Chapter IV: A 21st Century Broadband Infrastructure for Puerto Rico
A. Introduction

Puerto Rico needs broadband access that is fast, robust, redundant, and ubiquitous to meet the economic challenges of the twenty-first century, ensure continued competitiveness of our business community, help contain the cost of government and social services, and ensure that all Puerto Ricans continue to partake in the social discourse that is increasingly taking place online.

A robust twenty-first century island-wide broadband infrastructure is essential, in both urban and rural areas and across higher and lower income communities. A robust twenty-first century broadband infrastructure will include multiple competing networks offering both fixed and mobile broadband connections to all citizens, business, and government and community anchor institutions. A robust twenty-first century broadband infrastructure will offer fast broadband retail services aimed at all citizens and households (both fixed and mobile), and ultra-fast wholesale and retail services aimed at the business community, public safety and government facilities, and institutions including schools, libraries, hospitals, clinics, and other community anchor institutions.

A robust broadband infrastructure is essential to attract foreign direct capital that will generate the jobs and opportunities needed to sustain Puerto Rico’s competitiveness. Puerto Rico recently enacted the Export Services Law that gives substantial incentives for companies to relocate offices and plants to Puerto Rico. The objective of this legislative initiative is to promote foreign investment, particularly targeting companies that provide services in industries such as aerospace, manufacturing and other high-tech industries, that will leverage the large number of well-trained, bilingual engineers and other professionals graduating from the University of Puerto Rico system. A strong broadband backbone that will allow these investors to deliver better services to clients in and out of Puerto Rico is an essential asset to ensure the success of this initiative.

The networks that support broadband service and connectivity across the island will stand as a barrier to twenty-first century growth and competitiveness if they are inadequate to meet the capacity demanded by Puerto Rico’s consumers and businesses. On the other hand, with a robust broadband infrastructure, there is nothing that prevents the establishment of Puerto Rico as a key target of direct foreign investment and as the central point of broadband and information economy commerce for the Caribbean and the Southern Hemisphere.
There is no reason why, for example, every municipality in Puerto Rico cannot be “as connected” to the Internet as any other city in the Western Hemisphere. Puerto Rico businesses can overcome the distance barrier by interacting with their customers worldwide via broadband-enabled applications such as video conferencing. Students in Puerto Rico’s schools and universities can have the same access to distance learning opportunities as those on the U.S. mainland. Through telemedicine, patients in Puerto Rico can receive better quality of healthcare and access to doctors worldwide.

All of this is possible.

This is the vision that the Puerto Rico Broadband Taskforce has set as a goal for Puerto Rico. To define a strategy to achieve these goals, this chapter establishes a timeline with aspirational metrics. These goals are then contrasted with the measured broadband availability across the island to identify the scope of the digital challenges faced today across Puerto Rico and help establish quantifiable milestones. Finally, it examines different strategies aimed at accelerating investment in broadband built-out across the island, and establishes a series of strategic recommendations to achieve these goals.

**1. Broadband Capacity Goals for Puerto Rico**

Broadband infrastructure in Puerto Rico needs to support access to residential broadband services as well as a myriad of higher capacity applications and uses demanded by Puerto Rico’s businesses, government, and community institutions. The broadband needed by a small business to stay connected with customers and suppliers may necessitate different capacity and quality of service requirements than those needed to meet the usage demands of a hospital in San Juan, or an elementary school in the interior or in Vieques, or public safety needs across the island, or households across Puerto Rico. As a result, this Strategic Plan sets standards and goals for broadband infrastructure that address the capacity needs of multiple applications and uses.

Furthermore, the Puerto Rico Broadband Taskforce understands that these goals will only be achieved as private sector investors identify and pursue economic opportunity and invest in better and more infrastructure and services across the island. For this reason, a key goal of this Strategic Plan is to ensure that competition across the broadband sector thrives.
This framework of complementary broadband networks offering different capacity depending on the type of demand served is built on the foundation laid out by the FCC in the National Broadband Plan, as well as various international telecommunications institutions that are increasingly framing the broadband access challenge in this multi-layered network approach. This principle is consistent with a market driven sector where supply grows to meet demand where it emerges and as it evolves. In its National Broadband Plan, the FCC sets various broadband capacity goals depending on the intended demand and usage. These FCC standards are based on estimates of the actual capacity needs that consumers have today, given the type of institution, usage, and applications typically run through the broadband connection.

In particular, the FCC estimated the broadband capacity needed to support applications typically used by most online users. For example, while basic web-browsing or e-mail applications typically need about 0.1-0.3 Mbps actual speed connection, other applications need greater actual capacity to be viable, such as streamed classroom lectures (1-5 Mbps actual download speeds), video conference + VoIP for lower definition telemedicine (0.6 - 1.0 Mbps) or enhanced video teleconferencing (5-10 Mbps). Taking into account the broadband capacity needed to deliver these applications, the typical usage patterns by online users, and consumer broadband purchasing patterns, the FCC establishes in the National Broadband Plan a National Broadband Availability Target of 4 Mbps download/ 1Mbps upload actual speeds. This target broadband speed would meet the demand needs of the average consumer and can be thought of as a proposed floor – or minimum – network capacity essential to all Americans. The National Broadband Plan notes that such standards will need to be revised as consumer patterns for broadband demand change. The FCC recently created the Connect America Fund, which will subsidize the provision of broadband in areas of the United States where no broadband exists. At the same time (and as discussed below), the FCC recognized the need for higher speeds in certain (yet-to-be defined) areas of the country, and additionally established that all Connect America Fund recipients discuss and incorporate the unique needs of community anchor institutions like government, schools, libraries, and hospitals in their network planning.

The people of Puerto Rico contribute to the historical Universal Service Fund, and, eventually and as it replaces the USF program, to the Connect America Fund, through regulatory fees applied to their telecommunications bills. Many of Puerto Rico’s broadband providers benefit from the existing Universal Service Fund program, and are expected to partake in the newly created Connect America Fund. The standards and goals for broadband connectivity across Puerto Rico established by the Puerto Rico Broadband Taskforce take this reform into account to ensure consistency.
By 2015, 98% of all households should have broadband available at actual minimum speeds of 4 Mbps download /1 Mbps upload.

While the FCC National Broadband Availability Target establishes a de facto minimum capacity goal over the coming years, the FCC set in the National Broadband Plan higher aspirational goals for broadband capacity to most citizens. These goals recognize that across many metropolitan and suburban areas across the U.S. where the competition is thriving and investment is readily flowing, this minimum capacity standard has already been met and greatly surpassed. As a result, the National Broadband Plan established aspirational capacity goals of at least 100 million U.S. homes with affordable access to actual download speeds of at least 100 Mbps and actual upload speeds of at least 50 Mbps by 2020. It also establishes a milestone that by 2015, 100 million homes should have affordable broadband access to actual download speeds of 50 Mbps and actual upload speeds of 20 Mbps.\(^4\) Further, the National Broadband Plan called for the U.S. to lead the world in mobile innovation with the fastest and most extensive wireless network of any nation, and establishes recommendations to reach this goal and accelerate deployment of 3G mobile networks where it is lacking and the deployment of new 4G technology across the country. The National Broadband Plan further sets a goal of 1 Gbps connectivity for community anchor institutions such as schools, hospitals, and government institutions.\(^5\)

Taking into account these rich precedents as well as the current state of broadband networks across Puerto Rico, the Puerto Rico Broadband Taskforce establishes the following goals over the coming decade for a robust broadband infrastructure across Puerto Rico:

### Strategic Goals for Puerto Rico - Access

All urban areas across Puerto Rico should have available ubiquitous broadband infrastructure able to provide service at speeds, and quality of service comparable to that available in any city in the Western Hemisphere. All citizens across Puerto Rico, in both urban and rural areas, should have available ubiquitous broadband service meeting a minimum speed standard. Similarly, mobile broadband technology should continue expanding and ensure rapid expansion of next generation services across the island. Such service should be accessible to all residential, commercial and, or government customers.

**Fixed Broadband Capacity Goals:**
- By 2015, 98% of all households should have broadband available at actual minimum speeds of 4 Mbps download (DL)/1 Mbps upload (UL) at affordable prices to allow for at-home web 2.0 service offerings such one-way video streaming applications and two way video conference and collaboration applications.
- By 2015, all urban locations and 50% of all rural and remote areas should have access to broadband actual speeds of at least 10 Mbps DL/3 Mbps UL at affordable prices; 70% of urban locations should have access to at least 25 Mbps DL/10 Mbps UL, and 50% of urban locations should have access to at least 50 Mbps DL/10 Mbps UL.
• By 2015, across the island the average capacity available across all fixed broadband service offerings, provided through wireline or fixed-wireless networks, should be no less than 6 Mbps download speeds.
• By 2020, at least 85% of all customers should have access to at least 100 Mbps DL/50 Mbps UL.
• By 2015, average latency for IP traffic which originates and terminates in Puerto Rico should be no greater than 20 milliseconds; average latency for IP traffic which originates in Puerto Rico and terminates in the southeast coast of the U.S. mainland should be no greater than 90 milliseconds.

Mobile Broadband Capacity Goals:
• Mobile broadband offerings at next generation speeds will be available across at least 98% of the island’s geography where the population resides by 2015. Expansion of smart phone penetration and tablet end-user devices will be promoted.

Connectivity Across Community Anchor Institutions:
• By 2015, higher education, K-12 schools, and healthcare institutions across all urban and rural areas should have access to 100 Mbps DL/25 Mbps UL speeds to sustain virtual community learning and telemedicine.
• By 2020, higher education, K-12 schools, and healthcare institutions across all urban and rural areas should have access to 1 Gbps speeds to sustain virtual community learning and telemedicine.

Broadband Submarine and Backhaul Network Security:
• Puerto Rico broadband providers and local and national government officials will work together to derive a plan to improve the security, robustness, and redundancy of the backhaul broadband infrastructure across the island. Particular emphasis will focus on the security standards of alternative submarine cables, and strategies to encourage the underground construction of backhaul infrastructure across the island.
• A more robust backhaul and underwater cable infrastructure will support the expansion of Puerto Rico as a telecommunications and data hub for the Hemisphere.

Competition across the Broadband Service Market:
• By 2015, 98% of Puerto Ricans will have at least three competitive broadband offerings available.

Achievement of these goals will enable continued improvement of Puerto Rico within international rankings of ICT services by entities such as the World Bank and the World Economic Forum. In 2012 Puerto Rico made a significant gain, now 2nd in the region, elevating from a 43rd to 36th ranking on The Global Information Technology Report 2012, Network Readiness Index (NRI). Such rankings matter a great deal to companies assessing where to locate new expansions or initiatives. Hence, these advancements are important to improve Puerto Rico’s competitiveness and promote relocation of companies to Puerto Rico.
Across Puerto Rico, 14% of households, or approximately 177,000, lack any form of fixed broadband.

B. The Broadband Infrastructure Challenge in Puerto Rico

As the previous chapter describes in detail, thanks to the federally funded State Broadband Initiative program, there is timely data available to assess Puerto Rico’s progress toward these goals. However, more information will need to be collected and analyzed over the next ten years to continue to mark progress on meeting all of these goals. This segment summarizes the information available today to assess the access challenge, and identifies gaps in necessary data to track progress and assess the completion of strategic milestones.

1. Access Challenge - Fixed and Mobile Infrastructure

The previous chapter summarized the data available today regarding the state of the broadband landscape in Puerto Rico. Based on the broadband inventory data collected from service providers across Puerto Rico by Connect Puerto Rico, it is evident that Puerto Rico’s broadband infrastructure is markedly inadequate to meet the increasing needs for capacity of consumers, businesses, and institutions, and significantly lagging behind most jurisdictions across the U.S., and other regions. Table IV.1 restates the data presented in Chapter III summarizing broadband availability by speed tier as of June 2011.

<p>| Table IV.1 - Broadband Availability by Fixed Networks Across Puerto Rico - by Speed Tier |</p>
<table>
<thead>
<tr>
<th>Download/Upload Speed Tiers</th>
<th>Percent Households Served</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least 768 Kbps/200 Kbps</td>
<td>86%</td>
</tr>
<tr>
<td>At least 1.5 Mbps/200 Kbps</td>
<td>85%</td>
</tr>
<tr>
<td>At least 3 Mbps/768 Kbps</td>
<td>57%</td>
</tr>
<tr>
<td>At least 6 Mbps/768 Kbps</td>
<td>41%</td>
</tr>
<tr>
<td>At least 6 Mbps/1.5 Mbps</td>
<td>34%</td>
</tr>
<tr>
<td>At least 10 Mbps/768 Kbps</td>
<td>32%</td>
</tr>
<tr>
<td>At least 25 Mbps/768 Kbps</td>
<td>0.00%</td>
</tr>
<tr>
<td>At least 50 Mbps/768 Kbps</td>
<td>0.00%</td>
</tr>
<tr>
<td>At least 100 Mbps/768 Kbps</td>
<td>0.00%</td>
</tr>
<tr>
<td>At least 1 Gbps/768 Kbps</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

Source: Connect Puerto Rico, June 2011

This infrastructure is markedly insufficient to sustain the growing demand of businesses, citizens, schools, hospitals, or government for broadband connectivity and speed and falls far short of most basic capacity goals set in this Strategic Plan for 2015. Based on Connect Puerto Rico data, as of June 2011, between 34% and 57% of households across Puerto Rico did not have access available at the minimum target speeds capacity of 4 Mbps download (DL)/1 Mbps upload (UL). A core goal of this Strategic Plan is to close this significant access gap by ensuring broadband access at this capacity or higher to 98% of Puerto Rico households by 2015.
By contrast, data obtained from Puerto Rico’s mobile providers indicates that mobile broadband access across much of the island already meets the strategic goals set in this Plan, and surpasses estimates across the U.S. and the goals set by federal policy makers. As of June 2011, 99% of areas where households are located had broadband access available from at least one mobile broadband provider. By contrast, the National Broadband Map estimates that approximately 97% of U.S. households have access to at least one mobile broadband network.

2. Competition

As of June 2011, there were multiple competing broadband providers throughout Puerto Rico including 8 fixed broadband providers serving residential customers, 3 cable modem providers, 1 DSL island-wide provider, and at least 5 fixed wireless providers. Furthermore, there were 5 mobile broadband providers serving the great majority of the populated areas across Puerto Rico. Supporting the retail networks of all of these providers and, in certain areas offering retail service to customers, there are 11 broadband backhaul or middle-mile providers in Puerto Rico.

While these data indicate a degree of competition in broadband service across Puerto Rico, the data is insufficient to ascertain actual competition across the island. The level of competition across the island will depend on the degree of overlap and redundancy of alternative networks and the market strategies of broadband providers across different segments of the broadband market. To assess competition, it will be necessary to determine what competing alternatives are available to most Puerto Rican households, citizens, businesses, and institutions. Table IV.2 estimates the degree of penetration of various retail technology platforms across Puerto Rico. These data indicate that, relative to comparable mainland U.S. data available, platform penetration in Puerto Rico is lagging. As such, inter-platform and inter-carrier competition across Puerto Rico is likely lagging behind comparable areas in the rest of the U.S. Further research will be necessary to ascertain the level of competitive options availability to most Puerto Rico broadband consumers.

<table>
<thead>
<tr>
<th>Table IV.2 - Availability by Broadband Platform - Puerto Rico &amp; U.S. Comparisons At least 768 Kbps Download/200 Kbps Upload</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Platform Type</strong></td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>Cable</td>
</tr>
<tr>
<td>DSL</td>
</tr>
<tr>
<td>Fixed Wireless</td>
</tr>
<tr>
<td>Mobile</td>
</tr>
</tbody>
</table>

Source: For Puerto Rico estimates, Connect Puerto Rico, June 2011. For U.S. estimates, National Broadband Map, NTIA, December 2010 (which is the latest data available at the national level).
C. Strategies to Promote Investment in Broadband Capacity Across Puerto Rico

The broadband availability gap across Puerto Rico is an essential competitive challenge that necessitates a coordinated effort involving both public and private stakeholders. Achieving the infrastructure and speed goals set out in this Strategic Plan will require a significant increase in capital investments over the coming decade. This section first examines the impact across Puerto Rico of the FCC’s Universal Service Fund reform underway. It then addresses proposed strategies to enhance the economics of broadband and promote investment in broadband capacity across Puerto Rico.

1. FCC Universal Service Fund Reform - Impact Across Puerto Rico

In October 2011, the Federal Communications Commission adopted a sweeping reform of the federal Universal Service Fund’s (USF) High-Cost program that transitions it to a broadband-oriented structure. The reform establishes a transition of the High-Cost program, historically aiming to support voice-telephony service in rural and remote areas where market forces – left to their own devices – will not provide service, to a Connect America Fund that will aim to subsidize broadband infrastructure. This reform will impact Puerto Rico’s broadband sector in a number of ways. Private and public stakeholder members of the Puerto Rico Broadband Taskforce have monitored this reform as it unfolded, and sought to work collaboratively with the FCC to ensure a fair and effective allocation of subsidies to unserved areas in Puerto Rico under the new Connect America Fund.
The USF program is managed by the FCC and historically aimed to subsidize traditional voice telephony network build-out and services (a) across rural and remote areas; (b) across education, libraries or healthcare institutions; and (c) among low-income households. The fund is financed through a regulatory fee imposed by the FCC on all telecommunications providers and is passed on to consumers through a regulatory fee on their telecommunications services bill of approximately 15% in 2010. The size of the USF program in 2010 amounted to approximately $8.4 billion. The historical USF program is comprised of four components, including:

- **High Cost Program**: This support ensures that consumers in all regions of the nation have access to and pay rates for telecommunications services that are reasonably comparable to those in urban areas. The size of the program in 2010 was approximately $4.5 billion disbursed across an estimated 1,800 eligible telecommunications carriers.

- **Low Income Program**: This support, commonly known as Lifeline and Link Up, provides discounts that make basic, local telephone service affordable for more than 7 million low-income consumers. In 2010, approximately $1.2 billion was disbursed through this program.

- **Rural Health Care Program**: This support provides reduced rates to rural healthcare providers for telecommunications and Internet services so they pay no more than their urban counterparts for the same or similar telecommunications services. In 2010, approximately $240 million was disbursed through this program.

- **Schools & Libraries or E-Rate Program**: This support, commonly referred to as E-rate support, provides affordable telecommunications and Internet access services to connect schools and libraries to the Internet. This support goes to service providers that provide discounts on eligible services to eligible schools, school districts, libraries, and consortia of these entities. In 2010, approximately $2.7 billion was disbursed to schools and libraries through this program (Table IV.3).

<table>
<thead>
<tr>
<th>USF Program</th>
<th>Total USF Subsidies (Billion)</th>
<th>Puerto Rico USF Subsidies (Million)</th>
<th>Puerto Rico Subsidies as Percentage of USF Disbursements</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Cost Program</td>
<td>$4.5</td>
<td>$208.6</td>
<td>4.89%</td>
</tr>
<tr>
<td>Low Income</td>
<td>$1.2</td>
<td>$39.9</td>
<td>3.03%</td>
</tr>
<tr>
<td>Rural Health Care</td>
<td>$0.24</td>
<td>$0.0</td>
<td>0.00%</td>
</tr>
<tr>
<td>E-Rate</td>
<td>$2.7</td>
<td>$23.2</td>
<td>1.02%</td>
</tr>
<tr>
<td>Total USF Disbursement</td>
<td>$7.95</td>
<td>$271.8</td>
<td>3.42%</td>
</tr>
</tbody>
</table>

Table IV.4 summarizes the amounts disbursed under the High-Cost program across Puerto Rico fixed and mobile carriers.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Study Area Name</th>
<th>2010 Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T Inc.</td>
<td>Centennial Puerto Rico Operations Corp.</td>
<td>$27,058,494</td>
</tr>
<tr>
<td>AT&amp;T Inc.</td>
<td>Cingular Wireless</td>
<td>$37,380,228</td>
</tr>
<tr>
<td>América Movil</td>
<td>P R T C - Central</td>
<td>$6,996,693</td>
</tr>
<tr>
<td>América Movil</td>
<td>Puerto Rico Tel Co</td>
<td>$38,918,358</td>
</tr>
<tr>
<td>América Movil</td>
<td>Puerto Rico Telephone Company D/B/A Verizon Wireless Puerto</td>
<td>$46,091,439</td>
</tr>
<tr>
<td>Deutsche Telekom AG</td>
<td>Suncom Wireless Puerto Rico Operating Co.</td>
<td>$26,658,105</td>
</tr>
<tr>
<td>PR Wireless LLC</td>
<td>PR Wireless Inc.</td>
<td>$17,010,954</td>
</tr>
<tr>
<td>Spring Nextel Corporation</td>
<td>Spring Spectrum, LP</td>
<td>$7,935,228</td>
</tr>
<tr>
<td>Worldnet Telecommunications</td>
<td>Worldnet Telecommunications</td>
<td>$576,753</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>$208,626,252</strong></td>
</tr>
</tbody>
</table>


The New Connect America Fund

The FCC is currently undertaking a step-by-step reform of all the USF’s components, starting with the High-Cost program. The core objective of the ongoing reform is to transition the $4.5 billion fund from a support system for voice-telephony networks – a twentieth century technology – to a system that would subsidize broadband access across the U.S. through the creation of the Connect America Fund. This reform is more than a decade in the making and represents a significant development across the broadband industry. The details of the transition of the $4.5 billion annual fund towards both fixed and mobile broadband network construction will have a profound impact upon the quality and nature of broadband services available to millions across the U.S. There will be winners and losers as a result of this reform, with some providers and states experiencing a decrease in total USF disbursements relative to historical levels, with others experiencing a net growth in funding from the Connect America Fund. In the case of Puerto Rico, as discussed below, it is unclear at this point what the final impact will be.
The FCC’s USF reform order is complex and involves extensive discussion of a number of important issues, including the use of the State Broadband Initiative broadband availability data to direct funding to “unserved” areas. The transition to the Connect America Fund will take place in two phases starting in 2012 and should be completed by 2017. Through this process funds disbursed under the rules of the historical High-Cost program will be phased out from 2012 through 2015. The purpose of this staged approach is to avoid sudden disruption of businesses and existing services. In particular, the FCC’s USF reform plan will:

• Cap the high-cost support program at $4.5 billion per year;
• From 2012-2017, progressively shift that $4.5 billion from existing voice-service subsidies to a program that will support the provision of multi-use broadband and voice networks offering at least 4 Mbps download/1 Mbps upload (actual) fixed broadband service in “unserved” areas;
• Create a Mobility Fund to subsidize mobile broadband that will support the expansion of 3G/4G mobile service in areas currently without such access;
• Immediately implement a one-time injection of $600 million as early as July 2012 to subsidize fixed and mobile broadband service in areas that have no access available.

The reform underway calls for disparate transition rules and timelines for different categories of service provider, depending on whether they are mobile or fixed carriers, the size of the firm and its regulatory classification. Across Puerto Rico this implies that the impact of these reforms will be different for mobile and fixed providers, for Incumbent Telecommunications Carrier (ILEC) (the Puerto Rico Telephone Company), the three cable operators on the island, and new entrants into the market in the last decade.

To supplement the Connect America Fund, dedicated funding for tribal and remote areas is included in the order. This funding is designed to overcome the distinct, legacy challenges to telecommunications development in those areas and represents an effort by the FCC to ensure that the Order’s reforms do not impact tribal or remote areas any more adversely than absolutely necessary.
As a result of this transition, millions of dollars in Connect America Funds will be directed based upon how states, communities, carriers, and policymakers use and understand the State Broadband Initiative (the federal broadband mapping initiative) data in Puerto Rico collected by Connect Puerto Rico in collaboration with broadband providers across the island. The FCC will use current State Broadband Initiative mapping information to create a list of census blocks unserved by fixed broadband infrastructure. These census blocks will be eligible for disbursement of a component of the Connect America Fund - Phase I funds, which amount to $300 million. In parallel, the FCC has already defined eligible areas across the U.S. for the Mobility Fund – Phase I program, which will disburse a maximum of $300 million to subsidize mobile infrastructure build-out across unserved areas. In February of 2012, the FCC released a database identifying eligible areas across the U.S. for the Mobility Fund – Phase I program and established a "challenge" process to this database open to any stakeholder who believes the FCC database is inaccurate. To help assess the accuracy of the eligible areas database, Connect Puerto Rico has conducted an analysis of these eligible areas in Puerto Rico which is available at [http://www.connectpr.org/es/node/1492](http://www.connectpr.org/es/node/1492). This analysis reveals that there are very few geographic areas across Puerto Rico that are eligible for funding under the rules set for the Mobility Fund – Phase I.

**Impact Across Puerto Rico - Strategic Recommendations**

Possibly nowhere more than in Puerto Rico will this reform have a greater potential impact. Like in any reform of this magnitude there will be winners and losers. Individual providers and states or territories may experience a net decrease or increase in revenues disbursed under the Connect America Fund. The impact across individual providers and states or territories will depend on a myriad of program implementation details that the FCC has yet to determine. It is too soon to predict the full impact of this vast reform across Puerto Rico. This will ultimately depend on details determined by the FCC via rule making regarding the process to determine subsidy distributions.
The ultimate goal of this FCC reform is to prioritize funds to areas without broadband service, and where market forces are unlikely to drive investment for lack of a viable business case. As is detailed in Chapter III, Puerto Rico broadband access is significantly lagging behind most jurisdictions across the U.S. Across most U.S. states, upwards of 95% of households have broadband available. By contrast, as of June of 2011, approximately 86% of households across Puerto Rico have broadband available. Due to this significant lag in broadband availability across the island it is expected that – if the FCC succeeds in its stated goals – overall Puerto Rico will be a net winner from this reform. In other words, given Puerto Rico’s documented lag in broadband infrastructure and capacity, logic dictates that the amount of funds disbursed across Puerto Rico under the new Connect America Fund should be greater than under the historical High-Cost fund. However, much depends on the details of how this transition will be implemented, which the FCC is working to develop throughout 2012 and the ensuing years. It is imperative that Puerto Rico public and private stakeholders monitor and contribute to the public debate underway at the FCC as these important programmatic details are determined.

In particular, the FCC is in the process of developing complex cost models to estimate the cost of infrastructure build-out where broadband is unavailable, assess expected revenues in those areas from any commercial operation, and estimate the size of the gap to achieve sustainability of these business operations. Based on these generic costs models - the theory goes - the FCC will determine the necessary subsidies needed to attract investment in those areas. Simply put, these cost models strive to determine how much subsidy would be necessary to make a commercial operation whole and, thus, attract private investment now willing to enter those unserved markets. Such cost models are currently being developed at the FCC and will be applied to any area across the U.S. that remains unserved.

On April 25 2012, the FCC released estimates of maximum eligible subsidies for large price cap telecommunications carriers under the planned Connect America Fund – Phase I. Under this Connect America Fund – Phase I up to $300 million will be disbursed across price cap carriers providing a one-time capital injection to subsidize network build-out in unserved areas served by these carriers. In Puerto Rico the only eligible carrier for this Connect America Fund – Phase I is the incumbent carrier Puerto Rico Telephone Company (PRTC). FCC estimates for eligible subsidies by company are based on a cost allocation model designed to simulate the economics of network investment in unserved areas along the contiguous U.S. states. PRTC did not qualify to receive any subsidies under Phase I of the Connect America Fund. One possible explanation for this result is that the logic the FCC used to allocate that $300 million in funding was based on national estimates of the cost of building broadband networks. These estimates did not take into account the unique conditions in Puerto Rico that limit network investment. In particular, the low adoption rate across the island and the costs of broadband backhaul simply were not accounted
Three key factors behind investment lag: lagging demand, high capital investment costs, and high operations costs.

for by the FCC’s model, which focused nearly exclusively upon population and business density.

For Puerto Rico, it is imperative that such models take into account critical factors defining the Puerto Rico broadband landscape; in particular, and as described in Chapter III, a drastic lag in broadband demand, resulting in significantly lower expected revenues from any commercial operation. In order to develop a fair assessment of subsidies needed to sustain business operations across unserved areas in Puerto Rico, it is important that the FCC’s models do not assume economic factors prevalent across other U.S. jurisdictions, and instead reflect the economic reality of Puerto Rico. Such details will be crucial to achieve fairness for Puerto Rico citizens and businesses that remain unserved, and help overcome the access challenge still facing Puerto Rico. The Puerto Rico Broadband Taskforce will work collaboratively with the FCC to achieve this goal.

Much depends on the reliability of the broadband inventory data that will be used to determine eligible areas for subsidies under the new Connect America Fund. The FCC has determined that a key input into those decisions will be the National Broadband Map database, which in Puerto Rico is managed under the State Broadband Initiative grant program by the Office of the Chief Information Officer and collected by Connect Puerto Rico. It is imperative that these mapping efforts continue and that all broadband providers voluntarily collaborate with Connect Puerto Rico to ensure that the data source used by the FCC to determine the Connect America Fund transition is comprehensive and accurate.

Taking these important considerations into account, the Puerto Rico Broadband Taskforce recommends the following strategies to ensure Puerto Rico citizens fully leverage the opportunities under the new Connect America Fund.
While ensuring that the Puerto Rico broadband sector fully leverages the new opportunities under the FCC’s Connect America Fund is important and will be instrumental in helping close the access gap across Puerto Rico, it is not the panacea to Puerto Rico’s broadband challenge. Ensuring the sustainability and growth of this sector demands coordinated island-wide strategies involving the private and public sectors, including broadband providers and multiple other stakeholders who depend on the technology for their viability. The rest of this chapter examines key challenges affecting the access gap and proposes a series of strategies to ensure sustainability of this critical twenty-first century technology.
With expected demand and revenue flows less than half the U.S. average, the business case for deployment is weakened.

2. Promote Universal Adoption of Broadband Services

Greater adoption of broadband services across the whole population is a key and primary goal to make the broadband sector in Puerto Rico vibrant and sustainable. In a free market, such as the broadband market in Puerto Rico, demand is the key driver of capital investments. As more consumers are willing to pay for services, investment will follow. Yet, with home adoption rates in Puerto Rico less than one-half of the U.S. average – 31% home broadband adoption in Puerto Rico in 2010, contrasting with a U.S. national estimate of 68% home broadband adoption — this lagging demand is a hindrance to continued capital investment.\(^{14}\)

The challenges of the digital gap that exists today in Puerto Rico are documented in Chapter V of this Strategic Plan, focusing on the adoption gap. **This adoption challenge cannot be met solely by the broadband provider community. Private and public partnerships must work together to address this challenge.** Barriers to adoption primarily include relevance of the service and technology for many disconnected Puerto Ricans, and affordability of both devices to connect to the Internet and the broadband services.

While universal adoption is a key driver of investment, strategies to address the adoption gap are explored in a separate chapter and will not be further discussed here. However, it is essential that efforts to stimulate broadband adoption be understood as essential to achieve investment sustainability in the sector. The following chapter examines in detail factors affecting digital inclusion across Puerto Rico and proposes strategies to overcome the digital divide across vulnerable demographics. Chapters V, VI, and VII of this Strategic Plan examine the broadband adoption and usage challenge across Puerto Rico in depth.

**Recommendation:**

To encourage sustainable investment in network build-out, Puerto Rico must aggressively implement strategies to promote broadband adoption across vulnerable populations, whether residing in rural or urban areas.
3. Streamline the Regulatory Process to Promote Fair Competition and Market Entry

Competition in the market is a key trigger for continued investment in broadband upgrades, and improved quality of service and pricing across broadband providers striving to obtain and retain broadband subscribers. As such, it is imperative that the regulatory process effectively monitors anti-competitive behavior in the market, and aggressively strives to remove any entry barriers into the market that may delay or eliminate competition. Where competition is found to be lacking, or anti-competitive behavior is deemed to take place, appropriate action by the Junta or through legislation should be implemented.

Government should facilitate the provision of broadband at higher speeds in rural and urban areas enhancing competitiveness and provision of broadband in unserved and underserved communities. In order to foster economic development, social betterment, promote sustainable competition, and encourage private investment in broadband networks, it is important that the executive branch and the legislative branch understand ways in which government assets, processes, corporations, and other entities can block or promote these goals. In particular, it is important that government assets support the expansion of the broadband market in a competitively neutral way that will promote, and not distort, the competitive process. Government owned assets should facilitate a fair, competitively neutral environment for the telecommunications and broadband market, void of unfair competition from any private or public entity.

Government assets that have a profound impact in the broadband market and can either effectively contribute to broadband expansion, or block its development include Ultracom’s underwater cable facilities that provide essential backhaul for data transport; PREPA’s network of civil infrastructure including pole attachments that are essential for continued expansion of broadband infrastructure and competition; PREPA.Net’s retail and wholesale broadband offers to providers, institutions and end-users; Puerto Rico’s roads and transportation infrastructure, providing essential paths for broadband expansion; etc.

In order to promote a vibrant competitive broadband market that attracts the influx of capital necessary to continue expanding our broadband infrastructure, careful assessment of how these assets are contributing or deterring to broadband expansion is necessary.
4. Lower Cost Barriers to Improve the Business Case for Broadband Deployment

Puerto Rico is an island territory, which results in inherently higher costs of deployment and operations of broadband services than across most other jurisdictions in the U.S. The need to connect the island to the Internet backbone via undersea fiber optic cables increases the cost of service. In addition, Puerto Rico’s high construction costs, and mountainous tropical topography with high elevations, steep hills, valleys, and thick vegetation result in very high costs for the deployment of last mile infrastructure. These supply-side challenges are aggravated by a lagging demand across the island, which negatively impacts the business case for deployment and broadband growth. Puerto Rico’s current economic situation, and the unwillingness and inability of its citizens to pay for the cost of service are at the heart of the digital divide in Puerto Rico. These combined realities are the heart of the deployment lag, documented for the first time through the Connect Puerto Rico mapping data, that persists across many areas of Puerto Rico.\(^{15}\)

Moreover, the cost of doing business in Puerto Rico is a major deterrent to attracting network operators to the island. Primary concerns include:

- Puerto Rico’s labor laws are the most regulated in the nation, and present a serious challenge toward job creation and economic growth.
- Puerto Rico’s electricity costs are surging to the point that the Governor has declared an Energy Emergency. The electricity which is provided by the Puerto Rico Electric Power Authority (PREPA) is unreliable and unstable, and results in significant additional costs to broadband providers who must install and maintain costly and insufficient alternative power generation and backup systems (generators/batteries) to ensure ongoing operation of their services in spite of regular power interruptions.

**Recommendation:**
Streamline regulatory process to promote network investment and increase competition in the broadband sector.

**Recommendation:**
The legislative and executive branches, as well as the Junta Regulamentadora de las Telecomunicaciones, should work to ensure that government assets critical to the broadband market are effectively contributing to the expansion of the market in a fair and competitively neutral way. The Government and regulatory agency should be vigilant of anti-competitive activity blocking market expansion and increased capital investment in broadband capacity across Puerto Rico.
Puerto Rico’s labor pool is shrinking, as a result of increased migration from the island to the mainland. This “brain drain” has resulted in the loss of knowledgeable telecommunications and Internet networking staff.

There are, however, meaningful ways to promote investment by eliminating regulatory, institutional, and other hurdles that impact negatively the business case for deployment. Significant steps can and must be taken across Puerto Rico to improve the business case for broadband deployment and encourage private investment across low-income communities and nonurban areas of the island. This section discusses the challenges to broadband infrastructure investment in Puerto Rico and recommends strategies to address them.

**Planning and Coordination**

Access to right-of-way inventory at a state and municipal level is essential for effective and expedited outside plant fiber optic network design, deployment and operation, and will spur investment in telecommunication networks. In Puerto Rico, this doesn’t exist. This lack of infrastructure planning, coordination, and rights of way and conduit inventory at the state and municipal levels negatively impacts the business case for broadband deployment by resulting in:

- Increased costs for network planning and design, due to ill-defined rights of ways and lack of transparent information regarding local conduits and poles;
- Delays in the permitting processes (which is expanded on below);
- Lack of coordination of infrastructure deployment in urban, densely-populated areas of the island, resulting in spaghetti-like overhead cable infrastructure;
- Lack of identification & coordination of rights of ways, resulting in damages to existing network infrastructure.

The Government of Puerto Rico is already working to improve this process by working with local government officials to improve the planning processes for construction projects. Such efforts should be redoubled as they will impact positively the business case for broadband deployment, as well as other civil engineering and construction projects.

**Recommendation:**

Promote island-wide and municipal planning and coordination of construction projects.
High capital investment costs, including permit processing, pole attachment costs, and lack of effective planning and coordination with public authorities, negatively impacts the case for deployment.

Construction Permitting Processes

According to the World Bank’s “Doing Business 2012” comparative data regarding the ease of acquisition of construction permits, Puerto Rico is ranked 152 of 183 economies assessed on the ease of dealing with construction permits (up from 166th in 2011). This significant improvement is the result of a concerted effort by the Government of Puerto Rico, working in partnership with the private sector, to streamline the construction permitting process at all levels of government. Despite these significant improvements, permitting and Rights of Way (RoW) processing remains a significant burden for construction of any kind across Puerto Rico. According to the World Bank, dealing with construction permits in Puerto Rico entails an average of 189 days, at a cost of 369.1% of average income per capita. By contrast, across OECD countries, construction permits entail an average of 152 days at a cost of 45.7% of the average income per capita. Across Latin America and the Caribbean construction permits entail an average of 221 days at a cost of 160.3% of the average income per capita.

These permitting delays and the relative high costs of permitting processing directly impact the business case for broadband deployment in Puerto Rico by resulting in higher construction costs, greater cost of capital, and delayed revenue sources. The current administration has recognized this challenge and changes have been implemented to streamline the processes. However, for Puerto Rico to compete in the global economy, additional measures must be implemented to speed permitting and RoW approval and lower its costs.

This goal affects not only the broadband sector, but also all aspects of the Puerto Rico society. As a result, we recommend the formation of a public-private taskforce charged with reviewing this challenge and proposing specific tactics to improve this process. The taskforce would be ideally comprised of representatives from multiple industries including the broadband sector and other network industries, transportation and other construction and general manufacturing, as well as representatives from both local and island-wide government directly involved in permitting processes. The taskforce will address, among other, the following objectives:

1. Overall assessment of the layers of bureaucracy entailed in the permitting process with the goal to eliminate redundancies and streamline the process;
2. Encourage consolidation of processes island-wide so that permitting can be accelerated;
3. Institute a fast-track permitting route across all municipalities so permit applicants faced with a rejection can resubmit applications without having to necessarily start the process over;
4. Establish maximum timeline goals for permitting, pole attachment, and RoW approval that can be measured and tracked across various local and island-wide government jurisdictions.

For example, in order to encourage and support efforts to build out networks, permitting processes should be accelerated, with a target of response within 30 days.
Dig-Once Policies

Dig-Once policies would require any new roads, mass-transit projects, sidewalks, housing developments, and other construction projects partially or fully funded by the government of Puerto Rico, to include plans to incorporate conduits that can house fiber-optic cable that will sustain future data services (high-speed broadband/IPTV/Voice Over IP, etc.). The legislation must be competitively neutral and ensure that all broadband providers, regardless of technology used or regulatory status, have equal access to these conduits. Similar proposals have been made by the FCC’s National Broadband Plan\(^\text{18}\) as well as by members of the U.S. Congress including Rep. Anna Eshoo (California) who introduced similar federal legislation, and stated: “The legislation is a creative approach to more rapidly deploy broadband service, promote competition and do so with limited dollars. The ‘dig once’ policy would expand broadband at a fraction of the cost by including the conduit as roads are being built.”\(^\text{19}\) Puerto Rico Law 101 of 2005 is a step in the right direction regarding the needs to coordinate underground infrastructure deployment. Resolution of the Senate 1639 (R. de la C. 1639), approved in the Senate in December 2011 to study the viability and convenience of including subterrain conduit systems in all public contracts for highway and road construction, is also an important step in the right direction.\(^\text{20}\)

Recommendation:
Institute legislation that will encourage “Dig Once” policy for all future transportation and civil engineering construction projects.
Colocation in Public Buildings

Across regions of Puerto Rico that remain unserved, there is a need for access to colocation space in public buildings. Such colocation space would enable competing broadband providers to securely house the network access equipment necessary to provide service to public institutions, including government offices, public schools and hospitals, public housing buildings, public safety locations, etc.

Because government remains a key source of demand in the overall Puerto Rico broadband market, the expansion of such colocation space across public buildings will help spur competition. The proposed legislation would ensure that all colocation facilities in public buildings would be made available to all providers on equal terms and conditions, regardless of historic distinctions between telecommunication providers.

Recommendation:
Institute legislation that ensures competitively neutral access to colocation infrastructure in public buildings.

State & Municipal Tax Policies Pro-Investment

As a result of Puerto Rico’s current economic downturn, public sector leaders are seeking new revenue sources to address budget shortfalls. This search for new local government revenue sources has led various municipal governments to contemplate the idea of imposing future fees or taxes on broadband infrastructure in their municipalities. These proposals present uncertainty in the broadband market and, as in any market, uncertainty of future costs means weaker business cases for deployment. All of which ultimately results in lagged network deployment and higher costs to the Puerto Rico consumer.

As importantly, these short-sighted proposals fail to understand that, if implemented, such strategies would slow growth of the very infrastructure that is necessary to reverse the island’s economic contraction and to stimulate economic development and ultimately recuperate recent municipal tax losses. Municipalities with broadband infrastructure will (a) attract and retain residents and businesses; (b) create new job opportunities; (c) improve educational opportunities for students; (d) provide more effective means to deliver local healthcare services; (e) improve efficiencies of local public safety enforcement; and many others. In short, taxing local broadband deployment means taxing the economic engine necessary for that local community to ensure economic growth and competitiveness.
To encourage the expansion of high-speed broadband networks and ameliorate cost uncertainties, the Puerto Rico government should work with municipal government officials to ensure that new infrastructure installed for broadband services on public or private property, roads, easements or rights-of-way will not be subject to further state or municipal tax or fees.

**Recommendation:**
Reduce uncertainty of future costs by encouraging implementation of tax and fee policies by state and municipal government aimed to attract investment and encourage broadband network build-out.

**Pole Attachment Costs**

Broadband providers rely on pole attachments to deploy their infrastructure across the Puerto Rico landscape. Pole attachment costs are an important component of the capital investment and operations necessary to deliver broadband services. Recognizing the role of pole attachment in the development of the broadband market, the FCC recommended in its National Broadband Plan for the establishment of rental rates for pole attachment as low and close to uniform as possible. According to the FCC’s National Broadband Plan, the national average pole attachment rate ranges between $7-$10 per foot per year.

In Puerto Rico, PREPA.Net, a competitive broadband service provider and a subsidiary of the Puerto Rico Electric and Power Authority (PREPA), a wholly-owned government entity and the island’s electric power supplier, is the primary provider of poles used by broadband providers. Contractual documentation regarding PREPANET’s pole attachment rates reveals higher rates across Puerto Rico, despite the fact that Puerto Rico’s average household income significantly lags even some of the poorest U.S. states. Pole attachment rates charged by PREPA are $12.10 per attachment of a cable or other device. If the equipment requires more than one attachment, each would be charged separately. The minimum number of pole attachments per contract is 1,000. Finally, contractually PREPA can take up to 45 days to approve or reject petitions for new pole attachments.
These high pole attachment rates are ultimately passed on to consumers, unnecessarily increasing the retail prices and potentially pricing out of the market low income households across Puerto Rico. As such, high pole attachment costs are a key barrier to overcome the digital divide in Puerto Rico. To overcome this challenge, we recommend the formation of a taskforce to evaluate pole attachment costs and processes across the island and work to reduce its costs and improve efficiency of attachment processes. Such a taskforce should include key stakeholders in this process, including government officials, PREPA, JRT, broadband providers, and other stakeholders. The recent rulemaking by the FCC on pole attachment fees should be considered by the taskforce in the evaluation process.

**Recommendation:**
Establish low and uniform pole attachment rental rates and efficient processes.

**Recommendation:**
To achieve this goal, establish the formation of a taskforce to evaluate pole attachment costs across the island and work to improve efficiency of pole attachment processes.

**IP Traffic Peering**

One of the drivers of high cost for broadband providers in Puerto Rico is the means of terminating local IP traffic between networks and the high cost of backhaul. There are clear cost, quality of service, and security benefits to maintaining the flow of local communications through the island’s local broadband networks and within the island’s shorelines.

The Government of Puerto Rico should encourage efforts for the local interconnection and peering of broadband networks, and support compliance with the FCC rules for network openness, non-discrimination & interconnection by establishing minimum service level requirements from broadband providers.

**Recommendation:**
Promote local network interconnection and peering to lower costs of backhaul traffic in Puerto Rico.

**Recommendation:**
Create minimum service level requirements for broadband providers serving local government agencies and entities.
Economic Incentives to Promote Broadband Investment

While the Economic Incentives for the Development of Puerto Rico Act (Act No. 73 of May 28, 2008) was created to “provide an adequate environment and opportunities for the continued development of our local industry” and provide tax benefits that “fosters the economic development and social betterment in Puerto Rico,” it does not specifically provide benefits to broadband service providers, whose services are essential in order to facilitate the export of services and goods outside of Puerto Rico. Expanding these economic incentives to apply to the operation and deployment of broadband services will promote broadband infrastructure investment and have a significant impact across the broadband landscape in Puerto Rico. Significant local and foreign investment could be attracted if the benefits under the Act were also extended to revenues and costs associated with broadband services (as defined by the FCC).

Recommendation:
Institute legislation to amend Act No. 73 of May 28, 2008, to include companies which operate and deploy broadband networks in Puerto Rico.

Promote Public-Private Partnerships to Expand Infrastructure Across Unserved Areas

There are areas of Puerto Rico where it is not economically viable for the private sector to invest in the deployment of next-generation broadband services. Given that universal access and adoption of broadband is critical for Puerto Rico’s economic growth and well-being, additional efforts must be made to facilitate the provision of competitive broadband services in these areas by private network operators.

In order to serve the residents of these regions, the Government of Puerto Rico should consider the development of public-private partnerships (PPP) to provide infrastructure for use by all telecommunication and broadband providers. This PPP network would be composed only of dark, passive network infrastructure (i.e. dark fiber) that would provide layer-1 service elements to third parties on a wholesale basis exclusively, thus eliminating any potential anti-competition distortions generated between PPP operators serving an area and competitive broadband or telecommunication providers using the network. All end users and customers of this PPP network would be able to receive similar, competing services from multiple providers over this common infrastructure. All service providers must be given access to the infrastructure at a regulated, tariffed rate to ensure appropriate end-user pricing.
To implement such a program, planning should be coordinated with existing network operators, Puerto Rico’s municipal governments, and the Junta Reglamentadora de Telecomunicaciones to ensure that such PPP infrastructure will not overbuild into areas where significant private investment has already been made and competitive services are available. The availability of accurate, comprehensive broadband inventory data will be essential to streamline this process and avoid implementation of such PPP in areas that are already served. Existing network operators and broadband providers should play a critical part in the planning of the network, as well as the organization which administers it. Areas of the island without existing broadband service must be the initial priority for the PPP infrastructure deployment.

**Recommendation:**
Institute legislation for the establishment of public-private partnerships (PPP) for the exclusive purpose of designing, building, and operating a fully-passive fiber optic network to the premise in currently unserved areas for wholesale use by any *bona fide* telecommunications or broadband provider.

*Energy Costs*

To address these structural problems, the Government of Puerto Rico should continue to develop measures to help stabilize the price and reliability of energy on the island, and shelter Puerto Rico from sharp price fluctuations in the international energy market. Predictability of energy costs will significantly improve the business cases for broadband deployment as well as across any other sector with high energy use.

**Recommendation:**
Continue implementing policies aimed to stabilize the price of energy across the island.

*Theft Law Enforcement*

Crime in Puerto Rico is at an all-time high, and has its impact on the telecommunications industry as well. Over the past decade, there has been a significant increase in the theft of service as well as infrastructure, including copper cables, telecommunication tower parts, generators, batteries, among other items. Ultimately, service and infrastructure theft leads to higher prices and poor service to consumers.
The Puerto Rico Telecommunications Regulatory Board (JRT) has taken strong, swift action in the past year to address the rising problem of copper theft. JRT also is pursuing cases of theft of service. These efforts should be complemented to prevent future crime by working proactively to more effectively enforce existing laws and prosecute individuals who cause physical harm and damage to Puerto Rico’s communications infrastructure.

**Excavation Law Enforcement**

Another problem affecting the security and robustness of broadband infrastructure, and ultimately increasing the cost of providing the service across the island, is the poor enforcement of excavation laws designed to ensure protection for all existing infrastructure. The Public Service Commission’s Center for the Coordination of Excavations and Demolitions (Centro de Coordinación Excavaciones y Demoliciones) is the state entity responsible for coordinating all excavation and, or demolition work. Its goal is to ensure ease of construction projects while ensuring the protection of subterranean infrastructure and assets, such as tubes, ducts, gas lines, and telecommunication facilities. Due to poor enforcement of excavation laws, including inconsistent issuance of fines to violating public and private entities, broadband infrastructure across the island is being seriously affected. This results in increased costs to network operators, serves as a deterrent to broadband network build out, and impacts the reliability and quality of Puerto Rico’s broadband systems. All of which ultimately harms Puerto Rican consumers who will experience unnecessary service outages and greater cost of the broadband service. To ensure ongoing communication services and to protect consumers against unnecessary service interruptions, swift action must be taken to ensure compliance by all entities that carry out excavation work.

**Recommendation:**

Improve law enforcement efforts to reduce the theft of broadband network infrastructure and reduce service theft.

**Recommendation:**

Incentivize deployment of fiber networks, thereby reducing reliance on copper networks targeted by thieves.

**Recommendation:**

Improve the enforcement of existing excavation laws to reduce damages to infrastructure assets and end-user service interruptions.
Endnotes


5 Ibid.


7 Availability data by speed tier collected Connect Puerto Rico follows the speed tiers prescribed by the National Telecommunications Information Administration broadband mapping rules (see the previous chapter for further details). As such, the National Broadband Map and data in Puerto Rico does not measure availability at actual speeds of 4 Mbps (DL)/1 Mbps (UL). To proxy the digital gap, the FCC has proposed to use a combination of the most relevant speed tiers measured via the National Broadband Map (3 Mbps/768 Kbps and 6 Mbps/1.5 Kbps).


9 For more information on the USF program and its components refer to Universal Service Administrative Company (USAC) at www.usac.org


12 For a detailed assessment of the broadband inventory across Puerto Rico see Chapter III of this Strategic Plan.


14 Ibid.

15 Ibid.


17 Ibid.


22 Ibid.
