



April 2014

TELECOMMUNICATIONS

Projects and Policies Related to Deploying Broadband in Unserved and Underserved Areas

GAO Highlights

Highlights of [GAO-14-409](#), a report to congressional requesters

Why GAO Did This Study

Broadband service provides users with many opportunities to improve communications and broadband deployment is particularly critical in rural areas to provide advanced communications to remote users and communities. In 2010, FCC estimated that 7 million U.S. housing units—about 5 percent of the nation's housing units—did not have access to wireline broadband service, mostly in rural areas. Some municipalities, cooperatives, and non-traditional private providers are exploring ways to sponsor and fund broadband projects in unserved and underserved areas.

GAO was asked to provide information on options for broadband deployment in unserved and underserved areas. This report examines (1) what is known about the alternative approaches unserved and underserved areas have used to deploy broadband and some factors considered in deployment decisions; (2) stakeholders' views on broadband deployment in unserved and underserved areas; and (3) efforts FCC has undertaken to foster broadband deployment in unserved areas. GAO reviewed relevant documents and interviewed FCC officials, representatives from industry, and incumbent providers. GAO also conducted an in-depth review of 21 geographically dispersed broadband projects selected to include various sponsor types, such as municipalities, non-traditional private providers, and cooperatives, and various ownership and financing approaches. GAO provided FCC with a draft of this report for comment. In response, FCC provided technical comments, which have been incorporated as appropriate.

View [GAO-14-409](#). For more information, contact Mark Goldstein at (202) 512-2834 or goldsteinm@gao.gov.

April 2014

TELECOMMUNICATIONS

Projects and Policies Related to Deploying Broadband in Unserved and Underserved Areas

What GAO Found

The unserved and underserved areas that GAO reviewed used alternative approaches and considered various factors to deploy broadband. Broadband project sponsors in those areas included municipalities, non-traditional private providers, consortiums of sponsors in a region, and cooperatives. In making broadband deployment decisions, project sponsors said they considered diverse factors related to their ability to fund successful projects, such as the (1) likelihood of near-term service upgrades by incumbent providers, (2) potential demand for new services, (3) potential broadband technologies, and (4) existing infrastructure and potential local assistance available to providers. For financing approaches, some project sponsors used local private and public funds while others leveraged federal funds. In addition, project sponsors used a variety of ownership structures that ranged from public ownership to local private investors.

Stakeholders and project sponsors GAO contacted cited economic, legal, and policy concerns in deploying broadband in unserved and underserved areas. For example, regarding funding, stakeholders said that remote areas generally face high broadband deployment costs due to the expense of deploying technologies over long distances or difficult terrain and that often the return on investment is low since there are relatively few potential subscribers in those areas. Project sponsors and industry experts noted legal concerns, including concerns with laws in some states that limit or ban companies that are not telecommunications companies from deploying broadband due to concerns about unfair competition. For example, in Louisiana, a city official GAO contacted said state laws bar any municipality from deploying broadband directly to consumers, so the city is planning to build and own a fiber-optic network, but to comply with the state law, will not offer retail service. Stakeholders also noted several policy concerns, including concerns over the accuracy of federal broadband-mapping efforts and whether the Federal Communications Commission's (FCC) broadband-speed benchmark is set high enough. While there may be valuable lessons in the examples profiled in our case studies, their limited number does not allow us to generalize findings to the broader universe of all entities seeking to deploy broadband networks.

FCC has several efforts under way to increase broadband deployment in unserved areas, efforts that help address the economic and policy concerns raised by stakeholders. FCC established the Connect America Fund in November 2011 to support voice and broadband access in areas where no private business case exists to provide broadband—one of the key challenges these areas face in deploying broadband. Additionally, in January 2014, FCC adopted an order in which it stated that it will solicit proposals from non-traditional providers, including utilities and municipalities, to deploy broadband technologies in rural, high-cost areas. Through this effort, FCC plans to explore broadband policy issues and gather information on viable business models for deploying fiber-optic or next-generation wired technology in rural areas. FCC plans to also gather information on the conditions under which rural consumers would prefer next-generation wireless services over wireline.

Contents

Letter		1
	Background	3
	Unserved and Underserved Areas Used Alternative Approaches and Considered Various Factors to Deploy Broadband	10
	Stakeholders Cited Economic, Legal, and Policy Issues in Deploying Broadband in Unserved and Underserved Areas	20
	FCC Has Undertaken Various Efforts to Foster Broadband Deployment in Unserved Areas	25
	Agency Comments	28
Appendix I	Objectives, Scope, and Methodology	29
Appendix II	Selected Information on Broadband Projects in 21 Case Study Areas	34
Appendix III	GAO Contact and Staff Acknowledgments	40
Tables		
	Table 1: List of Telecommunications Industry Stakeholders Interviewed	29
	Table 2: Attributes of Broadband Projects in 21 Case Study Areas	34
	Table 3: Selected Examples of Wireline and Wireless Broadband Technology and Speeds for Alternative and Existing Networks	38
Figure		
	Figure 1: Broadband Technologies and Examples of Applications Performing at Various Speeds	6

Abbreviations

4G	fourth generation wireless
BTOP	Broadband Technology Opportunities Program
DSL	digital subscriber line
EC Fiber	East-Central Vermont Community Fiber-Optic Network
ETC	eligible telecommunications carrier
FCC	Federal Communications Commission
Gbps	gigabits per second
kbps	kilobits per second
LTE	Long Term Evolution
Mbps	megabits per second
NRTC	National Rural Telecommunications Cooperative
NTIA	National Telecommunications and Information Administration
Recovery Act	American Recovery and Reinvestment Act of 2009
RUS	Rural Utilities Service
USAC	Universal Service Administrative Company
USF	Universal Service Fund
UTOPIA	Utah Telecommunication Open Infrastructure Agency

This is a work of the U.S. government and is not subject to copyright protection in the United States. The published product may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.



April 23, 2014

The Honorable Henry A. Waxman
Ranking Member
Committee on Energy and Commerce
House of Representatives

The Honorable Anna G. Eshoo
Ranking Member
Subcommittee on Communications and Technology
Committee on Energy and Commerce
House of Representatives

The Honorable Edward J. Markey
United States Senate

Broadband Internet service provides users and their communities with many opportunities to improve communications, including enhancements in e-commerce, telemedicine, and educational tools, and can drive economic growth, productivity, and innovation. Broadband is particularly critical to provide advanced communications to remote communities and offer rural Americans new ways to participate in our economy and society. The American Recovery and Reinvestment Act of 2009¹ (Recovery Act) directed the Federal Communications Commission (FCC) to develop a national broadband plan to ensure every American had access to broadband service. In March 2010, FCC issued the *National Broadband Plan* that included a centralized vision for achieving affordability and maximizing use of broadband to advance community development, health care delivery, education, job creation, and other national purposes.²

Throughout most communities in the United States, cable and telephone companies have upgraded their networks or deployed new technologies to provide broadband services to their customers. Nevertheless, in 2010, FCC estimated that 7 million of the 130 million American housing units did

¹Pub. L. No. 111-5, § 6001(k)(1), 123 Stat. 115, 515-516 (2009).

²Federal Communications Commission, *Connecting America: The National Broadband Plan* (Mar. 16, 2010).

not have access to wireline broadband service.³ Most of those who lack access live in rural areas where low population density makes expanding cable and telephone networks considerably more expensive than in urban areas. FCC estimated in 2010 that it would cost \$23.5 billion to reach all unserved areas, of which \$13.4 billion would be needed to just reach the most remote 250,000 households.⁴ Furthermore, deployment costs vary according to the broadband technology and type of construction used. For example, according to FCC, the costs for new fiber construction can range from \$11,000 to \$24,000 per mile for aerial construction to \$25,000 to \$165,000 per mile for buried construction.

In this report, we refer to areas that lack broadband as “unserved,” and areas that have access to low quality broadband service and may have some households without access as “underserved.” In some unserved and underserved areas, entities other than traditional telephone or cable Internet service providers—such as municipalities, non-traditional private providers, consortium of sponsors in a region, and cooperatives—are exploring ways to sponsor and fund broadband projects. However, these entities face a range of challenges in deploying broadband in unserved and underserved areas.

You asked us to provide information on options for broadband deployment in unserved and underserved areas. This report examines (1) what is known about the alternative approaches unserved and underserved areas have used, or attempted to use, to deploy broadband and some factors considered in broadband deployment decisions; (2) stakeholders’ views on broadband deployment in unserved and underserved areas; and (3) efforts FCC has undertaken to foster broadband deployment in unserved areas.

To address these objectives, we conducted a review of relevant published literature and interviewed FCC officials and a broad array of stakeholders

³According to the *National Broadband Plan*, the availability of satellite broadband service is not considered in determining whether an area is served. The *National Broadband Plan* defines housing units as a house, apartment, or single room, etc. that is occupied or intended for occupancy as separate living quarters. The *National Broadband Plan*, endnote 30.

⁴These estimates include capital expenditures and operating costs to provide service minus anticipated revenues from service, and are present value in 2010 dollars. See *National Broadband Plan*, p. 136-139.

from 40 organizations, including associations representing consumers and industry, broadband consultants and providers, and officials from local agencies in selected areas where broadband projects were deployed or attempted. In selecting industry experts and incumbent providers, we considered relevant published literature and stakeholders' recommendations. We conducted an in-depth review of 21 broadband projects, selected because they were geographically dispersed and included various sponsor types, such as municipalities, cooperatives, economic development agencies often in regional consortiums, or private companies. For the 21 projects, we reviewed the broadband options that project sponsors considered and factors affecting their decisions. We interviewed project sponsors to obtain their views on economic, legal, and other issues they believe affected their ability to deploy a network. The economic, legal, and other issues identified by project sponsors should not be viewed as identifying all issues that could affect broadband deployment in unserved and underserved areas; however, project sponsors consistently raised the issues presented. Also, the economic, legal, and other issues that we report on should not be viewed as being representative of all entities deploying broadband in unserved or underserved areas. We also interviewed incumbent providers on their views of municipalities and cooperatives providing broadband service. We interviewed industry experts, incumbent providers, project sponsors, and stakeholders about FCC's efforts to facilitate broadband deployment in unserved areas and what further actions, if any, FCC might take. Further details of our scope and methodology are provided in appendix I.

We conducted this performance audit from May 2013 to April 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Broadband allows users to access information via the Internet through one of several high-speed transmission technologies. Broadband capacity, typically referred to as "speed," is described in download and upload capabilities and is measured by the number of bits of data transferred per second and include kilobits (1 thousand bits per second—kbps), megabits (1 million bits per second—Mbps), and gigabits (1 billion bits per second—Gbps). Download speed refers to the rate at which data

is transferred from the Internet to the consumer. Upload speed refers to the rate at which data is transferred from the consumer to the Internet.

A range of broadband technologies provides high-speed Internet access.

- Digital subscriber line (DSL) service is delivered by local telephone companies over upgraded copper-wire telephone networks that were originally built to provide traditional wireline voice service.
- Cable modem service is delivered by cable television companies through the same coaxial cables that deliver sound and pictures to television sets.
- Fiber-optic lines are a wired technology that converts electrical signals carrying data into light and sends the light through transparent glass fibers about the diameter of a human hair. Telephone companies provide most fiber-optic broadband service.
- Satellite is a wireless technology that transmits data using a subscriber's receiver dish and a satellite in a fixed position above the equator.
- Other wireless services, such as Long Term Evolution (LTE)—a commercial data standard for wireless technologies—use cellular radio links for consumers to access the Internet using their smart phones, tablets, and other portable devices.⁵

Broadband speeds vary significantly depending on the particular type of service provided and may range from as low as 256 kbps to 1 Gbps.⁶ In 2010, the *National Broadband Plan* stated that every household and business in America should have access to affordable broadband service with a speed of at least 4 Mbps download and at least 1 Mbps upload. In 2011, FCC adopted this 4 Mbps/1Mbps benchmark for broadband

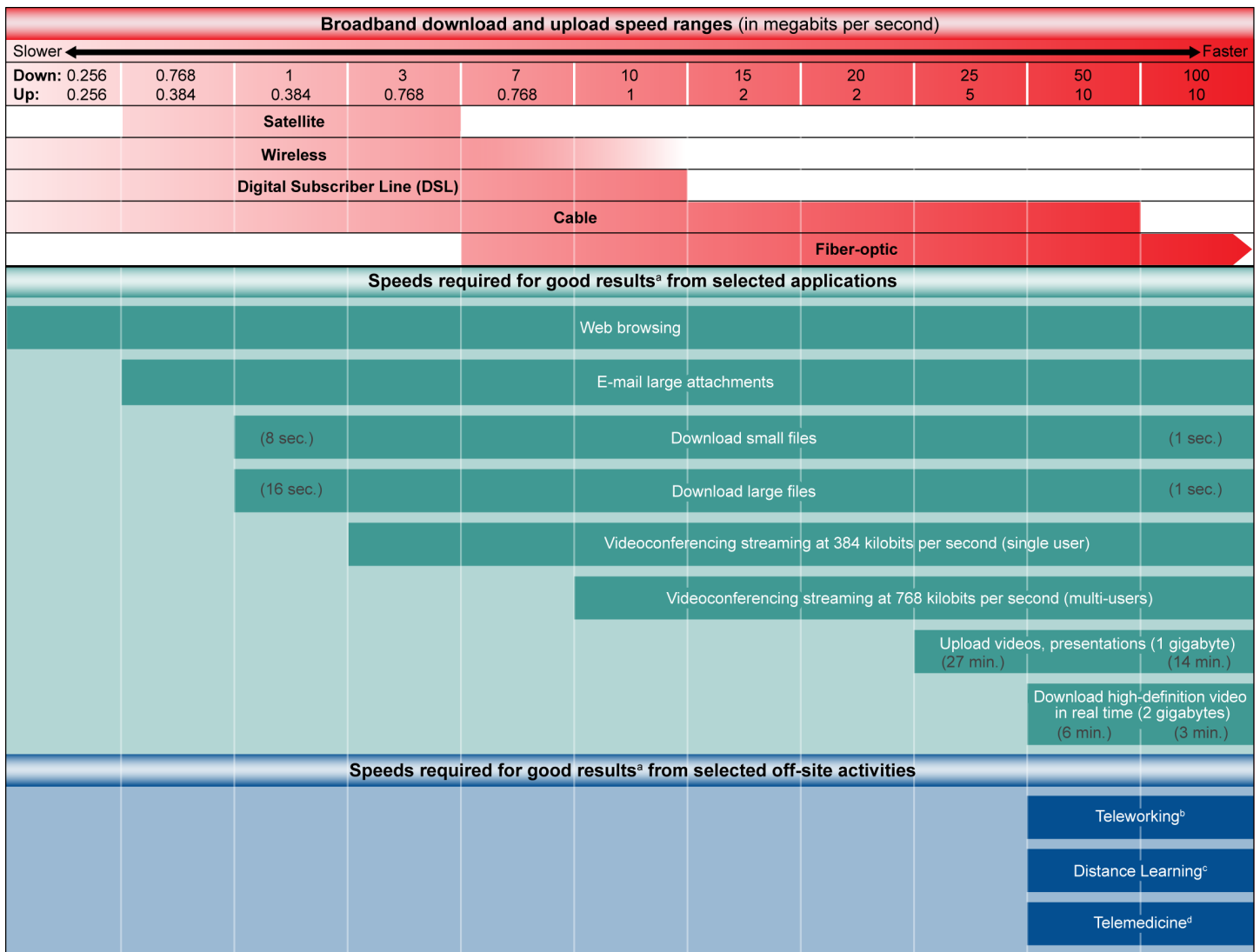
⁵ LTE is the standard created and adopted by the Third Generation Partnership Project, a standards organization, and is the closest standard to fourth generation wireless (4G) technology. LTE has been accepted and adopted by national and international communities as the foundation for future mobile telecommunications.

⁶ Data transfer rates (speeds) vary depending on a number of factors including the distance of users from core technology elements such as nodes or cell towers and the number of users on shared networks among other factors.

projects to be eligible to receive universal service support.⁷ The federal benchmark allows for such Internet applications as accessing websites, emailing with attachments like pictures, and simple video conferencing, but does not support some of the newer Internet applications that require faster speeds to use, as shown in figure 1. For example, applications such as distance learning, telecommuting, and telemedicine, which can involve transmitting large amounts of data and images in real-time, cannot perform acceptably at the federal benchmark speed of 4 Mbps/1Mbps.

⁷ According to FCC, nearly 100 percent of urban residents have access to 3 Mbps or higher download speeds, and about 94 percent of nonurban residents have access to such speeds as of December 2012.

Figure 1: Broadband Technologies and Examples of Applications Performing at Various Speeds



Source: GAO analysis of Small Business Administration information.

^a The figure above depicts applications, and the off-site activities they allow, that perform well at given speeds. While it is possible for the applications to perform at speeds lower than those indicated above, that performance is generally at a fair or unacceptable level, and is therefore undesirable for business and residential users.

^b Many people telework (also known as telecommuting), which is the ability for an organization's employees and contractors to perform work from locations other than the organization's facilities. Most teleworkers use remote access, which is the ability for an organization's users to access its non-public computing resources from external locations other than the organization's facilities. National

Institute of Standards and Technology, *Guide to Enterprise Telework and Remote Access Security*, Special Publication 800-46 Revision 1 (Gaithersburg, MD: 2009), page 2-1.

^c Distance learning today can take many forms and is defined by federal law and regulation as education that uses one or more specified technologies (e.g., the Internet or audio conferencing) to deliver instruction to students who are separated from the instructor and to support regular and substantive interaction between the students and the instructor. 20 U.S.C. § 1003(7) and 34 C.F.R. § 600.2.

^d Telemedicine technologies can allow rural patients to receive, through remote access, medical diagnosis or patient care, often from specialists who are located in urban areas or university hospitals. Increased use of video consultation, remote patient monitoring, and electronic health records enabled by telemedicine technologies hold the promise of improving health care quality, safety, and efficiency. GAO, *Telecommunications: FCC's Performance Management Weaknesses Could Jeopardize Proposed Reforms of the Rural Health Care Program*, [GAO-11-27](#) (Washington, D.C.: Nov. 17, 2010).

Unserved and underserved areas tend to have conditions that increase the cost of constructing and maintaining broadband networks. These conditions include low populations who might also be widely dispersed and in remote areas that might have challenging terrain, such as mountains, that increase construction costs. The choice of broadband technology and the ability to use or extend existing infrastructure also affects the costs of constructing and maintaining broadband networks. Certain technologies like cable and fiber, which must be buried underground or placed on raised poles, could be more expensive to deploy in remote areas than wireless technologies, such as cellular towers.

Within the federal government, FCC, the Department of Commerce, and the Department of Agriculture (USDA) have roles in broadband deployment. In particular, Congress gave FCC a large role in fostering broadband deployment when it directed FCC to “encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans.”⁸ In responding to that directive, FCC developed goals to broaden broadband deployment to unserved areas and encourage investment and innovation in broadband technologies and services. As part of the Recovery Act, the Department of Commerce’s National Telecommunications and Information Administration (NTIA) received \$4.7 billion to create the Broadband Technology Opportunities Program (BTOP). Through this program, as of September 2013, NTIA had awarded 233 competitive grants for a total of \$4 billion to a variety of entities for broadband infrastructure, public

⁸47 U.S.C. § 1302(a).

computer centers, and innovative projects to stimulate demand for and adoption of broadband. In addition, the Department of Commerce's Economic Development Administration also had programs in 2008 through 2012 that supported the construction of public infrastructure, which could include broadband infrastructure.⁹ USDA administers programs that support broadband deployment, including three Rural Utilities Service (RUS) programs: the Rural Broadband Access Loan and Loan Guarantee Program, the Community Connect Grant Program, and the Telecommunications Infrastructure Loan Program. USDA provided over \$7 billion in grants and loans for broadband projects from 2008 through 2012.

As of December 2012, the National Broadband Map¹⁰ depicted approximately 2 percent of the U.S. population as living in unserved areas—that is, those not having access to wireline or wireless broadband service of 3 Mbps download and 768 kbps upload.¹¹ The map shows broadband access by census block—if a single house or building in a census block has broadband access, the block is categorized as served.¹² Although FCC does not define underserved areas, NTIA created a definition and used it in reviewing projects for consideration to

⁹Programs include Economic Adjustment Assistance, Public Works, Disaster Supplement Appropriations, Global Climate Change Mitigation Incentive Fund, Community Trade Adjustment Assistance Program, and the Disaster Relief Opportunity Fund. The focus of these programs is to support economic recovery, promote regional competitiveness, or to help areas recover from a natural disaster, rather than explicitly fund the construction of broadband infrastructure.

¹⁰See www.broadbandmap.gov. The map is a joint effort of NTIA and FCC to report broadband speeds and technology available across the United States. According to NTIA and FCC, the map represents the most comprehensive nationwide data on broadband availability.

¹¹Although FCC's broadband speed benchmark is 4 Mbps/1Mbps, FCC and NTIA report on 3 Mbps download and 768 kbps upload because it is the closest speed to the FCC benchmark about which data is collected for the National Broadband Map.

¹²The U.S. Census Bureau defines a census block as a statistical area bounded by visible features, such as streets, roads, streams, and railroad tracks, and by nonvisible boundaries, such as selected property lines and city, township, school districts, and county boundaries. A block is the smallest geographic unit for which the Census Bureau tabulates decennial census data. Many blocks correspond to individual city blocks bounded by streets, but blocks—especially in rural areas—may include many square miles and may have some boundaries that are not streets.

receive BTOP grants.¹³ Since the National Broadband Map does not show underserved areas, it is unknown how many of these areas exist or what percentage of the population they represent.

The *National Broadband Plan* noted that because Internet service providers are unlikely to earn enough revenue to cover the costs of deploying and operating broadband networks in unserved areas, it is unlikely that private investment alone will bring service to these areas. To improve Americans' access to broadband, the *National Broadband Plan* recommended that FCC create the Connect America Fund to provide funds in geographic areas where there was no private sector business case to provide broadband. FCC established the Connect America Fund in 2011 as part of the Universal Service Fund (USF).¹⁴ In doing so, FCC reformed the USF high-cost program and adopted new rules to allow USF monies to be used to support voice and broadband capable networks. FCC established a \$4.5-billion annual program budget for the Connect America Fund for 6 years.¹⁵

¹³NTIA's definition of underserved is one in which (1) 50 percent or less of households have access to the minimum broadband speed, (2) no provider offers service speeds of at least 3 Mbps, or (3) 40 percent or less of the households choose to subscribe to a broadband service. American Recovery and Reinvestment Act of 2009 (*74 Fed. Reg. 33104, July 9, 2009*).

¹⁴The federal USF includes four programs designed to ensure access to affordable communications for schools, libraries, health care providers, and rural and low-income consumers. The high-cost program provides subsidies to telecommunications carriers that serve rural and other remote areas with high costs of providing telephone service. The other three USF programs are intended to reduce costs for low-income consumers, schools and libraries, and rural health care providers.

¹⁵We have previously reported on FCC's efforts to reform the USF high-cost program and create the Connect America Fund. See GAO, *Telecommunications: FCC Has Reformed the High-Cost Program, but Oversight and Management Could be Improved*, [GAO-12-738](#) (Washington, D.C.: July 25, 2012).

Unserved and Underserved Areas Used Alternative Approaches and Considered Various Factors to Deploy Broadband

Alternative Ownership and Financing Approaches

Project sponsors we spoke with pursued various approaches for financing and deploying broadband in unserved and underserved areas that differed from more traditional commercial project models, such as those often built by incumbent providers in more urban areas. In particular, types of project sponsors included (1) municipalities, (2) non-traditional private providers, (3) a consortiums of sponsors in a region, and (4) cooperatives. The following examples describe some of the alternative ownership and financing approaches we found (for summaries of all our 21 case study projects, see app. II).

Municipalities

Municipal networks are eligible to receive federal funding, but not all municipal networks discussed in this report received federal funding. Some municipalities support broadband deployment by funding, building, and operating networks to provide broadband access to their communities, much as some cities offer utilities such as water and electricity. The municipal entity providing this service may be, for example, a department within the city government or a cooperative formed among several communities. Communities have used federal funds, issued bonds, and taken out loans to fund the construction of municipal broadband networks. In some instances, voter referendums have been required for the city to take out loans or bonds for this purpose.

- **East-Central Vermont Community Fiber-Optic Network (EC Fiber); publicly owned, privately funded.** A group of 23 Vermont municipalities collaborated to build this “open-access” fiber-optic network to provide Internet and voice service to homes and

businesses.¹⁶ EC Fiber contracts with a non-profit Internet service provider to operate the network. Construction costs were approximately \$5 million, most of which was financed through local private investors. By December 2013, EC Fiber had 550 subscribers and had raised \$4.7 million from 365 investors—90 percent of whom are residents of towns the network serves or will serve. The founders decided on a local private-funding model after the 2008 financial crisis made private financing from the U.S. capital markets difficult to obtain and after the project did not receive the Recovery Act’s broadband deployment funds. However, project sponsors said one of the challenges of privately funding a publicly owned network was that the time frame for completing the network depends on the rate at which investments can be raised, which can vary according to the economic circumstances of each area’s residents. For example, the construction of the network is progressing in phases, with new segments being built as investments are raised by residents, a process that makes rapid expansion difficult. The service provider operating the network leases 39 miles of middle-mile and last-mile fiber-optic capacity from a statewide open access network being built by the Vermont Telecommunications Authority, a state agency that in 2013 provided EC Fiber a grant of \$167,569 that funded an expansion into unserved portions of two communities.¹⁷

- **Utah Telecommunication Open Infrastructure Agency (UTOPIA); publicly owned, publicly funded.** UTOPIA is a local government agency owned by 16 Utah municipalities, 11 of which raised public funding through bonds to build a \$177-million fiber-optic open-access network over which private providers offer Internet, voice, and video services. Five municipalities decided not to raise funds, but remain on the network’s board and can decide to pursue financing for their cities

¹⁶“Open access” generally refers to a structural requirement that would prevent a broadband network provider from bundling broadband service with Internet access from its own in-house Internet service provider and would require the network provider to make its broadband transmission capability available to independent Internet service providers on a nondiscriminatory basis. Congressional Research Service, *Telecommunications Act: Competition, Innovation, and Reform*, RL33034 (Updated Jan. 13, 2006).

¹⁷Middle-mile infrastructure provides a link from the Internet backbone to the last-mile networks of local providers (such as cable or phone companies) that provide broadband service to end users. The availability of broadband service to end users depends on access to adequate middle-mile facilities, which can be costly to deploy in rural areas. Middle-mile capacity, also known as “backhaul,” refers to the installation of a dedicated line that transmits a signal to and from an Internet backbone that is typically located in or near an urban area.

Non-Traditional
Private Providers

at a later date. Some of the network's municipalities own infrastructure, such as utility poles, which sponsors said helps reduce the cost and increase the speed of deploying broadband. Project sponsors said their goal is for the network to be financially self-sufficient, but said that goal has yet to be attained for various reasons. The project used \$16.2 million of BTOP funds to connect 288 community institutions with middle-mile service over UTOPIA's fiber backbone. In addition, UTOPIA received partial funding from a \$66 million RUS loan for broadband deployment to rural areas. After disbursing \$21 million to UTOPIA, RUS suspended the loan until UTOPIA could demonstrate improved financial performance. Project sponsors told us that they have taken steps to improve the performance and that 3 years ago they began deploying the network to areas that promise greater return on investment.

Private networks are eligible to receive federal funding but not all private networks discussed in this report received federal funding. Some private companies fund, build, and operate networks to provide broadband access to communities. In some instances, companies have used federal funds, contributed capital, and taken out loans to fund the construction of broadband networks. Some private companies we contacted used municipal resources, such as fiber-optic infrastructure or took construction loans backed by the federal government.

- **Lit San Leandro; privately owned, privately and publicly funded.** Lit San Leandro is a private venture that built, owns, and operates an 11-mile fiber-optic network providing Internet service directly to over 150 businesses and some community institutions in San Leandro, California. The network cost approximately \$5 million to build, and was financed in two stages. The owner of a local software company, who committed a total of \$3 million to the project, paid for initial construction; the second construction phase, covering the last 7.5 miles, was paid for with a \$2.1 million grant from the Department of Commerce's Economic Development Administration. The project was designed to use "dark fiber"—fiber-optic cable that had already been installed by the city but was not being used—and 10 percent of that capacity was reserved for the city's current and future municipal needs. In exchange for financing and constructing the network, the city waived leasing costs for the first 10 years of Lit San Leandro's operation, at which time the costs revert to prevailing market rates, should the venture be profitable.
- **Valu-Net; privately owned, privately funded.** This fiber-optic network in Emporia, Kansas, provides Internet, voice, and video services directly to over 300 businesses and over 400 residences.

While a survey issued by the city's Chamber of Commerce indicated strong demand by business owners for broadband, project sponsors said there was substantial opposition against the city using tax revenue to deploy a broadband network, and there was a general consensus that a private service provider should develop the infrastructure and provide the service. The network is being built first to areas where the most businesses operate, and project sponsors told us they would only connect a home once a subscriber requests service. They told us the company financed approximately \$5 million of the construction cost so far through community investors and approximately \$5 million through bank loans, including a low-interest Small Business Administration loan. They anticipate needing up to \$3 million more to complete construction. In addition, a healthcare firm in the northern part of the city that desired higher capacity broadband service helped finance part of the construction costs to deploy fiber-optic cable under a highway.

Consortiums of Sponsors in a Region

Regional networks are eligible to receive federal funding and all regional networks discussed in this report either received federal funding or are planning to apply for it. These networks focus on building middle-mile infrastructure and providing broadband services to schools, medical providers, public safety agencies, and other community anchor institutions. The availability of broadband service to end users depends upon access to adequate middle-mile facilities, which can be costly to deploy in rural areas, especially in mountainous or heavily forested areas where additional infrastructure can be required. In some cases, regional networks also provide the last-mile service to end users.

- **MassBroadband 123; publicly owned, publicly funded.** Built by a state economic development agency, this open-access, middle-mile network provides 122 towns in western and central Massachusetts with a fiber-optic backbone over which private service providers offer Internet, voice, and video directly to community institutions across western and central Massachusetts. The project is owned by a state technology agency and includes a public-private partnership with a company to sell network capacity to Internet service providers on a wholesale, open-access basis. Officials said they assigned the risk for operating and maintaining the network to the company, and structured a revenue-sharing agreement with it so that it would be motivated to operate the network efficiently. The project cost approximately \$90 million to build and was financed through a \$45.5 million BTOP grant in combination with \$44.5 million in state funds.

New Hampshire FastRoads; publicly owned, privately and publicly funded. This open-access middle-mile and last-mile network provides last-mile connectivity to 233 community institutions in 19 communities, and 1,300 residences and businesses in two towns. Four private Internet service providers use the network to serve customers directly. The venture is a wholly-owned limited liability corporation of a local economic development non-profit, and officials structured the network as a for-profit to allow them to raise additional private equity to expand service in the future. Two local economic development organizations and 42 towns collaborated on the project, which cost \$7.6 million to build, and was financed using \$5.4 million of BTOP funds, as well as additional funding from a variety of sources including banks, a county economic development corporation, individual donors, and vendors who offered in-kind contributions.

Cooperatives

Networks that are owned by cooperatives may qualify to receive federal funding. According to project sponsors for the cooperative networks we contacted, three rural electric cooperative networks received no federal funding and the fourth plans to seek support payments from FCC's Connect America Fund. Rural electric cooperative networks serve areas that have lower customer-per-mile density levels than those of privately owned or municipal utilities, levels that can make return on investment projections for broadband deployment less attractive to investors. Some cooperative networks link their broadband deployment efforts with "smart grid" efforts that allow two-way communications between the cooperative and the customer.¹⁸

- **Douglas Fast Net; privately owned, privately funded.** This subsidiary of the Douglas Electric Cooperative in southwest Oregon owns and operates a hybrid fiber-optic, DSL, and wireless network in collaboration with five other rural electric cooperatives and one Native American tribe, and provides connectivity, Internet, and voice services to businesses, residences, schools, and medical and community

¹⁸According to the Department of Energy, a "smart grid" is an automated, widely distributed energy delivery network characterized by a two-way flow of electricity and information made possible by distributed computing and communications. Smart grid systems can monitor everything from power plants to customer preferences and individual home appliances.

institutions in Douglas County.¹⁹ In extremely rural areas, rather than using wireless technology to reach residences, the fiber-optic network uses leased copper telephone lines—DSL. Like most rural electric cooperatives, Douglas Electric is a non-profit corporation incorporated under state statutes; however, its broadband subsidiary was established as a for-profit entity, so it can declare dividends and channel excess funds back to the electric cooperative. Officials financed \$6.5 million in construction costs using a \$300,000 grant from a county economic development entity, a loan of \$4.2 million from the electric cooperative, and \$2 million from customer installation charges. Project sponsors said existing infrastructure and personnel improved the project's business case, and they cited experienced line crews and ownership of most of their own plant—with the exception of a limited number of leases from third parties—as beneficial project components. While they have not sought federal funds for commercial deployment yet, officials said USF E-Rate funding allowed them to deploy broadband to schools and libraries, which lowered the deployment costs when they subsequently expanded the network to businesses and homes.²⁰

- **Midwest Energy Cooperative, Pilot Project; privately owned, privately funded.** Midwest Energy is building a 243-mile fiber-optic network to create a high-speed communication link to allow smart grid applications. As part of that effort, project sponsors said the cooperative has begun building a \$9.5-million pilot project connecting 963 homes and businesses with fiber-optic cable in order to assess the feasibility of a potentially larger future network deployment. Officials said they hope to reach 24,000 homes and 2,500 businesses by potentially financing approximately half the construction costs for the larger project with monies from FCC's Connect America Fund, should they be eligible for those funds in the future. Project sponsors cited the cooperative's experience maintaining utility rights-of-way and

¹⁹ The National Rural Electric Cooperative Association defines Rural Electric Cooperatives as private, not-for-profit businesses governed by their consumers (known as consumer-members), and lists two federal requirements for all cooperatives, including electric cooperatives, as (1) democratic governance and (2) operation at cost.

²⁰ The federal E-Rate program is one of four USF programs. It assists eligible schools and libraries through discounted telecommunications and information services. Discounts are available for local and long-distance telephone service, Internet access, and internal connection projects. See, e.g., *In the Matter of Schools and Libraries Universal Service Support Mechanism*, 25 FCC Rcd. 18762, 18831-18850 (2010).

electrical power infrastructure as factors that would allow them to deploy a broadband network quickly and cost-effectively.

Factors Considered

In making broadband deployment decisions, project sponsors told us they considered various factors related to their ability to fund successful projects, including the (1) likelihood of near-term service upgrades by incumbent broadband service providers; (2) potential demand for new service; (3) potential broadband technologies; and (4) existing infrastructure and potential local assistance for providers.

Likelihood of Service Upgrades by Incumbent Providers

Project sponsors told us that in evaluating the market, they considered existing broadband service, including speed available from current providers in their area, and whether further deployment or upgraded service from these providers was likely. The following examples describe some of the projects for which sponsors told us they considered existing service, including by asking incumbent providers about their plans to expand or improve service:

- **Camino Fiber Network Cooperative, Northern California (Planned, but currently inactive).** This municipal network was planned as a consumer telecommunications cooperative corporation, and was designed to provide open-access fiber-optic broadband service to about 50,000 mostly rural residences in El Dorado County, California. Officials told us that while planning the network, they asked the incumbent provider companies whether they had plans to extend broadband service to currently unserved areas in the county and were told the population density was too low in many areas to justify the cost of extending service. As a result, officials said they decided to attempt to build their own fiber-optic service over an open-access network. However, officials told us they could not secure enough public or private funding to hire engineering consultants to design the network and plan the business, and as a result the project is inactive.
- **Greenlight, Wilson, North Carolina.** Project sponsors for this municipal network said they approached both local cable and telephone incumbent carriers to ask if they had plans to improve their cable and DSL broadband networks for underserved areas or to extend their networks to unserved areas, and were told the companies had no plans to do so. Officials said they then asked if the companies would consider entering into a public-private partnership with Wilson; the companies declined to do so. As a result, officials said they decided to build, own, and operate their own fiber-optic network, and to use existing city-owned infrastructure, such as

telephone poles and utility rights-of-way, to do so. Officials said they decided to offer retail Internet, voice, and video services directly to customers to secure enough subscribers to support the network. To finance the \$35 million cost of construction, the city issued certificates of participation—a form of extended lease agreement secured by city property, payments on which are subject to annual appropriation by the city, and which are not considered a long-term obligation or debt.

Potential Demand for New Service

Project sponsors told us they considered potential demand for new service in their area. The following examples describe some of the ways sponsors told us they estimated potential demand for new service to ascertain the business case for deployment:

- **Gold Country Broadband Consortium, Northern California (Planned).** Project sponsors for this open-access regional network are investigating potential technologies and partners to bring broadband service to residential and commercial customers across five counties in the foothills of the Sierra Mountains. Officials told us a non-profit economic development agency leads the consortium. To determine the demand for broadband service, the agency held community meetings and conducted telephone and Internet surveys about current and desired levels of service and willingness to pay a competitive rate to subscribe. Currently the agency is presenting this demand data to independent Internet service providers at community meetings to determine when and if they are planning to offer service, and to investigate technologies they could use to deploy broadband. The agency helped potential Internet service providers apply for state and federal grants, and plans to use the knowledge gained to pursue other opportunities in the future.
- **Vermont Telecommunications Authority, Montpelier, Vermont.** This state-chartered entity provides infrastructure grants to finance regional open-access fiber-optic and wireless broadband networks, and develops infrastructure such as dark fiber, on which it leases capacity to multiple private service providers that serve customers. Authority officials told us they helped lower the cost of deployment in rural areas where population density is low by building and funding telecommunications infrastructure that is open to multiple uses and by gauging the combined demand of businesses, municipal governments, healthcare facilities, and community institutions such as libraries and state colleges that want broadband service and working to meet their broadband requirements. They said aggregating demand in this way, when combined with lowering the capital costs of the infrastructure, improves the business case for investing in broadband

networks, and may encourage providers to consider investing in network construction.

Potential Broadband Technologies

Project sponsors told us they considered various broadband technology options available to meet potential demand for service. The following examples describe some of the technologies sponsors told us they are using, have considered using, or have been unable to use:

- **Rappahannock Electric Cooperative, Fredericksburg, Virginia.** Officials from the rural electric cooperative said they have investigated various technologies and are considering using any one of them, or a combination of different technologies, to make broadband service available to cooperative members. They acknowledged that it might not be possible to deploy fiber-optic cable because of the high cost. Previously, the cooperative invested in a wireless company to provide broadband service, but the company went bankrupt before it could complete the network. Rappahannock officials said they are now considering marketing the services of a satellite broadband provider to customers, rather than constructing a network, primarily due to the expense of building a network.
- **Co-Mo Comm, a Subsidiary of Co-Mo Electric Cooperative, Tipton, Missouri.** Officials told us they considered deploying a wireless broadband network, but decided that the terrain in their area would obstruct wireless signals. They also considered satellite broadband, but cited concerns about speed and latency—that is, the time it takes for a set, or packet, of data to travel from one designated point to another in a network.²¹ They were also concerned about caps on data use that would make satellite service too expensive for larger-capacity users such as businesses. Officials said they decided to deploy a \$1.3 million fiber-optic pilot network, and possibly a larger \$60 million expansion project mainly because their members will need increasing amounts of bandwidth capacity in the future as new applications emerge.

²¹According to a 2013 FCC report, a new generation of satellites has greatly improved overall satellite broadband performance, resulting in decreased latency and improved quality of service. FCC reported that latency for satellites unavoidably remains much higher than for terrestrial services, but with the improvements afforded by the new technology, satellite service will support many types of popular broadband services and applications. *FCC, Measuring Broadband America: A Report on Consumer Wireline Broadband Performance in the U.S.* (Feb 3, 2013).

Existing Infrastructure and Potential Local Assistance to Providers

Project sponsors told us they considered their existing available assets as well as the extent to which assets or assistance from local governments is available to reduce costs for broadband providers. The following are examples of project sponsors who told us using existing assets can improve the business case for deploying broadband:

- **Google Fiber, Kansas City, Missouri.** This private network received assistance from Kansas City to deploy broadband. Kansas City officials counted among the city's available assets ownership of the rights-of-way and city properties, including public parks. The city helped facilitate an agreement for use of certain utility easements—the areas surrounding power lines—for approximately 90,000 utility poles owned by Kansas City Power and Light, a local utility owned by private investors. The city negotiated with Google Fiber the use of these rights-of-way and of city properties free of charge in exchange for the company's construction of a \$250—\$300 million fiber-optic network to serve homes with Internet and video service, as well as an agreement to provide free Internet connectivity to 300 public buildings, schools, community centers, and libraries. As the authority in charge of local regulation, the city streamlined the regulatory process governing permitting, fee waivers, and other requirements to allow for the accelerated construction of the Google Fiber network, and of any other potential future broadband networks. As part of that effort, the city utilized its online permitting system and expedited its reviews of pole attachment applications.
- **Municipal Power Utility, Princeton, Illinois.** The municipality initially installed fiber-optic cable to enhance its internal communications capacity. Princeton officials said the town's mayor then led a subsequent effort to deploy broadband on a larger scale as part of an economic development initiative to attract industrial companies. They said the combined cost for equipment, design, and construction for both networks was approximately \$1.2 million, and they told us they considered their utility crews' previous experience installing the fiber-optic cable as an asset that helped attract an independent service provider to provide broadband service to customers over the network.

Stakeholders Cited Economic, Legal, and Policy Issues in Deploying Broadband in Unserved and Underserved Areas

Economic

Stakeholders we contacted, including project sponsors, broadband providers, and industry experts, told us that broadband deployment projects in unserved and underserved areas face challenging economic issues. As noted above, remote areas generally have high costs to deploy broadband due to the expense of deploying technologies over long distances and potentially difficult terrain to often relatively few potential subscribers. For these reasons, stakeholders told us that being able to cover costs with potential revenues and thus make a return on investment is a key issue to deploying broadband in unserved and underserved areas. Stakeholders told us that deployment costs can be reduced if there is easier access to rights-of-way, public facilities, and conduits already underground. For example, the opportunity to install cellular antennas on public water towers or thread fiber into existing conduit can reduce construction costs while leveraging public infrastructure. Stakeholders also told us that the costs of financing projects affect the projects' overall costs. Project sponsors that could use public-financing, such as municipal bonds, had lower capital costs than private companies and thus could more cheaply finance their projects. Project sponsors that could use revenues from existing services, such as electricity subscribers, had funds available to deploy broadband which allowed them to leverage financing.

Project sponsors noted that the projects receiving federal funds were able to reduce their own costs of the project and obtain better financing terms due to the federal subsidy. However, project sponsors we contacted told us they are challenged by a lack of clear information about which federal funds are available for broadband deployment, which entities can make use of the funds, and how to apply for them. One sponsor from a small town said his staff lacked the expertise necessary to meet reporting requirements tied to using federal funds and his department did not have the financial resources available to hire consultants to assist. Another sponsor in a rural area said paying for telecommunications-engineering

consultants to estimate construction and operating costs was the main challenge the project faced, because without such estimates, the project could not apply for federal funds. We found some trade associations provided educational materials about federal broadband programs, but such associations typically only provided information or resources to their members. We also found the mission of some trade and industry groups steered them to advocate for a particular technology, rather than offering neutral advice on technological alternatives.

Legal

Project sponsors and industry experts we contacted told us that some states have laws that limit or ban companies that are not telecommunications companies from deploying broadband, on the basis that it creates unfair competition. As a result, project sponsors told us they considered their state's legal environment when considering alternate broadband service options. For example, in Vidalia, Louisiana, an official told us that state laws bar any municipality from deploying broadband directly to consumers, so the city is planning to build and own a new fiber-optic network, but will not offer retail service in order to comply with the law and avoid competing with incumbent cable and telephone companies. Instead, a Vidalia official said they will seek to improve broadband service options by offering independent service providers the opportunity to provide Internet, telephone, and video services over the network to the town's approximately 4,000 residents. According to one legal expert who works with states that we contacted, as of May 2013, 20 states had in place restrictions on community broadband services or other public communications initiatives.²² Some of the project sponsors we interviewed said that they had been affected by such laws. For instance, some, but not all, existing public providers in North Carolina are partially exempt from such requirements and can offer broadband service. We spoke to officials from one such provider, the city of Wilson, who said that they built their fiber-optic network before the state law that limits municipalities providing broadband service and were granted an exemption to operate the network which serves 6,000 accounts. However, the officials said they are not permitted to expand the network or otherwise provide telecommunications services outside the county due to the state's requirements, which limit their ability to bring broadband

²²"State Restrictions on Community Broadband Services or Other Public Communications Initiatives (as of May 2013)." The Baller Herbst Law Group, Washington, D.C. May 2013.

service to unserved and underserved areas in the region. While California public entities are generally allowed to provide communications services, Community Service Districts have the authority to provide communications services only as long as no private person or entity is willing to do so.²³ However, if such a private-sector operator emerges, the Community Service District must sell or lease its communications system to that person at “fair market value,” which could be below cost. An official from Lit San Leandro, a private California alternative provider, said two companies were formed as protection against incumbent provider lawsuits, which he said have been directed at some California municipalities for allegedly gaining unfair advantage by using city-owned conduit to compete against a private entity. A cable broadband provider told us that cable companies generally will not invest in broadband deployment in municipal areas that are already receiving public deployment funds because the public funds amount to subsidized broadband service, against which it is difficult for private companies to compete. According to the *National Broadband Plan*, Congress should make clear that state, regional, and local governments have the right to build broadband networks in the absence of private investment.²⁴

Policy

Stakeholders we contacted, including project sponsors and industry participants, noted that there are several policy issues that affect broadband deployments in unserved and underserved areas. First, stakeholders expressed concern that an area’s inaccurate designation on the National Broadband Map can have financial consequences when the map deems an area as served even if not all premises in the area have access to broadband service. For example, an official from an industry group told us accurate mapping is important because without it, areas that are served only by dial-up service can be ruled ineligible for federal broadband deployment funds. In one case, the official said the National Broadband Map shows the top half of an Indiana county as covered by broadband service and the bottom half as not covered, but in reality the entire county only has access to dial-up service (which is not considered broadband). Stakeholders stated that it could be difficult to obtain funding for broadband projects if the entire area is deemed served, so the accuracy of the National Broadband Map is very important. The data on

²³ *Cal. Govt Code § 61100 (af)*.

²⁴ *National Broadband Plan*, recommendation 8.19, page 153.

the National Broadband Map is displayed at the census block level and if one house or building has broadband access, the entire census block is deemed served. Stakeholders told us that this is an issue particularly for remote areas that are part of large census blocks and have premises located long distances from one another and from existing broadband networks.²⁵

Second, project sponsors told us that while they are required to meet the federal benchmark of 4 Mbps download/1 Mbps upload when applying for some types of federal funding, this benchmark generally does not allow for the use of advanced Internet applications such as video conferencing for online education and telemedicine, which project sponsors said their communities would like to have. Stakeholders told us that often universities and hospitals are located far from rural communities and therefore the ability to use online education and telemedicine could reduce the need to drive long distances to get a higher education or see a medical specialist. However, stakeholders stated it was difficult to garner political support and funding for broadband technology projects that provide the higher speeds needed for these advanced applications when the areas have been designated as served by the National Broadband Map. Moreover, stakeholders told us that federal universal service funds were provided to projects that met the federal benchmark although communities wanted projects that provided higher speeds. Stakeholders told us that federal funds could be more effectively used by granting funds to projects that provided the highest broadband speeds rather than to projects providing the federal benchmark. On the other hand, officials from a cable association told us municipal projects in particular result in a mismatch between demand for service and the costs of providing that service, because they tend to deploy the most advanced technology—fiber-optic—to the most remote areas with the least demand.

Third, stakeholders representing cable and telecommunications companies stated that they have policy concerns related to public funds—both federal and local—being used in areas in which there was an existing broadband provider. A trade association representing cable companies noted that federal funds such as Recovery Act grants have been used in areas already served by private broadband providers, such

²⁵A discussion of FCC actions that can help address National Broadband Map accuracy is discussed later in this report.

as cable companies, which built their networks with no public funds. The stakeholders representing cable and telecommunications companies stated that municipalities have used local public funds such as tax revenues to back municipal bonds in areas already served by private broadband providers. A trade association representing cable companies and an industry group representing small-community telephone companies told us that they believe that using public financing to “overbuild” in already served areas is unfair competition in that the private broadband provider has built its network with private capital and does not have the same financial advantages as the municipality. For example, an official from an industry group representing small community telephone companies told us that rather than overbuilding, municipalities should work with telephone companies to upgrade existing broadband infrastructure. The official said municipalities should not be in the business of providing broadband services themselves and, as evidence, cited bankruptcies and judicial opinions involving municipal networks in cities such as Provo, Utah, and Philadelphia, Pennsylvania. In addition, we heard from incumbent service providers that project sponsors that are public entities, such as municipalities, can use their existing infrastructure, property, and facilities to install broadband technologies which can reduce their deployment costs—an advantage that private companies do not have. These incumbent service providers noted that broadband networks proposed by alternate project sponsors generally have not targeted unserved areas without including already served areas, as it is more financially attractive to deploy networks in more densely populated areas that are often already served.

FCC Has Undertaken Various Efforts to Foster Broadband Deployment in Unserved Areas

As one of its primary goals, FCC has several efforts under way to increase broadband deployment, efforts that help to address the economic and policy issues raised by stakeholders. In particular, FCC established the Connect America Fund in the November 2011 USF Transformation Order²⁶ to provide funds for voice and broadband capable networks in areas where there is no private business case to provide broadband—one of the key challenges to deploying broadband.²⁷ As of March 2014, FCC had authorized the Universal Service Administrative Company (USAC)²⁸ to distribute almost \$438 million from the Connect America Fund for projects that, according to FCC, would reach an estimated 637,000 households and businesses by 2016.²⁹ As a condition of receiving funds, FCC requires an eligible telecommunications carrier (ETC) to offer voice and broadband services in its supported service area, meet certain broadband performance requirements, and report regularly on associated broadband performance measures.³⁰ Many project sponsors we contacted said they would like the opportunity to receive support from the Connect America Fund to deploy broadband in unserved and underserved areas, but since they do not have the ETC designation, they are not eligible to receive funding. FCC told us that any entity, including cooperatives and municipalities that meet the requirements for becoming an ETC under Section 214 of the Communications Act, can petition for ETC designation.³¹ However, project sponsors told us they

²⁶*In the Matter of Connect America Fund*, 26 FCC Rcd. 17663, 27 FCC Rcd. 4040 (2011).

²⁷Within the Connect America Fund, FCC created a Remote Areas Fund with a budget of “at least \$100 million annually” to ensure that even Americans living in the most remote areas of the nation, where the cost of providing terrestrial broadband service is extremely high, can obtain service. FCC sought comment on various issues relating to the fund, and in January 2013, FCC sought further comment on the design of the fund. *Id.*, 17657.

²⁸USAC is an independent, not-for-profit corporation designated by FCC as the USF administrator. USAC collects contributions from telecommunications carriers and administers universal service support payments.

²⁹This funding was provided under “Phase I” of the Connect America Fund to spur immediate broadband deployment to unserved locations. *Id.*, 17657. For more information on FCC’s establishment of the Connect America Fund, see [GAO-12-738](#).

³⁰Only ETCs are allowed to receive financial support from the Connect America Fund. ETCs are designated by their states or FCC and have requirements that they must meet, including offering phone service to all premises in the designated service area, reduced rates for voice service plans for low-income populations, and the ability to operate during emergencies. 26 FCC Rcd., 17673.

³¹See 47 U.S.C. § 214(e)(2), (e)(6).

believe they are ineligible to become an ETC because they do not provide the type of phone service that would make them eligible. Although project sponsors we contacted said they provide, or could provide, Voice over Internet Protocol (phone service that is provided over the Internet), they told us they believe such service does not satisfy the ETC phone service requirement. FCC officials told us that FCC has guidance on becoming an ETC and that Voice over Internet Protocol can be acceptable to satisfy ETC requirements.³²

In addition, FCC has taken other actions related to broadband deployment in unserved areas and to address some of the policy issues noted above. For example, FCC acknowledged that some have claimed that the National Broadband Map is not completely accurate and adopted a process by which parties can challenge whether a location was in fact served by an existing provider.³³ Furthermore, as part of FCC's January 30, 2014 Technology Transition Order, FCC adopted an experiment in which it intends to solicit proposals from non-traditional providers, including utilities and municipalities, to deploy wireline or wireless technologies in rural, high-cost areas.³⁴ Providers will be eligible to receive Connect America Funds for projects in high-cost areas and must meet requirements similar to those of ETCs including providing service to all those in a designated service area, reduced rates for voice service plans for low-income populations, and the ability to operate during emergency situations. Providers are not required to be ETCs to apply but, if selected for the program, must be designated an ETC before receiving funding. FCC has stated that it will use the experiment to gain experience and generate data that could help inform its future policy decisions,

³²According to FCC officials, FCC has acknowledged that a provider of Voice over Internet Protocol phone service can obtain the rights available to telecommunications carriers under Title II of the Communications Act if it voluntarily holds itself out as a telecommunications carrier and complies with appropriate federal and state requirements. *IP-Enabled Services*, 20 FCC Rcd. 10245, 10268 (2005).

³³Locations served by existing providers are ineligible for support from the Connect America Fund. According to FCC, over 80 interested parties participated in the first challenge process to, for example, challenge the status of a census block as shown on the National Broadband Map.

³⁴*In the Matter of Technology Transitions*, GN Docket No. 13-5 et al., FCC 14-5, 2014 WL 407096 (F.C.C.) (January 31, 2014). The order is aimed at allowing FCC and the public to evaluate how customers are affected by the historic technology transitions that are transforming voice communications from copper wires to an all-Internet Protocol network using copper, co-axial cable, wireless, and fiber as physical infrastructure.

including those related to streamlining the ETC designation process and whether and how to make support from the Connect America Fund more widely available. In addition, FCC has stated that it will collect information on viable business models that could support the deployment of fiber-optic or other next-generation wired technology in rural areas, despite the challenges in doing so. FCC plans to also gather information on the conditions under which consumers would prefer next-generation wireless services instead of wireline services. Most recently, in April 2014, FCC told us that the FCC Chairman indicated that he had circulated to his fellow Commissioners a draft notice of proposed rulemaking to review the broadband speed benchmark, as well as other issues relating to implementation of the Connect America Fund.³⁵

FCC also provides assistance to help unserved areas deploy broadband by participating in a federal working group that looks at streamlining policies and permitting on federal properties.³⁶ Many rural areas have federal highways and lands and stakeholders told us that attaining rights-of-way is costly, so streamlining federal policies and permitting could expedite broadband deployments and lower costs. The Broadband Deployment on Federal Property Working Group consists of seven federal agencies that plan to develop recommendations to create a more coordinated and consistent approach in implementing agency procedures, requirements, and policies related to access to federal assisted highways, lands, buildings, and rights-of-way and the leasing of federal assets for broadband deployment.³⁷ FCC also provides policy assistance by looking at ways in which broadband capacity and infrastructure could be shared, a step that could lower deployment costs and leverage private participation in broadband projects. For example, in response to a request from FCC's chairman, FCC's Intergovernmental Advisory Committee identified potential ways to use excess fiber capacity to accelerate broadband deployment through public-private partnerships

³⁵As of April 16, 2014, this draft notice of proposed rulemaking was an agenda item for FCC's open meeting scheduled for April 23, 2014.

³⁶FCC was named as a member of the working group established by *Accelerating Broadband Infrastructure Deployment*, Exec. Order No. 13616, § 2, 77 Fed. Reg. 36903 (June 14, 2012).

³⁷Other members of the Broadband Deployment on Federal Property Working Group are the Departments of Defense, Interior, Agriculture, Commerce, Transportation, and Veterans Affairs, and the U.S. Postal Service.

in January 2013.³⁸ Such opportunities include the lease, sale, or trade of broadband capacity with public and private partners, where such an arrangement advances public purposes.

Agency Comments

We provided a draft of this report to FCC for its review and comment. FCC provided technical comments, which we incorporated into the report as appropriate.

We are sending copies of this report to the Chairman of FCC and appropriate congressional committees. In addition, the report will be available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-2834 or goldsteinm@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Contact information and major contributors to this report are listed in appendix III.



Mark L. Goldstein
Director, Physical Infrastructure Issues

³⁸Intergovernmental Advisory Committee to the Federal Communications Commission Policy Recommendation 2013-2 Regarding Public-Private Partnerships in the Expansion of a World-Class Broadband Infrastructure (Sharing of Federally-Funded Broadband). Washington, D.C. January 7, 2013.

Appendix I: Objectives, Scope, and Methodology

This report provides information on (1) what is known about the alternative approaches unserved and underserved areas have used, or attempted to use, and some factors considered in broadband deployment decisions; (2) stakeholders' views on broadband deployment issues in unserved and underserved areas; and (3) efforts FCC has undertaken to foster broadband deployment in unserved areas.

To gather information on the alternatives unserved and underserved areas used, or attempted to use, to deploy broadband, and on stakeholders' views on deployment, we conducted a review of relevant published literature that included government reports, industry articles, and publications from associations, non-profits, and public policy research organizations. We also interviewed telecommunications stakeholders involved in broadband deployment to unserved and underserved areas to obtain their views on the deployment alternatives that unserved and underserved areas used, or attempted to use, their views on broadband deployment issues, and the extent of FCC's role in broadband deployment in these areas. We reviewed and analyzed reports provided by these stakeholders as appropriate. Those we interviewed included associations representing consumers and industry, broadband consultants and providers, and officials from local agencies in selected areas where broadband projects were deployed or attempted. To identify stakeholders, we referred to prior published literature, and we considered the recommendations stakeholders made during our interviews. Table 1 contains a detailed list of the stakeholders included in our study.

Table 1: List of Telecommunications Industry Stakeholders Interviewed

Stakeholder category	Name
Broadband consultants	Jim Baller, Telecommunications Lawyer Design Nine Consultants Lookout Point Communications
Case study projects: cooperative broadband networks	Camino Fiber Network Cooperative, El Dorado County, CA (a consumer telecommunications cooperative corporation) Co-Mo Electric Cooperative, Tipton, MO Douglas Electric Cooperative, Douglas County, OR Midwest Energy Cooperative, Cassopolis, MI Rappahannock Electric Cooperative, Fredericksburg, VA

Appendix I: Objectives, Scope, and Methodology

Stakeholder category	Name
Case study projects: municipal broadband networks	East Central Vermont Community Fiber Network, Royalton, VT Greenlight, Wilson, NC Powellink, Powell, WY Princeton, IL Utah Telecommunication Open Infrastructure Agency, UT Vidalia Broadband Initiative, Vidalia, LA
Case study projects: private company broadband networks	Google Fiber, Kansas City, MO Lit San Leandro, San Leandro, CA Valu-Net, Emporia, KS Vermont Telephone Company, Springfield, VT
Case study projects: regional consortiums broadband networks	Gold Country Broadband Consortium, Auburn, CA MCNC, Research Triangle Park, NC MassBroadband 123, Westborough, MA New Hampshire FastRoads, Keene, NH Golden Bear Broadband—Northern California Regional Middle Mile Infrastructure, Northern CA Vermont Telecommunications Authority, Montpelier, VT
Consumer advocacy group	Institute for Local Self-Reliance
Incumbent broadband providers	Midcontinent Communications Windstream Telecommunications
Municipal officials	Kansas City, MO
National non-profit	Connected Nation
Trade and industry groups	American Public Power Association Fiber to the Home Council National Association of Regulatory Utility Commissioners National Cable and Telecommunications Association National Rural Electric Cooperative Association National Rural Telecommunications Cooperative National Telecommunications Cooperative Association Rural Broadband Initiative United States Telecom Association Utilities Telecom Council

Source: GAO.

To gather in-depth information on the deployment alternatives that unserved and underserved areas used, or attempted to use, stakeholders' views on deployment, and the extent of FCC's role in deployment to these areas, we interviewed officials from 21 broadband network project cases studies and analyzed documents they provided to us. To select the 21 case studies, we analyzed the results of our literature

search and stakeholder interviews to assemble a list of potential broadband network projects in unserved and underserved areas and assigned each to one of four categories of networks established by: municipalities, private companies, regional consortiums, and cooperatives. The potential projects included some networks that were planned but did not come to fruition for various reasons. From these, we selected 21 case studies that represented all four project types and that included public, private, or a mixture of both types of funding. We sought geographic variety by assigning the cases to six U.S. regions: Midwest, Northeast, Northwest, South, West, and Mid-Atlantic, and as we selected cases, we included ones from each region. While there may be valuable lessons in the examples profiled in our case studies, their limited number does not allow us to generalize findings to the broader universe of all entities seeking to deploy broadband networks. The information we present on the deployment alternatives that have been used in our 21 case studies represents information provided by project sponsors. It was beyond the scope of our work to assess the reliability of this information. It was also beyond the scope of our work to determine whether all, or any, of the examples deployed, or not deployed, are the most effective models for broadband network deployment to unserved and underserved areas.

To assess what existing broadband speeds and technologies were available in the case study areas and to compare them to those offered by our case study projects, we took a sample of 6 of our 21 case studies and collected data from those areas from the National Broadband Map, which measures national access to broadband as of December 2012, and depicts available broadband technologies and maximum advertised speeds that are available in the United States.³⁹ Our sample included projects from three municipalities and one each from the private company, regional consortiums, and cooperative categories. Because the National Broadband Map was designed to provide data for one address or one town, and 14 of our 21 networks operated regionally, covering multiple towns, we did not try to determine broadband speeds for all 21 of our case study locations. Instead, we took a sample of the case study networks. To choose the sample, we considered the 7 networks (4

³⁹See <http://www.broadbandmap.gov>. The National Broadband Map reports maximum advertised speeds, not speeds actually delivered. When cities are entered, as they were for our analysis, the map displays providers offering service in the census block that is in the center of that city.

municipals out of 6, and 3 private companies out of 4) that operated in discrete locations, and chose 4 of those: 3 municipals and one private company. We chose a higher number of municipal networks because there were 6 in our case study sample, versus 4 private companies. Because we wanted to include examples of all 4 network types, we also chose one regional consortium network and one cooperative network. Even though all the networks from these two categories were regional in nature, and served large areas with multiple towns, we searched for and found one from each category that served a smaller population for a discrete area that was appropriate to enter into the National Broadband Map. For that reason, we included New Hampshire FastRoads, a regional network that directly serves customers with broadband in two New Hampshire towns, and Co-Mo Comm, a cooperative that serves customers in two Missouri towns as part of a broadband pilot project.

To gather information on stakeholders' views on economic, legal, and other issues they believe affected their ability to deploy a network, we interviewed project sponsors where projects were deployed or attempted and associations representing consumers and industry. The economic, legal, and other issues identified by project sponsors should not be viewed as identifying all issues that could affect broadband deployment in unserved and underserved areas; however, the issues presented were consistently raised by the project sponsors. Also, the economic, legal, and other issues that we report on should not be viewed as being representative of all entities deploying broadband in unserved or underserved areas.

To gather information on actions, if any, FCC has taken to foster broadband deployment in unserved areas, we interviewed FCC officials and analyzed documents they provided us. We also interviewed industry experts, incumbent providers, project sponsors, and stakeholders. In addition, we analyzed the 2010 *National Broadband Plan* and its recommendation that FCC create the Connect America Fund to provide universal service funds in geographic areas where there is no private sector business case to provide broadband. We analyzed the 2011 USF Transformation Order⁴⁰ and the January 2014 Technology Transition

⁴⁰*In the Matter of Connect America Fund*, 26 FCC Rcd. 17663, 27 FCC Rcd. 4040 (2011).

Order,⁴¹ and we interviewed FCC officials about how, if at all, FCC has made enhancements to Connect America Fund eligibility.

We conducted this performance audit from May 2013 to April 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

⁴¹*In the Matter of Technology Transitions*, GN Docket No. 13-5 et al., FCC 14-5, 2014 WL 407096 (F.C.C.) (Jan. 31, 2014).

Appendix II: Selected Information on Broadband Projects in 21 Case Study Areas

We gathered data on broadband projects in our 21 case study areas from interviews we conducted with project sponsors and, in some cases, from documents they gave us. As described in appendix I, we assigned each project to one of four categories. We collected information on scope, status, construction costs, and funding from officials we interviewed. Table 2 summarizes the information we collected from the project sponsors.

Table 2: Attributes of Broadband Projects in 21 Case Study Areas

Project category	Project name and operating status	Project description and infrastructure scope	Project construction costs and federal funding
Cooperative	Camino Fiber Network Cooperative Planned (Inactive)	Network was to provide fiber-optic broadband service over an open-access network for approximately 50,000 residences in El Dorado County, California New middle-mile infrastructure for multiple private Internet service providers to offer last-mile service	Construction cost estimates unavailable from sponsor No federal funding
Cooperative	Co Mo Comm, Co-Mo Electric Cooperative Pilot broadband network: Operational Potential expansion of pilot into larger broadband network: Planned	Fiber-optic network for residences and some businesses with Internet, telephone, and video services in central Missouri New middle and last-mile infrastructure	\$1.3 million pilot project \$60 million (estimated) network expansion No federal funding
Cooperative	Douglas Fast Net, Douglas Electric Cooperative Operational	Hybrid fiber-optic, DSL, and wireless network for residences and businesses with Internet and telephone service in Douglas County, Oregon New middle and last-mile infrastructure	\$6.5 million No federal funding
Cooperative	Midwest Energy Cooperative Internal communications network: Operational Pilot broadband network: Operational Potential expansion of pilot into larger broadband network: Planned	2 existing and 1 potential fiber-optic network projects involving new middle and last-mile infrastructure Communications network delivers smart grid ^a applications for electric utility customers Pilot and potential broadband networks are for serving residences, businesses, and community institutions in southwest Michigan with Internet and telephone service (with video service likely in the future)	\$9.5 million utility communications network, including \$1.4 million USDA RUS loan \$2.9 million for pilot network \$52.8 million (estimated) for planned broadband network Sponsors plan to seek FCC Connect America Fund funding for 50 percent of the construction cost of planned network

**Appendix II: Selected Information on
Broadband Projects in 21 Case Study Areas**

Project category	Project name and operating status	Project description and infrastructure scope	Project construction costs and federal funding
Cooperative	Rappahannock Electric Cooperative Marketing relationship with third-party satellite broadband provider: Planned	Rappahannock Electric Cooperative is considering a partnership with the National Rural Telecommunications Cooperative (NRTC) to offer its mostly residential customers in 22 Virginia counties third-party satellite broadband Internet service which it will market to its members, with NRTC responsible for installation, customer service, and billing No new Rappahannock Electric Cooperative infrastructure	No cost to Rappahannock Electric Cooperative, all costs borne by NRTC No federal funding
Municipal network	East Central Vermont Community Fiber-optic Network Operational	Fiber-optic Internet and telephone service for residences and businesses in 23 Vermont municipalities New infrastructure for last-mile service	\$5 million (estimated) No federal funding
Municipal network	Greenlight Operational	Fiber-optic Internet, telephone, and video service for businesses, residences, schools, and municipal utilities in Wilson, North Carolina New infrastructure using existing city-owned utility lines for last-mile service	\$35 million No federal funding
Municipal network	Powellink Operational	Fiber-optic Internet, telephone, and video service for businesses, residences, schools, a hospital, a junior college, and municipal government entities in the 6,000 person town of Powell, Wyoming New infrastructure using existing city-owned utility lines initially for one exclusive private Internet service provider to offer last-mile service, with other providers able to offer service in the future	\$5 million No federal funding
Municipal network	Princeton Fiber-optic and broadband over powerline ^b networks: Operational	Fiber-optic Internet service to 9 residential customers, 75 businesses, schools, a hospital, a library, and municipal entities in the 7,800 person town of Princeton, Illinois Limited-capacity broadband over powerline Internet service to residents desiring basic service Both networks: new infrastructure using existing city-owned utility lines for last-mile service	\$1.3 million for both networks No federal funding
Municipal network	Utah Telecommunication Open Infrastructure Agency Operational	Fiber-optic broadband service over an open-access network connecting municipal government entities and community institutions, and leasing access to private service providers that provide Internet, telephone, and video services to customers in 10 Utah municipalities New middle-mile infrastructure using existing city-owned utility lines in some locations for multiple private Internet service providers to offer last-mile service	\$177 million, including \$16.2 million NTIA BTOP grant, \$21 million of an up to \$66 million USDA RUS loan (withdrawn by RUS after \$21 million was loaned)

**Appendix II: Selected Information on
Broadband Projects in 21 Case Study Areas**

Project category	Project name and operating status	Project description and infrastructure scope	Project construction costs and federal funding
Municipal network	Vidalia Broadband Initiative Planned	Fiber-optic network for advanced utility applications will be expanded into hybrid fiber-optic and wireless network for Internet, telephone, and video services to customers in the 4,000 person town of Vidalia, Louisiana New middle-mile infrastructure using existing city-owned utility lines for private Internet service providers to offer last-mile service	\$11.7 million No federal funding
Private company	Google Fiber Operational	Fiber-optic broadband service providing Internet and video service to residences in Kansas City, Missouri New infrastructure using existing utility-owned lines for last-mile service	\$250-300 million (estimated) No federal funding
Private company	Lit San Leandro Original network: Operational Network expansion operational by the end of 2014: Planned	Fiber-optic network Internet service over 150 businesses and some community institutions including schools, hospitals, and a library, in San Leandro, California Original and expansion: new and existing infrastructure using city-owned conduit to install fiber-optic lines for last-mile service	\$4-5 million (estimated) \$2.1 million grant from Economic Development Administration
Private company	Valu-Net Operational	Fiber-optic network serving over 305 businesses and over 400 residences with Internet, telephone, and video in the 28,000 person town of Emporia, Kansas New infrastructure for last-mile service	\$12-13 million (estimated) No federal funding ^c
Private company	Vermont Telephone Company Operational	Hybrid fiber-optic and wireless network serving businesses, residences, a local energy utility, and community institutions in 14 Vermont villages with Internet, telephone, and video New middle-mile infrastructure using existing telephone utility lines for middle-mile and last-mile service	\$129.5 million, including \$81.69 million USDA RUS grant, \$35.01 million USDA RUS loan, \$8.96 million NTIA BTOP grant
Regional consortium	Gold Country Broadband Consortium Planned	Broadband network for 5 counties in northern California to be built, owned, and maintained by private Internet service providers using a variety of technologies New middle-mile infrastructure for multiple private Internet service providers to offer last-mile service	Construction cost estimates unavailable from sponsor No federal funding
Regional consortium	MCNC Operational	Fiber-optic, open-access network providing connectivity to 2,700 community institutions in 82 North Carolina counties, with capacity leased to a variety of private telecommunications companies, cooperatives, and local government. New middle-mile infrastructure for multiple private Internet service providers to offer last-mile service to residences and businesses.	\$144 million \$104 million NTIA BTOP grant

**Appendix II: Selected Information on
Broadband Projects in 21 Case Study Areas**

Project category	Project name and operating status	Project description and infrastructure scope	Project construction costs and federal funding
Regional consortium	MassBroadband 123 Operational	Fiber-optic, open-access network serving 122 towns in western and central Massachusetts over a middle-mile backbone that connects more than 1,200 community institutions, including schools, libraries, and hospitals New middle-mile infrastructure for multiple private Internet service providers to offer Internet, telephone, and video services	\$90 million (estimated) \$45.5 NTIA BTOP grant
Regional consortium	New Hampshire FastRoads Operational	Fiber-optic, open-access network providing connectivity to 233 community institutions in 19 communities in western New Hampshire, and 1,300 homes and businesses in 2 towns, with last-mile capacity leased to private providers New middle-mile infrastructure to connect 19 towns, which can be expanded for last-mile service by private Internet service providers	\$7.6 million \$5.4 NTIA BTOP grant
Regional consortium	Golden Bear Broadband - Northern California Regional Middle Mile Infrastructure Planned (Inactive as of February 2014)	Hybrid fiber-optic and wireless open-access network for businesses, residences, and community institutions in 16 counties in northern California with Internet, future service was to include telephone (through a 3rd party contracted company), and video New middle-mile infrastructure for multiple private Internet service providers to offer service	\$138 million (estimated) No federal funding, although sponsors had planned to seek grants from FCC's Connect America Fund and loans from USDA's Rural Broadband Access Loan and Loan Guarantee Program
Regional consortium	Vermont Telecommunications Authority Operational	The state-chartered Authority provides grants using a variety of technologies for open-access middle and last-mile broadband projects in unserved and underserved areas, which recipients use for broadband expansion, cellular service infrastructure, and fiber-optic infrastructure projects for businesses, residences, local government, and community institutions New middle and last-mile infrastructure leased to multiple Internet service providers to offer service	\$60 million (since 2007 inception, however besides deploying broadband infrastructure, funds also have gone toward broadband mapping and cellular projects) \$35.8 million in federal funding, including \$33.4 million NTIA BTOP grant, \$1.6 million Economic Development Administration grant ^d \$219,898 Northern Borders Regional Commission grant

Source: GAO based on project sponsor interviews and documents.

^a According to the Department of Energy, a "smart grid" is an automated, widely distributed energy delivery network characterized by a two-way flow of electricity and information made possible by distributed computing and communications. Smart grid systems can monitor everything from power plants to customer preferences and individual home appliances, and they allow real-time information that can better balance supply and demand.

^b FCC defines broadband over powerline as the delivery of broadband over the existing low- and medium-voltage electric power distribution network. Broadband over powerline speeds are comparable to DSL and cable modem speeds, and can be provided to homes using existing electrical connections and outlets. See http://www.broadband.gov/broadband_types.html.

^c Valu-net received a low interest Small Business Administration loan through a local bank.

**Appendix II: Selected Information on
Broadband Projects in 21 Case Study Areas**

^d The Department of Commerce's Economic Development Administration has programs that support the construction of public infrastructure, which could include broadband infrastructure.

We compared existing broadband network speeds to those offered by alternative fiber-optic networks for a sample of our case study locations, as shown in table 3. We found that speeds for wired services in some of our case study project areas varied depending on the extent of fiber-optic technology deployed, and that alternative network speeds were generally faster than speeds offered by existing networks. Our results showed that some alternative networks offered speeds substantially higher than existing networks, while for others the differences were slight. Alternative network speeds differed less from incumbent cable company network speeds than they did from telephone company DSL networks. As shown, wireless service was available in all the six areas, though speeds were much slower than wired technologies. Because each of the six areas featured multiple wireless providers, for our illustrative purposes, we chose the one provider that served all areas, Verizon, for inclusion in the table.

Table 3: Selected Examples of Wireline and Wireless Broadband Technology and Speeds for Alternative and Existing Networks

Case study project network	Existing wired networks			Existing wireless network
Municipal: Greenlight Fiber-optic network Download: 100 Mbps – 1 Gbps Upload: 100 Mbps – 1 Gbps	@ Communications DSL network Download: 10 – 25 Mbps Upload: 1.5 – 3 Mbps	Centurylink DSL network Download: 10 – 25 Mbps Upload: 1.5 – 3 Mbps	Time Warner Cable Cable network Download: 50 – 100 Mbps Upload: 3 – 6 Mbps	Verizon Mobile Wireless Download: 768 kbps – 1.5 Mbps Upload: 200 – 768 kbps
Municipal: Powellink Fiber-optic network Download: 10 – 25 Mbps Upload: 3 – 6 Mbps	Centurylink DSL network Download: 10 – 25 Mbps Upload: 768 kbps – 1.5 Mbps	CSC Holdings Cable network Download: 10 – 25 Mbps Upload: 768 kbps – 1.5 Mbps		Verizon Mobile Wireless Download: 768 kbps – 1.5 Mbps Upload: 200 – 768 kbps
Municipal: Princeton Fiber-optic network Download: 1 Gbps + Upload: 1 Gbps +	Comcast Cable network Download: 100 Mbps – 1 Gbps Upload: 10 – 25 Mbps	Frontier Communications DSL network Download: 3 – 6 Mbps Upload: 768 kbps – 1.5 Mbps	MTCO DSL network Download: 6 – 10 Mbps Upload: 768 kbps – 1.5 Mbps	Verizon Mobile Wireless Download: 10 – 25 Mbps Upload: 3 – 6 Mbps

**Appendix II: Selected Information on
Broadband Projects in 21 Case Study Areas**

Case study project network	Existing wired networks		Existing wireless network
Private: Valu-Net Fiber-optic network Download: 50 – 100 Mbps Upload: 25 – 50 Mbps	AT&T DSL Download: 10 – 25 Mbps Upload: 768 kbps – 1.5 Mbps	Cable One Cable Download: 50 – 100 Mbps Upload: 1.5 – 3 Mbps	Verizon Mobile Wireless Download: 10 – 25 Mbps Upload: 3 – 6 Mbps
Regional: New Hampshire FastRoads Fiber-optic network Download: 5 – 50 Mbps Upload: 5 – 50 Mbps	Comcast Cable network Download: 100 Mbps – 1 Gbps Upload: 50 – 100 Mbps	Fairpoint DSL network Download: 1.5 – 3 Mbps Upload: 768 kbps – 1.5 Mbps	Verizon Mobile Wireless Download: 768 kbps – 1.5 Mbps Upload: 200 – 768 kbps
Cooperative: Co-Mo Comm Fiber-optic network Download: 100 Mbps – 1 Gbps Upload: 50 – 100 Mbps	Centurylink DSL network Download: 10 – 25 Mbps Upload: 1.5 – 3 Mbps		Verizon Mobile Wireless Download: 10 – 25 Mbps Upload 3 – 6 Mbps

Source: GAO analysis based on data gathered from the National Broadband Map and project sponsors.

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

Mark Goldstein, 202-512-2834, or goldsteinm@gao.gov.

Staff Acknowledgments

In addition to the contact mentioned above, Sally Moino, Assistant Director; Amy Abramowitz; Gary Guggolz; Bert Japikse; Maureen Luna-Long; SaraAnn Moessbauer; Joshua Ormond; and Hai Tran made key contributions to this report.

GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's website (<http://www.gao.gov>). Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. To have GAO e-mail you a list of newly posted products, go to <http://www.gao.gov> and select "E-mail Updates."

Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, <http://www.gao.gov/ordering.htm>.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

Connect with GAO

Connect with GAO on [Facebook](#), [Flickr](#), [Twitter](#), and [YouTube](#).
Subscribe to our [RSS Feeds](#) or [E-mail Updates](#). Listen to our [Podcasts](#).
Visit GAO on the web at www.gao.gov.

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Website: <http://www.gao.gov/fraudnet/fraudnet.htm>

E-mail: fraudnet@gao.gov

Automated answering system: (800) 424-5454 or (202) 512-7470

Congressional Relations

Katherine Siggerud, Managing Director, siggerudk@gao.gov, (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov, (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, DC 20548

