Oregon Telephone Assistance Program Investigation: Broadband Internet Access Service

REPORT TO THE OREGON PUBLIC UTILITY COMMISSION ON BARRIERS FACED BY LOW-INCOME CONSUMERS AND POLICY INITIATIVES FOR OTAP TO OVERCOME THEM

Lee L. Selwyn
Elizabeth P. Tuff
Colin B. Weir
Susan M. Gately

May 8, 2023

ECONOMICS AND TECHNOLOGY, INC.
100 FRANKLIN STREET, 6TH FLOOR • BOSTON, MASSACHUSETTS 02110 • (617)-598-2200

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ECONOMICS AND TECHNOLOGY, INC.

LEE L. SELWYN
SENIOR VICE PRESIDENT

100 FRANKLIN STREET, 6TH FLOOR
BOSTON, MASSACHUSETTS 02110
Telephone (617) 598-2222
Washington (202) 331-7711
Email: lselwyn@econtech.com

May 8, 2023

Jon Cray, Residential Service Protection Fund Program Manager
Oregon Public Utility Commission
201 High Street SE
Salem, Oregon 97301

Re: Oregon Telephone Assistance Program Investigation: Broadband Internet Access Service

Dear Mr. Cray:

Economics and Technology, Inc. ("ETI") is pleased to submit our Final Report in satisfaction of our engagement by the Oregon Public Utility Commission ("PUC") under Intermediate Procurement under S-86000-00004451 regarding the Oregon Telephone Assistance Program Investigation: Broadband Internet Access Service.

The Report was prepared by myself, Elizabeth P. Tuff, Colin B. Weir and Susan M. Gately. We wish to acknowledge and express our appreciation for the assistance that we received in the course of this work from you, Melissa Nottingham, and Julie Thompson of the PUC Staff.

Attached to this Report are several appendices containing state and county-level maps of broadband availability in Oregon by the type of "last mile" technology being utilized, by maximum advertised downlink speed (bandwidth), and by service provider (brand). Also being provided are maps and broadband availability data for the nine federally-recognized Tribal reservations in Oregon.

We have all enjoyed the opportunity to work with you and your colleagues on this very interesting project, and hope that our Report will be of assistance to the PUC in developing and formulating policy to expand the availability of broadband Internet access to low-income households in all parts of the state.

Sincerely,

Lee L. Selwyn

Attachments

Report to the Oregon Public Utility Commission on Barriers Faced by Low-income Consumers and Policy Initiatives for OTAP to Overcome Them

Introduction and Executive Summary

In 2022, the Oregon State Legislative Assembly enacted House Bill 4092.[1] The legislation directed the Oregon Public Utility Commission (PUC), in consultation with the Oregon Broadband Office, the Oregon Broadband Advisory Committee and the Oregon Telephone Assistance Program Advisory Committee, to conduct an investigation of the Oregon Telephone Assistance Program ("OTAP"). OTAP was originally established in 1987 with the objective of providing financial support for low-income residents in obtaining basic wireline local telephone service and connectivity to the Public Switched Telephone Network (PSTN).[2] Over time, consumer reliance upon "Plain Old Telephone Service" ("POTS") has been supplanted by increased reliance upon Commercial Mobile Radiotelephone Service ("CMRS") and, over the past decade or so, upon broadband access to the public Internet. At the beginning of the 21st century, household penetration of basic wireline telephone service was in the range of 95% nationally; today it is below 20%. Over time, mobile handsets had become smaller, lighter, less expensive and, perhaps most importantly, were offering capabilities that far exceeded anything that was available with traditional wireline telephone service. So-called "smartphones" like the Apple iPhone or the Samsung Galaxy all support basic voice communication, but also provide for video calling and conferencing, text messaging, photography, GPS navigation, Internet access, and thousands of specialized "apps" (applications) that support a vast array of human interactions and information needs. In fact, mobile phones have become so ubiquitous that one recent estimate suggested that there are today more mobile phones in the world than there are people.[3]

In enacting HB 4092, the Oregon Legislature has recognized that the objective of achieving near-universal connectivity – the original objective of programs like OTAP – is still a key policy goal, but needs to adapt to the rapidly evolving nature of communications and information technology. To that end, the Oregon Legislature in HB 4092 identified two key areas for investigation and recommendations:

(1) Expanding or increasing the OTAP to support adequate and reasonable access to broadband Internet access service or other telecommunications services by residential customers with low incomes, including allowing participation of providers that are not designated as Eligible

1. Oregon Laws 2022 Ch. 60 § 7, HB 4092, *An Act Relating to Telecommunications Creating New Provisions; Amending ORS 192.355, 285A.154, 285A.160, 759.020 and .759.050 and declaring an emergency.*

2. Oregon Laws 1987 Chap. 290, HB 2663, *An Act Relating to Lifeline Telephone Service; appropriating money; and declaring an emergency*

3. World Economic Forum, "Charted: There are more mobile phones than people in the world," Apr 11, 2023. https://www.weforum.org/agenda/2023/04/charted-there-are-more-phones-than-people-in-the-world/

Telecommunications Carriers ("ETCs"); and

(2) Identifying barriers faced by residential customers with low incomes to obtaining broadband Internet access service or other telecommunications services that include, but are not limited to, (a) equipment and related services needed to obtain and use broadband Internet access service or other telecommunications services; (b) legal and regulatory incentives and limitations that may affect the state's ability to expand or increase the OTAP; and (c) the availability of other forms of federal, state or local support for broadband Internet access service or other telecommunications services.

Pursuant to the directives of HB 4092, the Oregon PUC engaged Economics and Technology, Inc. ("ETI") to collect accurate, current, and relevant data on the availability of broadband access throughout the state, to identify existing economic and other barriers to access to these services by low-income residents that are the target of OTAP support, and to recommend specific measures that may be adopted so as to overcome such barriers and in so doing increase the availability and use of broadband Internet access by low-income residents. The intention of the various findings and recommendations contained in this Report is to inform and assist the Oregon PUC in prioritizing unmet needs and identifying possible solutions and strategies that effectively expand or increase the scope of OTAP support to adapt to evolving telecommunications technologies and needs, and to prepare its report to the Oregon Legislature addressing these issues.

Summary of our principal conclusions and recommendations

1a: Sources of data on broadband availability in Oregon

The Federal Communications Commission (FCC) requires that all broadband service providers provide it with data, on a semi-annual basis, describing in considerable detail the nature and availability of their broadband services and facilities. Beginning with periods after June 2022, the FCC introduced a new Broadband Data Collection ("BDC") system that has been implemented to support the FCC's National Broadband Map. In December 2022, the FCC released the first iteration of its National Broadband Map that had been compiled using the BDC system. Among other things, the BDC system provides data on the types of broadband service that is available (technology), the maximum advertised uplink and downlink speeds (data rates), and the specific providers offering service, at the individual Census Block level. ETI has made extensive use of the FCC BDC data in order to identify existing availability gaps in Oregon. In so doing, we are relying upon the relative accuracy of this data, the source of which is the individual broadband service providers themselves. ETI has no independent means of verifying the accuracy or completeness of the data for Oregon that we have obtained from the BDC. Although we recognize that the BDC data upon which we have relied may be less than precise, we nonetheless believe that it is sufficiently reliable to support the type of policymaking use for which our Report is contemplated. Accordingly, and with the agreement of the PUC Project Team, we have determined that the currently available FCC BDC data is sufficiently complete and precise for purposes of this investigation.

The FCC data identifies the presence of some type of broadband infrastructure at roughly 1.4-

million individual locations in Oregon, identifying for each such location the specific “last mile” broadband technologies and key service attributes that are available to the customer, as well as the identity of the service provider or providers that offer service at each location. The “technology” classification refers to the type of infrastructure that is being used to deliver the broadband service to the customer’s premises – what is often referred to as the “last mile” – even though multiple technologies and types of infrastructure may be involved in bringing the service from the service provider to the end-user customer. In consultation with the PUC project Project tTeam and based upon our recommend-ation, it was agreed that the June 2022 BDC dataset was sufficiently complete with respect to Oregon that we can comfortably rely upon it for purpose of this examination of broadband available in the state.[4]

Broadband availability and adoption in Oregon

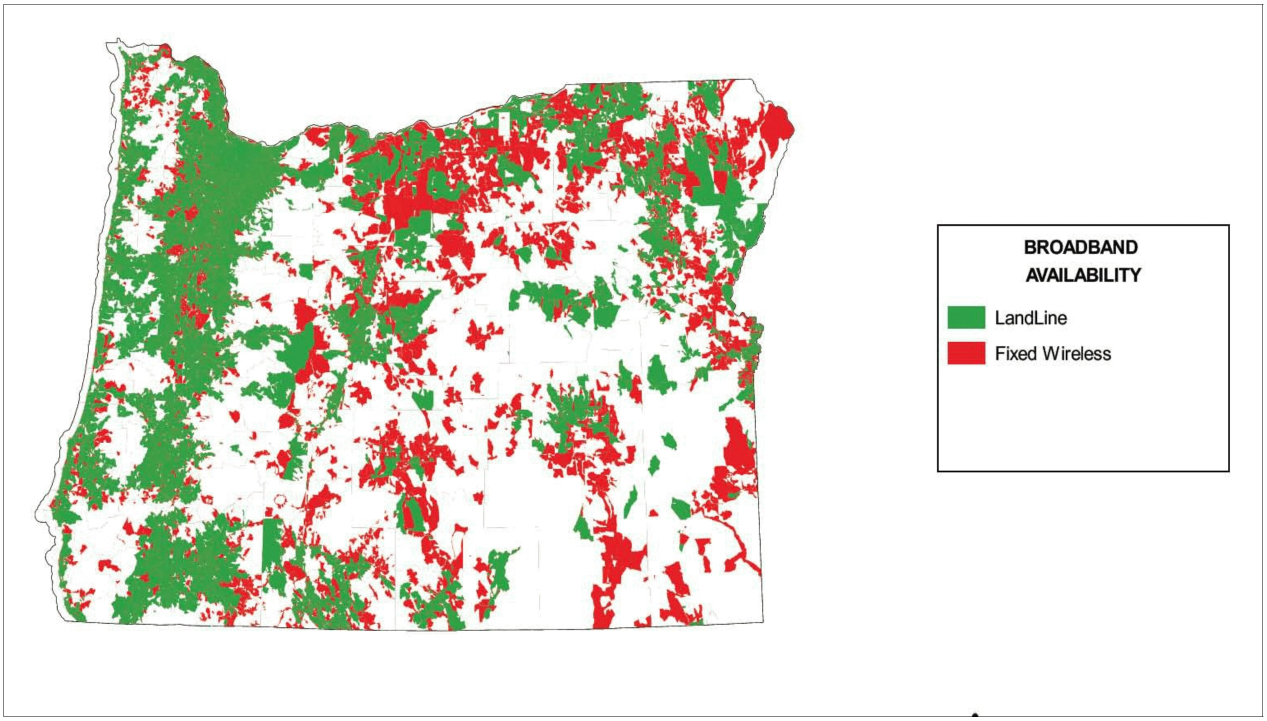
Oregon currently has one of the highest levels of broadband Internet access availability and adoption in the nation – ranking among the top tier of states in terms of the availability of broadband Internet access services in the home. Broadband access – landline (copper, cable, fiber) and/or fixed wireless – is deployed and available to 98.99% of Oregon’s population. As of 2021, 91.8% of households in Oregon are reported (based upon US Census Bureau American Community Survey data[5]) to have some type of Internet service already in their homes. The take-rate is likely even higher today, since this estimate was made prior to the introduction of the federal Affordable Connectivity Program (“ACP”) that became operational in 2022 as part of the 2021 federal Infrastructure Act low-income program. (We discuss the ACP in detail in our discussion of Tasks 3a and 4b below.) Where broadband is currently available (i.e., to 98.99% of Oregon’s population), 92.55% of households subscribe for some type of broadband Internet access. 8.2% do not currently have broadband Internet access in their homes; of these. 2.56% use but do not currently subscribe to any Internet access at home, and 5.64% neither use nor subscribe to any Internet service. Some portion of these currently unconnected households are potential candidates for OTAP or other forms of low-income support. *1b. Challenges in Areas Lacking Access to Broadband Internet Access*

1b. Challenges in areas lacking access to broadband Internet access service

Some form of broadband Internet access is available almost ubiquitously throughout Oregon, and the vast majority of the state’s population is offered broadband access at advertised downlink speeds in excess of 500 mbps. However, there are certainly areas where service is limited, both as to availability and, where available, speed. There are a number of potential explanations for the lack of sufficient broadband infrastructure in some areas. These include carrier prioritization being directed elsewhere, absence of any service provider, lack of competition, or physical impediments such as those related to low population density, inaccessible terrain, higher-than-average construction costs, and similar factors. All of the counties with low landline broadband availability are rural. Yet even in the ten counties with the lowest availability rates, landline

4. E-mail from J Cray, March 23, 2023.

5. See Table 1b-3 *supra*. This is the penetration rate for the state as a whole as reported by ACS using 1-year data for 2021.



Oregon landline broadband availability and fixed wireless availability where landline broadband is not available.

broadband is available to 105,746 people, i.e., to 82.2% of the total population of these ten counties. We have compiled certain demographic data from the US Census Bureau's American Community Survey (ACS) and have linked it with broadband availability data as contained in the FCC's BDC database. From this, we have examined the potential impact of certain population demographic attributes upon both providers' willingness to invest in, and upon consumers' willingness to purchase subscriptions for, broadband Internet access.

Provider investment

Providers – the vast majority of which are investor-owned for-profit companies – base their investment decisions upon the anticipated profitability of furnishing service in a given area. Thus, decisions as to service availability and quality in any given area lies within the control of the service providers, who must commit investment dollars to construct the infrastructure necessary to support their broadband offerings. It is not possible, however, to make any direct measurements as to the amounts being invested at each location or group of locations (e.g., within a census block, census block group, or county), because such geographically granular data on provider investments is not available. However, from the FCC's BDC database, we do have data on the availability of high-speed "last mile" facilities at the individual census block level and the maximum advertised downlink speeds being offered. We can infer, from the presence of such facilities in any given census block, that provider investment has been made there. We thus examine the availability of *high-speed* broadband – i.e., downlink speeds of 25 mbps and above – for any of the "last mile" technology categories – which allows us to make inferences as to the nature of the "feeder" technology that has been put in place between the provider's "head end" and individual customer locations.

We wanted to test the hypothesis that household income may have played some role in influencing these investment decisions. Copper-based broadband availability appears to drop off as income levels rise, while fiber availability shows a fairly strong income-related increase, ranging from 49.4% in the lowest income quintile to 69.8% in the highest. The seemingly inverse relationship between copper availability and income is actually consistent with the pattern for fiber, as Incumbent Local Exchange Carriers ("ILECs") have been decommissioning much of their copper infrastructure in favor of fiber and do appear to have directed their fiber investments more toward higher income communities. Cable broadband availability presents a similar pattern, although it is slightly higher in the lowest income quintile than in the second and third lowest. Fixed wireless availability does not appear to be materially related to income level. For downlink speed levels at or above the FCC's 25 mbps minimum, almost all of the landline broadband facilities available in Oregon claim to be capable of supporting downlink speeds of at least 1 Gbps (1000 mbps). Of greater importance, there does not appear to be any significant relationship between household income and the availability of 1 Gbps service, suggesting that, although "last mile" fiber does appear to have been deployed more heavily in higher income communities, sufficient investments in fiber have been made in feeder facilities to support the same 1 Gbps service level irrespective of the specific type of "last mile" delivery that is being used.

Consumer demand

Even where broadband Internet access is available, not all consumers subscribe to the service. ACS data indicate wide variations in the level of consumer demand – the percentage of households that subscribe to broadband service where it is available – from county-to-county across Oregon, ranging from a high of 96.11% in Benton County to a low of 70.6% in Lake County.

There appears to be a strong relationship between consumers' willingness to purchase a broadband Internet subscription and their household income level. Household Internet subscription rates increase steadily for households with higher income levels. Only 83.0% of households in the lowest median household income (MHI) quintile have broadband Internet access at home; whereas for the highest MHI quintile the take-rate is 95.4%. That lower-income households are less likely to subscribe for a broadband service at home underscores the need to maintain some level of low-income support for Internet access.

1c: Mapping of broadband availability in Oregon

Using the BDC data, we were able to prepare an extensive set of state and county-level maps providing details as to the extent and types of broadband availability that is present in Oregon. These are provided in Appendices 1c-1, 1c-2 and 1c-3 to this *Report*. In all, we have prepared 452 individual Broadband Availability Maps at both the state level and for each of Oregon's 36 counties, plus an additional 61 maps covering Oregon's nine federally-recognized Tribal reservations. Each set includes a map showing all landline broadband (copper, cable, fiber) availability at the individual census block level; a map showing all fixed wireless broadband availability, as well as a map presenting the availability of fixed wireless broadband services at the individual census block level in all census blocks where no landline broadband is currently present. Also included are maps showing the maximum advertised downlink speed (data rate) being offered by any landline service provider at the individual census block level; and individual maps showing, separately for each major service provider ("brand"), the census blocks being served by that provider. Maps are provided for the principal providers of Technology 10 (copper), 40 (cable), 50 (fiber optic), and 70+71 (fixed wireless combined). We have not provided maps for satellite-based services, since these are (theoretically) available ubiquitously throughout Oregon. In addition, we also provide a number of tabulations summarizing data on broadband service availability across the various technologies and brands, at the state, individual county, and Tribal reservation levels.

2a. "Adequate and reasonable" broadband for OTAP-supported services

One of the principal objectives of the Oregon Legislature in enacting HB 4092 was to examine the potential benefit of expanding or increasing the OTAP to support "adequate and reasonable access to broadband Internet access service or other telecommunications services" for residential customers with low incomes. In that regard, ETI has been asked to consider and examine what constitutes "adequate and reasonable" telecommunications service as the term has been used in the statute. In fact, what constitutes "adequate and reasonable" telecommunications service is a rapidly changing concept that has evolved and will continue to evolve over time

The statute requires that services supported by OTAP be only "adequate and reasonable" and sufficient to meet the requirements of a typical household that qualifies for OTAP support. In that regard, the determination as to what set of service attributes satisfies this "adequate and reasonable" requirement could be informed by one particular element of the ACP program – the provision of a subsidy of up to $100 for the purchase of equipment to be used in connection with the ACP-supported broadband service to permit the household to access and use the Internet. The $100 ACP equipment subsidy requires that (1) the recipient purchase a device (typically a laptop computer) that costs no more than $150, and that the recipient pay at least $10 in cash toward the purchase. Thus, to qualify for the full $100 subsidy, the customer must purchase a laptop whose retail price is in the range of $110 to $150. Of course, laptop prices can range up to several thousand dollars, so the capabilities of the type of device contemplated by ACP will necessarily be rather limited.

Laptops in the $110 to $150 price range will probably meet the needs of elementary school students and perhaps most (but not all) high school students, although those whose focus is on STEM will likely find these low-end units far too limiting. Most college students will likely require a more powerful computer than either of these devices. These entry-level laptops will probably also meet the needs of those adult members of these households whose uses of the Internet are limited mainly to web surfing, e-mail and social network usage. However, anyone attempting to run a home-based business, or use a home computer to access a company server for remote employment situations, will need something a lot better.

If the objective of providing broadband availability for low-income households is limited to furnishing a minimal level of broadband access, one that is consistent with the capabilities of the kinds of devices that qualify for ACP support, then an "adequate and reasonable" level of broadband access could be scaled so as to be consistent with the capabilities of these $150 laptops. However, if the policy goal includes providing capabilities that can support remote employment, reliable video conferencing, data analytics for work or education, running other IoT (Internet of Things) devices such as cameras, thermostats/energy saving devices, digital assistants (like Amazon's *Alexa*), something above this "bare minimum" would be indicated.

We have provided what we consider to be "bare minimum" as well as "adequate and reasonable" specifications for OTAP-supported broadband services. When considering these recommendations as a basis for policymaking, it is important to establish, as a threshold matter, whether the type of broadband service that is to be offered to low-income households should be at a "bare minimum" level (as implied by the $150 limit on ACP-supported laptop computers) or directed more toward providing qualifying households with a service that is capable of supporting more than basic e-mail and some entertainment applications. But even our "adequate and reasonable" recommendation may still be less than sufficient and, if adopted, might still disadvantage OTAP-qualified low-income households relative to others in terms of the overall functionality and utility of the broadband service that is offered to them.

2b. "Other telecommunications services" that may not be currently supported by the OTAP

In addition to the types of direct subsidies for the recurring monthly costs of voice and broadband services that OTAP has been offering up to this point, several additional types of support should be considered so as to further overcome existing barriers faced by Oregon consumers to obtaining access to broadband:

(1) Expand up-front equipment subsidies to support devices offering capabilities that exceed those of the ACP-supported $150 laptop computers;

(2) Consider the creation of grant programs to support the deployment of landline and/or fixed wireless services in areas where private sector investment is unlikely to be available; and

(3) Provide direct subsidies for the acquisition of CPE required for satellite broadband access to households in remote areas where the costs of deploying landline, and perhaps even fixed wireless, infrastructure are prohibitive.

(4) Provide affirmative financial support for the development of training materials, adult education programs, online tutorials and even live help desks to assist newly connected OTAP-eligible users, to the extent that such services are not already being offered by service providers themselves.

3a. Understanding the Oregon Telephone Assistance Program (OTAP) and encouraging service provider and low-income subscriber participation

ETI has been asked to investigate several matters related to participation in the OTAP low-income assistance program. Specifically,

- potential barriers to participation by broadband internet access service providers;

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- potential regulatory incentives that may encourage non-participating service providers to participate;

- specific issues that may be hampering low-income consumers from participating in the program (level of subsidy, eligibility requirements, equipment prices, and digital literacy); and

- other governmental programs designed to assist low-income consumers purchase broadband internet access and their relationship to OTAP.

OTAP is designed to provide a reduced/discounted rate for broadband Internet access service and/or basic voice service to eligible low-income customers in the state. It runs in parallel with, and in most cases as an additive to, the FCC's Universal Service Low Income Assistance Program, and is funded via revenues collected from all telephone subscribers in the state. Individually and combined, these programs are referred to as "Lifeline." As presently configured, OTAP, or "Oregon Lifeline," provides a $10 monthly subsidy that is reflected as a discount off of customer bills that is achieved through direct payments to the service provider participants in the program for each qualifying subscriber. In most cases, this discount is in addition to a corresponding monthly discount of $9.25 that is available through the FCC's Lifeline program for broadband access services, and $5.25 monthly for voice access, which can be landline or mobile. Combined, eligible low-income subscribers that participate in the program receive a monthly discount of $19.25 for broadband service or $15.25 monthly for voice-only service.

Subscriber participation levels in both the FCC and Oregon Lifeline programs have declined steadily over the past three years. Two major, perhaps interrelated, changes occurred during this time – first. two of the largest OTAP-approved providers exited Oregon, and second, temporary and more heavily funded federal programs were introduced, specifically the Enhanced Broadband Benefit (EBB) program enacted in 2020 specifically for pandemic era relief, followed by the federal Affordable Connectivity Program ("ACP") that became effective in 2022 as part of the 2021 federal Infrastructure Investment and Jobs Act.

The Oregon Lifeline program, as it exists today, supports both broadband access and voice only access. While the focus of this Report centers around the provision of broadband services, subsidized support of voice-only service for low-income consumers that live in areas without broadband availability remains important. Nearly 20% of subscribers in the OTAP program are subsidized for voice only access; that number increases to 53% for program participants purchasing service from rural incumbent LECs (e.g., fixed wireline services).

Barriers to service provider participation and potential regulatory incentives to encourage participation by additional providers

Service provider participation in Oregon in the FCC and state-run OTAP Lifeline programs has been fairly limited. Under the current federal and state legal framework, a service provider must petition the PUC for designation as a federal Eligible Telecommunications Carrier (“ETC”) in order for it to offer Lifeline-supported service, and as an Eligible Telecommunications Provider (“ETP”) for participation in the OTAP, which is the Oregon counterpart to the FCC’s Lifeline program. Under the existing regulatory framework, a service provider must petition the Oregon PUC for designation as an ETP in order to receive federal and state low-income support, respectively. Evidence that we have examined leaves us to conclude that, in most cases, service providers are reluctant to incur the time and expense required for designation, in addition to absorbing the administrative costs for a $10 OTAP subsidy, which may or may not be sufficient. Designated ETCs are eligible to receive federal universal service support (including low-income support) throughout a specified service area, and ETPs are eligible to receive OTAP funding throughout the same service area. Not all providers desire to obtain such designation across their entire service area. Many providers, particularly the largest non-ILEC “landline” providers (cable companies), have chosen not to offer lifeline options to their customers in Oregon at all. Under existing regulation, there is little that can be done to incent additional broadband access service providers to participate in OTAP. Even if the Oregon PUC or state legislature were to eliminate the state ETP designation as a requirement for participation in the state portion of the Lifeline program, the federal ETC requirement would remain as a barrier for some providers.

However, we do not believe that the *process of applying* for these designations is itself the source of carrier reluctance to participate. Instead, this is due to the attendant responsibilities that come with such designations – in particular, the requirement to make service available universally across the entirety of any geographic area in which the ETC/ETP designation applies. Additionally, the broad participation both by providers and by subscribers in the federal ACP suggest that there is little benefit to be gained from restructuring OTAP as long as ACP continues. However, the ACP’s current funding will be exhausted sometime in 2024, and Congressional action will be required to extend funding beyond that point

3b. Alternatives to the existing regulatory framework that could either encourage or mandate provider participation and recommendations.

The ability of the PUC to mandate participation in the OTAP by additional service providers is complicated by the murky legal and jurisdictional status of broadband access services. It is unclear whether the State even has jurisdiction to impose any regulatory or legislative mandate regarding broadband services. Conversely, the ability of the PUC to *encourage*, rather than *mandate*, OTAP participation by additional service providers *is* within the purview of the Oregon Legislature and PUC. Our recommendations directed at encouraging more provider OTAP participation are posited under two alternate scenarios – one with and one without Congressional action to extend the ACP beyond 2024. There are roughly 130 Oregon broadband providers and about 170,000 Oregon customers currently participating in the ACP. Our primary recommendation addresses potential changes to the requirement that providers be designated as ETPs.

Scenario 1: ACP is eliminated in 2024: At this time, it appears unlikely that the FCC could revise its Lifeline rules in time to allow the OTAP to evolve so as to maintain the ACP subscribership and subsidy levels. In this scenario, virtually all of the roughly 170,000 low-income subscribers currently participating in the ACP in Oregon will lose their broadband subsidy unless the providers that presently offer subsidized ACP service can be encouraged to participate in OTAP. Our primary recommendation involves the creation of a new category of provider eligible to participate in Oregon lifeline – the "OTAP provider" – essentially grandfathering into the program those carriers with a clean ACP service record and existing ACP subscribers in Oregon. We also make secondary recommendations to increase the $10 monthly subsidy (accompanied by an increase in the existing $0.35 pe-connection assessment cap) and to adjust the subscriber income-limit upward. These recommended changes would require PUC and Legislative action. The primary operational implications would be (a) increased funding requirements (b) potentially increased staffing (c) potentially reduced ability to monitor service quality and standards within the state, and (d) reduced ability to monitor for and limit waste, fraud and abuse in the OTAP program.

Scenario 2: ACP funding is extended, and ACP (or something similar) in 2024 and beyond: With existing ACP subsidies for broadband Internet access remaining available, there is no need to encourage additional providers to participate in OTAP. Thus, our recommendations are targeted at reaching low-income customers that are not presently subscribing to broadband service, either because they don't see its value or because it is not available at their location. We recommend increasing customer education and outreach by the PUC, and possibly restructuring OTAP funds to be available as an additive to the $30 federal ACP surcharge to be offered only in locations that do not presently have a broadband service available, to help incent provider(s) to extend service to those locations.

Although the future of the ACP is far from certain, the magnitude of the impact of its elimination upon low-income households in Oregon that have enrolled in the program cannot be understated.

4a. Issues hampering low-income consumers from participating in the OTAP

Broadband penetration rates among low-income households are influenced by household income, service availability in the communities in which the household resides, education levels and related digital literacy, available subsidies and discounts, prices of existing services net of existing support mechanisms, and costs of equipment needed to utilize broadband Internet access and other telecommunications services.

Is the current $10 level of OTAP support "adequate and reasonable?"

Our review of the evidence suggests that the existing $10 monthly OTAP subsidy is not set so low as to operate as a barrier to the ability of low income customers to obtain broadband Internet access. Moreover, as long as the ACP continues, the $10 subsidy is "adequate and reasonable" because OTAP program demand is low enough that the subsidy can be offered within current funding levels), and it may in fact be higher than is actually necessary to achieve target penetration levels for broadband subscription by low-income customers (although most of those customers are presently subsidized through the ACP, not OTAP).

We also find that given the relevance of the "net price" of any broadband offering to low-income customers' ability and desire to purchase service, it is not possible to set a long-term (out to 2030) support level that will have any relevance in the face of changing service provider prices for broadband access and service provider participation in the OTAP program over time. Moreover, we estimate roughly 220,000 low-income households are eligible for an OTAP subsidy and that in the event all eligible households were to claim the $10 monthly discount, the annual OTAP funding requirement would be $26.4-million – i.e., more than four times its current funding level. We recommend that rather than attempting to set a single subsidy level for the period until 2030, that a more flexible process be designed so as to maximize the level of subsidy given annual budget constraints with projected subscriber participation levels.

4b. Barriers created by subscriber equipment costs

Equipment requirements for in-home ("fixed") broadband access involve three principal types of customer premises equipment:

(1) A terminal device, such as a desktop, a laptop or tablet computer;

(2) Network interface equipment, such as a DSL or cable modem or, for fiber-to-the-premises ("FTTP") type services, an optical network terminal ("ONT"); and

(3) In order to extend Internet access to multiple devices in the home, a wi-fi router or gateway.

Equipment in categories (2) and (3) that are intended for home use are relatively inexpensive, and are usually available from the service provider at a modest monthly rental charge. However, in the case of satellite Internet access services such as Space-X's *Starlink*, the required network interface hardware involves an up-front purchase price of between $600 and $2,500, depending upon the level of services selected. This would surely create a formidable barrier for low-income customers where no alternative to satellite service is available. However, for those portions of the state where the construction of landline infrastructure is not economically feasible, services like *Starlink* may well be the only viable means of extending broadband to these communities. To the extent that the use of satellite-based services is to be given consideration in such cases – which it should be if the objective is to provide service in unserved and underserved areas – it may be necessary to develop some means for overcoming this up-front cost barrier.

For landline broadband, the network interface equipment and wi-fi routers or gateway devices are typically either included in the provider's service bundle or are available to rent from the provider at relatively low monthly rates. These devices can also be purchased and owned by the consumer, although the vast majority of residential consumers will typically choose to rent this equipment rather than purchase it.

4c. Sufficiency of existing consumer eligibility criteria

The current interrelationship between the OTAP and the FCC's Lifeline program has a consequential impact on the OTAP eligibility requirements. Low-income customers in Oregon desiring to participate in lifeline are required to apply directly to the Oregon PUC – by doing so they are qualified (or disqualified) for both the federal and state Lifeline programs at the same time. The eligibility criteria for OTAP participation are the same as those required for participation in the FCC's lifeline plan across the US. To the extent that changes are made to tighten or loosen the OTAP eligibility standards so that they are no longer identical to those of the FCC Lifeline plan, customers applying for both programs may find themselves eligible for one but not the other. In such a case, the total subsidy/discount available on the service the applicant desires to purchase will be roughly 50% of what they would receive – i.e. they would be eligible for either the $9.25 monthly FCC Lifeline subsidy *or* the $10 OTAP subsidy, but not both – creating additional confusion in the process.

There is no indication that the consumer eligibility requirements that underlie OTAP need to be either made more or less rigorous than they are today, Only about 3% of applicants are denied participation as a result of the existing eligibility criteria. Two changes are identified that would likely increase overall participation levels. The benefits of any changes that may be contemplated, including the two identified below, need to be weighed against the operational issues that would arise from divergence from the FCC Lifeline program.

(1) We recommend that OTAP consider allowing use of an alternate government-provided ID in place of the current Social Security Number requirement. Having a Social Security number is not an eligibility requirement *per se*, but it is required for an application to be considered as complete. (Notably the ACP programs accepts alternate government-issued IDs in place of SSNs).

(2) We also recommend that an increase in the "at or below" income ceiling to 200% of the Federal Poverty Level be considered.

4d. Availability of other federal, state, or local support for broadband access

Until recently, the Low Income Fund (Lifeline) component of the FCC's Universal Service Fund, and state-level counterparts like OTAP, have been the primary source of direct financial assistance to low-income consumers specifically for the purchase of broadband Internet access service or other telecommunications services. The federally-funded pandemic-response "Emergency Broadband Benefit" (EBB) program that operated between June 2020 and December 2021, and its (for now, temporary) successor, the Affordable Connectivity Program (ACP) that began disbursing Congressionally-appropriated funds in January of 2022 (with funding anticipated to expire in mid-2024) have stepped in to act as replacements for, rather than a companion program to, OTAP. As such, these programs offer few opportunities for synergies or leverage with OTAP, but because of the relatively rapid success of the programs in attracting both providers and subscribers, they are useful for comparative purposes. ACP operates as a slightly less generous but even more widely utilized version of the original EBB program, and is our focus here.

The ACP benefit was designed from the outset to be widely available to low-income households – with a much broader definition of "low income" than the Lifeline plan. ACP was also designed to appeal to potential providers. Untethered from the requirement that participating service providers be designated as ETCs, the ACP has achieved broad participation from a wide array of broadband Internet access service providers. No state-level approval is required in order for a carrier to become ACP-operational. A single application suffices for all areas in which a provider desires to operate. More than four times as many carriers are identified as offering services pursuant to the ACP in Oregon than under the Lifeline program. Many of the largest landline broadband providers (i.e., those using copper, cable and fiber) that have not historically participated in the Lifeline/OTAP program generally are participating in ACP throughout their entire service footprint.

Nationwide, households seeking financial assistance in their purchase of broadband Internet access services have flocked to the ACP. In just 2022 alone, close to six million new households have successfully enrolled in ACP at a remarkably steady pace, averaging 112,000 new households per week. Many ACP providers offer low-income broadband access plans with prices set at the $30 monthly per household subsidy level, with the result that in many cases providers offer a landline or mobile broadband service that is entirely "free" to qualifying low-income subscribers. Comparing Lifeline/OTAP enrollment in Oregon with ACP enrollment reveals that the ACP has subsumed the demand for much of the preexisting program. Enrollment data specific to Oregon shows steadily rising customer enrollment in ACP, with a corresponding drop-off in OTAP enrollment. That said, OTAP remains important to backfill gaps in the ACP program as it presently exists, and to begin absorbing those ACP participants that are eligible for OTAP if and when the ACP exhausts.

4e. Digital Literacy as a Barrier to Broadband Access

Besides the various *affordability* barriers that may work to limit the ability of low-income households to obtain broadband access in their homes, an additional concern may be the perception, on the part of many consumers, that special skills are needed to successfully use the Internet and the services and applications that it offers. The term "digital literacy" is often applied to such skills. However, there are several levels of digital literacy not all of which are required for successful Internet use by those targeted by OTAP and similar low-income support programs. The skill levels required for most consumer uses of the Internet are typically far less sophisticated than those demanded by many areas of employment. Indeed, gaining familiarity with basic Internet use has the ancillary benefit of enhancing the digital literacy of many who, up to now, have had little direct interaction with computers or the Internet, thus creating additional employment opportunities that such additional skills will open up. Thus, in many important respects, the relevant "barrier" here is *not* a lack of digital literacy operating to block consumer access to the Internet, but results instead from the missed opportunity for many individuals to utilize basic Internet skills to catalyze their acquisition of the additional levels of digital literacy that will enhance their employment opportunities– and incomes – overall.

The most important "digital literacy" barriers to broadband Internet access and use likely arise in the initial installation and setup of hardware and software. Once overcome, digital literacy at a level minimally needed for successful access to and use of the Internet should not present a major barrier to broadband connectivity, certainly not one that is anything close to the affordability barriers confronted by low-income households arising from the costs associated with subscribing to broadband Internet service and the purchase of computer and related equipment necessary for Internet use. This conclusion does not diminish the importance of assuring that those Oregon consumers who desire Internet access but who are currently unable to afford it – or who may become unable to afford it if existing subsidies, such as those available under the ACP, were to be substantially reduced or eliminated – are not financially precluded from subscribing to and using broadband services. The wide availability of well-designed graphical user interfaces and other intuitive website and application designs should help to overcome many obstacles that might otherwise be confronted by those with minimal computer skills. Moreover, even those not currently subscribing for broadband access at home, extensive user familiarity with smartphones and with commercial touchscreen and similar input devices can be expected to facilitate their use of the Internet once home connectivity is achieved. Additionally, service providers and others offer no-cost or low-cost online training materials that may assist novice users in getting started. Comcast, for example, has an extensive library of video training materials that are available without charge. However, in order to utilize these materials, users must first learn how to set up their equipment, get online, and navigate to the website(s) where such training videos or other training materials are provided. One essential component of OTAP or any other program aimed at overcoming barriers confronting low-income households should include the development of *printed* training materials, targeted specifically at those who do not currently have Internet access at home, and the development of curricula and materials to support community-based adult education initiatives aimed at enhancing basic digital skills.

In that regard, OTAP or other state-funded programs could consider providing affirmative financial support for the development of additional training materials, adult education programs, online tutorials and even live help desks to assist newly connected users, to the extent that such services are not already being offered by service providers themselves. While we have identified numerous studies and research that purport to assess the extent to which digital illiteracy is present or absent, the primary focus of such studies has been on a skill level necessary to meet employment demands, not on those needed for basic home Internet use. The proliferation of smartphones and the increased reliance upon computer interactions for many common retail commercial transactions suggests that the skills needed for basic Internet use are likely more widely available than much of the available research suggests. While these skill barriers should certainly not be ignored or lightly dismissed, they are nowhere as substantial as the financial barriers confronting those who want Internet access and require the basic equipment necessary for such use.

1a: Current gaps in access to broadband for low-income residential customers

Introduction

There are two key sources of gaps in broadband access to residential customers, including those on federally-recognized Tribal lands:

(1) **Geographic:** Lack of high qualify high speed broadband infrastructure in some parts of Oregon may limit or potentially deny access to broadband services to consumers at any income level.

(2) **Individual household income and demographics:** Even where broadband-capable infrastructure is present, access to it may still elude individual low-income consumers where the price of the services is set by the service provider at an unaffordable level and/or where the equipment necessary to obtain beneficial use of broadband services is either too expensive or unduly complex for the individuals involved.

In this section, we review the current state of broadband availability in Oregon based upon data obtained primarily from the FCC's Broadband Data Collection database. In Section 1b, we address the effects of income and other demographic attributes on customers' ability to afford broadband Internet access service.

Geographic availability data

FCC Broadband Data Collection (BDC)

Broadband service providers are required to file data with the FCC on a semiannually describing, in considerable detail, the nature and availability of their broadband services and facilities. Until mid-2022, these submissions were being made using what is referred to as "Form 477."[6] Form 477 is not a paper form, but is a data specification that is submitted electronically to the FCC. Beginning with periods after June 2022, much of the Form 477 filing requirements were replaced by a new FCC Broadband Data Collection ("BDC") system that has been implemented to support the FCC's National Broadband Map. In December 2022, the FCC released the first iteration of its National Broadband Map[7] that had been compiled using the BDC system.[8] The BDC system utilizes a newly-created "Location Fabric" that includes various location identifiers, one of which is the complete Census Block number. The BDC also includes individual street addresses. While these can be accessed on an individual basis using the FCC website by

6. https://www.fcc.gov/reports-research/guides/form-477-section-specific-information (accessed 1/27/23)

7. https://www.fcc.gov/BroadbandData (accessed 1/19/23)

8. https://broadbandmap.fcc.gov/data-download (accessed 1/23/23)

consumers seeking to determine broadband availability at their home address, street addresses are not included in public BDC files. However, these are not necessary for purposes of this study.

ETI has made extensive use of the FCC BDC data in order to identify existing availability gaps in Oregon. In so doing, we are relying upon the relative accuracy of this data, the source of which is the individual broadband service providers themselves. To obtain data to create its National Broadband Map, the FCC has required all broadband service providers to submit detailed location availability data regarding their respective broadband service offerings to the BDC.[9] Recognizing the possibility that this initial tranche of data might be incomplete or otherwise contain errors, the FCC also established a mechanism for reporting and correcting omissions or identifying instances where service is shown as available but where it is actually not.[10] Providers were also directed to submit, by March 1, 2023, revised data as of December 31, 2022,[11] and the Commission is expected to release a revised BDC dataset later this spring. ETI has no independent means of verifying the accuracy or completeness of the data for Oregon that we have obtained from the BDC.[12] Although we recognize that the BDC data upon which we have relied may be less than precise, we nonetheless believe that it is sufficiently reliable to support the type of policymaking use for which our Report is contemplated. Accordingly, and with the concurrence of the PUC Project Team,[13] we have determined that the currently available FCC BDC data is sufficiently complete and precise for purposes of this investigation.

The FCC data identifies the presence at roughly 1.4-million individual locations in Oregon of infrastructure, identifying for each such location the specific broadband technologies that are available to the customer as well as the identity of the service provider or providers that offer service at each location. The "technology" classification refers to the type of infrastructure that is being used to deliver the broadband service to the customer's premises – what is often referred to as the "last mile" – even though multiple technologies and types of infrastructure may be involved in bringing the service from the service provider to the end-user customer. The specific technologies identified in the FCC dataset are summarized in Table 1a-1 below.

9. https://www.fcc.gov/BroadbandData/filers (accessed 3/30/23)

10. https://www.fcc.gov/document/best-practices-broadband-fabric-challenges-announced (accessed 3/30/23)

11. "Broadband Data Task Force Announces Opening of the Second Broadband Data Collection Filing Window," WC Docket Nos. 11-10 and 19-195, FCC Public Notice DA 22-1372, rel. December 27, 2022, available at https://docs.fcc.gov/public/attachments/DA-22-1372A1.pdf (accessed 3/30/23).

12. In that regard, we asked the PUC Project Team to issue data requests to all Oregon broadband providers seeking copies of their respective March 1, 2023 submissions. With a few exceptions, we have not been successful in obtaining this data through this process.

13. E-mail from J Cray, March 25, 2023.

Table 1a-1

"LAST MILE" BROADBAND TECHNOLOGIES IDENTIFIED IN THE FCC BROADBAND DATA COLLECTION DATABASE

Technology	Description	Principal Oregon Service Providers
10: Copper	The available speed (datarate) varies inversely with the physical length of the copper segment. "Last-mile" copper is typically used in a "Hybrid Copper/Fiber" or "Fiber-to-the-Node" ("FTTN") architecture where fiber is extended into local neighborhoods near to customers so as to minimize the length of the copper segment.	CenturyLink Ziply Fiber Pioneer Telephone Cascade Access Wave Beaver Creek
40: Cable	Like copper, the available speed (datarate) varies inversely with the physical length of the coaxial cable segment. As with copper, last-mile cable is typically used in a hybrid cable/fiber FTTN architecture.	Xfinity Charter Wave TDS Telecom
50: Fiber	When the last-mile segment is fiber, the infrastructure is described as "Fiber-to-the-Premises ("FTTP"). High-capacity "feeder" cables are extended into local neighborhoods, where fiber distribution cables deliver the "last mile" connection to the customer's premises.	Ziply Fiber CenturyLink Wave Douglas Fast Net Wtechlink TDS Telecom DirectLink
60: Geostationary Satellite	Communications is achieved via a satellite "dish" located on the customer's premises. Satellite is at a fixed location 22.500 miles above the earth, requiring roughly 1/4 second for signals to make the round-trip between the earth stations and the satellite.	Viasat, Inc. HughesNet
61: Low-Earth Orbit ("LEO") Satellite	Communications is achieved via a satellite "dish" located on the customer's premises. LEO satellites are at an altitude of about 300 miles, and revolve around the earth in fixed orbits. Because individual satellites are constantly moving, communications with earth stations requires frequent hand-offs from one satellite to the next.	Starlink (SpaceX)
70: Unlicensed Fixed Wireless	The FCC has set aside certain spectrum bands for fixed wireless use that are available to providers for low-power transmissions without requiring a license. As with other hybrid architectures, broadband signals are transported from the service provider to points near the customer usually via fiber or microwave, where the unlicensed spectrum is then use to carry the signals relatively short distances to customer premises.	Alyrica StarTouch Rogue Broadband CASCO Blue Mountain Umpqua
71: Licensed (CMRS) Fixed Wireless	Licensed cellular ("CMRS") carriers may also offer "home Internet" type services utilizing the same spectrum and transmission/switching infrastructure that they use for their mobile services.	T-Mobile US TDS Telecom Alyrica Verizon Elevate ConnX Cal-Ore

Digital Subscriber Line (DSL) or hybrid copper/fiber optic cable is typically offered by wireline incumbent or competitive local exchange telephone carriers; Hybrid coax/fiber optic cable is typically provided by cable television Multi-System Operators ("MSOs"); FTTP services are typically offered by ILECs or by entities that have purchased the fiber infrastructure from an

ILEC (e.g., Ziply); Fixed wireless broadband services are offered by unlicensed low-power wireless providers; and fixed as well as mobile wireless broadband services are typically provided by Commercial Mobile Radio Service (CMRS) carriers and by certain others holding wireless spectrum licenses.

Tribal lands

The FCC broadband location data is organized with respect to standard Census Bureau geographies, principally census blocks. However, "tribal census tracts and tribal CBGs are separate and unique geographic areas defined within federally recognized American Indian reservations and can cross state and county boundaries. The tribal census tracts and tribal block groups may be completely different from the standard county-based census tracts and block groups defined for the same area."[14] In order to apply the FCC data to the nine federally-recognized tribal areas within Oregon, it is first necessary to identify the standard census blocks that lie within each of these reservations. The procedures that we have adopted for accomplishing this involves using Geographic Information System ("GIS") software to overlay "shape files" for each of the designated tribal reservations onto the standard census blocks.[15] As noted, there is not a perfect alignment between tribal and standard census blocks, such that any one standard census block may lie only partly within the geographic area of the tribal reservation. In such cases, we have utilized our judgment, based upon the percentage of the total area of the standard census block that lay within the tribal reservation and a determination, where possible, as to whether the portion of the census block that is within the tribal area constitutes the principal population center of the census block. Where this process determined that the census block should be considered as falling primarily within the tribal area, it was treated as if entirely within the tribal area; conversely, where our analysis indicated that the majority of the census block fell outside of the tribal land, it was treated as if entirely outside of the reservation. Appendix 1a-2 provides a listing of the standard census blocks that we have determined should be associated with each of the nine tribal reservations in Oregon.

Broadband availability in Oregon

FCC broadband mapping data indicate the presence of very high levels of broadband throughout the state, both with respect to availability of some type of fixed landline or fixed wireless service, but also with respect to very high maximum advertised speeds. As shown in Table 1a-2, out of the state's total population of 4,237,256, fixed landline broadband is available to 97.65%, i.e., to census blocks with a combined population of 4,137,628. There is, however, considerable variation in availability when viewed at the individual county level. Only 56.31% of the population of Wheeler County have fixed landline broadband available at their location, the lowest level in the state. At the other extreme, fixed landline broadband is available to 99.84% of the population in Clackamas County.

14. https://www2.census.gov/geo/pdfs/reference/GARM/Ch11GARM.pdf (accessed 3/28/23)

15. https://www.census.gov/cgi-bin/geo/shapefiles/index.php. (accessed 3/14/23)

Table 1a-2

LANDLINE BROADBAND SERVICE (COPPER, CABLE, FIBER) AVAILABILITY BY COUNTY

County	Total Census Blocks	Census Blocks with "Landline" Availability	Total Population	Population with Landline Availabilty	Percentage of Population with Landline Availability
Baker	2,442	1,018	16,668	15,584	93.50%
Benton	2,066	1,600	95,184	89,440	93.97%
Clackamas	7,650	6,258	421,401	420,733	99.84%
Clatsop	2,173	1,085	41,072	39,463	96.08%
Columbia	1,824	1,265	52,589	52,109	99.09%
Coos	3,425	1,836	64,929	62,736	96.62%
Crook	1,687	514	24,738	21,090	85.25%
Curry	1,923	677	23,446	22,333	95.25%
Deschutes	5,557	3,835	198,253	196,162	98.95%
Douglas	7,508	3,335	111,201	109,006	98.03%
Gilliam	496	149	1,995	1,559	78.15%
Grant	2,607	281	7,233	5,114	70.70%
Harney	2,422	410	7,495	6,201	82.74%
Hood River	809	524	23,977	23,767	99.12%
Jackson	6,690	3,914	223,259	218,101	97.69%
Jefferson	1,791	737	24,502	21,425	87.44%
Josephine	2,477	1,711	88,090	86,640	98.35%
Klamath	6,610	2,179	69,413	65,838	94.85%
Lake	2,824	434	8,160	6,204	76.03%
Lane	10,299	6,836	382,971	374,708	97.84%
Lincoln	2,498	1,673	50,395	49,753	98.73%
Linn	4,543	2,852	128,610	125,463	97.55%
Malheur	3,211	1,088	31,571	24,670	78.14%
Marion	5,975	4,883	345,920	339,117	98.03%
Morrow	1,112	362	12,186	10,830	88.87%
Multnomah	14,563	12,928	815,428	806,819	98.94%
Polk	2,058	1,384	87,433	83,925	95.99%
Sherman	354	171	1,870	1,568	83.85%
Tillamook	2,312	1,328	27,390	26,615	97.17%
Umatilla	3,894	2,042	80,075	75,170	93.87%
Union	2,470	1,239	26,196	24,642	94.07%
Wallowa	1,498	467	7,391	6,268	84.81%
Wasco	2,002	886	26,670	24,534	91.99%
Washington	7,431	6,460	600,372	597,950	99.60%
Wheeler	696	82	1,451	817	56.31%
Yamhill	2,910	2,134	107,722	101,274	94.01%
Total Oregon	130,807	78,577	4,237,256	4,137,628	97.65%

Table 1a-3

PERCENT OF "LANDLINE" BROADBAND SERVICE LOCATIONS AT EACH MAXIMUM ADVERTISED DOWNLOAD SPEED LEVEL

	Total	Total	Number of Locations in each Maximum Advertised Speed Category						
County	Population	Locations	< 10 mbps	10-24 mbps	25-49 mbps	50-99 mbps	100-499 mbps	500-999 mbps	>1000 mbps
Baker	16,668	7,555	4.67%	12.96%	9.12%	0.83%	1.91%	0.00%	70.51%
Benton	95,184	29,477	1.64%	3.97%	3.07%	1.77%	3.52%	2.05%	83.99%
Clackamas	421,401	142,305	1.72%	2.08%	0.12%	0.15%	2.44%	0.09%	93.39%
Clatsop	41,072	19,251	4.19%	2.99%	0.78%	0.22%	0.00%	0.00%	91.81%
Columbia	52,589	20,111	5.76%	10.29%	2.74%	2.49%	0.28%	0.14%	78.30%
Coos	64,929	27,889	4.42%	4.48%	0.40%	2.70%	0.27%	0.00%	87.73%
Crook	24,738	7,308	5.25%	3.34%	1.27%	0.75%	0.29%	0.00%	89.09%
Curry	23,446	10,882	2.18%	2.35%	0.08%	0.46%	0.05%	0.00%	94.88%
Deschutes	198,253	83,114	2.24%	1.69%	0.68%	0.51%	0.28%	0.00%	94.60%
Douglas	111,201	46,465	1.19%	2.03%	0.15%	0.66%	1.31%	0.02%	94.63%
Gilliam	1,995	844	5.45%	19.19%	16.23%	0.00%	0.00%	0.00%	59.12%
Grant	7,233	1,237	22.15%	4.28%	2.99%	0.81%	0.24%	0.00%	69.52%
Harney	7,495	2,691	8.55%	3.05%	0.97%	0.48%	0.07%	0.00%	86.88%
Hood River	23,977	8,672	7.60%	13.41%	4.07%	0.08%	0.00%	0.00%	74.84%
Jackson	223,259	77,398	3.80%	4.01%	1.89%	0.51%	0.03%	0.00%	89.74%
Jefferson	24,502	7,918	9.52%	5.10%	1.77%	1.10%	0.30%	1.01%	81.19%
Josephine	88,090	32,702	9.04%	10.50%	2.61%	6.31%	0.63%	0.00%	70.91%
Klamath	69,413	25,790	7.33%	9.53%	2.54%	0.90%	0.02%	0.00%	79.68%
Lake	8,160	2,750	14.44%	17.64%	1.60%	0.62%	0.00%	0.00%	65.71%
Lane	382,971	128,979	1.59%	2.32%	0.94%	0.67%	0.22%	0.36%	93.90%
Lincoln	50,395	28,794	0.72%	2.80%	1.03%	1.09%	1.35%	0.00%	93.01%
Linn	128,610	44,039	4.97%	4.21%	1.12%	0.39%	0.48%	0.01%	88.82%
Malheur	31,571	8,277	4.45%	8.30%	1.73%	1.73%	0.24%	0.00%	83.56%
Marion	345,920	103,004	1.67%	1.02%	0.13%	0.54%	0.68%	0.03%	95.93%
Morrow	12,186	3,665	10.50%	19.86%	9.20%	2.59%	21.91%	0.00%	35.93%
Multnomah	815,428	229,575	0.41%	0.23%	0.03%	0.02%	0.01%	0.19%	99.11%
Polk	87,433	25,823	5.11%	2.51%	0.78%	0.57%	0.42%	0.00%	90.60%
Sherman	1,870	854	7.38%	12.53%	5.62%	3.28%	0.00%	0.00%	71.19%
Tillamook	27,390	18,748	1.10%	1.44%	2.00%	0.15%	0.01%	0.00%	95.30%
Umatilla	80,075	25,146	3.03%	2.47%	1.24%	0.43%	7.35%	0.00%	85.48%
Union	26,196	10,848	8.55%	4.64%	0.61%	1.28%	0.61%	0.00%	84.32%
Wallowa	7,391	3,839	11.85%	19.61%	1.25%	19.98%	1.28%	0.00%	46.03%
Wasco	26,670	9,639	4.22%	5.70%	3.85%	1.27%	1.63%	0.00%	83.34%
Washington	600,372	169,739	1.35%	1.24%	0.13%	0.46%	0.06%	0.01%	96.75%
Wheeler	1,451	538	1.49%	0.93%	0.00%	0.00%	42.94%	0.00%	54.65%
Yamhill	107,722	33,258	8.18%	4.32%	0.28%	0.74%	0.07%	0.00%	86.41%
Total Oregon	4,237,256	1,399,124	2.62%	2.78%	0.82%	0.74%	0.78%	0.13%	92.14%

As part of its Broadband Data Collection specification, the FCC required providers to indicate the maximum *advertised* downlink and uplink speeds at each of the locations they serve.[16] Based upon this data, downlink speeds at or above 1 Gbps are available at 92.14% of the roughly 1.4-million locations in Oregon where landline broadband is available (see Table 1a-3). There is considerable variation in availability here as well, from a low of 35.93% in Morrow County to a high of 99.11% in Multnomah County. Table 1a-4 provides the counts of locations at each speed level in each county.

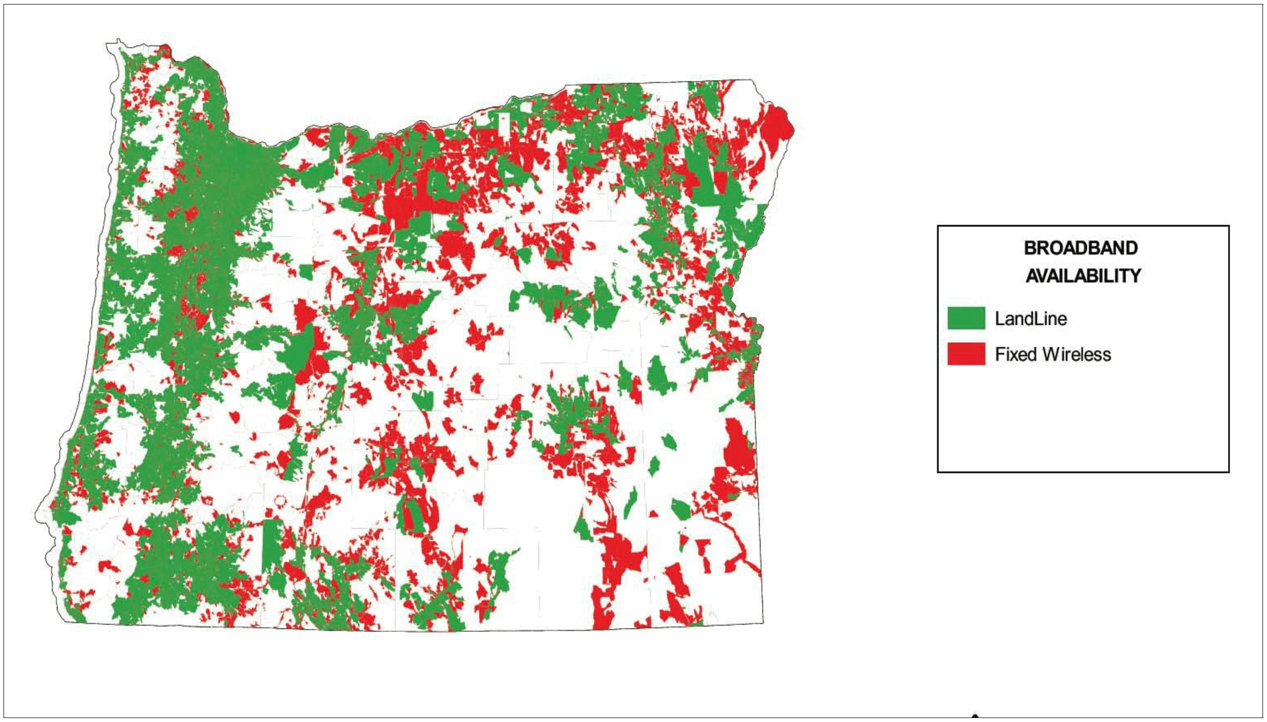


Figure 1a-1. Oregon landline broadband availability and fixed wireless availability where landline broadband is not available.

There is also widespread availability of fixed wireless throughout Oregon (Table 1a-5). In general, fixed wireless broadband offers somewhat lower speeds than landline broadband (Table 1a-6), and typically carries higher monthly charges. The same is true for satellite-based services (Table 1a-7), but with even higher monthly and substantial up-front equipment costs. However, where landline broadband is not available – often due to prohibitively high construction costs – fixed wireless is an efficient solution for areas that would otherwise go unserved. Figure 1a-1 above shows areas where landline broadband of some type is available and those areas where landline broadband is *not* available but where fixed wireless service is. Table 1a-8 presents this in tabular form. Landline broadband is available to 4,137,628 people, representing 97.65% of the total state population of 4,237,256. Where both landline and fixed wireless broadband are available, 4,194,487 people – i.e.,98.99% of the total state population – have access to broadband.

16. for consumer and small business grade services, there is typically no speed guarantee, and actual speeds may very considerably from the nominally advertised levels.

Table 1a-4

"LANDLINE" BROADBAND SERVICE (COPPER, CABLE, FIBER) LOCATIONS AT EACH MAXIMUM ADVERTISED DOWNLOAD SPEED LEVEL

County	Total Population	Total Locations	Number of Locations in each Maximum Advertised Speed Category						
			< 10 mbps	10-24 mbps	25-49 mbps	50-99 mbps	100-499 mbps	500-999 mbps	>1000 mbps
Baker	16,668	7,555	353	979	689	63	144	-	5,327
Benton	95,184	29,477	482	1,171	904	521	1,037	604	24,758
Clackamas	421,401	142,305	2,450	2,958	175	215	3,474	133	132,900
Clatsop	41,072	19,251	807	576	151	42	-	-	17,675
Columbia	52,589	20,111	1,159	2,069	552	500	56	29	15,746
Coos	64,929	27,889	1,233	1,250	111	752	75	-	24,468
Crook	24,738	7,308	384	244	93	55	21	-	6,511
Curry	23,446	10,882	237	256	9	50	5	-	10,325
Deschutes	198,253	83,114	1,862	1,401	565	424	235	3	78,624
Douglas	111,201	46,465	555	945	69	305	609	11	43,971
Gilliam	1,995	844	46	162	137	-	-	-	499
Grant	7,233	1,237	274	53	37	10	3	-	860
Harney	7,495	2,691	230	82	26	13	2	-	2,338
Hood River	23,977	8,672	659	1,163	353	7	-	-	6,490
Jackson	223,259	77,398	2,941	3,106	1,465	398	26	2	69,460
Jefferson	24,502	7,918	754	404	140	87	24	80	6,429
Josephine	88,090	32,702	2,957	3,434	853	2,063	207	-	23,188
Klamath	69,413	25,790	1,891	2,458	656	231	4	-	20,550
Lake	8,160	2,750	397	485	44	17	-	-	1,807
Lane	382,971	128,979	2,055	2,989	1,212	861	287	467	121,108
Lincoln	50,395	28,794	206	806	297	314	390	-	26,781
Linn	128,610	44,039	2,190	1,853	494	173	210	3	39,116
Malheur	31,571	8,277	368	687	143	143	20	-	6,916
Marion	345,920	103,004	1,725	1,048	133	556	701	27	98,814
Morrow	12,186	3,665	385	728	337	95	803	-	1,317
Multnomah	815,428	229,575	931	528	76	56	17	432	227,535
Polk	87,433	25,823	1,320	648	202	148	108	1	23,396
Sherman	1,870	854	63	107	48	28	-	-	608
Tillamook	27,390	18,748	207	270	375	28	1	-	17,867
Umatilla	80,075	25,146	763	620	313	108	1,847	-	21,495
Union	26,196	10,848	927	503	66	139	66	-	9,147
Wallowa	7,391	3,839	455	753	48	767	49	-	1,767
Wasco	26,670	9,639	407	549	371	122	157	-	8,033
Washington	600,372	169,739	2,287	2,100	218	779	107	23	164,225
Wheeler	1,451	538	8	5	-	-	231	-	294
Yamhill	107,722	33,258	2,720	1,438	92	245	24	-	28,739
Total Oregon	4,237,256	1,399,124	36,688	38,828	11,454	10,315	10,940	1,815	1,289,084

Table 1a-5

FIXED WIRELESS BROADBAND SERVICE AVAILABILITY BY COUNTY

County	Total Census Blocks	Census Blocks with Fixed WIreless Availability	Total Population	Population with Fixed WIreless Availabilty	Percent of Population with Fixed Wireless Availability
Baker	2,442	1,132	16,668	15,202	91.20%
Benton	2,066	1,585	95,184	89,563	94.09%
Clackamas	7,650	6,274	421,401	420,935	99.89%
Clatsop	2,173	1,236	41,072	40,665	99.01%
Columbia	1,824	1,267	52,589	51,788	98.48%
Coos	3,425	1,929	64,929	63,858	98.35%
Crook	1,687	779	24,738	24,372	98.52%
Curry	1,923	722	23,446	22,389	95.49%
Deschutes	5,557	4,019	198,253	197,740	99.74%
Douglas	7,508	3,460	111,201	109,279	98.27%
Gilliam	496	281	1,995	1,900	95.24%
Grant	2,607	368	7,233	5,967	82.50%
Harney	2,422	656	7,495	7,159	95.52%
Hood River	809	552	23,977	23,858	99.50%
Jackson	6,690	4,280	223,259	221,177	99.07%
Jefferson	1,791	950	24,502	23,728	96.84%
Josephine	2,477	1,789	88,090	87,364	99.18%
Klamath	6,610	2,867	69,413	68,982	99.38%
Lake	2,824	842	8,160	7,901	96.83%
Lane	10,299	6,756	382,971	373,036	97.41%
Lincoln	2,498	1,557	50,395	48,086	95.42%
Linn	4,543	3,086	128,610	128,165	99.65%
Malheur	3,211	1,585	31,571	31,106	98.53%
Marion	5,975	4,979	345,920	340,983	98.57%
Morrow	1,112	504	12,186	11,800	96.83%
Multnomah	14,563	12,977	815,428	808,161	99.11%
Polk	2,058	1,574	87,433	86,605	99.05%
Sherman	354	244	1,870	1,855	99.20%
Tillamook	2,312	1,312	27,390	26,046	95.09%
Umatilla	3,894	2,453	80,075	79,486	99.26%
Union	2,470	1,562	26,196	25,948	99.05%
Wallowa	1,498	693	7,391	7,045	95.32%
Wasco	2,002	1,068	26,670	26,014	97.54%
Washington	7,431	6,529	600,372	598,926	99.76%
Wheeler	696	162	1,451	1,145	78.91%
Yamhill	2,910	2,327	107,722	104,054	96.59%
Total Oregon	130,807	84,356	4,237,256	4,182,288	98.70%

Table 1a-6

"FIXED WIRELESS" BROADBAND SERVICE
MAXIMUM ADVERTISED DOWNLOAD SPEED

	Number of Census Blocks in each Maximum Advertised Speed Category							
County	**1-9 mbps**	**10-24 mbps**	**25-49 mbps**	**50-99 mbps**	**100-299 mbps**	**300-499 mbps**	**500-999 mbps**	**>1000 mbps**
Baker	68	133	715	1	215			
Benton	158		34	46	820	527		
Clackamas	1,129	1	1,164	1,688	1,767	525		
Clatsop	487		334	76	113	226		
Columbia	462	109	149	272	64	211		
Coos	45	142	1,568	91	83			
Crook	11	93	533	20	122			
Curry	10	64	291	50	307			
Deschutes	8	82	1,503	2,028	398			
Douglas	81	259	2,823	46	251			
Gilliam	16	89	168	1	7			
Grant		71	284	12	1			
Harney	47	211	394		4			
Hood River	3	15	492	39	3			
Jackson	13	91	562	39	3,575			
Jefferson	16	64	115	591	163	1		
Josephine	7	71	1,274	124	313			
Klamath	48	160	2,483	61	115			
Lake	68	396	358	19		1		
Lane	961	29	851	1,909	3,006			
Lincoln	928		343	193	93			
Linn	189		185	294	1,553	865		
Malheur	148	109	203	941	184			
Marion	426		763	701	2,236	852		1
Morrow	12	44	356	6	41		45	
Multnomah	336	364	1,285	1,288	6,951	2,266		487
Polk	91		75	319	888	201		
Sherman	3	22	217	2				
Tillamook	871		186	113	43	99		
Umatilla	18	104	842	145	1,344			
Union	29	267	1,249	17				
Wallowa	16	123	554					
Wasco	12	120	845	63	27		1	
Washington	337	54	800	731	2,808	1,785		14
Wheeler	20	21	119		2			
Yamhill	247	27	374	690	684	305		
Total Oregon	**7,321**	**3,335**	**24,491**	**12,616**	**28,181**	**7,864**	**46**	**502**

Table 1a-7

SATELLITE BROADBAND SERVICE
MAXIMUM ADVERTISED DOWNLOAD SPEED

	Number of Census Blocks in each Maximum Advertised Speed Category							
County	<10 mbpa	10-24 mbps	25-49 mbps	50-99 mbps	100-299 mbps	300-499 mbps	500-999 mbps	>1000 mbps
Baker						1,367		
Benton						1,642		
Clackamas					5,537	779		
Clatsop					167	1,116		
Columbia					1,058	284		
Coos					856	1,225		
Crook					162	746		
Curry						865		
Deschutes					3,340	683		
Douglas					1,319	2,409		
Gilliam						309		
Grant						741		
Harney						805		
Hood River					398	155		
Jackson					4,004	384		
Jefferson					105	864		
Josephine					1,527	320		
Klamath						2,911		
Lake						902		
Lane					5,983	1,269		
Lincoln						1,746		
Linn					599	2,555		
Malheur					626	1,110		
Marion					3,659	1,368		
Morrow						601		
Multnomah					12,976	5		
Polk					1,354	234		
Sherman					7	237		
Tillamook					1	1,440		
Umatilla					796	1,730		
Union						1,636		
Wallowa						804		
Wasco					751	336		
Washington					6,543	5		
Wheeler						286		
Yamhill					2,065	292		
Total Oregon	-	-	-	-	**53,833**	**34,161**	-	-

Table 1a-8

"LANDLINE" BROADBAND SERVICE (COPPER, CABLE, FIBER) AND FIXED WIRELESS BROADBAND SERVICE AVAILABILITY

County	Total Census Blocks	Total Population	Population With Landline Broadband Service Available	Population with Fixed Wireless Broadband Service Where Landline Broadband Service is Not Available	Population with Landline and/or Fixed Wireless Broadband Available	Percent of Population with Landline and/or Fixed Wireless Broadband Available
Baker	2,442	16,668	15,584	858	16,442	98.64%
Benton	2,066	95,184	89,440	393	89,833	94.38%
Clackamas	7,650	421,401	420,733	315	421,048	99.92%
Clatsop	2,173	41,072	39,463	1,337	40,800	99.34%
Columbia	1,824	52,589	52,109	232	52,341	99.53%
Coos	3,425	64,929	62,736	1,365	64,101	98.72%
Crook	1,687	24,738	21,090	3,288	24,378	98.54%
Curry	1,923	23,446	22,333	507	22,840	97.42%
Deschutes	5,557	198,253	196,162	1,578	197,740	99.74%
Douglas	7,508	111,201	109,006	809	109,815	98.75%
Gilliam	496	1,995	1,559	341	1,900	95.24%
Grant	2,607	7,233	5,114	1,364	6,478	89.56%
Harney	2,422	7,495	6,201	968	7,169	95.65%
Hood River	809	23,977	23,767	91	23,858	99.50%
Jackson	6,690	223,259	218,101	3,197	221,298	99.12%
Jefferson	1,791	24,502	21,425	2,312	23,737	96.88%
Josephine	2,477	88,090	86,640	1,051	87,691	99.55%
Klamath	6,610	69,413	65,838	3,174	69,012	99.42%
Lake	2,824	8,160	6,204	1,701	7,905	96.88%
Lane	10,299	382,971	374,708	2,589	377,297	98.52%
Lincoln	2,498	50,395	49,753	100	49,853	98.92%
Linn	4,543	128,610	125,463	2,816	128,279	99.74%
Malheur	3,211	31,571	24,670	6,617	31,287	99.10%
Marion	5,975	345,920	339,117	2,024	341,141	98.62%
Morrow	1,112	12,186	10,830	1,018	11,848	97.23%
Multnomah	14,563	815,428	806,819	1,365	808,184	99.11%
Polk	2,058	87,433	83,925	2,704	86,629	99.08%
Sherman	354	1,870	1,568	274	1,842	98.50%
Tillamook	2,312	27,390	26,615	222	26,837	97.98%
Umatilla	3,894	80,075	75,170	4,317	79,487	99.27%
Union	2,470	26,196	24,642	1,318	25,960	99.10%
Wallowa	1,498	7,391	6,268	813	7,081	95.81%
Wasco	2,002	26,670	24,534	1,510	26,044	97.65%
Washington	7,431	600,372	597,950	1,118	599,068	99.78%
Wheeler	696	1,451	817	347	1,164	80.22%
Yamhill	2,910	107,722	101,274	2,826	104,100	96.64%
TOTAL	130,807	4,237,256	4,137,628	56,859	4,194,487	98.99%

This is of particular importance in communities with a low landline broadband presence – e.g., Wheeler County's low rate of 56.31% landline availability increases to 80.22% when access to fixed wireless broadband is included. Similar availability gains are evident in a number of other counties as well. There is, however, considerable variation in availability when viewed at the individual county level.

For counties with low rates of landline broadband availability, the presence of fixed wireless broadband often results in considerably higher availability overall. Table 1a-9 compares the total availability in terms of populations for the ten counties with the lowest landline availability to the availability rates for these same counties at locations where at least one or both landline and fixed wireless are offered. Finally, Tables 1a-10 and 1a-11 show the distribution of maximum advertised speeds at locations where only fixed wireless and no landline broadband, is available.

Table 1a-9

INCREMENTAL EFFECT OF FIXED WIRELESS AVAILABILITY IN COUNTIES WITH LIMITED LANDLINE BROADBAND

		Landline broadband		Landline and/or Fixed Wireless	
County	Population	Population	Pct of total	Population	Pct of total
Wheeler	1,451	817	56.31%	1,164	80.22%
Grant	7,233	5,114	70.70%	6,478	89.56%
Lake	8,160	6,204	76.03%	7,905	96.88%
Malheur	31,571	24,670	78.14%	31,287	99.10%
Gilliam	1,995	1,559	78.15%	1,900	95.24%
Harney	7,495	6,201	82.74%	7,169	95.65%
Sherman	1,870	1,568	83.85%	1,842	98.50%
Wallowa	7,391	6,268	84.81%	7,081	95.81%
Crook	24,738	21,090	85.25%	24,378	98.54%
Jefferson	24,502	21,425	87.44%	23,737	96.88%
Morrow	12,186	10,830	88.87%	11,848	97.23%

Table 1a-10

PERCENT OF FIXED WIRELESS BROADBAND SERVICE WITH NO LANDLINE BROADBAND SERVICE AVAILABLE AT EACH MAXIMUM ADVERTISED DOWNLOAD SPEED LEVEL

County	Total Population	Total Locations	Number of Census Blocks in each Maximum Advertised Speed Category							
			1-9 mbps	10-24 mbps	25-49 mbps	50-99 mbps	100-299 mbps	300-499 mbps	500-999 mbps	>1000 mbps
Baker	16,668	610	18.69%	33.61%	46.39%	0.00%	1.31%	0.00%	0.00%	0.00%
Benton	95,184	87	16.09%	0.00%	22.99%	16.09%	41.38%	3.45%	0.00%	0.00%
Clackamas	421,401	123	88.62%	0.00%	4.88%	5.69%	0.81%	0.00%	0.00%	0.00%
Clatsop	41,072	778	82.01%	0.00%	14.40%	1.67%	0.39%	1.54%	0.00%	0.00%
Columbia	52,589	167	77.84%	20.96%	0.00%	1.20%	0.00%	0.00%	0.00%	0.00%
Coos	64,929	474	18.57%	48.10%	33.12%	0.00%	0.21%	0.00%	0.00%	0.00%
Crook	24,738	1,847	3.14%	24.91%	70.28%	1.30%	0.38%	0.00%	0.00%	0.00%
Curry	23,446	262	7.63%	38.55%	43.51%	3.44%	6.87%	0.00%	0.00%	0.00%
Deschutes	198,253	988	1.82%	21.76%	71.66%	4.15%	0.61%	0.00%	0.00%	0.00%
Douglas	111,201	504	12.50%	29.76%	56.75%	0.20%	0.79%	0.00%	0.00%	0.00%
Gilliam	1,995	298	21.81%	55.03%	21.48%	0.34%	1.34%	0.00%	0.00%	0.00%
Grant	7,233	760	0.00%	18.03%	81.32%	0.66%	0.00%	0.00%	0.00%	0.00%
Harney	7,495	599	18.20%	64.27%	17.03%	0.00%	0.50%	0.00%	0.00%	0.00%
Hood River	23,977	52	7.69%	32.69%	59.62%	0.00%	0.00%	0.00%	0.00%	0.00%
Jackson	223,259	1,510	3.64%	9.60%	10.33%	0.00%	76.42%	0.00%	0.00%	0.00%
Jefferson	24,502	833	4.92%	18.13%	37.45%	35.89%	3.60%	0.00%	0.00%	0.00%
Josephine	88,090	398	6.28%	26.88%	66.58%	0.25%	0.00%	0.00%	0.00%	0.00%
Klamath	69,413	2,614	4.44%	21.00%	73.18%	0.54%	0.84%	0.00%	0.00%	0.00%
Lake	8,160	1,188	15.32%	57.15%	25.34%	2.19%	0.00%	0.00%	0.00%	0.00%
Lane	382,971	896	65.18%	2.46%	10.94%	11.72%	9.71%	0.00%	0.00%	0.00%
Lincoln	50,395	48	97.92%	0.00%	0.00%	2.08%	0.00%	0.00%	0.00%	0.00%
Linn	128,610	1,119	9.74%	0.00%	7.60%	21.98%	51.74%	8.94%	0.00%	0.00%
Malheur	31,571	1,981	18.68%	10.50%	14.13%	53.21%	3.48%	0.00%	0.00%	0.00%
Marion	345,920	715	36.64%	0.00%	22.94%	6.43%	33.99%	0.00%	0.00%	0.00%
Morrow	12,186	424	8.96%	28.30%	42.22%	0.47%	0.00%	0.00%	20.05%	0.00%
Multnomah	815,428	83	32.53%	18.07%	25.30%	7.23%	16.87%	0.00%	0.00%	0.00%
Polk	87,433	1,298	28.66%	0.00%	8.63%	19.80%	39.83%	3.08%	0.00%	0.00%
Sherman	1,870	220	4.09%	35.45%	60.45%	0.00%	0.00%	0.00%	0.00%	0.00%
Tillamook	27,390	118	99.15%	0.00%	0.00%	0.00%	0.85%	0.00%	0.00%	0.00%
Umatilla	80,075	1,323	2.80%	20.33%	39.61%	6.88%	30.39%	0.00%	0.00%	0.00%
Union	26,196	1,083	10.16%	53.55%	36.29%	0.00%	0.00%	0.00%	0.00%	0.00%
Wallowa	7,391	647	4.33%	49.30%	46.37%	0.00%	0.00%	0.00%	0.00%	0.00%
Wasco	26,670	688	6.83%	41.72%	50.29%	0.58%	0.58%	0.00%	0.00%	0.00%
Washington	600,372	394	60.15%	17.51%	17.01%	1.27%	2.54%	1.52%	0.00%	0.00%
Wheeler	1,451	237	21.10%	34.18%	43.46%	0.00%	1.27%	0.00%	0.00%	0.00%
Yamhill	107,722	1,053	72.55%	7.88%	7.98%	2.18%	3.42%	5.98%	0.00%	0.00%
Total Oregon	**4,237,256**	**26,419**	**19.14%**	**22.18%**	**36.47%**	**8.69%**	**12.35%**	**0.85%**	**0.32%**	**0.00%**

Table 1a-11

**FIXED WIRELESS BROADBAND SERVICE LOCATIONS
WITH NO LANDLINE BROADBAND SERVICE AVAILABLE
AT EACH MAXIMUM ADVERTISED DOWNLOAD SPEED LEVEL**

County	Total Population	Total Locations	Number of Census Blocks in each Maximum Advertised Speed Category							
			1-9 mbps	10-24 mbps	25-49 mbps	50-99 mbps	100-299 mbps	300-499 mbps	500-999 mbps	>1000 mbps
Baker	16,668	610	114	205	283	-	8	-	-	-
Benton	95,184	87	14	-	20	14	36	3	-	-
Clackamas	421,401	123	109	-	6	7	1	-	-	-
Clatsop	41,072	778	638	-	112	13	3	12	-	-
Columbia	52,589	167	130	35	-	2	-	-	-	-
Coos	64,929	474	88	228	157	-	1	-	-	-
Crook	24,738	1,847	58	460	1,298	24	7	-	-	-
Curry	23,446	262	20	101	114	9	18	-	-	-
Deschutes	198,253	988	18	215	708	41	6	-	-	-
Douglas	111,201	504	63	150	286	1	4	-	-	-
Gilliam	1,995	298	65	164	64	1	4	-	-	-
Grant	7,233	760	-	137	618	5	-	-	-	-
Harney	7,495	599	109	385	102	-	3	-	-	-
Hood River	23,977	52	4	17	31	-	-	-	-	-
Jackson	223,259	1,510	55	145	156	-	1,154	-	-	-
Jefferson	24,502	833	41	151	312	299	30	-	-	-
Josephine	88,090	398	25	107	265	1	-	-	-	-
Klamath	69,413	2,614	116	549	1,913	14	22	-	-	-
Lake	8,160	1,188	182	679	301	26	-	-	-	-
Lane	382,971	896	584	22	98	105	87	-	-	-
Lincoln	50,395	48	47	-	-	1	-	-	-	-
Linn	128,610	1,119	109	-	85	246	579	100	-	-
Malheur	31,571	1,981	370	208	280	1,054	69	-	-	-
Marion	345,920	715	262	-	164	46	243	-	-	-
Morrow	12,186	424	38	120	179	2	-	-	85	-
Multnomah	815,428	83	27	15	21	6	14	-	-	-
Polk	87,433	1,298	372	-	112	257	517	40	-	-
Sherman	1,870	220	9	78	133	-	-	-	-	-
Tillamook	27,390	118	117	-	-	-	1	-	-	-
Umatilla	80,075	1,323	37	269	524	91	402	-	-	-
Union	26,196	1,083	110	580	393	-	-	-	-	-
Wallowa	7,391	647	28	319	300	-	-	-	-	-
Wasco	26,670	688	47	287	346	4	4	-	-	-
Washington	600,372	394	237	69	67	5	10	6	-	-
Wheeler	1,451	237	50	81	103	-	3	-	-	-
Yamhill	107,722	1,053	764	83	84	23	36	63	-	-
Total Oregon	**4,237,256**	**26,419**	**5,057**	**5,859**	**9,635**	**2,297**	**3,262**	**224**	**85**	**-**

Service providers offering broadband service in Oregon

There are more than 100 service providers offering broadband service of some type in Oregon. Some of these are affiliates of large companies with nationwide footprints; others have a more limited, largely local presence. Table 1a-12 below summarizes the number of providers offering broadband service in Oregon at each of the seven "last mile" technologies. Appendix 1a-1 includes a series of individual tables detailing broadband availability for each county by last-mile technology and service provider.

Table 1a-12

NUMBER OF SERVICE PROVIDERS AND LOCATIONS SERVED AT EACH "LAST MILE" TECHNOLOGY

Technology	Number of Providers	Total Locations (see Note)	Largest	Locations Served
10 – Copper	31	1,022,315	CenturyLink Ziply Fiber	636,943 342,637
40 – Cable	11	1,335,509	Xfinity Charter Wave TDS Telecom	768,492 328,963 142,182 81,112
50 – Fiber	56	636,460	Ziply Fiber CenturyLink Wave DFN	235,969 197,663 56,540 45,884
60 – Geostationary satellite	2	1,484,665	Viasat, Inc. HughesNet	1,484,114 1,484,665
61 – Low-Earth Orbit Satellite	1	1,484,665	Starlink	1,484,665
70 – Unlicensed fixed wireless	37	695,243 See Note	Alyrica StarTouch Rogue Broadband CASCO Blue Mountainnet	214,512 151,716 70,333 70,116 45,295
71 – Licensed fixed wireless	15	At least 1,434,026 See Note	T-Mobile US TDS Telecom Alyrica Verizon Elevate ConnX	1,434,026 442,998 338,500 297,378 216,968

Note: The total locations served may include duplicates for locations served by more than one provider.
Source: Appendix 1a-1.

Finally, satellite broadband service is available ubiquitously throughout Oregon. While typically slower and certainly more expensive than either landline or fixed wireless, the availability of either geostationary or low earth orbit services offers at least the technical possibility of assuring universal broadband availability throughout the state.

Broadband availability in Tribal Lands

There is at least some broadband availability in all nine of the state's federally recognized Tribal Lands, although the extent of such availability is highly variable. All seven FCC-defined broadband technologies have a presence in these areas, with fixed wireless and satellite services accounting for the largest numbers of locations served. Table 1a-13 summarizes the number of locations served by each broadband technology in each of the nine Tribal Lands.

Table 1a-14 shows the numbers of locations at each of the maximum advertised downlink speed categories for the three landline broadband technologies combined. Notably, where landline broadband is available – which occurs in only 1,592 out of the total 6,002 locations in the Tribal Lands – most have very high speed (> 1 Gbps) availability. Table 1a-15 provides similar data for locations in which fixed wireless broadband, but not any landline, is offered. Fixed wireless broadband brings service to an additional 94 locations in the tribal areas. In all of these locations, maximum advertised download speeds are below 500 mbps.

Table 1a-13

TOTAL BROADBAND SERVICE PROVIDERS BY LOCATIONS IN TRIBAL AREAS BY TECHNOLOGY (REFLECTS MULTIPLE PROVIDERS AT LOCATIONS)

Tribal Area	Population	Locations	Copper Tech 10	Cable Tech 40	Fiber Tech 50	Satellite Geo Stationary Tech 60	Satellite Low Earth Orbit Tech 61	Fixed Wireless Unlicensed Tech 70	Fixed Wireless Licensed Tech 71
Burns Paiute	133	56	10	12	-	63	21	23	42
Coos. Lower Umpqua, Siusla	77	81	27	25	30	81	27	2	52
Coquille	343	100	31	30	30	102	34	-	68
Cow Creek	289	493	148	95	104	510	170	80	334
Grand Ronde	604	561	125	185	85	564	188	18	622
Klamath	25	51	7	-	-	66	22	-	42
Siletz	685	374	117	155	83	477	159	2	64
Umatilla	2,877	2,776	388	531	794	3,000	1,000	914	1,846
Warm Springs	3,403	1,510	221	-	-	1,938	646	857	1,262
TOTALS	**8,436**	**6,002**	**1,074**	**1,033**	**1,126**	**6,801**	**2,267**	**1,896**	**4,332**

Table 1a-14

"LANDLINE" BROADBAND SERVICE (COPPER, CABLE, FIBER) IN TRIBAL LANDS
MAXIMUM ADVERTISED DOWNLOAD SPEED

			Number of Locations in each Maximum Advertised Speed Category					
Tribal Area	Population	Housing Units	< 10 mbps	10-24 mbps	25-99 mbps	100-499 mbps	500-999 mbps	>1000 mbps
Burns Paiute	133	52	1	-	1	-	-	12
Coos. Lower Umpqua, Siusla	77	33	-	1	-	-	-	26
Coquille	343	174	1	-	-	-	-	31
Cow Creek	289	122	19	3	3	-	-	131
Grand Ronde	604	263	-	-	-	-	-	185
Klamath	25	21	3	2	2	-	-	-
Siletz	685	231	-	-	-	-	-	153
Umatilla	2,877	1,175	7	1	2	-	-	787
Warm Springs	3,403	1,035	200	21	-	-	-	-
TOTALS	**8,436**	**3,106**	**231**	**28**	**8**	**-**	**-**	**1,325**

Table 1a-15

**FIXED WIRELESS BROADBAND SERVICE IN TRIBAL LANDS
WHERE LANDLINE BROADBAND IS NOT AVAILABLE
MAXIMUM ADVERTISED DOWNLOAD SPEED**

Tribal Area	Population	Housing Units	< 10 mbps	10-24 mbps	25-99 mbps	100-499 mbps	500-999 mbps	>1000 mbps
			Number of Locations in each Maximum Advertised Speed Category					
Burns Paiute	133	52	-	3	1	-	-	-
Coos. Lower Umpqua, Siusla	77	33	-	1	-	-	-	-
Coquille	343	174	-	-	-	-	-	-
Cow Creek	289	122	-	-	1	-	-	-
Grand Ronde	604	263	-	-	-	1	-	-
Klamath	25	21	1	-	1	-	-	-
Siletz	685	231	-	-	-	-	-	-
Umatilla	2,877	1,175	2	1	4	34	-	-
Warm Springs	3,403	1,035	6	21	17	-	-	-
TOTALS	**8,436**	**3,106**	**9**	**26**	**24**	**35**	**-**	**-**

Tribal area broadband availability maps

In Appendix 1c-3, we provide sets of five (5) maps for each of the nine Tribal Lands, as follows:

(1) A map showing all of the standard census blocks that are wholly or mostly included in the reservation. In several cases, the tribal land extends into two or more counties (Coos and Grand Ronde) or, in the case of Klamath, the reservation is in two non-contiguous parts of Klamath County. In each of these three cases, map sets for each county (or, in the case of Klamath, for each of the two regions) are provided.

(2) Areas showing the (standard) census blocks in which some type of landline broadband service is available.

(3) Areas showing the (standard) census blocks in which fixed wireless broadband service is available where landline broadband service is not available.

(4) Maximum advertised downlink speed for landline broadband, at each (standard) census block where landline broadband is available.

(5) Areas showing the (standard) census blocks in which fixed wireless broadband service is available.

Tribal lands have a presence in 18 counties. Table 1a-16 below compares the landline and fixed wireless availability for each of these counties as a whole with the corresponding availability for the individual tribal lands within each of these counties. In some cases, the identified tribal area appears to have no population. For the most part, the landline and fixed wireless broadband availability rates in the tribal areas appear to be similar to those for the county as a whole and, in some cases, the availability level for the tribal area is actually slightly higher than for the overall county. The one notable exception appears to be the portion of the Warm Springs reservation located in Wasco County. County-wide, the availability rates for landline and fixed wireless are 91.99% and 97.54%, respectively. However, for the Warm Springs reservation of Wasco County, which has a population of 781, the corresponding availability rates are 0% and 54%.

Table 1a-16

COUNTY-WIDE AND TRIBAL AREA BROADBAND AVAILABILITY

County	Population	% with Landline	% with Fixed Wireless	Tribal Area	Population	% with Landline	% with Fixed Wireless
Clackamas	421,401	99.84%	99.89%	Warm Springs	0	-	-
Coos	64,929	96.62%	98.35%	Coos. Lower Umpqua, Siuslaw	71	100%	100%
				Coquille	343	93%	93%
Curry	23,446	95.25%	95.49%	Coos. Lower Umpqua, Siuslaw	0	-	-
Douglas	111,201	98.03%	98.27%	Cow Creek	289	95%	98%
Gilliam	1,995	78.15%	95.24%	Warm Springs	0	-	-
Harney	7,495	82.74%	95.52%	Burns Paiute	133	98%	100%
Hood River	23,977	99.12%	99.50%	Warm Springs	0	-	-
Jefferson	24,502	87.44%	96.84%	Warm Springs	2,622	68%	76%
Klamath	69,413	94.85%	99.38%	Klamath	25	76%	88%
Lane	382,971	97.84%	97.41%	Coos. Lower Umpqua, Siuslaw	6	100%	100%
				Grand Ronde	0	-	-
Lincoln	50,395	98.73%	95.42%	Siletz	685	97%	44%
Marion	345,920	98.03%	98.57%	Siletz	0	-	-
				Warm Springs	0	-	-
Polk	87,433	95.99%	99.05%	Grand Ronde	441	100%	100%
Sherman	1,870	83.85%	99.20%	Warm Springs	0	-	-
Umatilla	80,075	93.87%	99.26%	Umatilla	2,877	83%	95%
Union	26,196	94.07%	99.05%	Umatilla	0	-	-
Wasco	26,670	91.99%	97.54%	Warm Springs	781	-	54%
Yamhill	107,722	94.01%	96.59%	Grand Ronde	163	98%	98%

1b: Challenges in areas lacking access to broadband Internet access service

Introduction

As we have noted, some form of broadband Internet access is available almost ubiquitously throughout Oregon, and the vast majority of the state's population is offered broadband access at advertised downlink speeds in excess of 500 mbps. However, there are certainly areas where service is limited, both as to availability and, where available, speed. There are a number of potential explanations for the lack of sufficient broadband infrastructure in some areas. These include carrier prioritization being directed elsewhere, absence of any service provider, lack of competition, or physical impediments such as those related to low population density, inaccessible terrain, higher-than-average construction costs, and similar factors. All of the counties with low landline broadband availability are rural. The ten counties with the lowest levels of landline broadband availability that are identified in Table 1a-7 above have a combined population of 128,592, representing only 3.03% of the total state population. Yet even here, landline broadband is available to 105,746 people, i.e., to 82.2% of the total population of these ten counties.

Household income and other demographic data

The FCC broadband data is organized at the census block level. However, while some Census Bureau data – population, number of households, area – are available at the census block level, many demographic attributes – median household income, age, ethnicity, race – as well as the extent and type of Internet access and use, are compiled as part of the Census Bureau's American Community Survey ("ACS") and are only available at the Census Block Group ("CBG") level. As summarized in Table 1b-1 below, we have compiled a number of census block and census block group attributes from the 2020 Census and from the ACS, the latter based upon 2020 and 2021 census data, and have developed several additional attributes by calculating these from the base data.

Census Block Groups are defined to contain between 600 and 3,000 people. Within the standard census geographic hierarchy, CBGs never cross state, county, or census tract boundaries, but may cross the boundaries of any other geographic entity.[17] Where our analyses require that we utilize both CB- and CBG-level data, where data is available only at the CBG level, we aggregate the individual CB-level data into CBGs.

17. US Census Bureau, available at https://www.census.gov/programs-surveys/geography/about/glossary.html#par_textimage_4 (accessed 3/23/23).

Table 1b-1

CENSUS BLOCK POPULATION AND DEMOGRAPHIC ATTRIBUTES

Census Attribute	Source	Geographic level
Population	Census	CB
Area	Census	CB
Housing Units	Census	CB
Density (Housing units per square mile)	Calculated	
Median Household Income	ACS	CBG
Internet service at home	ACS	CBG
Race – percent white	ACS	CBG
Race – percent non-white	Calculated	
Race – Percent Asian/Pac. Isl.	ACS	CBG
Age of Head of Household	ACS	CBG
Urban/Rural flag	ACS	CBG

We have attempted to identify relationships extant between broadband availability and various attributes, including area, terrain, household population, population density, and certain key demographics, such as income, ethnicity, race, age, and other population attributes.

Some ACS data is reported on a 1-year basis and is updated annually. Other data is reported on a 5-year average basis, and is also updated annually. In general, the ACS provides 1-year data for counties whose populations exceed 65,000. The 21 counties in Oregon that fall below this threshold accounted for only 11.3% of the state's population in 2021. We have elected to utilize 1-year data where available and 5-year average figures for the smaller counties where the 1-year data is not provided. Roughly 88.7% of the state's population is reported at the 1-year level. We believe that this approach, while seemingly inconsistent, should be used because it provides the most current data for the vast majority of Oregon.

Home Internet use

Not all consumers subscribe to broadband access even where it is available, or to service at the maximum advertised speed that is offered at their locations. The FCC BDC data focuses upon *availability*, not penetration or demand. The FCC does not publish geographically granular data on service take-rates (penetration). We had sought such data via data requests sent to Oregon broadband providers,[18] but have not received a sufficient number of sufficiently detailed responses to support a statewide rake-rate analysis. However, the U.S. Census Bureau's ACS does include counts of households with "Internet at Home" at the Census Block Group (CBG) level. The ACS reports a number of Internet consumption attributes, as detailed in Table 1b-2 below.

18. Data Request 1(b)(iii).

Table 1b-2

AMERICAN COMMUNITY SURVEY
"HOME INTERNET" SERVICE CATEGORIES

Quantities for categories marked with a ✓ are included in Tables 1b-3 and 1b-4

Total number of households	✓
Households with an Internet subscription of any sort	
Households with dial-up access and with no other type of Internet subscription	
Households with broadband of any type	✓
Households with a cellular data plan	✓
Households with a cellular data plan with no other type of Internet subscription	
Households with landline broadband – copper (DSL), cable, or fiber optic	✓
Households with landline broadband – copper (DSL), cable, or fiber optic – with no other type of Internet subscription	
Households with satellite Internet service	✓
Households with satellite Internet service with no other type of Internet subscription	
Households with another type of Internet subscription but with no other type of Internet subscription	
Households that use Internet access without a subscription (e.g., at a location other than their home)	✓
Households that have no Internet use or access	✓
Source: American Community Survey, Presence and Types of Internet Subscriptions in Household, Table B28002, 1-Year and 5-Year Estimates, accessed through Census website, https://data.census.gov (accessed 3/14/23).	

Table 1b-3 provides, for each of Oregon's 36 counties, the total number of households and the percentage of households that subscribe to the various types of Internet service at their homes that are marked with a ✓ in Table 1b-2. Table 1b-4 provides the household counts for each of these same service categories. Notably, the percentages of households with Cellular Data subscriptions exceeds the landline broadband take-rates. Thus, for many households, smartphones serve as the access point to the Internet.

Table 1b-3

2021 AMERICAN COMMUNITY SURVEY
PERCENTAGE OF OREGON HOUSEHOLDS WITH INTERNET ACCESS

County		Total Households	Broadband Internet subscription - any type	Landline Broadband (Cable, Fiber, DSL)	Satellite Broadband	Cellular Data	Use Internet - No Subscription	No Internet Use
Baker County	*	6,976	81.14%	59.16%	8.69%	65.77%	2.98%	15.22%
Benton County		39,350	90.49%	80.93%	9.11%	82.18%	5.31%	3.99%
Clackamas County		161,945	94.94%	83.56%	5.69%	89.64%	2.26%	2.76%
Clatsop County	*	16,649	87.52%	72.92%	8.84%	78.63%	2.37%	9.76%
Columbia County	*	19,933	89.69%	71.44%	9.07%	80.94%	1.29%	8.49%
Coos County	*	27,627	84.70%	64.72%	8.39%	73.07%	1.94%	12.95%
Crook County	*	9,951	85.50%	57.39%	20.65%	76.65%	2.09%	12.13%
Curry County	*	10,788	83.43%	65.66%	8.17%	72.79%	1.99%	14.02%
Deschutes County		83,763	93.16%	76.62%	8.13%	84.43%	1.98%	4.86%
Douglas County		45,981	87.15%	70.17%	8.88%	75.18%	1.28%	11.42%
Gilliam County	*	902	81.93%	56.76%	15.19%	57.10%	4.32%	13.75%
Grant County	*	3,274	80.85%	54.06%	15.18%	62.68%	0.76%	18.11%
Harney County	*	3,076	80.36%	42.62%	18.11%	69.08%	2.18%	17.20%
Hood River County	*	8,949	87.34%	72.70%	11.36%	81.33%	2.46%	10.06%
Jackson County		90,817	88.57%	73.02%	7.81%	82.38%	4.28%	6.94%
Jefferson County	*	8,244	86.50%	58.21%	16.65%	74.66%	1.86%	11.62%
Josephine County		36,755	89.38%	64.75%	12.13%	80.62%	1.01%	9.21%
Klamath County		28,888	85.70%	67.06%	11.50%	70.14%	3.63%	10.54%
Lake County	*	3,427	68.31%	46.10%	16.19%	49.37%	4.26%	27.34%
Lane County		160,158	92.53%	77.04%	6.88%	85.45%	2.34%	4.89%
Lincoln County	*	22,093	88.24%	72.10%	8.34%	74.20%	2.27%	8.99%
Linn County		51,347	90.16%	74.81%	4.89%	81.44%	2.55%	7.19%
Malheur County	*	9,783	83.14%	49.53%	12.76%	74.47%	2.23%	14.40%
Marion County		124,719	92.02%	76.96%	7.66%	85.80%	2.01%	5.66%
Morrow County	*	4,085	84.43%	57.50%	15.40%	73.44%	1.91%	11.53%
Multnomah County		348,216	93.15%	82.13%	3.80%	88.82%	2.06%	4.66%
Polk County		33,425	90.91%	75.65%	10.28%	84.32%	2.64%	6.07%
Sherman County	*	711	80.03%	58.51%	12.80%	65.82%	4.50%	15.47%
Tillamook County	*	11,381	87.05%	70.42%	11.24%	72.24%	2.58%	9.66%
Umatilla County		27,247	79.08%	57.16%	13.23%	74.73%	8.78%	11.87%
Union County	*	10,536	81.25%	61.50%	9.94%	69.81%	3.00%	14.35%
Wallowa County	*	3,269	80.64%	55.49%	17.44%	65.19%	5.93%	12.85%
Wasco County	*	10,345	83.64%	65.94%	11.25%	71.44%	4.05%	12.08%
Washington County		233,615	94.72%	85.94%	3.46%	89.89%	2.21%	2.91%
Wheeler County	*	630	76.51%	33.33%	33.02%	53.17%	6.67%	16.83%
Yamhill County		38,988	90.75%	73.14%	8.76%	82.78%	4.07%	4.91%
Total Oregon (ACS 1Y & 5Y			**91.40%**	**77.25%**	**6.76%**	**84.53%**	**2.51%**	**5.89%**
Total Oregon ACS 5Y			**89.50%**	**74.77%**	**6.66%**	**81.33%**	**2.68%**	**7.52%**
Total Oregon - ACS 1Y			**91.62%**	**77.54%**	**6.80%**	**85.18%**	**2.56%**	**5.64%**

*The ACS 1-year eatimates are not provided for geographic areas with less than 65,000 people. We use the ACS 5-Year estimates for counties (marked with a *) that have less than 65,000 people and are not reported in the ACS 1-year estimates.

Table 1b-4

2021 AMERICAN COMMUNITY SURVEY
OREGON HOUSEHOLDS WITH INTERNET ACCESS

County		Total Households	Broadband Internet Subscription - any type	Landline Broadband (Cable, Fiber, DSL)	Satellite Broadband	Cellular Data	Use Internet - No Subscription	No Internet Use
Baker County	*	6,976	5,660	4,127	606	4,588	208	1,062
Benton County		39,350	35,607	31,845	3,583	32,337	2,088	1,569
Clackamas County		161,945	153,755	135,324	9,218	145,175	3,665	4,477
Clatsop County	*	16,649	14,571	12,140	1,472	13,091	394	1,625
Columbia County	*	19,933	17,878	14,240	1,807	16,134	257	1,693
Coos County	*	27,627	23,399	17,881	2,317	20,186	536	3,578
Crook County	*	9,951	8,508	5,711	2,055	7,627	208	1,207
Curry County	*	10,788	9,000	7,083	881	7,853	215	1,513
Deschutes County		83,763	78,035	64,177	6,810	70,718	1,661	4,067
Douglas County		45,981	40,072	32,266	4,084	34,567	589	5,249
Gilliam County	*	902	739	512	137	515	39	124
Grant County	*	3,274	2,647	1,770	497	2,052	25	593
Harney County	*	3,076	2,472	1,311	557	2,125	67	529
Hood River County	*	8,949	7,816	6,506	1,017	7,278	220	900
Jackson County		90,817	80,435	66,315	7,094	74,812	3,887	6,305
Jefferson County	*	8,244	7,131	4,799	1,373	6,155	153	958
Josephine County		36,755	32,853	23,798	4,457	29,633	372	3,385
Klamath County		28,888	24,758	19,371	3,322	20,263	1,050	3,045
Lake County	*	3,427	2,341	1,580	555	1,692	146	937
Lane County		160,158	148,188	123,383	11,014	136,858	3,753	7,825
Lincoln County	*	22,093	19,495	15,928	1,843	16,392	502	1,986
Linn County		51,347	46,296	38,414	2,510	41,816	1,311	3,690
Malheur County	*	9,783	8,134	4,846	1,248	7,285	218	1,409
Marion County		124,719	114,770	95,987	9,553	107,004	2,505	7,053
Morrow County	*	4,085	3,449	2,349	629	3,000	78	471
Multnomah County		348,216	324,364	286,000	13,237	309,279	7,167	16,219
Polk County		33,425	30,386	25,285	3,437	28,184	881	2,028
Sherman County	*	711	569	416	91	468	32	110
Tillamook County	*	11,381	9,907	8,015	1,279	8,222	294	1,099
Umatilla County		27,247	21,546	15,575	3,604	20,363	2,391	3,234
Union County	*	10,536	8,560	6,480	1,047	7,355	316	1,512
Wallowa County	*	3,269	2,636	1,814	570	2,131	194	420
Wasco County	*	10,345	8,653	6,822	1,164	7,390	419	1,250
Washington County		233,615	221,279	200,770	8,074	209,998	5,156	6,791
Wheeler County	*	630	482	210	208	335	42	106
Yamhill County		38,988	35,380	28,514	3,417	32,273	1,585	1,913
Total Oregon (ACS 1Y & 5Y)		**1,697,843**	**1,551,771**	**1,311,564**	**114,767**	**1,435,154**	**42,624**	**99,932**
Total Oregon ACS 5Y		**1,658,091**	**1,484,006**	**1,239,795**	**110,391**	**1,348,590**	**44,431**	**124,709**
Total Oregon - ACS 1Y		**1,702,599**	**1,559,861**	**1,320,165**	**115,844**	**1,450,341**	**43,581**	**96,004**

*The ACS 1-year eatimates are not provided for geographic areas with less than 65,000 people. We use the ACS 5-Year estimates for counties (marked with a *) that have less than 65,000 people and are not reported in the ACS 1-year estimates.

While a comparison between consumer demand penetration and service availability might be useful, it cannot be done directly from the ACS and FCC data. The ACS data focuses upon *households*, whereas the FCC data focuses upon *locations* where service is available. A multi-unit residential building represents only a single *location* in the FCC dataset, whereas there will be many individual *households* at that one location in the ACS data. It is nevertheless instructive to examine these two rates – availability and penetration – in relation to one another. To accomplish this, we have assigned rankings to the two data series – availability and take-rate – for each of Oregon's 36 counties, and compare the two sets of rankings on Table 1b-5.

Table 1b-5 provides the rankings, from 1 (highest) to 36 (lowest) in both broadband availability rates and household penetration rates for each of Oregon's 36 counties. As the tabulation indicates, there is considerable variation in ranking between availability and penetration. To highlight this, we have also calculated the number and percentage of households in each county that subscribe for broadband Internet access where the service is available. For purposes of this analysis, we have assumed that the population availability rate (based upon FCC BDC data) is the same for household availability for the county. Notably, there is considerable variation in the penetration rate across the 36 counties.

Table 1b-5

RANKING OF COUNTIES BY BROADBAND AVAILABILITY AND SERVICE PENETRATION RATES (highest (1) to lowest (36))

County	Total Population	Population with Landline and/or Fixed Wireless Broadband Available	Percent of Population with Landline and/or Fixed Wireless Broadband Available	County Availability rank	Total Households	Households with Broadband Internet Subscription any type	Percent of Households with Broadband Internet Subscription any type	County Penetration rank	Households with Broadband Availability (Note 1)	Households where Broadband is Available but don't subscribe	Percent of Households where Broadband is Available who subscribe	Household Penetration Rank where Broadband is Available
Baker	16,668	16,442	98.64%	19	6,976	5,660	81.14%	29	6,881	1,221	82.25%	32
Benton	95,184	89,833	94.38%	34	39,350	35,607	90.49%	9	37,138	1,531	95.88%	1
Clackamas	421,401	421,048	99.92%	1	161,945	153,755	94.94%	1	161,809	8,054	95.02%	3
Clatsop	41,072	40,800	99.34%	9	16,649	14,571	87.52%	15	16,539	1,968	88.10%	20
Columbia	52,589	52,341	99.53%	6	19,933	17,878	89.69%	11	19,839	1,961	90.12%	13
Coos	64,929	64,101	98.72%	18	27,627	23,399	84.70%	22	27,275	3,876	85.79%	26
Crook	24,738	24,378	98.54%	21	9,951	8,508	85.50%	21	9,806	1,298	86.76%	23
Curry	23,446	22,840	97.42%	26	10,788	9,000	83.43%	25	10,509	1,509	85.64%	28
Deschutes	198,253	197,740	99.74%	4	83,763	78,035	93.16%	3	83,546	5,511	93.40%	8
Douglas	111,201	109,815	98.75%	17	45,981	40,072	87.15%	17	45,408	5,336	88.25%	19
Gilliam	1,995	1,900	95.24%	33	902	739	81.93%	27	859	120	86.03%	25
Grant	7,233	6,478	89.56%	35	3,274	2,647	80.85%	30	2,932	285	90.27%	12
Harney	7,495	7,169	95.65%	32	3,076	2,472	80.36%	32	2,942	470	84.02%	30
Hood River	23,977	23,858	99.50%	7	8,949	7,816	87.34%	16	8,905	1,089	87.78%	21
Jackson	223,259	221,298	99.12%	11	90,817	80,435	88.57%	13	90,019	9,584	89.35%	15
Jefferson	24,502	23,737	96.88%	28	8,244	7,131	86.50%	19	7,987	856	89.29%	16
Josephine	88,090	87,691	99.55%	5	36,755	32,853	89.38%	12	36,589	3,736	89.79%	14
Klamath	69,413	69,012	99.42%	8	28,888	24,758	85.70%	20	28,721	3,963	86.20%	24
Lake	8,160	7,905	96.88%	29	3,427	2,341	68.31%	36	3,320	979	70.51%	36
Lane	382,971	377,297	98.52%	22	160,158	148,188	92.53%	5	157,785	9,597	93.92%	6
Lincoln	50,395	49,853	98.92%	16	22,093	19,495	88.24%	14	21,855	2,360	89.20%	17
Linn	128,610	128,279	99.74%	3	51,347	46,296	90.16%	10	51,215	4,919	90.40%	11
Malheur	31,571	31,287	99.10%	13	9,783	8,134	83.14%	26	9,695	1,561	83.90%	31
Marion	345,920	341,141	98.62%	20	124,719	114,770	92.02%	6	122,996	8,226	93.31%	9
Morrow	12,186	11,848	97.23%	27	4,085	3,449	84.43%	23	3,972	523	86.84%	22
Multnomah	815,428	808,184	99.11%	12	348,216	324,364	93.15%	4	345,123	20,759	93.99%	5
Polk	87,433	86,629	99.08%	15	33,425	30,386	90.91%	7	33,118	2,732	91.75%	10
Sherman	1,870	1,842	98.50%	23	711	569	80.03%	33	700	131	81.24%	34
Tillamook	27,390	26,837	97.98%	24	11,381	9,907	87.05%	18	11,151	1,244	88.84%	18
Umatilla	80,075	79,487	99.27%	10	27,247	21,546	79.08%	34	27,047	5,501	79.66%	35
Union	26,196	25,960	99.10%	14	10,536	8,560	81.25%	28	10,441	1,881	81.98%	33
Wallowa	7,391	7,081	95.81%	31	3,269	2,636	80.64%	31	3,132	496	84.17%	29
Wasco	26,670	26,044	97.65%	25	10,345	8,653	83.64%	24	10,102	1,449	85.65%	27
Washington	600,372	599,068	99.78%	2	233,615	221,279	94.72%	2	233,108	11,829	94.93%	4
Wheeler	1,451	1,164	80.22%	36	630	482	76.51%	35	505	23	95.37%	2
Yamhill	107,722	104,100	96.64%	30	38,988	35,380	90.75%	8	37,677	2,297	93.90%	7
Total state	4,237,256	4,194,487	98.99%		1,697,843	1,551,771	91.40%		1,680,646	128,875	92.33%	

Note 1: Assumes that household broadband availability is the same as population broadband availability

Identifying potential explanations for variations in broadband availability and penetration

We have compiled certain demographic data from the ACS and have linked it with FCC BDC broadband availability data, and from this have examined the potential impact of certain population demographic attributes upon both providers' willingness to invest in, and consumers' willingness to purchase subscriptions for, broadband Internet access.

Provider investment

Providers – the vast majority of which are investor-owned for-profit companies – base their investment decisions upon the anticipated profitability of furnishing service in a given area. Thus, service availability and quality in any given area lies within the control of the service providers, who must commit investment dollars to construct the infrastructure necessary to support their broadband offerings. It is not possible, however, to make any direct measurements as to the amounts being invested at each location or group of locations (e.g., within a census block, census block group, or county), because such geographically granular data on provider investments is not available. However, from the FCC's BDC database, we do have data on the availability of high-speed "last mile" facilities at the individual census block level. We can infer, from the presence of such facilities in any given census block, that provider investment has been made there. We thus examine the availability of *high-speed* broadband – i.e., downlink speeds of 25 mbps and above – for any of the "last mile" technology categories. In order to offer high-speed broadband at advertised downlink speeds in excess of 25, 100, 500 mbps or more, the physical length of the "last mile" link (if other than itself provided via fiber) must be kept relatively short. This is accomplished by extending fiber optic "feeder" cables into individual neighborhoods so as to be relatively close in distance to customer locations. This arrangement is referred to as "Fiber-to-the-Node" ("FTTN") or sometimes as "Fiber-to-the-Curb" ("FTTC"). FTTN-type feeder/distribution architectures are utilized by landline providers as well as by wireless providers. Wireless providers will use fiber to interconnect their "head end" locations with individual transceiver sites, which must be located relatively close to customers both to support high-speed services as well as to permit reuse of the same spectrum at multiple locations. Thus, the greater the availability of high-speed broadband at individual service locations, one can infer that infrastructure investments have been made to provide services to these locations.

We wanted to test the hypothesis that factors such as household income may have played some role in influencing these investment decisions. Table 1b-6 and Figure 1b-1 compare the availability percentages across five Median Household Income (MHI) quintiles. As the table and graph indicate, copper-based broadband availability appears to drop off as income levels rise, while fiber availability shows a fairly strong income-related increase, ranging from 49.4% in the lowest income quintile to 69.8% in the highest. The seemingly inverse relationship between copper availability and income is actually consistent with the pattern for fiber, as ILECs have been decommissioning much of their copper infrastructure in favor of fiber and appear to have directed their fiber investments more toward higher income communities. Cable broadband availability presents a similar pattern, although it is slightly higher in the lowest income quintile than in the second and third. Fixed wireless availability does not appear to be materially related to income level.

Table 1b-6

BROADBAND AVAILABILITY BY MEDIAN HOUSEHOLD INCOME (MHI) QUINTILE

Households in Each Quintile with Availability (Note 1)

MHI Quintile	Weighted Average MHI	Block Groups	Households in Each Quintile	Landline (Copper, Cable, Fiber) Broadband Availability	Copper Broadband Availability	Cable Broadband Availability	Fiber Broadband Availability	Fixed Wireless Broadband Availability
1	$ 38,631	570	308,681	278,833	260,354	263,251	164,364	282,427
2	$ 56,031	570	321,831	313,347	301,101	291,723	158,977	314,201
3	$ 70,077	570	335,754	325,316	307,024	292,423	169,775	331,554
4	$ 88,804	570	331,635	324,951	296,355	297,084	177,951	328,550
5	$ 130,504	570	320,161	313,773	273,295	293,066	186,830	317,824
TOTALS		2,850	1,618,062	1,556,219	1,438,130	1,437,547	857,897	1,574,556
No MHI Data (Note 2)		120	40,029	39,581	34,565	37,679	27,946	39,871

Percentage of Households in Each Quintile with Availability (Note 1)

MHI Quintile	Weighted Average MHI	Pct of Block Groups	Pct of Households in Each Quintile	Landline (Copper, Cable, Fiber) Broadband Availability	Copper Broadband Availability	Cable Broadband Availability	Fiber Broadband Availability	Fixed Wireless Broadband Availability
1	$ 38,631	19.19%	18.62%	97.36%	93.56%	90.64%	49.40%	97.63%
2	$ 56,031	19.19%	19.41%	96.89%	91.44%	87.09%	50.57%	98.75%
3	$ 70,077	19.19%	20.25%	97.98%	89.36%	89.58%	53.66%	99.07%
4	$ 88,804	19.19%	20.00%	98.00%	85.36%	91.54%	58.36%	99.27%
5	$ 130,504	19.19%	19.31%	98.88%	86.35%	94.13%	69.81%	99.61%
TOTALS		95.96%	97.59%	96.18%	88.88%	88.84%	53.02%	97.31%
No MHI Data (Note 2)		4.04%	2.41%	90.33%	84.34%	85.28%	53.25%	91.49%

Source: 2021 American Community Survey, 5-year Estimates; FCC Broadband Data Collection, as of 6/30/2022; Block level population from
Note 1: Assume that household broadband availability is the same as population broadband availability.
Note 2: ACS did not provide MHI data for these census block groups. They were thus excluded from this analysis

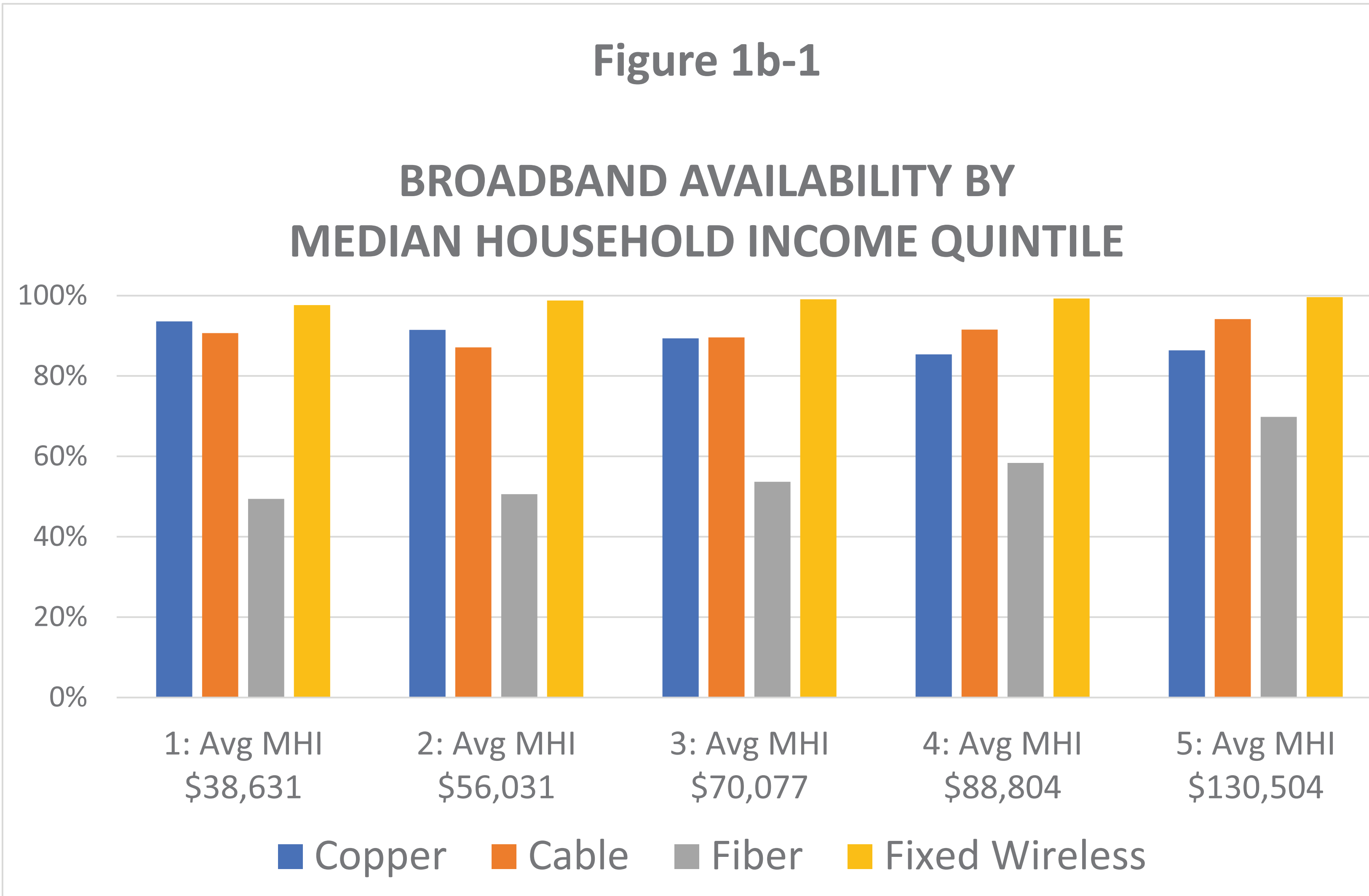


Figure 1b-1
BROADBAND AVAILABILITY BY
MEDIAN HOUSEHOLD INCOME QUINTILE
100%
80%
60%
40%
20%
0%
1: Avg MHI $38,631
2: Avg MHI $56,031
3: Avg MHI $70,077
4: Avg MHI $88,804
5: Avg MHI $130,504
Copper
Cable
Fiber
Fixed Wireless

The technology categories shown in Table 1b-6 and Figure 1b-1 are those associated with the "last mile" connection to the customer's premises. However, by themselves they teach little about the presence of fiber in the overall distribution infrastructure. This can be inferred by focusing upon maximum advertised speed (data rate) instead of "last mile" technology. Table 1b-7 and Figure 1b-2 show the availability of broadband service at maximum advertised downlink speeds of less than 25 mbps, at 25 to 99 mbps, at 100 to 999 mbps, and 1000 mbps and above, for each of the five MHI quintiles.

Notably, for downlink speed levels at or above the FCC's 25 mbps minimum, almost all of the landline broadband facilities available in Oregon claim to be capable of supporting downlink speeds of at least 1Gbps (1000 mbps). Of greater importance, there does not appear to be any significant relationship between household income and the availability of 1 Gbps service, suggesting that, although "last mile" fiber does appear to have been deployed more heavily in higher income communities (per Table 1b-6 and Figure 1b-1), sufficient investments in fiber have been made in feeder facilities to support the same 1Gbps irrespective of the specific type of "last mile" delivery that is being used.

Table 1b-7

BROADBAND AVAILABILITY BY MEDIAN HOUSEHOLD INCOME (MHI) QUINTILE
"LANDLINE" BROADBAND MAXIMUM ADVERTISED DOWNLOAD SPEED

Number of Locations in each Maximum Advertised Speed Category

MHI Quintile	Weighted Average MHI	Block Groups	Households	Total Locations	<25 mbps	25-99 mbps	100-999 mbps	>1000 mbps
1	$ 38,631	570	308,681	228,404	11,163	4,157	1,073	212,011
2	$ 56,031	570	321,831	268,363	16,952	7,605	3,723	240,083
3	$ 70,077	570	335,754	279,923	16,389	3,730	2,091	257,713
4	$ 88,804	570	331,635	292,195	15,462	3,231	2,993	270,509
5	$ 130,504	570	320,161	295,128	13,252	2,580	2,409	276,887
State Total	-	**2,970**	**1,658,091**	**1,399,124**	**36,688**	**11,454**	**10,940**	**1,289,084**
No MHI Data (Note 1)	-	120	40,029	35,111	2,298	466	466	31,881

Percentage of Locations in each Maximum Advertised Speed Category

MHI Quintile	Weighted Average MHI	Share of Oregon Block Groups	Share of Oregon Households	Share of Oregon Locations	<25mbps	25-99 mbps	100-999 mbps	>1000 mbps
1	$ 38,631	19.19%	18.62%	16.32%	4.89%	1.82%	0.47%	92.82%
2	$ 56,031	19.19%	19.41%	19.18%	6.32%	2.83%	1.39%	89.46%
3	$ 70,077	19.19%	20.25%	20.01%	5.85%	1.33%	0.75%	92.07%
4	$ 88,804	19.19%	20.00%	20.88%	5.29%	1.11%	1.02%	92.58%
5	$ 130,504	19.19%	19.31%	21.09%	4.49%	0.87%	0.82%	93.82%
State Total	-	100.00%	100.00%	100.00%	2.62%	0.82%	0.78%	92.14%
No MHI Data (Note 1)	-	4.04%	2.41%	2.51%	6.26%	4.07%	4.26%	2.47%

Source: 2021 American Community Survey, 5-year Estimates; FCC Broadband Data Collection, as of 6/30/2022.
Note 1: ACS did not provide MHI data for these census block groups. They were thus excluded from this analysis

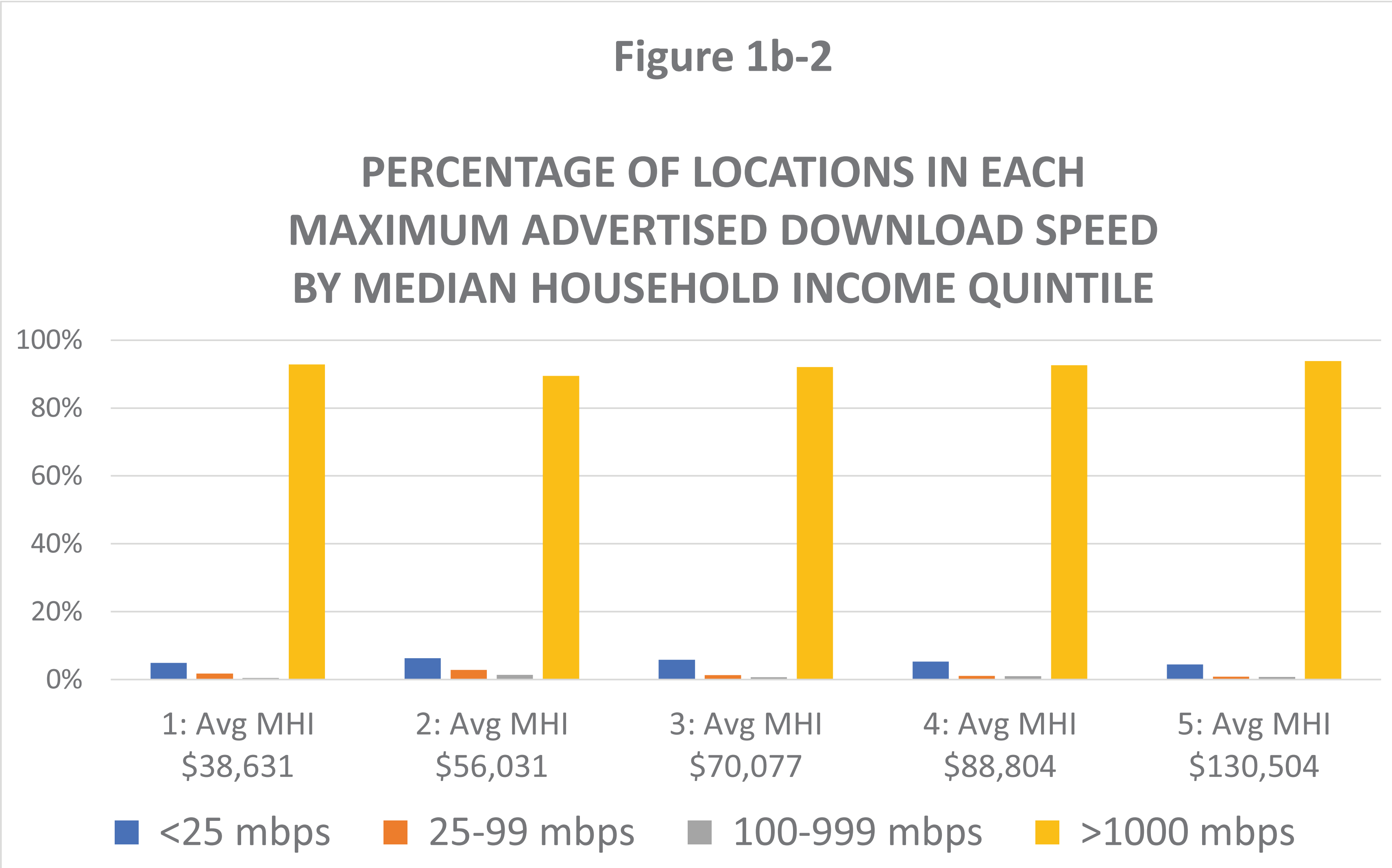


Figure 1b-2
PERCENTAGE OF LOCATIONS IN EACH MAXIMUM ADVERTISED DOWNLOAD SPEED BY MEDIAN HOUSEHOLD INCOME QUINTILE
100%
80%
60%
40%
20%
0%
1: Avg MHI $38,631
2: Avg MHI $56,031
3: Avg MHI $70,077
4: Avg MHI $88,804
5: Avg MHI $130,504
<25 mbps
25-99 mbps
100-999 mbps
>1000 mbps

Consumer demand

Even where broadband Internet access is available, not all consumers subscribe to the service. In fact, and as shown on Table 1b-5 above, ACS data indicate wide variations in the level of consumer demand – the percentage of households that subscribe to broadband service where it is available – from county-to-county across Oregon, ranging from a high of 96.11% in Benton County to a low of 70.6% in Lake County. Table 1b-5 also provides county rankings, from highest (1) to lowest (36), with respect to broadband availability relative to total population (based on FCC BDC data), subscription rates relative to total number of households (based on ACS data), and subscription rates relative to households where broadband access is available (based on both BDC and ACS data).

There appears to be a strong relationship between consumers' willingness to purchase a broadband Internet subscription and their household income level. As Table 1b-8 and Figure 1b-3 show, household Internet subscription rates increase steadily for households with higher income levels. Only 83.0% of households in the lowest income quintile have broadband Internet access at home; whereas for the highest income quintile the take-rate is 95.4%. That lower-income households are less likely to subscribe for a broadband service at home underscores the need to maintain some level of low-income support for Internet access.

Table 1b-8

HOUSEHOLDS WITH BROADBAND SUBSCRIPTIONS BY MEDIAN HOUSEHOLD INCOME (MHI) QUINTILE

Households in Each Quintile with Availability (Note 1)

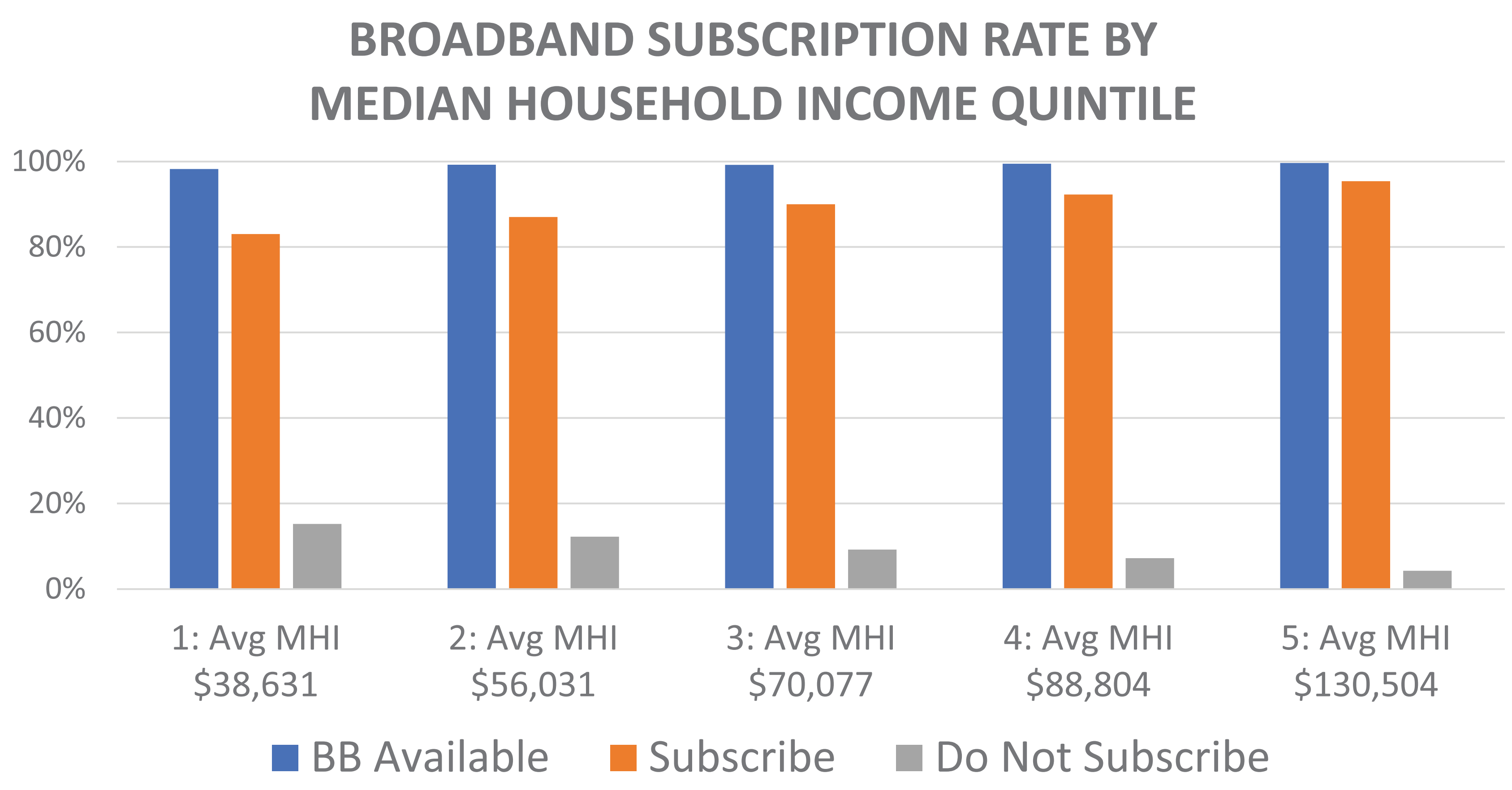
MHI Quintile	Weighted Average MHI	Block Groups	Households in Each Quintile	Households with Broadband Availability (Note 1)	Households with Broadband Subscriptions	Households with Broadband Availabilty, but do not Subscribe
1	$ 38,631	570	308,681	303,235	256,238	46,997
2	$ 56,031	570	321,831	319,368	279,958	39,410
3	$ 70,077	570	335,754	333,031	302,141	30,890
4	$ 88,804	570	331,635	329,835	305,970	23,865
5	$ 130,504	570	320,161	318,955	305,315	13,640
TOTALS		2,850	1,618,062	1,604,425	1,449,622	154,803
Nh MHI Data (Note 2)		120	40,029	36,978	34,384	2,594

Percentage of Households in Each Quintile with Availability (Note 1)

MHI Quintile	Weighted Average MHI	Pct of Block Groups	Pct of Households in Each Quintile	Pct of Households with Broadband Availability (Note 1)	Pct of Households with Broadband Availability that Subscribe	Pct of Households with Broadband Availabilty, but do not Subscribe
1	$ 38,631	19.19%	18.62%	98.24%	83.01%	15.23%
2	$ 56,031	19.19%	19.41%	99.23%	86.99%	12.25%
3	$ 70,077	19.19%	20.25%	99.19%	89.99%	9.20%
4	$ 88,804	19.19%	20.00%	99.46%	92.26%	7.20%
5	$ 130,504	19.19%	19.31%	99.62%	95.36%	4.26%
TOTALS		95.96%	97.59%	99.16%	89.59%	9.57%
Nh MHI Data (Note 2)		4.04%	2.41%	92.38%	85.90%	6.48%

Source: 2021 American Community Survey, 5-year Estimates; FCC Broadband Data Collection, as of 6/30/2022; Block level population from Decennial Census 2020.
Note 1: Assume that household broadband availability is the same as population broadband availability.

Figure 1b-3


BROADBAND SUBSCRIPTION RATE BY
MEDIAN HOUSEHOLD INCOME QUINTILE
100%
80%
60%
40%
20%
0%
1: Avg MHI $38,631
2: Avg MHI $56,031
3: Avg MHI $70,077
4: Avg MHI $88,804
5: Avg MHI $130,504
BB Available
Subscribe
Do Not Subscribe

Density and provider investment in broadband

Construction costs for landline infrastructure, whether in the "last mile" or in the fiber-to-the-Node (FTTN) infrastructure elements, tends to be higher, on a per home passed basis, in areas with low population density than in more densely populated urban and suburban areas. Having identified a strong relationship between household income and fiber broadband availability, we wanted to determine whether that relationship can be attributed to provider expectations as to the higher levels of consumer demand – and hence revenue opportunities – or other potential explanations. Having observed lower fiber availability rates in lower income areas, we have inferred a correspondingly lower level of provider investment in broadband infrastructure in those communities. However, correlation does not necessarily indicate causality. If low-density areas – those with the lowest availability rates – also tend to be low-income areas, it is difficult to ascribe household income alone as the driver of provider investment decisions. On the other hand, if income and density are not highly correlated, then there would be some basis for concluding that provider investment decisions are being driven by household income levels.

In that regard, we calculated the correlation between household income and population density at the census block group level, and determined that no statistically significant correlation is present.

We also wanted to examine the extent to which density directly affected the extent of provider investment. To do this, we examined broadband availability across each of five density quintiles (from lowest to highest) separately for landline, fixed wireless, and satellite "last mile" technologies. The results are summarized in Tables 1b-9, 1b-10 and 1b-11. Density is calculated at the individual census block level by dividing the number of households in the census block by the area of the census block (in square miles).

For these analyses, we have distinguished between "unique locations" and "carrier locations" in each of the five density quintiles. Where two or more service providers offer service at a given location, we count that as one "unique" location and the number of providers serving the location in our calculation of "carrier locations." Thus, if at a particular location there are three service providers, the location would be counted as one (1) unique location and as three (3) carrier locations. We make this distinction specifically because we are utilizing service availability as a surrogate for a direct measure of investment – i.e., the more carrier locations relative to unique locations within a given quintile, the greater the aggregate level of infrastructure investment that is being made. This can be seen in the ratio of carrier locations to unique locations – the higher that ratio, the more carriers that, on average, have a presence at each location in the quintile. We also provide a breakdown for each quintile by maximum advertised speed, because where higher speed services are offered, we can infer the presence of fiver-in-the-feeder investment.

For landline services (Table 1b-9), the ratio of carrier locations to unique locations increases with density, as does the percentage of locations served by highest bandwidth facilities. Thus, it is clear that investment in landline increases with density. Fixed wireless services (Table 1b-10) are, as one might expect, less sensitive to density than landline. Here, the ratio of carrier locations to unique locations also increases with density, but to a lesser extent than with landline.

Notably, however, the percentage of locations served by the highest speed services is higher for the higher density quintiles, indicating relatively more investment in high-speed fiber in the wireless provider feeder networks that connect to the individual transceiver sites. Finally, and again as one would expect, for satellite-based services, density is not a factor. All three satellite broadband providers offering services in Oregon serve all locations in populated census blocks statewide.

Table 1b-9

PROVIDER PRESENCE AND MAXIMUM ADVERTISED DOWNLOAD SPEED BY HOUSEHOLD DENSITY QUINTILE "LANDLINE" BROADBAND

Number of Carrier Locations in each Maximum Advertised Speed Category (Note1)

Household Density Quintile	Average Density (Households per Square Mile)	Census Blocks	Households	Population	Total Unique Locations	Total Carrier Locations	Ratio of Carrier to Unique Locations	<25 mbps	25-99 mbps	100-999 mbps	>1000 mbps
1	7	17,599	45,573	122,609	44,259	71,027	1.605	25,893	7,077	2,831	35,226
2	208	17,599	249,314	592,148	228,151	361,581	1.585	135,535	30,144	13,552	182,350
3	1,364	17,598	417,381	989,941	395,749	874,667	2.210	211,521	77,977	54,803	530,366
4	2,562	17,599	444,597	1,139,295	396,790	924,430	2.330	201,384	83,634	82,972	556,440
5	6,153	17,599	650,906	1,357,294	334,175	762,580	2.282	128,007	51,190	122,884	460,499
State Total	**1,252**	**130,807**	**1,813,747**	**4,237,256**	**1,399,124**	**2,994,285**	2.140	**702,340**	**250,022**	**277,042**	**1,764,881**
No FCC Data (Note 1)	37	42,813	5,976	35,969		-		-	-	-	-

Percentage of Carrier Locations in each Maximum Advertised Speed Category

Household Density Quintile	Average Density (Households per Square Mile)	Share of Census Blocks	Share of Households	Share of Population	Share of Unique Locations	Share of Carrier Locations		<25mbps	25-99 mbps	100-999 mbps	>1000 mbps
1	7	13.45%	2.51%	2.89%	3.16%	2.37%		36.46%	9.96%	3.99%	49.60%
2	208	13.45%	13.75%	13.97%	16.31%	12.08%		37.48%	8.34%	3.75%	50.43%
3	1364	13.45%	23.01%	23.36%	28.29%	29.21%		24.18%	8.92%	6.27%	60.64%
4	2562	13.45%	24.51%	26.89%	28.36%	30.87%		21.78%	9.05%	8.98%	60.19%
5	6153	13.45%	35.89%	32.03%	23.88%	25.47%		16.79%	6.71%	16.11%	60.39%
State Total	**1,252**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**		**23.46%**	**8.35%**	**9.25%**	**58.94%**
No FCC Data (Note 2)	39	32.73%	0.33%	0.85%	-	-		-	-	-	-

Source:FCC Broadband Data Collection, as of 6/30/2022; Decennial Census, 2020.
Note 1: Unique Locations reflect all locations in a Census block served by at least one provider. Carrier Locations reflect the number of providers at each location in a Census block.
Note 2: Census blocks not reported by providers to FCC were excluded from this analysis.

Table 1b-10

PROVIDER PRESENCE AND MAXIMUM ADVERTISED DOWNLOAD SPEED BY HOUSEHOLD DENSITY QUINTILE
FIXED WIRELESS BROADBAND

Number of Carrier Locations in each Maximum Advertised Speed Category (Note1)

Household Density Quintile	Weighted Average Density (Households per Square Mile)	Census Blocks	Households	Population	Total Unique Locations	Total Carrier Locations	Ratio of Carrier to Unique Locations	<25 mbps	25-99 mbps	100-999 mbps	>1000 mbps
1	7	17,599	45,573	122,609	69,375	158,308	2.282	69,073	70,116	19,097	22
2	208	17,599	249,314	592,148	260,116	565,125	2.173	232,086	277,850	55,176	13
3	1,364	17,598	417,381	989,941	398,238	915,384	2.299	242,343	526,045	146,801	195
4	2,562	17,599	444,597	1,139,295	396,469	961,952	2.426	202,321	559,166	200,048	417
5	6,153	17,599	650,906	1,357,294	334,345	860,565	2.574	207,642	432,414	219,599	910
State Total	**1,252**	**130,807**	**1,813,747**	**4,237,256**	**1,458,543**	**3,461,334**	2.373	**953,465**	**1,865,591**	**640,721**	**1,557**
No FCC Data (Note 2)	37	42,813	5,976	35,969		-		-	-	-	-

Percentage of Carrier Locations in each Maximum Advertised Speed Category

MHI Quintile	Weighted Average Density (Households per Square Mile)	Share of Census Blocks	Share of Households	Share of Population	Share of Unique Locations	Share of Carrier Locations		<25mbps	25-99 mbps	100-999 mbps	>1000 mbps
1	3	13.45%	2.51%	2.89%	4.76%	4.57%		43.63%	44.29%	12.06%	0.01%
2	108	13.45%	13.75%	13.97%	17.83%	16.33%		41.07%	49.17%	9.76%	0.00%
3	1,098	13.45%	23.01%	23.36%	27.30%	26.45%		26.47%	57.47%	16.04%	0.02%
4	2,440	13.45%	24.51%	26.89%	27.18%	27.79%		21.03%	58.13%	20.80%	0.04%
5	5,946	13.45%	35.89%	32.03%	22.92%	24.86%		24.13%	50.25%	25.52%	0.11%
State Total	**1,252**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**		**27.55%**	**53.90%**	**18.51%**	**0.04%**
No FCC Data (Note 2)	42	32.73%	0.33%	0.85%	-	-		-	-	-	-

Source:FCC Broadband Data Collection, as of 6/30/2022; Decennial Census, 2020.
Note 1: Unique Locations reflect all locations in a Census block served by at least one provider. Carrier Locations reflect the number of providers at each location in a Census block.
Note 2: Census blocks not reported by providers to FCC were excluded from this analysis.

Table 1b-11

PROVIDER PRESENCE AND MAXIMUM ADVERTISED DOWNLOAD SPEED BY HOUSEHOLD DENSITY QUINTILE
SATELLITE BROADBAND

Number of Locations in each Maximum Advertised Speed Category (Note 1)

Household Density Quintile	Average Density (Households per Square Mile)	Census Blocks	Households	Population	Total Unique Locations	Total Carrier Locations	Ratio of Carrier to Unique Locations	<25 mbps	25-99 mbps	100-999 mbps	>1000 mbps
1	2	17,599	45,573	122,609	80,665	241,995	3.000	14,604	118,302	109,089	-
2	75	17,599	249,314	592,148	270,381	811,143	3.000	11,373	400,199	399,571	-
3	949	17,598	417,381	989,941	401,787	1,205,361	3.000	18,358	577,689	609,314	-
4	2,365	17,599	444,597	1,139,295	397,312	1,191,934	3.000	9,661	534,549	647,724	-
5	5,827	17,599	650,906	1,357,294	334,520	1,003,560	3.000	3,377	419,044	581,139	-
State Total	**1,252**	**130,807**	**1,813,747**	**4,237,256**	**1,484,665**	**4,453,993**	3.000	**57,373**	**2,049,783**	**2,346,837**	**-**
No FCC Data (Note 2)	37	42,813	5,976	35,969							

Percentage of Locations in each Maximum Advertised Speed Category

Household Density Quintile	Average Density (Households per Square Mile)	Share of Census Blocks	Share of Households	Share of Population	Share of Unique Locations	Share of Carrier Locations		<25mbps	25-99 mbps	100-999 mbps	>1000 mbps
1	2	13.45%	2.51%	2.89%	5.43%	5.43%		6.03%	48.89%	45.08%	-
2	75	13.45%	13.75%	13.97%	18.21%	18.21%		1.40%	49.34%	49.26%	-
3	949	13.45%	23.01%	23.36%	27.06%	27.06%		1.52%	47.93%	50.55%	-
4	2,365	13.45%	24.51%	26.89%	26.76%	26.76%		0.81%	44.85%	54.34%	-
5	5,827	13.45%	35.89%	32.03%	22.53%	22.53%		0.34%	41.76%	57.91%	-
State Total	**1,252**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**		**1.29%**	**46.02%**	**52.69%**	**-**
No FCC Data (Note 2)	37	32.73%	0.33%	0.85%	-	-		-	-	-	-

Source:FCC Broadband Data Collection, as of 6/30/2022; Decennial Census, 2020.
Note 1: Unique Locations reflect all locations in a Census block served by at least one provider. Carrier Locations reflect the number of providers at each location in a Census block.
Note 2: Census blocks not reported by providers to FCC were excluded from this analysis.

Conclusions and policy recommendations

Our analysis of the FCC BDC data indicates that Oregon enjoys an extremely high level of very high data rate broadband availability in most areas of the state. Although we have identified some relationship between household incomes and provider "last mile" investment in fiber-to-the-premises infrastructure, there is near-universal availability of landline broadband with advertised downlink speeds at or above 1 Gbps across communities at all income levels, suggesting that provider investments in fiber-in-the-feeder has not been materially influenced by household income levels in the communities being served. Fixed wireless services are also widely available in Oregon, and cover areas where landline infrastructure is not present. And low Earth orbit satellite broadband – SpaceX's *Starlink* service – has the potential to provide service to even the most remote areas. The principal impediment to the use of wireless and satellite services is their higher cost – and for satellite services in particular, their high up-front costs for equipment. However, if the overall policy goal is truly universal broadband availability, it may still be far more efficient to find ways to subsidize such costs in high-cost areas where construction of landline facilities may never be economically justified.

Consumer demand for broadband does appear to confront economic barriers. Consumer willingness to subscribe to broadband at home appears to be highly correlated with household income, with the lowest penetration rates observable in the lowest income communities. On the other hand, it is not reasonable to expect or to develop policies or programs whose goal is truly universal coverage; there are consumers who have elected not to subscribe to Internet access for reasons other than cost, or who have found that mobile Internet access via a smartphone to be sufficient for their needs. But for those households who want Internet access at home and who would not be able to afford the service without support from OTAP or other low-income programs, continuation and potential expansion of these programs remains critically important.

1c: Mapping of broadband availability in Oregon

We have created an extensive set of maps and data showing various aspects of broadband availability in Oregon at both the state and county levels based upon the June 2022 FCC Broadband Data Collection dataset that was made available by the FCC in December 2022. The FCC has required service providers to submit, by March 1, 2023, a new set of broadband availability data that is current as of December 2022. However, the Commission is not likely to release a revised BDC dataset until sometime in May or June, which would be after the May 8, 2023 due date for our final report to the PUC and possibly even after the June 1, 2023 due date for the PUC's report to the Oregon Legislature.[19]

Description of the maps

The maps that we have prepared are provided in three Appendices to this Report, as follows:

Appendix 1c-1: State-level Broadband Availability Maps

Appendix 1c-2: County-level Broadband Availability Maps

Appendix 1c-3: Tribal Lands Broadband Availability Maps

Each set of maps contains the following:

(1) A map showing all landline broadband (copper, cable, fiber) availability at the individual census block level.

(2) A map showing all landline broadband (copper, cable, fiber) availability as well as availability of fixed wireless broadband services at the individual census block level in all census blocks where no landline broadband is currently available.

(3) A map showing the maximum advertised downlink speed at the individual census block level.

(4) Maps showing, separately for each major service provider ("brand") and for each Technology, the census blocks being served by that provider. Maps are being provided for the principal providers of Technologies 10, 40, 50, and 70+71.

We are not providing maps for satellite-based services, inasmuch as these are (theoretically) available ubiquitously throughout Oregon. Note also that "brand" maps were prepared only for the largest providers. Availability data for the smaller providers is presented in Appendix 1a-2. The maps are provided in pdf format; they are highly detailed, and the detail down to the individual census block level can be examined by zooming in on the desired area.

19. We had requested that Oregon broadband providers furnish us with copies of their March 1 filings; however, we have not received a sufficient number of these to permit us to update the earlier FCC dataset.

2a: “Adequate and reasonable” broadband for OTAP-supported services

Introduction

HB 4092 § 7 directs the PUC *et al* to examine the sufficiency of the existing plan of assistance “to support adequate and reasonable access to broadband Internet access service or other telecommunications services by residential customers with low incomes in this state ...” Exactly what constitutes “adequate and reasonable” telecommunications service has evolved and will continue to evolve over time, and efforts at establishing a quantifiable definition of “broadband,” as has been the FCC’s practice, are incapable of keeping abreast of current technologies and demands. Any such definition of “adequate and reasonable” broadband access must remain flexible and adaptable to changing conditions.

A particularly good example of the folly of attempting to establish a fixed definition of “broadband” can be found in an attempt by the Pennsylvania legislature to do just that. In 1993, the Pennsylvania legislature added Chapter 30 to the Public Utility Code with the specific goal of assuring that all areas of the state will be provided with a modern, state-of-the-art broadband telecommunications infrastructure. Basically, Chapter 30 offered Pennsylvania’s ILECs a *quid pro quo*: In exchange for a firm commitment to provide broadband service capability throughout its entire network by the year 2015, each participating ILEC would become subject to an “alternative form of regulation” providing substantially greater pricing and earnings flexibility than the traditional “rate of return” form of regulation under which the ILEC’s prices and earnings had been set. Hard-wired into the Pennsylvania statute was a technical definition of broadband as “a communication channel using any technology and having a bandwidth equal to or greater than 1.544 megabits per second.”[20] When this statute was enacted in 1993, most consumers accessed the Internet on a “dial-up” basis, using a conventional voice telephone line equipped with a 1200 or 2400 baud data modem capable of achieving, at the most, downlink and uplink data rates of around 19.2 kilobits per second (kbps). 1.544 mbps “broadband” offered speeds up to 80 times faster than the then-fastest dial-up services, and was, in 1993, seen as the state-of-the-art for consumer broadband. By the time 2015 rolled around some 20+years later, the Pennsylvania legislature’s 1.544 mbps goal had long since become woefully obsolete. Any attempt here to similarly “hard-wire” a definition of “adequate and reasonable” would suffer the same fate.

Moreover, while ORS 285A.154 (10) identifies a number of areas of broadband development and use for the Oregon Broadband Advisory Council to pursue, it does not provide any specific guidance as to their prioritization. Thus, what might be considered “adequate and reasonable” for elementary and most high school students would likely fall far short for other household members, such as those requiring broadband connectivity for remote work, for operation of a home-based business, for medical monitoring, or for other purposes. Thus, a critical element of this undertaking will be to identify service attributes that would meet the “adequate and

20. 66 Pa C.S. Sec. 3002.

reasonable" standard for consumers that qualify for OTAP, ACP or other support, even if these involve capabilities more sophisticated than those contemplated by providers of ACP-qualified services.

Attributes of broadband service

Data rate or "speed"

HB 4092 does not specifically define the term "broadband." The term "broadband" has been applied to a wide range of specific service attributes including, but not limited to, Internet access.[21] As applications, transmission and switching technology, and demand have all evolved over time, adjectives like "adequate" and "reasonable" are themselves evolving. Thus, the development of any policy premised upon these two concepts must necessarily be defined dynamically; it must not be "locked in" to any particular moment in time, since technology, needs and demands will almost certainly change rapidly, even from one year to the next. Moreover, as we have noted, what is "adequate and reasonable" for some users and for some purposes will almost certainly fall short for others.

The FCC's definition of "broadband" has traditionally been expressed in terms of downlink and uplink data transmission rates (down/up), usually stated in terms of bits per second (bps); in the context of current technology, these are typically stated in terms of megabits per second (mbps) or gigabits per second (Gbps). The FCC's definition of "broadband" has been modified several times, from 200/200 kbps in 1996, 4/1 mbps in 2010, and 25/3 mbps, where it is today. There are indications that the FCC is currently considering a further upward revision of its definition of "broadband," to 100/20 mbps.[22]

Attributes other than "speed"

In addition to the downlink and uplink data rates or, colloquially, "speeds" or "bandwidths," there are several other important technical attributes of broadband services that need to be considered in assessing adequacy and reasonableness.

Asymmetric vs. Symmetric data rates. For many years, most consumer Internet access requirements could be satisfied by "asymmetric" service, where the "uplink" speed would be relatively low (e.g., 3-6 mbps) while the "downlink" speed might be 25, 50, 100, 200 mbps or more. Traditionally, a residential consumer did not typically need very much uplink bandwidth relative to downlink bandwidth, for example, to order a movie to be streamed from Netflix, to initiate an e-mail message, or to order something from Amazon. However, the proliferation of

21. The term "broadband" generally refers to telecommunications transport media capable of supporting large volumes of digital data, typically measured in terms of megabytes per second (mbps) or gigabytes per second (Gbps) between or among two or more locations. Non-Internet broadband is widely used for a large variety of commercial applications. While the term "broadband" is nowhere expressly defined in the legislation, read in context, HB 4092is, and § 7 in particular, are clearly focused specifically upon broadband Internet access.

22. "Chairwoman Rosenworcel Proposes to Increase Minimum Broadband Speeds," FCC News Release, July 15, 2022. https://www.fcc.gov/document/chairwoman-rosenworcel-proposes-increase-minimum-broadband-speeds

interactive video applications, such as video conferencing (e.g., Zoom), gaming, YouTube and other types of video uploads, and Virtual Private Network (“VPN”) use by individuals working from home, among others, some of which have been spurred on by the pandemic, tends to place increased bandwidth demand in the uplink direction. While broadband services offered by cable television MSOs typically involve asymmetric bandwidths, fiber-to-the-Premises (“FTTP”) services, such as Verizon’s *FiOS*, offer symmetric high bandwidths in both the uplink and downlink directions.

Asynchronous vs. Synchronous service. One of the service attributes included in the FCC’s Broadband Data Collection (“BDC”) dataset is the “maximum advertised” downlink and uplink speeds that the service provider claims to be available at each location within its service area. Typically, different maximum authorized speeds carry different monthly subscription prices, with services offering higher maximum advertised speeds carrying higher monthly charges. What the FCC data does not indicate, however, is the extent to which these maximum advertised speeds are actually being delivered. The service provisioning architecture that is typically utilized for most residential and small business broadband services involves extensive amounts of common facilities whose aggregate capacity is shared among many individual customers. For example, the coaxial cable run in a given neighborhood or individual street that is used to distribute cable-based broadband and cable television will be connected to many customers. This distribution cable has a finite capacity in terms of total bandwidth. The more the number of active users that are connected to the same cable and are downloading and/or uploading data at any given time, the smaller amount of capacity that will be available to each. During particularly busy periods, such as late mornings or early evenings, the delivered bandwidth may be well below the maximum advertised level. The technical term for this type of variable speed service is “asynchronous” in that the amount of data capable of being transmitted during any specific interval of time is not fixed. Asynchronous service is typically the only form of broadband that is offered to most residential and small business customers. Larger businesses and governments, so-called “enterprise customers,” can purchase synchronous service, where data rates do not vary, but at considerable additional cost. These arrangements are typically specified in so-called “Service Level Agreement” (“SLAs”), whereby the service provider commits to continuously meet certain pre-specified service attributes that may include, *inter alia*, specified data transmission rates, percent uptime, mean time between failures, and the like.

Normally, streaming video devices like Roku and Apple TV settop boxes are capable of accepting download signals at a faster rate than they are displayed, in effect, buffering up to a few minutes of a program that can continue to be displayed even if there is some intermittent slow-down or interruption in the download data rate. This arrangement, locally storing several minutes of program material, is known as “buffering.” Most consumers have likely experienced periodic interruptions in video downloads from Netflix and other streaming services with messages such as “buffering – please wait” or the like. This can occur when service providers limit how much data the user is permitted to download at one time, a restriction that providers can and do impose, particularly during periods of heavy network use, as well as where the amount of local storage available to retain (buffer) downloaded signals is too small to overcome the data rate slowdown or interruption. These types of interruptions have become less of a problem, however, as down-link data rates have increased and as newer streaming devices have come equipped with larger capacity local storage. As long as there is sufficient storage to cover the effects of a download slowdown or interruption, the download speed variations may go unnoticed by the consumer. Where the interruption results from any restrictions on download speeds and/or volumes that may be imposed by the service provider, even a nominally high maximum speed may still not fully resolve this type of service deficiency.

However, in the case of two-way interactive video applications, such as for video conferencing applications like Zoom, Google Hangouts, and Apple's Facetime, with certain types of high-speed multiuser gaming, or even basic Internet-enabled voice services where synchronous communications are expected, variations in uplink and downlink speeds may create noticeable degradations in the quality of the user experience. While enterprise-level data rate guarantees and synchronous services may still not be necessary for most consumer applications, more stable data rates will become increasingly important as demand for and use of interactive video services grows.

FCC BDC data does identify the maximum advertised downlink and uplink speeds separately for each served location. Table 1c-13 above provides data at the individual county level showing the maximum advertised (but not guaranteed) uplink and downlink speeds being offered and available to residential consumers in Oregon. This data is provided at the individual census block level; we provide the highest speeds of any location within a given census block. To the extent that this highest speed is available at only some, but not all, of the locations served by a given provider in a given census block, this method of reporting may tend to overstate actual availability. In our third (analysis) report, we will undertake to provide more details as to the extent of availability of the maximum advertised speeds throughout the full census block, as well as to provide more details as to offered speeds at more granular geographic levels than full counties. Preliminarily, it appears that at approximately 92.26% of residential locations in Oregon where some type of fixed "landline" broadband service is currently being offered,[23] downlink speeds in excess of 500 mbps are available, well in excess of the FCC's current 25/3 broadband definition.

As of this writing, and although this information has been requested from Oregon broadband service providers, we do not have any data on consumer take rates of individual services and bandwidth offerings in Oregon.

Data caps and "throttling." Data caps are provider-imposed limitations on the aggregate

23. The term"landline" broadband refers to fixed broadband services that are furnished to the customer by means of some type of wire or cable infrastructure connected directly to the customer's premises. There are three categories of "landline" broadband: Copper (Technology 10), typically offered by ILECs, Coaxial cable (Technology 40), typically offered by cable television multi-system operators ("MSOs") such as Comcast and Charter, and Fiber-to-the-Premises ("FTTP"), offered by some ILECs as well as by competitive service providers. The technology involved refers to the physical medium that is connected to the customer's premises. However, most copper and cable broadband services are furnished on a "hybrid" basis whereby fiber optic facilities are extended from the provider's "head-end" into individual neighborhoods so as to minimize the physical length of the copper or coaxial cable segment, because the ability of these media to support high data rate broadband diminishes rapidly as the length of the "last mile" segment increases. This architecture is often referred to as "Fiber-to-the-Node" ("FTTN").

volume of broadband data that can be carried over the customer’s service during a given billing period). “Throttling” of data rates (a deliberate provider-imposed slowdown of data rates once a pre-specified volume “cap” has been used). Data caps and throttling policies are normally disclosed to customers as part of the overall service description. In some cases, these are absolute, and can only be overcome by upgrading to a higher service tier. In other cases, temporary one-time fees may be offered, allowing the user to temporarily increase the data cap or postpone the onset of throttling for a given billing cycle. Other types of “degradation” of available speeds due to the overuse of shared services, imposing limits on the number of devices that can be connected to a particular service as a technical or practical matter (e.g., placing a limit on the specific number of devices able to connect, or with wireless services, limitations due to the delivery of the service through an individual user’s device), imposing additional charges for “overages” or for optional “unlimited” plans to avoid data caps and throttling and, for wireless broadband services, limitations on the customer’s ability to create a “hotspot” to extend the customer’s broadband service to other devices), are examples of other service attributes that must be considered in addition to the more straightforward elements like downlink and uplink speeds.

Defining “adequate and reasonable” service for OTAP purposes

Establishing precisely what minimally constitutes “adequate” and “reasonable” broadband service requires a dynamic and multi-attribute approach that will be capable of quantitatively capturing prevailing market conditions and trends over time, and formulaically establishing then-current standards for “adequacy and reasonableness” that will evolve with technology, customer needs, and demands for services. In addition to downlink and uplink data rates – the two principal service attributes that are captured in the FCC BDC data, the adequacy and reasonableness of broadband service must also consider service attributes such as data caps, throttling policies, variability of delivered downlink and uplink data rates, latency (the time it takes for the service provider to transport and deliver individual packets from their origin to their destination), “jutter{ (the degree of speed variability), aggregate capacity of the provider’s individual distribution network and the extent to which that capacity is occupied during peak use periods, and the frequency and duration of service interruptions and outages.

Two principal types of consumer broadband Internet access

The majority of residential consumers have two separate means for obtaining broadband access to the Internet – mobile services using a so-called "smartphone" of some type, and "fixed" broadband, delivered to individual Internet-connected devices (e.g., desktop or laptop computers, streaming video devices (set-top boxes like Roku and AppleTV as well as so-called "smart TV" receivers), and tablets) via a wi-fi router located in the home.

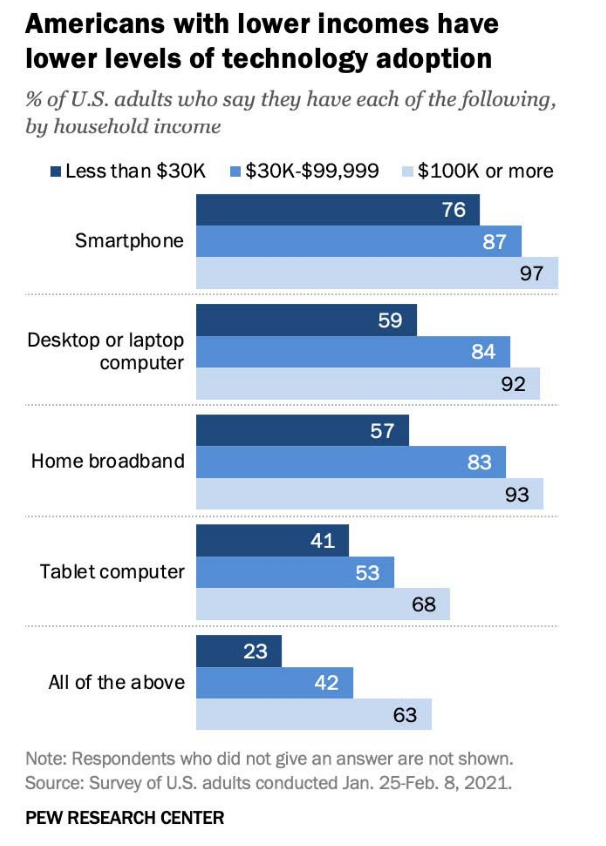


Figure 2a-1. More households have at least one mobile broadband device than have home broadband Internet access.

Notably, the number of households with some type of mobile service is greater – in some cases substantially greater – than the number of households with fixed broadband service. A 2021 Pew Research study, for example, found that, while "broadband adoption and smartphone ownership have grown rapidly for all Americans, ... the digital lives of Americans with lower and higher incomes remain markedly different." Pew found that 93% of households with incomes in excess of $100,000 reported having home (fixed) broadband; for the lowest income group – households with incomes below $30,000 – only 57% subscribed for home broadband access. The disparity was also present with respect to mobile smartphone type access, but was not as great: 97% of households in the highest income group indicated that they had at least one mobile smartphone, whereas for the lowest (< $30,000) income category, that penetration rate dropped to 76%.[24] Significantly in all three of the income categories that were studied, more households had at least one mobile broadband device than had any fixed home broadband service. Overall, the US smartphone market has experienced immense growth over the past decade, with ownership levels increasing from 35% in 2011 to 85% in 2021.[25] It is also noteworthy that a majority of households *at all income levels* have both mobile and fixed broadband Internet access. There are 294.1-million smartphone users in the United States; 85% of American adults use smartphones. And approximately 47% of all web traffic in the U.S. originated from mobile devices.[26] Clearly, while there is some overlap in the functionalities of these two types of broadband Internet access; for most US households the two are *complements*, not substitutes. Significantly, demand for

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24. Emily A. Vogels, "Digital divide persists even as Americans with lower incomes make gains in tech adoption," Pew Research Center, June 22, 2021, available at https://www.pewresearch.org/fact-tank/2021/06/22/digital-divide-persists-even-as-americans-with-lower-incomes-make-gains-in-tech-adoption/ (accessed 2/21/23)

25. https://www.zippia.com/advice/us-smartphone-industry-statistics/ (accessed 2/21/23)

26. *Id.*

smartphones appears to be more sensitive to the devices' capabilities than to their prices. Apple iPhones – which carry the highest prices overall – still command some 53% of the US market, followed by Samsung, at 26% and Lenovo at 12%.[27]

While a mobile device can obviously be used at one's home, the converse is not the case. Home fixed broadband supports a number of applications that cannot be satisfactorily supported by mobile devices – most notably the use of home computers (desktops, laptops, and tablets), video streaming devices, and various Internet-connected ("Internet-of-Things" or "IoT") devices such as Internet-connected thermostats, home monitoring cameras, "smart plugs," various home appliances, and digital assistants such as Amazon's *Alexa* and Apple's *HomePod*, among others. Fortune Business Insights estimates that "[t]he global Internet of things (IoT) market size was valued at USD 384.70 billion in 2021. The market is projected to grow from USD 478.36-billion in 2022 to USD 2,465.26-billion by 2029, exhibiting a CAGR [compound annual growth rate] of 26.4% during the forecast period."[28] While many potential IoT applications fall within various commercial/industrial categories, the home/consumer market represents a significant source of projected growth. Some home-based IoT devices can also be supported by mobile wireless services, with mobile connectivity built directly into the device. Central station home alarm monitoring systems are a good example. Some electric and gas utilities have been deploying "smart meters" that have the capability to enforce so-called "demand-side management" ("DSM") measures that control consumers' use of the utility's service – for example, limiting use of air conditioning on unusually hot days, or encouraging certain types of use to be shifted from peak to off-peak periods. These devices communicate with consumers in both directions – they support remote meter reading for billing purposes, but are also capable of providing consumers with real time demand-based pricing information so that pre-programmed actions can be taken as to the amount of energy consumption by various home appliances and lighting will be demanded at various price levels. Many utilities that have implemented such DSM systems have constructed their own proprietary "mesh networks," but communications between the utility and "smart meter" type devices can certainly be supported over the Internet, potentially at considerably lower cost than via the use of utility-owned mesh networks.[29] IoT devices of this sort could be supporting via the home wi-fi router or gateway. However, for security purposes, utilities may prefer that their smart meters be supported directly by a mobile wireless service. This will generally require that each such device have its own wireless service subscription. For example, in the case of wireless alarm monitoring devices, arranging and paying for the wireless service is generally the responsibility of the alarm monitoring company, which in turn bills its clients for these costs.

IoT devices can also be supported by mobile networks where maintaining them at fixed

27. *Id.*

28. https://www.fortunebusinessinsights.com/industry-reports/Internet-of-things-iot-market-100307 (accessed 2/21/23)

29. Some manufacturers of Internet-connected thermostats have entered into arrangements with electric and gas utilities whereby, with the customer's consent, the utility is provided with the ability to adjust the customer's thermostat(s) to limit demand during peak periods. For example, Honeywell Home programmable wi-fi thermostats, marketed by Resideo, offer such plans. https://www.resideo.com/us/en/utility-savings-programs/ (accessed 2/22/23)

locations is not practical. Medical monitoring devices are one good example. And one of the largest sources of potential growth in IoT devices can be found in Internet-connected automobiles. These will make limited use of fixed (home) broadband, typically for the downloading of software updates, but will ultimately represent a major category of mobile Internet traffic. As with other mobile IoT, connected cars will generally require individual subscriptions to a wireless carrier's service. Tesla, for example, provides such wireless service subscriptions and includes their cost either in the purchase price of the car, through recurring monthly or annual charges to the car owner, or a combination of both. Proliferation of connected cars will also force mobile service providers to expand their coverage and capacity to include more local streets and secondary highways than exists today.

While the vast majority of residential IoT applications individually involve relatively small quantities of data and thus require relatively low bandwidths, all involve some transmission in the uplink direction. Thus, cumulatively, the need for increased uplink bandwidth at individual customer premises is likely to increase as IoT applications proliferate, potentially forcing providers that offer asymmetric downlink/uplink services to provide for increased bandwidths in the uplink direction, or to move toward symmetric services altogether. In that regard, Comcast has recently announced plans to move in that direction: "Comcast's latest Xfinity 10G network upgrade will be launched to 10 million homes and businesses by the end of February [2023]. These locations now have the foundational network enhancements to begin deploying DOCSIS 4.0, setting the stage for introducing new symmetrical multi-gigabit Internet options before the end of 2023 that can be delivered across existing networks at less cost."[30] Verizon began deploying its FTTP *FiOS* symmetric broadband service in 2006, but largely disbanded further *FiOS* expansion after 2010.[31] Verizon has since divested former GTE and certain former Verizon ILEC operating areas to Frontier and other companies, including Ziply Fiber in Oregon, where preexisting *FiOS* service is still being offered.[32]

Wireless mobile "hotspots" as an alternative to fixed home broadband access

Many wireless smartphones have the ability to create a wireless "hotspot" by which the handset can use its mobile broadband connection to create what appears like a wi-fi network that can be made available to authorized users in close geographic proximity, usually within a radius of 20 to 30 feet from the mobile phone. The "hotspot" can be open or password-protected. From

30. "Comcast Launches 10G Network Upgrade for 10M Homes, Businesses," *Broadband Communities*, February 21, 2023, available at https://www.bbcmag.com/www-bbcmag-com/the-great-broadband-build/comcast-begins-10g-rollout-metronet-invests-350m-for-network-expansion (accessed 2/21/23)

31. *See* Robert Cheng, "Verizon to End Rollout of FiOS," *Wall Street Journal*, March 30, 2010, http://online.wsj.com/article/NA_WSJ_PUB:SB10001424052702303410404575151773432729614.html.

32. Verizon completed its merger with GTE in 2000, and included a number of the former-GTE service areas – including Oregon – when it began rolling out *FiOS* in 2005. In 2010, Verizon sold large portions of the former GTE ILEC territories to Frontier Communications, Inc., including its operations in Oregon. https://www.verizon.com/about/news/press-releases/oregon-public-utility-commission-approves-frontiers-acquisition-verizons-local-wireline-operations (accessed 3/2/23). In 2020, Frontier sold its ILEC operations in Oregon and several other states to the newly-formed Ziply Fiber. https://ziplyfiber.com/news/release/403 (accessed 3/2/23).

the perspective of the supported device (e.g., a laptop or tablet), connecting to a hotspot is just like connecting to any wi-fi network.

While it is necessary that the customer's smartphone possess the capability to create a wi-fi hotspot, its actual ability to do so lies solely within the control of the user's mobile carrier. The mobile carrier can block the creation of a hotspot altogether, can limit its down and up data rates, or can measure and limit hotspot usage volume within a given billing cycle. The carrier may limit the ability to create a hotspot to certain (typically more costly) service tiers, and also impose different hotspot rules for domestic (US) or foreign data usage. In some cases, even where the customer has an unlimited wireless service plan, the carrier may still impose limits on the aggregate (monthly) data usage of hotspots associated with the customer's service. Importantly, the ability for a customer to create and use a hotspot is a *required feature* of any lifeline-supported mobile service plan.[33]

These limitations aside, the use of mobile hotspots for home Internet access may be a reasonable alternative to fixed broadband, particularly in areas where landline broadband is simply not available and/or where the aggregate need for fixed home wireless is limited. A key benefit: Consumers who currently have mobile service and no fixed broadband can obtain many of the capabilities of fixed broadband without incurring any additional cost or requiring additional equipment and, subject to any carrier-imposed speed, volume or other limitations, can acquire the equivalent of a home fixed broadband service immediately. The availability of mobile hotspots should be considered by OTAP in assessing the adequacy and reasonableness of broadband services that are available to individual consumers.

Landline vs. satellite and wireless fixed broadband

The FCC's Broadband Data Collection (BDC) database, made available in December 2022,[34] contains approximately 12-million individual records for Oregon. Table 2a-1 below summarizes the contents of the BDC for Oregon:

33. 47 CFR § 54.408(e)(3).https://www.ecfr.gov/current/title-47/chapter-I/subchapter-B/part-54/subpart-E (accessed 3/6/34).

34. https://broadbandmap.fcc.gov/data-download (accessed 1/23/23)

Table 2a-1

FCC BROADBAND DATA COLLECTION ("BDC") DATA FOR OREGON AS OF 6/30/22

Last-Mile Technology:	Total State	10-Copper	40-Cable	50-FTTP	60-Geostat Satellite	61-Non-Geostat Satellite	70-Unlicensed Fixed Wireless	71-Licensed Fixed Wireless
Total Census Blocks	130,807							
Total Housing Units	1,813,747							
Census Blocks with Broadband Available	87,996	67,166	63,885	38,487	87,994	87,994	34,833	84,099
Locations with Broadband Available		1,022,316	1,335,509	636,460	4,452,892	1,484,665	695,243	2,766,091 x

There are a total of 130,807 Census Blocks in Oregon as of the 2020 Census. Of these, the FCC BDC includes data for 87,996 Census Blocks. Even though only about two-thirds of Oregon Census Blocks are included in the FCC BDC dataset, these areas contain 99.15% of the total Oregon population and 99.67% of all housing units in the state. Collectively, the FCC data indicates some form of broadband availability at approximately 1.4-million individual locations in Oregon. Thus, the vast majority of the roughly 43,000 Census Blocks that are *not* found in the FCC data appear to include an extremely small portion of the state's population. Using the BDC database, ETI has compiled broadband availability in Oregon at the individual census block level for each of the seven FCC-identified broadband technologies – 10-Copper, 40-Cable, 50-Fiber, 60-Geostationary satellite, 61-Low Earth Orbit satellite, 70-Unlicensed Fixed Wireless, 71-Licensed Fixed Wireless. We have categorized this data into two groups – "landline" broadband, which includes technologies 10, 40 and 50, and "wireless" broadband, which includes technologies 60, 61, 70 and 71. As shown in Table 2a-2 below, some form of "landline" broadband is available in 78,577 census blocks, encompassing 97.65% of the total state population.

Table 2a-2

"LANDLINE" BROADBAND SERVICE (COPPER, CABLE, FIBER) AVAILABILITY

Total Census Blocks in Oregon	130,807
Total Census Blocks with "Landline" Broadband Availability	78,577
Total State Population	4,237,256
Population with "Landline" Broadband Availability	4,137,628
Percentage of State Population with "Landline" Broadband Availability	97.65%
Source: Table 1a-2, *supra*..	

The specific technology that is used to provide broadband service has a significant impact upon its nature and quality. For example, Copper Wire (technology code 10), which has traditionally been used by ILECs to provide Asymmetric Digital Subscriber Line (ADSL) broadband service, might typically offer up to 10 mbps downlink and 1 to 3 mbps uplink speeds when connected directly between the customer's premises and the ILEC central office. However, the data rates than can actually be achieved for such configurations vary inversely with the *route distance* between the customer and the central office, with an absolute limit in the range of about 18,000 route feet. But when combined with fiber optic cable extended to locations in close geographic proximity to the customer (so-called Fiber-to-the-Node (FTTN) architecture), speeds can be considerably faster. The FCC data indicates speeds as high as 1000/50 for some copper technology providers and locations in Oregon. Fiber-to-the-Premises (sometimes referred to as Fiber-to-the-Home) can support speeds as high as 1000/1000 mbps or more, as can coaxial cable when combined with FTTN connectivity. Geostationary satellite broadband, which is (theoretically) available almost ubiquitously, generally offers more limited downlink and uplink speeds, and some providers impose monthly caps on the aggregate amount of data that can be transmitted at the full advertised data rate. Geostationary satellites also exhibit greater "latency" due to the time it takes for signals to make the 45,000 mile round trip between the earth station and the satellite. In 2019, Space-X began launching what will ultimately be more than 10,000 "low-earth orbit" ("LEO") *Starlink* satellites at altitudes of approximately 330 miles that will in principle be capable of providing broadband Internet access most anywhere in the world. Prices for satellite-based broadband are typically much higher than for comparable fixed landline services, making this technology attractive only where no other practical alternative is available. For example, Space-X has just announced price increases for *Starlink* services, which will now cost between $90 and $150 per month. depending upon satellite capacity in a given area.[35] Satellite data rates are also considerably lower than for landline broadband services. Starlink advertises download speeds of 50 to 250 Mbps for its basic plan, and speeds of 150 to 500 Mbps for its premium plan. However, "Starlink's median download speeds in the US dropped from 90.6Mbps to 62.5Mbps between the first and second quarters of 2022, according to Ookla speed tests. Starlink's median upload speeds in the US dropped from 9.3 mbps to 7.2 mbps in the same timeframe."[36] Use of *Starlink* service requires the one-time purchase of equipment at either $599 (for basic service) or $2,500 (for "Priority Access"), plus the $90 monthly charge.[37] Finally, while the FCC BDC data indicates the availability of *Starlink* throughout Oregon, the *Starlink* website contains an availability map that, as of this writing, shows only "wait list" availability for all of Oregon.[38]

Fixed wireless is another important broadband technology that is particularly well-suited to areas where the cost of running landline coax or fiber optic cables is relatively high, as is the case

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35. https://www.pcmag.com/news/starlink-to-increase-prices-for-many-us-c (accessed 2/22/23)

36. "Starlink is getting a lot slower as more people use it, speed tests show," Jon Brodkin, *ars Technica*, September 23, 2022 https://arstechnica.com/tech-policy/2022/09/ookla-starlinks-median-us-download-speed-fell-nearly-30mbps-in-q2-2022/ (accessed 2/27/23)

37. https://www.starlink.com/orders/?processorToken=eaa594c6-987b-4321-9edb-afd1f980052d (accessed 2/27/23)

38. https://www.starlink.com/map (accessed 2/27/23)

for low-density areas or those with relatively difficult terrains. Fixed wireless services offer data rates that are generally much slower than those available from cable and fiber providers. Mobile wireless CMRS carriers also offer "home Internet" type services using the same network as they use to furnish mobile wireless services, but combined these services are subject to the carrier's overall bandwidth capacity limitations.

In Oregon and according to the FCC BDC data, Alyrica Networks, Inc., is the largest provider of fixed wireless Internet in the state, and offers this service at approximately 214,000 locations in portions of Benton, Clackamas, Lane, Linn, Marion, Polk and Yamhill Counties. Alyrica does not specify the downlink and uplink speeds for each of its four levels of fixed wireless Internet access, but describes the types of use that each of these service levels is intended to support:

Table 2a-3

ALYRICA FIXED WIRELESS INTERNET SERVICE OFFERINGS

Plan	Capabilities	Monthly rate	Wi-Fi
"Essential"	Browse the web Check your email Watch Youtube Connect on social media	$59.99/month	$5.00/month
"Streaming"	Designed for HD video streaming Work from home using Zoom All the Essentials	$69.99/month	$5.00/month
"Gaming"	Play all your favorite online games Stream HD video on multiple devices at once	$79.99/month	$5.00/month
"Unlocked"	Unlock the fastest possible speeds! No throttling on download or upload Home Wifi included	$99.99/month	Included

Source: Alyrica website, https://alyrica.net/residential/ (accessed 2/28/21)

In addition to these monthly charges, Alyrica imposes an up-front $99 installation charge. There is no indication that Alyrica currently offers any ACP-eligible service.

Notably, FCC BDC data indicate that Alyrica serves 22,760 locations in Polk County, representing some 96.8% of the total 23,524 Polk County locations. In June 2022, Alyrica announced that it had been awarded $795,000 in local grant and American Rescue Plan Act (ARPA) funds to deploy next-generation fixed wireless service throughout Polk County. Alyrica states that its G1 towers will cover 33 square miles of hilly, remote, and well-forested rural terrain near Dallas, Oregon, that Alyrica knew would have been prohibitively costly to reach with fiber."[39] Thus, while no ACP support is currently available for low-income customers in areas served by Alyrica, public support has been made available to support fixed wireless deployment.

39. https://www.yahoo.com/now/alyrica-networks-wins-funding-bring-120000397.html (accessed 2/28/23)

While satellite and fixed wireless services represent an important alternative to landline broadband where the costs of landline construction are not economically feasible, ETI considers all of the currently available satellite and wireless offerings to be inferior to most landline broadband services. Some types of satellite or fixed wireless broadband services are nominally available almost ubiquitously throughout Oregon. However, consumers will almost certainly exhibit a strong preference for a landline offering where one is available. Whether or not satellite or fixed wireless broadband satisfies the "adequate and reasonable" standard as called for in HB 4092, these are, at least at the present time, "second best" forms of broadband that nonetheless serve an important need *in those areas where the costs and complexities of landline infrastructure deployment make such construction impractical*.

Principal uses of fixed home broadband Internet services

Any assessment as to what constitutes "adequate and reasonable" broadband Internet access service requires that one first examine how consumers utilize broadband. One particularly credible and well-respected source of this data is Sandvine, a company that works with content provider clients to "analyze, optimize and monetize networks [and to] accurately identify who, what, when, and where [application qualify of experience] issues are occurring, enabling operations teams to quickly resolve problems, and planning teams to precisely plan for future growth." Sandvine compiles and publishes a number of statistical reports on Internet use, including its annual *Global Internet Phenomena Report*, the most recent edition of which was published in January 2023.[40] Sandvine reports that Video applications, which include streaming video entertainment services like Netflix, Amazon Prime, Hulu, Disney+ and HBO Max, as well as user-contributed video services like YouTube and Vimeo, together account for approximately two-thirds of all Internet traffic. The remaining nine categories in the "top 10" group are all dwarfed by video. E-Commerce ("Marketplace") apps come in second, but still represent less than 6% of total Internet traffic.

APP CATEGORY TOTAL VOLUME

	2022 Categories	Total Volume
1	Video	65.93%
2	Marketplace	5.83%
3	Gaming	5.58%
4	Social Networking	5.26%
5	Cloud	4.98%
6	Web Browsing	4.63%
7	File Sharing	3.39%
8	Messaging	2.30%
9	VPN	1.13%
10	Audio	0.95%

Figure 2a-2. Top Ten Broadband applications

Among these top-10 application categories, Video, Gaming, File Sharing, and VPN (Virtual Private Network) benefit most from high-speed Internet access. For example, as Cisco Systems

40. Sandvine, "2023 Global Internet Phenomena Report," January 2023. available at https://www.sandvine.com/global-Internet-phenomena-report-2023 (accessed 2/21/23)

notes in its *Annual Internet Report (2018–2023)*[41] "Consider how long it takes to download an HD movie at these speeds: at 10 Mbps, it takes 20 minutes; at 25 Mbps, it takes 9 minutes; but at 100 Mbps, it takes only 2 minutes. High-bandwidth speeds will be essential to support consumer cloud storage, making the download of large multimedia files as fast as a transfer from a hard drive."[42] And average fixed and mobile broadband Internet speeds have been growing steadily, as the following data from the *Cisco Report* for the North America region indicates:

Table 2a-4

FIXED AND MOBILE BROADBAND CONNECTION SPEEDS 2018-2023

	2018	2019	2020	2021	2022	2023	CAGR
Average Fixed broadband speeds (in Mbps)	56.6	70.1	92.7	106.8	126.0	141.8	20%
Percent of Broadband Connections > 10 Mbps	81%	84%	86%	89%	93%	97%	
Percent of Broadband Connections > 25 Mbps	59%	66%	84%	95%	98%	99%	
Percent of Broadband Connections > 100 Mbps	16%	21%	31%	37%	40%	46%	
Average Mobile broadband speeds (in Mbps)	21.6	27.0	34.9	42.4	50.6	58.4	22%
Wi-Fi speeds from mobile devices	46.9	56.8	70.7	87.3	98.4	109.5	18%

Source: Cisco Annual Internet Report (2018–2023), Tables 5-8, data for North America region

The growing demand for successively higher data rates is driven heavily by the requirement of specific applications and devices. Consider, for example, the case of Internet-connected TV sets and video streaming devices. Table 2a-5 below shows the download speeds (in mbps) required for Standard Definition (SD) TV, High-Definition (HD) TV, and 4K Ultra High definition TV:

41. Cisco Systems, Inc., *Cisco Annual Internet Report (2018–2023)*, available at https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-Internet-report/white-paper-c11-741490.html (accessed 2/21/23).

42. *Id.*, at 15.

Table 2a-5

INTERNET-CONNECTED TELEVISION DOWNLOAD SPEEDS

Video quality	Download speed
Standard Definition (SDTV)	2.0 mbps
High Definition (HDTV)	5.0 – 7.2 mbps
Ultra High Definition (4KTV)	15.0 – 18.0 mbps

Source: Cisco Annual Internet Report (2018–2023), Figure 3.

And over the 2018-2023 period, the demand for UHD 4K Internet-connected TV sets experienced dramatic growth:

Table 2a-6

GLOBAL DEMAND FOR Internet-CONNECTED 4K UHD TV SETS 2018-2023

	2018	2019	2020	2021	2022	2023	CAGR
Millions of units in service	268	371	493	621	751	895	27%

Source: Cisco Annual Internet Report (2018–2023), Figure 3. Separate data for North America is not available.

Demand for Internet bandwidth is also impacted by the number and types of connected devices in the household, which have been steadily increasing over the 2018-2023 period:

Table 2a-7

AVERAGE NUMBER OF DEVICES AND CONNECTIONS PER CAPITA 2018-2023

	2018	2023	CAGR
Number of connected devices	8.2	13.4	10.3%

Source: Cisco Annual Internet Report (2018–2023), Table 2. Data for North America region.

Note that the device counts in Table 2a-8 are *per capita*, not per household. Demand for bandwidth on a per-account basis is obviously over the entire household.

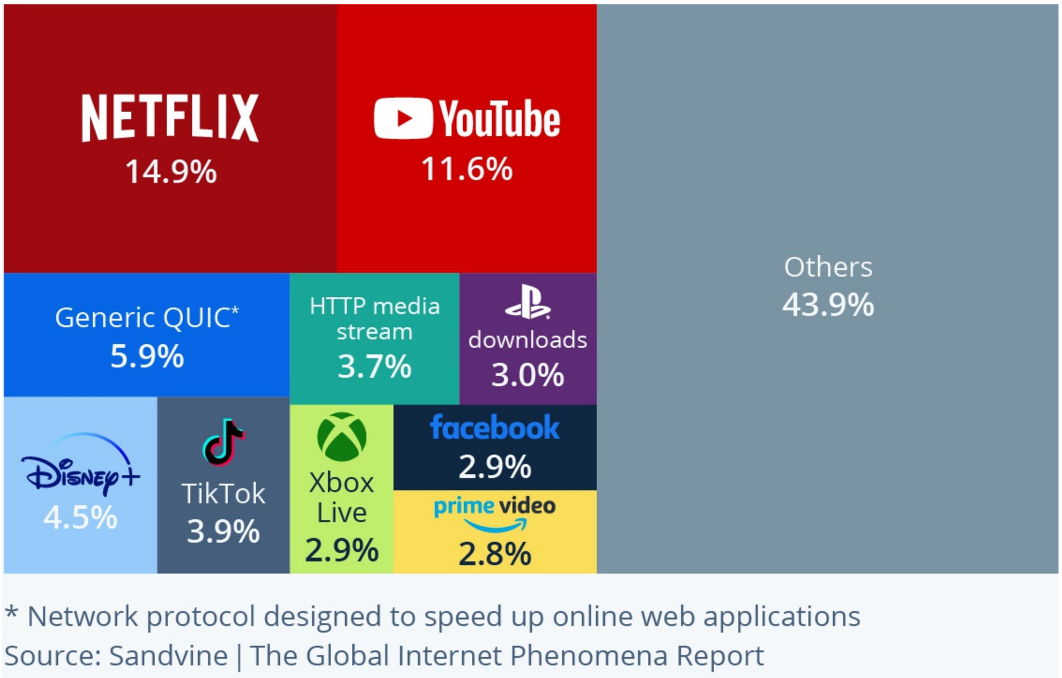

Figure 2a-3. Netflix is responsible for 15% of global Internet traffic.

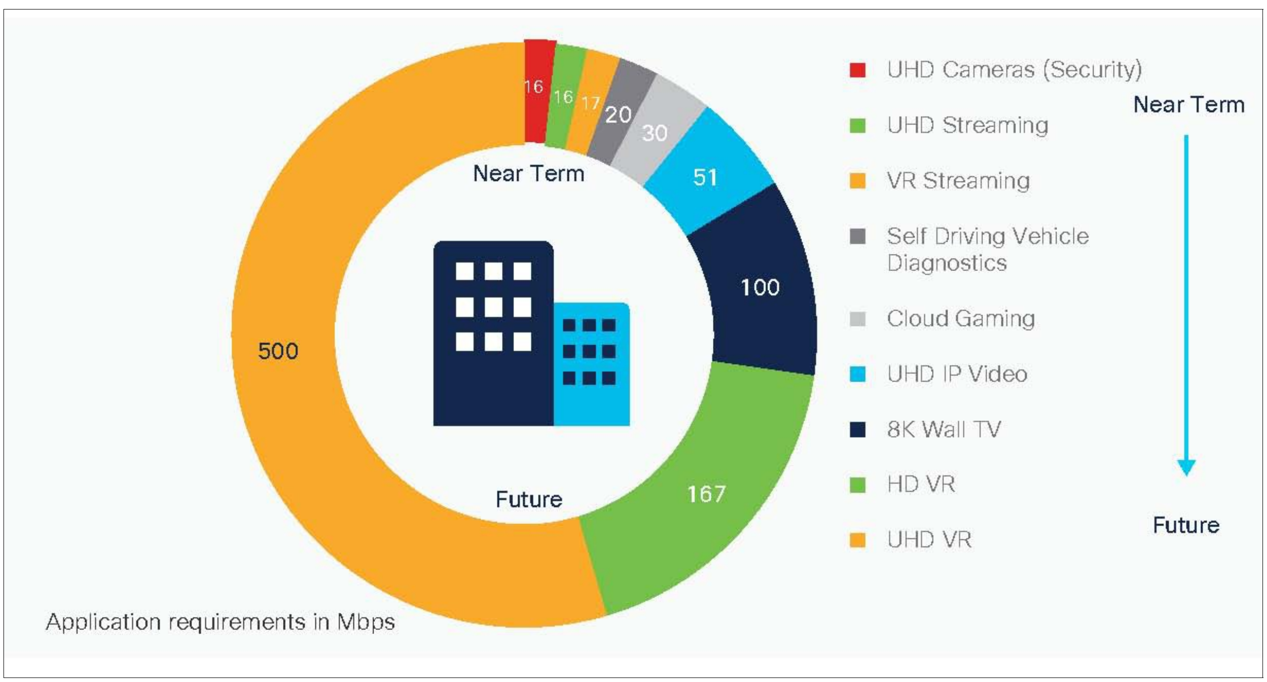

Figure 2a-4. Significant demand for bandwidth and video in the connected home of the future [Source: *Cisco Report*, at Figure 13]

As the *Cisco Report* notes, “[v]ideo and other applications continue to be of enormous demand in today’s home, but there will be significant bandwidth demands with the application requirements of the future, even beyond the forecast period of 2023. [Figure 2a-4 explores] a scenario with video applications of the future; today’s bandwidth needs are a sliver of the future needs.” Here, Cisco compares the bandwidth requirement of popular current applications with the potential demands arising from future applications, which include things like virtual reality, HD wall-size TV displays, and more.

ORS 285A.154 (10) assigns a series of specific duties to the Oregon Broadband Advisory Council: “The council shall [*champion statewide access to broadband services and shall encourage*] ... (e) [*Schools, education service districts and local education agencies in unserved areas to promote broadband access for the surrounding community*] As the use of computers and the development of computer literacy takes on increased importance and focus in elementary and secondary education, creating policies that promote access to the Internet from desktop or laptop computers in students’ homes easily falls within the scope of this statute. In that regard, the National Center for Education Statistics (“NCES”) is an important source of data on household use of computers and Internet access. NCES compiles data both at the national level as well as for individual states on computer availability and Internet access in households with school-age children. Tables 2a-9 and 2a-10 below summarize the NCES data for the US overall and for Oregon on the percentages of children ages 3 to 18 by type of computer in the household and percentage distribution of children ages 3 to 18 by home Internet access, by poverty status and state, for 2019, the latest year for which this data is available. Earlier editions of this NCES compilation do not provide the same level of detail on the types of devices owned and used for Internet access, and do not appear to be limited only to households with school-age children. Nevertheless, it is instructive to compare the home computer and Internet penetration rates for 2015 and 2019, despite the differences in the nature of this data.

Table 2a-8

HOUSEHOLDS WITH COMPUTERS AND INTERNET ACCESS

		Oregon		US Total	
	Metric	**2015**	**2019**	**2015**	**2019**
DEVICES	Total, any computer or smartphone	90.9%	99.1%	86.8%	98.1%
	Total, any type of computer		92.6%	94.5%	90.1%
	Desktop or laptop		87.6%		83.5%
	Tablet or other portable wireless computer		79.5%		77.2%
	Smartphone		97.8%		96.2%
Internet	Have some type of Internet access, total	81.7%	96.6%	77.3%	94.6%
	Use Internet through desktop or laptop, tablet, or some other type of computer		91.2%		88.1%
	Only through smartphone		5.4%		6.5%

	No Internet access		3.4%		5.4%

Source: National Center for Education Statistics (NCES), Digest of Education Statistics, Table 7.60 for 2015 and 2019. https://nces.ed.gov/programs/digest/ (accessed 2/22/23). Note: the 2015 edition of Table 7.60 does not include data on the types of computers owned or used for Internet access. Also, the 2015 edition appears to cover all households, whereas the 2019 edition appears to be limited to households with school-age children. See also, Table 7.10.

Table 2a-9

EFFECTS OF HOUSEHOLD INCOME UPON HOUSEHOLDS WITH COMPUTERS AND INTERNET ACCESS

Metric	Oregon		US Total	
	In Poverty	Not in Poverty	In Poverty	Not in Poverty
Percentage of children in a household with a desktop, laptop, tablet, or other portable wireless computer	79.4%	94.6%	74.1%	93.2%
Percentage of children with home Internet access through a desktop, laptop, tablet, or other portable wireless computer	76.9%	93.4%	69.9%	91.7%

Source: National Center for Education Statistics (NCES), Digest of Education Statistics, Table 7.60 for 2019. https://nces.ed.gov/programs/digest/ (accessed 2/22/23). "Data are for related children in families. Children are considered to be in poverty if their family income falls below the Census Bureau's poverty threshold, which is a dollar amount that varies depending on a family's size and composition and is updated annually to account for inflation. For example, the poverty threshold for a family of four with two children was $25,926 in 2019 [nationally. Respondents were interviewed throughout the year and reported on the income they received during the previous 12 months."

Notably, Oregon scores well above the national average both with respect to households with desktop or laptop computers and with Internet access, as well as for households in and not in poverty conditions. And, notwithstanding the limitations on direct comparability of the 2015 and 2019 results as reported by NCES, it does appear that household ownership of some type of computer device and Internet access has increased over the four-year period.

There are other sources of data on household ownership of personal computer devices that corroborate the NCES findings. One such source is IBISWorld, a firm specializing in industry and market data and research. IBIS data confirm both a steady increase in US household ownership of at least one computer *and* that growth is slowing as penetration rates approach 100%:

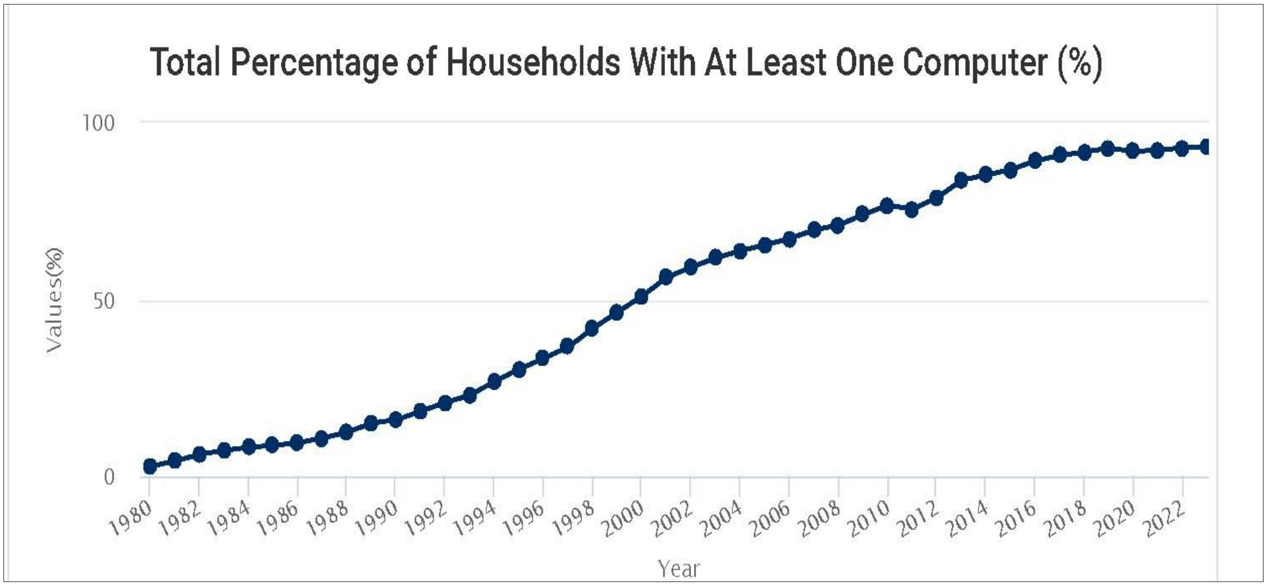

Figure 2a-5. Households with at least one personal computer device. Source: IBISWorld, https://www.ibisworld.com/us/bed/percentage-of-households-with-at-least-one-computer/4068/ [accessed 2/22/23)

IBIS reports that "[h]ousehold computer ownership continued its slow, steady growth in the last decade, spurred by the falling cost and increasing necessity of computers. Computers continue to become less expensive, with new laptops now readily available for a few hundred dollars. As a result, the percentage of families that own a computer is projected to reach 93.3% in 2023. Notably, the adoption rate has slowed as computers are rapidly approaching full saturation in American households. ... The percentage of households with at least one computer is largest among young households where the householder is below 50 years of age and the percentage is over 98.0% in households that have a yearly income of over $100,000. The percentage was lowest among households where the householder is above 65 years old."[43]

As we discuss in more detail in our discussion of Task 3a below, the Affordable Connectivity Program (ACP) provides certain subsidies for both broadband access and for certain equipment for use therewith. The specific attributes of the services and equipment that qualify for ACP subsidies are limited when compared with providers' standard retail offerings or equipment that would be eligible for ACT support. What might be considered "adequate and reasonable" for some customers may fall short for others. Elementary and most high school students should be able to fully satisfy the schoolwork's computer and Internet requirements with services and equipment that qualifies for ACP support. But this may not be the case for other situations.

Voice and other two-point communications services

Public assistance programs like OTAP, Connect America, Lifeline and others were traditionally motivated by the need to provide *voice* communications capability to low-income individuals

43. IBISWorld, https://www.ibisworld.com/us/bed/percentage-of-households-with-at-least-one-computer/4068/ [accessed 2/22/23)

and communities, and to those in high-cost, and thus underserved or unserved areas. Until the mid-2000s, ILECs and so-called "Competitive Local Exchange Carriers" ("CLECs") whose retail offerings were largely provided utilizing ILEC wholesale services and network facilities, overwhelmingly dominated the basic voice telephone services market. But at around that time, Cable MSOs began competing with ILECs for basic voice telephone service and, as mobile wireless service prices began to fall and flat-rate nationwide calling became the norm, demand for wireless services took off, ultimately being accepted by large numbers of consumers as a practical alternative to landline voice service.

Census data indicates that, in 2000, 97.6% of all US households had a landline telephone; for Oregon, the penetration rate was 98.4%.[44] By 2022, only 37.5% of US households still had landline phones.[45] Current data for Oregon is not available. The National Center for Health Statistics ("NCHS") of the Centers for Disease Control and Prevention ("CDC") has been routinely collecting and compiling data on household wireline and wireless telephone availability for many years. Table 2a-10 below provides a summary of the NCHS data for Oregon as it existed in 2010 and 2020:

Table 2a-10

**NATIONAL HEALTH INTERVIEW SURVEY
PERCENT DISTRIBUTION OF PERSONAL TELEPHONE STATUS
FOR ADULTS AGED 18 AND OVER,
STATE OF OREGON**

	2010	2020
Wireless-only adults	30.6%	66.6%
Wireless-mostly adults	15.0%	16.6%
Dual wireless/landline users	18.1%	6.8%
Landline-mostly adults	22.4%	5.5%
Landline-only adults	12.2%	3.9%
Phoneless adults	1.7%	0.6%

Source: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, For 2010: *Wireless Substitution: State-level Estimates From the National Health Interview Survey, January 2007–June 2010* https://www.cdc.gov/nchs/data/nhsr/nhsr039.pdf ; For 2020: *National Health Interview Survey Early Release Program, Modeled estimates (with standard errors) of the percent distribution of personal telephone status for adults aged 18 and over, by state, United States, 2020*, Released 12/2022. https://www.cdc.gov/nchs/data/nhis/earlyrelease/Wireless_state_202212.pdf (accessed 2/22/23)

Nationally, demand for landline telephone service has decreased precipitously over the past decade or so, as illustrated in the following chart, which is based upon CDC data:

44. https://www2.census.gov/programs-surveys/decennial/tables/time-series/coh-phone/phone2000.txt (accessed 2/27/23)

45. https://www.digitalinformationworld.com/2021/05/data-shows-625-percent-of-american.html (accessed 2/27/23)

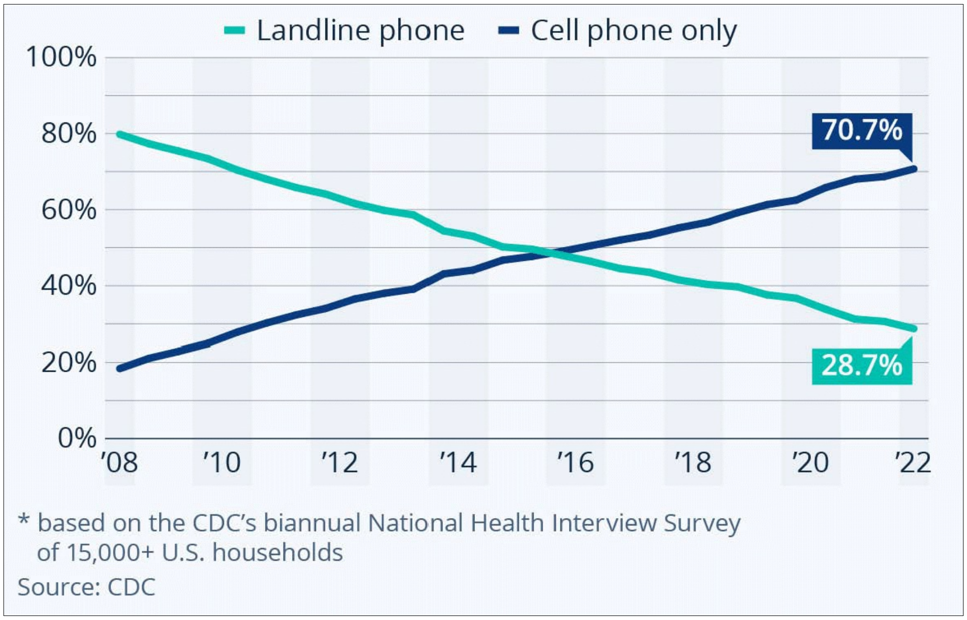

Figure 2a-6. Wireless vs. landline telephone service, 2008-2022. Source: https://www.statista.com/chart/2072/landline-phones-in-the-united-states/

There have been several critical developments over the past 20 years that have fundamentally reshaped the nature of person-to-person voice communication and accelerated the migration away from traditional landline telephone services, among other things, by offering features that are not even available with landline phones:

- Replacement of per-minute “airtime” charges on mobile phones with flat-rate pricing, and removal of “roaming” charges universally within the US, eliminated an important barrier to widespread mobile telephone use. Previously, customers were charged on a per-minute basis for both outgoing and incoming calls, and were subject to “roaming” surcharges for usage outside of their home metropolitan service area.

- Near-elimination of any distinction between “local” and domestic “long distance” calling on most mobile rate plans beginning with the introduction of AT&T’s *One Rate* pricing in the late 1990s. Charges for long distance calls remained in place for almost all basic wireline services and, for the most part, continue to this very day.

- Inclusion of service features like voice mail, caller id, call waiting, three-way calling and call forwarding at no additional charge on wireless services; additional charges for these features continue to apply on basic landline telephone service.

- “Free” or very low priced international calling also became available initially on mobile phones – indeed, it is still largely nonexistent for wireline pricing plans. Notably, these “free” or very low priced international calling services were not introduced by the wireless carriers themselves, but came instead from handset manufacturers (e.g., Apple’s *Facetime* video calling, introduced on its iPhones around 2010) and by companies like Skype and WhatsApp for use on mobile handsets. These innovations not only shifted person-to-person calling off of the public switched telephone network (“PSTN”), they also introduced, at no additional cost, video phone service that could be used both for domestic and international calling.

- Introduction of web-based – and subsequently app-based – voice calling services like Skype, WhatsApp, and Google Voice. Some of these services also included video calling.

- Introduction of consumer-oriented VoIP services like Vonage, MagicJack, and Ooma, that were supported “over-the-top” on the public Internet but were accessed via conventional analog telephone handsets.

- The introduction of multi-handset “family plans” that make individual wireless phones affordable for all household members – even for young children.

- Increased availability of video calling smartphone apps

- Availability of high-quality mobile telephone cameras, including both front-facing and rear-facing cameras on the same device.

- Increased use of person-to-person communications via social media.

The migration away from traditional wireline phone services was further stimulated by the proliferation of robocalls directed to wireline phones to a level that now likely dominates all inbound landline calling to residential users.

The vast majority of consumers – even those at the lower end of the income spectrum – have access to some sort of non-landline voice calling service, mostly via mobile telephones and also using any of several low-cost or “free” Internet-based applications. At the same time, there are still some households – admittedly relatively few at this point – that continue to retain some type of wireline phone service. Data suggest that many, perhaps most, “landline-only” households are either elderly and/or low-income. Thus, assistance programs such as OTAP must continue to support these users’ needs. However, shifting the primary focus of such assistance programs away from traditional voice telephone service and onto broadband will continue to assure that all qualified consumers are provided with “adequate and reasonable” voice telephone service.

Although voice services typically utilize a very small fraction of the maximum advertised speeds of even the most basic residential broadband service offerings, their highly interactive nature requires service with relatively low latency and high stability of both downlink and uplink data rates. Geostationary satellite services are the least amenable to two-way voice (and certainly video) conversations due to their high latency – as noted earlier, the roughly 45,000 mile round trip from an earth station to the satellite and back to another earth station takes about a quarter of a second, result in a delay of that length in each party’s receipt of the other party’s voice. Services subject to severe throttling – particularly in the uplink direction – will result in very choppy voice quality with frequent interruptions and garbling. Two-party video calling and multi-party video conferencing, similarly require very stable speeds in order to provide reasonable quality connections. These video conferencing needs for connections among business locations have traditionally been addressed by firms when specifying their broadband needs. The proliferation of participation in such meeting from homes, spurred by the pandemic, has elevated the need for similarly considerations to be applied for home broadband as well. For all of these reasons, the requirements of "adequate and reasonable" broadband services necessarily require that attention be paid to service attributes other than to just speed.

Attributes of "adequate and reasonable" telecommunications service

As noted at the outset of this discussion, what constitutes "adequate and reasonable" telecommunications service has evolved and will continue to evolve over time. Moreover, attempts to establish a quantifiable definition of "broadband," as has been the FCC's practice, are incapable of keeping abreast of current technologies and demands.

Moreover, while ORS 285A.154 (10) identifies a number of areas of broadband development and use for the Oregon Broadband Advisory Council to pursue, it does not provide any specific guidance as to their prioritization. As we noted above, what might be considered "adequate and reasonable" for elementary and most high school students would likely fall short for others. A critical element of this undertaking will be to identify service attributes that would meet the "adequate and reasonable" standard for consumers that qualify for OTAP, ACP or other support, even if these fall short of satisfying the needs of non-subsidized users.

In that regard, it is instructive to consider the eight (8) specific areas identified in the statute for consideration by the Oregon Broadband Advisory Council and, for each, to identify the essential service attributes necessary to satisfy the technical requirements of each of the enumerated application areas:

Table 2a-11

"ADEQUATE AND REASONABLE" FOR SPECIFIC POLICY GOALS

Policy goal	"Adequate and Reasonable"	Key Service Attributes
(10(a) Coordination between existing organizations and sectors that can leverage broadband to their advantage	Maximum capability consistent with economic efficiency	Relatively high data rates in both directions, increased symmetry and synchronousity, low latency
(10)(b) State agencies to encourage and facilitate broadband deployment	Maximum capability consistent with economic efficiency	Relatively high data rates in both directions, increased symmetry and synchronousity, low latency
(10)[(c) The development and support of digital inclusion and education programs to encourage broadband adoption and provide citizens with institutions to teach digital skills necessary for success in the workplace	Industry specific, but likely requires capacity sufficient to support quality 2-way video	Moderate (50-100 mbps downlink, at least 10 mbps uplink data rates, increased symmetry and synchronousity, low latency
(10)(d) Efforts to provide cost-effective quality workforce development training using telecommunications infrastructure and facilities to access distance learning opportunities	Industry specific, but likely requires capacity sufficient to support quality 2-way video	Moderate (50-100 mbps downlink, at least 10 mbps uplink data rates, increased symmetry and synchronousity, low latency
(10)(e) Schools, education service districts and local education agencies in unserved areas to promote broadband access for the surrounding community	Service level sufficient to support needs of elementary and secondary school students	Moderate (50-100 mbps downlink, at least 10 mbps uplink data rates, increased symmetry and synchronousity, low latency, potentially higher subsidies for terminal equipment and, where landline broadband is not economically viable, increased subsidies for up-front equipment and installation costs.
(10)(f) Public and private entities to seek opportunities for partnership with educational institutions that will stimulate the use of broadband technologies through community projects and public education	Maximum capability consistent with economic efficiency	Moderate (50-100 mbps downlink, at least 10 mbps uplink data rates, increased symmetry and synchronousity, low latency, potentially higher subsidies for terminal equipment and, where landline broadband is not economically viable, increased subsidies for up-front equipment and installation costs.
(10)(g) The use of broadband communications technologies for telehealth and telemedicine	Maximum capability consistent with economic efficiency	Relatively high data rates in both directions, increased symmetry and synchronousity, low latency
(10)(h) Public and private organizations to work together in partnership to	Maximum capability consistent with	Relatively high data rates in both directions, increased symmetry

As we have discussed here at some length, downlink and uplink data rates – which have up to now been the principal service attributes underlying the FCC's definition of "broadband" and the only ones specifically included in the FCC's Broadband Data Collection dataset – have not been sufficient to fully assess the adequacy of broadband services being furnished to residential customers. We have suggested several additional service attributes, including:

- Synchronicity and "jutter" – the stability of the delivered data rates
- Presence of data caps, throttling, and "overage" charges in consumer broadband plans
- Extent to which distribution networks are capacity-limited, resulting in service slowdowns and/or interruptions during peak demand periods
- Latency
- Sufficiency of delivered downlink and uplink capacity and other service attributes to support concurrent use of the consumer's broadband service by a specified number of devices (e.g., computers, video streaming boxes) in the household

Importantly, certain trade-offs can be made among the various attributes identified here. For example, consumers could probably make do with modest speeds in both directions as long as those speeds are not subject to throttling or degradation due to capacity limitations in shared community facilities during peak demand periods. And providing data rates sufficient to support high data volume applications, such as video calling, video streaming, and online gaming, will be of limited value if the use of these applications subjects the consumer to data caps, throttling, overage charges, or limitations on the number of devices that can be concurrently supported. Affecting all of these attributes is the overall reliability of the service, such as the frequency and duration of service outages and associated restoration intervals.

Each of these service attributes can be stated quantitatively, and are thus amenable to evaluation vis-a-vis a set of metrics that can be developed through policy and/or regulatory measures. However, it is critical that these metrics not be locked-in or fixed over time, that they be reviewed and revised periodically as a basis for establishing the then-current standard for adequate and reasonable service.

"Adequate and reasonable" service attributes for OTAP-supported broadband access

The discussion here has identified a number of specific attributes associated with broadband Internet access service that include, in addition to "bandwidth" (the term typically used to refer to uplink and downlink data rates or speeds), latency, jutter, throttling, data caps, and speed variability during peak traffic periods. The statute requires that services supported by OTAP be only "adequate and reasonable" and sufficient to meet the requirements of a typical household that qualifies for OTAP support.

In that regard, the determination as to what set of service attributes satisfies this "adequate and reasonable" requirement could be informed by one particular element of the ACP program – the provision of a subsidy of up to $100 for the purchase of equipment to be used in connection with the ACP-supported broadband service to permit the household to access and use the Internet. The $100 ACP equipment subsidy requires that (1) the recipient purchase a device (typically a laptop computer) that costs no more than $150, and that the recipient pay at least $10 in cash toward the purchase. Thus, to qualify for the full $100 subsidy, the customer must purchase a laptop whose retail price is in the range of $110 to $150. Of course, laptop prices can range up to several thousand dollars, so the capabilities of the type of device contemplated by ACP will necessarily fall at the low end of the range of such devices.

We discuss this in detail in Section 4b below. By current standards, the types of entry-level, low-priced laptop computers that fall within the ACP-qualified price range are all quite minimal with respect to the suite of features being offered. The processors are quite slow, the amount of memory (4GB RAM) is close to the bare minimum needed for current Windows 10 or 11 operating systems, which could limit the scope of software that could be run on these devices, and the hard disk size – which may range between 16 GB and 64 GB, is quite limited by comparison with the more typical 256 to 512 GB available on laptops and desktops in the $500 to $1500 price range. Laptops in the $110 to $150 price range will probably meet the needs of elementary school students and perhaps most (but not all) high school students, although those whose focus is on STEM will likely find these low-end units far too limiting. Most college students will likely require a more powerful computer than either of these devices. These entry-level laptops will probably also meet the needs of most adult members of these households whose uses of the Internet are limited mainly to web surfing, e-mail and social network usage. However, anyone attempting to run a home-based business, or use a home computer to access a company server for remote employment situations, will need something a lot better.

This $100 limit on ACP equipment support – coupled with the fact that no support at all will be available to anyone whose needs exceed the capabilities of these low-end machines – raises an important policy question for the OTAP: What is the objective of providing broadband availability for low-income households? If the goal is limited to furnishing a minimal level of broadband access, one that is consistent with the capabilities of the kinds of devices that qualify for ACP support, then an "adequate and reasonable" level of broadband access could be scaled so as to be consistent with the capabilities of these $150 laptops. However, if the policy goal includes providing capabilities that can support remote employment, reliable video conferencing, data analytics for work or education, running other IoT devices such as cameras, thermostats/energy saving devices, digital assistants (like Amazon's *Alexa*), something above this "bare minimum" would be indicated. In Table 2a-12 below, we provide our recommendations for what would constitute a "bare minimum" level of broadband Internet access that is consistent with the capabilities of the ACP $150 laptop, as well as recommendations for what we believe would be appropriate to meet the needs of qualifying households that are not limited mainly to entertainment, e-mail and social media use.

When developing minimum specifications for "adequate and reasonable" service, it is important to keep in mind that all retail, consumer-level broadband services are furnished on what is referred to as a "best efforts" basis. That is, the service provider agrees that it will undertake to use its best efforts to provide the service as described in its advertising, while making no guarantees as to whether it will actually deliver the service as described. This is in stark contrast to the manner by which services are provided to large enterprise and government customers. For these, the customer and the service provider typically enter into what is known as a "Service Level Agreement" ("SLA") in which the various service attributes (i.e., uplink and downlink data rates, latency, uptime, and the like) are quantitatively specified, with monetary penalties applicable where the provider fails to met the required service specifications.

Thus, when a "maximum advertised downlink speed" of, say, 25 mbps is stated for a retail service, the provider offers no guarantee or other assurance that this particular level will actually be delivered to the retail customer over any sustained period of time. It is also unlikely that any service provider would agree to any guaranteed service levels for OTAP-supported services or for any retail services that may be supported by any other state or federal low-income program. Depending upon the specific "last mile" delivery technology that is being utilized, there may be considerable variation in any of several service attributes over the course of a 24-hour day or 7-day week. Some technologies, such as those involving the use of coaxial cable, involve facilities that are shared among multiple users along the same cable segment between the remote terminal where fiber from the cable provider's "head end" is cross-connected to coaxial cables each of which will then serve multiple addresses along individual streets or roads. During peak-use (high-traffic) periods such as mid-mornings and early evenings,, the quantity of transmission capacity available to any individual customer may be limited, resulting is reduced data rates, increased latency, and increased jutter as delivered speeds are subject to increased variability. For this reason, in establishing a specification for "adequate and reasonable" service, it may be appropriate to require that "maximum advertised speed" be defined in terms of what will be delivered during peak "busy hour" periods, since delivering the maximum advertised speed during off-peak periods only is neither particularly challenging for the provider nor all that useful for the consumer.

In that regard, we have factored the absence of any guaranteed service specifications in developing our recommendations for "adequate and reasonable" service as summarized in Table 2a-12 below. Individual customers can monitor actual delivered service levels. Ookla's *SpeedTest* app (https://www.speedtest.net/), which can be invoked from a smartphone or a Windows or Mac OS PC, is one of several sources that provides real-time readouts of downlink and uplink speeds, latency, and 'ping" – the time it takes for a small data set to be transmitted from a user's device to a server on the Internet and back again. OTAP could consider establishing a sampling program where selected users as asked to periodically run a speed test and report the results.

Table 2a-12

RECOMMENDED SPECIFICATIONS FOR "ADEQUATE AND REASONABLE" BROADBAND ACCESS TO BE SUPPORTED BY OTAP

Service Attribute	Bare minimum	"Adequate and Reasonable" level	Comments
Downlink/uplink speed (data rate)	25/3 mbps	25/10 mbps. The increased uplink speed is needed to support two-way video calling and conferencing. Moreover, the term "maximum advertised speed" should refer to what is available during peak ("busy hour") periods.	As discussed above, what constitutes "broadband" is an evolving concept, driven by technological change and the introduction of new and more advanced applications. This standard must be reviewed and revised periodically to reflect these developments.
Latency	100-200ms or lower	100ms or lower	
Stability and "jutter" – the stability of the delivered data rates	Maximum 15% volatility	Maximum 10% volatility	Calculated as the mean deviation between latency samples / mean of those latency samples
Presence of data caps, throttling, and "overage" charges in consumer broadband plans	A monthly data cap of at least 200 GB.	A monthly data cap of at least 500 GB. In 2022, the average household used 586.7 GB of broadband data per month; 551.4 GB on downstream data, 35.3 GB on upstream data. 18.7% of broadband subscribers use more than 1 TB of data every month.[46]	Settling on what may be an acceptable cap may be contingent on the consequences of reaching the cap. For example, if the cap is low but the consequence is only moderately slower speeds, that may still be acceptable. If the cap is pecuniary – you pay a fee if you exceed it – or if the subsequent throttling eliminates the possibility of using core services, that may be unacceptable.
Extent to which distribution networks are capacity-limited, resulting in service slowdowns and/or interruptions during peak demand periods	Subscribers to services supported by OTAP or other low-income programs should be treated no differently than subscribers to standard (non-subsidized) broadband services.		
Term contracts with early termination penalties	OTAP-supported services should not require a term contract		

46. "2023 report: Internet users are gobbling data by the half-terabyte," https://www.allconnect.com/blog/report-internet-use-over-half-terabyte (accessed 4/17/23)

Conclusions and policy recommendations

In our discussion above, we have identified several credible sources of performance data upon which such periodic evaluations of "adequate and reasonable" can be based. These are reported at least annually by firms like Cisco, Sandvine, Akamai, among others. The "consistent with economic efficiency" requirement would apply where the cost of deploying any type of high-bandwidth landline infrastructure is exceptionally high, as in sparsely populated rural areas and/or areas with difficult physical terrain. In such cases, the capabilities of the highest quality wireless technology would be deemed "adequate and reasonable." Of course, the cost structure associated with satellite and fixed wireless services – and particularly the costs associated with equipment located at the customer's premises – may be considerably higher than for landline services – e.g., to utilize a satellite-based service some type of satellite "dish" antenna and transceiver equipment will be needed. These up-front costs of connecting a customer to these services may present a significant affordability barrier that will need to be addressed if the overall goals of the OTAP are to be achieved.

We have also provided what we consider to be "bare minimum" as well as "adequate and reasonable" specifications for OTAP-supported broadband services. However, when considering these recommendations as a basis for policymaking, it is important to establish, as a threshold matter, whether the type of broadband service that is to be offered to low-income households should be at a "bare minimum" level (as implied by the $150 limit on ACP subsidy-eligible laptop computers) or directed more toward providing qualifying households with a service that is capable of supporting more than basic e-mail and entertainment applications. As noted in Table 2a-12 above, even a data cap as high as 500 GB per month still falls below the average household monthly usage of 586.7 GB. As such, even our "adequate and reasonable" recommendation may still be less than sufficient and, if adopted, might still disadvantage OTAP-qualified low-income households relative to others in terms of the overall functionality and utility of the broadband service that is offered to them.

2b: "Other telecommunications services" that may not be currently supported by the OTAP.

Introduction

Up to this point, OTAP's focus has been to provide subsidies to low-income households to assist in their purchase of basic voice telephone service – the original objective of OTAP when the program was first introduced in 1987 – and, more recently, mobile telephone services and broadband Internet access. The nature of these subsidies has, up to now, been primarily directed toward offsetting the recurring monthly charge for the telecommunications service, and did not address any up-front costs associated with the initial connection of the service at the customer's premises, or any customer premises equipment ("CPE") that might be required in order to utilize the service itself.

Subsidizing the costs of customer premises equipment for OTAP-qualified households

As we discuss in more detail in Section 4b below, the ACP provides up to $100 in up-front subsidies toward the purchase of a basic laptop computer, provided that its cost falls within the range of $110 to $150. Laptops in this price range will probably meet the needs of elementary school students and perhaps most (but not all) high school students, as well as those of most adult members of these households whose uses of the Internet will be limited mainly to web surfing, e-mail, video streaming and social network usage, They will fall far short of meeting the needs of most college students as well as anyone attempting to run a home-based business, or use a home computer to access a company server for remote employment opportunities.

In our discussion of what constitutes "adequate and reasonable" telecommunications services for OTAP support in Section 2a above, we noted that providing what amounts to a "bare minimum" type of broadband access and a "bare minimum" type of laptop computer, while perhaps sufficient for households with no prior Internet experience and/or for elementary school students, will generally be incapable of supporting more sophisticated applications that may be necessary for work-from-home types of employment and even for basic household needs, once basic Internet skills have been mastered.

The ACP equipment subsidy – both in its absolute amount ($100) and its availability only for the very lowest priced devices – helps to reduce the barrier to broadband access but only for those households whose requirements are themselves at the "bare minimum" level. Moreover, even this limited ACP subsidy may not even persist if ACP funding is not renewed. OTAP could consider providing an equipment subsidy directly to the eligible customer that is less restrictive and that will continue to be available if ACP funding ceases, so as to further reduce barriers to broadband access for many Oregon households that can potentially benefit from capabilities beyond the "bare minimum."

Subsidizing the costs of equipment needed for satellite access where no other form of broadband is available

In Section 2a above, we also noted that, for households in remote locations where the costs of construction of landline broadband infrastructure may be prohibitive and where landline infrastructure investment by investor-owned service providers is not likely to be forthcoming, fixed wireless and satellite-based Internet access may be an efficient, and in some cases, the only alternative. Prices for satellite-based broadband are typically much higher than for comparable fixed landline services, making this technology attractive only where no other practical alternative is available. For example, SpaceX prices for its low-Earth orbit ("LEO") *Starlink* services are between $90 and $150 per month. depending upon the volume of usage, plus a one-time purchase of equipment at either $599 (for basic service) or $2,500 (for "Priority Access"). OTAP could consider offering financial support for the up-front purchase of equipment to individual households in remote areas where satellite broadband is the principal or sole means of obtaining broadband service. While the prices of this type of equipment are high when compared with the costs of CPE needed for typical landline broadband access, these costs need to be evaluated relative to the costs of deploying landline or fixed wireless facilities in such remote locations.

Expanding digital literacy among low-income households in Oregon

As we discuss in Section 4e below, digital literacy at a level minimally needed for successful access to and use of the Internet should not present a major barrier to broadband connectivity, certainly not one that is anything close to the financial barriers confronted by low-income households arising from the costs associated with subscribing to broadband Internet service and the purchase of computer and related equipment necessary for Internet use. The widespread availability of well-designed graphical user interfaces and other intuitive website and application designs will overcome many obstacles that might otherwise be confronted by those with minimal computer skills. Moreover, even for those not currently subscribing for broadband access at home, extensive user familiarity with smartphones and with commercial touchscreen and other input devices can be expected to facilitate their use of the Internet once home connectivity is achieved. Nevertheless, OTAP could consider providing affirmative financial support for the development of additional training materials, adult education programs, online tutorials and even live help desks to assist newly connected users, to the extent that such services are not already being offered by service providers themselves. An important ancillary benefit of such initiatives would be to catalyze the acquisition of other computer skills by those Oregon residents that are the principal focus of OTAP, potentially qualifying them for employment opportunities that may not at present be available to them.

Conclusions and policy recommendations

In addition to the types of direct subsidies for the recurring monthly costs of voice and broadband services that OTAP has been offering up to this point, several additional types of support should be considered so as to further overcome existing barriers faced by Oregon consumers to obtaining access to broadband:

(1) Expand up-front equipment subsidies to support devices offering capabilities that exceed those of the ACP-supported $150 laptop computers;

(2) Provide direct subsidies for the acquisition of CPE required for satellite broadband access to households in remote areas where the costs of deploying landline, and perhaps even fixed wireless, infrastructure are prohibitive.

(3) Provide affirmative financial support for the development of training materials, adult education programs, online tutorials and even live help desks to assist newly connected OTAP-eligible users, to the extent that such services are not already being offered by service providers themselves.

3a: Service provider participation in programs to support broadband access by low-income households

Introduction

Section 214(e)(2) of the Federal *Communications Act of 1934*, as amended by the *Telecommunications Act of 1996* (the 96Act), delegates authority to state commissions to designate common carriers that are eligible to receive federal universal service support, i.e., Eligible Telecommunications Carriers ("ETC"s). State PUCs may confer federal ETC status on ILECs or competitive common carriers that meet the conditions set out in Section 214(e)(1) of the 96Act. In general, those conditions require that the ETC offer and advertise, throughout its designated service area, the services that are supported by federal universal service support mechanisms. Section 214(e)(1) specifies that the carrier must provide the supported services using either its own facilities or a combination of its own facilities and resale of another carrier's service; however, in 2012, the FCC granted blanket-forbearance from that requirement to carriers that had filed and had approved a "Compliance Plan" in place of the owned-facility requirement. Each state may adopt specific requirements for ETC designation that are consistent with requirements of the 96Act. The Oregon PUC updated its own set of requirements for federal ETC designation in Docket UM 1648, Order No. 15-382 entered December 1, 2015.

FCC regulations require that an ETC offer Lifeline services to qualifying low-income customers within its designated service area. In order to offer Lifeline services in Oregon and to participate in the OTAP, a carrier must be designated as an Eligible Telecommunications Provider ("ETP"), which is the state-mandated counterpart of the FCC's Lifeline program. A single, combined petition is filed for participation in both programs. OTAP requirements are based upon the Residential Service Protection law found in ORS 759.687 and Chapter 290, Sections 2-6 and 16, Oregon Laws 1987 as amended. PUC rules governing OTAP are found in Chapter 860, Division 033 of the Oregon Administrative Rules.

ETI has been asked to investigate barriers to participation confronting broadband Internet service and other telecommunications providers in these low-income assistance programs, and recommend potential regulatory incentives that may encourage non-participating providers, including but not limited to municipal broadband Internet access service providers, to petition the PUC for the requisite designation.

OTAP – the Oregon Telephone Assistance Program – "is designed to provide a reduced rate or discount for an Eligible Telecommunications Provider's broadband Internet access service, basic service, or both, whether sold separately or in combination with other services, to low-income customers who meet eligibility requirements."[47] The program runs in parallel with, and in most cases as an additive to, the FCC's Universal Service Low Income Assistance Program, and is funded via revenues collected from most telephone subscribers in the state. Individually and combined, these programs are referred to as "Lifeline." As presently configured, OTAP, or

47. *Oregon Administrative Rules* (OAR) 860-033-0010 (1)

"Oregon Lifeline," provides a $10 monthly subsidy that is reflected as a discount off of customer bills that is achieved through direct payments by OTAP to the service provider participants in the program for each qualifying subscriber.[48] In most cases, this discount is in addition to a corresponding monthly discount of $9.25 that is available through the FCC's Lifeline program for broadband access services, and $5.25 monthly for voice access, which can be landline or mobile. Combined, eligible low-income subscribers that participate in the program receive a monthly discount of $19.25 for broadband service or $15.25 monthly for voice-only service.[49]

Table 3a-1

OTAP AND LIFELINE SUBSIDY AMOUNTS EFFECTIVE 2023

Service	FCC Lifeline Subsidy	Oregon Lifeline Subsidy	Total Discount
Non-Tribal Broadband	$9.25	$10.00	$19.25
Non-Tribal Voice	$5.25	$10.00	$15.25
Tribal Broadband	$34.25	$10.00	$44.25
Tribal Voice	$30.25	$10.00	$40.25

Subscriber Eligibility Requirements

Generally, low-income customers apply directly to the Oregon PUC to participate in the program – this process qualifies them for both the federal and state Lifeline programs at the same time.[50] To be eligible, the customer, one or more of the customer's dependents, or the customer's household must meet and provide documentation for the criteria outlined in Table 3a-2 below. Only a single subscription is available per household.

48. OAR 860-033-0035 (1)(b).

49. OAR 860-033-0035 (1)(b).

50. There are exceptions. An approved Service Provider that is offering a "free" prepaid wireless monthly service may accept applications directly and then forwards the information to the PUC on the subscriber's behalf.

Table 3a-2 **OTAP AND LIFELINE SUBSCRIBER ELIGIBILITY REQUIREMENTS EFFECTIVE 2023**		
Non-Tribal Households		
	Receive benefits from one of the following public assistance programs, or	
		Medicaid
		Supplemental Nutrition Assistance Program
		Supplemental Security Income
		Federal Public Housing Assistance (Section 8)
		Veterans and Survivors Pension Benefit
	Have income that is at or below 135 percent of the applicable Federal Poverty Guidelines for a household of that size.	
Tribal Households		
	Meet any of the qualifying requirements above for non-tribal households, or	
	Receive benefits from one of the following Tribal-specific federal assistance programs	
		Bureau of Indian Affairs General Assistance
		Tribally administered Temporary Assistance for Needy Families
		Head Start (only those households meeting its income qualifying standard)
		Food Distribution Program on Indian Reservations
Source: OAR Rule 860-033-0030		

Service Provider eligibility requirements

Under the current federal and state legal framework, a service provider must petition the PUC for designation as a federal ETC and in Oregon as an ETP to participate in the federally-supported Lifeline program and the state supported OTAP. As defined in the Oregon Administrative Rules, an ETC and an ETP are defined as a "provider of telecommunications service, including a cellular, wireless, or other radio common carrier, that is designated by order of the Commission as eligible to receive" respectively, federal universal support and OTAP to its qualifying low-income customers "throughout a designated service area. Providers must be designated as both.

While the ETC and ETP designations allow carriers to become eligible to draw funding through the FCC's Universal Service Fund programs for federal Lifeline and the Residential Service Protection Fund for OTAP, providers are not guaranteed that designation, nor do they all desire to obtain it across their entire service area. The process of seeking and gaining the ETC or ETP designations ranges from a few months to as long as two years, depending upon the type of supported service the carrier offers. Most providers of fixed, wireless or satellite broadband Internet access service receive their designation within a matter of months. However, prepaid wireless providers that offer "free" service, most of which are resellers, are subject to more scrutiny due to perceived opportunities for waste, fraud and abuse. Table 3a-3 below details, at a very high level, the requirements for ETC/ETP designation.

Table 3a-3

OREGON ELIGIBLE TELECOMMUNICATIONS CARRIER AND ELIGIBLE TELECOMMUNICATIONS PROVIDER CERTIFICATION EFFECTIVE 2023

Eligibility requirements:		
	ETCs and ETPs with owned-facilities in Oregon	
		Providers apply to, are evaluated by, and approved by the Oregon PUC for both programs
		ETC designation required for carriers to draw federal USF High Cost funds in a specific geographic area
		Approved ETCs/EPTs must offer a Lifeline service in geographic areas in which they are certified
		Offer services using either its own facilities or a combination of its own facilities and resale of another carrier's services (including the services offered by another Eligible Telecommunications Carrier) throughout the service area: Potential Carrier of Last Resort responsibility
		Advertise the availability of and the charges for Lifeline services
		Request ETP designation for participation in the OTAP
	Lifeline-only ETCs and ETPs, generally MVNO resellers.	
		Providers submit a compliance plan that must be evaluated by and approved by the FCC. Providers then petition for ETC and ETP designation in Oregon.ply to, are evaluated by, and approved by the FCC
		Providers are not required to offer service over owned facilities, but must instead demonstrate that it is financially and technically capable of offering the Lifeline service and that it is compliant with a variety of requirements including the ability to remain functional in emergency situations
		Approved ETCs/ETPs must offer a Lifeline service in geographic areas in which they are certified
		Advertise the availability of and the charges for Lifeline services
Source: OAR 860-033-0021 and US 47 C.F.R. § 54 Subpart C		

Sources of OTAP Funding

The $10 monthly subsidy/discount provided under OTAP is funded through the application of a monthly Residential Service Protection Fund surcharge on the bills of telephone (voice) service subscribers in Oregon. The surcharge is applicable to all customers and to all services, on all lines or line equivalents, that interact with the public switched network (PSN), including circuit switched services (traditional Plain Old Telephone Service ("POTS")), Interconnected (with the Public Switched Network) Voice over Internet Protocol ("VoIP"), and wireless services, with limited exceptions for specific classes of customers (government entities, etc.).[51] The applicability of the surcharge to customers of prepaid wireless service has not been resolved. Per statute, the monthly surcharge, currently $0.03, can be increased to as high as $0.35, depending upon the demands of the program.[52]

51. OAR Rule 860-033-0006

52. Oregon Laws 1987, Chapter 290, Section 7., https://www.oregon.gov/puc/pages/rspf.aspx (accessed 3/29/23)

Fluctuations in Lifeline program demand

Subscriber participation levels in the Lifeline program nationwide have declined steadily since the FCC issued a series of orders beginning with the 2012 Lifeline Reform Order that, among other things, served to substantially strengthen protections against waste, fraud and abuse.

Customer participation in the OTAP fluctuates and is impacted by the service providers that participate in the program. At present, a majority of OTAP-participating service providers are incumbent LECs, e.g., CenturyLink; some are CLECs, e.g., Douglas Fast Net, and a few are wireless. Many customers have discontinued their subscription to service from traditional ILEC providers like CenturyLink, and have migrated to service providers that do not participate in OTAP, such as Comcast, Verizon Wireless, Metro, etc.

Other providers have exited the Oregon Lifeline market altogether. Cricket Wireless was a popular service provider for approximately 30,000 low-income households in Oregon; however, AT&T Mobility, after acquiring Cricket Wireless, relinquished the Company's ETC and ETP designations in 2015. Assurance Wireless relinquished its ETC and ETP designations in April 2022, claiming it was leaving to focus on other business initiatives; prior to its service winddown, Assurance Wireless was serving approximately 27,000 eligible customers.

Assurance's decision to leave followed a May 2021, announcement by the Oregon PUC and Oregon Attorney General Ellen Rosenblum of a $1.6-million False Claims Act settlement with the then-Sprint (now T-Mobile) Assurance Wireless subsidiary, for overcharging the Oregon Lifeline program. In 2019, PUC staff launched an investigation of Sprint's billing practices and discovered that the company had been systematically overcharging the Oregon Lifeline program for ineligible usage. The PUC's discovery eventually led to a nationwide investigation, where the FCC recovered approximately $368-million for the federal Lifeline subsidy and assessed a $200-million penalty. After securing an Oregon refund of $788,061 in December 2020, the PUC assisted the Oregon DoJ's civil enforcement team in securing an additional settlement payment of $859,451 under the Oregon False Claims Act, for a grand total of $1,647,512 that was returned back to the state.

Recent changes in Lifeline program demand following the enactment of temporary – and more generous – federal support programs

As is discussed in more detail below, subscriber participation levels that had already been in decline in both the FCC and Oregon Lifeline programs have continued to decline (or remained stubbornly low)[53] since the introduction of the temporary and more heavily funded federal Enhanced Broadband Benefit ("EBB") program enacted in 2020 specifically for pandemic era relief, followed by the federal Affordable Connectivity Program ("ACP") that became effective in 2022 as part of the 2021 federal Infrastructure Act.

53. The decline in Oregon since the start of the pandemic era was exacerbated by the loss of Assurance Wireless (a T-Mobile brand) as a lifeline provider in Oregon at the end of 2021. Assurance Wireless continues to participate in the lifeline market in the other 41 states in which it operates.

It is widely expected that current funding for these programs will be exhausted by 2024, unless extended by Congress, and there is no assurance that this will occur. Subscribers (and perhaps some providers) who migrated to these new plans with higher discount levels may find their way back to traditional Lifeline programs if/when ACP funding runs out. The reduction in traditional Lifeline program subscriber participation levels since 2020 should thus not be interpreted as an indication that the existing plans are no longer necessary.

Importance of voice-only service offerings

The Oregon Lifeline program, as it exists today, supports both broadband access and voice only access. While the focus of this Report centers around the provision of broadband services, the importance of the voice-only service subsidies to those subscribers that live in areas without broadband availability must not be overlooked. Nearly 20% of subscribers in the program are subsidized for voice only access.[54] The demand for traditional POTS and other voice-only or voice-mostly services has been on the decline for some time – and this decline is reflected in applications for Lifeline type support for voice-only services – voice services are still highly relevant and essential to the broader universal service objectives. It should also be noted that of Oregon Lifeline participants subscribing to services offered by rural Incumbent LECs (e.g., fixed wireline services), 53% are voice-only,[55] suggesting that for many of these subscribers a broadband offering may not even be available. The FCC's monthly $5.25 Lifeline subsidy for voice-only services will be phased out on December 31, 2023,[56] leaving the $10-monthly Oregon Lifeline subsidy as the only support for telecommunications services for those low-income subscribers that are located in geographic areas without broadband service available or for those who, for whatever reason, do not currently want broadband and who thus still rely upon traditional copper-based wireline telephone services in their homes (see sections 1a and 1b above).[57]

The FCC adopted 47 C.F.R. § 54.403(a)(2)(i) in the 2016 Lifeline Modernization Order as part of its efforts to modernize and transition the Lifeline program to include broadband Internet access service and phase out voice as a supported service. First, the 2019 Oregon Legislature enacted Senate Bill 69,[58] effective January 1, 2020, to align Oregon law with FCC regulations,

54. Data as of year-end 2022. Source: FCC Lifeline Disbursement tool.

55. *Id.*

56. *I/M/O Lifeline and Link Up Reform and Modernization Telecommunications Carriers Eligible for Universal Service Support Connect America Fund*, WC Docket Nos. 11-42, 09-197, 10-90, *Order*, Rel. July 1, 2022. DA 22-706, at 12.

57. Table 1a-6 indicates that broadband access – landline (copper, cable, fiber) and/or fixed wireless – is deployed and available to 98.99% of Oregon's population. Table 1b-3 above, which is based upon ACS data, indicates that 91.8% of Oregon households currently subscribe to some type of Internet access, that 2.51% of Oregon households use the Internet but have no subscription at their home, and another 5.89% neither use nor subscribe to any Internet service.
58 Or Laws 2019 c.91 §1

58. Oregon Laws 2019 c.91 §1

under which eligible low-income customers can receive the OTAP discount on broadband Internet access service. Originally, the statute governing the OTAP specified that state support *is* in addition to (emphasis added) available funding offered by the FCC; however, the 2021 Oregon Legislature enacted House Bill 2507 to amend the statute so that OTAP support *may be* in addition to (emphasis) FCC funding; otherwise, eligible low-income Oregonians would not be able to use OTAP support for voice service. On June 23, 2021, Oregon Governor Kate Brown signed into law House Bill 5032[59] that comprises the overall Oregon PUC's legislatively adopted budget for the 2021-2023 biennium. The legislatively-adopted budget included a package, which the Oregon PUC had originally submitted in its Agency Request Budget, to adjust the OTAP discount from $3.50 to $10.00. The primary objective of the package was to offset, to a large extent, the elimination of federal Lifeline support for Oregon customers who need voice-only service because they either do not have access, cannot afford, or do not want to subscribe to broadband internet access service. As a result of the Oregon Legislature and PUC's proactive measures, the Oregon Lifeline program, as it exists today, supports both broadband access and voice-only access.

Barriers to service provider participation and potential regulatory incentives to encourage participation by additional providers

As discussed above, under the current federal and state legal framework, in order to participate in the Lifeline programs, facilities-based service providers must petition the Oregon PUC for ETC and ETP designation through a consolidated application. Resale service providers file first with the FCC to have it approve a "compliance plan." If approved, they follow that up with a petition to the Oregon PUC for a combined ETC/ETP designation. Service provider participation in Oregon in both the FCC and state-run OTAP Lifeline programs (we will refer to these collectively as the "Oregon Lifeline Program") has been fairly limited. Many providers, particularly the largest non-ILEC "landline" providers, have chosen not to offer Lifeline options to their Oregon customers at all. ETI has been asked to investigate the barriers that currently confront broadband Internet service and other telecommunications providers to their participation in these low-income assistance programs, and to recommend potential regulatory incentives that may encourage non-participating providers, including but not limited to municipal broadband Internet access service providers, to petition the PUC for the requisite designation.

As a starting point for that investigation, ETI undertook several analyses. First, we examined the level of broadband adoption by subscribers (and by low-income subscribers in particular) in Oregon compared to subscription rates in other states, in order to assess whether service provider participation levels are negatively impacting the ability of Oregon consumers to obtain broadband access. We then analyzed service provider participation levels in the Lifeline program in Oregon compared to participation levels in the FCC's Lifeline program in other jurisdictions. We did this in order to ascertain whether there were barriers specific to Oregon's ETC/ETP designation process or to the operation of the program in Oregon. Finally, we also compared the number and types of service providers participating in the Lifeline program in Oregon to those currently

59. See Oregon State Legislature; Oregon Legislative Information; 2019-2020 Interim Joint Emergency Board, https://olis.oregonlegislature.gov/liz/2019I1/Committees/EB/2020-06-05-15-00/Agenda

participating in the federal ACP program.

Relative broadband adoption levels

Oregon has one of the highest levels of broadband Internet access adoption in the nation – ranking among the top tier of states in terms of the availability of Internet access services in the home. Statewide, 91.8% of households in Oregon are reported to have some type of Internet service already in the home, according to the most recent ACS released by the US Census Bureau.[60] This number is likely even higher today, since this survey was based upon 2021 data, before the introduction of the federal ACP low-income program at the end of 2021. Enrollment in that program has more than doubled since its introduction. Hard data on how many of the ACP enrollees were already purchasing Internet access prior to moving into an ACP plan is not yet available, but at least one major provider – Cox Cable – has reported that roughly 50% of the purchasers of its ACP offering did not previously have a broadband Internet access subscription.[61] We know, from the data in Table 1a-6 above, that broadband access – landline (copper, cable, fiber) and/or fixed wireless – is deployed and available to 98.99% of Oregon's population. From Table 1b-3 above and based upon ACS data, 91.62% of Oregon households currently subscribe to some type of broadband access. Thus, maximum potential increase in overall subscribership that might result from any expansion of the low income program is no more than about 7.37% of the total population (i.e., 98.99%-91.62%). Moreover, referring again to Table 1b-3, ACS data indicate that 2.56% of Oregon households use the Internet but have no subscription at their home, and another 5.64% neither use nor subscribe to any Internet service. The 2.56% that use but do not currently subscriber to any Internet access are clearly potential beneficiaries of low-income programs. We do not know what portion of the currently unconnected 5.64% are low-income households or have simply seen no need for any Internet use, and for those that would qualify for a low-income support program, would want an Internet service subscription even at a highly subsidized – or even "free" – price.

The success in reaching the target population of the low-income assistance programs in Oregon (which might serve as an indication as to the adequacy of the existing programs) falls squarely toward the middle of experience nationwide. Table 3a-4 below provides estimates of the relative broadband adoption rates and the percentage of the target low-income population for Lifeline and for ACP that have actually subscribed to service under one of those programs for Oregon relative to rest of the US.

60. See Table 1b-3, *supra*. This is the penetration rate for the state as a whole as reported by ACS using 1-year data for 2021.

61. Cox Cable news release,12/02/2022, "Affordable Internet Improves Lives, Survey Finds" https://www.coxenterprises.com/news/affordable-Internet-improves-lives-survey-finds (accessed 3/29/23)

Table 3a-4

ESTIMATED RELATIVE BROADBAND ADOPTION AND LIFELINE/ACP PROGRAM PARTICIPATION RATES

Service	Oregon	Nationwide Range	Nationwide Average	Oregon place in state ranking (best to worst)
Percent of Households with Broadband Access	92%	62% to 93%	90%	11
Lifeline subscriptions as a % of households at or below 138% of poverty level (2020)	30%	1% to 68%	37%	28
Combined Lifeline and ACP subscriptions as a % of households at or below 200% of poverty level (1 Q 2023 subscriber counts)	56%	24% to 95%	62%	25

The target population for the Lifeline/OTAP Program was based upon a translation of Census Bureau population-wide data reported on individuals at or below 138% of the federal poverty level[62] (Lifeline uses 135% as a cap) into households using the average population per household. Lifeline/OTAP subscriptions were based upon USAC-reported subscriber counts for the year ending December 2020 before Assurance Wireless left the Oregon Lifeline market and the introduction of the EBB program (the predecessor to the ACP). The data reveals that roughly 30% of the estimated households that would have qualified for Lifeline/OTAP at the end of 2020 were subscribing. This compares to an average of 37% nationwide, with Oregon ranking 26th overall. Participation across the 50 states and DC ranged from a low of 1% in Wyoming to a high of 68% in California. Oregon's 30% estimated rate should not be interpreted as indicating that only 30% of the target population have subscribed to broadband, but rather that only 30% of the target population have availed themselves of a broadband service offered pursuant to the Lifeline/OTAP program.[63]

The target population for the Combined Lifeline and ACP Programs was based upon a translation of the same Census Bureau population-wide data, but for individuals at or below 200% of the federal poverty level (since the ACP programs is available to subscribers up to a cap of 200%) into households using the average population per household. Lifeline/OTAP and ACP subscriptions were based upon USAC-reported subscriber counts for the most recent month available (March 1, 2023 for ACP and January 2023 for Lifeline). The data reveals that roughly 56% of the estimated households that would have qualified for Lifeline/OTAP at the start of 2023 were subscribing. This compares to an average of 62% nationwide, with Oregon ranking 25th overall. Participation across the 50 states and DC ranged from a low of 24% in Alaska to a high of 95% in

62. *See*, https://aspe.hhs.gov/topics/poverty-economic-mobility/poverty-guidelines (accessed 3/31/23). The 2023 federal poverty thresholds for the lower 48 states and DC that apply for Lifeline eligibility vary by household size. For households with 1, 2, 3, 4 and 5 people, the household income thresholds are $14,580, $19,720, $24,860, $30,000 and $35,140, respectively.

63. As an example, a low-income customer subscribing to a broadband offering through Charter Communications (a service provider that has declined to apply for ETC eligibility across the broad base of its service territory in Oregon) would still be obtaining service, but not at a discount and not included in the participation rate discussed herein.

the District of Columbia. As was the case above, Oregon's 56% estimated participation rate should not be interpreted as indicating that only 56% of the target population has subscribed to broadband, but rather that only 56% of the target population has availed themselves of a broadband service offered pursuant to the Lifeline/OTAP or ACP program.

Analysis of comparative service provider participation levels in Oregon Lifeline and elsewhere:

A comparison of the list of service providers identified by USAC as operating in Oregon to those operating in surrounding states offers some insight into whether barriers to service provider participation in Oregon Lifeline may exist. Table 3a-5 below contains the results of an analysis of data provided by USAC on the number of service providers registered as ETCs (those carriers that have an obligation to offer Lifeline in at least some service areas) in California, Idaho, Montana, Nevada, Oregon, Utah, Wisconsin and Wyoming, On an aggregate basis (all providers of all types), Oregon has more providers with ETC designation than any of those states with the exception of California.

Table 3a-5

REPORTED NUMBERS OF ETCs OPERATING IN OREGON AND NEARBY STATES (DATA AS OF DECEMBER 2022)

State	Incumbent LEC Home Service	Competitive LEC Home Service	Competitive LEC Mobile Service	Total
Oregon	**32**	**8**	**7**	**47**
California	23	12	15	50
Idaho	20	4	17	41
Montana	19	4	6	29
Nevada	14	3	19	36
Utah	14	4	15	34
Washington	25	6	16	46
Wyoming	10	7	9	26

Source: Compiled from data found in USAC Lifeline Disbursement Tool, available at https://opendata.usac.org/Lifeline/Lifeline-Disbursements/tfxa-gt3x

However, a simple counting of providers is not particularly useful, since in some cases, including Oregon, there are many more rural ILECs ("RLECs")), all of which have participated in the federal USF High Cost Fund at some point, and therefore all must also participate in state lifeline programs in order to continue to receive those funds. Each of those ILEC providers only offers service within its own service area (some not even throughout the entire area), such that the roughly 30 identified ILECs in Oregon provide no more service options to the low income community than do the ten ILECs operating in Wyoming. Moreover, in many cases, the incumbent carriers, particularly the largest, have been seeking de-certification of their ETC status in areas where they no longer receive HCF funds, indicating that they are no longer offering a subsidized broadband service in only a portion of their service territories. Finally, more important than the total number of participants are the types of providers and service offerings. Table 3a-5 also includes the relative numbers of non-ILEC providers operating in neighboring states. Competitive carriers operate as either providers of fixed broadband services to the home, or as providers of mobile broadband services.

Like the ILECs, none of the non-ILEC providers of fixed home-based services offer service statewide, generally limiting their offerings to those areas where they have built facilities. And also like the ILECs, these carriers primarily limit their applications for ETC status to those same built-out areas within their already limited footprints. Oregon has more of these competitive fixed service providers operating as ETCs than any neighboring state, except California.

Competitive mobile ETCs operate differently and provide a very different picture. Most of the wireless ETCs are resellers that have repackaged service offerings purchased at wholesale from one of the three major wireless companies (AT&T, Verizon and T-Mobile). Those carriers that have ETC status generally have obtained it (or maintain it) primarily to participate in the Lifeline market and, for the most part, they offer service broadly across the states in which they operate. Adding an additional mobile Lifeline provider generally means adding an additional statewide competitor, albeit a competitor that is reselling the same underlying services as the other market participants. From Table 3a-5, it is clear that Oregon has fewer wireless ETC's than all but one (Montana) of the surrounding states.

The explanations for the variation in wireless carrier participation levels are not readily apparent. Oregon has had several wireless Lifeline carriers exit the market – Cricket Wireless in 2015, SafeLink Wireless by TracFone in 2017, and most recently Assurance Wireless in 2022. While AT&T Mobility pulled Cricket Wireless out of the Lifeline market across the country, SafeLink Wireless and Assurance Wireless continued their operations in other states while ceasing operations in Oregon. Some states (like Oregon) have rigorous ETC approval processes and monitor service providers' operations to dissuade bad actors, thus potentially discouraging entry into the market. The Lifeline program has in the past been riddled with waste, fraud and abuse by mobile ETCs; thus, while there may be additional providers operating in other jurisdictions, some of these may not be those whose participation Oregon necessarily wants to encourage.[64] That said – these same carriers are participating in ACP, so to the extent there is waste/fraud/abuse or poor service interactions, customers in Oregon are being exposed to that already (although funds from the OTAP are not being used to subsidize these providers).

64. Since 2011, the FCC has been working to address potential waste, fraud, and abuse in Lifeline by preventing duplicate payments for multiple Lifeline-supported services to the same individual and other potential abuses. See, e.g., *Lifeline and Link Up Reform and Modernization*, WC Docket No. 11-42, *Report and Order*, 26 FCC Rcd 9022-23, 9026, paras. 1, 7 (2011) (*Lifeline Duplicates Order*) (clarifying that each eligible Lifeline consumer is entitled to only one Lifeline benefit); *Lifeline and Link Up Reform and Modernization*, WC Docket No. 11-42, Order, 28 FCC Rcd 9057 (WCB 2013) (*2013 Lifeline Reform Order*) (codifying the requirement that ETCs verify a Lifeline subscriber's eligibility before activating service); *2012 Lifeline Reform Order*, 27 FCC Rcd at 6662-67, paras. 11-18, and 6689, para. 74, n.192 (emphasizing the restriction on duplicates and moving the rule from section 54.401(a) to revised section 54.409(c)); see also *Bridging the Digital Divide for Low-Income Consumers, Lifeline and Link Up Reform and Modernization*, WC Docket Nos. 17-287, 11-42, 09-197, *Fifth Report and Order*, 34 FCC Rcd 10886, 10922-24, paras 87-91 (2019)(*2019 Lifeline Reform Order*)(adopting enrollment process improvements to assist USAC's efforts to detect improper duplicate addresses among Lifeline subscribers in the NLAD).

Comparison of service provider participation in Lifeline to participation in the ACP

Currently offering low-income broadband assistance at the same time as the Lifeline program is the federally-funded low-income Internet assistance program, the Affordable Connectivity Program. The presence of both of these programs, each with its own set of certification requirements and regulatory oversight, offers an opportunity for examining and comparing carrier participation levels. The ACP is in many respects similar to Lifeline, but with a higher monthly subsidy/discount on broadband services, a subsidy of up to $100 for the purchase of equipment, a carrier enrollment process that does not require that providers be certified as ETCs, and little to no state-level oversight. The number of Oregon service providers currently participating in the ACP stands in stark contrast to those participating in Lifeline. The same pattern also exists across the country. Approximately 130 service providers are reported as participating in the ACP in Oregon,[65] with many offering discounted or free service (net of the ACP subsidy) throughout much, if not all, of their operating areas. Per the FCC, only 42 of these service providers are reported as having ETC status (with the concomitant responsibility to offer Lifeline service), but roughly a quarter of those ETCs did not have any Lifeline subscribers in the state during 2022 because the company had not yet deployed the services supported by High Cost funds. Only about 30 service providers currently participate in the Oregon Lifeline Program,[66] most with very limited geographic coverage. Table 3a-6 below provides a listing of Oregon service providers that are identified by the FCC as ETCs, indicating those that currently have subscribers and those that do not. This smaller list of carriers with subscribers matches the Oregon PUC's identification of current Lifeline Providers in the state.

65. Affordable Connectivity Program Providers, Federal Communications Commission (fcc.gov) https://www.fcc.gov/affordable connectivity program providers#Oregon (accessed 3/1/23).

66. a from USAC reveals that as of September of 2022, only 31 service providers were offering subsidized service to customers in Oregon, and that one of those was providing a single subsidized voice service line. *See*, https://www.usac.org/wp content/uploads/about/documents/fcc filings/2023/first quarter/low income/LI04 Qtrly Low Income Disbursement Amts by Company 3Q2022.xlsx (accessed 1/26/23).

Table 3a-6

SERVICE PROVIDERS DESIGNATED AS ETCs OPERATING IN OREGON
(INCLUDING THOSE WITH NO SUBSCRIBERS IN 2022)
AS OF DECEMBER 2022

INCUMBENT LECs - "HOME" SERVICE	COMPETITVE LECs - "HOME" SERVICE
Beaver Creek Cooperative Telephone Company	Douglas Services, Inc.
Canby Telephone Association	MINET - Monmouth Independence Networks/Willamett Valley Fiber
Cascade Utilities, Inc.	Warm Springs Telecommunications Company
Centurylink Centurytel Of Oregon, Inc.	Competitive LEC ETCs with no active customers in 2022
Centurylink Qwest Corporation	Casco Communications (dba Peak Internet)
Centurylink United Telephone Co of NW(fka Embarq)	Charter Fiberlink Or-Ccvii, LLC
Clear Creek Mutual Telephone Company	Columbia Fiber, LLC
Colton Telephone Company	Hunter Communications & Technologies, Inc.
Eagle Telephone System Inc	Suislaw Broadband, LLC (dba Hyak)
Gervais Telephone Company (dba Datavision)	Starlink Services, LLC
Helix Telephone Company	Viasat Carrier Services, Inc.
Home Telephone Company	
Molalla Telephone Company	**COMPETITVE LECS - "MOBILE" SERVICE**
Monitor Cooperative Telephone	At&T Mobility LLC
Monroe Telephone Company	Boomerang Wireless LLC (aka Entouch Wireless)
Nehalem Telecommunications Inc.	Eagle Telephone System Inc (dba Snake River PCS)
North-State Telephone Co	I-Wireless, LLC (aka Access Wireless)
Oregon Telephone Corporation	Yakima Msa Limited Partnership (dba US Cellular)
Oregon-Idaho Utilities, Inc.	Beacon Broadband, Inc.
People S Telephone Co.	Competitive LEC ETCs with no active customers in 2022
Pine Telephone System, Inc.	Assurance Wireless USA, L.P.
Pioneer Telephone Cooperative	
Roome Telecommunications Inc	
Scio Mutual Telephone Association	
Stayton Cooperative Telephone Company	
Trans Cascades Telephone	
Ziply Fiber Northwest, LLC	
Ziply Fiber Of Oregon, LLC	
ILEC ETCs with no active customers in 2022	
Asotin Telephone Company-Oregon	
Mt. Angel Telephone Company (dba Datavision)	
St. Paul Cooperative Telephone Association	

Table 3a-7 below identifies all service providers in Oregon that are participating in either the ACP or in the state Lifeline programs, and the service(s) ("Home" or "Mobile") that are offered by each provider through the program. Analysis of the data reveals that roughly one hundred more providers offer subsidized/discounted services through the ACP than through Lifeline.

Not shown on the table, but of equal if not greater import, is the broader geographic scope of service availability of ACP participants – and this is particularly so for the "Home" (fixed wireline) broadband offerings of the Competitive LEC providers. For reasons known only to themselves, the largest of the competitive wireline carriers – the major cable MSOs – have steadfastly avoided participation in the FCC's Universal Service Program, including the high cost program. As a result, even though these providers have widely deployed wireline broadband networks that cover most of the population of Oregon, they have in virtually all cases not participated in the offering of Lifeline subsidized services. These same carriers, however, have chosen to participate in the ACP. Their addition to the mix means that a second provider – the local cable company – presents an alternative to the incumbent LECs' broadband offering (or in many cases to no broadband offering at all) for discounted service to low-income households.

Table 3a-7

COMPARISON OF SERVICE PROVIDER PARTICIPATION IN OREGON'S LIFELINE PROGRAM AND THE FEDERAL ACP

	Lifeline/OTAP		Affordable Connectivity Plan	
Service Provider	Home Service	Mobile Service	Home Internet	Mobile Internet
Access Wireless*		X		X
Airtalk Wireless				X
Althea - Hawk Networks, Inc.			X	
Alyrica Networks Inc			X	
Anthem Broadband			X	
Assurance Wireless*		X		X
Astound Broadband powered by Wave			X	
AT&T Mobility LLC		X		X
Beacon Broadband, Inc.			X	
Beaver Creek Cooperative Telephone Company*	X		X	
Boomerang Wireless, LLC				X
Boost Mobile				X
Cal-Ore Communications				X
Canby Telephone Association	X		X	
Cascade Access, LLC			X	
Casco Communications, Inc.			X	
CenturyLink or Quantum Fiber	X		X	
Cintex Wireless, LLC				X
Clear Creek Communications*	X		X	
Clear Wireless, LLC			X	X
Colton Telephone Company*	X		X	
Comcast (Xfinity)			X	X
Comlink Total Solutions Corp				X
Comspan Communications	X			
Cricket Wireless				X
Culture Wireless			X	X
Dailytel Inc.				X
Datavision Communications, LLC*			X	
Douglas Services, Inc.			X	
Eagle Telephone System		X		
EARTHLINK, LLC			X	
Eastern Oregon Telecom			X	
Easy Wireless				X
ECOMOBILE, INC.			X	X
Emerald Broadband, LLC			X	
enTouch Wireless*		X		

ECONOMICS AND TECHNOLOGY, INC.

Table 3a-7

COMPARISON OF SERVICE PROVIDER PARTICIPATION IN OREGON'S LIFELINE PROGRAM AND THE FEDERAL ACP (page 2 of 4)

Service Provider	Lifeline/OTAP Home Service	Lifeline/OTAP Mobile Service	Affordable Connectivity Plan Home Internet	Affordable Connectivity Plan Mobile Internet
Excess Telecom, Inc.				X
Farmers Mutual Cooperative Telephone Co			X	
Farmers Mutual Telephone Company			X	
FastMesh LLC			X	
Fidelity Cablevision, LLC			X	
FMTI			X	
Foundation for California Community Colleges			X	
Gervais Telephone Company*	X			
Global Connection Inc. of America				X
Go Technology Management, LLC				X
Gorge Networks LLC			X	
Helio Broadband			X	
Helix Telephone*	X		X	
Hello Mobile Telecom LLC				X
Home Telephone Company*	X		X	
Hood River Electric Co-op			X	
Hoop Wireless, LLC				X
Hughes Network Systems, LLC			X	
human-I-T				X
Hunter Communications			X	
Hyak			X	
IDT Domestic Telecom, Inc.				X
Illinois Valley Data Center, LLC			X	
Infiniti Mobile				X
Insight Mobile, Inc.				X
Integrated Path Communications, LLC			X	
InterConnection				X
K20 Wireless				X
Lane Fi			X	
Life Wireless				X
Lingo			X	
LTE Wireless				X
Maxsip Telecom Corporation			X	
MINET			X	
Molalla Communications Company*	X		X	
Monitor Cooperative Telephone Company*	X		X	

Table 3a-7

COMPARISON OF SERVICE PROVIDER PARTICIPATION IN OREGON'S LIFELINE PROGRAM AND THE FEDERAL ACP (page 3 of 4)

	Lifeline/OTAP		Affordable Connectivity Plan	
Service Provider	Home Service	Mobile Service	Home Internet	Mobile Internet
Monroe Telephone Company*	X		X	
Native Network, Inc.			X	
Nehalem Telecommunications, Inc.*	X			
NewPhone Wireless, LLC				X
North American Local, LLC				X
North-State Telephone Company*	X		x	
OnelineNW			X	X
Oregon Telephone Corporation	X		X	X
Oregon-Idaho Utilities (Humboldt)	X			
PCs for People				X
PDTFast			X	
Pendleton Fiber			X	
Pine Telephone System*	X		X	
Pioneer Telephone Cooperative*	X		X	
PocketiNet Communications, Inc.			X	
PTC			X	
Q Link Wireless LLC				X
Red Pocket, Inc				X
Reliance Connects	X		X	
Roome Telecommunications Inc*	X		X	
Rural4G				X
SafetyNet Wireless				X
SandyNet			X	
Sano Health LLC				X
Sarver Wireless				X
Scio Mutual Telephone Association*	X			
SCTC*			X	
Selectel Wireless				X
Skybeam, LLC				X
SMTA, SMT-Net*			X	
Sparklight			X	
Spectrum (Charter Communications Operating, LLC)			X	
Spot On Networks, LLC			X	
St. Paul Cooperative Telephone Association	X			
Stayton Cooperative Telephone Company*	X			
Straight Talk, Total Wireless, Simple Mobile, Walmart Family Mobile, TracFone, Net10, Page Plus & Go Smart				X

Table 3a-7

COMPARISON OF SERVICE PROVIDER PARTICIPATION IN OREGON'S LIFELINE PROGRAM AND THE FEDERAL ACP (page 4 of 4)

	Lifeline/OTAP		Affordable Connectivity Plan	
Service Provider	Home Service	Mobile Service	Home Internet	Mobile Internet
SWA Connect, LLC			x	X
TDS Telecommunications Corporation			X	
T-Mobile USA, Inc.				X
Tone Communication Services LLC				X
Torch Wireless				X
TruConnect Communications, Inc.				X
Twigby			X	
U.S. Cellular*		X		
U2 CONNECT NOW			X	
United States Cellular Corporation*			X	X
Unity Wireless Inc.				X
Uprise Fiber			X	
UVNV, Inc.				X
Verizon Wireless			X	X
Viasat			X	
Warm Springs Telecom*	X		X	
Whoop Connect Inc.				X
Wrazzle, Inc.				X
Ziply Fiber*	X		X	
Ztar Mobile, Inc				X

Analysis of potential barriers to service provider participation

In order to identify existing barriers to service provider participation in the Oregon Lifeline Program, and to evaluate possible incentives that might be adopted in order to increase participation levels, we attempted to identify which potential barriers to participation might be operating in Oregon. We then analyzed whether the available evidence indicates that such barriers were likely discouraging service providers from participating in the program. The specific barriers that were evaluated are identified in Table 3a-8 below. Each will be discussed individually, but taken in total the results of this analysis suggest that the primary barrier to participation is the construct of the federal Lifeline program to which the Oregon program is tied – more specifically, the (federal) requirement that service providers be designated as ETCs and ETPs. As discussed later in more detail, even if the Oregon PUC or state legislature were to decide to eliminate the state ETP designation as a requirement for participation in the state portion of the Lifeline program, the federal ETC requirement would remain as a barrier for some providers.

Table 3a-8

IDENTIFICATION OF POTENTIAL BARRIERS TO PROVIDER PARTICIPATION IN OREGON LIFELINE PROGRAM

1	Statutory tie-in to FCC Lifeline program a. Subscriber eligibility limited to a specific cadre of low-income consumers b. Requires provider participants to have an ETC designation
2	Required ETC / ETP Designation in areas where Oregon Lifeline discounts are offered – process issues a. Time and expense associated with ETC designation process in Oregon b. Time and expense associated with state-by-state approval process for providers wanting to operate nationwide
3	Responsibilities accompanying ETC / ETC designation. a. To receive OTAP support, requirement for Lifeline-only ETC/ETPs that offer “free” prepaid wireless service to provide unlimited voice and data; otherwise, company is only eligible for federal Lifeline support. b. Advertising and other responsibilities c. Requirement to provide universal service to all that desire it within the footprint of the designated ETC service area. d. General provider aversion to being identified as an ETC – even a lifeline-only ETC.
4	Non-Participation in Lifeline National Verifier (Oregon is one of only 3 states that do not participate).
5	Combined Lifeline subsidy amount of $19.25 per household not sufficient to support carrier participation

It is also worth noting that, while not a barrier to participation *per se*, the ability of providers to achieve a higher subsidy at a lower transaction cost, through first the EBB program in 2020-21 and the replacement ACP since the start of 2022, should itself have been a disincentive to potential new Lifeline service provider participants. However, the Oregon PUC, as of May 2023, received two Lifeline-only ETC applications each in 2021 and 2022. It is surprising that any non-

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ETC providers, aside from those that need that designation to obtain high cost funds from the latest FCCRural Digital Opportunity Fund (RDOF) awards,[67] had sought ETC/ETP status simply for the purpose of offering Lifeline service at any time in the last three years. This situation may change if it becomes clear that Congress will not allocate additional funds to the ACP once the $14-billion that had been allotted to that program is exhausted (which is widely-expected to occur in mid-2024). Prior to the expiration of ACP, the PUC may see an uptick in ETC/ETP applications from non-ETC ACP providers that will face losing all of their low-income subsidy revenues (and potentially a large number of subscribers as well) if they don't choose to participate in Lifeline.

Tie-in to FCC Lifeline program

The Oregon Lifeline plan is designed to work in parallel with the FCC's Lifeline program. As such, the subscriber base to which the low-income assistance is available, and the requirements related to which service providers may participate and what requirements come along with participation that have been set by the FCC, are incorporated directly into the Oregon program.

Eligibility threshold. The parameters surrounding subscriber household eligibility for participation in the Lifeline program are detailed on Table 3-a2 above. Generally, eligibility is available only to households with incomes up to 135% of the federal poverty guidelines, or to those that qualify for a handful of other federal assistance programs. US Census Bureau data for 2021 indicates that roughly 13% of the Oregon population – roughly 220,000 households – is at or below 138% of the poverty line. Intuitively, it makes sense that having too small a base of potential customers available to a Lifeline service provider would keep it from entering the market. But there is no data here that suggests that the restricted base of subscribers is actually operating as a barrier to participation. That said, an expanded base (for example, increasing the household income cap to 200% of the poverty guidelines) would greatly increase the size of potential market available to Lifeline providers. In Oregon, the pool of eligible subscribers would increase by almost 60%, according to the most recent Census Bureau data.

ETC Designation Requirement. Evidence suggests that the requirement for designation as an ETC does act as a barrier to service provider participation in the Lifeline market – at least for most facilities-based landline service providers. Neither the Oregon Legislature nor the PUC can eliminate the requirements for ETC designation for carriers desiring to participate in the federal portion of the Lifeline Program. The FCC Lifeline program is a component of the larger Universal Service Fund, and the requirement that a telecommunications carrier obtain ETC status in order to participate in (i.e., to receive funds from) the Universal Service Fund flows directly from

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More than a decade ago, the FCC took steps to expand the pool of potential providers that would qualify as ETCs – allowing resale carriers (i.e., those with no facilities of their own) that had originally been prohibited from participating in the Lifeline program, to be designated as Lifeline-only ETCs subject to specific Compliance Filing Requirements.[69] That action, FCC forbearance of the facilities requirement, brought new wireless resellers into the program – several of which designed their entire offerings around the Lifeline market. Lifeline-only ETC applicants must apply for and receive approval of a "compliance plan" directly from the FCC. Compliance plan approval allows the Lifeline-only ETC applicant to petition a state in which they desire to operate for designation if the state has jurisdictional authority over that class of applicant, otherwise applicants apply to the FCC directly for designation. To operate in Oregon, Lifeline-only providers need to have their Compliance Plans approved by the FCC and then file for ETC / ETP status with the state.

Required ETC/ETP Designation in areas where Oregon Lifeline discounts are offered: process issues

The initial hurdle faced by a service provider contemplating offering Lifeline services is obtaining designation by regulators in each state (unless the state does not have jurisdiction over that class of applicant) in which they intend to operate for facilities-based providers, with an added step of having a compliance plan first approved by the FCC for those seeking Lifeline-only ETC designation. We postulated that the time and expense associated with obtaining the required ETC designations might be acting as a barrier to service provider entry into the Lifeline market. To test this theory, we first looked at whether the nature of the state-by-state approval process required by the FCC operates as a barrier. The data does not reveal any conclusive evidence that this is the case, despite the time and effort that a carrier is required to devote to this undertaking. The process that allows states to perform the required due diligence with respect to service providers that will be obtaining subsidies and in so doing attempt to ferret out those with a history of "waste, fraud, and abuse" may represent a barrier to those carriers that don't make it through the process. But that means that the system is working as intended.

That said, looking at the numbers of carriers participating in the federal ACP program vs. the numbers participating in Lifeline offers some insight as to what a streamlining of the designation process might accomplish. As we have previously discussed, the ACP program does not require

68. 47 U.S.C. § 214(e).

69. *Lifeline and Link Up Reform and Modernization et al*., WC Docket No.11-42 et al., *Report and Order and Further Notice of Proposed Rulemaking*, 27 FCC Rcd 6656, 6671-72, paras. 27-30 (2012) (*Lifeline Reform Order*).

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Analysis of potential barriers to service provider participation

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Required ETC/ETP Designation in areas where Oregon Lifeline discounts are offered: process issues

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any state-level approval for a carrier to become operational. A single application suffices for any areas in which a provider desires to operate. We were unable to obtain data on the relative speed with which carrier applications for participation are approved, but given that it was only a matter of months between when the program was created as part of the 2021 federal Infrastructure Act and when it was operational in January 2022, the turnaround was of necessity fairly quick. More than four times as many carriers are identified as offering services pursuant to the ACP in Oregon as through the Lifeline program. Certainly, the ease with which carriers were able to become eligible to participate has incented the increased participation. The program is still young and, since provider-specific data relative to numbers of subscribers is not publicly available in the same way it is for the Lifeline ETCs, there is no way of knowing whether all of those providers have successfully rolled out ACP offerings that have attracted subscribers.

We then examined whether there was anything specific about the process in Oregon, including the addition of the ETP designation required for participation in OTAP that might be presenting a barrier beyond any that the state-by-state approvals may be imposing. Both the ETC and ETP applications occur concurrently (and the request for the ETP designation is a requirement for and integral component of the ETC application), so that the construct of the process is unlikely to cause additional barriers that would work to dissuade a carrier from participating.

The Oregon PUC's role in approving the ETC/ETP petitions from carriers looking to provide Lifeline service in the state includes a public interest determination. In the case of a state like Oregon that has a companion state-level Lifeline plan, state approval of an ETC/ETP petition involves accepting responsibility for assuring that state revenues – not just federal USF dollars – are protected from waste and fraud.

Some large nationwide wireless providers that operate as ETCs and Lifeline providers in many other jurisdictions in the US are not Lifeline providers in Oregon. Tracfone Wireless, at the time the largest Lifeline provider in the US, exited the market in Oregon in 2017. And Assurance Wireless stopped participating in the program, effective April 1, 2022. Q-Link Wireless, the third largest Lifeline provider by 2021 (the last year for which statistics have been published) withdrew its petition from Oregon in 2019. TruConnect, another large wireless Lifeline provider, also withdrew its petition for ETC/ETP status two years later, in 2021. It is possible, but not likely, that these withdrawals from the Oregon market may indicate that the approval process in Oregon is more difficult to navigate than in most other states, and represents a barrier. It is our understanding, based upon information from PUC Staff, that in all three instances the exit (or withdrawal of petition) resulted from investigations into either non-compliance with Lifeline rules in Oregon or inquiries into findings of financial sanctions or investigations of misconduct in other jurisdictions. Staff's diligence in ensuring that waste and fraud is eliminated from the Oregon Lifeline market identified an issue that culminated in a $200-million settlement that the FCC entered into with T-Mobile in 2020 – as explicitly recognized by the FCC in its News Release on the Settlement.[70] In 2006, the Oregon PUC opened a formal investigation into a landline phone

70. FCC Reaches $200 Million Settlement in Sprint Lifeline Investigation, Federal Communications Commission https://www.fcc.gov/document/fcc-reaches-200-million-settlement-sprint-lifeline-investigation-0

service reseller that culminated in a 2007 order to pay $203,392.[71] It was not until March 2016 that the Oregon PUC recovered $203,391.97 in addition to $99,340.90 in interest..

Responsibilities accompanying ETC/ETC designation

Eligible Telecommunications Carriers are, by federal statute, required to provide universal service to all that desire it within the footprint of their designated ETC service area. ETCs are also required to offer Lifeline service throughout their service territory. Many providers, particularly those that operate their own networks and that do not participate in receiving funds from the full range of federal and state universal service programs, have, for nearly thirty years, steadfastly chosen to not be classified as ETCs. Cable companies in particular have historically eschewed participating in the Universal Service Fund.[72] As such, the prerequisite of being an ETC to participate in the Lifeline program has represented a barrier to participation in the program by cable companies and other non-ILEC wireline service providers (including some municipal providers).

Despite recent participation by some cable companies like Charter in the USF High Cost auctions, most recently the RDOF, their willingness to become ETC's has been limited very specifically to the narrow areas in which they receive RDOF funds and are required to be ETCs. Charter has petitioned the Oregon PUC for ETC status in a very small subset of its geographic footprint in the state. At the time of its application, Charter had approximately 257,000 subscribers in Oregon, yet its request for ETC/ETP designation covered only 15,139 locations (roughly 5%).[73] Despite a request from PUC Staff to expand the ETC Petition to cover the remainder of its service territory and to begin offering Lifeline throughout its service territory, Charter has declined to do so.[74] It appears that Charter is not opposed to offering a subsidized/discounted low-income service across its footprint in Oregon (it does so through the ACP), it is opposed to being classified as an ETC in all of those areas.[75] Similarly, AT&T Wireless is designated as an ETC in only part of its service territory with approximately 300 Oregon Lifeline customers, as are six other service providers.[76]

71. See 9/26/2007 Commission Order at https://apps.puc.state.or.us/edockets/docket.asp?DocketID=13763

72. Until fairly recently the "high cost" funds that so many wireline providers rely upon to fill out the networks that allow them to provide "universal service" were not available to cable companies.

73. See https://apps.puc.state.or.us/orders/2021ords/21-188.pdf. Appendix A p 3

74. Response to Question 1a in ETI's Third Set of Data Requests to Staff.

75. USAC's "Find a Carrier Near Me" Tool reports Charter (as Spectrum) as participating in the ACP and offering "home internet" (wireline) service for a $0 price (net of ACP discount) in 114 zip codes (161 cities) in Oregon. Data sourced from: Lifeline Companies Near Me Tool | USAC | Data Platform https://opendata.usac.org/Lifeline/Lifeline-Companies-Near-Me-Tool/c23k-jw3b

76. Response to Questions 1b, c and d in ETI's Third Set of Data Requests to Staff.

Non-Participation in the Lifeline National Verifier

Subscriber applications for discounted service pursuant to Lifeline plans are processed through the "Lifeline National Verifier" for services offered in all states except California, Texas and Oregon to ensure that the applicants are indeed eligible for the program. The three non-participating states had each petitioned the FCC for waivers to opt out of the program in order to maintain the fraud detection control of that step internally.[77] ETI investigated whether requiring providers selling Lifeline services to set up their systems and train their staff to interface with a different eligibility verifier (and receive potentially different results from the queries than in the rest of the US) was acting as a barrier to carrier participation in the programs. Our review of data relating to carrier participation levels and numbers of subscribers in states that have opted out of the National Verifier compared to states that continue to participate in it revealed no discernable impact from the choice by Oregon, California and Texas to verify subscriber eligibility on their own.

Sufficiency of the combined FCC/OTAP Lifeline subsidy of $19.25 per household to support carrier participation

There is no evidence that the level of the OTAP subsidy ($10 per month per subscriber) in combination with the federal subsidy operates as a barrier to service provider participation in this market. The monthly subsidy/discount per subscriber that is available in Oregon is greater, by and large, than the subsidy rates across most of the rest of the country. Only a third or fewer of states have state-funded plans that supplement the federal Lifeline offering – with Oregon's being among the highest of the additional subsidies. The federal Lifeline subsidy of $9.25 alone appears to be sufficient to encourage even carriers that operate almost exclusively in the Lifeline market to provide service in many jurisdictions.

Analysis of potential incentives to increase service provider participation

In conjunction with attempting to identify barriers that may be keeping service providers from participating in the Oregon Lifeline program, ETI evaluated potential incentives to increase provider participation. Our finding is that there is little that can be done under the existing regulatory framework – although we do posit two possibilities below. In Section 3b, we will explore and recommend alternatives to the existing regulatory framework, some of which may require legislation. However, as long as the ACP program continues, there seems little purpose in tweaking the Lifeline plan to compete with it. ACP, with a $30 per month discount, leaves more dollars in the pockets of low income households in Oregon than would be possible through Lifeline. Roughly 170,000 households in Oregon subscribe to an ACP-subsidized service, and new subscribers keep enrolling each week.

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77. States that opted out of the National Lifeline Database (the database underlying the National Verifier) also verify potential subscribers without use of the National Verifier. Only California, Oregon and Texas are still verifying subscribers on their own. https://www.lifelinesupport.org/ (accessed 3/29/23). Oregon's Opt Out request was approved in 2012. See, Lifeline and Link Up Reform and Modernization et a., Petition and Certification of the PUC of Oregon to Opt Out of the National Lifeline Database, FCC WC Docket Nos. 1142 et al (filed Nov. 30, 2012).

Two possible adjustments to OTAP to incent increased provider participation could be considered. However, we do not recommend that either of these be purused at this time:

(1) Increase the amount of the current $10 OTAP subsidy/discount. There is no hard evidence on the sensitivity of carrier participation to subsidy level, but even if the new combined subsidy were below the $30 available through the ACP, it is possible that it may have some beneficial effect in incenting carriers to participate.

(2) Perform a less-rigorous review of ETC/ETP applications, thus speeding up the processing, particularly for applications from resellers petitioning for Lifeline-only ETC status. Adjusting the process would be unlikely to incent additional facilities-based providers to participate, but it may incent participation by some additional wireless resellers. However, that may not result in increased subscriber levels or geographic coverage. Additionally, streamlined, less-rigorous review may result in more instances of waste, fraud or abuse.

Conclusions and policy recommendations

Within the confines of the existing regulatory construct, there is little that can be done to incent additional broadband access service providers to participate in Oregon's Telephone Assistance Program. The primary barrier to service provider participation in OTAP is the requirement that providers be designated as Eligible Telecommunications Carriers (ETCs) and as Eligible Telecommunications Providers (ETPs). Evidence that we have examined leaves us to conclude that, in most cases, the process of applying for these designations is not the source of carrier reluctance to participate. Instead, it is the attendant responsibilities that come with such designations – in particular, the requirement to make service available universally across the entirety of any geographic area in which the ETC/ETP designation applies. Additionally, the broad participation both by providers and by subscribers to the federal Affordable Connectivity Program suggest that there is little benefit to be gained from restructuring OTAP as long as that program is still being funded and maintained in operation.

However, as we have noted, the ACP's current funding will be exhausted sometime in 2024, and Congressional action will be required to extend funding beyond that point. Moreover, the FCC's monthly $5.25 Lifeline subsidy for voice-only services will be phased out on December 31, 2023, leaving the $10-monthly Oregon Lifeline subsidy as the only support for telecommunications services for those low-income subscribers that are located in geographic areas without broadband service available or for those who, for whatever reason, do not currently want broadband and thus must still rely upon traditional copper-based wireline telephone services in their homes. The current $10 per month level of OTAP support can be adjusted to incent additional provider participation (thereby maintaining critical access) as well as for affordability purposes as long as the increase can be funded within the constraint of the $0.35 monthly surcharge cap. The potential discontinuation of ACP broadband subsidies and the scheduled elimination of FCC Lifeline voice-only subsidies would thus indicate a need to consider upward adjustments to the level of OTAP support to offset, at least to some extent, the elimination of these federal programs.

3b: Alternatives to the existing regulatory framework that either encourages or mandates provider participation

Introduction: Regulatory Framework Impacting Provider Participation in Current OTAP Program

The ability of the PUC to encourage participation in the OTAP by additional service providers is constrained both by state laws and by PUC rules implemented pursuant to those laws. Specifically, these are the legislatively set rules codified in Oregon Laws 1987, Chapter 290, Section 7 (as revised) and Oregon Revised Statutes, Chapter 759, Telecommunications Utility Regulation (Legislative Rules) and the PUC rules detailed in Oregon Administrative Rules, Sections 860-33-0010 to 0100 (PUC Rules). The ability of the PUC to mandate participation in the OTAP by additional service providers is further complicated by the unclear legal and jurisdictional status of broadband access services. As we discuss in more detail below, it is not clear that the state of Oregon has jurisdiction to impose any regulatory or legislative mandate relative to service provision upon broadband service providers.

The relevant rules constraining the operation of the OTAP program as they relate to service provider participation in the plan, per state legislation as it exists at present, are as follows:

- Limiting low-income assistance to customers at or below 135% of Federal Poverty Guidelines.[78]

- Limiting monthly OTAP assessment on telecommunications-services to a maximum of $0.35 per connection.[79]

- Mandatory participation in low-income assistance program by public utilities,[80] a designation that does not include many broadband service providers. At the time of its enactment in 1987, the original legislation required that the OTAP plan be closely tied to the FCC's then-existing lifeline plan:

> The plan of assistance shall be designed to use, to the maximum extent possible the available funding offered by the Federal Communications Commission. …[81]

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78. ORS Section 759.685(1)(a). 135% is used here as shorthand for proof of income at or below that level or participation in specific programs for which eligibility requirements are similar.

79. Oregon Laws 1987, Chapter 290 Section 7(1).

80. Oregon Laws 1987, Chapter 290 Section 6(2).

81. Oregon Laws 1987, Chapter 290 Section 7(1). At that time, the FCC's lifeline plan offered larger subsidies to states that provided state assistance to the same customers, making matching the system to the FCC an important component of Oregon's new OTAP program.

In legislation enacted in 2019 and 2017, the OTAP program was modified to provide subsidies for broadband services and to ensure continued support for voice service, at the same time it reduced the former tie-in to the FCC Lifeline program

> The plan of assistance may be in addition to the available funding offered by the Federal Communications Commission.[82]

Importantly, however, the OTAP plan as created by the PUC was designed in response to the original 1987 text, and despite a number of modifications throughout the 35 intervening years to adapt to changes in the marketplace and to the federal regulatory environment, it still retains at its core a tie-in to the FCC program.[83] The PUC's rules still require that a provider participant be designated as an ETP[84] and that carries with it many of the responsibilities that also accompany status as an FCC ETC.

Revising or eliminating any of the relevant constraints imposed by legislation or through revision of PUC rules is likely to be a lengthy and contentious process. PUC regulations do, however, allow it to waive any of the OTAP rules, potentially offering a faster and more straightforward approach to modifying operational limitations in the short term.[85]

Recommendations to Encourage Provider Participation

The development of our recommendations to encourage more provider participation in the Oregon Telephone Assistance Program flowed out of our analysis of potential barriers to participation in the existing program and our analysis of potential changes to the environment in which that program operates – specifically, the continuation or cessation of the federal ACP program. These recommendations are posited under two alternate scenarios – one with and one without Congressional action to extend the ACP when its funding is exhausted.[86] Our analysis of potential barriers indicated that the primary barrier to service provider participation in OTAP is the requirement that providers be designated as ETPs and as ETCs. As such, our primary recommendation addresses potential changes to that requirement.

82. Oregon Laws 2017, Chapter 434 revisions to Oregon Laws 1987 Chapter 290 Section 7(1).

83. The FCC's low-income lifeline plan was radically altered almost a decade later by passage of the federal 1996 Telecommunications Act that ushered in local competition as we know it today. The FCC's universal service lifeline plan has steadily evolved since that time – including first expanding the base of services covered to include broadband access and, more recently, approaching the complete phase-out of low-income assistance for voice-only services. The OTAP program has mirrored many of those changes.

84. OAR Section 860 033 0021(1)(a).

85. OAR Section 860 033 0001(2).

86. As we discussed above, the ACP's current funding is expected to exhaust sometime in 2024.

Scenario 1: ACP is eliminated in 2024

Table 3b-1 below outlines our recommendations for expanding provider participation in OTAP. These are premised upon a scenario in which the federal ACP program with its expansive provider participation (more than 100 Oregon broadband providers currently participate in the ACP), its continually increasing low-income customer participation rate (currently 17-million subscribers nationwide, about 170,000 in Oregon), and its $30 per month broadband subsidy, does not receive additional funding when the initial $14-billion in funding runs out in 2024. At this time, it appears unlikely that the FCC could revise its Lifeline rules in time to allow that program to evolve to maintain the ACP subscribership and subsidy levels.[87]

In this scenario, virtually all of the roughly 170,000 low-income subscribers currently participating in the ACP in Oregon will lose their broadband subsidy. The need to encourage the providers that presently offer subsidized ACP service to these subscribers to participate in OTAP would be essential in order to assure that some level of subsidy continues to be available – even if it is only the current $10 per month under OTAP today.[88]

The primary operational implications flowing from adoption of our recommendations as summarized in Table 3b-1 below would be (a) increased funding requirements flowing from higher participation levels, (b) potentially increased staffing to process service provider and subscriber applications, (c) reduced ability to assure that service providers are offering and providing an adequate level of service within the state, and (d) reduced ability to monitor for and limit waste, fraud and abuse in the OTAP program.

87. The FCC's overall USF program, of which Lifeline is a part, itself faces a somewhat uncertain future. The program is presently funded by a surcharge on interstate carrier revenues that has risen to over 30% in recent quarters and that is projected to continue to climb in the face of years of FCC inaction. There is also an outstanding court challenge to the FCC's authority to collect USF funds. (See, *Consumers' Research, et al v. FCC, et al*, Case: 22-13315, (11th Cir., filed Oct. 21, 2022). Two other, virtually identical cases, (See. *Consumers' Research, et al v. FCC, et al*, Case: 22-60008 (5th Cir., filed January 5, 2022, DENIED March 23, 2023 and *Consumers' Research, et al v. FCC, et al*, Case No. 21-3886 (6th Cir., filed Sep. 30, 2021, DENIED May 4, 2023)), were recently denied, but those decisions have no direct impact upon the other pending case. If successful, this lawsuit could effectively end the FCC's Lifeline program and have significant impacts upon the OTAP program that is tied to Lifeline.

88. The vast majority of ACP service providers do not currently participate in the FCC’s Lifeline program. Thus, absent major changes to the FCC’s plan, these providers’ subscribers will not automatically be transitioned to the FCC’s Lifeline program and its $9.25 subsidy.

Table 3b-1

RECOMMENDED CHANGES TO INCENT BROADBAND PROVIDER PARTICIPATION IN OTAP
SCENARIO 1: ACP FUNDING EXHAUSTS WITHOUT A COMPARABLE REPLACEMENT

1. De-couple OTAP from ETC construct by modifying or eliminating ETP requirement and adopting regulations that more closely parallel requirements in the ACP. Redesignate as "OTAP Provider."

   a. Expand "OTAP provider" designation to encompass service providers presently participating in federal ACP. Grandfather all service providers offering ACP service in Oregon with a clean ACP track record and active subscribers in Oregon – requiring only Oregon-specific registration with the PUC as an "OTAP provider".

   OR

   b. Retain ETP category of participants and introduce new "OTAP Provider" designation to encompass service providers presently participating in federal ACP, offering ACP service in Oregon and with active subscribers in Oregon. Retain Oregon-specific application and review process to become "OTAP Provider" – but with minimal requirements. Implement a two-tier subsidy/discount level, with a higher subsidy available to providers that obtain ETP designation to encourage ETP-level participation.

   Required Regulatory Change: PUC Action either through rulemaking or waiver of existing rules pursuant to OAR 860 033 0001(2). To the extent that the PUC may need to seek a waiver from the FCC to modify the ETP certification requirement, it would need to do so.

2. Increase monthly discount/subsidy above the current $10 level to $20 (for broadband service only). This will bring the combined OTAP and (existing) FCC Lifeline discount/subsidy to close to the existing ACP level of $30.

   Note that even if the current $10 OTAP subsidy is not increased, additional funding may be required if all of the existing ACP subscribers were to migrate to OTAP; hence, the ability to increase the monthly per-connection assessment above the present $0.35 limit may still be necessary.

   Required Regulatory Change(s): PUC Action either through rulemaking or waiver of existing rules pursuant to OAR 860 033 0001(2) and potentially legislative action to increase the maximum monthly assessment above $0.35.

3. Expand OTAP subscriber-eligibility to a wider swath of participants (revising the low-income definition found in the ORS Section 159.685(1)a. to include households with income up to 200% of the Federal Poverty Guidelines to mirror what is offered via ACP today) thereby increasing the potential subsidized market-size and incenting additional providers to participate.

   Required Regulatory Change(s): Legislative action to modify ORS Section 159.885(1)a, and potentially to increase the maximum monthly assessment above $0.35.

Scenario 2: ACP funding is extended, and ACP continues in 2024 and beyond

The potential program changes and regulatory revisions summarized in Table 3b-2 below are premised upon a scenario in which the funding for the ACP program is renewed by Congress (or the FCC revises its Lifeline rules to account for the loss of the ACP). Notably, under this scenario, there is no real need to encourage additional providers to participate in OTAP because existing low-income subsidies for broadband Internet access will continue. The number of low-income households subscribing to broadband Internet access has been steadily increasing in Oregon since the ACP was initiated in January 2022. The 170,000-plus households presently enrolled likely represent more than 50% of the households in Oregon with income at or below 200% of the Federal Poverty Guideline and close to three quarters of the households with income at 135% or below.[89] The recommendations are targeted at reaching low-income customers that are not presently subscribing to broadband service, either because they don't see its value or because it is not available at their location.

Table 3b-2 **POTENTIAL OTAP PROGRAM CHANGES AND POLICY REVISIONS SCENARIO 2: ACP FUNDING IS EXTENDED OR FCC MODIFIES PLAN TO MATCH**
1. Undertake greater marketing and outreach education to make broadband service more appealing to customers that are presently subscribing to voice-only service that have a broadband service available in their area. **Required Regulatory Change: PUC Action either to use the marketing and outreach funds available under the existing law (ORS 759-689)**
2. Recraft the existing OTAP broadband subsidy/discount to be an additive to the ACP discount that is available only in locations that do not presently have a broadband service available, to help incent provider(s) to extend service to those locations **Required Regulatory Change(s): PUC Action through rulemaking or waiver of existing rules pursuant to OAR 860 033 0001(2).**

Recommendations to Mandate Provider Participation

The regulatory and jurisdictional classification of broadband access services has been in flux and dispute since its inception.[90] At this point, it is not at all clear that the state of Oregon has jurisdiction over broadband service providers that would allow it to mandate anything. Over time, those waters have become increasingly murky and litigious, and a series of flip-flopping FCC decisions over the past decade dealing with the regulatory jurisdiction and classification of broadband have only made matters worse.[91] As such, we cannot recommend any specific actions

89. US Census Bureau data reports 1.7-million households total in Oregon. It also reports that roughly 13% of the population lives at or below 138% of the Federal Poverty Guideline and roughly 20% lives below 200% of the Federal Poverty Guideline. Assuming that the 13% and 20% low-income percentages are consistent at the household level yields roughly 220,000 households and 340,000 households respectively.

90. See, Selwyn, Lee L. and Helen E. Golding, "Revisiting the Regulatory Status of Broadband Internet Access: A Policy Framework for Net Neutrality and an Open Competitive Internet," *Federal Communications Law Journal*, Vol. 63, No. 1, December 2010, at pp. 91-140.

91. See, *Preserving the Open Internet; Broadband Industry Practices*, GN Docket No. 09-191, WC Docket No. 07-52, Report and Order, 25 FCC Rcd 17905, 17972-80, 17981, paras. 124-35, 137 (2010) (*Open Internet Order*); see also, *Protecting and Promoting the Open Internet*, WC Docket No. 14-28, *Report and Order on Remand,*

that would be available to the Oregon PUC to require OTAP participation by currently non-participating broadband access service providers. On the other hand, the enthusiasm with which providers have voluntarily embraced participation in the ACP certainly suggests that, at the $30 support level that has enabled many providers to offer a "free" ACP-supported service package to qualifying customers, this level of revenue is, at least incrementally, seen as profitable. We don't know, of course, at what specific level below $30 the provision of such services becomes unprofitable to the point where providers would drop out of any support program. However, it is certainly possible that providers might accept a somewhat lower amount (e.g., $25) if the administrative burdens associated with OTAP participation – principally the ETC/ETP certification requirement – were to be removed. It seems unlikely, however, that even including the current FCC's $9.25 broadband subsidy, the existing $10 OTAP amount would be sufficient to induce providers to offer what would then amount to a $19.25 monthly rate. Increasing the OTAP maximum to, for example, $15, plus the FCC's $9.25, plus perhaps a small co-payment by the customer (of no more than $5) might well be sufficient to provide a satisfactory replacement for the ACP that providers would find acceptable. Indeed, even if no increase in the OTAP subsidy is implemented, at the current $30 price point for ACP broadband access, the combined OTAP/FCC subsidy of $19.25 would require customers to pay about $10 to retain their service. There is a strong possibility that this small co-pay would not materially discourage demand.

State attempts to establish regulations related to the operation and pricing of broadband Internet access providers prompted by the FCC's 2018 *Restoring Internet Freedom Order* have been challenged in court, with uneven results. An industry motion for a preliminary injunction to be issued against rules promulgated by the California PUC was denied in a federal district court case in California, and no final decision on the challenge has yet been issued.[92] At around the same time, however, a preliminary injunction against a similar New York law that would have required broadband access providers to offer a low-income broadband service was granted in a federal district court case there.[93] As with the California case, there is as yet no final decision in the New York litigation. Any attempt to impose any regulatory or legislative mandate upon Oregon broadband service providers requiring their participation in the OTAP program is likely to be challenged, at least in the short term, by similar industry resistance and litigation. The long term prognosis may be better, but is still uncertain.

Conclusions and policy recommendations

Any regulatory changes that may be undertaken by the PUC or the Oregon Legislature to encourage additional broadband provider participation will thus need to be made in recognition of (1) the potential implications of expiration of the federal ACP and the impact that would have upon low-income subscribers in Oregon, and (2) the existing jurisdictional limitations – and currently under judicial review in several places – regarding a state's ability to pursue policies that

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Declaratory Ruling, and Order, 30 FCC Rcd 5601 (2015) (*Title II Order*); *Restoring Internet Freedom*, FCC WC Docket 17-108, *Declaratory Ruling, Order, Report and Order*, 33 FCC Rcd 311 (1).

92. *American Cable Assoc. v. Becerra*, (9th Cir., Case No. 21-15430)

93. New York State Telecommunications Assoc. v. James, Case No. 2:21-cv-2389 (E.D. N.Y. June 11, 2021)

amount to regulation of broadband Internet access providers. Although the future of the ACP is far from certain, the magnitude of the impact of its elimination upon low-income households in Oregon that have enrolled in the program cannot be understated.

In principle, OTAP could be modified to serve as a replacement for the ACP. It appears to be within the PUC's existing authority to adopt rule changes that would allow current ACP providers – those that do not currently have ETC/ETP certification – to participate in Oregon Lifeline in the future. However, the federal $9.25 subsidy may not be available for providers that are not also ETCs. OTAP participation would enable these providers to retain those subscribers on a broadband plan with the help of at least the OTAP subsidy dollars as currently allowed. However, providing subsidies as high as those available from the ACP – both for monthly service and for the initial purchase of equipment – will likely require legislative action and additional sources of OTAP funding.

4a: Sufficiency of the current level of OTAP support

Introduction

In order to determine the overall sufficiency of existing support mechanisms, it is important to first understand the factors that influence broadband penetration rates among low-income households. These may include household income, service availability in the communities in which the household resides, education levels and related digital literacy, available subsidies and discounts, prices of existing services net of existing support mechanisms, and costs of equipment needed to utilize broadband Internet access and other telecommunications services. Using the data we have compiled and analyzed, we evaluate these factors, identify barriers and, where appropriate, make recommendations to address those barriers.

Under Task 4a of this investigation, ETI has been asked to research the extent to which the current level of OTAP support, i.e., $10, is "adequate and reasonable," and to propose a sustainable support amount sufficient to provide for "adequate and reasonable" access to broadband Internet access service or other telecommunications services through 2030. To begin that process, it is first necessary to examine the workings of the current OTAP subsidy.

As described in Section 3a above, OTAP, sometimes referred to as "Oregon Lifeline," "is designed to provide a reduced rate or discount for an Eligible Telecommunications Provider's broadband Internet access service, basic [voice telephone] service, or both, whether sold separately or in combination with other services, to low-income customers who meet eligibility requirements."[94] OTAP runs in parallel with, and in most cases as an additive to, the FCC's Universal Service Low Income Assistance Program.[95] OTAP currently provides a $10 monthly subsidy that is reflected as a discount on customer bills that is achieved through direct payments made by OTAP to the service provider participants in the program for each eligible participating subscriber.[96] The amount of that subsidy has increased significantly over the past few years.[97] In most cases, this $10 discount is in addition to a corresponding discount of $9.25 monthly for broadband access services and $5.25 monthly for voice access that is available through the FCC's Lifeline program. Discounted services can be provisioned as landline or mobile. Combined, eligible low-income subscribers that participate in the two programs receive a discount of $19.25 monthly for broadband service or $15.25 monthly for voice-only service. Subsidy levels in Tribal areas are $25 per month higher. Table 3a-1 above summarizes the OTAP and FCC Lifeline

94. Oregon Administrative Rules (OAR) 860-033-0010 (1).

95. OTAP is funded via revenues collected from most telephone subscribers in the state.

96. OAR 860-033-0035 (1)(b).

97. The OTAP monthly discount doubled, increasing from $3.50 to $7.00 in 2020 (See In the Matter of Permanent Rulemaking to Address Lifeline Support, Docket No. AR 635, Order No. 20-492 (December 29, 2020)) and then increased again to $10.00 in September 2021. (See Permanent Rulemaking Regarding Changes to Rules Governing OTAP and TDAP Programs, PUC Docket No. AR 646, Order No. 22-030, (February 10, 2022))

subsidy amounts effective in 2023.

Evaluation of the level of the current OTAP subsidy

The question of whether the current OTAP discount level of $10 per month is "adequate and reasonable" to allow low-income customers in Oregon to access broadband Internet access or other telecommunications services does not have a straightforward answer, since the discount does not exist in isolation. Equally if not more important as the subsidy level, is the market price at which broadband Internet access is sold and the carriers from which service is available. At present, the prices at which broadband Internet access service are available vary widely. A $10 per month discount ($19.25 with the companion FCC Lifeline discount) may not be "adequate and reasonable" if the available broadband service offerings are priced at $50, $60 or $70 per month. Conversely, it may be "adequate and reasonable" if a $30 per month broadband Internet access service option is available to low-income customers. The "net" price after application of subsidies and discounts determines whether that service is affordable.

Prior to introduction of the EBB/ACP program, only the Federal USF subsidy was available to low-income customers throughout most of the US. Yet examination of the relevant data did not reveal consistently higher Lifeline penetration rates in states like Oregon that had existing state subsidy additives vs. in those states without such programs. Either non-participating households were able to afford to subscribe to services of a non-participating provider, or they were not interested in the services that were available, or the "net prices" resulting from application of even the most generous low-income subsidization plans were still too high for many low-income consumers. Overall, the demand for broadband Internet access service has been demonstrated to be relatively price-inelastic[98] – i.e., relatively insensitive to changes in price. However, these studies do not specifically address the low-income segment of the overall market. Thus, if subscribers want the service, and the net price is within their financial reach, reducing the price (through a higher subsidy) is unlikely to have any real effect on demand or program subscription.[99] On the other hand, and as we discussed in Section 1b above, customers in the lowest median household income (MHI) quintile do tend to exhibit the lowest penetration or take-rate, suggesting the presence of some positive income-elasticity in the demand for this service.[100] But these are the things we do know:

- There are roughly 220,000 households with income levels below 135% of the Federal Poverty

98. NTCA-USF Study, "Universal Service Contribution Methodology," Michael A. Williams, and Wei Zhao, December 13, 2022. Filed as attachment to December 13, 2022 NTCA Ex parte Letter in FCC re: Report on the Future of Universal Service, WC Docket No. 21-476; Universal Service Contribution Methodology, WC Docket No. 06-122, https://www.ntca.org/ruraliscool/newsroom/press-releases/2020/7/new-analysis-indicates-reforming-universal-service (accessed 4/10/23)

99. This is not to say that additional subsidy dollars are not valuable to low-income subscribers.

100. The term "income elasticity" refers to the relationship between a consumer's income level and his/her demand for a product or service. A positive income elasticity indicates that higher incomes results in higher consumption levels, all else equal.

Guidelines in Oregon[101] (OTAP-qualifying households), but currently fewer than 10% of those households participate in OTAP.

- Over the time span that the level of the OTAP monthly discount was increasing from \$3.50 to \$7.00 and then on to \$10.00, low-income customer participation in OTAP declined. See Table 4a-1 below and Figure 4d-2, *infra*.

- OTAP subscriptions dropped from a high of roughly 56,000 in mid-2020 to roughly 15,000 by January 2023 (a drop of more than 70%). During that same time, Oregon subscriber enrollments in the federal EBB/ACP program climbed from 0 to 150,000 (that number has since risen to about 171,000). Extrapolating from this data, it appears that roughly 40,000 of the OTAP subscribers de-enrolled from OTAP, most of them due to the departure of Assurance Wireless from the OTAP program and moved onto EBB/ACP, and that an additional 130,000 low-income subscribers in Oregon applied for ACP and began receiving subsidized service for the first time.[102]

- Mobile wireless (CMRS) services, which include some level of broadband Internet access, have generally been priced at levels significantly lower than landline offerings. Historically, over 80% of OTAP participants subscribe to a mobile wireless broadband service. See Table 4a-2 below.

- Landline broadband access providers (particularly cable companies) have been rolling out reduced-price "low-income" service offerings – dropping the price to levels comparable to the offerings of mobile wireless providers.[103] These providers are generally not participants in the OTAP program, but do participate in the ACP.

- ACP participants nationwide subscribe to landline broadband access almost as frequently as mobile wireless – with 47% of subscribers purchasing a non-mobile service option. See Table 4a-3 below.

101. US Census Bureau data reports 1.7-million households total in Oregon. It also reports that roughly 13% of the population lives at or below 138% of the Federal Poverty Guideline. Assuming that the 13% low-income percentage is consistent at the household level yields roughly 220,000 households.

102. Some of the increased subscription in the ACP plan is likely due to a higher "low-income" threshold in that program so that some portion of the ACP subscribers would not have qualified for OTAP.

103. Data on the level of these prices should be available later this year following the FCC's data collection from ACP providers.

Table 4a-1

TOTAL ENROLLED ACP SUBSCRIBERS BY PROGRAM: OTAP VS EBB/ACP APRIL 2021 – FEBRUARY 2023

	Oregon		Nationally
	OTAP Subs.	EBB/ACP Subs	EBB/ACP Subs
Apr-21	61,436		
May-21	40,940	15,484	2,036,272
Jun-21	43,105	27,293	3,203,433
Jul-21	42,614	34,754	4,156,277
Aug-21	40,496	41,865	5,139,519
Sep-21	40,832	48,832	6,111,126
Oct-21	39,565	57,414	7,120,912
Nov-21	38,678	68,811	8,159,564
Dec-21	37,952	78,663	9,046,220
Jan-22	12,909	86,733	9,697,257
Feb-22	14,212	93,768	10,264,545
Mar-22	14,899	103,432	11,156,487
Apr-22	15,243	109,483	11,576,051
May-22	15,448	113,522	12,154,560
Jun-22	15,254	119,343	12,701,694
Jul-22	15,403	125,055	13,105,235
Aug-22	15,801	128,905	13,514,836
Sep-22	15,930	136,113	14,104,334
Oct-22	16,046	142,884	14,693,076
Nov-22	16,064	148,150	15,099,202
Dec-22	15,770	148,006	15,481,869
Jan-23	15,625	154,197	15,934,070
Feb-23		161,645	16,488,760

Source: For OTAP subscribers, Staff Response to ETI 3rd set of Data Requests, response #6. For EBB/ACP Subscribers, data developed from following datasets: https://www.usac.org/wp-content/uploads/about/documents/acp/EBB-Households-and-Claims-by-County-May-2021-Dec-2021.xlsx, https://www.usac.org/wp-content/uploads/about/documents/acp/ACP-Households-by-County-January-December-2022.xlsx, and https://www.usac.org/wp-content/uploads/about/documents/acp/ACP-Households-by-County-January-February-2023.xlsx

Table 4a-2

AVERAGE LIFELINE MONTHLY SUBSCRIBERS BY PROVIDER AND SERVICE TYPE OREGON SUBSCRIBERS – 2019 TO 2022

	ILEC	CLEC – ETC			
Year	Wireline	Wireline	Wireless	Total	Pct Wireless
2019	10,958	284	36,546	47,788	76%
2020	9,176	285	40,363	49,824	81%
2021	8,452	388	37,889	46,729	81%
2022	4,140	453	6,682	11,275	59%

Source: Lifeline Disbursements | USAC | Data Platform (https://opendata.usac.org/Lifeline/Lifeline-Disbursements/tfxa-gt3x) Accessed February 27, 2023. Data processed for Oregon Subscribers, by provider by technology type for each year. Annual results divided by 12 to achieve a monthly average for the year.

Table 4a-3

TOTAL ENROLLED ACP SUBSCRIBERS BY SERVICE TYPE

Service type	Total Subscribers	Pct of Total
Mobile Broadband	8,838,957	53.60%
Fixed Broadband (incl. cable & fiber)	7,505,159	45.50%
Fixed Wireless or Satellite	144,644	0.90%
Total	6,488,760	100.00%

Source: https://www.usac.org/about/affordable-connectivity-program/acp-enrollment-and-claims-tracker/additional-acp-data/, Accessed April 17, 2023

From our review of the available data, it appears that the $10 OTAP subsidy is "adequate and reasonable" for low-income subscribers whose broadband Internet access service needs can be met through a mobile service option, and may perhaps be higher than necessary. Given that subscriber participation in the OTAP plan was close to three times greater when the subsidy was set at $3.50 – it appears that $3.50 (or perhaps less) is "adequate and reasonable" for this purpose. The picture is not as clear for consumers requiring a landline broadband service option.

It is tempting to draw the conclusion that the greater subsidy/discount level offered through the ACP is responsible for the movement of subscribers from OTAP to ACP and for the substantially higher participation rates, but that is likely not the case. Our analysis indicates that the vast majority of ACP participants had not migrated from an OTAP/Lifeline plan. These are new enrollees to a subsidized low-income offering, purchasing primarily fixed landline broadband. The most likely explanation for the higher participation rates is the widespread participation of the largest of the landline broadband access providers in the ACP, combined with the introduction of service packages by those providers at price levels that have been coordinated specifically with the $30 ACP subsidy, often resulting in a zero or minimal net price to the subscriber.

Put differently, even if the OTAP subsidy were increased to $20.75, a level that, in combination with the federal Lifeline subsidy, were to match the $30 discount available through the ACP, it is unlikely that OTAP subscription levels would have grown in the same manner because the same range of services from the same providers are not available for purchase. Indeed, it is possible that if the service options and market prices available to subscribers participating in the ACP had been available to OTAP subscribers with the current $10 OTAP subsidy, similar subscribership levels might also have been achieved. Notably, the original EBB plan introduced during the pandemic provided a $50 per month subsidy. That subsidy dropped by $20 per month (40%) to $30 with the transition to ACP in January of 2022, with no drop in subscribership levels (see Figure 4d-1). This was likely due to providers concurrently dropping their low-income service prices to match the now-reduced $30 subsidy level, thereby retaining essentially the same *net* price ($0) to the consumer. In fact, the number of subscribers increased during the very first week of 2022 and has continued to grow – there are today almost twice as many enrolled subscribers than when the subsidy was $50 monthly.[104] It may be that the $30 ACP subsidy could be reduced yet again and still support low-income households' ability to obtain broadband Internet access services. There is also no knowing how many of the enrolled ACP participants would have subscribed to the newly available lower-priced service packages offered by the broadband providers since the start of the pandemic even without a subsidized price.

Proposed sustainable support amount for "adequate and reasonable" access to broadband Internet access service or other telecommunications services through 2030

To be sustainable, the OTAP level of low-income support cannot exceed the total amount collected from the maximum OTAP assessment – in other words, the program can not give out more in subsidies than the legislative cap on the monthly surcharge allows to be collected . And in order to be "reasonable" in addition to "adequate," the support level cannot create a funding demand that cannot be met. Those two elements are clear and can be modeled. But absent the ability to hold service provider prices for broadband access and service provider participation in the OTAP program constant, it is impossible to determine a single "adequate and reasonable" level of required support – particularly over a timeframe stretching out to 2030. There is no single "correct" amount. The low level of OTAP subscriber participation at present is not a signal that the subsidy/discount is too low to allow low-income consumers to obtain broadband, but simply reflects the more advantageous support program available through the ACP.

The aggregate annual funding level required to support the OTAP program is a function of both the level of the subsidy and the number of subscribers. OTAP's current annual budget is just under $6-million.[105] If all of the roughly 220,000 low-income households in Oregon were to participate in OTAP at the present $10 monthly subsidy level, the total annual funding required would be about $26-million. Table 4a-4 below demonstrates the annual funding level required to provide subsidized service to enrolled subscribers, ranging from all eligible households

104. https://www.usac.org/about/affordable-connectivity-program/acp-enrollment-and-claims-tracker/

105. *See,* Oregon State Legislature; Oregon Legislative Information; 2021 Regular Session. https://olis.oregonlegislature.gov/liz/2021R1/Downloads/MeasureDocument/HB5032/Enrolled. Approving a maximum RSPF budget for the biennium beginning July 1, 2021 of $11.9-million.

(220,000), households presently enrolled in the ACP (171,000), or 25% of eligible households (55,000), each at different price points.[106] The current OTAP funding is approxi-mately $6-million. Dividing that by the number of OTAP subscribers, we calculate the maximum subsidy level sustainable at each of the illustrative subscribership levels (highlighted rows in the table). Only at the 25% participation level (55,000) would a subsidy approaching the current $10 be financially sustainable for OTAP. If all 220,000 households that could qualify for OTAP participation were to sign up, without any increase in overall OTAP funding the maximum subsidy would drop to $2.27. Even if OTAP migration is limited to only those currently in ACP, the maximum OTAP subsidy at the current funding level would be only $2.90.

Table 4a-4

ANNUAL RSPF REVENUE REQUIREMENT AT VARYING SUBSCRIBERSHIP AND SUBSIDY LEVELS

Enrolled Subscribers	Monthly Subsidy	Funding Requirement
220,000	$ 20.75	$54,780,000
220,000	$ 10.00	$26,400,000
220,000	$ 2.27	$5,992,800
170,000	$ 20.75	$42,330,000
170,000	$ 10.00	$20,400,000
170,000	$ 2.90	$5,916,000
55,000	$ 20.75	$13,695,000
55,000	$ 10.00	$6,600,000
55,000	$ 5.00	$5,940,000

Our analysis of the available evidence leads to a recommendation not of a single “sustainable” and “adequate and reasonable” subsidy through 2030, but rather a series of target subsidies. Given that the aggregate level of OTAP funding is fixed irrespective of the number of partici-pants, adjustments would need to be made in accordance with the following process:

1. Retain the current OTAP monthly subsidy of $10 for a six-month period following the end of the ACP (or any comparable replacement) program. The present budget can accommodate the $10 subsidy, and no useful evaluative data will be gained by changing the subsidy level during that time.

2. Examine quantitatively the trend of any growth in OTAP program subscriptions for the initial six-month period following the end of the ACP, and apply this trend as a basis for forecasting growth in OTAP participation over the subsequent twelve month period, and using that as an estimate of program demand, reset (if necessary) the subsidy level at the highest level possible

106. $20.75 is the amount that the OTAP subsidy would need to be that, when combined with the FCC’s $9.25, would equal the current $30 ACP subsidy. The $10 is the current OTAP subsidy.

within the program funding caps.

3. Repeat step (2) annually.

However, any fixed OTAP funding level will necessarily result in an inverse relationship between the per-household subsidy level and the number of households that participate in the program. The more participants, the lower the subsidy, and vice versa. It is difficult to see how this could result in an "adequate and reasonable" subsidy level. Ultimately, a mechanism will need to be developed that focuses upon a target *per-household subsidy* rather than upon the aggregate level of funding, and that target level is necessarily driven by provider pricing and demand responses.

Conclusions and policy recommendation

Our review of the evidence suggests that the existing $10 monthly OTAP subsidy is not set so low as to operate as a barrier to the ability of low income customers to obtain broadband Internet access. Moreover, the $10 subsidy is "adequate and reasonable" in the current environment (during the pendency of the ACP program because OTAP program demand is low enough that the subsidy can be offered within current funding levels), and it may in fact be higher than is actually necessary to achieve target penetration levels.

We also find that given the relevance of the "net price" of any broadband offering to low-income customers' ability to purchase service, it is not possible to set a support level that will have any relevance in the face of changing service provider prices for broadband access and service provider participation in the OTAP program over time. The "adequate and reasonable" support level needs to be stated in terms of a target *per-household* subsidy that is itself established in relation to price levels being charged by service providers and by consumer responses to price.

4b: Barriers created by subscriber equipment costs

Introduction

Under Task 4b of this investigation, ETI has been asked to research the extent to which the cost of equipment, e.g., modems, Wi-Fi routers, smartphones, tablets, desktop computers, laptops, and other devices necessary for broadband Internet access or other telecommunications services, operates to create a barrier for residential customers with low incomes. In that regard, ETI has also been asked to identify and recommend possible solutions and equipment standards for quality and useful life.

Subscriber equipment minimally required for broadband Internet access

In the case of mobile Internet access, the only piece of equipment that is normally required is a wireless handset of some sort, generally referred to as a "smartphone." Equipment requirements for in-home ("fixed") broadband access are somewhat more complex. Several types of customer premises equipment are needed:

(1) A terminal device, such as a desktop, a laptop or tablet computer;

(2) Network interface equipment, such as a DSL or cable modem or, for fiber-to-the-premises ("FTTP") type services, an optical network terminal ("ONT"); and

(3) In order to extend Internet access to multiple devices in the home, a wi-fi router or gateway.

In most cases, the equipment in categories (2) and (3) that are intended for home use are relatively inexpensive; the principal exception, however, is found in the case of satellite Internet access services. As we noted earlier, in the case of low-Earth-orbit (LEO) satellite broadband services such as Space-X's *Starlink*, the required network interface hardware involves an up-front purchase price of between $600 and $2,500, depending upon the level of services selected. This would surely create a formidable barrier for low-income customers and, as best we can determine, *Starlink* does not currently offer any ACP-eligible service. However, for those portions of the state where the construction of landline infrastructure is not economically feasible, services like *Starlink* may well be the only viable means of extending broadband to these communities. To the extent that the use of satellite-based services is to be given consideration in such cases – which it should if the objective is to provide service in unserved and underserved areas – it may be necessary to develop some means for overcoming this up-front cost barrier.

In the case of landline broadband, the network interface equipment and wi-fi routers or gateway devices are typically either included in the provider's service bundle or are available to rent from the provider at relatively low monthly rates. The cost of computers, on the other hand, varies from around $100 to as much as several thousand dollars, depending upon capabilities and features. For households with no or limited exposure to computer or Internet use, some training will also be required to overcome what many refer to as a "digital literacy" barrier.

Prices of desktop and laptop computers have been steadily decreasing over an extended period of time, and "entry level" laptops are available for purchased at multiple retail outlets – both online and brick-and-mortar, at prices in the $100 to $200 range. However, the capabilities of such low-priced devices are often quite limited when viewed in the larger context of the full range of capabilities available over the Internet and/or that may be required for remote access to one's job. While equipment more sophisticated than an entry-level laptop is needed, their prices could easily fall into the $500 to $1500 range, or higher.

Modems, routers or gateways can be purchased and owned by the consumer, or rented from the broadband service provider. The vast majority of residential consumers will choose to rent this equipment rather than purchase it, although the latter is often a far less costly option for those with some degree of technical knowledge as to the installation and functions of these devices. Renting equipment, however, does offer certain benefits, primarily by shifting responsibility for maintenance to the broadband provider, and largely eliminating the need for the customer to determine whether any service problem is being used by this equipment or by some other network or home wiring issue. This "purchase" option may not, as a practical matter, be available to recipients of ACP-subsidized services. ACP will contribute up to $30 per month for the broadband service, and up to $100 toward the purchase of equipment. The $100 equipment subsidy is barely sufficient to offset most of the cost of an entry-level laptop; if the consumer were to purchase both a computer and network interface hardware, there would be no additional subsidy available for the network interface devices. On the other hand, most broadband providers that furnish services eligible for ACP or similar support seem to be including the rental of the network interface devices in the total monthly subsidy-eligible charge. For example, Comcast's "Internet Essentials" provides for up to 50 mbps download speed and includes the required network equipment at no charge for consumers eligible for ACP support. Charter offers a similar service targeted at ACP-eligible low-income consumers, called the *Spectrum* Low-income Assist Program. Charter describes this service as follows: "Your household may be eligible for a government-sponsored program that allows you to save up to $30 a month on your Internet service. If you qualify for the stimulus Internet credit, you'll enjoy all the benefits of *Spectrum* Internet® while saving every month with the ACP program."[107] Unlike Comcast, which describes its Internet Essentials service as "free" to ACP-eligible households, Charger's website describes the ACP benefit as offering an opportunity "to save up to $30 a month on your Internet service." However, an April 2022 public policy release from Charter appears to suggest that the company is offering two alternate low-income Internet access services – the *Spectrum* Low-income Assist Program offering up to 30 mbps download speeds, or its recently launched *Spectrum* Internet 100 service, described as "a high-speed, low-cost broadband service with 100 Mbps download and 10 Mbps upload speeds available to households qualifying for the ACP.[108] According to Charter's website, four ACP-eligible Internet services are offered – 30 mbps for $19.99/month; 100 mbps

107. https://www.spectrum.com/cp/broadband-get-qualified (accessed 2/26/23)

108. "Charter is Advancing Access to Affordable, Reliable High-Speed Internet Service," Charter Public Policy release, April 28, 2022, available at https://policy.charter.com/advancing-access-to-affordable-reliable-Internet (accessed 2/26/23)

for $29.99/month; 500 mbps for $39.99/month; and 1 Gbps for $59.99/month.[109] These monthly rates include a cable modem, but do not include a wi-fi router, which is available from Charter for an additional $5 per month.[110] The $30 monthly ACP subsidy is applied to whichever service the customer selects.

Entry-level laptops are inexpensive, but may not meet the needs of some users

ACP will also provide up to $100 of subsidy for the consumer's purchase of a laptop computer, provided that the customer pays at least $10 in cash and spends no more than $150 total (excluding tax) on the device.[111] In that regard, Comcast offers qualifying Internet Essentials customers a choice of two laptops – a Dell Chromebook 3100 or a Dell Latitude 3120, each for $149.99. Net of the ACP subsidy, the cost to the consumer would be approximately $50 for either of these devices. Table 4b-1 below summarizes the principal features of these two offerings:

Table 4b-1

ENTRY-LEVEL LAPTOPS OFFERED BY COMCAST TO QUALIFYING "INTERNET ESSENTIALS" CUSTOMERS

	Dell Chromebook 3100	Dell Latitude 3120
Screen size	11.6"	11.6"
Operating System	Chrome OS	Windows 11
Processor type	Intel Celeron	Intel Celeron
Memory (RAM)	4GB	4GB
Hard Disk Size	16 GB eMMC	64 GB eMMC
WebCam	Yes	Yes
Support (warranty)	1 Year Mail in Service	1 Year Mail in Service
Software included	Google Docs/Google Play Store	Microsoft Office
Price (before subsidy)	$149.99	$149.99

Charter does not appear to offer any laptops or other devices to its ACP-eligible customers, who would then be required to purchase such equipment from other sources, such as Walmart or Amazon, which both offer laptop computers at prices below $150.[112]

109. https://www.spectrum.com/buy/featured (accesses 2/28/23)

110. https://www.spectrum.com/buy/Internet (accessed 2/28/23)

111. ACP will provide "[a] one-time discount of up to $100 for a laptop, tablet, or desktop computer (with a co-payment of more than $10 but less than $50)." https://www.affordableconnectivity.gov/ (accessed 3/4/23)

112. For example, Walmart offers a Lenovo Ideapad 1i, 14.0" Laptop, Intel Pentium N5030, 4GB RAM, 128GB eMMC Storage, Windows 11 in S Mode, Model 82V6001DUS, for $129.00. https://www.walmart.com/ip/Lenovo-Ideapad-1i-14-0-Laptop-Intel-Pentium-N5030-4GB-RAM-128GB-eMMC-Storage-Cloud-Grey-Windows-11-in-S-Mode-82V6001DUS/218677627?athbdg=L1102 (accessed 2/28/23) or a Samsung 11.6" Chromebook 4, 32GB,

There are, in fact, a number of entry-level laptops available in this $110 to $150 price range, making them eligible for the $100 ACP subsidy. However, by current standards, these are all quite minimal with respect to the suite of features being offered. The processors are quite slow, the amount of memory (4GB RAM) is close to the bare minimum needed for current Windows 10 or 11 operating systems, which could limit the scope of software that could be run on these devices, and the hard disk size – particularly the 16 GB being offered by the Chromebook, is quite limited by comparison with the more typical 256 to 512 GB available on laptops and desktops in the $500 to $1500 price range. Even the 64 GB hard disk on the Dell 3120 is barely above the minimum level needed for a Windows computer, especially when one considers the fact that the Windows operating system itself would likely require somewhere in the range of 11 GB to 20 GB of hard disk storage. The Dell Latitude 3120 is itself offered in several far more robust configurations, although even these are still close to "entry level." For example, Dell offers a Latitude 3120 configuration for $759 that includes a faster Intel Pentium processor, Windows 11 Pro operating system (instead of the "Home" edition of Windows 11), 8 GB of RAM (instead of 4 GB), a 256 GB hard drive (instead of the 64 GB hard drive on the Comcast model), a touch-screen display (the Comcast model does not provide a touch screen display) two webcams (one facing the user, the other facing forward), a longer-life rechargeable battery, and a more powerful power supply. Notably, the model being offered by Comcast also includes some (unspecified) version of Microsoft Office (Word, Excel PowerPoint), although the extremely small 4 GB of RAM memory would severely limit the capabilities of some of the Windows applications, such as Excel in particular. There is no applications software included in the $759 Dell Latitude 3120 configuration.[113]

While laptop prices have certainly come down over the past several years, so too have desktop prices. For many purposes, a desktop computer will offer greater overall functionality and capability than a comparably-priced laptop. For example, for $849, Dell offers an Inspiron 24 All-in-One with a 23.8" screen, a considerably faster processor, 12 GB of RAM memory, a 256 GB hard drive, among other features.[114] The "all-in-one" configuration includes a built-in 23.8" monitor. Dell offers a similar configuration, but without a built-in display monitor, but with a 512 GB hard drive, for $619.99.[115] Add a Dell 24 Monitor Model SE2422H – the same size as in the all-in-one, for $98.99,[116] for a total price of $718.98.

Model XE310XBA-K01US, for $149.00 https://www.walmart.com/ip/Samsung-11-6-Chromebook-4-32GB-XE310XBA-K01US/558190726?athbdg=L1101 (accessed 228/23). Amazon has several laptops in this price range as well.

113. https://www.dell.com/en-us/shop/cty/latitude-3120-education/spd/latitude-11-3120-2-in-1-laptop {accessed 2/26/23)

114. (accessed 2/26/23) https://www.dell.com/en-us/shop/desktop-computers/inspiron-24-all-in-one/spd/inspiron-24-5410-aio/na5410fnxgs

115. (accessed 2/26/23) https://www.dell.com/en-us/shop/desktop-computers/inspiron-desktop/spd/inspiron-3910-desktop/nd3910fsgsh

116. https://deals.dell.com/en-us/productdetail/g6b9 (accessed 2/26/23)

Laptops in the $110 to $150 price range will probably meet the needs of elementary school students and perhaps most (but not all) high school students, although those whose focus is on STEM will likely find these low-end units far too limiting. Most college students will likely require a more powerful computer than either of these devices, although the inclusion of Microsoft Office on the Dell 3120 would at least open the possibility that this could be satisfactory for at least some college students. These entry-level laptops will probably also meet the needs of most adult members of these households whose uses of the Internet are limited mainly to web surfing, e-mail, video streaming and social network usage. Anyone attempting to run a home-based business, or use a home computer to access a company server for remote employment situations, will need something a lot better.

This $100 limit on ACP equipment support – coupled with the fact that the support will be unavailable to anyone whose needs exceed the capabilities of these low-end machines – raises an important policy question for the OTAP: What is the objective of providing broadband availability for low-income households? If the goal is limited to furnishing a minimal level of broadband access, then these $150 laptops may be sufficient. If, however, the goal is to assist families in these low-income brackets to obtain the capability for remote employment, home business initiatives, remote learning and other *non-entertainment* types of applications, denial of any subsidy support for more sophisticated home computer devices seems rather counter-productive. At the very least, qualifying households should be afforded the opportunity to apply the $100 ACP-level subsidy to enable the purchase of somewhat more powerful devices, perhaps up to some higher purchase price (e.g., $1,000). Notably, the $30 monthly ACP subsidy for the broadband service itself does appear to be applicable to higher-end services, as evidenced by Charter's inclusion of its 1 Gbps $59.99/month service as "ACP-eligible." Indeed, there is really no benefit to using a 1 Gbps service vs. slower offerings in connection with a $150 entry-level laptop, since the speed and capabilities of the computer will be far more constraining than the download speed of the Internet access.

Home Local Area Network (LAN) requirements

As noted earlier, most consumers typically obtain both their cable modem and wi-fi router or gateway from their broadband provider. One or more of these devices may be bundled with the broadband service, as Comcast does with its ACP-eligible Internet Essentials offering, but may be subject to some additional charge, as is Charter's policy with respect to the wi-fi router portion of the ACP-eligible *Spectrum* broadband services. In theory, a single device, such as a laptop, can be connected directly to the cable modem (or equivalent) by connecting an ethernet cable between the device and the RJ-45 jack on the modem. However, this arrangement will then permit only a single device to be connected to the consumer's broadband service. The "router" allows multiple devices to share the (so-called Wide Area Network ("WAN")) broadband service.

Connections to a router can be made either by means of an ethernet cable or wi-fi. Not all routers have wi-fi capability, and in any event there is usually a limit on the number of ethernet ports on a typical consumer-grade router, usually between 4 and 8. There is also a limitation on the distance between a wi-fi router an individual wi-fi devices. That limit is generally in the 30 to 40 foot range. This will normally be sufficient for most apartments and for relatively small houses, particularly if the router is centrally located. For larger dwellings, configurations involving a router and one or more "network access points" can be set up, or a multi-unit "mesh" system of wi-fi routers can be used. In a mesh system, only one of the routers is directly connected to the cable modem (or equivalent), with the others communicating wirelessly with the unit that is directly connected.

Most consumer Internet-connected devices can be successfully used with a wi-fi connection; however, in certain cases, the use of a hard-wired ethernet cable will provide best results. For example, interconnected VoIP services such as Vonage utilize a so-called Analog Telephone Adapter ("ATA") that is located on the customer's premises and is connected to the customer's router via an ethernet cable. For most customers, the home Local Area Network is the weakest link in the overall broadband equipment configuration. Depending upon the distance between the wi-fi router and any specific computer or other device, the effective data rates from/to that device may be considerably slower than the data rates that are delivered to the home by the broadband service provider.

Routers are also capable of prioritizing certain devices or applications over others on the customer's LAN. Data rate variations are far less noticeable for e-mail and most web surfing applications than for interactive voice or video. Routers can be programmed to give priority to the latter to the extent that the aggregate demands within the LAN approach capacity. For customer-owned routers, the ability to set such priorities is within the control of the customer, notwithstanding the fact that this will require some level of customer knowledge and familiarity with the issues involved and with the router's user interface where this prioritization is specified. For routers that are owned by the service provider and rented to the user, the provider may assume control of these functions, and the consumer may or may not be permitted to affect them. This arrangement is sometimes referred to as "managed wi-fi"; Charter and other carriers use this term in referring to wi-fi equipment that is available from them.

In some instances, "managed wi-fi" may involve the service provider preemptively (and without the customer's express consent) seizing control of a portion of the wi-fi capacity for use unrelated to the customer's service. Comcast, for example, uses Comcast-provided wi-fi routers at its broadband subscribers' homes to create "hotspots" that are then made available to Xfinity Mobile and Xfinity broadband customers. Under Comcast's mobile services business model, customers are first directed to available broadband customer wi-fi routers; if none are available to the mobile user at a particular location, Comcast will then route the call to a CMRS carrier (usually Verizon Wireless) with whom it has a "Mobile Virtual Network Operator" ("MVNO") arrangement. Comcast claims that such use is transparent to its broadband customers and has no impact upon the quality or speed of their wi-fi or broadband service overall.[117] Irrespective of the specific validity of Comcast's claim, the establishment of any standards for "adequate and

117. Comcast claims that "[t]he broadband connection to your home will be unaffected by the Xfinity WiFi feature. We have provisioned the Xfinity WiFi feature to support robust usage, and therefore we anticipate minimal to no impact to the in-home WiFi network. WiFi uses shared wireless spectrum, and as with any shared medium, there can be some impact as more devices share the network. Also, the usage and activities of visiting users are associated with the visitors' accounts and therefore do not impact the homeowner." https://www.xfinity.com/support/articles/xfinity-wifi-hotspots (accessed 3/1/23)

reasonable" broadband should not ignore the effects of carrier-provided wi-fi routers or gateways upon the overall performance of the service from the customer's perspective. Finally, because there are situations where a direct ethernet connection to a router is desirable or even necessary, the standard should also require that any carrier-provided wi-fi router or gateway also include some minimum number of ethernet ports.

Conclusions and policy recommendations

The $30 monthly and $100 equipment subsidies available under the ACP will largely eliminate any significant cost barrier to *entry-level* Internet access, since with the ACP subsidy the monthly service cost for ACP-qualified (Low-Income) Internet access, which most participating service providers price at $30 or less, is effectively eliminated altogether, and the cost of an entry-level laptop, using Comcast's pricing to ACP-qualified customers, can be held to under $50. As long as ACP funding continues to be available, OTAP support for this level of broadband access does not appear to be required. If and to the extent that ACP funding ceases to be available, OTAP funding at at least this same level would appear to be indicated for qualifying low-income households, and providers currently offering services that qualify for ACP subsidies should be encouraged to continue those offerings under whatever alternative low-income subsidy mechanism is adopted to supplement or replace ACP.

However, several important policy questions still remain to be considered:

(1) Is the entry-level service and equipment that is eligible for ACP funding really sufficient to meet the needs of low-income households in Oregon? As we have noted, this level of access will be sufficient for most elementary and high school students and for personal household applications, but will not be sufficient where more robust computer capabilities – such as those required for employment tasks, access to telehealth, education or for home-based businesses – are needed.

(2) For those remote and low-density communities that are not presently being served by any landline broadband provider, some form of fixed wireless or satellite-based service may be the only economically feasible means for providing access. One of the stated goals of *Starlink* LEO satellite broadband is to make Internet access available to such locations. However, as we have noted, the up-front equipment costs associated with *Starlink* service are quite high – $600 to $2,500 – and are thus well beyond the scope of any existing ACP or other low-income funding mechanism. There are also some additional up-front costs associated with fixed wireless services (e.g., Alyrica's $99 installation charge), although these are nowhere near the level of those associated with satellite access. For both of these cases, and where landline access is not currently available or likely to be provided in the foreseeable future, some means of providing additional equipment support for wireless and satellite alternatives will need to be considered. The Polk County grant to Alyrica, while it helped make the fixed wireless service widely available throughout the County, does not by itself address the matter of "affordability" for low-income households.

Equipment requirements for in-home ("fixed") broadband access involve three principal types of customer premises equipment:

(1) A terminal device, such as a desktop, a laptop or tablet computer;

(2) Network interface equipment, such as a DSL or cable modem or, for fiber-to-the-premises ("FTTP") type services, an optical network terminal ("ONT"); and

(3) In order to extend Internet access to multiple devices in the home, a wi-fi router or gateway.

Equipment in categories (2) and (3) that are intended for home use are relatively inexpensive, and are usually available from the service provider at a modest monthly rental charge. However, in the case of satellite Internet access services such as Space-X's *Starlink*, the required network interface hardware involves an up-front purchase price of between $600 and $2,500, depending upon the level of services selected. This would surely create a formidable barrier for low-income customers. However, for those portions of the state where the construction of landline infrastructure is not economically feasible, services like *Starlink* may well be the only viable means of extending broadband to these communities. To the extent that the use of satellite-based services is to be given consideration in such cases – which it should be if the objective is to provide service in unserved and underserved areas – it may be necessary to develop some means for overcoming this up-front cost barrier.

For landline broadband, the network interface equipment and wi-fi routers or gateway devices are typically either included in the provider's service bundle or are available to rent from the provider at relatively low monthly rates. These devices can also be purchased and owned by the consumer. The vast majority of residential consumers will choose to rent this equipment rather than purchase it, although the latter is often a far less costly option for those with some degree of technical knowledge.

Prices of desktop and laptop computers have been steadily decreasing over an extended period of time, and "entry level" laptops are available for purchased at multiple retail outlets – both online and brick-and-mortar – at prices in the $100 to $200 range. However, the capabilities of such low-priced devices are often quite limited when viewed in the larger context of the full range of capabilities available over the Internet and/or that may be required for remote access to school or work. While equipment more sophisticated than an entry-level laptop is needed, their prices could easily fall into the $500 to $1500 range, or higher.

One particularly important feature of the Affordable Connectivity Program is the one-time $100 equipment subsidy that is available to newly qualified households. OTAP does not currently offer any financial support for equipment purchases. Some service providers have integrated the ACP equipment subsidy into their low-income offerings – Comcast, for example, offers ACP-qualified customers a choice of two entry-level Dell laptops at about $150 each which, after applying the ACP subsidy, costs the consumer about $50. Comcast has also included the cable modem and wi-fi router into its $30 ACP monthly rate, resulting in a $0 net monthly recurring charge to the customer.

Thus, equipment needed by new and currently unconnected households can be obtained at minimal net cost as a direct result of the $30 monthly and $100 one-time ACP subsidies. If ACP funding is not renewed in 2024, however, these subsidies will not be replaced by anything available from OTAP. Even the one-time ACP equipment subsidy may be insufficient as one looks to the future. Cable modems and routers have service lives in the range of 3 years. But if the ACP monthly $30 subsidy ceases to be available, service providers that currently include the costs of these devices in their recurring monthly rate will likely be forced to impose separate rental charges. The ACP-subsidized laptop will likely have a technological life of no longer than about three years, even if it is well taken care of and its physical life is extended beyond that time frame. Under ACP, equipment costs should not create a material barrier to broadband access for ACP-qualified low-income households. However, that may not be the case if ACP funding goes away, and some affirmative response by OTAP may be necessary if the penetration gains achieved by the ACP are to be preserved.

4c: Sufficiency of existing consumer eligibility criteria

Introduction

Under Task 4c of this investigation, ETI has been asked to assess whether existing consumer eligibility criteria are sufficient for participation in OTAP, or how any modification in eligibility requirements might affect participation. We begin our analysis recognizing the current interrelationship between the OTAP and the FCC's Lifeline program, and the consequent impact upon the OTAP eligibility requirements of that interaction.

Verification of eligibility

The eligibility verification system is designed so that low-income customers in Oregon are required to apply directly to the Oregon PUC to participate in Lifeline – by doing so they are qualified (or disqualified) for both the federal and state Lifeline programs at the same time.[118] The eligibility criteria for OTAP participation are the same as those required for participation in the FCC's lifeline plan across the US.

The legislation underlying the OTAP program no longer requires that OTAP be linked to the FCC's Lifeline plan, but for all intents and purposes the two programs continue to operate in tandem. To the extent that changes are made to tighten or loosen the OTAP eligibility standards so that they are no longer identical to those of the FCC Lifeline plan, customers applying for both programs may find themselves eligible for one but not the other. In such a case, the total subsidy/discount available on the service the applicant desires to purchase will be roughly 50% of what they would receive – i.e., they would be eligible for either the $9.25 monthly FCC Lifeline subsidy *or* the $10 OTAP subsidy, *but not both* – creating additional confusion to the bifurcated process that will present administrative challenges.

To be eligible under the existing criteria, the customer, one or more of the customer's dependents, or the customer's household, must meet and provide documentation for the criteria outlined for convenience in Table 4c-1 below (which is a repetition of Table 3a-2 above). Household street address data and the last four digits of a social security number or full Tribal ID number are also required.[119] A social security number is not an eligibility requirement *per se*, but it is required in order for an application to be considered complete. Only a single subscription per household is eligible for OTAP support. Only a single subsidy is available per household.

118. An exception exists for OTAP Service Providers offering a "free" monthly prepaid wireless service – these providers accept applications directly from the applicant and then forward the information to the PUC on the applicant's behalf, at which point the PUC reviews that application for eligibility pursuant to the same standards and rigors as applications coming directly through the PUCs applicant verification portal.

119. https://www.usac.org/wp-content/uploads/lifeline/documents/forms/LI_Application_NVstates.pdf

Table 4c-1

OTAP AND LIFELINE SUBSCRIBER ELIGIBILITY REQUIREMENTS EFFECTIVE 2023

Non-Tribal Households		
	Receive benefits from one of the following public assistance programs, or	
		Medicaid
		Supplemental Nutrition Assistance Program
		Supplemental Security Income
		Federal Public Housing Assistance (Section 8)
		Veterans and Survivors Pension Benefit
	Have income that is at or below 135 percent of the applicable Federal Poverty Guidelines for a household of that size.	
Tribal Households		
	Meet any of the qualifying requirements above for non-tribal households, or	
	Receive benefits from one of the following Tribal-specific federal assistance programs	
		Bureau of Indian Affairs General Assistance
		Tribally administered Temporary Assistance for Needy Families
		Head Start (only those households meeting its income qualifying standard)
		Food Distribution Program on Indian Reservations
Source: OAR Rule 860-033-0030		

ETI reviewed data furnished to us by PUC Staff on the number of recent applicant disqualifications, and determined that, while 15% of all applications were denied, only 3% were rejected on the basis of the existing eligibility criteria.[120] For those applying to the program in an attempt to obtain broadband service with the aid of the OTAP subsidy, in 97% of the cases the eligibility criteria did not create a barrier. Despite the lack of data demonstrating the existing eligibility criteria acting as a barrier to participation, there are two potential areas where expansion of eligibility could be expected to stimulate additional participation in OTAP – one that could increase participation by potential applicants that meet the existing eligibility criteria and another that would expand the pool of eligible applicants. To the extent that these changes would result in divergence from the requirements of the FCC program, there would be the potential for countervailing discrepancies and confusion resulting from the diverging FCC and OTAP eligibility requirements described above.

(1) Modify the Oregon Lifeline application requirement that applicants provide a social security number. At a minimum, allow applicants to provide only the last four digits of their social security number (which is all that is required by the FCC). Ideally, supplement that change by also allowing applicants to submit a scanned or photocopied image of a government-issued ID that does not contain the applicant's social security number if desired; some applicants are

120. Response to Question 6 in ETI's Third Set of Data Requests to Staff. The remaining denials were made for other reasons, including the applicant was already participating in the program, the applicant was not purchasing service from an OTAP service provider, and incomplete and mismatched data.

reluctant to provide their full, or any part of, their social security number. This change could result in an increased number of "complete" applications, and thus fewer denials, without having to expand the definition of "low-income" and possibly stimulate additional participation.[121] Obtaining and verifying social security numbers has been a consistent area of contention among consumers, providers and regulators for the Lifeline program across the US. Potential subscribers applying to participate in the ACP plan rather than the FCC's Lifeline or OTAP plan are given the option of providing the last four digits of their SSN, a Tribal Identification number, or a scanned or photocopy of any one of a Driver's License, Military ID, Passport, Taxpayer Identification Number (ITIN), or other government-issued ID.[122] Proof of the alternate ID methods can be appended to a paper ACP application or uploaded directly into the verifier portal by either the subscriber or a provider. Such a change, if implemented for OTAP applications, could stimulate additional participation in OTAP. However, it would also have the potential to introduce the kinds of discrepancies and confusion resulting from the diverging FCC and OTAP eligibility requirements described above.

(2) Expansion of the eligibility requirements to include slightly higher income, but still low-income, consumers. Per Table 4b-1 above, only households with incomes at or below 135% of the Federal Poverty Guidelines (or those that qualify for any of several other federal assistance programs) are presently eligible for both the FCC and OTAP subsidies. The OTAP income limitation is a function of PUCs rules, and as such the relevant administrative rule governing eligibility criteria could be amended. At last count, the 135% represented roughly 220,000 households in Oregon. Expanding the eligibility criteria upwards to 200% of the Federal Poverty Guideline would make an additional 120,000 or so households eligible to participate in OTAP. This expanded definition would only apply for OTAP, not for FCC Lifeline and would cause further bifurcation and administrative challenges in addition to potential for confusion resulting from the diverging benefit amounts.

Conclusions and policy recommendations

There is no indication that the consumer eligibility requirements that underlie OTAP need to be either made more or less rigorous than they are today. About 3% of applicants are denied as a result of the existing eligibility criteria; the remainder are denied for other reasons. The benefits of any changes that may be contemplated, including those discussed above (modifying the requirement for a social security number or increasing the income threshold), need to be weighed against the operational issues that would arise from divergence from the FCC Lifeline program with which OTAP operates in tandem. To the extent a decision is made to pursue changing the

121. The full social security number may have been beneficial in preventing waste, fraud and abuse up to this point – but the movement away from the use of SSNs in many situations suggests that, at least in some cases, the benefits of providing alternate forms of identification have been seen to outweigh potential costs and risks, A social security number is no longer required in Oregon to obtain a driver's license or even a federal Real ID. Moving away from the use of a full social security number would require the Oregon PUC and Oregon Department of Human Services to modify their respective systems and, if found necessary, to identify other layers of safeguards to ensure eligibility determinations are accurate.

122. http://affordableconnectivity.gov/wp-content/uploads/ACP-Application-Form-English.pdf

social security number requirement, the PUC could petition the FCC to either change its requirement for the last 4-digits of a social security number, or petition it to allow a waiver of that rule for Oregon (since, as discussed above, Oregon performs the eligibility approval for applicants in Oregon rather than participating in the National Verifier).

4d: Availability of other federal, state, or local support for broadband access

Introduction

ETI has been asked to research the availability of other forms of federal, state, or local support for broadband Internet access service or other telecommunications services; to evaluate how the program supports access to and adoption of broadband Internet access service or other telecommunications services by residents with low incomes; identify possible synergies between these programs; and recommend how the OTAP can leverage or incorporate strategies and program solutions. We undertake this task in the context of the overall focus of Task 4 of identifying "barriers faced by residential customers with low incomes to obtaining broadband Internet access service or other telecommunications services" and read "support" to "residential customers with low incomes" as referring to direct financial assistance, not to deployment of broadband facilities to unserved areas.

Other available forms of federal, state, or local support for broadband Internet access service or other telecommunications services

The Low Income Fund (Lifeline) component of the FCC's Universal Service Fund, and state-level counterparts like OTAP have occupied the field as it relates to direct financial assistance to low-income consumers specifically for the purchase of broadband Internet access service or other telecommunications services.[123] The exceptions to that are the federally-funded pandemic response "Emergency Broadband Benefit" (EBB) program that operated between June 2020 and December 2021, and its (for now, temporary) successor, the Affordable Connectivity Plan (ACP) that began disbursing Congressionally appropriated funds in January of 2022 (with funding anticipated to expire mid-2024).[124] ACP operates as a slightly less generous but even more widely utilized version of the original EBB program, and will be the focus of our discussion here.[125] As discussed in Section 4b above, ACP also provides up to $100 in support for the purchase of equipment, such as a laptop computer, by qualifying households. However, the price of such equipment cannot exceed $150. This budget limit means that ACP will support only most basic, entry level device; no subsidy will be offered for anything more sophisticated than the most basic type of laptop.

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123. The focus and funding of most government intervention as it relates telecommunications (broadband and voice) has been financial support of telecommunications service providers, not purchasers.

124. Approximately $14-billion in federal funding was appropriated to the ACP program to be used until those funds were exhausted.

125. One could argue that municipal broadband systems or those that offer free-metro-wide wi-fi services benefit low-income customers through lower-priced or free service – but inasmuch as that benefit is not specifically directed to low-income customers, but rather to the population of those service areas as a whole, we do not discuss it here.

ACP support of access to and adoption of broadband Internet access service or other telecommunications services by residents with low incomes

The Affordable Connectivity Program is funded by a one-time federal appropriation made as part of the 2021 Infrastructure Act and is run under the auspices of the FCC and administered by the Universal Service Administrative Company (USAC). It is designed to help ensure that eligible low-income households can afford the broadband they need for work, school, healthcare, and more. Despite both the USF Lifeline program and the ACP being operated under the direction of the FCC, the two programs operate independently.

The ACP benefit provides a discount of up to $30 per month toward broadband Internet access service for eligible households and up to $75 per month for households on qualifying Tribal lands. Those benefit amounts act as a cap – if the consumer subscribes to a service offered at a price below that cap, the benefit is correspondingly reduced. Eligible households can also receive a one-time discount of up to $100 to purchase a laptop, desktop computer, or tablet directly from participating ACP providers, with the caveat the subscriber contributes a minimum of $10 and no more than $50 toward the purchase price.[126]

The ACP benefit was designed from the outset to be widely available. Households with a demonstrated household income at or below 200% of the Federal Poverty guidelines and those that have been found to have qualified for financial assistance from any of several other government programs are eligible to participate. Table 4d-1 below documents the many avenues through which an applicant can qualify for ACP. Additionally, participating ACP carriers that offer approved low-income targeted pricing plans can enroll customers in those plans and automatically qualify them for the ACP benefits.

126. https://www.fcc.gov/affordable-connectivity-program-providers Thus, the full retail price of the laptop must fall in the range of $110 to $150.

Table 4d-1

AFFORDABLE CONNECTIVITY PROGRAM SUBSCRIBER ELIGIBILITY REQUIREMENTS EFFECTIVE IN 2023

A household is eligible for the ACP if:
Household income is at or below 200% of the Federal Poverty Guidelines
Received a Federal Pell Grant during the current award year;
Meets the eligibility criteria for a participating provider's existing low-income internet program;
Participates in one of these assistance programs:
Free and Reduced-Price School Lunch Program or School Breakfast Program, including at U.S. Department of Agriculture (USDA) Community Eligibility Provision schools.
SNAP
Medicaid
Federal Housing Assistance, including:
Housing Choice Voucher (HCV) Program (Section 8 Vouchers)
Project-Based Rental Assistance (PBRA)/Section 202/ Section 811
Public Housing
Affordable Housing Programs for American Indians, Alaska Natives or Native Hawaiians
Supplemental Security Income (SSI)
Supplemental Nutrition Program for Women, Infants and Children (WIC)
Veterans Pension or Survivor Benefits
FCC Lifeline program
Household is located on Tribal Lands and participates in one of these programs
Bureau of Indian Affairs General Assistance
Tribal TANF
Food Distribution Program on Indian Reservations
Tribal Head Start (income based)
Source: https://www.affordableconnectivity.gov/do-i-qualify

For purposes of scale, recent Census Bureau data indicates that 20% of the population in Oregon reside in households with income at or below the 200% of the Federal Poverty Guidelines.[127] The percentage of households eligible to participate in ACP is likely significantly higher – although we do not know by how much. The state of California (estimated by the US Census bureau to have 28% of its population at or below 200% of the Federal Poverty Guideline) reports an estimate that 45% of California households qualify to participate in the ACP[128] USAC provides a breakdown of the verification methods used by enrolled ACP subscribers to qualify reproduced as Table 4d-2 below.

127. https://www.census.gov/data/tables/time-series/demo/income-poverty/cps-pov/pov-11] Accessed Feb 28, 2023: POV11: Poverty Status by State: 2021: Below 125% and 138% of Poverty – All People (1) and Below 185% and 200% of Poverty – All People (1) [Poverty Status: POV-11

128. https://broadbandforall.cdt.ca.gov/affordable-connectivity-program/acp-enrollment/. The same study estimates that 32% of ACP eligible households have enrolled in the program.

Table 4d-2

TOTAL ENROLLED ACP SUBSCRIBERS BY METHOD OF VERIFICATION

Method of Verification	Total Subscribers
Pre-existing Lifeline Subscriber	5,094,701
New applicant via ACP National Verifier Application	7,141,726
New Applicant via Provider-specific Alternative Verification Process	4,246,547
New Applicant Verified by School	5,786
TOTAL	16,488,760

Source: https://www.usac.org/about/affordable-connectivity-program/acp-enrollment-and-claims-tracker/additional-acp-data/

Untethered from the requirement that participating service providers be designated as ETCs, the ACP encourages broad participation from a wide array of broadband Internet access service providers. No state-level approval is required in order for a carrier to become ACP-operational. A single application suffices for all areas in which a provider desires to operate. As was discussed earlier, more than four times as many carriers are identified as offering services pursuant to the ACP in Oregon than under the Lifeline program. A comparative analysis of service provider participation levels in Lifeline versus the ACP in Oregon is provided in the discussion in Task 3a above and documented in Table 3a-7. As a review of the data in Table 3a-7 indicates, many of the largest landline broadband providers (i.e., those using copper, cable and fiber) that have not historically participated in the Lifeline/OTAP program generally are participating in ACP throughout their entire service footprint.

Nationwide, households seeking financial assistance in their purchase of broadband Internet access services have flocked to the ACP program. Figure 4d-1 below presents a graphic representation of the subscriber enrollment data from program inception to the present. In just 2022 alone, close to six million new households have successfully enrolled in ACP, at a remarkably steady pace, averaging 112,000 new households per week.[129]

129. USAC reports 17.2-million enrolled households as of April 10, 2023. Calculations above taken from data for period of April 11, 2022 to April 10, 2023 available at https://www.usac.org/about/affordable-connectivity-program/acp-enrollment-and-claims-tracker/

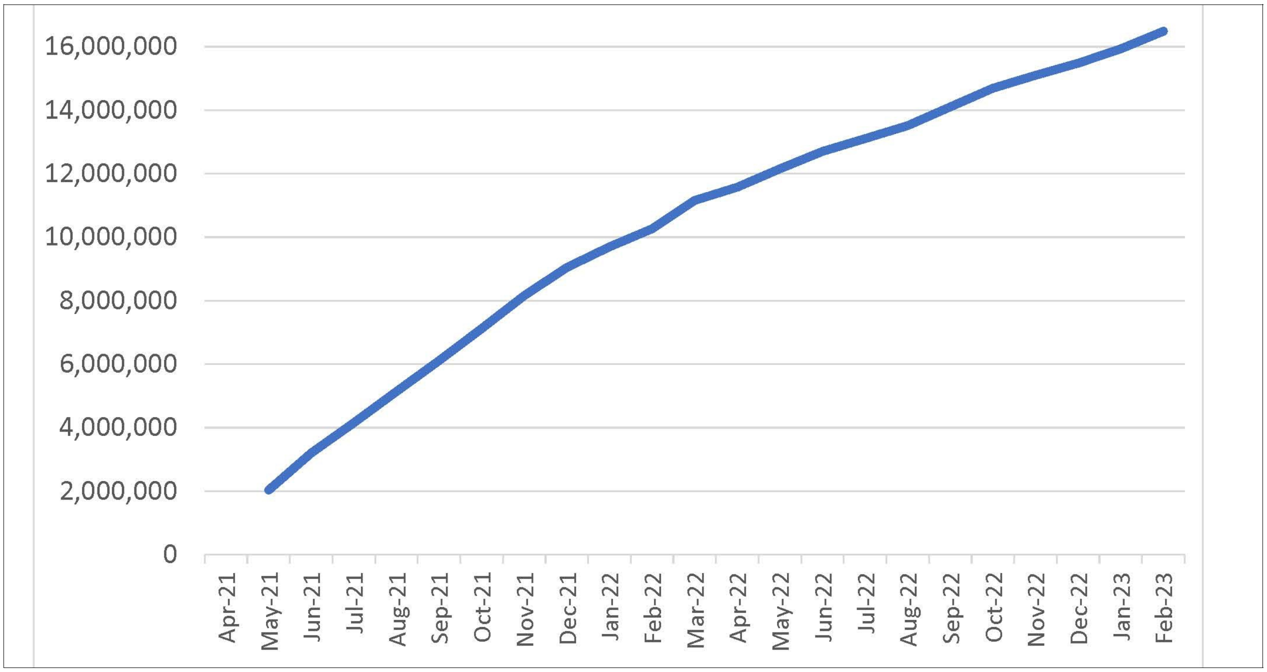

Figure 4d-1. Enrolled subscribers in EBB/ACP nationwide, 2021-2023

Many ACP providers offer low-income broadband access plans with prices set at the $30 monthly per household subsidy level, with the result that in many cases ACP-qualified consumers are able to obtain a landline or mobile broadband service without charge.

Possible synergies and leverage opportunities between ACP and OTAP

ACP is currently serving as a replacement for, rather than a companion program to, OTAP, and offers few opportunities for synergies or leverage. Enrollment data specific to Oregon reveals steadily rising customer enrollment in ACP accompanied by a drop off in OTAP enrollment. This is illustrated in Figure 4d-2 below.

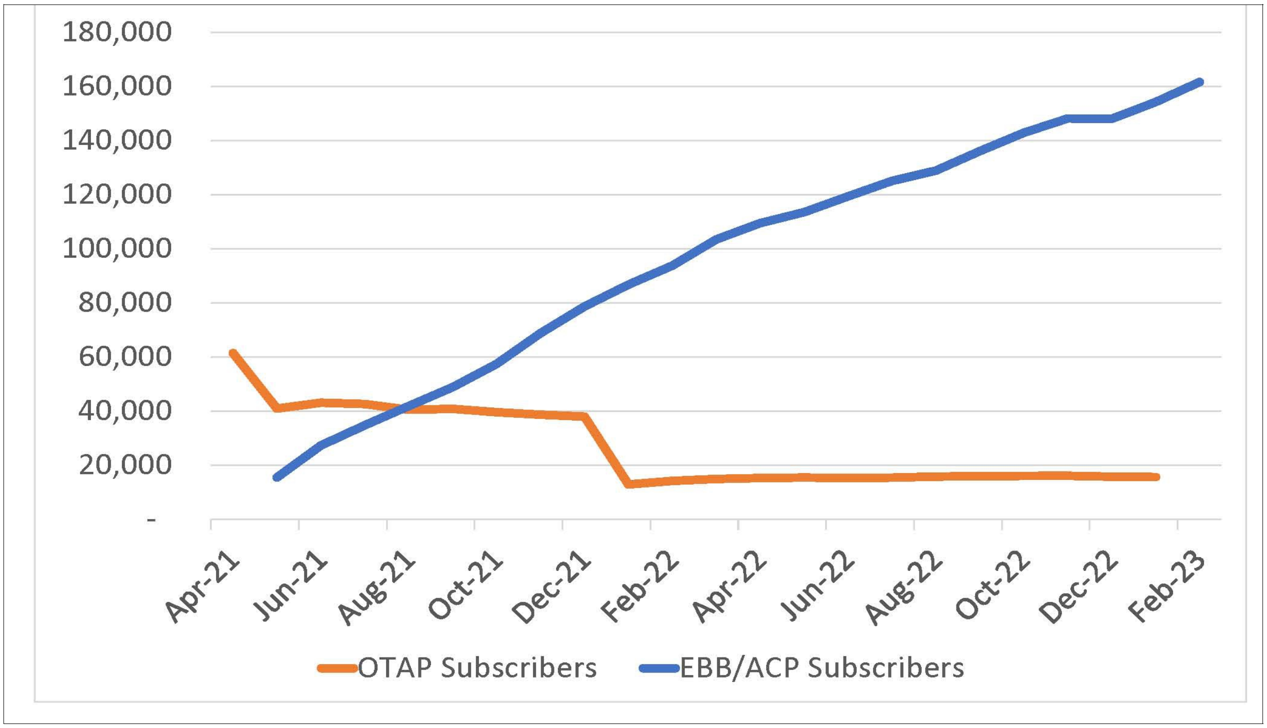

Figure 4d-2. Oregon subscribers enrolled in OTAP and EBB/ACP, 2021-2023.

Given the success of the ACP program, OTAP's continued usefulness would appear limited as long as ACP remains funded. That said, OTAP remains important to backfill gaps in the ACP program as it presently exists[130] and to begin absorbing those ACP participants that are eligible for OTAP if and when the ACP exhausts. ETI's discussion of barriers to both service provider and low-income consumer participation in OTAP found in other sections of this Report offer insights into areas where potential lessons can be learned from comparison of OTAP to ACP.

Conclusions and policy recommendations

The ACP differs from Lifeline (and OTAP) in several ways: ACP offers a higher monthly subsidy, a one-time equipment subsidy, and program participation by a much larger base of service providers – particularly landline broadband providers (i.e., those using copper, cable and fiber as their "last mile" delivery technology) that have not historically participated in the Lifeline/OTAP program. By encouraging/enabling more provider participation in the program, ACP makes a low-income broadband service available to a considerably larger base of potential subscribers. While consumer and provider participation rates in the ACP program are markedly higher than in OTAP, no data is available as to how many of the additional ACP-funded subscribers actually come from the low-income (under 135% of the federal Poverty Guideline) vs. the additional, higher-income target households of the ACP.

130. ACP does not provide subsidies for voice-only access, as such OTAP remains crucial to provide access to subsidized voice service to those to low income customers in Oregon without an available broadband option at their location.

4e: Digital Literacy as a Barrier to Broadband Access

Introduction

As we have determined, some form of fixed landline (i.e., copper, cable or fiber) broadband access is currently available to 97.65% of Oregon's population.[131] If fixed wireless broadband is included, the total level of availability increases to 98.99%.[132] Yet according to the U.S. Census Bureau's 2021 Census American Community Survey, only 91.6% of all Oregon households, and 92.45% of Oregon households where broadband Internet access is available) subscribed to broadband Internet access.[133] A principal source of this lack of universal connectivity is likely due to affordability concerns – issues that programs such as OTAP, ACP and Lifeline are intended to address and, at least with respect to ACP, were not even available when the 2021 ACS data compiled.[134] But even where effectively "free" service is available – for example, with the $30 ACP subsidy being used to entirely offset providers' $30 monthly broadband Internet access charges – many households still remain unconnected. There have been a number of efforts to "explain" this lack of universal adoption with respect to factors that have little or nothing to do directly with "affordability" of the service.

One potential barrier to obtaining broadband Internet access is the perception, on the part of many consumers, that special skills are needed to successfully use the Internet and the services and applications that it offers. The term "digital literacy" is often applied to such skills. However, and as we discuss in more detail below, there are several levels of digital literacy not all of which are required for successful Internet use. The subject of "digital literacy" has received extensive coverage in academic journals and other sources. We have reviewed a number of these writings, and find that the primary barriers arising from a lack of digital literacy relate to employment opportunities, as an increasingly larger array of jobs are requiring at least some level of computer skills. Although the skill levels required for most consumer uses of the Internet are typically far less sophisticated than those demanded by many areas of employment, familiarity with basic Internet use has the ancillary benefit of enhancing the digital literacy of many who, up to now, have had little direct interaction with computers or the Internet, thus creating additional employment opportunities that such additional skills will open up. Thus, in many important respects, the relevant "barrier" here is *not* a lack of digital literacy operating to block consumer access to the Internet, but results instead from the missed opportunity for many individuals to utilize basic Internet skills to catalyze their acquisition of the additional levels of digital literacy that will enhance their employment opportunities– and incomes – overall.

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131. See Table 1a-2, *supra.*

132. See Table 1a-6, *supra.*

133. See Table 1b-5, *supra.*

134. ACP broadband subsidies first became available in January 2022..

What is "digital literacy?"

In 2021, the National Telecommunications and Information Administration (NTIA) studied the reasons why households remained unconnected. The results are summarized in Table 4e-1 below:

Table 4e-1

ATTRIBUTES OF HOUSEHOLDS WITH AND WITHOUT BROADBAND ACCESS

		Have Internet at Home	Don't have Internet at Home: No Interest or No Need	Don't have Internet at Home: Too expensive
Total Households		108.5-million	13.8-million	4.4-million
ATTRIBUTES	Family income < $25K/year	15%	35%	45%
	School age Child Present	24%	12%	19%
	Rural area location	12%	16%	14%
	Use Internet at Other Locations	85%	13%	24%
	Previous home Internet use	N/A	14%	29%
	Mean age	50.6	60.5	51.3
	No post-secondary school education	30%	59%	57%
	White, non-Hispanic	66%	61%	49%
	African American, non-Hispanic	12%	16%	25%
	Hispanic	14%	17%	19%
	Willingness-to-pay – Mean price	N/A	$5.92	$15.69
	Would subscribe if price were $0 or below	N/A	83%	54%

Source: "Switched Off: Why Are One in Five U.S. Households Not Online?" NTIA Report, https://ntia.gov/blog/2022/switched-why-are-one-five-us-households-not-online (accessed 3/20/23)

As the NTIA data demonstrate, there are a number of potential explanations for different adoption rates for home Internet access, including age, household income, presence of school age children, and education, among others. But for those in the "No Interest/No Need" category, a lack of some level of "digital literacy" may well be a major, if not the principal, driver.

There are a number of dimensions to "digital literacy" that need to be understood and addressed. A 2016 Pew Research study identified five distinct groups "along a spectrum from least ready to most ready" – what the study refers to as "Digital Readiness:" These are summarized in Table 4e-2 below:

<table>
<tr><th colspan="4">Table 4e-2

PEW RESEARCH ON DIGITAL READINESS:
THE FIVE GROUPS ALONG A SPECTRUM FROM LEAST READY TO MOST READY
% of U.S. adults in each group</th></tr>
<tr><td></td><td></td><td></td><td>MORE LIKELY TO BE</td></tr>
<tr><td rowspan="3">Relatively hesitant

52%</td><td>The Unprepared

They have relatively lower levels of tech adoption and do not use the Internet for learning, need help setting up new tech devices, and are not familiar with “ed tech” terms. The Unprepared do not have confidence in their computer skills and are not sure they can find trustworthy information online.</td><td>14%</td><td>Women
Ages 50 and older
Lower income households
Lower levels of formal education</td></tr>
<tr><td>Traditional Learners

They are active learners and have technology, but are not as likely to use the Internet for pursuing learning and have concerns about whether to trust online information.</td><td>5%</td><td>Women
Minorities
Age: 50 and older
Lower income households</td></tr>
<tr><td>The Reluctant

They have higher levels of digital skills than The Unprepared, but they have low levels of awareness of new education technology concepts. This translates into relatively low use of the Internet for learning.</td><td>33%</td><td>Men
Age: 50 and older
Lower income households
Lower levels of formal education</td></tr>
<tr><td rowspan="2">Relatively more prepared

48%</td><td>Cautious Clickers

They have high levels of tech ownership as well as confidence in their online skills and abilities to find trustworthy information. But they are less familiar with online learning terms and less apt than the Digitally Ready to use online tools for learning.</td><td>31%</td><td>Higher income households
Some college experience
Age: In their 30s and 40s</td></tr>
<tr><td>Digitally Ready

They are ardent learners for personal enrichment. They have technology and are confident about their digital skills and abilities to find trustworthy online information. They also know the most about online learning resources.</td><td>17%</td><td>Higher income households
Higher education level
Age: In their 30s and 40s</td></tr>
<tr><td colspan="4">Source: Horrigan, John B. “Digital Readiness Gaps.” Pew Research Center, September 2016. Available at: http://www.pewInternet.org/2016/09/20/2016/Digital-Readiness-Gaps/ (accessed 3/20/23)</td></tr>
</table>

A 2021 study on Digital Readiness undertaken for the State of Hawaii Department of Labor & Industrial Relations identified seven (7) aspects of readiness:[135]

- Confidence in using digital devices
- Ability to get new technology to work
- Productivity from using electronic info devices
- Ability to determine the trustworthiness of online info
- Perception of info overload from electronic devices
- Use of digital tools for learning
- Familiarity with contemporary “education tech” terms

Notably, the array of “digital readiness” skills identified in the Hawaii study are focused upon the needs of employers with respect to employee qualifications; they go well beyond what is required for basic access to and use of the Internet.

Digital literacy among workers also exhibits substantial variation across different industries. A 2020 study by The National Skills Coalition observed that “[t]he Covid-19 pandemic has thrown a stark spotlight on need for digital skills among a wide swath of the American workforce. But even before the pandemic, the US labor market reflected a growing demand for workers across industries to have strong digital skills.”[136] The study found that “[a]cross all industries, data show that nearly one-third (31 percent) of workers lack digital skills. This number includes the 13 percent of overall workers who have no digital skills and another 18 percent who have limited skills. An additional 35 percent have achieved a baseline level of proficiency in their digital skills, and the final 33 percent of workers have advanced skills.”[137] As shown in Table 4e-3 below, extreme variations in skill levels were identified across industries and occupations:

135. “Hawaii Digital Literacy & Readiness Study,” State of Hawaii, Department of Labor & Industrial Relations, Workforce Development, prepared by Omnitrak, Honolulu, HI, at 17. https://labor.hawaii.gov/wdc/files/2021/11/Final-Statewide-Digital-Literacy-Survey-Report-from-Omnitrak-11.15.2021.pdf (accessed 3/20/23)

136. Amanda Bergson-Shilcock, “The New Landscape of Digital Literacy: How workers’ uneven digital skills affect economic mobility and business competitiveness, and what policymakers can do about it.” National Skills Coalition, May 2020, available at https://nationalskillscoalition.org/resource/publications/the-new-landscape-of-digital-literacy/ (accessed 3/20/23)

137. *Id.*, at 4.

Table 4e-3

PERCENTAGE OF WORKERS WITH NO DIGITAL SKILLS FOR SELECTED INDUSTRIES

Industry	Pct with no Digital Skills
Construction, transportation and storage 22%	22%
Retail, wholesale, and auto repair	14%
Hospitality and other services	18%
Manufacturing	16%
Administrative and support services; arts, entertainment and recreation	13%
Health and social work	12%
Finance, insurance, and real estate	6%
Education	5%

Source: "The New Landscape of Digital Literacy," at 6.

Across industries, there is also substantial variation in the level of digital literacy among different occupations:

Table 4e-4

PERCENTAGE OF WORKERS WITH NO DIGITAL SKILLS FOR SELECTED OCCUPATIONS

Occupation	Pct with no Digital Skills
Plant and machine operators and assemblers	33%
Skilled agricultural and fishery workers; elementary occupations	32%
Craft and related trades workers	21%
Service workers and shop and market sales workers	16%
Clerks	6%
Technicians and associate professionals	8%
Professionals	4%

Source: "The New Landscape of Digital Literacy," at 8.

And as this and several other studies have demonstrated, these variations across industries and occupations translate directly into income levels, increasing the value of workers with greater digital skill levels:

Table 4e-5

WORKERS WITH LIMITED OR NO DIGITAL SKILLS HAVE CONSISTENTLY LOWER EARNINGS

Income percentile	Pct of Workers with No Digital Skills
Top 20% (first quintile)	10%
2nd Quintile	11%
3rd Quintile	21%
4th Quintile	32%
Lowest 20% (5th quintile)	25%

Source: "The New Landscape of Digital Literacy," at 10..

A 2021 review article by Livingstone *et al* classified digital skills into four dimensions, each of which "encompasses functional subskills and digital knowledge (or critical literacy), and all are important for wellbeing in a digital society." The authors observe that these "can also be combined to generate more complex skills – for instance, the skills required for problem-solving online, or to protect one's privacy or safety online, participate in civic activities or cope with harmful experiences."[138] These four "dimensions of digital skills," with several additions and modifications that we are believe are needed to achieve greater relevance, are summarized in Table 4e-6 below:

138. Sonia Livingstone, Giovanna Mascheroni and Mariya Stoilova, "The outcomes of gaining digital skills for young people's lives and wellbeing: A systematic evidence review," *Sage Journal of New Media & Society*, (OnlineFirst, September 13, 2021), at 3; available at https://doi.org/10.1177/14614448211043189 (accessed 4/33/34)

Table 4e-6

THE FOUR "DIMENSIONS" OF DIGITAL SKILLS

Dimension	Description
Technical and Operational Skills	The ability to manage and operate information and communication technologies (ICTs) and the technical attributes of devices, platforms and apps, ranging from basic controls or "button" knowledge (i.e., basic operation of the device) to the use of settings and, where supported, programming
Information navigation and processing skills	The ability to find, select and critically evaluate digital sources of information, including its trustworthiness and safety.
Communication and interaction skills	The ability to utilize a range of digital media and technological features to interact with others and build interpersonal networks
Content creation and production skills	The ability to create quality digital content and understand how it is produced and published, and the potential impact that it is capable of generating

Source: Livingstone *et al*, fn. 10 *supra*, at 3-4, citing Helsper E. J., "The Digital Disconnect," London: SAGE, 2021.

Notably, these and the other attempts to define "digital literacy" all tend to focus upon a broad range of skills and knowledge that are needed to equip an individual for life in the digital age. But this level of "digital literacy" far exceeds the minimal level of digital knowledge needed to achieve beneficial use of the Internet and the range of applications and information that are available thereon. As we discuss below, these broad indicia of "digital literacy" are not the proper scope of any examination of the presence of "barriers" to broadband access that is the focus of HB 4092, the OTP, and this investigation.

Does a lack of digital literacy work to create a barrier to broadband Internet access?

Individuals that lack digital literacy and digital skills confront numerous barriers as we move into the middle years of the 21st century. Jobs in most industries – and in most occupations – are increasingly dependent upon information technology, and those who do not have, or who are unable to acquire, the skills necessary to accommodate to the demands of many categories of employment suffer enormous disadvantages.

A US Department of Education 2018 report that focused upon US adults who are not digitally literate offered the following definition of "digital literacy:"

> ... in order to operate effectively in today's digital environment, one needs to master foundational computer skills, including (a) skills associated with manipulating input and output devices (e.g., the mouse, the keyboard, and digital displays), (b) awareness of concepts and knowledge of how the digital environment is structured (e.g., files, folders,

> scrollbars, hyperlinks, and different types of menus and buttons), and © the ability to interact effectively with digital information (e.g., how to use commands such as Save, Delete, Open, Close, Move, Highlight, Submit, and Send). Such interaction involves familiarity with electronic texts, images, graphics, and numerical data, as well as the ability to locate, evaluate, and critically judge the validity, accuracy, and appropriateness of accessed information. These skills constitute the core aspects of the digital problem-solving assessment; adults who have at least some fluency with these skills are termed "digitally literate." ...[139]

Based upon this definition, the study concluded that, overall, 16% of US adults were "not digitally literate."[140] The study found that "[a]dults who are not digitally literate are, on average, less educated, older, and more likely to be Black, Hispanic, or foreign born, compared to digitally literate adults. Compared to digitally literate adults, adults who are not digitally literate have a lower rate of labor force participation and tend to work in lower skilled jobs."[141]

That said, the level of digital literacy minimally needed to successfully access and utilize the Internet and the numerous online services that it supports does not require the broad range of skills and related formal training that many jobs now demand. There are several reasons for this:

- The basic suite of applications that are typically included with consumer Internet access services and/or devices – e-mail, text messaging, video conferencing, web searching, and in some cases basic virus protection – are relatively easy to use and require little instruction or training. Some devices and applications provide voice-controlled "digital assistants" such as Apple's Siri, Amazon's Alexa, and Microsoft's Cortana that are able to understand and execute a range of voice commands. In addition to serving as gateways to search engines, these "assistants" can also be used to control various applications, including GPS navigation, control of IoT devices, initiation of applications like playing music, watching a video, and many others. Recent gains in Artificial Intelligence (AI) technology are continuously increasing the capabilities of these digital assistants in understanding and executing even more complex voice commands and requests.

- Application developers have expended enormous effort to design the user interfaces with their websites and apps to simplify user interactions. Making effective use of some of the most popular websites and apps, for example, requires little more skill than is needed to use a TV remote to select channels and control volume. Well-designed "graphical user interfaces" ("GUIs") are intuitive and easy to use. While not all online service providers have made the effort and investment needed to create effective GUIs, those that have done so – e.g., Amazon, Netflix, Facebook, Uber, Google – have acquired massive numbers of users,

139. Saida Mamedova and Emily Pawlowski, "A Description of U.S. Adults Who Are Not Digitally Literate," US Department of Education, May 2018, NCES 2018-161, at 2. Available at https://nces.ed.gov/pubs2018/2018161.pdf (accessed 3/21/23).

140. *Id.,* Figure 1, at 3.

141. *Id.,* at 5.

underscoring the economic benefit of these GUI investments.

- Tablet computers and smartphones tend to be far more intuitive – and require far less training and skill development – than desktop and laptop computers. While often limited in their ability to support more complex tasks, these devices are more than capable of meeting the needs of most users for basic Internet applications – e-mail, streaming video and audio, social media, web surfing, as well as for applications like online banking, shopping, travel reservations, taking, viewing and sharing photographs, ordering ride sharing services, controlling IoT devices, and countless others. For some uses, tablets may be superior to a desktop or a laptop. For example, by using an "Apple Pencil" with an iPad, a user can make handwritten notes or mark up documents and photographs while working at a jobsite far more effectively and conveniently than with a laptop computer.

- Increased reliance upon tablets and smartphones by retailers and service establishments for customer interactions. For example, many restaurants and fast food establishments now require their customers to enter their food and drink orders on a tablet or touchscreen provided by the establishment or, in some cases, to access the menu on the customer's own smartphone and to use that device to place the order and to pay the check. Consumers are also sometimes required to use their smartphones to pay for parking, both at parking garages and for parking meters. Touchscreen kiosks are also now widely used to purchase mass transit, railroad (Amtrak) and even airline tickets, and their use is certainly required to obtain airline boarding passes at airports. Many interactions between Americans returning home from abroad with US Customs and Border Protection have also been replaced with touchscreen kiosks. Other common tasks such as withdrawing funds from a bank account using a bank ATM similarly require user interactions with touchscreens and keypad input entry devices. Thus, even those who have resisted or are otherwise unable to obtain Internet access at home, are still being forced to acquire minimal computer skills in order to engage in activities that now require some type of online interactions in place of traditional person-to-person interactions.

Formal definitions and studies addressing "digital literacy" such as those cited above tend to be focused upon more advanced computer skills, those needed for successful job-related activities. The ability to interact with touchscreens or using a mouse or trackpad with a desktop or laptop computer, for example, are not in and of themselves central elements of "digital literacy," but are an essential basic skill for home Internet use. Indeed, many automobiles introduced in the past few years now include touchscreen interfaces through which the driver controls many of the car's operations, as well as navigation. Even those with minimal "digital literacy" in the formal sense, users have successfully learned how to interact with their automobile's touchscreen-based GUI.

While the dissemination of fundamental computer and Internet skills such as these has been increasing and, in view of the widespread acceptance of smartphones across populations of all income and educational levels, should no longer be considered a serious "barrier" to achieving universal access to broadband and to the Internet. Indeed, the acquisition of such basic skills can be expected to catalyze the development of more advanced digital skills across these same populations, potentially reducing barriers they currently face with respect to employment where digital literacy is required. Thus, while the primary concern remains the reduction or elimination of *financial* barriers to broadband access among unserved and underserved communities, a critically important ancillary benefit is the potential for those populations that are being specifically targeted by the support mechanisms under examination here to acquire marketable digital skills that will work to improve their employment opportunities and incomes overall.

Efforts to enhance digital literacy among newly connected Internet users.

Basic Internet and computer skill development is already a central focus of elementary and secondary education, and as these populations age into adulthood, barriers created by a lack of essential digital skills will continue to diminish. Additionally, efforts aimed at providing necessary education and training to those with limited or no computer and/or Internet skills can also help to reduce barriers, provided of course that such materials are accessible to the uninitiated and that individuals are willing to make the relatively modest effort to take advantage of available training materials.

One such collection of training materials directed toward the newly connected is offered by Comcast without charge and without the requirement that the user be a Comcast subscriber. The Comcast program covers a broad range of subjects, from the most basic skills – selecting and setting up equipment, navigating websites, using e-mail – to more advanced topics including safety and security, using social media and other apps, and even introductory materials on such subjects as programming and website development, art and design, and doing college-level research. These programs include both text and video components, and can be viewed on any type of connected device – a desktop or laptop computer, a tablet, or a smartphone. Of course, because programs such as these are only available online, accessing them requires that the user possess sufficient ability to get online and navigate to the desired programs. For example, one of the basic Comcast training videos provides instruction on selecting and setting up equipment – connecting a cable modem and router to the Comcast service, and connecting a home computer to the router via wi-fi. Thus, in order to access a program that instructs you how to set up your equipment and get online, you need first to be online in order to view the program – a sort of “Catch-22" if ever there was one.

Table 4e-7 below provides summary descriptions of the principal elements of the Comcast *Internet Basics* program, which is organized around a series of specific skill areas:

Table 4e-7

COMCAST "INTERNET BASICS" TRAINING PROGRAM PRINCIPAL SUBJECT AREAS

Internet Basics: Acquiring and Setting up equipment	
	WiFi 101: Getting the strongest WiFi signal at home is important. Follow these tips to optimize your connection.
	A Guide to Buying Devices: Resources to help you consider all of your options
Internet Basics: Learning to Navigate Your Computer: The essentials you'll need to get started.	
Internet Basics: Basic Internet skills	
	Email: What it is, how it works, and why it's useful.
	Social Media: Learn how to use social networks to your benefit.
	Seniors' Guide to Navigating the Web: Lessons designed specifically for seniors who are just starting out on the Internet.
	Learning with Technology: Resources for utilizing the Internet to learn new skills at any age.
	Smart Phones: Lessons on how to stay safe when using your smart phone.
Online Safety and Security: Guidance on how to stay safe while using the Internet.	
	How to Use the Internet Responsibly: Things to keep in mind as you browse.
	Staying Safe and Secure: How to protect your personal information online.
	Parenting Tips: Everything you need to know to keep your family safe online.
	Avoiding Scams: Learn how to recognize harmful scams before they can affect you.
	NewsGuard: Trust ratings for news and health information websites to help you locate reliable sources and avoid misleading news or misinformation.
	Cyberbullying: How to deal with abusive behavior and harassment.
	Seniors' Guide to Online Safety: You're a-to-Z guide of helpful tips for navigating the Internet.
Getting Things Done: Resources for education, finance, career and social services.	
	Personal Finance: Helpful resources and other digital tools for managing your finances online.
	Education Resources: Learn how the Internet can be a helpful tool for education at all levels.
	Employment Resources: Guidance on everything from navigating the job hunt to walking in ready on your first day.
	All Things College: Helpful resources for finding schools and applying for financial aid and scholarships.
	Social Services: Learn how to manage your benefits online.
Building New Skills: Challenge yourself.	
	Programming + Web Development: Learn to code from the ground up.
	Language: Check out these helpful resources for learning a new language online.
	Art and Design: An introduction to graphic design, digital illustration and photography.
	Academics: Resources for furthering your education online or in-person for all ages and interests.

Source: https://www.xfinity.com/learn/Internet-service/Internet-essentials/learning/Internet-basics (accessed 3/21/23)

Most broadband service providers provide new customers with "self-installation" kits, usually consisting of a cable modem (or fiber equivalent) and a wi-fi router, or a "gateway" device that integrations both of these functions. ACP-eligible consumers may also obtain a laptop computer from the same broadband provider (as noted in Section 4b above, Comcast offers two Dell laptops at $149 each which, after the $100 ACP equipment subsidy, will cost the consumer about $50). But all of these hardware typically arrives in a box, whereby the consumer is expected to unpack the various devices, connect them with the supplied RF and ethernet cables, set up a secure wi-fi home network, and perform various other initial tasks that will be entirely unfamiliar to many ACP-targeted consumers. Some service providers may offer home installation/setup services, but typically not without additional charges.

Providing cash subsidies of the type offered by OTAP, ACP and other programs targeted at low-income households may well be necessary to overcome *financial* barriers to obtaining broadband Internet access, but these may be insufficient to overcome even the minimal barriers created by the lack of experience with the initial steps needed to set up and connect hardware, set up an online service account, set up a home wi-fi network, and begin actually using the broadband service. Although perhaps currently outside the scope of existing OTAP mandates, creating and disseminating easy-to-use *printed* instructional materials may be an important step in overcoming those limited digital literacy barriers that would otherwise stand in the way of extending broadband service to those presently unserved.

Conclusions and policy recommendations

For the reasons discussed above, we believe that the most important "digital literacy" barriers to broadband Internet access and use likely arise in the initial installation and setup of hardware and software. Once overcome, digital literacy at a level minimally needed for successful access to and use of the Internet should not present a major barrier to broadband connectivity, certainly not one that is anything close to the financial barriers confronted by low-income households arising from the costs associated with subscribing to broadband Internet service and the purchase of computer and related equipment necessary for Internet use. This conclusion does not diminish the importance of assuring that those Oregon consumers who desire Internet access but who are currently unable to afford it – or who may become unable to afford it if existing subsidies, such as those available under the ACP, were to be substantially reduced or eliminated – are not financially precluded from subscribing to and using broadband services. The availability of well-designed graphical user interfaces and other intuitive website and application designs will overcome many obstacles that might otherwise be confronted by those with minimal computer skills. Moreover, even those not currently subscribing for broadband access at home, extensive user familiarity with smartphones and with commercial touchscreen and other input devices can be expected to facilitate their use of the Internet once home connectivity is achieved. And while the availability of no-cost online training materials, such as those offered by Comcast, can help to further overcome any current knowledge gaps that might otherwise limit such users from obtaining the full scope of benefits from access to broadband Internet service from their home, the development of additional *printed* materials, targeted specifically at those who do not currently have Internet access at home, should be considered as an essential component of OTAP or any other program aimed at overcome barriers confronting low-income households.

In that regard, OTAP or other state-funded programs could consider providing affirmative financial support for the development of additional training materials, adult education programs, online tutorials and even live help desks to assist newly connected users, to the extent that such services are not already being offered by service providers themselves. While we have identified numerous studies and research that purport to assess the extent to which digital illiteracy is present or absent, the primary focus of such studies has been on a skill level necessary to meet employment demands, not on those needed for basic home Internet use. The proliferation of smartphones and the increased reliance upon computer interactions for many retail commercial transactions suggests that the skills needed for basic Internet use are likely more widely available than much of the available research suggests. While these skill barriers should certainly not be ignored or lightly dismissed, they are nowhere as substantial as the financial barriers confronting those who want Internet access and require the basic equipment necessary for such use.