 21, 2018: <https://docs.fcc.gov/public/attachments/DOC-349352A1.pdf>.

²²See Sharon Minelli Pérez, “La FCC Fiscalizará el Uso de los Fondos para las Telecomunicaciones,” *El Nuevo Día*, March 8, 2018: <https://www.elnuevodia.com/negocios/economia/nota/la-fcc-fiscalizara-el-uso-de-los-fondos-para-las-telecomunicaciones-2404761>.

²³See Joint Comments of Free Press and the National Hispanic Media Coalition, PS Docket No. 17–344 & WC Docket No. 17–287, filed April 17, 2018: https://www.freepress.net/sites/default/files/2018-04/joint_comments_nhmc_freepress_2017_hurricane_season.pdf.

²⁴See Public Safety and Homeland Security Bureau Announces Workshop to Identify Critical Information Needs to Improve Communications During Disasters, Public Notice, DA 18–292, released March 23, 2018: <https://docs.fcc.gov/public/attachments/DA-18-292A1.pdf>; see also FCC’s Public Safety and Homeland Security Bureau announces the agenda for the April 13, 2018 public workshop to identify critical information needs to improve communications during disasters, Public Notice, DA 18–357, released April 10, 2018: <https://docs.fcc.gov/public/attachments/DA-18-292A1.pdf>.

²⁵*Id.*

²⁶See *Uniendo a Puerto Rico Fund and the Connect USVI Fund*, Order and NPRM, WC Docket Nos. 18–143, 10–90, 14–58, FCC 18–57, May 29, 2018: <https://docs.fcc.gov/public/attachments/DA-18-670A1.pdf>.

²⁷See Federal Emergency Management Agency, “2017 Hurricane Season FEMA After-Action Report” (2018): <https://efscapi.fcc.gov/file/10720156823712/FP%20Rosenworcel%20Ex%20Parte%20re%20Puerto%20Rico%20-%20July%2020%202018.pdf>.

²⁸See Letter from Joseph Torres, Free Press, to FCC Secretary Marlene H. Dortch, WC Docket No. 18–143, filed July 20, 2018.

²⁹See “2017 Atlantic Hurricane Season Impact on Communications Report and Recommendations,” Public Safety Docket No. 17–344, Aug. 24, 2018: <https://docs.fcc.gov/public/attachments/DOC-353805A1.pdf>.

³⁰See U.S. Government Accountability Office, GAO–18–472, “2017 Hurricanes and Wildfires: Initial Observations on the Federal Response and Key Recovery Challenges,” 32 (2018): <https://www.gao.gov/assets/700/694231.pdf>.

³¹See Letter from Free Press *et al.* to FCC Chairman Ajit Pai, PS Docket No. 17–344 & WC Docket No. 18–143, filed Sept. 20, 2018: <https://www.freepress.net/sites/default/files/2018-09/Call%20for%20Independent%20Commission%20on%20Puerto%20Rico.pdf>.

³²See Free Press, “Reflections on Hurricane Maria: Communications in Puerto Rico,” <https://www.facebook.com/freepress/videos/992587910924018/> (last visited March 5, 2019).

³³See Comments of Free Press, PS Docket No. 17–344 *et al.*, filed Sept. 17, 2018: https://www.freepress.net/sites/default/files/2018-09/free_press_puerto_rico_recovery_comments.pdf.

³⁴See Free Press, “Puerto Ricans Speak Out About Islands’ Communications Crisis,” Oct. 18, 2018: <https://www.freepress.net/our-response/advocacy-organizing/stories-field/puerto-ricans-speak-out-about-islands-communications>.

³⁵Free Press press release, “Chairman Pai’s Call for an Investigation of Communication Failures in Florida Contrasts His Inaction in Puerto Rico,” Oct. 24, 2018, <https://www.freepress.net/news/press-releases/free-press-chairman-pais-call-investigation-communication-failures-florida>

³⁶See Letter from Rep. Frank Pallone Jr. to FCC Chairman Ajit Pai, OL 17–18, Oct. 26, 2018: <https://docs.fcc.gov/public/attachments/DOC-355997A2.pdf>.

³⁷Congress created the FCC to “promot[e] safety of life and property through the use of wire and radio communications.” 47 U.S.C. § 151 and it “is required to consider public safety . . . its enabling act.” *Nuvio Corp. v. FCC*, 473 F.3d 302, 307–08 (D.C. Cir. 2006).

³⁸See Letter from Joseph Torres, Free Press, to FCC Secretary Marlene H. Dortch, PS Docket No. 18–339 & WC Docket Nos. 09–197, 11–42 & 17–287, filed Dec. 17, 2018.

³⁹See Letter from Carmen Scuro, Free Press, to the FCC, filed Nov. 9, 2018 https://www.freepress.net/sites/default/files/2019-05/free_press_foia_request_11_09_18.pdf.

⁴⁰See Letter from Reps. Frank Pallone Jr. and Mike Doyle to FCC Chairman Ajit Pai, OL 18–17, Feb. 4, 2019.

⁴¹See “October 2018 Hurricane Michael’s Impact on Communications: Preparation, Effect, and Recovery,” Public Safety Docket No. 18–339, May 9, 2019: <https://docs.fcc.gov/public/attachments/DOC-357387A1.pdf>.

⁴²*Id.*

⁴³See Free Press, “Cuenta su historia: La FCC necesita saber sobre el impacto del huracán María en los servicios de comunicación en Puerto Rico,” (last visited April 16, 2018): <https://>

act.freepress.net/act/internet/fcc/pr/spanish/; “Free Press, Tell Your Story: The FCC Needs to Know About the Impact of Hurricane Maria on Communications Services in Puerto Rico” (last visited March 6, 2018): <http://act.freepress.net/letter/internet/fcc/pr/>.

⁴⁴ Comment of Michael Brossi, Framingham, Massachusetts (Feb. 1, 2018).

Telecommunications Policy 45 (2021) 102094

EMERGENCY COMMUNICATIONS POLICIES IN PUERTO RICO: INTERACTION BETWEEN REGULATORY INSTITUTIONS AND TELECOMMUNICATIONS COMPANIES DURING HURRICANE MARIA

Luis Rosario-Albert^a, Bruno Takahashi^b

^a*Department of Liberal Arts, Program of Communication, Universidad Ana G. Méndez, Carolina Campus, USA*

^b*School of Journalism and AgBioResearch, College of Communication Arts and Sciences, Michigan State University, USA*

ARTICLE INFO	ABSTRACT
Keywords: Emergency communications Communication administration Puerto Rico Hurricane Maria Telecommunications policy	Extreme infrastructure collapse poses unique challenges to emergency communications. This was the case in Puerto Rico in 2017 after hurricanes Irma and Maria. In this study, we first examined telecommunications carriers representatives' views of the adequateness of emergency communications policies. Their views were contrasted with the perspectives of a selection of telecommunications experts and regulators. Secondly, we conducted a policy analysis to assess the FCC, the Telecommunications Bureau of Puerto Rico, and telecommunications companies' emergency communications processes and outcomes. An electronic questionnaire and in-depth interviews with telecommunications companies' representatives, and secondary data analysis were used. The analysis revealed that most participants considered favorably the 2017 Wireless Resiliency Cooperative Framework but did not look favorably upon various state-level emergency communications policies. The policy analysis points to ineffective state emergency communications policies due to the impact of external factors and the lack of coordination of the state government electrical power provider and private telecommunications companies. The results also revealed that between 2017 and 2019, policy makers and the application of policy tools in regard to emergency communications were largely reactive and relied on vigorous state level intervention through a prescriptive regulatory approach. The analysis includes policy recommendations for emergency communications.

1. Introduction

Natural and human-made disasters validate the social importance of traditional news media, new media, and emergency warning systems. Extreme infrastructure collapse poses unique challenges to emergency communications. This was the case in the Commonwealth of Puerto Rico in 2017 after hurricanes Irma and Maria battered the island and left its citizens without access to communication channels and emergency communication services. This study examines emergency communications policies carried out by the Federal Communications Commission (FCC), the Telecommunications Bureau of Puerto Rico (TBPR), and Privately-Owned Telecommunications Companies (PTCs) during Hurricane Maria response and recovery phases.

Federal and state laws and rules adopted or enforced by the FCC and the TBPR¹—the regulatory agencies for telecommunications services in Puerto Rico—serve to define roles and emergency communications policy objectives. These objectives are adopted by a range of policy actors such as public safety organizations, regulatory institutions, citizenry, and PTCs. During emergency situations, PTCs (*e.g.*, wireline carriers, wireless carriers, broadband services companies, telecommunications infrastructure companies) rely on a combination of legal mandates, policy tools (*e.g.*, technical standards, licensing, subsidies, tax credits) and industry self-regulatory standards (*e.g.*, best practices, codes), and agreements (*e.g.*, cooperative frameworks). Also, PTCs' activities are integrated to federal, state, and municipal governments, private organizations (non-governmental organizations), and volunteer emergency response activities. In particular, PTCs' conduct is aimed at providing

¹ On August 12, 2018 the Act to Execute the Reorganization Plan of the Puerto Rico Public Service Regulatory Board (Law Num. 211) was signed into law. The law created the Puerto Rico Public Service Regulatory Board (PRPSRB). The law renamed the Puerto Rico Telecommunications Regulatory Board (PRTRB) to the Telecommunications Bureau of Puerto Rico. With the exception of the resolutions and orders, the study will refer to the state telecommunications regulator as the Telecommunications Bureau of Puerto Rico (TBPR).

continuity of emergency communications services for public safety services (*e.g.*, 911 emergency services) and commercial services to citizens (*e.g.*, wireline and wireless telephony).

This study of emergency communications policies in Puerto Rico is articulated at two levels of analysis. First, adopting a stakeholder approach, we analyze PTCs' (*i.e.*, carriers, broadband & network services, communications infrastructure) views of the adequacy of emergency communications regulatory policies and the need to strengthen them. Their views were contrasted with a selection of five interviews with state level telecommunications experts and regulatory officials. This second group of interviews contributed to the analysis by providing a better understanding of the regulatory framework for emergency communications in Puerto Rico, but their responses are not included in the results. Therefore, the study only analyzes carriers' perspectives. Secondly, we carried out a policy examination of FCC, TBPR, and PTCs' interaction and outcomes through a detailed analysis of the emergency management activities and adoption of policy tools during the emergency situation in 2017.

The analysis is conceptually grounded in policy studies and media and telecommunications policy analysis. Since the study focused on PTCs' opinions, it followed an inductive and exploratory approach but was grounded in an analytical framework proposed by *Picard and Pickard (2017)* for media and telecommunications policy making and policy analysis. This framework served as the starting point for the analysis of PTCs' opinions about emergency communications policies and the analysis of the organizations' conduct during the response and recovery phases. The policy problem explored is the extent to which emergency communications policies carried out in Puerto Rico provided citizens and public safety authorities effective use of emergency communications services during the response and recovery phases. The policy problem is framed in three types of relationships and influences: 1) FCC and telecommunications industry interaction, 2) TBPR and telecommunications industry interaction, and 3) Wireless industry self-regulatory practices during emergency situations, specifically the roaming service agreement in 2017.

This study also presents a detailed narrative of the diverse, overlapping, and complementary Federal and state emergency communications policies at play after Hurricane Maria in Puerto Rico. The analysis of governmental literature and other documentation, embedded within the accounts of companies' representatives, provide a unique in-depth view of emergency communications policy processes. Our purpose is to contribute to the academic literature examining contexts of extreme infrastructure collapse in relation to emergency communications policy objectives, policy mechanisms, and policy tools. In addition, we draw from the participants' in-depth interviews to present practical recommendations (as suggested by *Enserink et al., 2013*) for telecommunications at the federal and state levels that could be implemented to strengthen emergency communications in Puerto Rico and other contexts.

2. Conceptual considerations of emergency communications policies

2.1. Policy analysis and telecommunications policy

The literature on policy analysis for public policymaking shows that changes in the legal sphere and technological innovation have been two significant factors in the evolution of emergency communications regulatory policies. First, telephone companies have to provide access to local public safety emergency systems such as 911 and E911 (*Nuechterlein & Weiser, 2007; Ten, 2001*). Also, *Ryan and Peha (2008)* recommended the deployment of a single nationwide network that serves all public safety personnel, and *Peha (2009)* analyzed long-term spectrum policy reform in relation to public safety spectrum. Moreover, given the wide adoption of wireless communication services, *Seeman et al., (2018)* analyzed the policies for implementing and funding the transition from Enhanced 911 to Next Generation 911 (NG911) and its integration into the Nationwide Public Safety Broadband Network.

Several scholars have addressed some of the challenges for media and communications policy analysis. For instance, *Napoli (1999)* elaborated on the unique characteristics of media regulation in relation to other industries' regulatory regimes and proposed a symmetrical approach to communications policymaking. For Napoli, policy makers should base their decisions on analytical assessments that take into account economic and social values for policy objectives in an equitable way.

Another perspective within a framework based on legal principles has been proposed to address how economic viability and political feasibility limit the adoption of sustainable policy options for telecommunications regulation (*Cherry, 2006*). Cherry pointed out a trend in academic research on the relationship between deregulatory policies and the design of regulatory incentives to affect the behavior of private parties in order to achieve expected policy goals. More recently, *Picard (2020)* has

addressed the historical evolution and the normative topics for media, information, and telecommunications policies (e.g., policy mechanisms, policy tools and policy outcomes).

Picard and Pickard (2017) proposed a framework for media and telecommunications policy making and policy analysis based on seven principles. The framework serves to “inform the development of policy objectives and policy mechanisms and to provide consistency across varying issues, technologies, and actions by defining fundamental criteria that can be used to inform discussion and guide policy decisions” (5). Their emphasis was on defining fundamental principles from which specific policy objectives, policy tools, and desired outcomes can be originated. For *Picard and Pickard (2017, 5)*, policy analysis for policymakers, policy advocates, and scholars should start from “a more principled level and then link policy objectives and tools to these normative foundations rather than merely seeking immediate problem solutions.” These principles for media and communications policymaking and policy analysis are:

- 1) Meeting fundamental communication and content needs;
- 2) Providing effective ability for public use of media and communications;
- 3) Promoting diversity/plurality in ownership of media and content available;
- 4) Affording protection for users and society;
- 5) Providing transparency and accountability;
- 6) Pursuing developmental and economic benefits; and
- 7) Pursuing equitable and effective policy outcomes.

Picard and Pickard (2017) argue that the main stakeholders in emergency communications are the citizenry and authorities (e.g., first responders), and that during emergency situations the primary objectives of communications are: 1) To allow the public to communicate with authorities and among themselves, and 2) To allow authorities to communicate directly with the public and to enhance communication among authorities themselves. In this study we used these two principles as conceptual lenses for a policy examination of emergency communications processes and outcomes during the response and recovery phases in Puerto Rico. The lack of existing theoretical models or frameworks for emergency communication policy analysis requires an exploratory and inductive approach that allows for the development of emergency communications performance analysis instruments.

2.2. Law, regulation, and self-regulation

The legal and regulatory literature distinguishes Federal and state provisions for public safety communication services from those emergency communications requirements specific for PTCs. In this section we will refer to Federal and state laws and rules for emergency communications that make up a dynamic framework that sets different types of requirements, either mandatory or voluntary, for Public Safety Organizations and PTCs.

The FCC’s definition of emergency communications details roles and services related to the 911/E911 Service, the Emergency Alert System, Commercial Mobile Alert System, Emergency Management Information Systems (e.g., Disaster Information Reporting System, Network Outage Reporting System), and spectrum interoperability for public safety systems.² The Communications Act of 1934 sets the principle of universal service; that is, telephone access for all citizens (*Jayakar, 2009*) and eligible telecommunications carriers receiving UniversalService low-income support are required to meet emergency communications provisions. According to the Federal requirement on 47 CFR54, Subpart-C-Carriers Eligible for UniversalService Support, 54.202 (a) (2), a company must:

Demonstrate its ability to remain functional in emergency situations, including a demonstration that it has a reasonable amount of back-up power to ensure functionality without an external power source, that it is able to reroute traffic around damaged facilities, and that it is capable of managing traffic spikes resulting from emergency situations.³

At the state level, Telecommunications Law 213–1996, created the Puerto Rico Telecommunications Regulatory Board (PRTRB) and reaffirmed the Universal Service principle of the Telecommunications Act of 1996. As in the Federal statute, state law provided that eligible telecommunications carriers could receive subsidies through the Puerto Rico Universal Service Fund (a complementary fund) to provide

²FCC. 2015. Emergency Communications. Retrieved from: <https://www.fcc.gov/general/emergency-communications>.

³47 CFR 12. PS Docket No. 14–174. FCC 15–98. See also FCC. (2015). Ensuring Continuity of 911 Communications.

vulnerable groups and low income households access to telecommunications services (e.g., Lifeline Program and Link-Up America Program).⁴

The TBPR requires telecommunications companies to demonstrate the ability to deal with emergency situations. The *Reglamento para la Expedición de Certificaciones y Franquicias* (Regulations for the Issuance of Certifications and Franchises) and the *Reglamento de Servicio Universal* (Regulations for Universal Service) also set the legal and procedural basis for the state regulator to certify ETCs every two years, and to formulate new requirements related to the ability of companies to continue providing services during emergency situations. Also, Article 2 of Chapter III of Law 213–1996 provides that companies must demonstrate “moral and economic solvency, their experience or history in the area in which they request certification.” Therefore, the regulatory regime at the Federal and state level impose on telecommunications carriers and PTCs the responsibility, and require of them the ability, to restore telecommunications services to consumers during emergency situations (e.g., require the capacity to provide continuity of services, reroute traffic, network interconnection, and interoperability).⁵

As noted by *Picard and Pickard (2017)*, self-regulation is a topic of growing importance for international and industry professional organizations, telecommunications companies, and media and communications policymaking organizations.⁶ Emergency communications intra-industry standards (e.g., best practices, codes) and agreements (e.g., cooperative frameworks) for emergency situations are important self-regulatory provisions.⁷ In 2016 the Wireless Resiliency Cooperative Framework adopted by U.S. wireless carriers and industry associations and endorsed by the FCC was the basis for an important, if not historic agreement and collaboration between wireless carriers in Puerto Rico, later endorsed by the TBPR. This agreement’s main outcome was that it provided roaming service to wireless subscribers during the recovery phase. This cooperative initiative fits under what Freeman refers to as business and top-down approaches to crisis informatics, in which “an overarching policy effort (e.g., national) is used to assist and make decisions on how the technology can be used by citizens” (*Freeman, 2011*, p. 74).

2.3. Emergency communications framework

In natural disasters, acts of terrorism, and other man-made disasters, the Homeland Security Act of 2002 (6 USC 101 et seq.) identifies communications networks as critical infrastructure. During emergency situations, communications networks’ response and recovery activities are led by the Department of Homeland Security (DHS). DHS has designated a group of agencies that provide communications support to state, local, tribal, and territorial (SLTT) governments, agencies, and first responders “when their systems have been impacted and provides communications and information technology (IT) support to the Joint Field Office (JFO) and JFO field teams.”⁸ The FCC and the TBPR are Emergency Support Function #2 (ESF#2) organizations with specific emergency plans⁹ and calls to action.¹⁰ Under these considerations, first responders’ organizations and citizenry are the main subjects of a dynamic emergency communication model that entails various emergency warning systems (e.g., Emergency Alert System, Wireless Emergency Alerts/Commercial Mobile Service Alerts, and the Integrated Public Alert & Warning System), emergency management information systems (e.g., Disaster Information Reporting System, Network Outage Reporting System), use of multiple technologies (e.g., wireless serv-

⁴Telecommunications Act of 1996, Section 254(b) and the Puerto Rico Telecommunications Law 213–1996, Statement of Reasons.

⁵See Article 9.3 in *Puerto Rico Telecommunications Board (PRTRB)*. (1997). *Reglamento para la Expedición de Certificaciones y Franquicias* (Regulations for the Issuance of Certifications and Franchises). *PRTRB*, 2009.

⁶See *International Telecommunications Union*. (2020a). ITU Guidelines for national emergency telecommunication plans; The World Bank/GFDDR. “Communication during Disaster Recovery. Disaster Recovery Guidance Series”.

⁷Cited in *Picard and Pickard, Haufler, V.* (2001). *A Public Role for the Private Sector: Industry Self-Regulation in a Global Economy*. Washington, DC: Carnegie Endowment for World Peace.

⁸DHS. (2016). *National Response Framework* (3rd ed); NRF. (2008). *Emergency Support Function Annexes: Introduction*.

⁹As an ESF#2 organization the TBPR during an emergency situation supports the restoration of communications infrastructure and services and in the coordination between PTC’s and federal, state, and local public safety organizations. See *Torres López (2017, November 7)*. Letter to Hon. Miguel A. Laureano Correa, President, Innovation, Telecommunications, Urban and Infrastructure Commission, Senate of Puerto Rico (Explanatory Report for Senate Resolution 457).

¹⁰DHS (2008). National Emergency Communications Plan. P.11; *DHS (2013)*. NIPP 2013. Partnering for Critical Infrastructure Security and Resilience. P. 21–25; *Torres López (2018, May 25)*. Letter to Hon. Henry Neumann Zayas, President, Public Safety Commission, Senate of Puerto Rico (Explanatory Report for Senate Resolution 708).

ices, broadcasting services), and a dedicated segment of the electromagnetic spectrum to provide access to emergency communications services.

At the state level, since 1999 the TBPR has had a dual role in emergency communications. First, it is the coordinator of the communications component in the Puerto Rico Agency for Emergency and Disaster Management (PRAEDM). Over the years following 1999, the TBPR's mission was to provide assistance for the continuity of public communications services in PRAEDM and more than a dozen other state agencies. This role includes providing support in the coordination of federal, state, and local communications during emergency situations. Secondly, in 1999 the TBPR created the Emergency Management Program. This program is based on a cooperation agreement between the state regulator and ETCs. The agreement was the foundation for the creation of the Committee of the Telecommunications Industry for Emergency Management (CTIEM). The committee's main objective is to restore and protect the telecommunications and cable television infrastructure, as well as to be responsive to the communications needs that arise out of emergency or disaster situations (Rosario-Albert, 2016).

3. Background to emergency communications in Puerto Rico

In this study we examine emergency communications policies in Puerto Rico around the time of Hurricane Maria because of the uniqueness of the case, one in which the telecommunications infrastructure collapsed entirely. In this section we provide an overview of the telecommunications sector, including access to and adoption metrics of main electronic media and telephone services, and economic and historical trends.

In 2017, Puerto Rico's telecommunications industry profile showed that in the wireline sector, Claro/Puerto Rico Telephone Company (Claro/PRTC) was the Incumbent Local Exchange Carrier, and that AT&T, Liberty of Puerto Rico, T-Mobile, Sprint, and Open Mobile were the other Competitive Local Exchange Carriers. By then, Liberty of Puerto Rico was the only cable television service, which also provided telephony (VoIP) and Internet services. Up until 2017, telecommunications industry revenues reported consecutive gains from 2011 (\$2,329,985,690) to 2016 (\$2,269,116,256), while in 2017, the year of hurricanes Irma and Maria, telecommunications industry revenues (\$1,912,882,859) decreased 16 percent.¹¹

In 2017, mobile subscriptions per 100 inhabitants reached 107.04 percent, while only 70.60 percent of the population used the Internet.¹² Mobile telephony accounted for 81 percent (3,389,402) of all telephone lines, while wireline telephony accounted for 19 percent (783,739 lines). In 2017 the consolidated total (4,173,141) of wireline and wireless lines, as well as for total broadband subscribers (3,372,768), reached its peak. Another indicator is the number of low-income customers (556,455) subscribed to the Lifeline Program in relation to the consolidated total of lines for 2017.¹³ By the time of Hurricane Maria, 13 percent of the consolidated total (wireline and wireless) lines represented low-income subscribers (a vulnerable group). Since 2017 was a year of record growth in broadband subscribers and in wireless services, which are provided by PTCs, the analysis of emergency communications policies in Puerto Rico becomes more relevant, and may provide data for other emergency communications policies reviews.

The analysis of emergency communications policies in Puerto Rico also considers historical trends in infrastructure and the economy. First, in 2015 the state government's credit classification had been progressively degraded and in 2016, for the first time in its history, a Federal District Court decided that the island's government was insolvent and unable to pay its obligations. This finding deepened the political, social, and economic crisis that the island was already undergoing. In 2017 the island's poverty rate was 44.4 percent and its unemployment rate had reached 10.8 percent.¹⁴

The second consideration was the devastation of the already degraded electric power infrastructure. As the Government Accountability Office (2017) pointed out, wireline and wireless networks are dependent on external and commercial electrical power companies in order to provide uninterrupted telecommunications services.

¹¹ *Puerto Rico Telecommunications Bureau. (2020). Statistics for Telecommunications and Cable Television Industries in Puerto Rico.*

¹² *ITU (2020b). Mobile-Cellular Subscriptions; Puerto Rico Telecommunications Bureau. (2020). Statistics for Telecommunications and Cable Television Industries in Puerto Rico.*

¹³ The Lifeline Program was established in 1985. The FSU has two items: one item is to company infrastructure and the other item is for the Lifeline grant program, which is a telephone subsidy for low income families.

¹⁴ *U.S. Census Bureau (2019) More Puerto Ricans Move to Mainland United States, Poverty Declines. (September 26, 2019); Center for Economic and Policy Research. (2017). Life After Debt in Puerto Rico: How Many More Lost Decades?.*

Also, to provide wireless services to consumers, wireless carriers' networks inter-connect to wireline networks (*e.g.*, local telephone company or cable company). Hence, power failures in wireline services can create outages in the backhaul network, affecting wireless networks. In relation to backup power at cell sites, a GAO report stated that in 2007 the FCC had set a requirement of 8 h of backup power for wireless carriers. However, the Office of Management and Budget disapproved FCC's requirement because of the rule's information collection requirements, with the effect of withdrawing the rule.¹⁵

Miller *et al.*, (2018) analyzed the destruction and inability of the Puerto Rico Electric Power Authority (PREPA) to restore electricity production and distribution after Hurricane Maria, leading to the largest power outage in U.S. history. The collapse of the electrical network had a cascade effect on public safety services (*e.g.*, 911 emergency service and first responders' activities, access to healthcare, nutrition, and housing services) and in wireless telephony, resulting in more than three million wireless lines out of service for weeks during the emergency situation. Access to and adoption of wireless telephony services is paramount in the effectiveness of plans to restore telecommunications services to citizens and its use by news organizations (Nieves-Pizarro *et al.*, 2019; Takahashi *et al.*, 2019).

The considerations above serve to contextualize the process of restoring emergency communications services, particularly through wireless telephony. As stated by the FCC, in Puerto Rico "service was restored gradually over a six-month period, considerably longer than for any other storm."¹⁶ The combination of the historical trends in the economy and in the electrical power infrastructure, together with the devastation caused by hurricanes Irma and Maria, meant from the outset unique challenges to public safety organizations and PTCs' readiness and capacity to restore emergency communications.

Based on the discussion above, we pose the following research questions:

RQ1 In what ways and to what extent did Federal regulations facilitate the continuity of emergency communication services?

RQ2 In what ways and to what extent did state regulations facilitate the continuity of emergency communication services?

RQ3 What external and structural factors were the most influential in the reestablishment of emergency communications?

4. Methods

The study integrates two approaches. First, we conducted an analysis of Private Telecommunications Companies' opinions about telecommunications policies and emergency communications using the following methods: 1) an electronic questionnaire; 2) semi-structured in-depth interviews; and 3) institutional documentation from Federal and state agencies, the local and national press, and academic studies.

Second, a policy examination was conducted focusing on the FCC, TBPR, and PTCs' emergency communications processes and outcomes during Hurricane Maria response and recovery phases. The research used a qualitative approach supported by the analysis of data compiled mainly by regulatory agencies. This provided a granular look at the implementation of regulatory policies for emergency communications.

4.1. Interview and questionnaire data collection and analysis

A purposive sampling approach was used to select a group of eligible telecommunications companies certified by the TBPR. After Hurricane Maria, and for the next 60 days, the TBPR organized daily meetings with representatives of both telecommunications and telecommunications infrastructure companies. During the process to reestablish telecommunications services, 17 telecommunications service companies participated in the meetings at the Emergency Operations Center (EOC) of the Government of Puerto Rico (GPR). In 2019, to facilitate the participation of these companies in the study, we used a list with the companies' contact details that the TBPR provided. E-mail invitations were sent to 16 companies and follow-up calls were made to explain the purpose of the research project. The qualitative analysis is based on the answers to the electronic questionnaire and in-depth interviews. Eight of the 16 companies responded to the electronic questionnaire (*Table 1*). The response rate to the electronic questionnaire was 50 percent. The questionnaire used

¹⁵The report affirmed that nine of the stakeholders interviewed for their study were open "about the feasibility of guidance." See *U.S. Government Accountability Office (2017). FCC Should Improve Monitoring of Industry Efforts to Strengthen Wireless Network Resiliency*. DC: GAO. P. p.6–7, 31.

¹⁶FCC (2018). 2017 Atlantic Hurricane Season Impact on Communications Report and Recommendations. Public Safety Docket No. 17–344. p.15.

closed and multiple-choice questions that reflected the research questions to gather the opinions and different emphasis of PTCs.

The PTCs that participated in the in-depth interviews include all companies listed in *Table 1* plus Neptuno Networks (Broadband & Network Services) and T-Mobile Puerto Rico (Wireless Carrier). Ten interviews were conducted, and two interviews included more than one participant for a total of 13 participants. The response rate for the in-depth interviews was 62 percent. Of the interviews, eight were conducted in Spanish and two in English. The audio files of the interviews were transcribed verbatim by professional transcribers. Transcripts in Spanish were analyzed directly, with only those quotes used in the results section translated into English by the authors. The list of the de-identified interview subjects' information appears in *Appendix 1*. The participants' PTCs represent different industry sectors (*e.g.*, broadband providers, cable TV providers, network infrastructure, network services and wireless telephony) providing an outlook on the opinions for emergency communications in Puerto Rico. Most of them are members of the Puerto Rican Alliance for Telecommunications (PRTA), an industry organization that represents eligible telecommunications companies in Puerto Rico.

In-depth interviews followed a semi-structured approach using open-ended questions based on the research questions and organized thematically and chronologically (before and after September 17, 2017, three days before the hurricane made landfall in Puerto Rico). The qualitative data analysis application *Deedose* was used to analyze interview transcripts. The answers and content obtained were coded according to the research questions, the three subjects (*i.e.*, FCC, TBPR and PTCs) and relationships analyzed, and factors that influenced restoring emergency communications services (*e.g.*, infrastructure, regulatory, logistical). The analysis of the interviews focused on identifying themes related to emergency communications and other emerging and complementary themes directly related to the research questions. Due to respondents' availability, data collection was conducted during two time periods: May to December 2019 (nine companies) and February 2020 (one company). The data collected from the answers to the electronic questionnaire and the in-depth research interviews from carriers (T-Mobile Puerto Rico, Liberty of Puerto Rico) is a limited representation of the total eligible telecommunications carriers at the time of Hurricane Maria. The data from the remaining PTCs (8) and those that actively participated during the rehabilitation of telecommunications services provide a more representative account of their point of views on the research questions. In addition to interviews with PTCs, five interviews were conducted with state telecommunications experts (1) and regulatory officials (4) between January 2018 and September 2019. This second group of interviews contributed to a better understanding of the regulatory framework for emergency communications in Puerto Rico, but their responses are not included in the electronic survey results.

4.2. Policy examination: data collection and analysis

In regard to emergency communications during the response and recovery phases after Hurricane Maria, the FCC and the TBPR were the two government agencies with the responsibility to assist in the restoration of communication and telecommunications services. These organizations interacted primarily with PTCs and public safety organizations. Therefore, our analysis takes into account the activities of the FCC's Public Safety and Homeland Security Bureau (PSHSB) and the TBPR's Committee of the Telecommunications Industry for Emergency Management (CTIME). To provide a comprehensive assessment of the FCC, TBPR, and PTC's activities, secondary data analysis results are organized under two rubrics: emergency management activities (*e.g.*, daily emergency incident reports, fact-finding visits, interagency committees), and adoption of policy tools (*e.g.*, resolutions and orders, thematic reports).

The study used secondary research sources (*e.g.*, government documents) for two objectives: 1) To summarize and assess FCC, TBPR and PTC's emergency communications processes and outcomes during the response and recovery phases, and 2) To triangulate the answers to the research questions providing a deeper and multifactorial understanding of the respondents' opinions about the feasibility of strengthening emergency communications policies in Puerto Rico.

Table 1

Companies that answered the electronic questionnaire.

Companies	Services
AeroNet	—Broadband & Network Services
Crown Castle	—Communications Infrastructure
DatAccess	—Broadband & Network Services
Liberty Cablevision of Puerto Rico LLC.	—Carrier, Cable TV, Telephony, Broadband Services
PREPA Networks	—Network Infrastructure
Verizon	—Network Infrastructure
VPnet	—Broadband & Network Services
WorldNet Telecommunications, Inc.	—Broadband & Network Services

The research examined Federal and state institutional documentation published by the Department of Homeland Security, the Government Accountability Office (GAO), and the Government of Puerto Rico.¹⁷ In particular, the review included documents and statistical and economic data published by the FCC and TBPR.¹⁸ Also, we considered reports and journalistic accounts on the social and economic effects after the passage of hurricanes Irma and Maria in Puerto Rico, carried out by international organizations (*e.g.*, World Meteorological Organization), non-governmental organizations (*e.g.*, Resilient Puerto Rico Advisory Commission), research centers (Free Press), and journalistic organizations (*e.g.*, Centro de Periodismo Investigativo, *El Nuevo Día*, NotiCel).

The second analysis focuses on three types of relationships between regulatory organizations and PTCs during the aftermath of Hurricane Maria: 1) FCC and telecommunications industry interaction, 2) TBPR and telecommunications industry interaction, and 3) industry self-regulatory practices during emergency situations, specifically the roaming service agreement in 2017.

5. Results and discussion

The results section first presents a short summary of responses from PTC representatives to the preliminary closed-ended questionnaire and follow-up interviews that sought to establish the position of the companies on the topic of Federal and state emergency communications policies. The second part of this section presents a more detailed account of the emerging themes related to those questions that were extracted from the interviews and supported by the analysis of secondary data.

The results show that half of the companies considered the Federal regulation for emergency communications inadequate. A participant considered it necessary to improve control and access to telecommunications infrastructure. The participant commented: “Federal entities seemed to take over jurisdiction over private tower owners and block access to certain facilities as they pleased and take control of private property as they pleased without providing proper documentation.”¹⁹ Another participant expressed that regulation must consider employees of telecommunications companies as a priority group that support access “to infrastructure services that allow for a faster and more effective recovery.”²⁰

Second, representatives of four companies disagreed or strongly disagreed about the need to strengthen Federal regulation. Several telecommunications companies stated that it was not necessary to strengthen regulation but rather to improve the application of administrative procedures and the distribution of detailed information on contacts with the Federal government. In this sense, a participant said, “I don’t

¹⁷ U.S. Government Accountability Office. (2018). *2017 Hurricanes and Wildfires. Initial Observations on The Federal Response and Key Recovery Challenges*. DC: GAO; Puerto Rico Emergency Management Bureau, Puerto Rico Department of Public Safety. (2019). *Joint Operational Catastrophic Incident Plan of Puerto Rico (Version 1.10)*; *Resilient Puerto Rico Advisory Commission*. (2018). *Reimagina Puerto Rico Informe Sectorial de Infraestructura Física*. San Juan PR.

¹⁸ In regard to Hurricane Maria and Puerto Rico, the FCC published Public Notices (16); news releases, statements and presentations (12); reports (1); and communications status reports (107). On the other hand, between September 18 and December 28, 2017, the TBPR issued 74 resolutions and orders, as well as participating in legislative hearings (6) of the State Legislature on issues related to the vulnerabilities of the telecommunications industry and public safety communication systems after the passage of hurricanes Irma and Maria.

¹⁹ Interview #2 with Senior Executive.

²⁰ Interview #9 with Senior Executives (2 participants).

think it is a matter of the regulations but a matter of well documented and agreed upon procedures.”²¹

Third, most of the responses (n = 5) expressed disagreement with state regulation for emergency communications. One participant said: “What I believe was missing was the communication from all government agencies with the telecom providers. We had to extract information from them.” Another participant stated: “I mean if there was regulation and cooperation and a good plan, I think, communications could have been up weeks before it was.”²²

Fourth, representatives of four companies favored strengthening state regulation. Several respondents indicated the importance of communication and coordination for the state government to facilitate and accelerate the processing of permits during the response and recovery phase. Regarding cooperation and emergency communications, one participant stated that “regulation needs to be strengthened in the area of company cooperation . . . These types of situation are exactly where government needs to regulate, when market forces work against the safety of society.”²³ Another participant provided a singular view on the need to strengthen state emergency communications regulatory policies. For instance, the viability of a non-governmental organization responsible for the emergency communications services. On this matter the participant said:

I think the hardest part of that was who manages the network. You don’t want the government managing it. It’s going to be inefficient . . . But then who is? And maybe the answer is, you know, you got to get the board to hire an external, independent party, to manage it because it’s got to be fair and equal for everybody to get access.²⁴

The remaining remarks from the results and discussion section are organized in six sub-sections. The first two sections derived mostly inductively from the interview data. The first sub-section addresses telecommunications infrastructure damages, while the second sub-section discusses the factors that influenced the effective use of emergency communications. References to press articles and government documentation are used to develop and support various themes. The next three sub-sections entail the policy examination on the interaction of the FCC and TBPR with PTCs, and the roaming service agreement, as an industry self-regulatory practice adopted in Puerto Rico during the emergency situation. The last sub-section provides an analysis of recent Emergency Communications State Regulatory Reform.

5.1. Telecommunications infrastructure and services after Hurricane Maria

The analysis of damages to emergency communications associated with Hurricane Maria shows the complex process to restore emergency communications services. For instance, the National Oceanic Graphic Administration’s weather radar was destroyed.²⁵ The FCC reported that the two call centers in Puerto Rico managed by the Government of Puerto Rico were out of service for a period of time or “could not receive the types of information (location, call back number, etc.), as happened in both Puerto Rico and the U.S. Virgin Islands (USVI), that both they and the American public have come to expect.”²⁶

In regard to Public Safety Systems, restoring the 911 service required technical assistance from the Department of Defense’s Joint Force Land Component Command. For instance, the Air Force 85th Engineering and Installation Squadron was deployed to restore radio communications for local emergency personnel and first responders across the island. This account provides information related to the resiliency of public safety networks, as the following remark shows: “What most would consider a redundant communication system in the [mainland] United States, they don’t have here . . . As soon as we get that back up, I think it will definitely help that level of communication.”²⁷ During the in-depth interviews, the resiliency of public safety communication systems was also addressed. In regard to compliance with Federal government standards, a state regulatory official stated that:

And what happens is that each agency chooses . . . the one that it’s going to provide service and most of the time those systems do not talk to each other . . . that

²¹ Interview #10 with Executive.

²² Interview #7 with Senior Executives (3 participants).

²³ Interview #7 with Senior Executives (3 participants).

²⁴ Interview with Senior Executive #10.

²⁵ World Meteorological Organization. (2018). *Center for Economic and Policy Research, 2017 Hurricane Season an Evidence-Based Assessment of the Early Warning System*. Geneva, Switzerland. P.19.

²⁶ FCC. (2018). 2017 Atlantic Hurricane Season Impact on Communications Report and Recommendations. Public Safety Docket No. 17–344. P.3.

²⁷ State News Service. Airmen work to restore Radio Communications in Puerto Rico. Oct. 23, 2017.

explains a lot of what happened in the hurricane At the time of the event, some government agencies did not meet the P25 standard of government emergency management organizations.²⁸

Damage to public safety networks were numerous. Even though PTCs' networks, which interconnect with emergency communications services, were active for a period of time, they were unable to activate their services due to power outages and damages to other networks with which they interconnect.²⁹ Based on interview data, the portfolio of government clients of some PTCs included security and emergency organizations such as firefighters, health services, and hospitals. When discussing the effects of the telecommunications collapse on health services, a participant mentioned the following:

A lot of communication couldn't be done and that could possibly have had an impact on the accounting of the missing and the deaths. Ultimately, the effect it had on communications for first responders was disastrous.³⁰

Wireless telecommunication services between the 78 municipalities of Puerto Rico, including the islands of Vieques and Culebra, were very scarce, if not null, during the following weeks. On this matter, the FCC affirmed that "All *municipios* in Puerto Rico had greater than 75 percent of their cell sites out of service. Forty-eight out of the 78 *municipios* in Puerto Rico had 100 percent of their cell sites out of service."³¹ With respect to wireless telecommunications services, the dominant telephone service, one respondent noted that "at the worst point, 95.6 percent of cell sites were out of service in Puerto Rico."³²

Six months after Hurricane Maria, as part of a fact-finding visit to Puerto Rico and the Virgin Islands, FCC Chairman Ajit Pai's remarks provide a description of Puerto Rico's communications infrastructure damages that still included "poles down, cell towers toppled, electrical power depleted, and otherwise unavailable, wireless infrastructure completely destroyed, many radio and television broadcast facilities impacted."³³ The TBPR estimated damages to the communications network at \$1.5 billion.³⁴

5.2. Factors affecting the restoration of telecommunications services

In regard to the third research question, participants identified the following factors as the most influential in the process of restoring emergency communications services during the response and recovery phases: 1) Lack of electricity and dependence on PREPA's electricity service, 2) Difficulties in access and security of fuels for backup power systems and transportation, 3) Hurricane Irma's degrading effects on the electrical power and telecommunications networks, 4) Human-caused damage (*i.e.*, questionable practices during debris cleaning and restoration of the electrical system), and 5) Aerial deployment of fiber optics.

On the issue of lack of electricity and dependence on the Puerto Rico Electric Power Authority service, all participants considered this to be the main factor in the restoration process. With respect to the extended power outages and wireless telephone service availability, one participant stated that:

If the electrical power connection was lost, they used the backup power, which are generally small because they serve small areas and their specifications at the tolerance level that will be given for a certain time. It is possible that the plants could supply energy for 8 h and after that the tanks had to be refilled and without the transportation mechanisms or the closed or blocked roads, the cell tower lost its service and left all the clients of that area without service. That was what caused

²⁸Interview #12 with Telecommunications Regulatory Official. Project 25 (P25) is a process to establish wireless communication standards for the public safety community. *Associated Public-Safety Communications Officers, 2018*. Project 25 Steering Committee BY-LAWS. (April 16, 2018).

²⁹Some of them also contracted services from private telecommunications companies for data transmission services, support tasks, maintenance and security.

³⁰Interview #11 with Telecommunications Regulation Specialist. See *Kishore et al., (2018)* for an assessment on the total number of official reported deaths and the lack of telephone services during the response and recovery phases.

³¹FCC. (2018). Atlantic Hurricane Season Impact on Communications Report and Recommendations. Public Safety Docket No. 17–344. DC: FCC. P.5. The word *municipios* refers to counties.

³²FCC. (2018). 2017 Atlantic Hurricane Season Impact on Communications Report and Recommendations. Public Safety Docket No. 17–344. P.15.

³³FCC. (2018). 2017 Atlantic Hurricane Season Impact on Communications Report and Recommendations Public Safety Docket No. 17–344. P. 27.

³⁴Torres López, S. E. (2017). Letter to Ajit Pai, Chairman. FCC WC Docket No. 10–90, at 1 (filed Dec. 13, 2017).

more than 95 percent of cell phone customers to lose their service after the hurricane. That experience was very similar for almost all cell phone companies.³⁵

Participants also discussed the difficulties in fuel access and security for backup power systems and transportation. Regarding the distribution of fuels, a participant commented:

When the event occurred, Federal agencies arrived, specifically FEMA, and took control of all fuel supplies with the intention of them establishing their recovery process . . . But that in turn meant that local operators did not have access to fuel when they needed it. And that's one of the critical points because everything runs on power and we need the generators running.³⁶

A particular feature of the restoration process was the ongoing recovery mode in place after Hurricane Irma's impact just two weeks before Hurricane Maria. According to some participants, that was a main factor in the difficulty of restoring telecommunications services after Hurricane Maria.³⁷ On this matter, a participant commented: "I think, back-to-back events posed a unique challenge because you were already in emergency mode and you had to beat another emergency mode."³⁸

Participants also mentioned human-caused damage related to difficulties in coordination during debris cleaning and restoration of the electrical system, particularly between the Puerto Rico Electric Power Authority, the TBPR, and telecommunications companies. For example, transmission paths and fiber optic and coaxial cables were accidentally cut as branches and trees were removed in order to allow vehicular access and restoration work. With respect to this practice, a telecommunications regulatory specialist stated:

The Electric Power Authority in its process of reestablishing service cut fiber optic cables for telephone distribution. We did not lose the service as a consequence of the hurricane, but we did lose it in the recovery process because contractors or employees of the Authority *motu proprio* decided to cut them in order to advance the restoration of the electrical power service.³⁹

Another factor identified by some of the participants was the aerial deployment of fiber optics. Historically, fiber optics were deployed mainly overhead, with underground fiber optics lagging behind, mostly due to high installation costs for underground fiber optics. On this matter, a participant stated:

When we left the metropolitan area, and this is what happens to most carriers, almost all infrastructure is overhead. In the wake of the storm, initiatives have been made to bury sections to help mitigate the impact on future events. But most of the infrastructure outside the metropolitan area is aerial.⁴⁰

5.3. Policy examination of the interaction and outcomes between the FCC, TBPR, and PTCs

This section addresses the interaction between the FCC and the telecommunications industry during the response and recovery phases, outlined under two rubrics: emergency management activities and adoption of policy tools.

5.3.1. Emergency management activities

The FCC activated its Incident Management Team (IMT), a technical and policy experts group from other FCC's Bureaus and Offices. The IMT's activities included addressing information and action requests from Federal and state government agencies such as the Emergency Operations Center of the GPR, the TBPR, and PTCs. During the response and recovery phases the FCC activated the Disaster Information Reporting System (DIRS) and over the next two months issued daily Communications Status Reports about Puerto Rico and the U.S. Virgin Islands.⁴¹

With respect to Puerto Rico, the FCC deployed three employees to its Joint Field Office in San Juan. Also, on October 6, 2017, the FCC created a Hurricane Recovery Task Force to transition from a short-term to a longer-term recovery phase. Both groups provided support in areas such as waivers of FCC rules, the extension of the

³⁵ Interview #11 with Telecommunications Regulation Specialist.

³⁶ Interview #6 with Senior Executive.

³⁷ This opinion was also subscribed by the FCC. FCC. (2018). 2017 Atlantic Hurricane Season Impact on Communications Report and Recommendations Public Safety Docket No. 17-344. P.5.

³⁸ Interview #4 with Senior Executive.

³⁹ Interview #12 with Telecommunications Regulatory Official.

⁴⁰ Interview #6 with Senior Executive. In relation to fiber optics costs another participant stated: "I mean we looked into this. I mean the cost was prohibitive. It was like 10 times the cost of aerial which is why people don't do it. . . . So that may be another example of where you need government assistance." Interview #10 with Senior Executive.

⁴¹ The Communications Status Reports were generally organized under the following categories: 911 Services, Wireless Services, and Cable Systems and Wireline and Broadcasting (combined).

period for regulatory filings, the granting of Special Temporary Authority (STA), personnel support to Roll Call, support in shipping of equipment and materials, and other regulatory filings and requests to Federal agencies (e.g., United States Environmental Protection Agency).

For the 2017 Atlantic hurricane season and related to Hurricane Maria, the FCC's Bureaus and Offices granted 824 STAs (Wireless Telecommunications Bureau—717, Public Safety & Homeland Security Bureau—8, Media Bureau—85, International Bureau—5, Office of Engineering & Technology—9).⁴² The FCC data are useful in recounting the complexities and scale of FCC's activities during Hurricane Maria. However, a specific breakdown of STAs for Puerto Rico was not found. In regard to the specific number of STAs for Puerto Rico, one participant stated that because of having the Emergency Operations Center, the FCC granted over 300 STAs to just one company during the recovery phase.⁴³ Participants stated that FCC staff approved "the needed Special Temporary Authority to operate in Puerto Rico as part of our efforts to support a roaming partner on the island."⁴⁴

The FCC STAs facilitated access to frequencies and use of technologies, such as microwaves, granted a request from the American Radio Relay League (ARRL) for amateur data transmissions to facilitate hurricane relief communications between the continental United States and Puerto Rico, waived location accuracy obligations for 911 calls for certain service providers, and waived rules that allowed public safety use of interoperable channels in Puerto Rico. Other examples of FCC and industry interaction in the restoration of telecommunications services was the FCC's permission for deployment of the 600 band and the temporary use of some of our frequencies in the radio spectrum to support Google Looms technology. Also, after the event and for two years approximately, on a one week per month basis, the FCC had an expert in public safety spectrum issues available in Puerto Rico.

For over a year, the FCC's Public Safety and Homeland Security Bureau issued additional public reports on the status of communications services, published public notices seeking comment on communications infrastructure resiliency, and hosted a workshop of government and consumer stakeholders to identify critical information needs and facilitate access to information in support of preparedness and response activities. Also, Ajit Pai, FCC Chairman, made two fact-finding visits (November 2017 and March 2018) to Puerto Rico during the response and recovery phases. These visits included meeting with stakeholders (state government and public safety officials, industry representatives, and community members in Utuado, Puerto Rico).⁴⁵

5.3.2. Adoption of policy tools

As part of the administrative provisions, the FCC activated the DIRS system and provided public information regarding the state of communications services in Puerto Rico.⁴⁶ By December 2017, along with the funding allocations to telecommunications carriers in Puerto Rico, the FCC announced a public consultation process seeking comments from stakeholders on the resiliency of the communications infrastructure during hurricanes Harvey, Irma, Maria, and Nate. The purpose was to obtain "information to better understand how well such access was provided during these hurricanes in order to assess what lessons may be learned for the future."⁴⁷ *El Nuevo Día*, the newspaper of record in Puerto Rico, reported the FCC public notice and based on their journalistic investigation found that approximately 80 percent of mobile antennas were operating 90 days after the event. This means be-

⁴² FCC. (2018). 2017 Atlantic Hurricane Season Impact on Communications Report and Recommendations Public Safety Docket No. 17–344. P.21.

⁴³ Interview #7 with Senior Executives (3 participants).

⁴⁴ Interview #10 with Senior Executive.

⁴⁵ González, J. (2017, December 19). La FCC abre proceso sobre efectividad de telecomunicaciones tras Maria (The FCC opens a process on telecommunications effectiveness after Maria). *El Nuevo Día*; FCC. (2018). 2017 Atlantic Hurricane Season Impact on Communications Report and Recommendations Public Safety Docket No. 17–344. P. 27. Also on March 2018 FCC Commissioner Jessica Rosenworcel visited Puerto Rico to assess damages to the communications sector and recovery efforts. More recently, in February 2020 FCC Commissioner Geoffrey Starks visited Puerto Rico. See Minelli Pérez, S. (March 8, 2018). La FCC fiscalizará el uso de los fondos para las telecomunicaciones (The FCC will monitor the use of funds for telecommunications). *El Nuevo Día*.

⁴⁶ Torres López, S. E. (2018, May 25). Letter to Hon. Henry Neumann Zayas, President, Public Safety Commission, Senate of Puerto Rico (Explanatory Report for Senate Resolution 708).

⁴⁷ FCC. (December 7, 2017). Public Safety and Homeland Security Bureau seeks comment on response efforts undertaken during 2017 Hurricane Season. Public Notice.

tween six and seven out of 10 antennas were still working with backup power generators due to the extended power outage across the island.⁴⁸

One of the FCC's first economic measures during the restoration of telecommunications services was a first allocation of funds for telecommunications companies in Puerto Rico (Supplemental Emergency Support). Telecommunications companies had already expressed the need for financial assistance to restore telecommunications services. In regard to supplemental Federal emergency assistance to PTCs, on October 4, 2017, the FCC authorized a first allocation of \$77 million for Puerto Rico and the Virgin Islands from the Universal Service Fund High Cost Program to PTCs. Later, on August 7, 2018, the FCC issued a Public Notice announcing the allocation of \$64 million for Stage 1 for telecommunications service providers in Puerto Rico and the Virgin Islands. By May of 2018, in response to the damage to telecommunications infrastructure in Puerto Rico and the U.S. Virgin Islands, the FCC created the *Uniendo a Puerto Rico* Fund (Bringing Puerto Rico Together Fund) and the Connect USVI Fund.⁴⁹

More recently, in 2019 the FCC approved \$750 million in funding over ten years to strengthen communications networks in Puerto Rico, 500 million for fixed broadband and \$250 million over three years for mobile broadband.⁵⁰ Since telecommunications companies are responsible for restoring service, maintaining and hardening infrastructure, the FCC's financial assistance goes to companies and that economic assistance indirectly benefits customer service. In this sense, according to one of the participants, "as there is more money for companies to have infrastructure, I think that this is beneficial for all of us."⁵¹ The policy objectives of this Federal funding allocation are to improve, expand, and harden communications networks.

5.4. TBPR and the telecommunications industry interaction

This section addresses the TBPR's emergency management Activities and adoption of policy tools.

5.4.1. Emergency management activities

Prior to hurricanes Irma and Maria, on August 22, 2017, the major telecommunications providers in Puerto Rico signed a cooperation agreement with the TBPR.⁵² The purpose of the cooperation agreement was to "to unite efforts between public and private entities in order to restore and protect the telecommunications and cable television infrastructure, and meet priorities arising from disasters or emergencies."⁵³

After Hurricane Maria and for the following 60 days approximately, the TBPR organized daily meetings with representatives of telecommunications companies and established its own Telecommunications Operations Center (COT) in the facilities of the Government Command Center, with the purpose of dealing with incidents from the telecommunications industry and government agencies. There, in collabora-

⁴⁸ González, J. (2017, December 19). La FCC abre proceso sobre efectividad de telecomunicaciones tras Maria. (The FCC opens a process on telecommunications effectiveness after Maria). *El Nuevo Día*.

⁴⁹ FCC. (October 4, 2017). FCC Approves Advance of \$77 M to Restore Connectivity in PR and USVI. FCC. WC Docket No. 10-90. Retrieved from <https://www.fcc.gov/document/fcc-approves-advance-77m-restore-connectivity-pr-and-usvi>; FCC. (2019, May 8). FCC Gives Additional Funding to Restore Networks in PR and USVI. FCC. Docket 18-143, 10-90, 14-58. Retrieved from <https://docs.fcc.gov/public/attachments/FCC-18-57A1.pdf>; FCC. (2020, February 5). Uniendo A Puerto Rico Fund and Connect USVI Fund Procedures PN.; FCC. Docket 18-143, 10-90, 15-58. Retrieved from <https://www.fcc.gov/document/uniendo-puerto-rico-fund-and-connect-usvi-fund-procedures-pn>.

⁵⁰ FCC. (September 26, 2019). FCC Invests \$950 Million to Improve Broadband in Puerto Rico, USVI (Press Release); FCC. (February 5, 2020). The Uniendo a Puerto Rico Fund and Connect USVI Fund Notice and Filing Requirements and Other Procedures for Stage 2 Fixed Competitive Proposal Process. WC Docket Nos. 18-143, 10-90, 14-58; FCC WC Docket Nos. 18-143, 10-90, 14-58. Retrieved from <https://www.fcc.gov/document/uniendo-puerto-rico-fund-and-connect-usvi-fund-procedures-pn>.

⁵¹ Interview #12 with Telecommunications Regulatory Official. The TBPR supported the allocation of financial aid to companies through the Universal Service Fund.

⁵² The signatory companies were AT&T, Puerto Rico Telephone Co./Claro, Open Mobile, Sprint, Telefonica Larga Distancia, T-Mobile Puerto Rico, WorldNet Telecommunications, Liberty Cablevision & PREPA Networks. Torres López (February 4, 2019). Letter to Hon. Victor L. Pares Otero. President, Economic Development, Planning, Telecommunications, Public & Private Alliances and Energy Commission, Representatives of Representatives of Puerto Rico (Explanatory Report for House of Representatives Resolution 64).

⁵³ The agreement was renewed in June 2019. See Serrano-Román, (2019, June 19). Acuerdo permitirá mejorar el restablecimiento de las telecomunicaciones después de una emergencia (Agreement will improve the restoration of telecommunications after an emergency). *El Nuevo Día*.

tion with DHS, FEMA, the FCC and other Federal entities, TBPR staff, and the Puerto Rico Innovation and Technology Service (PRITS), the telecommunications companies carried out support activities for the restoration of telecommunications services (e.g., PTCs Daily Status Reports).⁵⁴ Other activities of the TBPR, in conjunction with CTIME, included the management of a telephone bank for first responders and people in transit at airport and ports.⁵⁵

In addition to providing satellite telephones (22) to the Governor's Office and heads of designated agencies for use during emergency situations, during this period the activities of the TBPR included the use of an interactive map of the critical telecommunications infrastructure in Puerto Rico, identification and security for the distribution of fuels, support for several orders for telecommunications companies' exemptions from state and municipal permits making arrangements for and constructing their infrastructure, relief of taxes for equipment and materials destined for the recovery phase, and access to back yards and easements without civil or Criminal liability.⁵⁶

Several participants favorably described TBPR's emergency management activities during the response and recovery phases.⁵⁷ In response to the need for information to restore emergency communications and wireless telecommunications services, one project developed by the TBPR was the adoption of Map Plus, an electronic platform that traced telecommunications service connectivity and outages according to geographical coverage areas. This initiative was mentioned by several participants as an important instrument in support of the restoration of emergency communications.⁵⁸

5.4.2. Adoption of policy tools

With regard to TBPR's resolutions and orders during the first three weeks after Hurricane Maria, on October 10, 2017, the state regulator requested that PTCs provide detailed information on the recovery of essential telecommunications infrastructure. According to the TBPR, aside from the voluntary information provided by the PTCs during the response phase, the state regulator "still continues to face problems with getting data from companies, despite the fact that they have a duty to report to the Federal Communications Commission (FCC) once the Disaster Information Reporting System (DIRS) has been activated. This information is not shared with the states."⁵⁹ The order's mandate, a prescriptive policy measure, required daily information reports from PTCs with fines for noncompliance, and a Restoration Plan from each company.⁶⁰

With respect to consumers, the TBPR issued a statement and order requiring PTCs to provide information related to the granting of credits to consumers, specifically to include a description of the type of credit and the time without service, the

⁵⁴ The Telecommunications Operations Center was opened on *PRTRB (September 20, 2017)*. See *PRTRB Administrative Order JRT 2017-004, PRTRB (October 10, 2017)*; *PRTRB. Order JRT-2017-OA-0003*, September 18, 2017; *Torres López, S. E. (2018, May 25)*. Letter to Hon. Henry Neumann Zayas, President, Public Safety Commission, Senate of Puerto Rico (Explanatory Report for Senate Resolution 708).

⁵⁵ For instance, AT&T supplied 103 telephones for First Responders. Also, the TBPR and CTIME's agreement provided for an inventory of "at least thirty (30) cell phones activated by company (subject to availability) to be used by representatives of the state and Federal government, according to priorities during an emergency, and after these have exhausted their resources." See *Torres López, S. E. (2018, May 25)*. Letter to Hon. Henry Neumann Zayas, President, Public Safety Commission, Senate of Puerto Rico (Explanatory Report for Senate Resolution 708).

⁵⁶ See *Torres López, S. E. (2018, May 25)*. Letter to Hon. Henry Neumann Zayas, President, Public Safety Commission, Senate of Puerto Rico (Explanatory Report for Senate Resolution 708); Interview #12 with Telecommunications Regulatory Official.

⁵⁷ Interview #5 with Senior Executive.

⁵⁸ The context for this resource is traced back to Hurricane Irma. After Hurricane Irma the TBPR asked the FCC's Public Safety and Homeland Security Bureau for information about critical telecommunications infrastructure in Puerto Rico. Because the information reported by the companies to the DIRS system was confidential, the information request didn't materialize. It is noteworthy that in the order of October 10, 2017, that reported the problems in getting information from the PTC's, the state regulator also stated that it had not received information related to critical telecommunications infrastructure from the FCC.

⁵⁹ *PRTRB. Administrative Order JRT 2017-004*, October 10, 2017. Translation by the authors.

⁶⁰ On the matter of compliance with the voluntary reporting to the DIRS system, later, in 2018, the FCC provided information on PTCs participation in DIRS in the aftermath of Hurricane Maria. It stated: "During Hurricane Maria, the major incumbent local exchange carrier and cable providers in Puerto Rico and the USVI did not provide detailed information in DIRS. In some cases, the lack of participation was due to service providers' loss of communications, which precluded access to the DIRS platform. In other cases, service providers may not have been aware of DIRS prior to the hurricanes." FCC. (2018). 2017 Atlantic Hurricane Season Impact on Communications Report and Recommendations Public Safety Docket No. 17-344. P.28.

number of billing cycles with credits to consumers, how the credits were communicated to their clients, and how many clients had requested credit for service outages. It is worth mentioning that before the order, telephone service providers offered credits to consumers for 60 or 90 days of service. PTCs also voluntarily agreed to give credits to other telecommunications companies due to the inability to interconnect between them.⁶¹

After the response and recovery phases, other policy tools to further emergency communications objectives were TBPR's agreements with the Patriot Amateur Radio Emergency Club and the Federation of Radio Amateurs of Puerto Rico (*Federación de Radioaficionados de Puerto Rico*).⁶² Also, in regard to public safety organizations, the TBPR collaborated with other emergency communications partners in the Central Recovery and Reconstruction Office's *Report on Puerto Rico Critical Communications Preparedness for the 2018 Hurricane Season*,⁶³ and in 2019, with the Puerto Rico Emergency Management and Disaster Bureau's *Joint Operational Catastrophic Incident Plan of Puerto Rico*, the renewal of cooperation agreements between the TBPR and the Puerto Rican Alliance for Telecommunications, and policy briefs to several state hearings on the telecommunications industry's emergency plans.⁶⁴

5.5. Wireless industry self-regulatory practices during emergency situations: the roaming service agreement

Before and during the first days after Hurricane Maria's landfall, several PTCs reached confidential cooperation agreements for the transportation of generators, materials, and personnel, access to submarine cables, and preliminary agreements for roaming services between companies. Also, during the process of reestablishing telecommunications networks, other companies adopted written and verbal agreements of cooperation for interconnection services, exchange of materials and equipment, and acquisition and repair of equipment.⁶⁵

Other initiatives adopted by the telecommunications providers to mitigate the loss of telecommunications services were the deployment of Satellite Cells on Light Trucks (COLTs) and Cell on Wheels (COWs). Of these PTC cooperation initiatives, with regard to citizenry's and first responders' emergency communications access, several respondents considered the cooperation agreement between the wireless carriers as the most important. This agreement is based on the 2016 Wireless Resiliency Cooperative Framework, supported by the FCC on December 14, 2016.⁶⁶ The framework is a voluntary mechanism enacted by wireless carriers during emergency situations that provides continuity of wireless services (roaming) to subscribers of wireless services (citizens), first responders, and public safety systems. As noted by

⁶¹See PRTRB. Resolution and Order JRT-2017-CCG-0002, *PRTRB* (November 11, 2017); Torres López, S. E. (November 7, 2017). Letter to Hon. Miguel A. Laureano Correa. President, Innovation, Telecommunications, Urban and Infrastructure Commission, Senate of Puerto Rico (Explanatory Report for Senate Resolution 457).

⁶²Torres López (2018, May 25). Letter to Hon. Víctor L. Pares Otero. President, Economic Development, Planning, Telecommunications, Public & Private Alliances and Energy Commission, Representatives of Representatives of Puerto Rico (Explanatory Report for House of Representatives Resolution 64).

⁶³The agencies that collaborated in the report were the TBPR, Puerto Rico Department of Public Safety, DHS, FEMA, FCC National Coordinating Center for Communications, Mobile Emergency Response Support Team, and the National Telecommunications and Information Systems. See (2018, May 25). Torres López (2018, May 25). Letter to Hon. Henry Neumann Zayas, President, Public Safety Commission, Senate of Puerto Rico (Explanatory Report for Senate Resolution 708).

⁶⁴The *Joint Operational Catastrophic Incident Plan of Puerto Rico* was approved on August 18, 2019. However, in 2018, a year after Hurricane Maria, the Puerto Rican Alliance for Telecommunications, a professional organization representing telecommunications companies in Puerto Rico, expressed its disappointment because the GPR had not submitted its new emergency communications plan to the telecommunications industry. On the contrary, by then PTCs had complied with the legal and regulatory mandates to provide new emergency communications plans to the regulator while undertaking voluntary network hardening and emergency communications-related investments. See Suárez, D. (2018, September 12). Desconectadas empresas de comunicaciones de nuevo plan emergencia. *Noticel*; Minelli Pérez, S. (2018, December 30). La reparación en telecomunicaciones dio paso a sentar las bases para 5G (Telecommunications repair gave way to laying the groundwork for 5G). *El Nuevo Día*.

⁶⁵Interview with Senior Executives #7.

⁶⁶The Competitive Carriers Association also endorsed the cooperative framework. FCC (2016a, 2016b). Wireless Resiliency Cooperative Framework.

the GAO, the agreement was in response to “FCC’s 2013 notice of proposed rule-making on wireless network resiliency.”⁶⁷

In 2016 the signatory companies of the framework included AT&T Mobility, the Cellular Telecommunications Industry Association (CTIA), General Communication Inc., Southern Linc, Sprint, T-Mobile, U.S. Cellular, and Verizon Wireless. The agreement sets five objectives, of which four are directly related to restoring mobile telephony services during emergency situations.⁶⁸

Based on the Wireless Resiliency Cooperative Framework of 2016 and the fact that no single company could restore mobile phone services, the agreement was adopted to establish a roaming phone service. The Puerto Rican Alliance for Telecommunications supported the agreement and the TBPR endorsed it. For instance, there were companies that could extend the roaming service to other competing companies, allowing the coverage area to be expanded. In this regard, a participant mentioned:

There were pieces of Sprint and Open that could roam on Claro. But Claro, AT&T, and T-Mobile could roam based on their LTE and based on their GSM infrastructure under lane. And then we quickly found out that some of the handsets that Sprint had actually sold came from Europe which meant they had a GSM chip set. So, we quickly then started turning on those numbers as well to allow those guys to roam on our network . . . It actually cost a lot of problems because there was no continuous coverage all the way to any one place . . . So it wasn’t the most perfect of networks but at least it allowed somebody to call somebody to say, “I need help”.⁶⁹

A favorable outcome of the framework was that alongside the wireless carriers’ efforts to provide a roaming service, other telecommunications companies endorsed and provided support for this initiative. Another group that benefited from this cooperative agreement was first responders, as they obtained another communication system to carry out safety, health, and other support activities.

Approximately three weeks after Hurricane Maria, on October 10, 2017, the FCC reported that the four major wireless companies had opened a roaming service that could benefit 54 percent of the population subscribed to wireless services.⁷⁰ The roaming agreement concluded once wireless carriers reached between 50 and 60 percent of their service in order to avoid affecting the service of other companies.⁷¹ Later, on November 5, 2017, almost seven weeks after Hurricane Maria, the TBPR reported that service had reached 50 percent.⁷²

The roaming service agreement adopted in 2017 by the principal wireless carriers (AT&T, Claro, Open Mobile, Sprint, and T-Mobile) was a positive factor in the restoration of emergency communications and telecommunications services during the response and recovery phases.⁷³ The roaming agreement was considered by various participants a historic initiative and it had a direct impact on citizens and on first responders’ ability to perform their work. Nonetheless, data show that initially half of the total wireless subscribers benefited from the roaming service, and that due to the prolonged restoration of wireless services and other telecommunications services in order to provide access to emergency communications services—a policy objective—was significantly limited to citizens. Hence, outages in emergency communications (*i.e.*, 911 emergency service, wireless services) compromised the citizenry’s

⁶⁷ U.S. Government Accountability Office. (2017). FCC Should Improve Monitoring of Industry Efforts to Strengthen Wireless Network Resiliency. DC: GAO. P. 23.

⁶⁸ The objectives related to our analysis are: 1) Provide reasonable roaming under disaster arrangements when technically feasible, 2) Foster mutual aid among wireless providers during emergencies, 3) Support municipal preparedness and restoration with local government public safety representatives and develop best practices and establishing a provider/PSAP contact database, 4) Improve public awareness and stakeholder communications on service and restoration status, through Commission posting of data on cell site outages on an aggregated, county-by-county basis in the relevant area through its Disaster Information Reporting System.

⁶⁹ Interview #7 with Senior Executives (3 participants).

⁷⁰ FCC. (October 10, 2017). Communications Status Report for Areas Impacted by Hurricane Maria October 10, 2017. *Primera Hora*, a local newspaper provided an earlier date, circa October 2, 2017, approximately two weeks after Hurricane Maria. The source indicates the agreement to provide a roaming service benefits nearly 2.5 million mobile subscribers. By then, only 12 percent—15 percent of the telecommunications infrastructure had been repaired. See Rivera Cruz, Y. (2017, October 2). Acuerdo entre Claro, T-Mobile y AT&T beneficia a 2.5 millones de usuarios (Agreement between Claro, T-Mobile and AT&T benefits 2.5 million users). *Primera Hora*.

⁷¹ Interview #12 with Telecommunications Regulatory Official.

⁷² The report doesn’t specify if the 50 percent refers to a specific service (*e.g.*, wireline, wireless) or is an aggregated number. Torres López, S. E. (May 25, 2018) Letter to Hon. Henry Neumann Zayas, President, Public Safety Commission, Senate of Puerto Rico (Explanatory Report for Senate Resolution 708). P.6.

⁷³ Other telecommunications companies endorsed the roaming service agreement, such as Verizon and Neptuno Networks.

use of safety and health services and social media platforms (e.g., Twitter, Facebook, Instagram, WhatsApp) for communication activities during the emergency.⁷⁴

5.5.1. GAO and FCC assessments of the wireless resiliency framework

In December of 2017 the GAO published a report entitled *FCC Should Improve Monitoring of Industry Efforts to Strengthen Wireless Network Resiliency*. The report covered the years 2009–2016 and its focuses were trends in mobile wireless outages attributed to physical incidents, Federal agencies’ and industry’s steps to improve wireless network resiliency, and a classification of stakeholders’ proposed measures that could be adopted by Federal agencies. With respect to the Wireless Resiliency Cooperative Framework as it relates to our analysis of emergency communications in Puerto Rico, the main consideration to be taken from the GAO’s report is the concern expressed by various stakeholders as to whether the framework represented a sufficient path forward, due to the following factors: 1) Lack of Federal agency enforcement or monitoring, 2) Adequate testing to enable roaming during and after disasters, and 3) High threshold to trigger the response elements to the detriment of local events.⁷⁵ In light of the previous issues and to improve wireless network resiliency, the GAO submitted recommendations in three areas of action: preparedness, response, and awareness. Three executive actions were submitted to the FCC: 1) Develop specific and measurable objectives, 2) Plan to monitor the outputs and outcomes that serve to document and evaluate results, 3) Promote awareness in state and local public safety officials and industry stakeholders through outreach mechanisms.⁷⁶

Later, in 2018, the FCC published the *2017 Atlantic Hurricane Season Impact on Communications Report and Recommendations*, which completed the documentation and assessment of the 2017 hurricane season. With respect to the Wireless Resiliency Cooperative Framework, the FCC reported various stakeholders’ favorable opinion of the Framework’s outcomes. The report also adopted T-Mobile’s broader view of the Framework, recommending to the FCC that it consider “a similar approach to cover the entire communications ecosystem, including backhaul providers to provide faster and more complete service restoration.”⁷⁷ With respect to the Framework, the report made a series of voluntary recommendations that we have classified under two categories: emergency management initiatives and communication and outreach Activities. The emergency management initiatives aim to: 1) Widen the number of signatory companies and encourage backhaul providers to work cooperatively with wireless service providers, 2) Promote other voluntary industry commitments from Framework signatory companies to provide detailed information when the Framework is active and making it public on an aggregated and anonymous basis, and 3) PSHSB active engagement with emergency management partners (e.g., Critical Infrastructure and SLTT governments) during disaster situations to better address and position communications needs.⁷⁸

5.6. Review of the Emergency Communications State Regulatory Reform

During the response and restoration phases, the Senate of Puerto Rico approved three resolutions to carry out investigations of the telecommunications industry’s response to Hurricane Maria and industry readiness in 2018.⁷⁹ Moreover, Table 2 shows three state laws approved between January 2018 and mid-2019 that reformed the state emergency communications regulatory regime.

In 2018, Law No. 5–2018 declared it public policy to recognize “telecommunications as an essential service,” placing it on equal footing with other essential services such as the production and distribution of electrical power and potable water. With regard to Law No. 5–2018, a telecommunications regulatory specialist stated: that came because the telecommunications service was not seen as a priority. . . . Now the Bureau can require other government agencies to contribute to maintain-

⁷⁴ See *Fitzpatrick et al.*, (2019). Connecting the dots. The telecommunications crisis in Puerto Rico. Free Press.

⁷⁵ U.S. Government Accountability Office. (2017). *FCC Should Improve Monitoring of Industry Efforts to Strengthen Wireless Network Resiliency*. DC: GAO. P. 3–4, 27.

⁷⁶ U.S. Government Accountability Office. (2017). *FCC Should Improve Monitoring of Industry Efforts to Strengthen Wireless Network Resiliency*. DC: GAO. P. 36.

⁷⁷ FCC. (2018). *2017 Atlantic Hurricane Season Impact on Communications Report and Recommendations* Public Safety Docket No. 17–344. P. 29.

⁷⁸ FCC. (2018). *2017 Atlantic Hurricane Season Impact on Communications Report and Recommendations* Public Safety Docket No. 17–344. P. 28–29.

⁷⁹ Puerto Rico’s Senate Resolution Num. 457, October 23, 2017; Puerto Rico Senate Resolution Num. 467, October 24, 2017; Puerto Rico Senate Resolution Num. 708, April 16, 2018; Puerto Rico Senate Resolution Num. 708, April 16, 2018. In response to Puerto Rico’s House of Representatives Resolution Num. 64, from January 18, 2017, the TBPR also submitted a detailed report on the state of the telecommunications industry after Hurricane Maria.

ing the service because it helps the Government, first responders, and recovery efforts. It allows the Bureau to ask for certain things within its design plan to make the system more resilient. As the ministerial function of the Bureau is to ensure compliance with public policy at the telecommunications level, it can request it and at the same time Federal agencies are involved in the process.⁸⁰

The second measure was Law No. 211, of August 12, 2018, known as the Execution Law of the Reorganization Plan of the Puerto Rico Public Service Regulatory Board (PRPSRB), which created a new regulatory agency. According to the statement of intentions, the “Law is not intended to change the public policy of the Government of Puerto Rico on this subject. Its main intention is to bring the new organizational and administrative structure into conformity with the current legal order”.⁸¹

Table 2
Laws approved for the Telecommunications State Regulator, 2018–2019

Law	Purpose
Law No. 5, January 20, 2018	To amend subsection (a) of Article 2 of Chapter I of Act 213–1996, known as the <i>Puerto Rico Telecommunications Act</i> .
Law No. 211, August 12, 2018	Law of Execution of the Reorganization Plan of the Public Service Regulatory Board of Puerto Rico
Law No. 22, May 15, 2019	To add new Article 8 A to Chapter III of Act 213–1996, as amended, known as the “ <i>Puerto Rico Telecommunications Act 1996</i> ”, in order to require providers of telecommunications services to have a contingency and continuity plan for services in the face of a duly declared emergency or disaster, and for other related purposes.

Law No. 22, of May 15, 2019, directed its attention to emergency communications. The legislators’ objective was to strengthen state regulation in the field of emergency communications through a series of policy measures aimed at two subjects: the TBPR and PTCs. Law No. 22–2019 mandates to the state regulator new policy objectives such as:

- 1) Establishing TBPR’s functions during an emergency situation aimed at to restoring communications infrastructure and networks.
- 2) Leading efforts to coordinate, establish, and maintain federal, state, and local communications during emergency situations.
- 3) Creating and managing a pool of amateur radio operators to support public safety activities during emergency situations.
- 4) Supporting the 911 Emergency System Bureau under the Department of Public Safety.
- 5) Giving the TBPR the authority to carry out inspections, investigations, and audits, if necessary, to achieve the purposes of this Law.

Law No. 22–2019, while reaffirming the jurisdiction of the state regulator, conditioned PTC’s licensing to the state regulator examination and approval of their contingency and continuity plans for a duly declared emergency or disaster. Article III–8 A of the new law provided that “through this plan, the Company will, to the extent possible, establish the necessary mechanisms for maintaining the continuity of the services and operations that they offer to the public.”

Law No. 22–2019 charged the state regulator with the responsibility for the approval of the contingency plans and ordered that they be in accordance with the Government of Puerto Rico’s State Emergency Management Plan. However, Law No. 22–2019 establishes an administrative procedure consistent with Law No. 5–2018, that sets a shared responsibility between the Department of Public Safety and the TBPR. In this sense, and in order to comply with Law 5–2018, the Department of Public Safety was ordered to coordinate the integration of the TBPR and certified

⁸⁰ Interview with Telecommunications Regulatory Official #12. See Torres López (December 7, 2017). Letter to Hon. Miguel A. Laureano Correa. President, Innovation, Telecommunications, Urban and Infrastructure Commission, Senate of Puerto Rico (Explanatory Report for Senate Project 711). The TBPR endorsed the state senate project that resulted in the approval of Law No. 5–2018.

⁸¹ As an umbrella organization, the PRPSRB brings together the Telecommunications Bureau of Puerto Rico, the Energy Bureau of Puerto Rico, and the Transportation and Other Public Services Bureau of Puerto Rico.

telecommunications providers in the development, management, and implementation of the State Plan for Emergency Management. Furthermore, Law No. 22–2019 established *in situ* inspection of infrastructure sites by the state regulator as part of the certifications process and gave the regulator the ability to take administrative measures, “including notifications of non-compliance and, if necessary, the imposition of fines up to a maximum of five thousand dollars, to ensure faithful compliance with what is established herein.”⁸² Prior to 2019, mandatory state regulatory field inspections related to emergency communications were not required. In sum, Law No. 22–2019 reflects the state government’s intervention in the telecommunications industry through a prescriptive regulatory approach, that establishes new legal mandates through the PTCs’ licensing process—a structural intervention tool—and specific emergency communications policy objectives to the state telecommunications regulator.

The laws discussed above were approved for the telecommunications state regulator and aimed at strengthening the TBPR’s powers, setting new policy objectives, and defining intergovernmental procedures for the TBPR. These laws amended the *Puerto Rico Telecommunications Act* of 1996 (Law No. 213–1996), and during the legislative process received TBPR support. In particular, Law No. 22–2019 showed that at a state level the policymaking process had resulted in a political and legal reform aimed at strengthening emergency communications policies. Based on these developments, we can conclude that state legislators and the state regulator took a vigorous stand, as opposed to simply adopting other regulatory tools (*e.g.*, incentives) in the emergency communications field.

6. Conclusions

This study examined emergency communications policies in Puerto Rico during the response and recovery phases after Hurricane Maria in September of 2017 using a qualitative analysis of PTCs’ responses and a policy analysis of the emergency communications regulatory framework, the conduct of Federal and state regulatory institutions, PTCs’ adoption of the Wireless Resiliency Cooperative Framework, and the intervention measures taken by the state legislature between 2017 and 2019.

Due to the limited number of participants in the survey, the research questions presented in the paper can only partially be answered and cannot be generalized to all other PCTs. A general conclusion drawn for the results is that the majority of participants had no particular opinion on strengthening emergency communications policies at the Federal level (RQ1). Similarly, the results show that the majority of opinions considered emergency communications policies at the state level not adequate, yet that only half the participants favored strengthening state regulation (RQ2).

In regard to the role of external and structural factors (RQ3), the results suggest that such factors such as lack of fuel and backup power systems, inadequate debris cleaning practices, and reliance on the deployment of aerial fiber optics were highly consequential and affected the execution of existing emergency communications policies.

At a more nuanced level of analysis, the policy analysis of emergency communications policies in Puerto Rico examined the interaction of the FCC, the TBPR, and PTCs based on the emergency management activities carried out and the policy tools adopted. Their activities were contextualized according to emergency communications policy objectives, the historical trends mentioned above, and the specific factors related to Hurricane Maria’s catastrophic impact noted by the research’s participants, regulatory institutions, and governmental and academic literature.

This study was grounded in two principles of telecommunications policymaking proposed by *Picard and Pickard (2017)*. The first principle suggests that policies should allow the public to communicate with authorities and among themselves. The 911 emergency service was an active designated emergency service number before the hurricane, but for several months after Hurricane Maria, access and adoption of the 911 emergency service was largely limited to citizens and first responders due to the technical damage and an extended power outage. Aside from the adoption of the Wireless Resiliency Cooperative Framework, the results demonstrate that in Puerto Rico, in the immediate aftermath of Hurricane Maria, both Federal and state emergency communications policies already in place were initially ineffective, largely due to the external factors discussed above and to limited short-term policy requirements regarding power outages.⁸³

⁸² Puerto Rico. Law No. 22, of May 15, 2019. P.2. Translation by the authors.

⁸³ See FCC Commissioner Geoffrey Starks’ comments on PTCs outcomes during Hurricane Maria recovery phase. *Pacheco Santa*, G. (2020, February 22). La FCC admite que su respuesta

In comparison, state legislation was more vigorous than the Federal efforts by mostly intervening in the telecommunications sector, through a prescriptive regulatory policy approach. Additionally, restoring the power grid had an impact on the restoration of telecommunications systems, revealing the lack of coordination between the Puerto Rico Electrical Power Authority, the TBPR, and PTCs during the recovery phase. During 2017 and 2019, several policy agreements between PTCs and government agencies were put in place to address the structural and implementation failures. Hence, policymaking and policy tools application in regard to emergency communications were largely reactive.

The second principle suggests that policies should allow authorities to communicate directly to the public and should be aimed at enhancing communication among authorities themselves. The results show that communication from authorities to the public was hampered by the same factors described above under the first principle. In regard to communication between authorities, the results show that at the time of the event, access to early warning systems such as EAS, WEA/CMAS, and IPAWS were available.⁸⁴ After the event these services were limited due to technical damage and an extended power outage. The information examined suggests that access and adoption of enhanced technology to support first responders' activities was limited. Data from the in-depth interviews indicated funding difficulties to meet Federal technological standards. After the event, broadcasting services (e.g., terrestrial and satellite), wireless services (e.g., Wireless Resiliency Cooperative Framework), FCC's DIRS system, and TBPR's Map Plus System provided a multiple-technologies approach to avoid single technology disruption during emergency situation. Further research is needed in order to address public safety organizations communications networks.

Drawing from *Cherry (2006)*, after Hurricane Maria the reform of the emergency communications regime shows two distinctive policymaking processes at the Federal and state levels. The FCC has addressed the financial viability for carriers' network reconstruction and hardening, through supplemental and long-term funding allocations. Meanwhile the political feasibility of emergency communications policies was the state legislator's task, as its intervention resulted in new rules and workflows for PTCs and the TBPR. This study also aimed at improving emergency communications policymaking processes and their outcomes by providing practical recommendations based on the findings reported in the results section. One of the study's findings is that after Hurricane Maria, telecommunications companies made investments in technology and have reevaluated their emergency plans.⁸⁶ Based on the participants' responses, nine applicable recommendations were identified:

1. Establish government-approved procedures for the distribution of fuel to telecommunications companies during emergency situations.
2. Strengthen public safety communication systems.
3. Create a tax incentive program for the broadband market in order to encourage competition and to acquire resilient technologies.
4. Establish a subsidy program to improve infrastructure such as underground fiber optics and to acquire resilient technologies.
5. Strengthen the exchange of information between Federal and state agencies during emergency communications.
6. Evaluate underwater infrastructure vulnerabilities due to the island's geographical position and increase and decentralize the number of cable mooring points.
7. Revisit the proposal to use the underground infrastructure of the Department of Transportation and Public Works in the metropolitan area (San Juan).
8. Designate Hot Zones across the island so that telecommunications service providers are required to offer free access to Wi-Fi.
9. Re-evaluate the use of satellite technology in regard to satellite bandwidth to support emergency communications.

These recommendations include a mix of policy tools that are aimed at strengthening Federal or state emergency communications policies, and some of them are already at a development stage.

The implications and recommendations of this study, although particular to Puerto Rico, may further research in emergency communications in contexts of extreme

tras el paso de María debió ser más eficiente (The FCC admits that its response after María's passage should have been more efficient). *El Nuevo Día*.

⁸⁴ Interview with Telecommunications Regulatory Official #12, Interview with Telecommunications Regulatory Official #15.

infrastructure collapse. Furthermore, other media and telecommunications policy research topics are derived when emergency communications policies are considered as a legal framework that asserts citizens' right to communicate with their community and public safety organizations during emergency situations.

Declaration of competing interest

No potential conflict of interest was reported by the authors. This research was funded by the National Science Foundation (Grant number #1824976); Division of Civil, Mechanical and Manufacturing Innovation.

APPENDIX 1

Interviewee List

Telecommunications Company	Position	Code
Telecommunications Company #1	Senior Executive	1
Telecommunications Company #2	Senior Executive	2
Telecommunications Company #3	Senior Executive	3
Telecommunications Company #4	Senior Executive	4
Telecommunications Company #5	Senior Executive	5
Telecommunications Company #6	Senior Executive	6
Telecommunications Company #7	Senior Executives (3 participants)	7
Telecommunications Company #8	Senior Executive	8
Telecommunications Company #9	Senior Executives (2 participants)	9
Telecommunications Company #10	Senior Executive	10
Telecommunications Expert		11
Telecommunications Regulatory Official		12
Telecommunications Regulatory Official		13
Telecommunications Expert		14
Telecommunications Regulatory Official		15

References

- Associated Public-Safety Communications Officers. (April 16, 2018). Incorporated (APCO). Project 25 steering committee BY-laws. Retrieved from https://www.dhs.gov/sites/default/files/publications/895_Project-25-Steering-Committee-Bylaws_Aproved_180416-508.pdf.
- Center for Economic and Policy Research. (2017). Life after Debt in Puerto Rico: How many more lost Decades?. Retrieved from <https://cepr.net/images/stories/reports/puerto-rico-2017-07.pdf>.
- Cherry, B. A. (2006). Regulatory and political influences on media management and economics. In A. B. Albarran, S. M. Chan-Olmstead, & M. O. Wirth (Eds.), *Handbook of media management and economics*. New Jersey, London: Lawrence Erlbaum Assoc.
- Department of Homeland Security. (2008). *National emergency communications plan*. DHS. Retrieved from https://www.dhs.gov/xlibrary/assets/national_emergency_communications_plan.pdf.
- Department of Homeland Security. (2013). *NIPP 2013. Partnering for critical infrastructure security and resilience*. DHS. Retrieved from <https://www.cisa.gov/sites/default/files/publications/national-infrastructure-protection-plan-2013-508.pdf>.
- El nuevo Día. Retrieved from <https://www.elnuevodia.com/negocios/empresas-comercios/notas/la-reparacion-en-telecomunicaciones-dio-paso-a-sentar-las-bases-para-5g/>.
- Enserink, B., Koppenjan, J. F. M., & Mayer, I. S. (2013). A policy sciences view on policy analysis. In W. A. H. Thissen, & W. E. Walker (Eds.), *Public policy analysis: New developments*. New York: Springer Science Business Media.
- 47 CFR 12. PS Docket No. 14–174. FCC 15–98. See also FCC. (2015). *Ensuring continuity of 911 communications*.
- Federal Communications Commission (FCC). Emergency communications. Retrieved from <https://www.fcc.gov/general/emergency-communications>.
- Federal Communications Commission (FCC). (2016a). *Wireless resiliency cooperative framework*. FCC. Retrieved from <https://www.fcc.gov/wireless-resiliency-cooperative-framework>.
- Federal Communications Commission (FCC). (December 14, 2016). *Improving the resiliency of mobile wireless communications networks, Reliability and continuity of communications networks, including broadband technologies. PS Docket No. 13–239*. PS Docket No. 11–60. FCC. Retrieved from <https://www.fcc.gov/wireless-resiliency-cooperative-framework>.

Retrieved from Federal Communications Commission (FCC). (December 7, 2017). *Public safety and Homeland security Bureau seeks comment on response efforts undertaken during 2017 hurricane season*. Public Notice. FCC <https://www.fcc.gov/document/fcc-seeks-comment-2017-hurricane-season-response-efforts>.

Federal Communications Commission (FCC). (October 10, 2017). *Communications status report for areas impacted by Hurricane Maria October 10, 2017*. FCC. Retrieved from <https://www.fcc.gov/document/hurricane-maria-communications-status-report-oct-10>.

Federal Communications Commission (FCC). (October 4, 2017). *FCC Approves advance of \$77M to restore connectivity in PR and USVI*. FCC. WC Docket No. 10–90. Retrieved from <https://www.fcc.gov/document/fcc-approves-advance-77m-restore-connectivity-pr-and-usvi>.

Federal Communications Commission (FCC). (2018). *2017 atlantic hurricane season impact on communications report and recommendations*. Public Safety Docket No. 17–344. FCC. Retrieved from <https://docs.fcc.gov/public/attachments/DOC-353805A1.pdf>.

Federal Communications Commission (FCC). (2019, May 8). *The Uniendo a Puerto Rico fund and the Connect USVI fund*. WC Docket No. 18–143, WC Docket No. 10–90. WC Docket No. 14–58. FCC. Retrieved from <https://docs.fcc.gov/public/attachments/FCC-18-57A1.pdf>.

Federal Communications Commission (FCC). (2020, February 5). *Uniendo a Puerto Rico fund and Connect USVI. Fund notice and filing requirements and other procedures for stage 2 fixed competitive proposal process*. WC Docket Nos. 18–143, 10–90, 14–58. FCC. Retrieved from: <https://docs.fcc.gov/public/attachments/DA-20-133A1.pdf>.

Federal Communications Commission (FCC). (2019). FCC Invests \$950 million to improve broadband in Puerto. September 26, WC Docket Nos. 18–143, 10–90, 14–58. FCC. Retrieved from <https://docs.fcc.gov/public/attachments/DOC-359891A1.pdf>.

Federal Communications Commission (FCC). (September 26, 2019). *FCC Invests \$950 million to improve broadband in Puerto Rico*. USVI (Press Release). FCC. Retrieved from <https://docs.fcc.gov/public/attachments/DOC-359891A1.pdf>.

Federal Emergency Management Agency (FEMA). (2008). *Emergency support function Annexes: Introduction*. Retrieved from <https://www.fema.gov/pdf/emergency/nrf/nrf-annexes-all.pdf>.

Federal Emergency Management Agency (FEMA). (2016). *National response framework* (3rd ed.) Retrieved from https://www.fema.gov/media-librarydata/14660146829829bcf8245ba4c60c120aa915abe74e15d/National_Response_Framework_3rd.pdf.

Fitzpatrick, L., Scurato, C., & Torres, J. (2019). *Connecting the dots. The telecommunications crisis in Puerto Rico*. Free Press. Retrieved from https://www.freepress.net/sites/default/files/2019-05/connecting_the_dots_the_telecom_crisis_in_puerto_rico_free_press.pdf.

Freeman, M. (2011). Fire, wind and water. Social networks in natural disasters. *Journal of Cases on Information Technology*, 13(2), 69–79.

González, J. (2017, December 19). La FCC abre proceso sobre efectividad de telecomunicaciones tras María (The FCC opens a process on telecommunications effectiveness after Maria). *El Nuevo Día*. Retrieved from <https://www.elnuevodia.com/negocios/empresas/nota/lafccabreprocesosobreefectividaddetelecomunicacionesstrasmaria-2383362/>.

International Telecommunications Union (ITU). (2020a). *ITU Guidelines for national emergency telecommunication plans*. Retrieved from <https://www.itu.int/en/ITU-D/EmergencyTelecommunications/Pages/Publications/Guidelines-for-NETPs.aspx>.

International Telecommunications Union (ITU). (2020b). *Mobile-cellular subscriptions*. Retrieved from [https://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2019/Individuals Internet 2000-2018 Dec2019.xls](https://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2019/Individuals%20Internet%202000-2018%20Dec2019.xls).

Jayakar, K. (2009). Universal service. In A. M. Schejter (Ed.), *And communications for all: A policy agenda for a new administration*. Lexington Books.

Kishore, N., Marqués, D., Mahmud, A., Kiang, M. V., Rodriguez, I., Fuller, A., & Maas, L. (2018). Mortality in Puerto Rico after hurricane Maria. *New England Journal of Medicine*, 379(2), 162–170.

Miller, T. R., Chester, M., & Munoz-Erickson, T. A. (2018). Rethinking infrastructure in an era of unprecedented weather events. *Issues in Science and Technology Winter*, 47–58.

Minelli Pérez, S. (2018). December 30). *La reparación en telecomunicaciones dio paso a sentar las bases para 5G (Telecommunications repair gave way to laying the groundwork for 5G)*.

Minelli Pérez, S. (March 8, 2018). La FCC fiscalizará el uso de los fondos para las telecomunicaciones (The FCC will monitor the use of funds for telecommunications).

El Nuevo Día. Retrieved from <https://www.elnuevodia.com/negocios/economia/notas/la-fcc-fiscalizara-el-uso-de-los-fondos-para-las-telecomunicaciones/>.

Napoli, P. M. (1999). The unique nature of communications policy regulation: Evidence and implications communications policy analysis. *Journal of Broadcasting & Electronic Media*, 43(4), 565–581.

Nieves-Pizarro, Y., Takahashi, B., & Chavez, M. (2019). When everything else fails: Radio journalism during hurricane Maria in Puerto Rico. *Journalism Practice*, 13(7), 799–816.

Nuechterlein, J., & Weiser, P. J. (2007). *Digital crossroads: American telecommunications policy in the Internet age*. Cambridge, Mass: MIT Press.

Pacheco Santa, G. (2020, February 22). La FCC admite que su respuesta tras el paso de María debió ser más eficiente (The FCC admits that its response after María's passage should have been more efficient). *El Nuevo Día*. Retrieved from <https://www.elnuevodia.com/negocios/economia/notas/la-fcc-admite-que-su-respuesta-tras-el-paso-de-maria-debio-ser-mas-eficiente/>.

Peha, J. M. (2009). A spectrum policy agenda. In A. M. Schejter (Ed.), *And communications for all: A policy agenda for a new administration*. Lexington Books. Picard, R. G. (2020). *Media and communications policy making. Processes, dynamics and international variations* (1st ed.). United Kingdom: Palgrave Macmillan.

RISJ report Picard, R. G., & Pickard, V. (2017). *Essential principles for contemporary media and communications policymaking*. Reuters Institute: University of Oxford. Retrieved from <https://reutersinstitute.politics.ox.ac.uk/sites/default/files/research/files/Essential%2520Principles%2520for%2520Contemporary%2520Media%2520and%2520Communications%2520Policymaking.pdf>.

Puerto Rico Emergency Management Bureau, Puerto Rico Department of Public Safety. (2019). *Joint operational catastrophic incident plan of Puerto Rico*. Retrieved from version 1.10. <http://manejodeemergencias.pr.gov/wp-content/uploads/2019/08/planconjuntohuracanes-min.pdf>.

Puerto Rico Telecommunications Act. Law 213—1996. Retrived from http://www.presupuesto.pr.gov/adopted_Budget_2012_2013/Aprobado2013Ingles/suppdocs/baselegal_ingles/141/141.pdf.

Puerto Rico Telecommunications Board (PRTRB). (1997). *Reglamento para la Expedición de Certificaciones y Franquicias (Regulations for the Issuance of Certifications and Franchises)*.

Puerto Rico Telecommunications Board (PRTRB). (2009). Reglamento de Servicio universal (regulations for universal service. Retrieved from https://jrtpr.pr.gov/download/pdf/leyes_reglamentos/7795.pdf.

Puerto Rico Telecommunications Board (PRTRB). (November 11, 2017).) *resolution and order JRT-2017-CCG-0002*. Puerto Rico Telecommunications Board (PRTRB). (October 10, 2017). *Administrative order JRT 2017-004*.

Puerto Rico Telecommunications Board (PRTRB). (September 18, 2017).). *Order JRT-2017-OA-0003*.

Puerto Rico Telecommunications Bureau. (2020). *Statistics for telecommunications and cable television industries in Puerto Rico*. Retrieved from <http://www.jrtpr.pr.gov/estadisticas-2/>.

Resilient Puerto Rico Advisory Commission. (2018). *Reimagina Puerto Rico Informe sectorial de Infraestructura física*. San Juan PR. Retrieved from https://www.unausapr.org/uploads/3/1/1/7/3117189/reimaginapr_infraestructura_f%C3%ADsica.pdf.

Rivera Cruz, Y. (2017, October 2). *Acuerdo entre Claro, T-Mobile y AT&T beneficia a 2.5 millones de usuarios (Agreement between Claro, T-Mobile and AT&T benefits 2.5 million users)*. Primera Hora. Retrieved from <https://www.primerahora.com/noticias/puerto-rico/notas/acuerdo-entre-claro-t-mobile-y-att-beneficia-a-25-millones-de-usuarios/>.

Rosario-Albert, L. (2016). *Redes: Estado, Empresa y Telecomunicaciones en Puerto Rico*. San Juan, Puerto Rico: Junta Reglamentadora de Telecomunicaciones de Puerto Rico.

Ryan, H., & Peha, J. (2008). *Quantifying the costs of a nationwide broadband public safety wireless network*. Figshare.

Seeman, E., Kleckley, J., & Holloway, J. (2018). Data management, technology, and public policy: The implementation of next generation 911 and its connection to nationwide public safety broadband network at public safety answering points. *Journal of Information Policy*, 8, 472–496.

Serrano-Román, A. (2019, June 19). Acuerdo permitirá mejorar el restablecimiento de las telecomunicaciones después de una emergencia (Agreement will improve the

restoration of telecommunications after an emergency). *El Nuevo Día*. Retrieved from <https://www.elnuevodia.com/noticias/locales/notas/acuerdo-permitira-mejorar-el-restablecimiento-de-las-telecomunicaciones-despues-de-una-emergencia/>.

State News Service. (Oct. 23, 2017). *Airmen work to restore radio communications in Puerto Rico*. Retrieved from <https://www.defense.gov/Explore/News/Article/Article/1350647/airmen-work-to-restore-radio-communications-in-puerto-rico/>.

Suárez, D. (2018, September 12). *Desconectadas empresas de comunicaciones de nuevo plan emergencia* (Communications companies disconnected from new emergency plan). Noticel. Retrieved from <https://www.noticel.com/meet-the-team/damaris-surez/601644162>.

Takahashi, B., Zhang, Q., & Chavez, M. (2019). Preparing for the worst: Lessons for news media after hurricane Maria in Puerto Rico. *Journalism Practice*.

Ten, P. (2001). Dial 911 and report a congressional empty promise: The wireless communications and public safety act of 1999. *Federal Communications Law Journal*, 54(1), 53–77.

The World Bank/GFDDR. “Communication during Disaster Recovery. Disaster Recovery Guidance Series”. Retrieved from https://www.gfdrr.org/sites/default/files/publication/Communications_Sector_Guidance_Note_0.pdf.

Torres López, S. E. (November 7, 2017).). *Letter to Hon. Miguel A. Laureano Correa, President, Innovation, Telecommunications, Urban and Infrastructure Commission*. Senate of Puerto Rico (Explanatory Report for Senate Resolution 467).

Torres López, S. E. (2017b). Letter to Ajit Pai, chairman, FCC. *WC Docket No. 10–90*. at 1 (filed Dec. 13, 2017).

Torres López, S. E. (2018, May 25). *Letter to hon. Henry neumann Zayas, President, public safety commission*. Senate of Puerto Rico (Explanatory Report for Senate Resolution 708).

Torres López, S. E. (2018, October 25). *Letter to hon. Víctor L. Pares Otero, President, economic development, Planning, telecommunications, public & private Alliances and energy commission*. Representatives of Representatives of Puerto Rico (Explanatory Report for Senate Project 710).

Letter to Hon. Víctor L. Pares Otero Torres López, S. E. (February 4, 2019). *President, economic development, Planning, telecommunications, public & private Alliances and energy commission*. Representatives of Representatives of Puerto Rico (Explanatory Report for House of Representatives Resolution 64).

U.S. Census Bureau. (September 26, 2019). *More Puerto Ricans move to mainland United States, poverty Declines*. Retrieved from <https://www.census.gov/library/stories/2019/09/puerto-rico-outmigration-increases-poverty-declines.html#:~:text=The%20poverty%20rate%20in%20Puerto,state%20poverty%20rates%20in%202018>.

U.S. Government Accountability Office. (2017). *FCC should improve monitoring of industry efforts to strengthen wireless network resiliency*. DC: GAO. Retrieved from <https://www.gao.gov/products/GAO-18-198>.

2017 Hurricanes and Wildfires U.S. Government Accountability Office. (2018). *Initial observations on the Federal response and Key recovery challenges*. DC: GAO. Retrieved from <https://www.gao.gov/products/GAO-18-472>.

World Meteorological Organization. (2018). *Caribbean 2017 hurricane season an evidence-based assessment of the early warning system*. Geneva, Switzerland (p. 19). Retrieved from https://library.wmo.int/index.php?lvl=notice_display&id=20700#.XrXcSRNKhUM.

GAO CONFIRMS INADEQUATE FCC DISASTER RESPONSE IN PUERTO RICO

June 8, 2021—Carmen Scurato, Leo Fitzpatrick



A scene of devastation in Puerto Rico following Hurricane Maria Army Corps of Engineers

The Government Accountability Office (GAO), the government's in-house watchdog, recently **released a report** (<https://www.gao.gov/assets/gao-21-297.pdf>) that examines the Trump FCC's protracted attempts to restore communications in Puerto Rico after Hurricane Maria struck in September of 2017. This report was years in the making and is part of a long struggle to learn the whole truth of the government's response to this disaster.

The report found that the FCC's role was not clearly defined and that the agency wasn't transparent about its efforts. On this last point, the GAO noted that the FCC did not sufficiently engage with the Puerto Ricans on the islands who were most impacted by the devastation. Unfortunately, the report does not offer any specifics about how the FCC's murky role and lack of engagement harmed affected communities.

There are still many questions left to be answered. The Trump FCC ignored our **constant** (https://www.freepress.net/sites/default/files/2018-09/Call_for_Independent_Commission_on_Puerto_Rico.pdf) and **repeated** (<https://www.freepress.net/news/press-releases/free-press-report-and-foia-documents-expose-trump-fccs-neglect-toward-puerto>) **requests** (https://www.freepress.net/sites/default/files/2020-05/free_press_comments_puerto_rico_fcc.pdf) to thoroughly investigate the near-collapse of Puerto Rico's communications infrastructure and the delayed recovery efforts that left people on the islands without the ability to communicate for months. With hurricane season underway, we urge the Biden FCC to undertake this long-overdue task.

What led to the GAO report

Hurricane Maria obliterated the communications infrastructure on the islands of Puerto Rico in 2017: 95 percent of cell sites were out of service, TV and radio stations went dark, and, for those fortunate few who had phone service, calls to 911 went unanswered.

Free Press, along with our allies, **immediately urged** (<https://www.nhmc.org/release-fcc-must-aid-puerto-rico-virgin-islands-proactive-steps-restore-communications-says-national-hispanic-media-coalition-four-public-interest-groups/>) the FCC to use its expert knowledge to closely monitor and help accelerate recovery and restoration efforts. Over a year after the hurricane devastated the islands, it was clear that an **investigation into the agency's role was necessary** (<https://www.freepress.net/our-response/expert-analysis/explainers/building-future-communications-puerto-rico>) to truly understand why Puerto Ricans were still struggling to get reliable access to communications.

And yet we met resistance to our questions when we called on the Trump FCC to be more transparent and engage with the affected populations.

In an attempt to get some answers on our own, Free Press filed a **Freedom of Information Act request** (https://www.freepress.net/sites/default/files/2019-05/free_press_foia_request_11_09_18.pdf) asking the FCC for several types of documents—including documents related to its secretive Hurricane Recovery Task Force. We received wired and wireless **consumer complaints** (<https://www.freepress.net/policy-library/fcc-foia-response-puerto-rico>) in response to the FOIA, which offered a small window into a much larger problem where carriers promoted refunds and relief for the extensive loss in services, but failed to deliver on those promises.

One complainant in Bayamon, Puerto Rico, wrote that communications remained unreliable nearly **two months** after Maria made landfall:

“I live in Puerto Rico and system was down for 2 months (September and October) due to hurricane Maria. Cellphone service is still not working at 100 percent capacity. No signal available in some areas. [The carriers] said they were going to credit two months of service towards the bill and when I called today they said no credit due to data usage which makes no sense since we were using the Internet from the landline and had to go to the freeway to get a little service. Communication right now in PR is essential to keep us safe. I want what they promised: no payment for September and October since we did not have service.”

Our report **Connecting the Dots: The Telecommunications Crisis in Puerto Rico** (https://www.freepress.net/sites/default/files/2019-05/connecting_the_dots_the_telecom_crisis_in_puerto_rico_free_press.pdf) showed how much was unknown about the destruction of communications networks following Hurricanes Irma and Maria. Our report documented how the communications blackout contributed to the unfolding tragedy and loss of life and illustrated how the Trump FCC acted in secrecy and treated Puerto Rico differently than parts of the mainland that had experienced disasters. Our report also raised questions to try to bring light to why this failure in communications occurred and understand the FCC's role in restoring communications services.

In response to our report, House Energy and Commerce Committee Chairman Frank Pallone Jr. **wrote a letter** (<https://energycommerce.house.gov/sites/democrats.energycommerce.house.gov/files/documents/GAO.2019.10.3.%20Letter%20re%20Puerto%20Rico%20and%20US%20VI.CAT.pdf>) on Oct. 3, 2019 to the GAO and requested an investigation into the FCC's role after Hurricane Maria. The letter listed a series of questions for the GAO to investigate, including:

- Has the FCC adequately responded to the communications problems in Puerto Rico and the U.S. Virgin Islands following Hurricane Maria?
- To the extent the FCC took action, were the actions timely or could the FCC have acted more quickly?
- Did the FCC's response differ from the agency's response to hurricanes that hit the U.S. mainland?

Now in May 2021—nearly four years after the storm—we've made progress with the release of the GAO report. But we still don't have all the answers.

What the GAO found

The GAO report affirmed much of what we already knew: The ability to communicate is a life-and-death issue. The report rightly notes that “[t]he loss of telecommunications in an emergency has cascading detrimental effects on other critical infrastructures due to interdependencies among sectors, including the transportation, medical, and financial sectors.”

And resilient communications networks are key to recovery and rebuilding efforts.

People need to ensure loved ones are safe and can call emergency services, receive emergency alerts and find out where to access emergency food and water supplies. Puerto Ricans felt abandoned after the storm, with little-to-no clarity of when life would return to normal. That's why we **urged the FCC to conduct field hearings** (https://www.freepress.net/sites/default/files/2018-04/joint_comments_nhmc_freepress_2017_hurricane_season.pdf) and directly reach out and engage with Puerto Ricans on the islands to better inform agency regulations and policies to accelerate recovery efforts at the time.

The first recommendation: The FCC's emergency role must be clearly defined

The GAO report notes that the “lack of clarity could have contributed to confusion and delays in the hurricane's aftermath.” However, we already knew that this delay was no mere possibility. FEMA's report of its own response to Hurricane Maria, released in July 2018, describes how “FEMA and supporting Federal agencies strug-

gled to gain situational awareness and assess the status of critical infrastructure, in part due to communications outages[.]”

At a critical time, the government struggled to gather and disseminate important information about what infrastructure and services were available and where to deploy its limited resources—and this struggle surely contributed to delays. The GAO report recommends that the Department of Homeland Security (which includes FEMA) define specific actions for the FCC in its emergency guidance on how to restore communications infrastructure.

The second recommendation: The FCC must be more transparent in its efforts to help restore communications

While the FCC established an internal cross-bureau Hurricane Recovery Task Force soon after Hurricane Maria devastated Puerto Rico, it was not clear what the task force was doing. Even after we submitted our FOIA request over a year after Hurricane Maria, the FCC was unwilling to share any information regarding the task force’s actions or recommendations.

It should come as no surprise that the GAO report “found that FCC obtained limited public input and that the Hurricane Recovery Task Force’s efforts lacked transparency because FCC had not publicly communicated the task force’s actions or findings.”

While the report confirmed much of what we already knew, what’s important now is what comes next.

Where do we go from here? An FCC investigation & a new playbook

The GAO report lays the groundwork for the Biden FCC to step into its role as the expert agency in communications and take the lead in restoring communications after a disaster. The FCC should create regulations to ensure our communications infrastructure is more resilient—which is an urgent need in light of the climate crisis.

The agency should also commit to greater transparency with the public to help people know what it’s doing after a disaster strikes. That means incorporating feedback that addresses the needs of the public—not corporations. Here, the FCC must start with the largely unexamined disaster in Puerto Rico following Hurricane Maria.

We urge the Biden FCC and Acting Chairwoman Jessica Rosenworcel to preserve documents related to its response to Hurricane Maria and expeditiously release relevant documents publicly, as the GAO recommends. These two acts can set in motion an investigation and a full accounting of what happened in Puerto Rico after the storm.

We also agree with Acting Chairwoman Rosenworcel that the FCC needs a “**new playbook**” (<https://docs.fcc.gov/public/attachments/DOC-359891A5.pdf>) when it comes to disaster preparedness and recovery—and a playbook that accounts for the impact of the climate crisis. The Biden FCC should propose new rules to ensure the resiliency of our networks—and to prevent a total collapse of communications from ever happening again.

LYNK GLOBAL, INC.
Falls Church, VA, June 21, 2021

Senator BEN RAY LUJÁN,
Chair, Subcommittee on
Communications, Media, and
Broadband,
Washington, DC.

Senator JOHN THUNE,
Ranking Member, Subcommittee on
Communications, Media, and
Broadband,
Washington, DC.

Dear Chair Luján and Ranking Member Thune:

Thank you for joint efforts to examine potential Federal government actions to support the deployment of resilient, redundant, and secure broadband and telecommunications infrastructure. Reviewing lessons from past outage incidents as well as current proposals to improve network resiliency and reliability is an important step in enhancing connectivity for consumers and first responders throughout the United States and the world.

Lynk Global, Inc. (Lynk) fully supports your work and appreciates the Subcommittee’s focus on this critical issue.

Lynk was founded on the belief that by keeping consumers connected wherever they are, at all times, the phones in their pockets can save their lives. To accomplish this goal, Lynk is building a constellation of small satellites which will essentially function as cell towers in space. When fully built, Lynk’s constellation will automati-

cally fill in unconnected areas on Earth for mobile phone users everywhere. The Lynk constellation fills in unserved areas where there is simply no—or very limited—infrastructure, such as at our national and state parks. Notably, the Lynk system can also be utilized in areas where infrastructure exists but is unavailable due to natural disasters, power failures, or intentional shutdowns to prevent fires. In those situations, Lynk will provide an automatic, instantaneous backup system from space—resilient against threats and damage to infrastructure on the ground.

As Acting FCC Chairwoman Jessica Rosenworcel stated during her testimony to the U.S. House Subcommittee on Communications & Technology during a hearing in the last Congress: “When utilities in California turned off power to mitigate wildfires last year it exposed a glaring weakness in our preparation for disaster. In some areas more than half the cell sites were rendered inoperable.” Such circumstances surely call for new, different, and better approaches to keeping consumers and first responders connected to critical communications services, like 911 and Wireless Emergency Alerts.

Lynk is currently demonstrating its capabilities through its ongoing test program. To date we have launched four demonstration missions, with our fifth planned for June 25, 2021. Last year, Lynk achieved an historic “first”—sending the world’s first ever text message from an orbiting satellite to a standard mobile phone on Earth. For that demonstration, we sent a Wireless Emergency Alert from one of our American-built satellites in space directly to phones on the ground. That capability alone could save lives, notifying affected residents of evacuations or other emergencies, even when terrestrial towers are down or not working.

As you evaluate potential Federal actions or requirements, Lynk respectfully submits that it is critical that solutions do not create unintended consequences. Specifically, some proposals to ensure resiliency may create additional threats or challenges. Requiring mobile phone towers to have on-site backup power, for example, may require large tanks of fuel or numerous batteries in a fire zone. Obviously, this creates a host of additional risks, not to mention inconsistencies with state or Federal environmental laws.

In contrast, satellite systems like that proposed by Lynk can provide a resilient communications option without requiring additional, potentially hazardous ground equipment. Moreover, Lynk’s approach eliminates the need for specialized handsets or equipment—the satellites connect directly to the phones already in the pocket of hundreds of millions of Americans.

We therefore urge consideration of satellite systems like that proposed by Lynk as part of America’s resiliency and reliability solutions.

Again, thank you for your leadership on this critical matter.

TONY DETORA,
VP, *Government Affairs*.

COMPETITIVE CARRIERS ASSOCIATION
Washington, DC, June 22, 2021

Hon. BEN RAY LUJÁN,
Chairman,
Subcommittee on Communications,
Media, and Broadband,
U.S. Senate Committee on Commerce,
Science, and Transportation,
Washington, DC.

Hon. JOHN THUNE,
Ranking Member,
Subcommittee on Communications,
Media, and Broadband,
U.S. Senate Committee on Commerce,
Science, and Transportation,
Washington, DC.

Dear Chairman Luján and Ranking Member Thune:

Competitive Carriers Association¹ (“CCA”) commends the Subcommittee for holding today’s hearing on “Building Resilient Networks” and respectfully requests that this letter be included in the hearing record. CCA and our members are deeply committed to ensuring the resiliency and security of the Nation’s communications infrastructure, and CCA members work to harden networks to increase resiliency and take decisive steps before, during, and after emergencies and disasters to maintain and restore connectivity.

¹ CCA is the Nation’s leading trade association for competitive wireless providers and stakeholders across the United States, and our members range from small, rural carriers serving fewer than 5,000 customers to regional and nationwide providers serving millions of customers, as well as vendors and suppliers that provide products and services throughout the wireless communications ecosystem.

CCA has endorsed the voluntary Wireless Network Resiliency Cooperative Framework, and CCA members have individually committed to many of its principles, with proven results including sharing information and resources among carriers and with authorities in response to natural disasters, expanding roaming access for consumers on compatible networks to maintain connectivity, and positioning mobile assets, including generators and fuel, in advance of anticipated events. This approach has allowed each carrier to prioritize the needs of their consumers based on unique network and resource needs to serve distinctive topography and challenges related to a particular disaster. Just as all disasters are different, there is no one-size-fits-all framework for responding to recovery efforts, and policymakers should support continued flexibility to allow each carrier to appropriately take steps to maintain connectivity or restore services as expeditiously as possible. Further, CCA participates in the Cross-Sector Resiliency Forum with telecommunications and power companies to improve communications before, during, and after emergencies.

Any consideration of generational investment in our Nation's infrastructure, including broadband and digital infrastructure, provides a rare opportunity to significantly increase the resiliency of our communications networks and ensure that consumers and wireless networks are adequately prepared to respond to emergencies and disasters. But to take advantage of this opportunity, investing in our digital infrastructure must include a focus on wireless services in addition to fiber connections.

Wireless network resiliency is a critical priority because consumers turn to mobile devices and wireless networks for information and to communicate during natural disasters and catastrophic events, especially if they are not in a fixed location during the event or are forced to evacuate. These technologies deliver wireless emergency alerts and other notifications and connect consumers with emergency services, recovery assistance, and their loved ones during challenging times. Wireless assets, such as Cells on Wheels, Cells on Light Trucks, and other deployables, can be swiftly positioned to enhance coverage or capacity or provide connectivity while impacted base stations or wireline networks are restored. Even in instances where an individual remains in a fixed location, wireless networks provide an important layer of redundancy for voice and data communications should wired networks go down.

Because of the critical role wireless services take on during emergency situations, it is crucial that support for the latest wireless networks, including 5G services, is included in any broadband infrastructure legislation. Not only will policies that advance wireless deployment increase mobile services and drive economic growth, but they are also vital to ensuring that resilient communications services are available when and where Americans depend on them most.

CCA strongly agrees with the bipartisan goal to close the digital divide and connecting all Americans with broadband that meets future demands for communications services. With the focus today on resiliency, we are again reminded that to truly provide ubiquitous connectivity, policy efforts must support both wired and wireless networks. Please do not hesitate to contact me with any questions or if CCA can be helpful to your efforts in any way.

Sincerely,

STEVEN K. BERRY,
President & CEO,
Competitive Carriers Association.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. RAPHAEL WARNOCK TO
JEFFREY D. JOHNSON

Technical Assistance. I am glad we are having this timely conversation on how to increase network availability and resiliency. As you've noted, different communities in Georgia, and across America, face different challenges when it comes to deploying, operating, and securing broadband networks.

Question. In light of these diverse requirements, what steps can Congress take to ensure that Federal agencies involved in our communications networks, including the FCC, USDA, and NTIA, meet the needs of all our communities?

- Do you feel they are providing adequate technical assistance in order to comply with regulations and/or access available programs and funding?
- If not, what are your recommendations for improvement?

Answer. Federal Agencies could best help by streamlining Broadband Construction and related permitting on Federal lands especially for FirstNet, our National Public Safety Broadband Network built with and for public safety. The FirstNet Au-

thority is a Federal agency which governs the public-private partnership so other Federal agencies could easily assist in this mission. This could best be accomplished by setting a “shot clock” on Federal permitting processes, avoiding needless delays. Furthermore, establishment of a FirstNet liaison within the Departments of Agriculture and Interior would aid in streamlining processes.

Regarding NTIA, this administration will need the full support of the Department of Commerce and other agencies to quickly, and with accountability, distribute the current Broadband Stimulus Funding. The allocation of stimulus funding for wireless Public Safety Broadband needs, cannot just be for fiber/wireline but also tower infrastructure, and should incentivize public private partnerships on infrastructure to further leverage the Federal funding.

Technical Assistance is often difficult for practitioners to access due to confusion over what assistance exists and for whom. There are concerns in the public safety community that DHS and S&T often cause confusion and/or redundancy for public safety and their programs often serve technical needs from the last technical generation rather than the current generation. An example is the recent emphasis by DHS on the wireless priority program, which in its prime was horribly underutilized and clumsy, as opposed to FirstNet which has priority for public safety embedded in the technology and requires no further action by responders.

With respect to Next Generation 911 (NG911) funding, this funding needs a nationwide refresh to become current with technology. In the same action, diversion of 911 funds should be stopped and the future funding tied to 3 key factors:

1. Require non-proprietary technology to avoid excessive costs for the local 911 center.
2. Future NG911 funds should incentivize but not require PSAP consolidation.
3. Our ability to afford security and technology upgrades will be enhanced if there are

Ideally, both the Senate and the House of Representatives would embrace FCC Chairwoman Rosenworcel’s approach for NG911 refresh as part of the FCC’s spectrum auction authority.

Chairwoman Rosenworcel has steadfastly engaged and supported the public safety community and has a great sense of what will address our communication issues. We applaud her efforts.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. BEN RAY LUJÁN TO
JONATHAN ADELSTEIN

Cellular Wireless and Fiber Wireline

During questioning, in response to my question whether or not wireless can perform and scale at the same level as fiber, you stated that it is already doing so. Furthermore, in response to my question on whether wireless can replace wireline broadband infrastructure, you stated:

“Not only can, it is. One in five Americans are using their smartphone as their only broadband connection.”

Many Americans in rural communities that experience dead-zones and service interruptions on their smartphones may express skepticism that a smartphone can effectively serve as their primary broadband connection. Especially in states like New Mexico, it’s critical that we support solutions that suit challenging geography. We need solutions that keep Americans connected to their work, healthcare, and emergency services without interruption. To restate my question,

Question 1. Is cellular wireless comparative to fiber connectivity for a connection to a household? In the scope of the question, is cellular wireless a complete and competitive substitute to fiber in terms of upload and download speeds, resiliency against outages from weather and disasters, line of site, and other topographic challenges?

Answer. For many consumers, wireless is the only viable primary broadband connection. For some, it is the only connection they have. Fifteen percent of all U.S. adults nationwide now rely solely on their smartphone for Internet connectivity. In rural communities, nearly 20 percent of users rely on smartphones only and more than 25 percent of low-income users are smartphone only.¹ In addition, all three nationwide wireless carriers currently offer mobile home Internet at broadband speeds, with many smaller carriers offering home broadband, as well. The quality and speed of these programs will only increase as 5G is rolled out.

Wireless broadband's high download speeds and mobility are why consumers increasingly view it as a substitute for wireline connections. Wireless networks are responsive and optimized based on consumer use patterns. Wireless networks are engineered to favor downloads to meet their customers' demand. While upload speeds are not as high as for fiber, data shows that consumers use over ten times the downstream bandwidth compared to upstream. The gap between downstream and upstream traffic has consistently grown over the last ten years. Recently, the ratio of downstream consumption to upstream is fourteen to one. Current consumer trends demonstrate significant increases in downstream consumption while upstream increases at a fraction of the rate. Even if upload speed demand doubles, it will remain far below download speed demand.

Network resiliency is also a key focus for wireless providers. This is also a high priority issue for WIA and we appreciate you bringing attention to it. In 2017, during Hurricane Harvey, only 5 percent of wireless facilities in the affected areas of Texas and Louisiana were taken offline by flooding. After Hurricane Katrina, cellular service was fully operational within six months, while over 100,000 telecommunications lines were still offline. After a disaster, wireless providers can minimize network disruptions through traffic management and reestablish service quickly, as restoring one tower can provide service to an entire area. Additionally, wireless providers have made significant investments in deployable assets, allowing for supplemental service while repairs are being made.

Wireless can be easier to maintain, meaning greater connection reliability.¹ Wireless technology is less subject to external disruption than other technologies. If one wireless facility goes offline, traffic can quickly be rerouted throughout the network to minimize disruptions. Furthermore, wireless Internet uses point-to-point connections, which makes identifying technical issues much quicker and simpler.² As noted in your question, there are some physical limitations that must be accounted for when planning a wireless network, such as line of sight. However, fiber must also consider geographic limitations in planning to avoid areas that are difficult to deploy.

Ultimately, it is not an apples-to-apples comparison. Certain technologies will be better suited for certain deployments. I do not claim that one technology is better than another, rather we should let all technologies compete and communities can pick the best technology for their unique requirements.

Question 2. And to follow up, under what conditions should Congress consider wireless broadband as a viable primary broadband connection for a fixed connection to a household?

Answer. Wireless is part of any solution to close the digital divide and end the homework gap. Current consumer usage already suggests that wireless is viable as a primary form of broadband connection for many households. Many customers across the country have decided to prioritize their mobile connections over fixed.³ According to a recent survey by Pew Research Center, among individuals who do not have a home broadband connection, 45 percent say they do not subscribe because their smartphone lets them do everything they need to do online.⁴ In rural America, nearly one in five residents has decided to rely solely on wireless devices for broadband, while over one in four Americans, who make less than thirty thousand dollars a year, have made the switch to smartphone only; the same is true for those that have a high school degree or less.⁵ Thus, millions of Americans already rely on wireless broadband as their primary broadband connection given the reliability and mobility it provides.

Research and Next Generation Resilience

Mr. Adelstein. It's important to highlight the vital role that technological research, especially done in collaboration with our national labs has on improving the resilience and reliability of critical communications infrastructure. The U.S. Department of Energy's Argonne National Laboratory recently partnered with AT&T on a series of projects to enhance the resilience of AT&T's infrastructure to climate change. Similarly, in New Mexico, Sandia National Labs has been a leader in research to modernize the electrical grid through safety, security, and resiliency research.

¹ Riviera Networks, *Line of Sight Internet: What is it, and What are the Benefits*, <https://www.riviera-networks.co.uk/blog/internet/what-is-line-of-sight-internet/>.

² *Id.*

³ Andrew Perrin, *Mobile Technology and Home Broadband 2021*, PEW RESEARCH CTR. (June 3, 2021), <https://www.pewresearch.org/internet/2021/06/03/mobile-technology-and-home-broadband-2021/>.

⁴ *Id.*

⁵ *Id.*

Question 3. Can you elaborate on the importance of investing in new technologies that support network resilience?

Answer. The innovation that occurs at places like Sandia National Laboratories is essential to resolving our most challenging security and resiliency issues. For instance, having resilient electrical grids has become increasingly important during destructive wildfire seasons. As electrical grid operators aim to enhance their networks for greater reliability and resiliency, sensors and analytics enabled by 5G applications are increasingly critical, “allowing for timely diagnosis, prediction, and prescription of all system variables and assets during normal and extreme-event conditions.”⁶

Beyond responding to emerging threats, wireless networks enable efficiencies that can help reduce contributors to climate change. The World Economic Forum documents that the digital technology sector, relying on 5G connectivity, “is probably the world’s most powerful influencer to accelerate action to stabilize global temperatures well below 2°C.”⁷ Indeed, “digital technologies could already help reduce global carbon emissions by up to 15 percent—or one-third of the 50 percent reduction required by 2030.”⁸

All telecommunications technologies, including wireless broadband, have their own vulnerabilities. Resilient networks are sustainable networks. Real “future proofing” requires that the companies that are provided funding to build networks will remain in business to provide service to customers into the future. Resiliency is key because ongoing operating costs must be covered by the revenue stream, or the networks will fall into disrepair and will not remain open consistently, provide adequate customer service or quick outage restoration, or could become inoperable.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. RAPHAEL WARNOCK TO JONATHAN ADELSTEIN

Technical Assistance. I am glad we are having this timely conversation on how to increase network availability and resiliency. As you’ve noted, different communities in Georgia, and across America, face different challenges when it comes to deploying, operating, and securing broadband networks.

Question. In light of these diverse requirements, what steps can Congress take to ensure that Federal agencies involved in our communications networks, including the FCC, USDA, and NTIA, meet the needs of all our communities?

- Do you feel they are providing adequate technical assistance in order to comply with regulations and/or access available programs and funding?
- If not, what are your recommendations for improvement?

Answer. Thank you, Senator Warnock, for highlighting the importance of digital equity. In particular, the bipartisan infrastructure bill that recently passed the Senate makes great strides toward closing the digital divide. The bill wisely creates digital equity programs whose purpose is “to promote the achievement of digital equity, support digital inclusion activities, and build capacity for efforts by States relating to the adoption of broadband by residents of those States.” By allocating \$2.75 billion for Digital Equity Act programs, as well as another \$14.2 billion for broadband assistance to households that are not able to afford a connection, Congress will ensure that NTIA is involved in our communications networks as it considers whether an applicant will increase Internet access and the adoption of broadband among covered populations to be served and the comparative geographic diversity of the application in relation to other eligible applications.

Title III of the infrastructure bill states that for both the State Digital Equity Plans and the Digital Equity Competitive Grant program, NTIA “shall, to the extent practicable, carry out this title in a technologically neutral manner.” This guidance is crucial to promoting network resiliency and ensuring that the programs meet the needs of all our communities. In rural America, nearly one in five residents has decided to rely solely on their wireless devices for broadband, while over one in four

⁶Louis Brasington, *Digital Smart Grid Resilience: Wildfire Mitigation and Reliability*, CLEANTECH GRP. (Oct. 22, 2020), <https://www.cleantech.com/digital-smart-grid-resilience-wildfire-mitigation-and-reliability/>.

⁷Börje Ekholm & Johan Rockström, *Digital technology can cut global emissions by 15 percent. Here’s how*, WORLD ECON. FORUM (Jan. 15, 2019), <https://www.weforum.org/agenda/2019/01/why-digitalization-is-the-key-to-exponential-climate-action>.

⁸Andrew Perrin, *Mobile Technology and Home Broadband 2021*, PEW RESEARCH CTR. (June 3, 2021), <https://www.pewresearch.org/internet/2021/06/03/mobile-technology-and-home-broadband-2021/> (providing a demographic breakdown of smartphone only users).

Americans who make less than thirty thousand dollars a year have made the switch to smartphone only; the same is true for those that have a high school degree or less.⁷

Federal agencies, including the ones mentioned, have an excellent track record of supporting broadband initiatives. As a former FCC Commissioner and Administrator of the Rural Utilities Service (RUS) under the USDA, I know that these agencies are staffed with highly skilled and professional public servants who want to see broadband brought to every American. One thing these agencies need from Congress is flexibility. I quickly learned as Administrator of RUS that you do not get to pick which applications come in the door. We received requests for nearly three times the amount of total funding. However, only one in eight of those applications were deemed financially and technically feasible. However, almost all the projects that made it through the screening ultimately won funding. By allowing expert agencies to use their best judgment, rather than unnecessarily proscriptive gating requirements, they can find the best solutions to address the various challenges we face in deploying broadband across the country, especially to communities that have not had the same opportunities as others.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. RAPHAEL WARNOCK TO
DENNY LAW

Technical Assistance. I am glad we are having this timely conversation on how to increase network availability and resiliency. As you've noted, different communities in Georgia, and across America, face different challenges when it comes to deploying, operating, and securing broadband networks.

Question. In light of these diverse requirements, what steps can Congress take to ensure that Federal agencies involved in our communications networks, including the FCC, USDA, and NTIA, meet the needs of all our communities?

- Do you feel they are providing adequate technical assistance in order to comply with regulations and/or access available programs and funding?
- If not, what are your recommendations for improvement?

Answer. As Congress has appropriated funding related to broadband service, including funds for the deployment of new broadband networks, sustainability of existing networks, or affordability programs for customers to access broadband services, I recommend Congress do more than merely require the respective Federal agencies to "consult" with each other to prevent duplicative or conflicting spending efforts. With increasing amounts of Federal funds being spent to address broadband availability and affordability, it is important these dollars are not wasted with one federally funded program being used to potentially compete or duplicate a different federally funded program. It is also important for federally funded programs to adhere to similar (preferably identical) broadband qualification standards, such as desired speed and capability requirements for new broadband networks constructed using Federal funds, or qualification standards for recipients to receive funds designed for affordability programs.

When allocating funds to the various Federal agencies to administer, Congress should require a report be provided to Congress indicating the specific actions taken by the agencies to ensure that allocated funds did not overlap or conflict with funds or programs from other programs.

Regarding the technical assistance provided by these Federal agencies in order to comply with regulations and/or access to available funding, I believe it will be critical for Federal agencies to closely evaluate state and local governments, who will be tasked with implementing several new Federal programs—including the distribution of funds to sub-grantees—to ensure state and local officials possess the resources to properly implement these new broadband programs and to provide these eligible entities with sufficient guidance and technical assistance.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. BEN RAY LUJÁN TO
HAROLD FELD

Cellular Wireless and Fiber Wireline

Mr. Feld. Many households in rural America are currently either unserved by broadband, or underserved with legacy DSL systems that are not being maintained. As we consider options to connect these communities, some have advocated for wireless as a viable alternative to fiber.

Question 1. Under what conditions should Congress consider wireless broadband as a viable primary broadband connection?

Answer. Modern households need broadband that will suit their needs in terms of speed and reliability both now and into the future. Investing money in networks that don't meet these needs is a waste of taxpayer money, and ensures that Congress will have to continuously invest in order to close the digital divide, instead of investing once and being done for decades. Currently, households need high-speed broadband connections with symmetrical upload and download speeds. Speeds of 100/100 should meet needs household needs for the next few years, but the further out we look to ensure connectivity, the faster speeds will need to be.

At the same time, mobile wireless networks aren't suitable for modern household needs—including working and learning from home. As an initial matter, the quality of mobile service can vary wildly throughout a service area depending on factors such as terrain, foliage, weather conditions, and the distance between the home and the receiving tower. Consumers know from their daily lives that even within the same neighborhood—or even within the same house—signal quality can vary wildly. Mobile network providers do not monitor the quality of the network signal for each individual location, and doing so would be a difficult and expensive process.¹ Additionally, many wireless connections have data caps that force households to ration connectivity. The difficulty in connecting multiple devices through tethering to a mobile phone makes it even more difficult for a household to have multiple users engaged in bandwidth-intensive work (such as distance learning or telework) simultaneously.

Fixed wireless networks, by contrast, can attain stronger and more reliable connections. Because these networks use different technologies than mobile networks, fixed wireless networks can test signal quality to each premises in the same way a wireline connection can. Because they do not need to accommodate mobility, they can route around terrain obstacles. Because they employ a receiving antenna on a fixed point in the premises, the home environment is no more relevant to fixed wireless than to wireline. In geographic areas where terrain makes pulling fiber difficult, fixed wireless networks may well offer a more cost-effective alternative without sacrificing quality. “Technology neutral” should mean that any technology that can meet the standard for a future-proof network that meets our many and growing needs for connectivity can receive funding. It should *not* mean lowering the standards so that inferior technologies that do not meet our needs are eligible.

With this in mind, Congress should only consider wireless broadband as a viable primary broadband connection if that wireless connection offers speeds of at least 100/100, is fixed, and does not have data caps.

Question 2. Even if wireless is not a substitute for wireline connectivity, should Federal funds be used to support expanding access to mobile wireless technologies?

Answer. Yes. Although wireless is not a substitute for wireline connectivity, it is nevertheless a needed connection. Most households expect to have both fixed and mobile connectivity. Mobile enables participation in the Wireless Emergency Alert System (WEAS) and connection with 911. Mobile telephony is so ubiquitous that it is assumed by most employers, school systems and others that individuals have a cell phone. In the event of an emergency evacuation—such as in the case of a wild-fire or a hurricane—a cell phone is the only means by which people can remain in contact with emergency responders and loved ones.

Additionally, two factor identification, which cybersecurity experts recommend as one of the best ways for individuals to protect themselves online, often requires texting a confirmation code to a cell phone. Furthermore, although many online tasks such as completing forms cannot be easily done (or done at all) with a cell phone, many applications are now designed for mobile devices rather than for laptops or desktops.

Every American deserves access to the communications networks necessary to participate fully in our digital society. That means both an affordable broadband connection in the home and an affordable mobile phone service.

Next Generation Networks

Mr. Feld. Right now, legacy carriers are in the process of retiring their copper lines, and wireless providers are shutting down their 3G networks. As you highlight in your testimony, critical decisions are being made right now that will determine

¹Standard testing for a region is to do “drive throughs” with vans and sensing equipment. But this cannot tell even the most diligent network operator how the home environment (*e.g.*, thickness of walls) or weather conditions might alter the strength and reliability of the signal for a specific address.

how the next generation of American communications infrastructure will take shape.

Question 3. What opportunities does this period of transition present to Congress? How can it best use this moment to restore resilience and reliability requirements for critical communications infrastructure in rural America?

Answer. When networks are shut down, we can build new, reliable, future proof networks in their place. Network transitions must be an upgrade for all, not an upgrade for some and a downgrade for others. Because carriers are replacing their older equipment and replacing it with newer equipment, the Federal government can impose new standards of reliability and quality without the added difficulty of trying to retrofit existing networks. The widespread upgrade in the industry introduces economies of scale for equipment that will meet any new reliability or quality of service standards. The total replacement brought about by the phase out of old wireless and legacy wireline technologies essentially creates a new “greenfield” opportunity to deploy more resilient, superior networks. Once these assets are deployed, they will be subject to the usual depreciation cycle. Network operators will seek to minimize capital expenditures and maintain the legacy technology for as long as possible—as we have seen with the legacy copper network.

But this will require Federal regulation of appropriate standards. As we have seen, for-profit companies are poor judges of what is required to maintain reliable networks. Reliability and preparation for emergencies that occur infrequently, does not immediately offer tangible return on investment—whereas reducing capital expenditures is rewarded with higher stock valuations and fatter bottom lines. This creates strong incentives to skimp on reliability and to take unduly optimistic views about the network’s resiliency. This is a classic example of “market failure,” *i.e.*, the unregulated market creates incentives for the wrong behavior. Regulatory action is necessary to remedy the failure of the market incentive in this case. Such action should include direct grants/subsidies to cover the added cost of higher reliability standards. If reliability is a public benefit that is unrewarded in the marketplace, it is only reasonable to subsidize it with public funds. This was traditionally done in telecom through rate regulation, which included reliability costs in the rate base. Today, it should include targeted grants.

Unfortunately, the FCC doesn’t currently guide the shutdown of these networks, leaving ISPs free to replace the network with anything they want, and consumers without a promise of a suitable replacement. One reason for this is the absence of clear authority following the FCC’s reclassification of broadband as a Title I “Information Service” and failure to determine the regulatory status of voice-over-IP (VOIP). Congress designed Title II so that the FCC could impose adequate oversight through standard setting and rulemakings to ensure adequate reliability and quality of service. If Congress were to reclassify broadband as a Title II service—the FCC could regulate these transitions and ensure that any new networks are future proof, reliable, and resilient.

Next Generation Networks

Mr. Feld. As you discuss in your testimony, cybersecurity must be a central point in network resilience. As we have seen from recent national cybersecurity incidents, this is critical. Unless we take this threat seriously, we risk massive vulnerabilities to our critical communications networks.

Question 4. How should the FCC and Congress work to set standards for cybersecurity in our national telecommunications infrastructure?

Answer. The United States is the only developed nation whose telecommunications regulatory does not play a significant role in cybersecurity. This has created a significant FCC-shaped hole in protecting our national communications infrastructure. It is time to take the FCC off the bench when we need a “whole of government” approach.

Communications networks are the circulatory system for data, and therefore the primary vector by which infection can spread from system to system. The FCC and Congress can work together to set and enforce standards for communications networks that achieve the following:

1. Ensure that the communications providers networks are themselves secure. Penetrating the security of a communications network can give bad actors unlimited access the devices connected to the network and the traffic that rides on the network.
2. Detection of cyberattacks and countermeasures, in ways that respect privacy and national security. Communications carriers are ideally positioned to detect when devices across the network are being hijacked for nefarious purposes by detecting significant deviations in traffic output. If devices are infected and in-

jecting harmful traffic into the network, the network operator can take steps to alert the relevant device owners and authorities and, if necessary, temporarily block the sources of harmful traffic. Because of the enormous sensitivity of using carriers as “traffic cops” (e.g., the potential for carriers to abuse this gatekeeper position to accumulate private data for commercial purposes or discriminate against purportedly “suspicious” traffic to advantage their own services and products), carrier activity in this area must be subject to strict oversight by the FCC. Although the FCC already possesses adequate authority pursuant to Title II of the Act, Congress may wish to remove any uncertainty with targeted legislation (and, of course, classification of broadband service as Title II).

3. Wireless vulnerabilities. The FCC can, and should, require wireless licensees to take adequate precautions to guard against unauthorized interception of wireless traffic or hijacking of consumer devices. For example, the FCC recently opened a proceeding to require carriers to take appropriate precautions to prevent “SIM-swapping,” a form of identity-theft/cyberattack where the bad actor persuades the wireless carrier to transfer the customer’s account to a device controlled by the bad actor, is an example of how the FCC can use its authority to improve cybersecurity for consumers.²

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. RAPHAEL WARNOCK TO
HAROLD FELD

Technical Assistance. I am glad we are having this timely conversation on how to increase network availability and resiliency. As you’ve noted, different communities in Georgia, and across America, face different challenges when it comes to deploying, operating, and securing broadband networks.

Question. In light of these diverse requirements, what steps can Congress take to ensure that Federal agencies involved in our communications networks, including the FCC, USDA, and NTIA, meet the needs of all our communities?

- Do you feel they are providing adequate technical assistance in order to comply with regulations and/or access available programs and funding?
- If not, what are your recommendations for improvement?

Answer. Congress should ensure that all of the agencies working on network deployment communicate with each other, set similar standards, and make it easy for entities to coordinate applying for money.

We should recall that Congress created the different grant and subsidy programs to address different aspects of the digital divide challenge, and to take advantage of the different expertise of each agency. These are not competing pots of money where a community must choose between one or the other. Just as we do not require those in need of Federal assistance to choose between subsidized school lunches for their children or subsidized heating oil for their homes, we should not require communities to choose between funding designed to expand rural networks, expand educational access, or address affordability. Certainly, agencies should coordinate to prevent “double dipping” by having the same set of costs covered multiple times. But where a grant program only covers a portion of the cost, or only covers costs associated with a specific portion or function of the network, applicants should be helped and encouraged to apply for multiple grants that will provide the necessary funding for their communities. At the least, Congress should explicitly prohibit these agencies from penalizing applicants who have successfully applied for a different grant, or force applicants to forgo application to programs for which they are qualified.

Moreover, many eligible entities report difficulties with navigating the landscape of grants. It would be helpful if there was a one stop shop for those entities to seek technical assistance, so they don’t have to go to multiple agencies.



²See “In the matter of Protecting Consumers from SIM SWAP and Port-Out Fraud, WC Docket No. 21–341, Notice of Proposed Rulemaking (Sept 30, 2021).