

Extracted version



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Fixed Wireless Access handbook

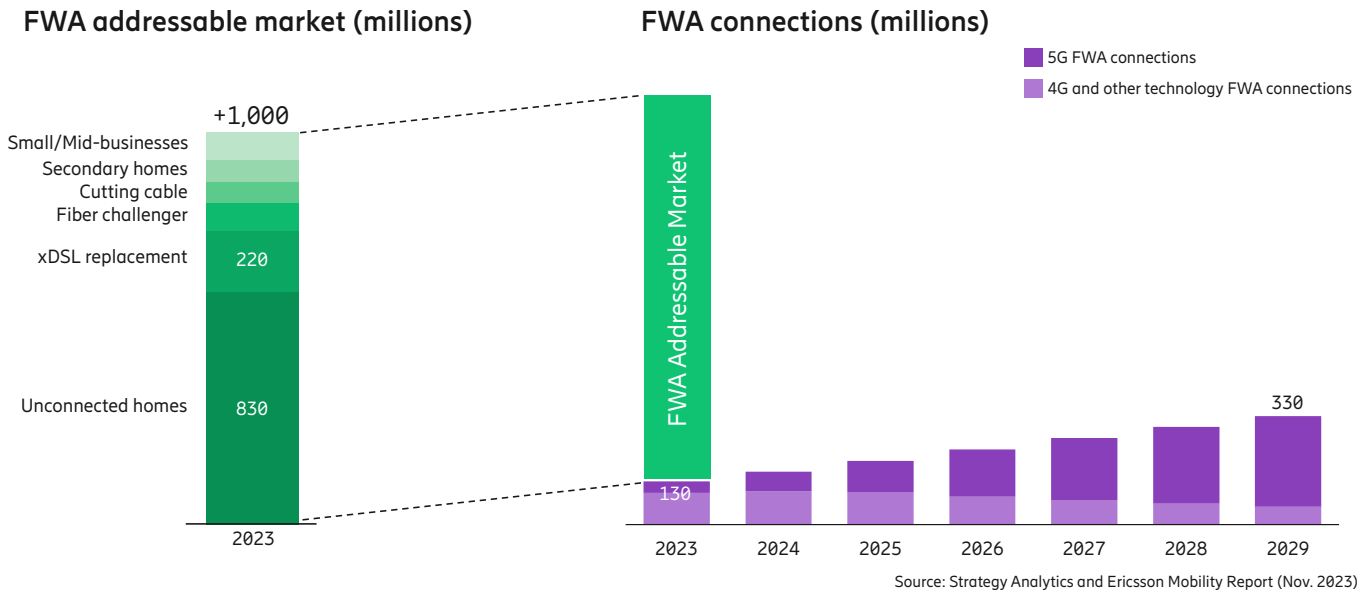
# Insights

2024

Insight 3 of 6

**Closing the digital divide  
with 5G FWA**

# Six opportunities for addressing the +1 billion premises digital divide

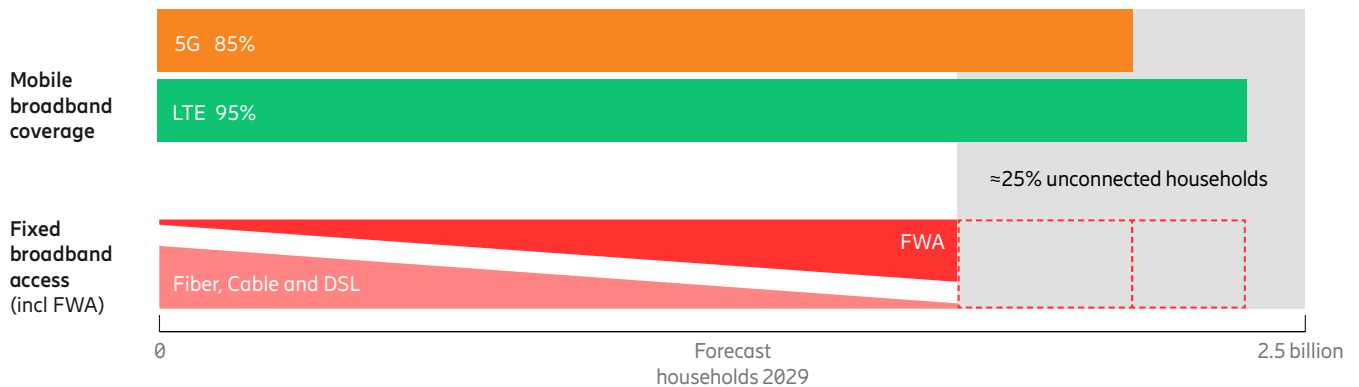


Even though the global broadband landscape continues to expand, more than 1 billion premises are unconnected or underserved globally, representing a potential addressable market for FWA globally.

- 1. Unconnected:** out of the 2.1 billion households globally in 2023 (Strategy Analytics), there are over 800 million that are still unconnected, lacking fixed broadband connectivity. Many of these households are today covered with LTE and, in the future, with 5G.
- 2. xDSL replacement:** there are around 220 million xDSL connections with speed limitations and future-proofness, and many service providers have already started to discontinue these services. FWA is an efficient and scalable alternative to wired connections, particularly in less densely populated areas.
- 3. Fiber challenger:** given the high upfront investments for fiber roll-out, there are various locations with only one provider. Some service providers utilize 5G FWA as a cost-efficient and fast alternative to bring competition to these markets.
- 4. Cutting cable:** an opportunity driven by three trends. First, some service providers target legacy cable areas with high-speed FWA offerings. Another approach is to target cable users with cheaper offers or broadband-only offerings, as many consumers prefer to access content such as streaming services over the top. Last, FWA can provide a competitive alternative for locations where cable is the only available broadband alternative
- 5. Secondary homes:** many people want broadband connectivity for leisure and work at their vacation/holiday homes. For example, Sweden has over 600,000 cottages (around 12 percent of permanent homes), and there are more than 4 million recreational homes in the US (US census).
- 6. Small and medium businesses:** connectivity plays an important role for enterprises, and FWA can address primarily connectivity-only solutions for medium and small premises.



# Broadband households by 2029



The chart shows a forecast of how household broadband needs will be met by a variety of technologies in 2029.

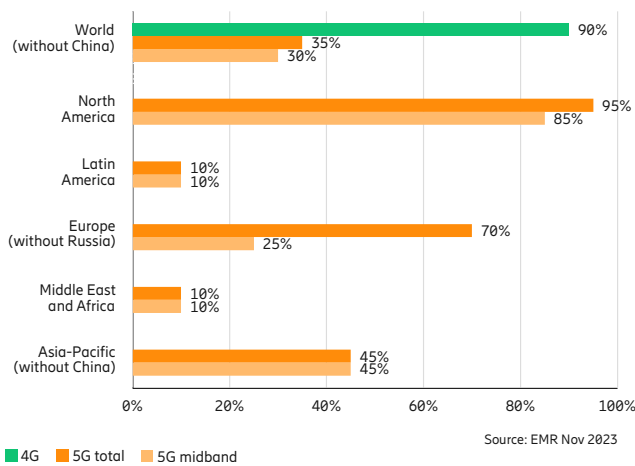
3GPP technologies will have a considerable population and household coverage by 2029. For instance, LTE is forecast to reach over 95 percent of population and household coverage, while 5G is expected to cover around 85 percent of the world's population by 2029 (Ericsson, 2023). The vast potential household coverage creates an excellent opportunity for mobile service providers to deliver FWA services on top of their existing MBB offerings.

Regarding fixed broadband, including FWA, approximately 75 percent of all households will have to have a copper, cable, fiber, or FWA connection in 2029. In many markets, building such broadband infrastructure much further is not economically viable. The forecast of over 330 million FWA connections by the end of 2029 represents over one billion individuals having access to broadband over a wireless connection. Based on ITU data, we estimate that around 25 percent of households will still be unconnected in 2029.

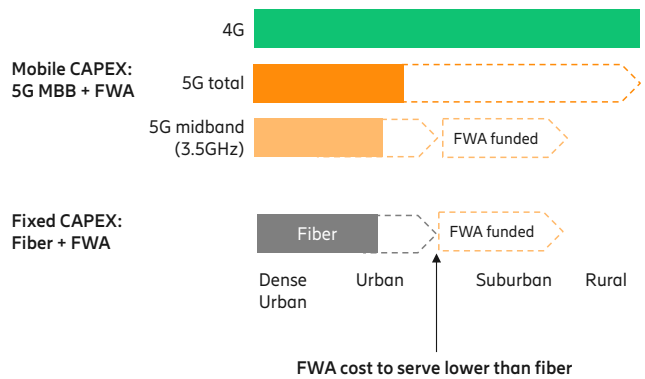


# FWA to drive 5G mid-band roll-out outside large cities

4G and 5G population coverage (end of 2023)



Technology agnostic capex allocation (European example)



## Opportunity to drive 5G mid-band coverage outside large cities with FWA

On a global scale, 4G population coverage reached about 90 percent of the population by the end of 2023. In North America and Europe, many countries are above 95 percent, while some countries in emerging markets are above 70 percent. For 5G coverage, the development is more varied. In North America and parts of Asia (e.g., China, South Korea, and Japan), total 5G coverage and mid-band coverage grew hand in hand, with the US reaching 90 percent of 5G mid-band coverage by the end of 2023.

Europe has a large 45 percent population coverage gap for the 5G mid-band. Total 5G coverage in Europe reached 70 percent

of population coverage, driven primarily by deployment of lower spectrum bands such as 700 MHz. High-capacity 5G mid-band spectrum (e.g., 3.5 GHz) deployments are concentrated to large cities, therefore reaching only 25 percent of population coverage. FWA can narrow this gap by driving 5G mid-band deployment outside cities in Europe, which is an approach that can be replicated in other regions.

## Technology agnostic capital allocation approach

Service providers with a holistic capital allocation approach can determine – at a detailed local level – where it is more suitable to deploy fiber or FWA. This enables them to optimize the delivery cost per home, identifying the breaking point for FWA instead of fiber. As a result,

more homes can be served with the same capex investment. Moreover, by leveraging FWA, service providers can achieve faster coverage, deterring competitors from making fiber investments in the same area. Such a broad approach may also include the use of government subsidies, perhaps including a mix of fiber and FWA to meet service obligations. The main benefits of this approach include:

- Lowest capex per home for high-speed broadband using fiber or 5G FWA.
- Fast time to market with FWA.
- Mobile site synergies with capacity configured for FWA and MBB, with one-site visit (first time right).
- Improved MBB experience in suburban and rural areas as consumers also get mid-band coverage.

# Three main advantages over fiber

## 1. Time to market

- Fiber roll-out is time consuming
- Fast time to market with FWA

## 2. Financial attractiveness

- Fiber build-out is capital intense with lower ROI outside dense urban areas
- FWA has light investment profile with lower risk

## 3. Re-use

- Fiber build is resource-intensive
- FWA reuses existing site infrastructure
- 5G enables service providers to have one network for multiple services, including MBB, FWA and IoT

Many service providers view FWA and fiber as their future fixed technologies, replacing legacy fixed technologies and bringing access to unconnected homes and businesses. FWA deployments have three main advantages over fiber deployments: time to market, financial investment profile, and reuse of mobile infrastructure.

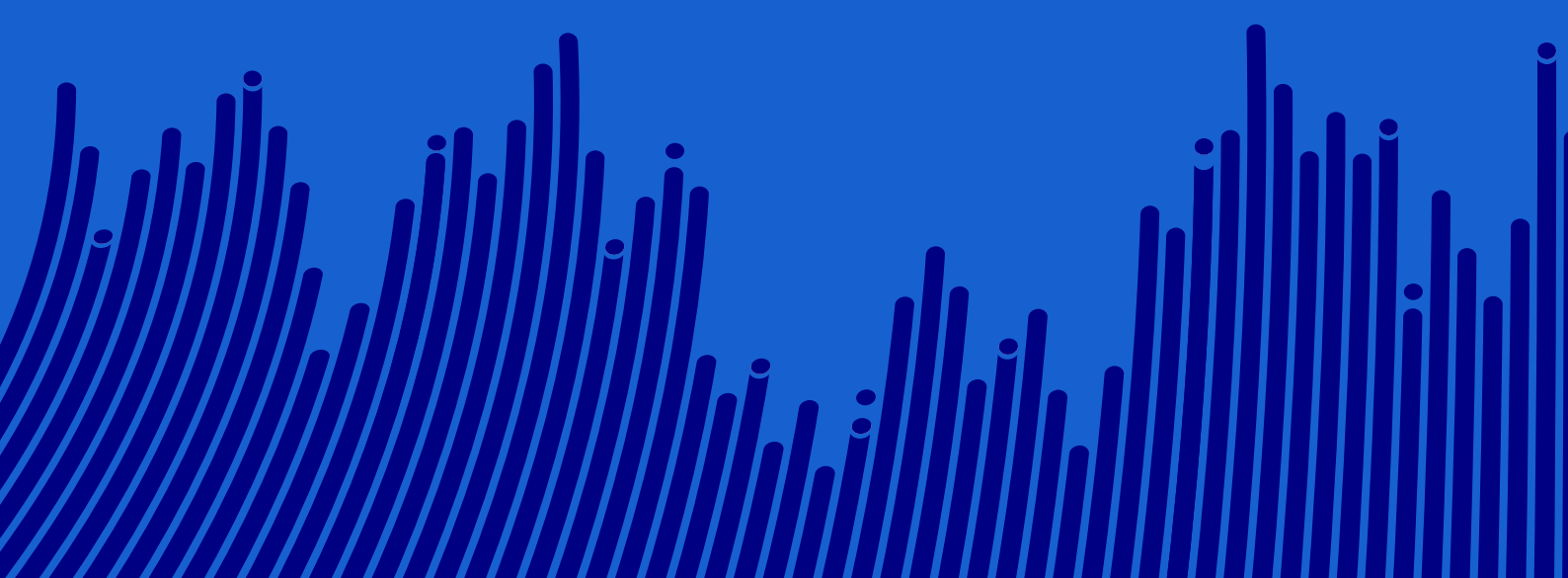
First, FWA has a shorter time to market than fiber. FWA leverages existing mobile network infrastructure, utilizing spare capacity and already-acquired but undeployed spectrum. Once that capacity is utilized, new capacity can be added to existing sites through software upgrades or additional new hardware – meaning there is no immediate need to build new sites. Conversely, building out fiber is a much longer process, often requiring permits and civil works to dig fiber. FWA deployment on customer premises is also typically

faster than fiber deployment. Fiber always requires home activation on-site, while FWA can be deployed through self-installation in most cases.

FWA also has a more attractive investment and risk profile than fiber. Fiber build-out is a capital-intensive process, with most of the investment made up-front (that is, before signing up customers and earning revenues). At the same time, the investment returns diminish as fiber deployments move away from dense urban areas and fewer homes are served per kilometer of fiber. As a comparison, Norway is offering subsidies for FWA-connected rural homes in the range of USD 1000. In contrast, Sweden has provided subsidies for fiber-connected rural homes that are five times higher, i.e., USD 5300. Notably, these countries have high fiber penetration, and these subsidies relate to rural areas.

FWA has a lighter investment profile, with lower initial investment (if any, when spare capacity is utilized) and investment scaling in line with subscriber growth. Moreover, capacity investments for FWA can be shared with other mobile network services, resulting in lower risk. Even if there is no uptake of FWA services, the service provider can still use that capacity for other services, including MBB and IoT.

Finally, FWA deployments reuse existing infrastructure. FWA reuses main sites and towers already built, with most upgrades performed without site visits (unless new hardware is required). On the other hand, fiber build-out is resource-intensive, requiring construction, often with excavation and transportation of resources, including site visits to customer premises.



# Growing opportunity for xDSL replacement

There are several reasons FWA is of growing interest as a DSL replacement.

First, even with developments to increase the broadband speeds offered by copper-based networks, speeds are reduced as the distance between the home and the first aggregation point increases. As a result, these networks need to be upgraded. FWA offers a very effective DSL replacement, especially in areas with low household density (such as rural areas), where fiber build-out is costly.

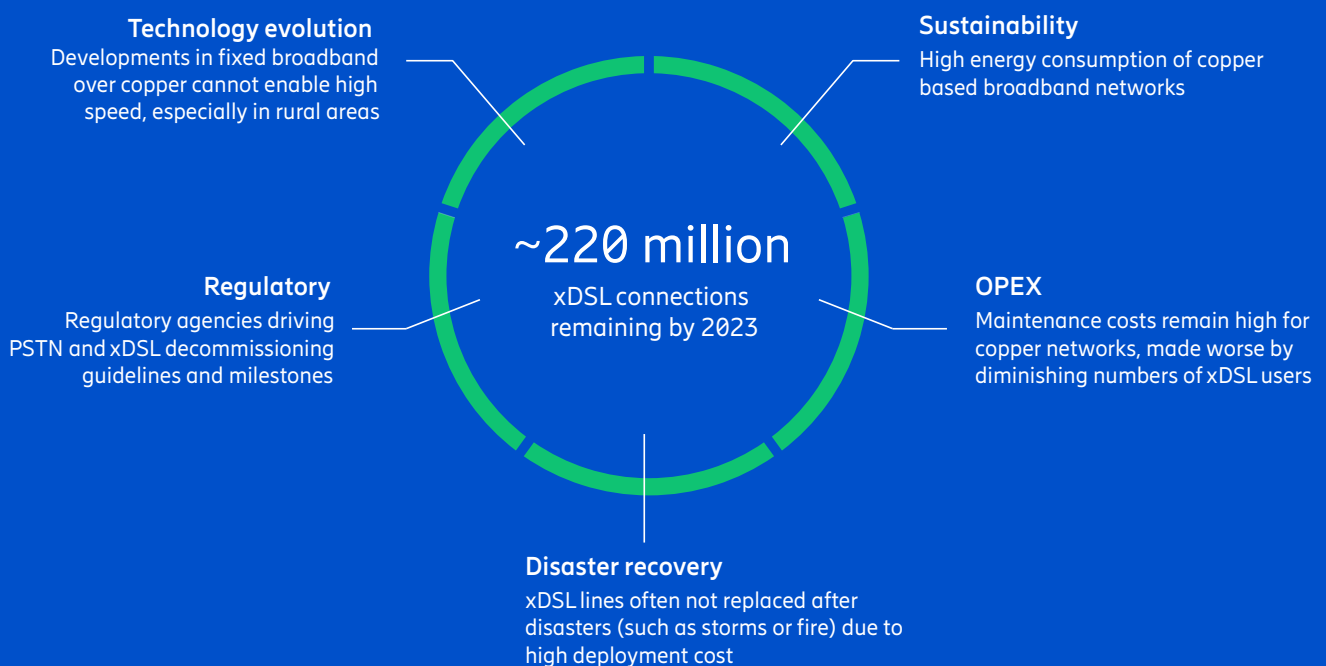
Second, most incumbent service providers worldwide plan to decommission existing legacy copper networks. For instance, in Europe, more than a dozen

countries have announced plans to consider decommissioning in the next decade, with a handful of service providers successfully implementing copper sunset projects. Some markets like Singapore, Norway, and the island of Jersey have already achieved 100 percent decommissioning of their legacy copper networks. Other markets like Denmark, Sweden, Spain, Portugal, Estonia, and the Netherlands, among others, have active programs in place to accelerate copper decommissioning (Arthur D Little, 2021). Some of these markets are driven by regulatory conditions. In contrast, others are driven by economic conditions, as maintenance and operational costs remain

stable while the number of copper-based subscribers falls steadily.

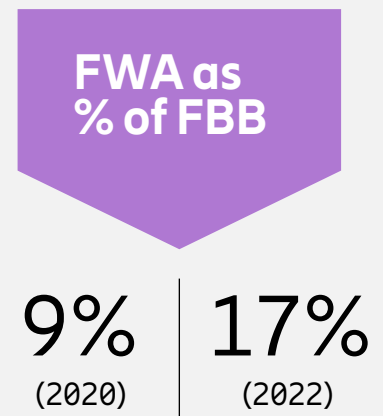
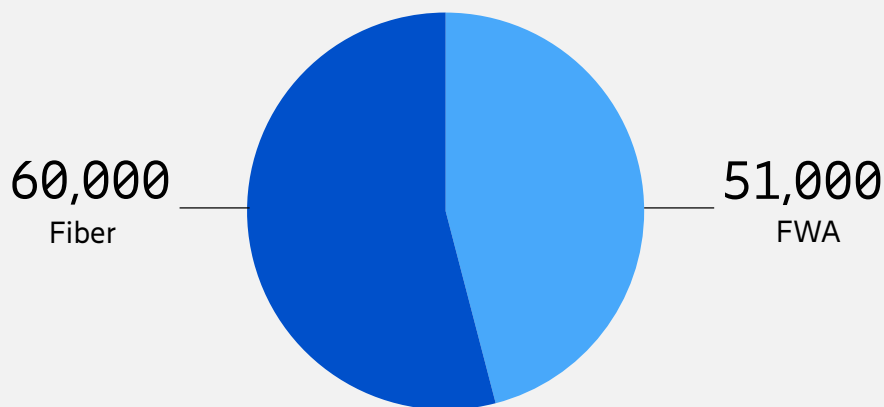
Third, some service providers are not replacing copper networks after damage caused by storms, fires, floods, and earthquakes. It is increasingly common for service providers to rebuild these networks with newer technologies such as fiber and FWA.

Finally, decommissioning copper-based networks is likely the largest sustainability opportunity for fixed broadband service providers. As the energy consumption of xDSL-based networks is very high, decommissioning with efficient technologies is a key part of sustainability initiatives.



# DSL decommissioning by Telenor Norway

## Fixed Broadband (FBB) Net Adds (past 2 years – to 4Q22)



### Challenge – decommissioning of 18 percent of broadband connections

Copper networks are unable to meet the need for speed, stability, and capacity for broadband services. They have high operating costs due to high power consumption, faults, customer churn, and maintenance costs. Many of the remaining 18 percent (136,000) DSL lines are in rural areas, where replacement costs with fiber increase significantly.

### Solution – a mix of 5G FWA and fiber

Copper-based broadband (DSL) replaced with a mix of fiber and Fixed Wireless Access (FWA). Telenor and Ericsson partnered to deploy 5G with commercial launch in 2020. Telenor added 51,000 FWA and 60,000 fiber broadband connections in the past two years.

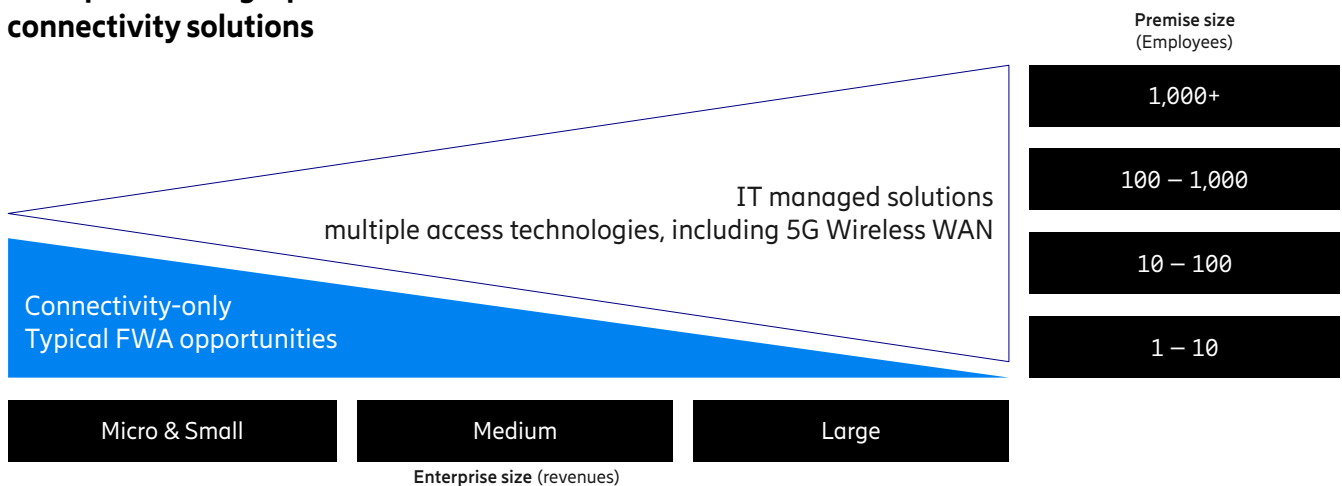
### Result – major savings in maintenance and electricity costs

Telenor's copper network has accounted for approximately half of the electricity consumption of Telenor's infrastructure. With the decommissioning of all its customers on the copper network in December 2022, Telenor will have major savings in maintenance and electricity costs. In connection with the clean-up of the copper grid, Telenor has, by the end of October 2023, been able to turn off electricity, corresponding to an annual consumption of 21 GWh. This is as much as the average annual consumption for 1050 Norwegian detached houses. Most energy savings come from power cuts on tele-technical equipment at the largest control panels. The remaining wholesale customers on the copper network will continue with services for decommissioning by 2025.

# Business connectivity – the role of FWA in different enterprise segments

Targeting the enterprise market with FWA solutions means understanding the market opportunity being addressed, taking into account businesses' wide diversity of broadband needs. Business size (revenue), premises size, and number of employees per location are some basic parameters to consider.

## Enterprise demographics and connectivity solutions



Regarding the size of the business, it refers to the company revenues, which then relate to the presence and size of the workforce. The other dimension is related to the size of the premise that needs connectivity. Small and micro enterprises are typically only present in one location. Conversely, large enterprises have multiple premises, including a large headquarters with many employees, regional offices, and even local offices. The larger the enterprise, the more sophisticated IT systems and centralized and standardized solutions.

In addition to the size of the enterprise and premise, it is also important to

understand how company segments drive the usage of IT solutions and connectivity needs. For instance, some retail branch offices (such as small stores or fast-food outlets) may require connectivity only for payment, inventory management, and facilities management (such as security), which have relatively low connectivity needs. On the other hand, IT-intensive service companies (such as gaming developers or design agencies) with high levels of cloud-based IT solutions will have much higher demands on connectivity. As a result, some market segments may want to procure integrated managed IT solutions,

which include connectivity as part of the offer (using multi-access solutions, encompassing wireline and wireless, to enable redundancy). This segment is called Wireless WAN and includes solutions such as Cradlepoint.

Regarding FWA for enterprise, the opportunity is typically for connectivity-only solutions, primarily addressing premises with fewer than 100 employees – micro, small, and medium businesses. Some service providers may include value-added services on top of connectivity-only solutions, including security, SD-WAN, and IT services (like Microsoft 365).





# Incentives to close the digital divide

Governments are fueling connectivity and broadband rollouts through various programs and subsidies, as there is a clear link between increased broadband penetration and economic growth (Ericsson and Imperial College London, 2017). There are several initiatives to close the digital divide, addressing issues such as infrastructure availability, affordability, digital literacy, and digital institutions (Harvard Business Review, 2021). Forward-thinking governments employ a technology-agnostic approach, permitting a mix of technologies to be deployed to address each of these issues as needed.

The USA has been a pioneer in connectivity programs, starting with the Connect America Fund (CAF I and CAF II) and recently expanded to Rural Digital Opportunity Fund (RDOF, USD ~20b), Broadband Equity, Access, and Deployment Program (BEAD, USD ~42 b) and Affordable Connectivity Program (ACP, USD ~14b).

Among these programs, incentive models include among them:

- Coverage incentive for high-speed broadband: cover specific addresses with high-speed broadband (using broadband definition) using reverse auction approach (i.e., lowest incentive) (CAF, RDOF, BEAD).
- Threshold for extremely high cost per location: incentivize the use of alternative technologies to fiber deployments in case subsidy cost per location exceeds an extreme high-cost threshold (BEAD).
- Subsidies for low-income households: address affordability barriers to broadband access by providing qualifying low-income households with a monthly discount of up to USD 30/month or up to USD 75/month for households residing on qualifying tribal lands (ACP).

Europe has a mix of initiatives at the local and central levels. In 2021, the European Commission (EC) presented the Path to the Digital Decade, setting out mechanisms for cooperation between EU institutions

and the Member States to ensure they jointly achieve the Digital Decade targets, objectives, and principles. The EC approved the Recovery and Resiliency Facility for post-COVID-19 economic support (Eur 17b for household gigabit and Eur 15 b for 5G coverage). Main tools include:

- Coverage incentive for high-speed broadband: cover specific addresses with high-speed broadband (using broadband definition) using reverse auction approach (i.e., lowest incentive) (RRF)
- Coverage incentive for high-speed broadband for schools and health care centers: cover specific schools and health care centers with high-speed broadband using reverse auction approach (i.e., lowest incentive) (RRF)
- Voucher to cover installation cost and/or CPE cost: incentive to cover CPE installation cost and/or CPE is included in the EU State Aid Guideline for Broadband, and a similar program was included in France. →

Norway has implemented a unique model to foster FWA deployment as part of its latest 5G spectrum auction. The District Development model was launched in conjunction with the 2.6 GHz and 3.6 GHz spectrum auction, where service providers could apply for spectrum auction discounts for providing 100/10 Mbps DL/UL connectivity to 62,000 premises (including homes, businesses, and schools) up to NOK 560 m. (NKOM 2021). The spectrum auction was completed in September 2021, with three winners (Telenor, Telia, and Altibox) committing to district development against spectrum auction discounts totaling NOK 480 m.

In Brazil, FWA deployment could be incentivized through local funding, such as the Telecommunications Services Universalization Fund (FUST), and through investment coverage obligations from the 5G auction. For instance, potential FWA projects could leverage up to USD 860m in loans from the Universalization Fund by 2026 for connectivity projects in rural

regions or shanty towns (favelas) covering infrastructure and FWA CPEs.

Another approach has been adopted in Australia, where the state-owned National Broadband Network (NBN) is building a fast, wholesale local access broadband network to connect the nation and bridge the digital divide. NBN's key objective is to ensure all Australians have access to fast broadband as soon as possible, at affordable prices, and at the lowest cost (NBN, 2019). It is worth noting that NBN is technology-agnostic and uses the technology most appropriate for the household or area – including fiber, FWA, and satellite, among others. A similar nationwide wholesale model has been launched in Malaysia, where the Government of Malaysia has mandated the Digital Nasional Berhad (DNB) to be the single neutral party to undertake nationwide deployment of 5G infrastructure and network to provide wholesale 5G coverage and capacity to other licensees.

## Variety of incentives to close the digital divide



### USA

- Coverage incentive for high-speed broadband for homes
- Promote alternative technology using threshold for extreme high cost per location
- Subsidy for low-income households



### Europe

- Coverage incentive for high-speed broadband for homes
- Coverage incentive for 5G FWA in conjunction with 5G spectrum auction
- Coverage incentive for connectivity for schools and healthcare centers
- Voucher to cover installation cost and/or CPE cost



### Brazil

- Coverage incentive for 5G FWA in rural areas and shanty towns
- Incentive for financing of infrastructure and gateways for 5G FWA



### Asia-Pacific

- Achieve universal service and competition by building one large shared wholesale network
  - Australia: nbn
  - Malaysia: DNB



# Connecting El Tortuguero National Park — Costa Rica

## Bridging the digital divide. Internet connectivity is trans- forming rural areas of Latin America.

FONATEL, Claro, and Ericsson bring universal telephony and internet access to Tortuguero and its neighboring rural communities in Limón, Costa Rica.

As an ecosystem, FONATEL, Claro, and technology providers like Ericsson have taken on the challenge of connecting the unconnected in rural and hard-to-reach areas to eliminate the digital divide in the region and bring digital transformation to all communities.

We have seen a significant improvement in access to education, an increase in the abilities of the community to reach beyond the city limits to attract more tourism, and an increase in entrepreneurial efforts.

“At Claro, we always look for initiatives that allow us to contribute to reducing the digital divide, generating a positive impact on local development. (...) All this is possible thanks to allies like Ericsson who contribute their knowledge, and thus, we can fulfill our purpose.”

— Seth Artavia, spokesperson for Claro Costa Rica.



**More than 15 schools  
connected and around  
4,000 habitants benefited.**

## The challenge

- Delivering high-speed connectivity to rural communities is technically and economically challenging.
- The area where Tortuguero is located is considered a rural area with little or no access to connectivity.
- Environmental and technological aspects: protected areas and sites where the towers were installed do not have access to the electricity grid.

## Solution:

- While millions of people continue to wait for access to efficient connectivity, FWA presents an efficient and scalable alternative to wired connections.
- By installing 12 radio site solutions, some of them solar powered to provide FWA and mobile services for an average coverage area of 1.2–2.0 km<sup>2</sup>.
- Using pre-existing radio technology, FWA provides the capacity to deliver high-speed connectivity services to previously underserved areas and communities.

## Impact

- Twelve radios were enabled and distributed in the area, connecting around 12 communities and 4,000 inhabitants, with better access to education, health services, financial services, innovation, information, among other benefits.
- **Changes people's lives:** the inhabitants carry out daily activities, many related to the tourism sector. This means that thanks to connectivity, local companies now have the opportunity to access more markets and new business models.
- **Education for the future:** 13 elementary and three junior high schools are now connected.

Learn more in six actionable  
insights on capturing the  
value of 5G FWA

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