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Comments on Proposed BEAD Alternative Broadband Technology Guidance

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We are responding to NTIA’s request for comments on its “Proposed BEAD Alternative Broadband Technology Guidance.” Our analysis leads to two key policy suggestions so NTIA and the implementing states (“Eligible Entities”) can achieve the goals of the legislation and enhance overall benefits from the BEAD funding.¹

Key policy recommendations:

1. NTIA should be flexible about the level of Extremely High Cost per Location (EHCPL) to ensure Eligible Entities can maximize total benefits from their grants.
2. Eligible entities should decide on a maximum EHCPL and maximum differential between fiber and alternative technologies for subsidy money *before* accepting bids from providers.

Key economic observations driving the recommendations

The fundamental concept policymakers must explicitly confront is tradeoffs: More of a good thing, like broadband quality, means less of other good things. Policymakers can make informed tradeoffs by understanding how much their citizens value the components of the tradeoffs. The following factors, at the highest level, reflect the key tradeoffs and information needed to determine the best answers.

1. Costs to provide service. The costs to build and maintain fiber, terrestrial wireless, and low earth orbiting (LEO) satellite connections differ, especially in unserved areas targeted

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¹ These comments are limited to the narrow question of Alternative Broadband Technologies. We (along with other economists) provided more extensive guidance for BEAD programs in state broadband proceedings. Those comments are attached as Appendix A to these comments.

by BEAD funding. Generally, fiber has very high fixed costs to connect homes and relatively low ongoing costs of service. In contrast, LEO satellites, once a system is launched and operational, have relatively low connection costs (a receiving dish) but high costs of service (additional satellite launches and opportunity cost of capacity). Terrestrial wireless generally falls in between these two on both aspects. Maximizing social welfare in most cases requires including terrestrial and satellite wireless technologies along with fiber as possible means to provide service.

2. Opportunity costs. BEAD spending has an opportunity cost, even within the constraints imposed by the Infrastructure Investment and Jobs Act (IIJA). A dollar spent on connections is a dollar not available to spend on other priorities such as broadband equity programs. The IIJA did not specify that all of the money should be spent on connecting unserved locations and did not specify fiber everywhere. In fact, it expressly included other possible uses of the money.
3. Preferences. In addition to the cost and opportunity cost of the funds discussed in 1 and 2 above, many other factors affect the net present social value of a broadband connection, including how much people value the incremental broadband quality that fiber can provide and the time they must wait for connectivity.

The remainder of this submission explains these economic observations in more detail and how they lead to the policy recommendations. We mostly focus on the differences between fiber and LEO satellite for expositional ease and recognize that the additional competitive benefits of terrestrial wireless are also important for universal service policy.

BEAD Should Maximize Total Net Benefits While Connecting All Unserved Areas

BEAD's main goal is to serve all unserved locations. Another way to think about how best to spend BEAD funds is that they should maximize consumer welfare while serving all unserved locations. Doing so requires taking into account the different ways, costs, and levels of service that make it possible to serve all unserved locations, how much people value each, and what can be done with leftover funds.

NTIA should address these tradeoffs explicitly now rather than after providers bid on service to high-cost areas. Ignoring those tradeoffs is the easiest approach, but implicitly assigns zero value to factors other than fiber connectivity, making it impossible for states to create coherent plans that generate the most value for their citizens.

Consider a back-of-the-envelope thought experiment. Even \$42 billion (plus the billions more over many years and different programs) is not enough to connect every location to fiber optic

service.² It may, however, be more than enough to connect all unserved locations to LEO satellite internet service, subsidize years of service, even at a retail price of \$500 per antenna,³ and have funds left over for other broadband-related programs.

To be clear, we are not suggesting LEO as the sole solution. That would almost certainly be inefficient for a host of reasons. Fiber provides higher quality than satellite service. The net present value of costs for some locations will be lower with fiber. LEO service may not have enough capacity to provide sufficiently high-quality service for such a large influx of customers.

Instead, the point of the thought experiment is to show how much money could remain for other important broadband-related objectives if states are allowed to spend funds efficiently, which means allowing flexibility in how they define the EHCPL.

A Framework for Defining the Tradeoffs

NTIA provided some guidance in its NOFO about the tradeoff. “NTIA expects Eligible Entities to set the Extremely High Cost Per Location Threshold as high as possible to help ensure that end-to-end fiber projects are deployed wherever feasible.” (NOFO, p-13). Unfortunately, this language does not help evaluate the tradeoffs because it does not define “feasible.” Feasible could mean fiber to as many locations as possible given the allocated funds, even if that leaves some locations unserved. Feasible could mean fiber to as many locations as possible as long as all other currently unserved locations are served by an unpriced alternative technology. Or, as we would hope, feasible could mean maximizing social benefits overall by considering demand and the alternative uses of the subsidy money within the constraints of the legislation.

No Eligible Entity has set a concrete definition either. Instead, they seem to be waiting to see how much fiber providers say their costs will be before setting a level. It is like deciding to buy a Cadillac when the dealer knows how much money you have, you haven’t decided how much you are willing to spend on the Caddy, and only after you learn you can’t afford the car of your dreams do you start to think about how much less a Ford would cost instead and what you could do with the leftover money.

Most people don’t buy cars this way, of course. Instead, they do their research beforehand, decide how much the car is worth to them, what other cars cost, and consider how much they value being able to buy groceries with the leftover money. State broadband officials need to do the same.

² In November 2023 the FCC reported 7.2 million locations without access (excluding satellite). <https://www.fcc.gov/news-events/notes/2023/11/17/national-broadband-map-30-thankful-continued-improvements#:~:text=The%20number%20of%20unserved%20homes,map%20was%20released%20in%20May.>

³ Or possibly less. As of September 7, 2024, the antennae were available for \$299, although that appeared to be a promotion. <https://www.starlink.com/us/residential>. The program requirements (guaranteed speed and levels of quality, rapid availability, etc.) may lead to a higher price for monthly residential service while guarantees of bulk purchases may lead to lower monthly prices.

The cost to provide a specified level of service to a specific location over a set number of years consists of two main components. The first is the initial cost of building the connection. The second is the ongoing cost of providing service, which includes maintenance and upgrades, to that location once it is connected.

Represented mathematically, C_f , the total net present cost of fiber is a function of the fixed cost of building out the fiber, F_f , the annual cost of maintenance and upgrades, M_f , the discount rate r , and the relevant time horizon, N .

$$C_f = F_f + \sum_{t=1}^N \frac{M_f}{(1+r)^t}$$

Similarly, C_a , the total net present cost of an alternative technology is a function of the fixed cost of building out the alternative technology, F_a , the annual cost of maintenance and upgrades, M_a , the discount rate r , and the relevant time horizon, N .

$$C_a = F_a + \sum_{t=1}^N \frac{M_a}{(1+r)^t}$$

In areas where the cost of installing fiber, F_f , is high, the net present cost of fiber may exceed the net present cost of the alternative technology, which does not vary by geography for LEOs and varies differently for terrestrial wireless.

Cost, however, is not the only factor in determining which is the socially better option. Fiber can be the preferred technology even when the net present value of its cost is higher than the cost of the alternative technology, but only up to some level of quality and at some time difference in availability.

Two features of demand affect the choice. First, people value the higher quality of fiber, although the incremental value they place on quality decreases as quality increases. Second, people value service they can receive tomorrow more than service they will receive in five years.

Again, represented mathematically, the net present benefits of fiber broadband, B_f , and the alternative technology, B_a , are a function of how much people value the quality of fiber broadband, $V(Q_f)$, and the alternative technology, $V(Q_a)$, where fiber benefits begin to flow T_f years after the grant is made and benefits from the alternative technology begin to flow T_a years after the grant is made. $T_a < T_f$, but even though some can connect immediately, others will have to wait as the system increases capacity.

$$B_f = \sum_{t=T_f}^N \frac{V(Q_f)}{(1+r)^t}, \quad B_a = \sum_{t=T_a}^N \frac{V(Q_a)}{(1+r)^t}$$

$V(B_f) > V(B_a)$ in each time period, but the functions are concave in speed and other factors, reflecting consumers' diminishing marginal value of higher quality. That is, for example, people highly value the difference between 5 Mbps and 50 Mbps but place less value on the difference between 100 Mbps and Gigabit service.

Given the benefits and costs, some combination of technologies will be the right answer if the goal is maximizing consumer welfare subject to connecting every location. The question is how NTIA should guide eligible entities to determine where that tradeoff should be.

The point at which fiber becomes inefficient will differ by state. However, all states are likely to have some locations that are expensive to serve with fiber, and every state should set a tradeoff in advance to maximize their chance of connecting all locations for a reasonable amount of money and ensuring high quality to all.

Regulators should set an upper bar on the difference that should be spent on fiber over alternative technologies that meet NTIA's performance standard.⁴ Understanding how consumers value the difference in service quality is an important feature of determining the differential the government should then be willing to subsidize to maximize social welfare. Without thinking about the incremental social benefits of fiber, it is impossible to determine if the government is over or under subsidizing fiber.⁵

In setting the EHCPL threshold, states should consider what else they can do with the money they would save. Although we don't know of studies that have investigated the effectiveness of adoption programs, it is possible that some, like a state ACP, could help low-income households. To start, the number of households with broadband availability, even excluding satellite, is larger than the number where terrestrial service is not available.⁶ So, to paraphrase Willie Sutton (apocryphally) go where the unconnected people are, especially if it might be less expensive to connect them.

Finally, NTIA must set performance limits for alternative technologies to be considered. For example, NTIA decreed that 100 Mbps would be the minimum download speed. We are unsure if that is the right level, but it seems sufficient for most home uses for several years.

⁴ Fiber is not necessary for the vast majority of today's services. See Rosston, G. and Wallsten, S. "[Overhauling the Universal Service Fund: Aligning Policy with Economic Reality](#)," The 100mbps standard is above what is generally needed for a family of four so that it should satisfy most households for some time.

⁵ Many rural residents in "unserved" locations already subscribe to satellite internet service with no subsidy. For example, Ted Turner's luxury guest ranches (<https://tedturnerreserves.com/vermejo/>) in rural New Mexico are "underserved" but provide satellite internet service to their guests. (Source: phone call with guest services, 9/6/2024). Given service availability, income-based vouchers would be a better overall solution, but that is beyond the scope of the NTIA information request.

⁶ The distribution of people is approximately 80% Urban and Suburban and 20% rural. <https://www.census.gov/newsroom/press-releases/2022/urban-rural-populations.html>. Pew reports that 23% of Urban, 14% of suburban, and 27 of rural households do not have home broadband. <https://www.pewresearch.org/internet/fact-sheet/internet-broadband/?tabItem=89fe9877-d6d0-42c5-bca0-8e6034e300aa>. From these numbers (using the midpoint of urban and suburban), we can calculate that almost three times as many unconnected homes are in urban/suburban areas (14.5%) as in rural areas (5.4%).

Another feature that should be considered is speed to deployment. NTIA has said that deployment should be within four years. We hope that will be an enforceable standard. If it is, there is still a consideration of alternative service that can be delivered much sooner and how much is the early service worth to those with no home service.

APPENDIX A – Economists Comments Submitted in State BEAD Proceedings

Economists’ Comments on State BEAD Proposals¹

December 2023

Michelle Connolly (Duke University)
Janice Hauge (University of North Texas)
Mark Jamison (University of Florida)
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Introduction

Congress found that “Access to affordable, reliable, high-speed broadband is essential to full participation in modern life in the United States.” (IIJA, 60101 (1)). We write to provide

¹ We are scholars who have studied telecommunications and broadband for several decades, have served at the Federal Communications Commission, and provided advice to state and local regulatory agencies. Affiliations are for identification – the views represented here are our own. Corresponding author: grosston@stanford.edu.

economic insight to help the state maximize the benefits of its Broadband Equity Access and Deployment (BEAD) and other funds for its residents. We are happy to talk with state staff about these (or other) ideas.

Several economic concepts are critical to maximizing the benefit of the BEAD money for state residents.

- BEAD money is limited. A dollar spent for one use cannot be used for another.
- Prices set by competition usually result in more efficient outcomes than prices set by regulators.
- Consumers care whether they can get sufficient service when and where they want, not which technology underlies the service.
- Service today is worth more than tomorrow. The longer the delay in providing service, the more detrimental to people forced to wait.
- Risks of non-performance should fall on the party best able to bear and control that risk. A party is less likely to perform if it faces few or no consequences for failing to fulfill its promises.
- Every decision involves tradeoffs. For example, attempting to provide the highest quality of broadband everywhere makes it more difficult to provide affordable access to the greatest number of people.

We recommend that the state adopt the following five rules to maximize the BEAD benefit:

1. Set a specific and measurable (i.e., quantitative) scoring mechanism for selecting among subsidy applicants to maximize competition and keep BEAD buildout costs down.
2. Allow suppliers of all technologies to compete, without preference over technologies, to provide sufficient service for state residents.
3. Determine geographic service areas for bidding before the competition.
4. Ensure that applicants have the capability to perform on their promises of delivering service, and ensure subgrantees do perform.
5. Any price commitments as part of the selection process should be tied to prices for similar service in unsubsidized areas.
6. Determine and communicate in advance specifically how the projects will be evaluated.

Key economic recommendations

Ensure competition for awards

The Infrastructure Investment and Jobs Act (IIJA) requires states receiving grant funds “...to *competitively* award subgrants...” (IIJA, 60102 (f), *emphasis added*). As such, the National Telecommunications Information Agency (NTIA) included several references to competition in

its Notice of Funding Opportunity (NOFO).² For example: “Include a detailed plan to competitively award subgrants” (NOFO, p-31); “Each Eligible Entity must establish fair, open, and competitive processes for selecting subgrantees.” (NOFO, p-35); “When selecting subgrantees for non-deployment uses of BEAD funds, an Eligible Entity must adhere to the Infrastructure Act’s requirement that subgrants be awarded “competitively.” (NOFO 40, footnote omitted).

Competition in the award process is important not merely to comply with the law, but also to ensure that the money makes broadband access available to as many people as possible for the lowest possible cost. Without competition, subgrantees may charge much higher prices leading to fewer people connecting to broadband services.

The best way to create competition for the BEAD money is to make providers compete to serve well-defined areas in a process with clear guidelines for how winners will be chosen. Auctions provide one of the best ways to create this competition to provide service at the lowest price. While auctions can be run in several ways, the keys are to set clear rules in advance, establish mechanisms to prevent non-competitive outcomes, and ensure that the subsidy recipients follow through on their commitments.

A successful auction for service to unserved areas requires details to be set in advance. Luckily, the FCC has built a framework for these details that states could use completely or in part. The FCC’s Rural Digital Opportunity Fund (RDOF) auction would be a useful starting point for the state in setting up an auction. The RDOF auction allowed the FCC to spend only \$9 billion to serve areas that its cost model had predicted would cost more than \$26 billion to serve.³ Companies were willing to commit to provide service with much lower subsidies than the government thought would be required.

A reverse auction requires setting a reserve, or starting, price that should be the state’s highest willingness to pay for coverage of that area. Competition can drive down the price and allow states to use the leftover money to enhance service in underserved areas or provide assistance to low-income households. If the states do not set up a competitive mechanism like an auction, they will likely end up paying the reservation (highest) price, which is probably more than they need to spend and ultimately takes money away from other beneficial broadband uses.

The company with the highest-scoring bid (based on subsidy, cost per household served, and other service characteristics including consumer price) to provide service in an area would receive a subsidy and be responsible for serving all locations in that area. Any company would be eligible to win a subsidy for multiple areas, as discussed below.

² Notice of Funding Opportunity, available at <https://broadbandusa.ntia.doc.gov/sites/default/files/2022-05/BEAD%20NOFO.pdf>.

³ See, FCC, “Successful Rural Digital Opportunity Fund Auction to Expand Broadband to over 10 million Rural Americans” Dec 7, 2020, available at <https://docs.fcc.gov/public/attachments/DOC-368588A1.pdf> Such discounts from expected levels also occurred in other FCC subsidy auctions for wired and wireless service.

Set performance standards, not technology mandates

People do not care how they get broadband; instead, they care about what their broadband service allows them to do. Broadband is not an end in itself. Broadband is a means to an end for people – getting online and using the internet for business, entertainment, education, and other things. Just like the people it serves, the state should care most that people get online at high enough speeds and low enough latency so that they have the ability to use services they want without a preference regarding the underlying technology.

Congress agreed with this idea when it said that all locations should be connected to “reliable broadband service” and defines such service as “broadband service that meets performance criteria for service availability, adaptability to changing end-user requirements, length of serviceable life, or other criteria, other than upload and download speeds [see next paragraph], as determined by the Assistant Secretary in coordination with the Commission.” IJJA § 60102(a)(2)(L).⁴ NTIA identified a variety of “reliable” broadband technologies: fiber, cable coax, DSL, and terrestrial wireless. NTIA’s list does not include terrestrial wireless with only non-exclusive spectrum or satellite broadband technologies although neither is explicitly excluded by Congress.

Congress also determined that “unserved areas” did not have reliable broadband service providing at least 25 megabits per second (Mbps) download and 3 Mbps upload. (IJJA, 60102 (a)(1)(A)). Congress defined an “underserved area” as one that did not have reliable broadband service of at least 100 Mbps download and 20 Mbps upload. (IJJA, 60102 (a)(1)(C)). Congress did not specify symmetric upload and download speeds. Symmetry requirements may not be necessary, may favor certain technologies, and may increase cost.

Starting with these definitions, NTIA determined that subgrant awards should prioritize fiber over other technologies even though the other technologies might already be providing reliable service to areas that Congress’s definition would determine were neither unserved nor underserved. (NOFO, p-7, NTIA).

Essentially, NTIA has told states to choose fiber-based projects over all other projects unless the cost is too high. While NTIA will allow states to award grants to entities using other “reliable” technologies, it did not provide guidance or a rationale for how much less expensive these reliable technologies would have to be to receive an award when a fiber-based provider was willing to serve an area.

⁴ NTIA determined that “[f]or the purposes of this definition, the Assistant Secretary adopts the criteria that Reliable Broadband Service must be (1) a fixed broadband service that (2) is available with a high degree of certainty, (3) both at present and for the foreseeable future, and finds, after coordination with the Commission, that the definition of Reliable Broadband Service set forth in this NOFO best meets those criteria” (NOFO 15) It further determined that “[t]he term “Reliable Broadband Service” means broadband service that the Broadband DATA Maps show is accessible to a location via: 10 (i) fiber-optic technology; (ii) Cable Modem/ Hybrid fiber-coaxial technology; (iii) digital subscriber line (DSL) technology; or (iv) terrestrial fixed wireless technology utilizing entirely licensed spectrum or using a hybrid of licensed and unlicensed spectrum. (NoFo 15, footnotes omitted)

NTIA included a concept of the “Extremely High Cost Per Location Threshold,” but provided little guidance about what that level should be: “NTIA expects Eligible Entities to set the Extremely High Cost Per Location Threshold as high as possible to help ensure that end-to-end fiber projects are deployed wherever feasible.” (NOFO, p-13). At such levels, other reliable providers may be allowed to provide service. If none of them are willing, then satellite or unlicensed terrestrial wireless providers may be allowed to provide service.⁵

Because NTIA did not define a threshold or what it means by “feasible,” the state will need to determine what level is too high to preclude competition from other reliable technologies. The higher the level that a state sets, the more money that will be spent on connecting very high-cost locations and the less money that will be available for other programs. NTIA also states a preference to minimize the amount of BEAD outlay for projects (NOFO, p-20), which may conflict with setting a high threshold.

The state should evaluate the tradeoffs and decide explicitly how to balance them in their competitive process. For example, exactly how much more is the state willing to pay for its citizens to have 1 Gbps service than 100 Mbps service? And if the BEAD and other support is not enough to connect every household in the state, what is the acceptable tradeoff between spending extra money to provide 1 Gbps service instead of 100 Mbps service to a household and not connecting another household in a high-cost area at all?

The FCC’s RDOF auction made the tradeoffs explicit by penalizing, but not prohibiting, slower speeds.⁶ That way if, for example, a state would be willing to pay 20% less for 100 Mbps than 1 Gbps service, a slower speed provider could win if it offered to provide service for 30% less.⁷

Setting a very high threshold for allowing competition will be expensive

States have a large but limited amount of money to give out. Congress identified possible uses for the money to connect people to broadband service. A large portion of the money is likely to be used for high-cost rural areas. Congress also contemplated other uses for the money in the IJA, including broadband adoption (IJA, 60102 (f)(5)). Nationally, roughly 75% of unconnected households already have access to terrestrial broadband but do not subscribe. As a result, states face a tradeoff between spending additional dollars for very high cost fiber buildout

⁵ Note that the NTIA rules are unclear about the possible use of reliable non-fiber technologies in areas that are not Extremely High cost. “If no Reliable Broadband Service technology meeting the BEAD Program’s technical requirements would be deployable for a subsidy of less than the Extremely High Cost Per Location Threshold at a given location, an Eligible Entity is authorized to select a proposal involving a less costly technology for that location, even if that technology does *not* meet the definition of Reliable Broadband Service but otherwise satisfies the Program’s technical requirements. In this instance, Eligible Entities are directed to seek out the most robust, affordable, and scalable technologies achievable under the circumstances particular to that location.” (NOFO 38-39)

⁶ FCC, <https://www.fcc.gov/auction/904#technology>. The FCC set out that if it did not exhaust its budget, it would grant the highest speed service provider the subsidy at the going price if there was no other comparable provider.

⁷ In setting penalties for lower speeds, the state should understand how other factors affect service quality. For example, constraints on in-home WiFi service due to factors like low-quality equipment and house design and construction materials, can affect the quality people experience. As a result, the state may set a lower speed penalty.

and spending that money on other broadband programs that might get people online in different ways.

NTIA sets forth criteria for non-deployment uses: "...an Eligible Entity that can demonstrate it has a plan for bringing affordable, high-speed broadband service to all unserved and underserved locations within its jurisdiction may also allocate funding to non-deployment activities." (NOFO, p-39). As such, NTIA implicitly recognizes the tradeoff.

An efficient mechanism would account for the relative effectiveness of the different programs to get people online and allocate relatively more to programs that promise to be more successful at meeting the program goals. Even a change that could save five percent of the state's BEAD money from stringing fiber to very expensive rural buildout areas could lead to a large overall amount available for connecting other state residents. Well-defined, explicit, tradeoffs allow the state to say that very high-cost premiums to provide somewhat better service may not be worth the opportunity cost of using the money instead for something else, like free WiFi service in low-income buildings.

A reasonable method for determining the threshold would be to determine how much more the state would be willing to pay for different speeds of service and to have a maximum amount spent on high-cost rural buildout. With enough competition for the subsidies, the state might not spend the rural area maximum. If the state does hit the budget, then it should decrease the penalty for less speedy (or "reliable") technologies to provide service to as many locations as possible within the budget.

Geographic Areas

While it is tempting for a state to allow potential providers to divide up service areas on their own, that approach is likely to have detrimental effects. First, it can reduce competition as potential competitors explicitly or implicitly remove overlaps with other potential providers, increasing subsidy costs.⁸ Second, having potentially overlapping areas would require complicated rules or allow negotiations among competitors to divide areas, which would also make it possible for providers to gerrymander areas favorable to them. Instead, designating areas and allowing all providers to compete for those areas will preclude inefficient geographic division and increase competition, and increases the chances that truly unserved areas have bidders.

⁸ Another tool to reduce collusion is to reveal the awards for all areas in a state at the same time. Many studies have shown that collusion depends on "tit for tat" strategies that are based on sequential awards as has happened with highway construction projects. In these kinds of bidding rings, firms trade who wins the next project even though the bids are supposed to be anonymous. That way they can submit high bids and still win projects. If a firm "cheats" by submitting a competitive bid and winning when it shouldn't, then the next time when it is that firm's turn to win, the other firms can punish it by also bidding low. So, this "mutually assured destruction" is a mechanism to keep the cartel in place. Revealing all winners at the same time takes away the ability to punish cheating so the tit for tat strategy will not work and each bidder will be wary that the others will bid low so they will also.

While defining geographic areas in advance is key, it is also important to remember that economies of scope across areas may exist. That is, in some cases providing service to one area may only be economically viable if the provider also wins adjacent areas that can share infrastructure such as backhaul. As a result, while providers should not be able to divide up areas, it may be useful to allow them to bid for combinations of areas, at least in some limited fashion. In this way, a firm can express its willingness to provide service at different levels of subsidy depending on the magnitude of nearby areas for which it is also awarded subsidies. The FCC's RDOF auction implemented a form of package bidding that allowed some expression of desire for groups of areas. This mechanism can be used or adapted for state BEAD auctions.

Time to provide service matters

Service today is worth more than service in the future. Because different technologies have different cost structures and input requirements, providers may have very different timelines for initiating service to new areas. The state should explicitly consider in its criteria for awarding subsidies how long it would take to provide service. Service promised in four to ten years from receiving an award should be worth less than service promised within a year. If it is truly critical for citizens to have broadband, then presumably we should get it to them as quickly as possible, all else equal.

To incorporate time, the state could set scoring penalties for longer time-to-service, much like it sets penalties for lower speeds. For example, a bid could have no penalty for service delivered within two years; 10% penalty for service between two and three years; 25% for service between three and four years; and so on. See Table 1 below for an example of how that would work.

Align Incentives to fulfil service promises

States should make rules clear to make it difficult for participants to try to redefine areas they are required to serve to exclude some high-cost location, change commitments, come back to the state for additional money, or petition to exclude other bidders after the auction. With clear rules upfront, bidders will have the strongest incentives to bid truthfully and competitively.

The FCC's RDOF auction had two procurement-related problems. These problems were not related to the fact that the FCC was using auctions, these were selection mechanism problems that should be avoided regardless of the procurement mechanism employed.

First, the pre-auction maps identifying unserved locations were not accurate. Many areas that the FCC deemed "unserved" and included in the auction actually had service. Many of those were taken back post-auction and will not receive subsidies, but mistakes can affect the auction's integrity and efficiency. The FCC's newer maps, along with states' own efforts to increase the

accuracy of those maps, should help keep this problem to a minimum, although it is important to understand that all maps have errors.⁹

Second, the FCC effectively changed its eligibility rules after the auction. Specifically, after the auction the FCC deemed parties that were awarded subsidies ineligible. Some providers did not qualify as eligible telecommunications carriers within the states they wanted to serve. States should not face this problem if they verify eligibility before the competitive bidding process and award of the grants. The FCC disqualified one provider after the auction because the FCC decided that the provider would not be able to meet its promised speeds in the future. Rather than disqualifying this provider and delaying service, the FCC should have ensured that the provider complied with its promises or forfeited its subsidy plus a penalty. Similarly, the state should set firm criteria for eligibility and stick to them.

The states need to make sure providers live up to their promises by building the necessary conditions into their awards. Potential providers should be given the money only when the service is complete, not simply as a matter of cost reimbursement. Because the potential providers will have a government guarantee of the money, they should be able to go to the private capital market to raise money for the construction and operation of their networks. In that way, the risk is not borne by the public, but instead is born by the party in the best position to understand it and to manage it. Without the proper allocation of risk, providers will be less likely to follow through on their promises to provide service.

Price matters

One key factor for adoption is the price consumers pay for service. Mechanisms already exist to ensure that prices for areas that receive subsidies are comparable to prices in other areas without resorting to price regulation, which Congress explicitly prohibited in the IIJA (IIJA, 60102(h)(5)(D)).

For example, if a provider has extensive operations in the state, the state could require that the price of service in the subsidized areas be no higher than the price for the same (or similar) service offered in non-subsidized areas. Another possibility, given that such a requirement could create opportunities for gaming the system by providers with limited operations in a state, would be requiring a commitment to a price based on the price of a basket of providers to ensure that the new operator does not price as a monopolist (which it is likely to be in currently unserved areas, except for satellite service). The FCC's existing annual Urban Rate Survey can serve as the mechanism for determining the relevant benchmarks, just as it does for providers subsidized by the Universal Service Fund.

⁹ Additionally, some unserved areas are not included as unserved in either the FCC's maps or a state's own map because those areas have already been "claimed" for service under a prior grant program. Some of those areas have been waiting for the service promised years ago. States might consider the length of time those areas have been claimed for service without any buildout accomplished. While those areas may not be eligible for BEAD funds, an awareness of those locations and contiguous areas may be useful in establishing areas for which subgrantees can bid and evaluating expected cost of service in those areas. In addition, the state should be wary of providing subsidy funding to entities that received buildout subsidies and failed to perform.

Sample Rural Buildout Competitive Scoring Mechanism

The Commission should define service areas that need to be served and set forth clear points for specific, objective metrics and a requirement to minimum levels for other factors such as complying with state labor standards. Then it would entertain bids (either single-round submissions or a declining clock auction).¹⁰ It would compare the bids net of discount.¹¹ There would be discounts for both speed of service and time to deployment.

For example, a hypothetical weighting could have a discount factor (multiplied by the subsidy amount bid) of 0 (no discount) for service with 1 GBPS symmetric service for the entire area, 0.2 for locations served with speeds of 500 MBPS, and 0.5 locations greater than 100 MBPS but less than 500 MBPS. In addition, it could use a discount of 0 (no discount) for locations to be served within two years, 0.1 for locations to be served between 2 and 3 years, and 0.25 for locations to be served between 3 and 4 years, and so on.

Such a plan allows providers with different speeds of service and deployment plans to be compared. At the same time, some clear requirements such as the necessity to prioritize the connection of all locations and to abide by labor standards are also met by all applicants.

For example, if a state predefines an area with 100 unserved locations, it might get the following bids:

Provider	HH in Group 1	Speed in Group 1	Time to deploy to Group 1	HH in Group 2	Speed in Group 2	Time to deploy to Group 2	Subsidy requested
A	90	1 Gbps	3 years	10	100 Mbps	1 year	\$1m
B	100	500 Mbps	1 year	0	n/a	n/a	\$800,000
C	100	1 Gbps	4 years	0	n/a	n/a	\$900,000

Scores under this example weighting would be

A: $\{(0.9) \text{ locations in Group 1} \times ((0) \text{ (speed discount)} + (0.1) \text{ (deployment discount)} + (0.1) \text{ locations in Group 2} \times (0.50) \text{ (speed discount)} \times (0) \text{ (deployment discount)}\} \times \1m
 $= \$140,000$ adjusted bid for comparison

B: $\{(1.0) \text{ locations in Group 1} \times ((0.8) \text{ (speed discount)} + (0) \text{ (deployment discount)}\} \times \$800,000 = \$160,000$ adjusted bid for comparison.

C: $\{(1.0) \text{ locations in Group 1} \times ((0) \text{ (speed discount)} + (0.25) \text{ (deployment discount)}\} \times \$900,000 = \$225,000$ adjusted bid for comparison

¹⁰ See <https://www.fcc.gov/auction-formats> for definitions.

¹¹ Note that we use the term “discount” to reflect an inferior bid.

The framework allows bids to be compared objectively and makes explicit the tradeoffs between the various characteristics of the network. Other very clear criteria could be added to the scoring matrix. In this case, provider A would win the comparison and get its \$1m subsidy bid.

The state should set its weights prior to the bidding competition. By setting weights so that all bids are comparable, the state would place substantial weight on service quality, availability, and BEAD cost.¹²

Availability and Take-up Together are Needed to Get People Online

Availability means that it is possible to get the internet into a home. Most households already have broadband at home, but in some more rural areas, households do not have any terrestrial internet service available.

Take up (people subscribing to broadband service at home) is also important. Some people have broadband available and do not buy home broadband for myriad reasons. Currently, cost should not be among them since the Affordable Connectivity Program (ACP), which makes broadband essentially free for low-income households, should ensure that price is not an issue for low-income households. That may change as the program is currently scheduled to use up its funding potentially as soon as 2024. In the future, states may face some of the responsibility for ensuring that state-defined low-income households (in both urban and rural areas) can afford to subscribe to broadband service. The possible end of the ACP is another reason to spend BEAD funds judiciously.

States should consider setting aside some of the federal money they will be getting to connect households that have access to service, but cannot afford to connect. The tradeoff may be connecting fewer higher cost households to fiber compared to getting many more low-income households online. The money is not unlimited so such tradeoffs should be considered explicitly.

Use Explicit Criteria for Ex-post Project Evaluation

It also will be important to evaluate the effectiveness of the projects after they have been completed. Compared to the amount of money being spent on broadband itself, such evaluations will not be expensive. To ensure that the evaluations are fair, time should be spent in advance to set up criteria by which deployment projects will be evaluated. Evaluating the effectiveness of

¹² If the state finds that with the initial weights, it overspends the BEAD money it allocates to rural buildout, it can put more weight on lower cost proposals to serve the area by reducing the penalty for slower speed bids for example. Such a mechanism would need to be a pre-announced mechanical part of the evaluation of bids. This mechanism would have the added benefit of creating competition across areas as well as within geographic areas. Of course, the state must announce this plan in advance so that bidders understand the rules completely.

subsidies is not the same as simply determining compliance with the promises, although that is also important. An evaluation determines whether the subsidy made a difference compared to what would have happened without the subsidy.

Often, projects are evaluated on metrics developed post hoc and are set as compliance measures rather than true evaluations. Such after-the-fact criteria usually are set by interested parties to show how successful a project has been rather than to offer an objective evaluation of the effectiveness and efficiency of a project.

To combat such issues, the state should prior to the awarding of grants set forth clear, quantifiable measures that it will use to evaluate and compare all projects in three, five, seven, and ten years. Such measures for each predefined area might include the percentage of locations with access, the percentage of locations subscribing to service, the cost per location passed, the cost per new location passed, the cost per location served, the cost per new location served, and other metrics. Importantly, these all must be compared with something else, such as similar areas that did not receive subsidies and thus can serve as a “control group”, to know whether the subsidies were effective. Agreeing to and setting such metrics in advance will lead to a less biased evaluation of project success.