GSMA Intelligence

The 5G FWA opportunity

A scenario for Southeast Asia

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Executive summary

About this research

In this report, we focus on the opportunity for mobile network operators (MNOs) and internet service providers (ISPs) in Southeast Asia to provide 5G fixed wireless access (FWA) services. We start with an overview of the state of the fixed broadband market in the region and then use our unique total cost of ownership (TCO) model to show under what conditions 5G FWA would be a cost-effective alternative to fibre to the home (FTTH) for providing download speeds of at least 100 Mbps.

We focus on three area types (an urban area, suburban area and rural town) over a 10-year period. The area types have been constructed using real-world data on surface area and population, buildings and road density.

In Figure 1, we compare the TCO of FTTH with the TCO of a 5G FWA network according to three different scenarios:

- a 5G mmWave FWA network for an MNO with an existing 5G network [1]
- a 5G mid-band plus mmWave FWA network for an MNO with an existing 5G network[2]
- a greenfield 5G mmWave FWA network for an ISP.[3]

1 Assuming the MNO holds 40 MHz of mid-band spectrum and 400 MHz of mmWave spectrum.
2 Assuming the MNO holds 100 MHz of mid-band spectrum and 400 MHz of mmWave spectrum.
3 Assuming the ISP holds 400 MHz of mmWave spectrum.

These scenarios are relevant to mobile-only operators considering providing a new fixed broadband alternative, and converged operators or ISPs considering entering new markets or upgrading their networks in underserved areas.

We provide several sensitivity checks, including alternative CPE strategies, different spectrum assignment profiles and changes in the cost of building the underlying fibre infrastructure.

Key findings

Average fixed broadband penetration in Southeast Asia is about a third of the penetration seen in countries such as the US and UK, with significant growth in the market expected. In this context, 5G FWA can help drive first-time adoption of broadband with speeds comparable to FTTH but with reduced time to market. Countries in the region can therefore reap the socioeconomic benefits of increased broadband adoption and faster broadband speeds earlier than would occur with FTTH rollouts.

Operators in the region that have rolled out 5G have an opportunity to maximise the value of their assets by providing 5G FWA along with 5G mobile to connect new fixed customers and drive incremental revenues. Those with limited sub-6 GHz assets can generally consider a 5G mmWave FWA network cost-efficient versus FTTH where new ducts or poles have to be built to deploy fibre cables. Those with reasonable sub-6GHz assets can consider a 5G mid-band plus mmWave network to be cost-effective in more instances – even where fibre cables can be deployed in ducts or poles that can be rented or shared.

ISPs can typically expect a greenfield 5G mmWave FWA network to be cost-effective versus FTTH where the cost of building the underlying fibre infrastructure involves the need to build new ducts. This is particularly relevant in rural towns where ducts or poles that can be shared or rented are not generally available. It is also relevant in urban and suburban areas suffering from difficult terrain and/or regulatory red tape.

- MNOs deploying 5G mmWave FWA can expect cost savings of up to 55% versus FTTH in rural towns, 40% in suburban areas and 30% in urban areas where ducts or poles to deploy fibre cables need to be built by the MNO. FTTH is generally cost-effective where ducts or poles for fibre cables can be rented or shared from another provider or local authority.

- MNOs assessing a mid-band plus mmWave 5G FWA deployment strategy can expect it to be up to 80% more cost-effective than FTTH in rural towns, 65% in suburban areas and 50% in urban areas, where the underlying underground or overground fibre infrastructure is not available to rent or share. Where it is available to rent or share, mid-band plus mmWave 5G FWA can deliver cost savings of up to 40% in rural towns and suburban areas and 25% in urban areas.

- ISPs considering a greenfield 5G mmWave FWA deployment strategy can expect cost savings of 45% versus FTTH in rural towns and suburban areas, and 25% in urban areas, where new ducts to deploy fibre cables need to be built. Where new aerial poles need to be built to deploy fibre cables, it would cost approximately as much as FTTH, making 5G FWA a potentially attractive option in areas served by a single FTTH provider.

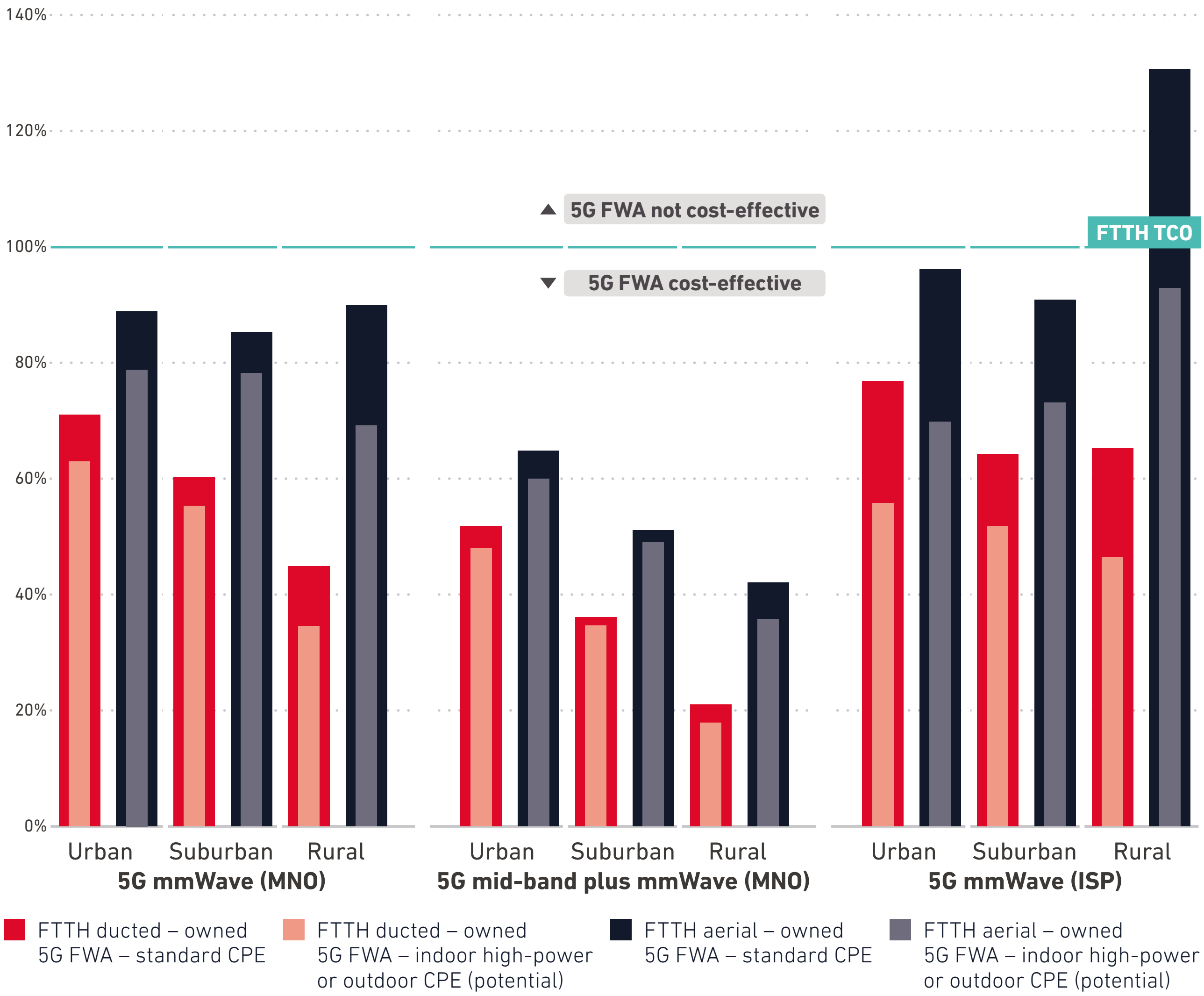
Our baseline scenario is based on the most common network configuration in the market today, with transmitters connecting with subscribers equipped with standard, self-mounted indoor CPE. We also examine the potential impact of adopting three alternative CPE solutions: rooftop-mounted antennas; high-power, self-mounted indoor CPE; and a scenario involving equipping multi-dwelling buildings where possible with a single rooftop-mounted CPE unit, which requires a truck roll but saves on the amount of CPE deployed.

- Deploying high-power CPE can improve cost savings in urban and suburban areas by up to 10 percentage points for MNOs and up to 25 percentage points for ISPs.
- A hybrid approach that involves providing subscribers located far away from base stations with outdoor antennas, and the remainder with indoor CPE, can improve the cost-effectiveness of 5G FWA versus FTTH by up to 10 percentage points for MNOs and up to 20 percentage points for ISPs.
- A further approach that involves multi-dwelling buildings with a single CPE unit serving multiple subscribers, and the remainder with standard indoor CPE, can improve cost savings in urban and suburban areas by up to 20 percentage points for MNOs and 35 percentage points for ISPs.

Finally, when we assume more mmWave and mid-band assets, cost savings improve in the high traffic demand scenarios.

Figure 1

Southeast Asia: net present value (NPV) of 5G FWA TCO as a percentage of NPV of FTTH TCO, according to baseline assumptions



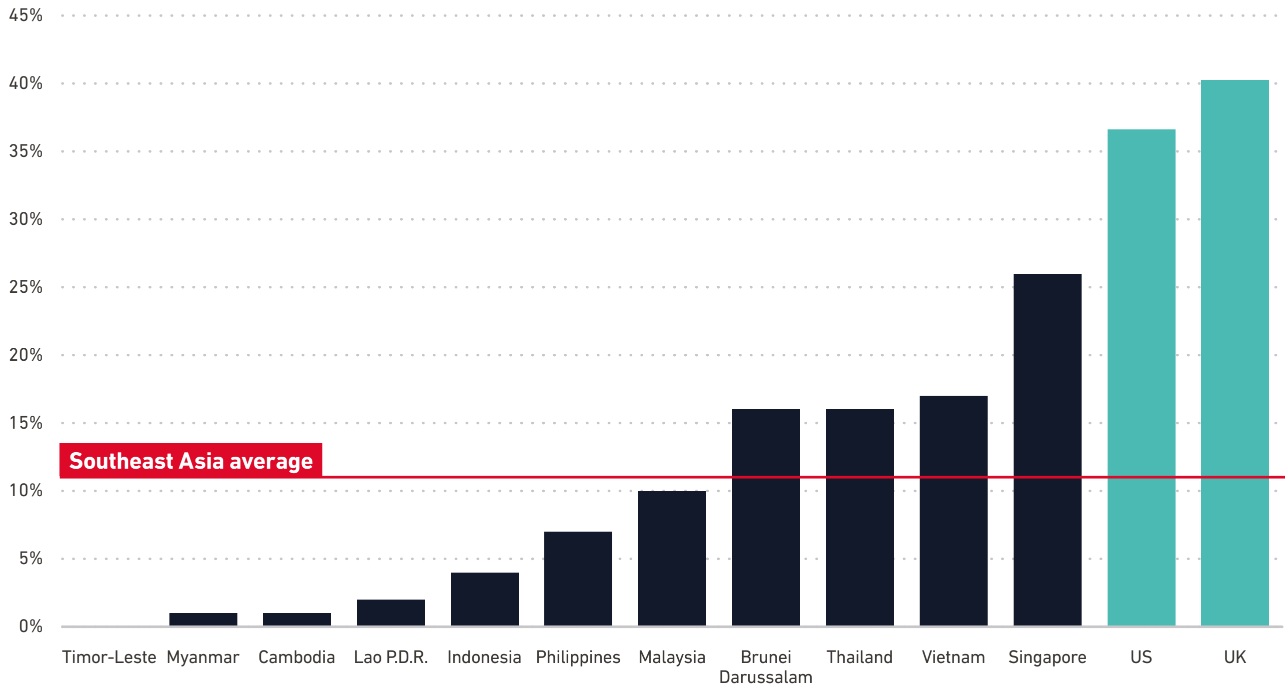
Main assumptions: 85% DL share of total residential traffic, self-mounted indoor CPE, 1:32 fibre cables split ratio, baseline data consumption growth, 30% market share, 10% busy hour share of traffic.
Source: GSMA Intelligence analysis

1 Market context

Figure 2 shows fixed broadband subscriptions as a percentage of the total population for each country in Southeast Asia. While fixed broadband penetration varies widely within the region and is strongly correlated with income levels, the regional average stands at about a third of countries such as the US and the UK, so we expect significant growth in the region.

Figure 2

Fixed broadband subscribers as a share of total population, end of 2020



Source: ITU

In Southeast Asia, 5G FWA can help drive first-time adoption of broadband and boost the user experience in underserved areas. At least one operator in each country of the region, except Vietnam and Brunei Darussalam, offers FWA services. Most operators offer LTE FWA, with 5G FWA the next natural step to improving fixed broadband experiences. An example here is Globe Telecom in the Philippines; it is the first operator to launch a 5G FWA network in Southeast Asia, targeting the urban middle class and offering download speeds of up to 100 Mbps. Other recent 5G FWA launches include those from Dito and Smart in the Philippines, Telkomsel in Indonesia, and TrueMove and AIS in Thailand. GSMA Intelligence forecasts 5G FWA connections in the Philippines, Indonesia and Thailand will reach approximately 5.5 million by the end of 2025.

Since 5G services have been launched in most countries in Southeast Asia and mid-band spectrum assignments for 5G services vary significantly across the region, both the 5G mmWave FWA scenario and the 5G mid-band plus mmWave FWA scenario are relevant to MNOs in the region.[4]

4 For instance, in Singapore, operators on average have 50 MHz of mid-band spectrum and 800 MHz of mmWave spectrum. In the Philippines, operators on average have 80 MHz of mid-band spectrum, while mmWave spectrum is yet to be assigned. In Thailand, operators have an average of 60 MHz of mid-band spectrum and 800 MHz of mmWave spectrum. In Indonesia, the 3.5 GHz band is yet to be assigned and operators are relying on the 1800 MHz band for 5G services, with 25 MHz on average (source: GSMA Intelligence).

2 The TCO model

We compare the costs of FTTH with those for 5G FWA, according to three scenarios:

- A 5G mmWave FWA network for an MNO with existing 5G services, assuming the MNO holds 40 MHz of mid-band spectrum and 400 MHz of mmWave spectrum. This scenario involves leveraging existing site locations to the maximum extent and mmWave spectrum for coverage and capacity.
- A 5G mid-band plus FWA network for an MNO with existing 5G services, assuming the MNO holds 100 MHz of mid-band spectrum and 400 MHz of mmWave spectrum. This scenario involves leveraging existing site locations to the maximum extent, mid-band spectrum for coverage and initial capacity, and deploying mmWave equipment where and when needed, as traffic demand exceeds supply.
- A greenfield 5G mmWave FWA network for an ISP with no wireless infrastructure, assuming the ISP holds 400 MHz of mmWave spectrum. This scenario involves the greenfield deployment of mmWave-enabled base stations for coverage and capacity.

In our model, we evaluate the TCO of each deployment strategy compared to the TCO of FTTH according to different deployment modes (in order of increasing cost):

- **ducts – rented:** fibre cables are deployed underground in existing ducts rented from a utility provider or local authority
- **aerial – rented:** fibre cables are deployed overground using existing poles rented from a utility provider or local authority
- **aerial – owned:** fibre cables are deployed overground, with the poles built by the operator
- **ducts – owned:** fibre cables are deployed underground in ducts, with the ducts deployed and owned by the operator.

The choice of deployment mode depends on factors specific to each local area. Ducts or poles that can be shared or rented may not be available, particularly in rural areas and some suburban areas. Certain terrain can make the cost of trenching prohibitive, while overground deployment is less reliable than underground deployment since it exposes cables to external forces; areas that are prone to harsh climate events are not well suited to this type of deployment. Finally, operators are usually constrained in their deployment choice by local authorities, who generally prefer one deployment type over another.

3 Main results

We find that 5G FWA can in many instances be a suitable solution to help reduce the digital divide and improve user experiences in rural towns and urban and suburban areas in Southeast Asia.

MNOs with limited mid-band assets can consider a 5G FWA network where coverage and capacity needs are provided by mmWave spectrum to be cost-effective versus FTTH where the deployment of fibre cables requires building new ducts or poles. This is generally the case in rural towns but also in urban and suburban areas suffering from difficult terrain and/or regulatory red tape.

MNOs with reasonable mid-band assets that are planning to initially leverage mid-band spectrum for capacity and coverage, and place mmWave equipment where and when traffic demand exceeds supply, can expect sizable cost savings in all three area types where new ducts or poles to deploy fibre cables need to be built by the operator. They can also expect moderate cost savings where fibre cables can be deployed in ducts or poles that can be rented or shared and the MNO cannot avoid the cost of in-premises wiring.

Where fibre cables can be deployed in ducts or poles that can be shared or rented, the FTTH TCO is significantly lower than where they need to be built by the operator. In the former case we assume, however, that the operator would incur the cost of buying and pulling fibre cables plus the costs associated with connecting each premises with the distribution network, including the CPE, optical network terminal (ONT) and cost of wiring the premises. In densely populated areas, in-premises wiring represents a significant share of the FTTH TCO. If in-premises wiring can be avoided in urban and suburban areas, FTTH would be more cost-effective than 5G mid-band plus mmWave FWA.

ISPs looking at a greenfield 5G mmWave FWA deployment to complement their wireline networks or upgrade legacy infrastructure can expect it to be cost-effective versus FTTH where new underground ducts need to be built to deploy fibre cables. Where new aerial poles for fibre cables need to be built, a greenfield 5G mmWave FWA network would cost approximately as much as FTTH.

An important factor that cost models do not generally capture is the opportunity cost of the longer time to market associated with FTTH deployments. ISPs and MNOs should consider this when assessing the different deployment strategies. They should also consider the first-mover advantage that arises when faster broadband options initially become available in underserved areas. 5G FWA's faster time to market means service providers can deploy improved broadband before the arrival of FTTH, appealing to potential subscribers eager for improvements in network performance.

4 Sensitivities

In our model, the precise value of cost savings that can be delivered by 5G FWA depends on several factors. Three areas are outlined below:

- traffic
- civil works
- CPE strategy, spectrum assignments and performance requirements.

Traffic

FTTH can generally support more traffic than 5G FWA, making 5G FWA less cost-effective than FTTH for the highest traffic demand scenarios. The 5G mid-band plus mmWave FWA scenario is more sensitive to higher levels of traffic demand than the other two scenarios. The higher bandwidth of mmWave spectrum supports much more traffic than the mid-bands.

In our baseline case, we assume that data consumption continues to grow according to past growth rates ("baseline data consumption growth"); we set a target market share at the end of the period at 30%; and we assume that the busy hour share of traffic stands at 10% for residential customers. Keeping data consumption growth constant, the higher the busy hour share of traffic and operator market share, the lower the 5G FWA cost savings, as more mmWave-enabled base stations would need to be deployed to support higher levels of traffic in the network.

Table 1 shows the levels of market share and busy hour share where 5G FWA would be cost-effective in a rural town, urban area and suburban area in Southeast Asia.

- Where fibre cables need to be deployed underground in ducts or trenches built by the operator, 5G FWA is cost-effective in all scenarios where the busy hour share of traffic is at 10% and market share is below 40%.

- Assuming fibre cables are deployed overground on poles built by the operator, a 5G FWA network would be cost-effective for MNOs adopting the mmWave-only approach at 10% busy hour share of traffic and market share below 40%, and for those adopting the mid-band plus mmWave approach even where market share stands at 50% and busy hour share is at 10%.

- If fibre cables can be deployed using existing ducts or poles that can be shared or rented, 5G mid-band plus mmWave is cost-effective assuming 20% busy hour share and market share below 50%. It is also cost-effective in urban and suburban areas where the busy hour share of traffic stands at 10% and market share is below 20%. FTTH is cost-effective in other instances.

- The use of high-power, self-mounted indoor CPE or the hybrid approach involving the use of outdoor antennas or CPE for premises further away from base stations (and standard indoor CPE for the remainder) can improve cost savings and make 5G FWA cost-effective in more instances.

Table 1

Southeast Asia: 5G FWA TCO versus FTTH TCO by market share, busy hour share of traffic and deployment mode

			RURAL TOWN				SUBURBAN AREA				URBAN AREA			
			Owned civil infrastructure		Rented or shared civil infrastructure		Owned civil infrastructure		Rented or shared civil infrastructure		Owned civil infrastructure		Rented or shared civil infrastructure	
	Market share	Busy hour share	Ducted	Aerial	Ducted	Aerial	Ducted	Aerial	Ducted	Aerial	Ducted	Aerial	Ducted	Aerial
5G mmWave FWA (MNO)	10%	10%	■	■	□	□	■	■	■	■	■	■	■	■
		15%	■	■	□	□	■	■	■	■	■	■	■	■
		20%	■	■	□	□	■	■	■	■	■	■	■	■
	20%	10%	■	■	□	□	■	■	■	■	■	■	■	■
		15%	■	■	□	□	■	■	□	□	■	■	□	▨
		20%	■	■	□	□	■	■	□	□	■	■	□	□
	30%	10%	■	■	□	□	■	■	□	□	■	■	□	□
		15%	■	■	□	□	■	■	□	□	■	▨	□	□
		20%	■	■	□	□	■	▨	□	□	■	□	□	□
	40%	10%	■	■	□	□	■	■	□	□	■	■	□	□
		15%	■	■	□	□	■	□	□	□	■	□	□	□
		20%	■	▨	□	□	■	□	□	□	▨	□	□	□
	50%	10%	■	■	□	□	■	□	□	□	■	□	□	□
		15%	■	▨	□	□	■	□	□	□	□	□	□	□
		20%	■	▨	□	□	■	□	□	□	□	□	□	□
5G mid-band plus mmWave FWA (MNO)	10%	10%	■	■	■	■	■	■	■	■	■	■	■	■
		15%	■	■	■	■	■	■	■	■	■	■	■	■
		20%	■	■	■	■	■	■	■	■	■	■	■	■
	20%	10%	■	■	■	■	■	■	■	■	■	■	■	■
		15%	■	■	■	■	■	■	■	■	■	■	■	■
		20%	■	■	■	■	■	■	■	■	■	■	■	■
	30%	10%	■	■	■	■	■	■	■	■	■	■	■	■
		15%	■	■	■	■	■	■	■	■	■	■	■	■
		20%	■	■	■	■	■	■	■	■	■	■	■	■
	40%	10%	■	■	■	■	■	■	■	■	■	■	■	■
		15%	■	■	■	■	■	■	■	■	■	■	■	■
		20%	■	■	■	■	■	■	■	■	■	■	■	■
	50%	10%	■	■	■	■	■	■	■	■	■	■	■	■
		15%	■	■	■	■	■	■	■	■	■	■	■	■
		20%	■	■	■	■	■	■	■	■	■	■	□	■
5G mmWave FWA (ISP)	10%	10%	■	▨	□	□	■	■	▨	▨	■	■	▨	▨
		15%	■	▨	□	□	■	■	▨	▨	■	■	▨	▨
		20%	■	▨	□	□	■	■	▨	▨	■	■	▨	▨
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	30%	10%	■	▨	□	□	■	■	▨	▨	■	▨	▨	▨
		15%	■	▨	□	□	■	▨	▨	▨	■	▨	▨	▨
		20%	■	▨	□	□	■	▨	▨	▨	■	▨	▨	▨
	40%	10%	■	▨	□	□	■	▨	▨	▨	■	▨	▨	▨
		15%	■	▨	□	□	■	▨	□	▨	■	▨	▨	▨
		20%	■	▨	□	□	■	▨	□	▨	■	▨	▨	▨
	50%	10%	■	▨	□	□	■	▨	□	□	■	▨	□	▨
		15%	■	▨	□	□	■	▨	□	□	■	▨	□	□
		20%	■	▨	□	□	■	▨	□	□	■	▨	□	□

■ 5G FWA cost-effective ▨ 5G FWA cost-effective - high-power or outdoor CPE (potential) □ FTTH cost-effective

Main assumptions: 85% DL share of total residential traffic, 1:32 fibre cables split ratio.
Source: GSMA Intelligence

Civil works

Our research highlights considerable variation in the costs incurred in deploying civil infrastructure (ducts or poles) to support FTTH networks. Aside from whether the infrastructure can be shared or rented, variation is driven by factors such as the characteristics of the terrain (e.g. rocky versus sandy, flat versus uneven), the cost of obtaining local permits, the cost of labour in the area, and the choice of duct size. We have looked at different values of these costs to understand under what conditions a 5G FWA deployment would be cost-effective.

MNOs looking to deploy a 5G mmWave FWA network can expect it to be cost-effective, for instance, where market share is at 35% and civil works costs are above $25,000 per kilometre or where market share is at 40% and civil works costs are above $30,000 per kilometre.

MNOs considering a 5G mid-band plus mmWave FWA deployment strategy can expect it to be cost-effective where civil works costs are above $5,000 per kilometre and market share is at 50%. Assuming the operator is able to leverage existing in-premises wiring for fibre cables, it would be cost effective, for instance, where civil works costs are above $5,000 per kilometre and market share is at 20%.

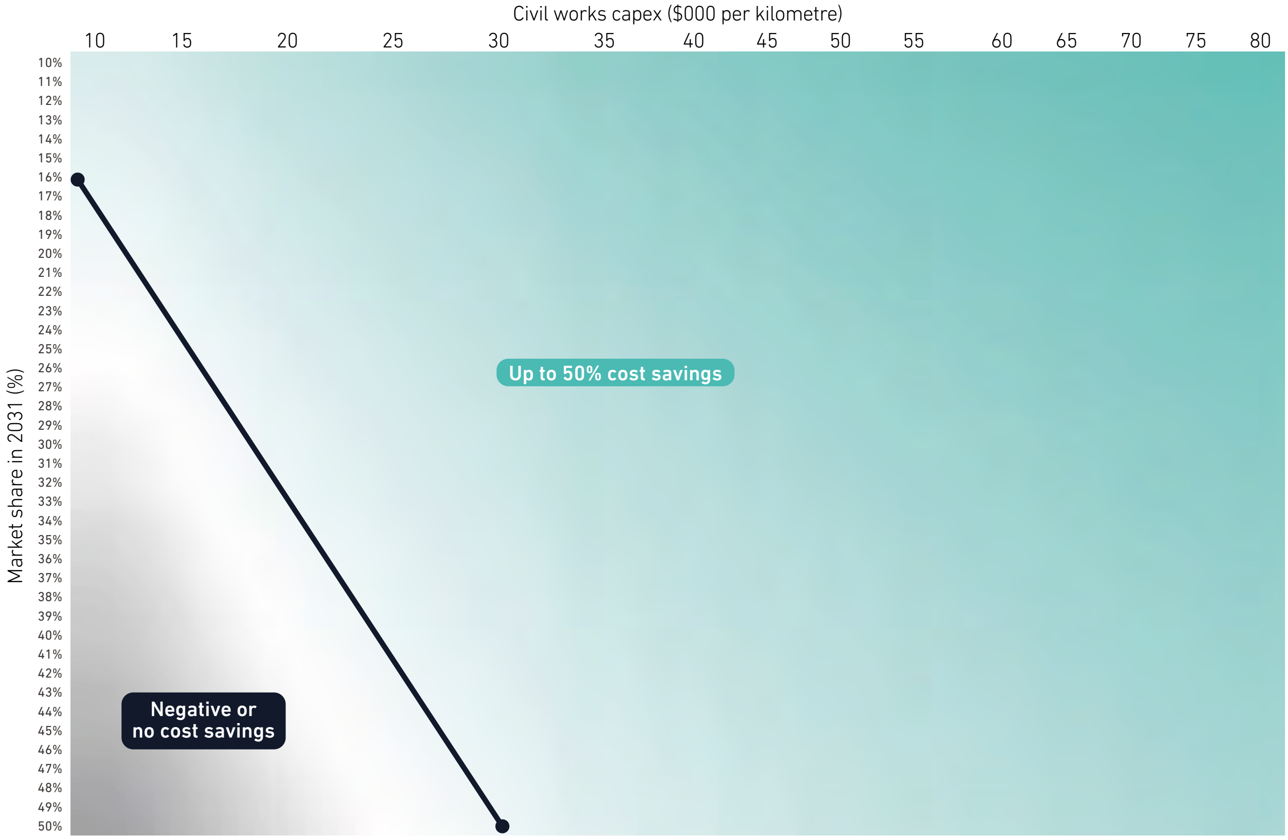
ISPs looking at a 5G mmWave FWA deployment can expect it to be cost-effective where market share stands at 50% and civil works costs are above $50,000 per kilometre, or where market share stands at 40% and civil works costs are above $40,000 per kilometre.

In some areas, civil works capex can be much higher, because of difficult terrain and/or regulatory red tape. Assuming civil works capex stands at $80,000 per kilometre or above, 5G FWA would be cost effective in any scenario at any level of market share.

Figure 3 presents the expected cost savings for an MNO deploying a 5G mmWave FWA network according to different values of civil works capex and market share in a suburban area in Southeast Asia. While the relative changes are different in the other scenarios, changes in civil works capex and market shares have a similar impact.

Figure 3

Cost savings for an MNO deploying a 5G mmWave FWA network according to different values of civil works capex and market share, for a suburban area in Southeast Asia



Main assumptions: existing 5G network, 400 MHz in the 26–28 GHz band, 85% DL share of total residential traffic, standard, self-mounted indoor CPE, 1:32 fibre cables split ratio.
Note: civil works opex is reduced proportionally to the percentage reduction in baseline civil works capex.
Source: GSMA Intelligence analysis

CPE strategy, spectrum assignments and performance requirements

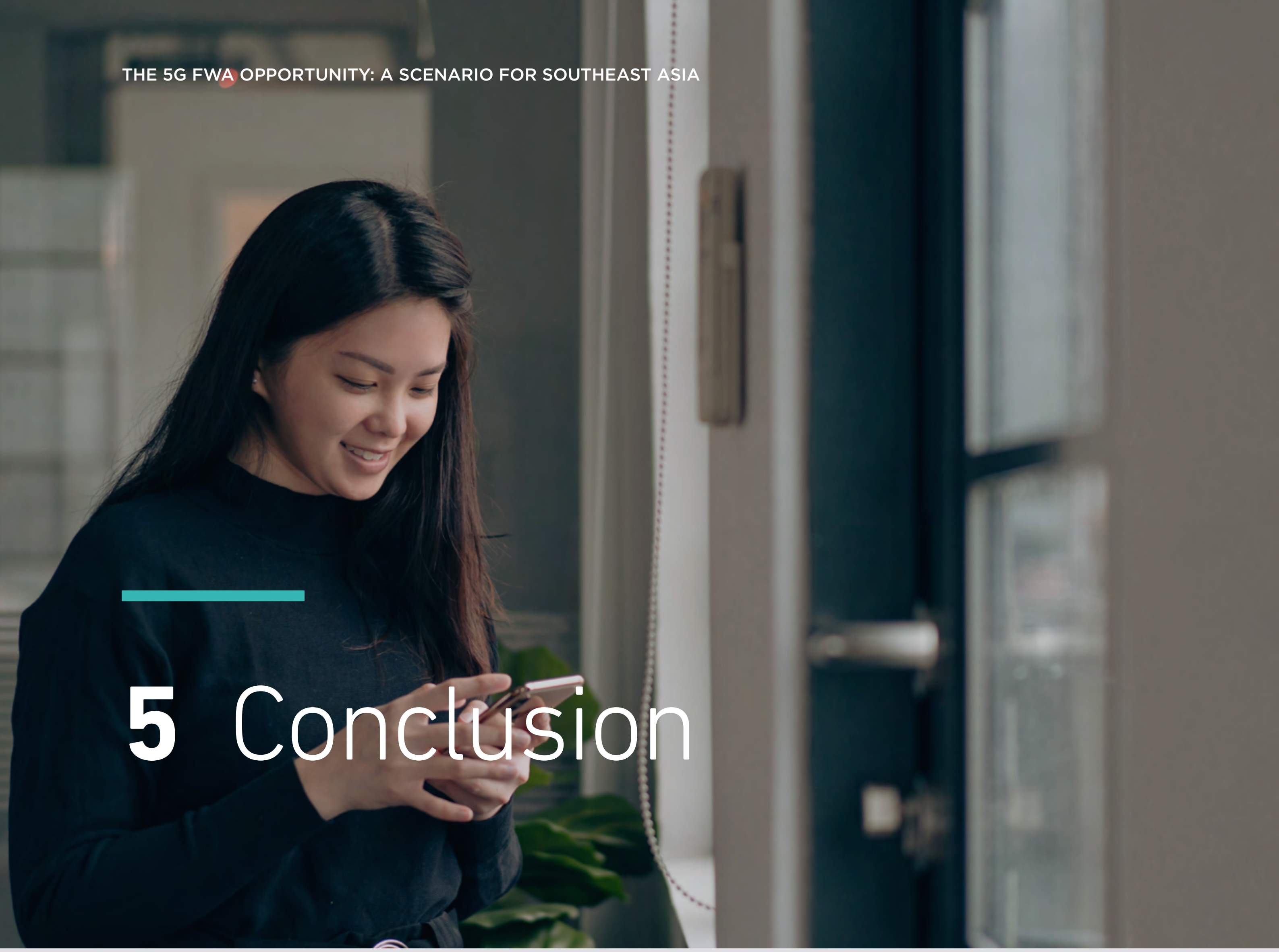
In our baseline case, we assume subscribers would be equipped with self-mounted indoor 5G FWA CPE. However, there are alternative CPE strategies available to MNOs and ISPs. We study three alternative strategies: rooftop-mounted outdoor antennas; high-power, self-mounted indoor CPE; and rooftop-mounted outdoor CPE installed in multi-dwelling units serving multiple subscribers at once.

Where 20% of premises are equipped with an outdoor antenna, MNOs can expect 5G FWA cost savings to improve by up 10 percentage points and ISPs by up to 20 percentage points. Similarly, where all premises are equipped with high-power, self-mounted indoor CPE, cost savings could improve by 10 percentage points for MNOs and 25 percentage points for ISPs.

The use of rooftop-mounted, shared outdoor CPE in multi-dwelling units can significantly improve cost savings in urban and suburban areas. While such CPE requires a truck roll for installation and costs more than CPE serving one subscriber at a time, it allows providers to serve up to 16 subscribers at once instead of equipping each subscriber with a single CPE unit. The improvement in cost savings largely depends on the specific area of deployment and the density of multi-dwelling units. In our baseline case, we find that such CPE can improve cost savings in urban and suburban areas by up to 20 percentage points for MNOs and 25 percentage points for ISPs.

In our TCO model, higher mid-band and mmWave spectrum assignments improve the TCO of 5G FWA, especially in suburban and urban areas, since they delay the need to deploy additional infrastructure to cope with higher levels of traffic demand. Assuming 50% market share and 20% busy hour share, an MNO considering a 5G mid-band plus mmWave FWA network will see cost savings improve by up to 5 percentage points if the MNO has twice the baseline spectrum assignment (200 MHz in mid-band spectrum and 800 MHz in mmWave spectrum). Assuming 80 MHz of mid-band spectrum and 200 MHz of mmWave spectrum, the 5G mid-band plus mmWave network will still deliver substantial cost savings where the underlying fibre infrastructure is not available to share or rent, while FTTH would be cost effective where ducts or poles for fibre cables can be rented or shared.

Finally, we assume that the 5G FWA network would provide for at least 100 Mbps download (DL) and 20 Mbps upload (UL) speeds. Increasing the performance requirement to at least 200 Mbps DL and 50 Mbps UL, we estimate that a 5G mmWave FWA deployment strategy is cost-effective in rural towns where new ducts for fibre cables need to be built, with cost savings of 40% for MNOs and 30% for ISPs. MNOs deploying 5G mid-band plus mmWave FWA can expect cost savings of 60% in rural towns, 40% in suburban areas and 25% in urban areas where the operator needs to trench and build ducts. FTTH would cost less where ducts or poles can be rented or shared.



5 Conclusion

MNOs and ISPs in Southeast Asia can consider 5G FWA a cost-effective alternative to FTTH in rural towns, urban areas and suburban areas in a number of instances, particularly where new ducts or poles need to be built to deploy fibre cables. Our TCO analysis therefore shows that 5G FWA is a relevant connectivity option for helping to tackle the digital divide in Southeast Asian countries, since it can cost-effectively provide speeds comparable to FTTH in many scenarios and in a more timely manner.

According to baseline assumptions, where new ducts need to be built to deploy fibre cables, MNOs deploying a 5G mid-band plus mmWave FWA network can expect cost savings of 80% in rural towns, 65% in suburban areas and 50% in urban areas. They can also expect it to be cost effective where ducts or poles to deploy fibre cables can be rented or shared, with up to 35% cost savings.

MNOs considering deploying a 5G mmWave FWA network in areas where they need to trench and build ducts for fibre cables can expect it to deliver cost savings of 55% in rural towns, 40% in suburban areas and 30% in urban areas. Where they need to build poles for fibre cables, cost savings range from 10–15%, depending on the area.

ISPs looking at a greenfield 5G mmWave FWA deployment strategy can expect cost savings of 35% in rural towns and suburban areas, and 20% in urban areas, where fibre cables need to be deployed in ducts built by the service provider.

5G FWA deployments can benefit from the use of alternative CPE strategies. The use of high-power, self-mounted indoor CPE in urban and suburban areas could provide significant benefits over standard indoor CPE, boosting the cost-effectiveness of 5G mmWave FWA versus FTTH by up to 10 percentage points for MNOs and up to 25 percentage points for ISPs.

An alternative strategy involving equipping subscribers further away from site locations with outdoor antennas, and the remainder with standard indoor CPE, could also improve cost savings in rural towns, urban areas and suburban areas by up to 10 percentage points for MNOs and up to 20 percentage points for ISPs.

Finally, the use of shared, rooftop-mounted outdoor CPE in multi-dwelling units, serving up to 16 subscribers at once, could significantly benefit 5G FWA deployments in urban and suburban areas in Southeast Asia, with an improvement of up to 20 percentage points in cost savings expected for MNOs and 35 for ISPs.

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