



Investing in Sustainable Access to Communications:

The Role of Telecom Energy Services Companies

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LIST OF ABBREVIATIONS

CAPEX	Capital Expenditure
EAP	East Asia and the Pacific
ECA	Europe and Central Asia
ESG	Environmental, Social and Corporate Governance
IBRD	The International Bank for Reconstruction and Development
ICSID	The International Centre for Settlement of Investment Disputes
ICT	Information and Communications Technology
IDA	The International Development Association
IFC	The International Finance Corporation
LAC	Latin America and the Caribbean
MIGA	Multilateral Investment Guarantee Agency
MENA	Middle East and North Africa
MNO	Mobile Network Operator
NaaS	Network-as-a-Service
O&M	Operations and Maintenance
OPEX	Operational Expenditure
R&D	Research and Development
RE	Renewable Energy
REIT	Real Estate Investment Trust
RfP	Request for Proposal
RMS	Remote Monitoring System
PaaS	Power-as-a-Service
PPA	Power Purchase Agreement
PV	Photovoltaic
SA	South Asia
SLA	Service Level Agreement
SSA	Sub-Saharan Africa
TESCO	Telecom Energy Services Company
TCO	Total Cost of Ownership
Towerco	Tower Company
TMT	Telecommunications, Media and Technology
WBG	World Bank Group

FOREWORD

It is my pleasure to present *Investing in Sustainable Access to Communications: The Role of Telecom Energy Services Companies*.

IFC is the largest global development institution focused on the private sector in emerging markets. For decades, we have been investing in infrastructure in order to address development challenges. IFC brings a 50-year investment track record in the Telecommunications, Media and Technology (TMT) sector, having committed and mobilized more than \$11 billion for over 300 projects. We seek to enable widespread digital connectivity and to promote inclusive growth of the digital economy sector in emerging markets.

Half of the world's population still lacks reliable internet access. There is a growing digital divide between those with access to reliable telecom services and those who are cut off from these essential resources. Most of those facing access challenges live in emerging market economies. One of the most significant barriers to the full expansion of digital connectivity is the lack of a reliable electricity supply. This barrier is especially acute in rural and remote areas.

Employing renewable energy solutions in remote areas will facilitate the expansion of digital connectivity to isolated communities. As part of the World Bank Group's Climate Action Plan, IFC has pledged to align 100% of its new operations with the Paris Agreement by 2025. IFC is promoting new energy-efficient business models to connect rural communities to the internet and boost national economies.

Strengthening the digital capacity and reach of developing countries will enable significant progress to be made towards improved quality-of-life measures and economic stability around the world. This report focuses on the critical topic of enabling digital connectivity in underserved areas by financing the construction of environmentally-sustainable telecommunications towers. As a leading financier of low-cost renewable energy projects around the world, IFC is well-equipped to help make these innovative new business solutions a reality.



Morgan Landy
Senior Director, Global
Infrastructure

ACKNOWLEDGEMENTS

The preparation of this report was led by a joint team of industry specialists in IFC's Global TMT practice, under the leadership of Ariana Batori (Global Lead for Broadband and TESCO Investments) and Carlo Maria Rossotto (Global Lead for TMT Upstream) and in partnership with a team of consultants from Roland Berger. The core team also included Ferdinand Van Ingen (Senior Industry Specialist) and Karla Diaz Clarke (Investment Officer). The team is grateful for the valuable contributions by Georges HOUNGBONON (Economist), Tunc ALYANAK (Senior Investment Officer and Global Lead for Distributed Generation), Ishan PUROHIT (Energy Specialist), Peter MOCKEL (Principal Industry Specialist), Neelam PATEL (Investment Officer), Pranab GOSH (Principal Investment Officer), Doyle GALLEGOS (Lead Digital Development Specialist, World Bank), Eric DUNAND (Senior Digital Development Specialist, World Bank), Hoda MOUSTAFA (Head MIGAF, MIGA), Yann BURTIN (Senior Underwriter, MIGA) and a number of other World Bank Group staff who contributed advice and inputs.

The report was produced under the overall guidance provided by Morgan Landy (Senior Director, Global Infrastructure), German Cufre (Manager, Global TMT) and Diep Nguyen-van Houtte (Senior Manager, Infrastructure Upstream).

This report benefitted from the generous insights offered during an extensive global consultation process and over 60 interviews conducted with representatives of the following stakeholders from across the telecommunications and TESCO value chain. Lastly, we would also like to acknowledge the research and analyses conducted by Roland Berger, a global consulting firm retained by IFC for this study, and in particular Damien Dujacquier, Dieter Billen and Elena Goh.

TESCOS



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ASSOCIATIONS



GSMA
 Tower and Infrastructure Provider Association, India
 TowerXchange

REGULATORS



National Agency of Telecommunications, Morocco
 Myanma Posts and Telecommunications

DEFINITIONS

Tower sites include ground-based (macro) towers and rooftop towers, but exclude small cells and social poles such as streetlights.

A point of presence is defined as one Mobile Network Operator (MNO) hosted on a single site, regardless of the number of antennas hosted, base station, or technologies used.

Greenfield sites refer to newly-built tower sites where the power supply is provided by TESCOs from the start of operations.

Brownfield sites refer to existing tower sites already in operation which switch to having power supplied by TESCOs.

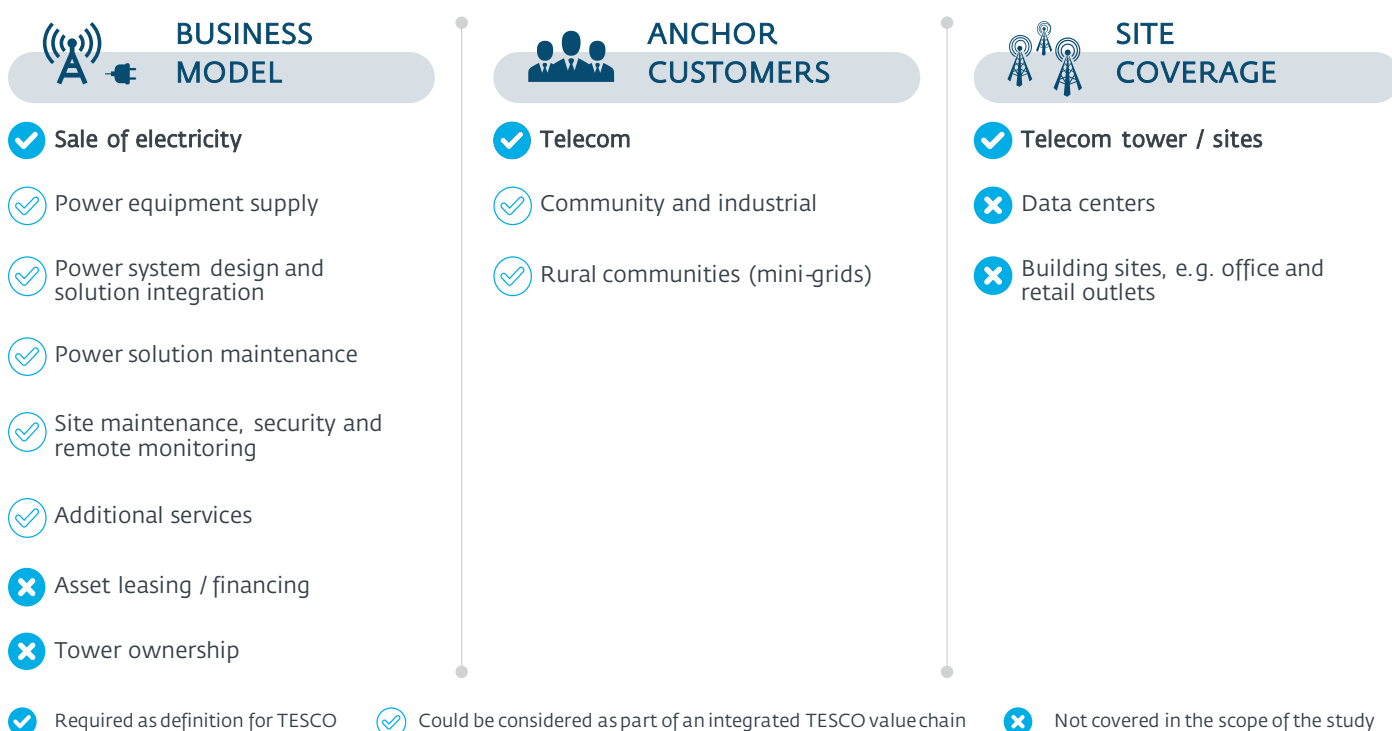
Off-grid sites refer to sites that are not connected to the national grid.

Bad-grid sites refer to sites which are connected to the national grid, but experience an average of more than eight hours of electricity supply outage per day.

Good-grid sites refer to sites which are connected to the national grid and experience fewer than eight hours of electricity supply outage on average per day.

Telecom Energy Services Companies (TESCOs) are firms whose core business is to own power assets and supply power to telecom sites. TESCOs supply electricity, governed by strict commitments to achieve service level agreements (SLAs), and not just as a source of backup power. TESCOs can also be integrated with other parts of the power solution value chain, for example maintenance and equipment supply (figure o-1). Excluded from the definition of TESCOs are pureplay power equipment supply, pure power asset installation providers, pure power solution maintenance providers, pure power optimization providers and Tower Companies (Towercos) with Power-as-a-Service (PaaS) offerings.

Figure o-1: Definition of TESCOs



EXECUTIVE SUMMARY

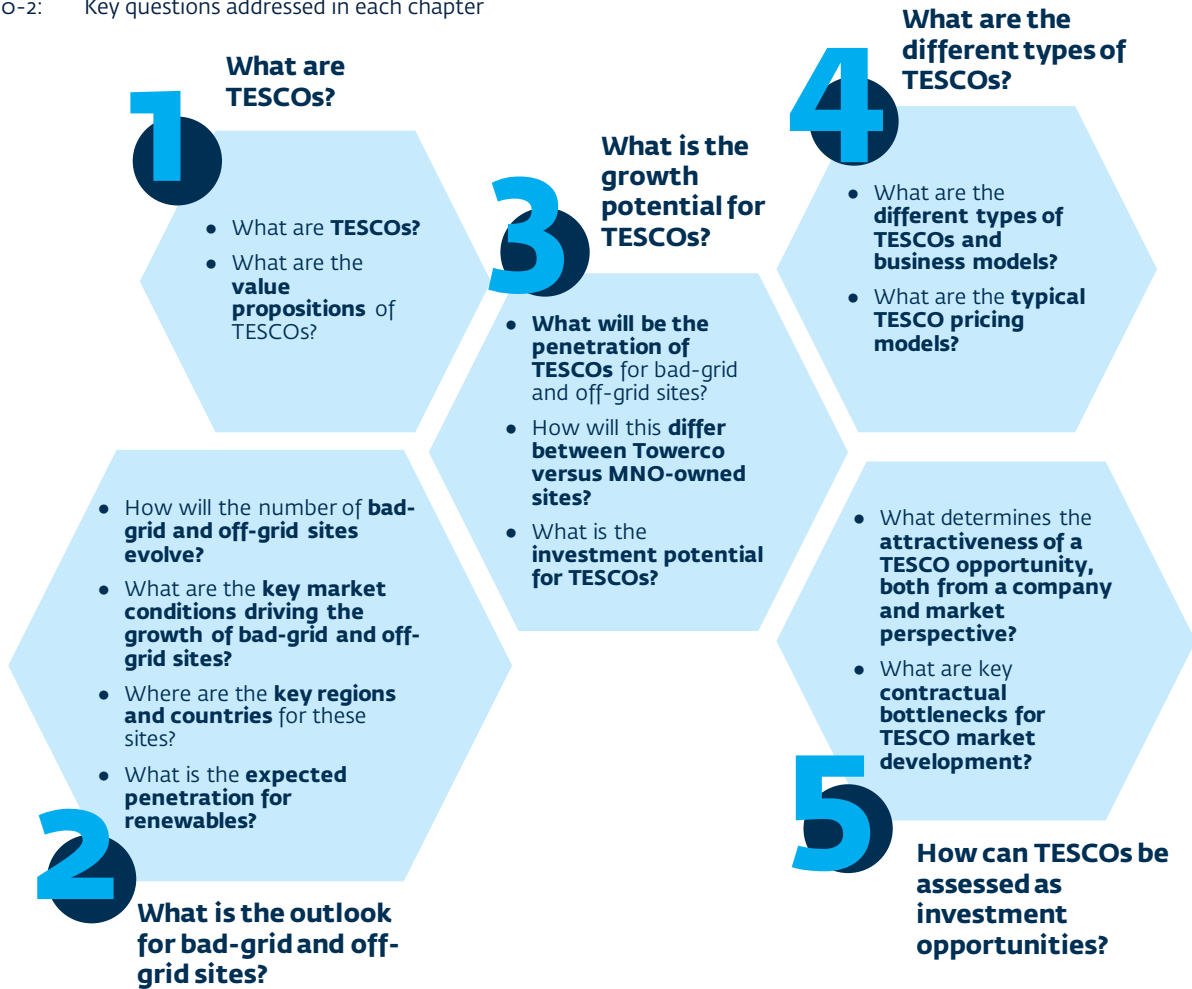
Background and objectives

The expansion of telecommunications services to unserved and underserved areas is key to reduce the digital connectivity gap. In order to do so, it is important to explore innovative and cost-efficient technologies and business models. TESCOs offer solutions for powering and managing telecom companies' networks in off-grid and bad-grid areas (Chapter 1). TESCOs typically replace diesel-powered solutions with hybrid renewable energy options. By anchoring the demand around a large telecom client, they can also aggregate the demand of nearby villages, contributing to the rural electrification agenda, and providing a viable model where village-level electrification programs have failed in the past. Access to reliable power remains a challenge for telecom operators in many emerging markets. Non-existent to poor grid infrastructure at many tower locations has driven a high dependence on diesel fuel to power such sites, increasing energy costs and carbon footprint for telecom operators. TESCOs have emerged as solution providers to MNOs and Towercos, offering them a diverse portfolio of energy solutions and services for sites, typically through the use of distributed renewable energy generation and battery energy storage systems. TESCO solutions, which increasingly rely upon renewable energy, such as solar PV (Photovoltaic) systems, provide a tremendous opportunity to reduce costs and carbon footprint, due to rapidly declining cost and increasing maturity of renewable energy and battery energy storage systems technologies. TESCOs can play a pivotal role in expanding telecommunications coverage by addressing the power supply challenges faced by MNOs and Towercos at tower sites with either unreliable or no grid connectivity (bad- or off-grid sites).

Having financed the network expansion of mobile network operators, or MNOs, and Towercos over the past 30 years, IFC is now turning its attention to TESCOs as additional solution providers for addressing these issues. IFC is seeking to contribute to the growth and development of innovative solution providers for telecom sites located in areas with little to no access to electricity by providing insights into the growth perspectives of the TESCO market globally (Chapters 2 and 3). TESCOs can deliver high development impact in terms of access to mobile communications and broadband for unconnected communities in rural areas when serving bad-grid and off-grid areas. Communities benefit from increased access to services enabled by mobile connectivity. TESCO investments also contribute to improved environmental sustainability and combat climate change, as they enable large-scale use of green power solutions like solar PV systems that result in significant greenhouse gas savings.

IFC proposes a market segmentation framework based on current business models (Chapter 4). The report then examines the typical commercial arrangements and key drivers which influence the bankability of TESCOs (Chapter 5). IFC also estimates the total amount of financing needed in order to address the pressing need for connectivity in unserved and underserved areas and acts as a call to action to stakeholders in the industry and in the financing community to work towards bridging this important connectivity gap. The five sections covered in this report represent the key dimensions required to assess the investment opportunity for TESCOs. Many of these topics are the first of their kind in the industry and have been built on a foundation of excellent collaboration with both industry associations and private companies.

Figure o-2: Key questions addressed in each chapter



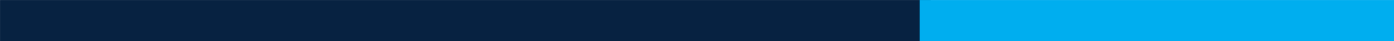
Key findings

TESCOs control the power equipment at nearly half of all renewable energy-powered sites

The outsourcing of telecom power assets is part of the progression of MNOs towards the outsourcing of non-core network functions that began in the 1990s with the outsourcing or spin-off of tower assets. This evolution toward the Power-as-a-Service (PaaS) model has been particularly prevalent in emerging markets, where power supply has remained a challenge. Factors such as technology evolution, which increases power consumption at the site, as well as the ever-increasing demand for data, have pushed MNOs to search for more efficient power solutions. This has also coincided with the development of the distributed generation business model in the power sector, with increasing on-site decentralized electricity production, rather than large power plants. At the same time, the heightened focus on carbon footprint reduction has led to a focus on renewable energy solutions for the telecommunications industry.

In the traditional model, power assets were owned by MNOs and typically managed by third parties on a cost pass-through basis, with little incentive for these third parties to improve cost efficiency, despite the fact that power generation costs could account for as much as half of total site costs in bad-grid and off-grid sites for an MNO.

In contrast, the Power-as-a-Service TESCO model introduces incentives to parties involved to optimize power solution costs for MNOs. Under a Power-as-a-Service TESCO model, power assets and their entire operation can be owned by TESCOs with electricity and network availability being provided to MNOs on a fixed cost or shared savings basis. TESCOs will take



on the burden of upfront Capital Expenditure (CAPEX) on behalf of the tower owner or MNO. With full control over energy management, TESCOs approach power solutions from a Total Cost of Ownership (TCO) perspective and are hence highly incentivized to generate cost savings for both parties and make the required upfront investments to modernize power assets. The primary means by which TESCOs achieve cost efficiencies is by converting existing diesel-powered sites to either solar or solar-hybrid technologies.

To meet the global sustainability challenge, MNO industry body GSMA has announced an industry-wide roadmap to achieve carbon neutrality by 2050 in line with the Paris Agreement. In addition, many leading MNOs have gone a step further to bring forward carbon neutrality targets to 2040. As a significant part of achieving carbon neutrality for MNOs will involve the switch towards renewable sources of energy, TESCOs will play a major role in catalyzing this industry shift.

In the last decade, both MNOs and Towercos have embraced the Power-as-a-Service model offered by TESCOs, largely procuring energy solutions from specialized energy experts in order to improve energy cost efficiencies, achieve better cost predictability, guarantee service improvement and coverage and address environmental sustainability targets whilst ensuring resiliency and future-proofing their network infrastructure. In fact, while TESCOs now control the power equipment at one percent of the total number of tower sites globally, this represents nearly half of all renewable energy-powered sites globally.

The number of bad-grid and off-grid sites is expected to grow by 22 percent over the next 10 years and the penetration of renewable energy solutions at such sites is expected to increase threefold

Bad-grid and off-grid sites offer TESCOs the greatest opportunities to achieve cost savings through site power solution optimization, especially by reducing reliance on diesel. In the six regions covered in this report, the total number of bad- and off-grid sites is expected to increase by 22 percent from 611,000 in 2019 to 745,000 in 2030. The increase is driven by rising mobile penetration due to rising per capita incomes, network densification due to higher per capita network traffic, Universal Service Obligations to expand rural coverage and the pace of power grid expansion lagging behind the construction of new telecom sites.

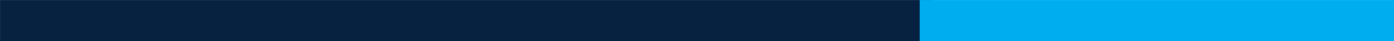
The majority of bad-grid and off-grid sites can be found in South Asia (SA), Sub-Saharan Africa (SSA) and East Asia and the Pacific (EAP), which account for 36 percent, 29 percent and 19 percent of global bad- and off-grid sites, respectively. The largest increase in bad- and off-grid sites is expected in SSA, where it will increase by 89,000 from 115,000 in 2019 to 205,000 in 2030. Unsurprisingly, the proportion of these sites is highly correlated with the rate of grid access, as well as to the quality of electricity supply where sites are connected to the grid.

The penetration of renewable energy solutions at bad-grid and off-grid sites is expected to increase from 10 percent to 27 percent by 2030. In terms of regional split, the top three regions of EAP, SSA and SA are expected to account for over 34 percent, 29 percent and 24 percent of bad- and off-grid sites with renewable power solutions by 2030 respectively.

The number of TESCO sites is expected to quadruple by 2030

Today there are 26 countries with operational TESCO sites as well as 57 countries which could be new markets for TESCOs by 2030. Of these, 10 countries are expected to account for nearly half of the TESCO market. By 2030, TESCO penetration of bad-grid and off-grid sites could increase from 7 percent (42,000 TESCO sites) to 22 percent (166,000 TESCO sites). On a regional level, SSA and SA lead in the number of current TESCO sites, accounting for 48 percent and 38 percent of global TESCO sites, respectively. These two regions are also expected to comprise a majority of TESCO sites in 2030.

The estimated total TESCOs sites of 166,000 by 2030 represents a 38 percent penetration rate of the total addressable market (436,000 sites). The estimate takes into account a minimum scale required for a commercially viable TESCO contract, as well



as the usable solar resources need to support solar power generation. The estimate also considers potential competition with Towercos offering Power-as-a-Service. The penetration rate in 2030 will still fall short of its full potential due to a variety of reasons, including lengthy contract negotiations, resistance to new technologies, individual market complexities, and the preference of some MNOs to maintain in-house power operations. However, growing acceptance of Power-as-a-Service and improved market conditions could unlock potential upsides, bringing the total number of TESCO sites to 250,000 by 2030.

There are four key types of TESCO players present in the market today

TESCOs are typically integrated with Operations and Maintenance (O&M) service providers (44 percent of TESCO sites), power producers (36 percent), power equipment manufacturers or integrators (17 percent), or pureplay TESCOs (3 percent). Value chain integration is common for TESCOs which seek to take advantage of synergies from expertise developed from other business segments. For example, service providers of O&M for passive infrastructure assets can leverage on existing field technicians on-the-ground to provide O&M for power assets. Power equipment manufacturers bring to the TESCO model their strong expertise in technical power solutions and Research and Development (R&D) capabilities, while distributed power producers, especially those specializing in solar power generation, can bring their existing expertise in optimizing solar power generation technology.

A TESCO attractiveness and bankability framework takes into account operator-specific considerations and market risks

Factors to consider in determining a TESCO's ability to secure contracts and deliver on its long-term contractual commitments include the TESCO's track record and on-the-ground experience in similar operating environments, operational expertise, and technical solutions, as well as the TESCO's access to equity and financing capital. In order to ensure bankability of contracts, key clauses include the tenor, fee structure, committed generation and services, Service Level Agreements (SLAs) and penalties, currency and indexation, valuation of legacy assets and termination clauses. In addition, there are also macro risks in emerging regions, including currency risk, internal or external country conflicts, uneven power market regulation, and the safety and security of remote sites.

The estimated investment need for the forecast growth in TESCO sites amounts to \$3.9 billion by 2030

SSA is expected to require the biggest investment for new TESCO sites at \$1.6 billion, followed by SA at \$800 million, and Middle East and North Africa (MENA) at \$600 million, and EAP at \$400 million (largely driven by Southeast Asian countries). The financing community is called upon to support the growth of TESCOs and assist in bridging the connectivity gap in underserved regions.

TESCOs have the potential to deliver high development impact in terms of the benefits brought about to unconnected communities and to the regional economy, as well as their contribution to environmental sustainability

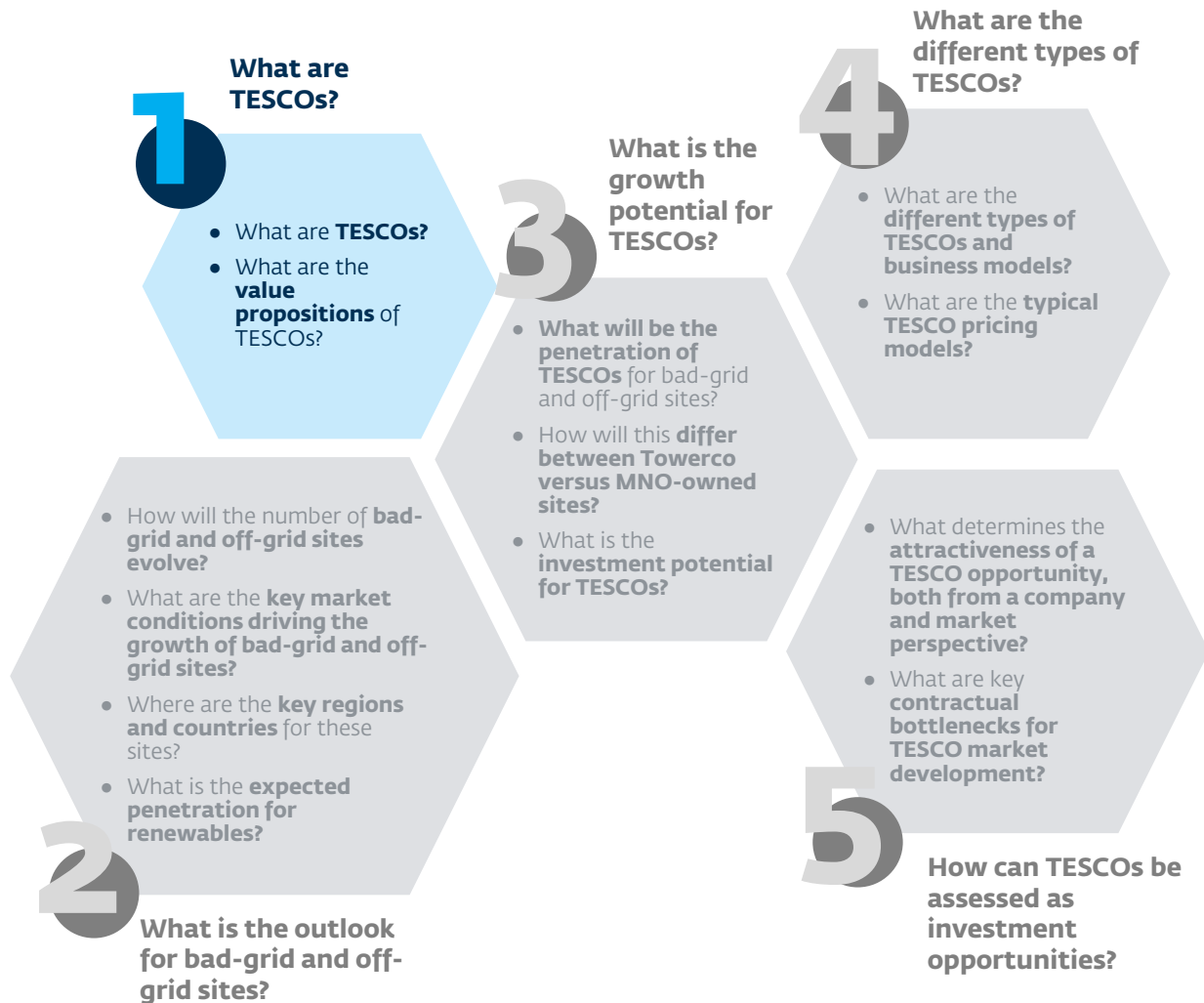
Finally, TESCOs have a key role to play in opening opportunities for the social and economic inclusion of unconnected communities in bad-grid and off-grid rural areas. TESCOs can also support network deployment, and offer energy cost savings that can be partially passed to end-users. In addition, TESCOs' investment can result in increased communities' coverage of mobile telephony or broadband networks, including 3G or higher-speed mobile networks. Also, by employing greener power solutions like solar PV systems, TESCO investments can result in significant greenhouse gas savings, bringing the additional benefit of environmental sustainability.

Chapter 1

WHAT ARE TESCOS?



1. WHAT ARE TESCOs?



1.1 Background

Context

Today, access to reliable power solutions remains a challenge for telecom operators in developing markets which lack reliable grid infrastructure. As a result, towers with unreliable grid access and off-grid towers often rely on diesel power generation, driving up both energy costs and the carbon footprint of MNOs. In a search for cleaner and more cost-effective power solutions, MNOs and Towercos have begun outsourcing tower power solutions to dedicated TESCOs, which offer a diverse portfolio of solutions for their sites based on distributed renewable energy generation and battery energy storage systems. This outsourcing trend has also coincided with the rapidly declining cost and growing technology maturity of renewable energy and battery energy storage systems. TESCOs can support telecom operators in their efforts to reduce emissions and energy costs by adopting renewable energy solutions, while also ensuring uptime and quality of service.

With energy costs accounting for as much as half of operating costs at sites without reliable grid connection, MNOs are faced with a growing power challenge. While MNOs attempt to improve network coverage in rural areas, they must recognize that the regions they seek to serve are also often the areas with the poorest grid connectivity. In addition, MNOs are subject to

increased power requirements from the deployment of newer technologies, as well as the overall mobile network sector's commitment to reduce emissions by 45 percent by 2030 and achieve net zero emissions by 2050. It is in this context that the emergence of TESCOs has had the impact of catalyzing a transition towards renewable energy generation at telecom sites.

Nevertheless, the TESCO market is still in its early growth stage today, with many emerging players and varying business models. This report, *Investing in Sustainable Access to Communications: The Role of Telecom Energy Services Companies*, contains the findings of a global assessment of the current status and potential of TESCOs.

Scope of the report

This report covers the TESCO market in SSA, MENA, Latin America and the Caribbean (LAC), SA, EAP, and Europe and Central Asia (ECA) as per IFC's definitions. In these regions, the proportion of bad-grid and off-grid sites is expected to be higher compared to developed economies. In all, a total of 173 countries within the six identified regions are covered in this report.¹

This report also complements other authoritative studies by TowerXchange and GSMA which have already been published.

Figure 1-1 summarizes the complementarity between TowerXchange's ESCO Market Report 2018, GSMA's Renewable Energy Adoption for Off-grid Sites report and this TESCO market assessment, which is done from the perspective of prospective investors.

TowerXchange has been involved in the TESCO market since 2015, before TESCOs have achieved the growth momentum as seen today. Recognizing the need for power solutions in grid-challenged tower environments, *TowerXchange's ESCO Market Report 2018*² and the *ESCO Borderless Report 2020*³ provide a comprehensive view of key stakeholders such as TESCO, MNOs, Towercos, equipment suppliers, financiers and regulators. The two reports also document recent market developments and opportunities, and provide exclusive interviews with actors in the TESCO market.

In 2014, the GSMA Green Power for Mobile program published the *Global Telecom ESCO Tower Market*⁴ report, which identified over one million bad-grid and off-grid sites. The report indicated that 90 percent of these sites were powered by diesel generators, emitting over 45 million tons of carbon dioxide per year. In September 2020, the GSMA ClimateTech program published the *Renewable Energy for Mobile Towers*⁵ report, which updated the estimates of existing renewable energy penetration for bad- and off-grid sites in 91 low- and middle-income countries. The 2020 report also identified key issues faced by MNOs as they pursued renewable energy solutions on such sites.

Investing in Sustainable Access to Communications: The Role of Telecom Energy Services Companies aims to analyze the opportunities and barriers supporting or hindering the growth of TESCOs and their impact on TESCOs' ability to attract capital. This analysis is conducted through a market forecast for such energy services for telecom towers, focusing largely on emerging markets. *Investing in Sustainable Access to Communications* provides a comprehensive view of TESCO bankability, including a detailed review of the key market conditions, economic, technology and regulatory trends likely to impact the TESCO market and an assessment of the relationship between the key stakeholders.

1 Refer to the Annex A for the full list of countries covered in this report.

2 TowerXchange (2018), TowerXchange's ESCO Market Report 2018, accessed at: <https://www.towerxchange.com/publication/towerxchanges-annual-telecom-esco-market-report-2018/>

3 TowerXchange (2020), ESCO Borderless Report 2020, accessed at: https://content.comms.euromoneyplc.com/esco_borderless_report_2020.html

4 GSMA (2015), Global Telecom ESCO Tower Market, accessed at: <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2015/01/140617-GSMA-report-draft-vF-KR-v7.pdf>

5 GSMA (2020), Renewable Energy for Mobile Towers: Opportunities for low- and middle-income countries, accessed at: https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2020/09/Clean_Tech_Report_R_WebSingles.2.pdf

Figure 1-1: Overview of the key TESCO reports

	TowerXchange	GSMA	IFC International Finance Corporation BERGNER
TITLE OF REPORT, YEAR	ESCO Market Report 2018 November 2018	Renewable Energy for Mobile Towers September 2020	Investing in Sustainable Access to Communications: The Role of Telecom Energy Services Companies September 2021
OVERALL THEME	Address power solution challenges from towercos' perspective	Address power solution provision (use of RE) from MNO perspective	Address bankability of power solution providers
SCOPE OF REPORT	Addressable market Business model Key industry players Market drivers - technology Market drivers - regulation Barriers to entry Contractual agreement Investment consideration	Bad and off-grid sites in 2018, and forecast of TESCO penetration by 2024 TESCO player's business model TESCO players globally and sites managed + list of TESCO related players Power equipment vendors and technologies utilized by TESCOs	Bad and off-grid sites 2019 to 2030 and TESCO and RE penetration to 2030 TESCO player's business model and pros and cons TESCO players globally and key stakeholders Telecom site technology drivers incorporated in market forecast Towers and RE policy and regulatory drivers incorporated in market forecast Operational risk and contractual bottlenecks impeding TESCO growth Benchmark of TESCO contractual agreement Framework in assessing potential TESCO market and investment opportunity

1.2 Introduction to TESCOs

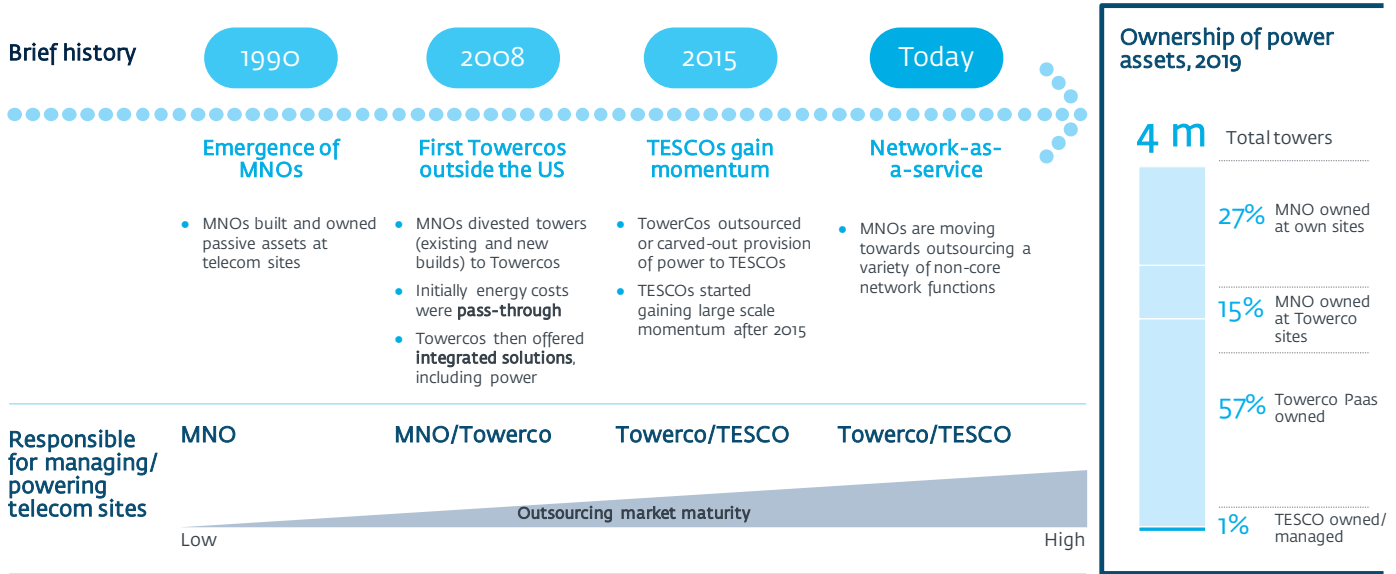
Power assets are the natural next step in MNO outsourcing

For MNOs, divesting power assets and turning to Power-as-a-Service can be seen as a natural next step in the evolution of MNO network outsourcing. Since the emergence of MNOs in the 1990s, passive assets have been built and owned by MNOs. But, starting in the late 2000s, MNOs began to divest towers to Towercos in order to attain a more asset-light positioning and focus on serving customers. Initially, energy costs incurred by Towercos were passed through to MNOs, but subsequently Towercos began offering integrated solutions which included power provision. While TESCO activities started around 2010, the TESCO model gained global momentum after 2015 (figure 1-2). This growth was driven by both the declining costs of solar generation and battery energy storage systems, and increasing de-carbonization efforts. These changes also coincided with the rapid growth of distributed renewable power generation.⁶

With outsourcing having gained widespread acceptance among MNOs, the concept of Network-as-a-Service (NaaS) is increasingly popular today. MNOs are moving towards outsourcing a variety of non-core functions, potentially adding on the divestment of power assets to the already well-established tower asset carveouts. In fact, in 2019, about 60 percent of site power assets were no longer owned by MNOs.

⁶ After being at the margins of the power industry for a prolonged period, distributed PV generation capacity now represents close to 40 percent of all new solar deployment. See IEA (2020), Renewables 2020, accessed at: <https://www.iea.org/reports/renewables-2020/solar-pv>

Figure 1-2: Evolution of power asset ownership



When power assets are owned and maintained by the same party, there is a very strong incentive to optimize cost and prolong the life of the asset

Traditionally, MNOs own and manage their own power assets – either on their own tower sites, or with Towercos. As power supply is a non-core function, MNOs sometimes lack power expertise and typically outsource the management of power assets to third parties. These arrangements are usually sub-optimal for an MNO, as power supply tends to be on a cost-pass through basis, with the third party having little incentive to reduce costs.

By contrast, under the emerging Power-as-a-Service model where power is provided under a fixed fee structure either by a TESCO or a Towerco, Power-as-a-Service providers which internalize the cost of providing power are incentivized to improve cost efficiencies. Power-as-a-Service providers are incentivized to consider the lifetime costs of power supply and are hence more likely to make upfront CAPEX investment in order to achieve cost and operational efficiencies over the longer term.

The Power-as-a-Service model also provides some additional benefits for MNOs. Firstly, they enjoy greater cost predictability since power power is supplied at pre-negotiated prices. Secondly, the CAPEX requirements are also outsourced from the MNO to the Power-as-a-Service provider, allowing MNOs to focus their efforts on core network and service improvement.

While Power-as-a-Service can be provided by either TESCOs or Towercos, TESCOs are differentiated by being specialized in power provision, which can bring better operational expertise and economies of scale. This thesis is also supported by the fact that many Towercos contract the services of TESCOs themselves. Today, some two-thirds of TESCO sites, have a Towerco as anchor client, but demand is expected to increasingly come directly from MNOs. Some of the larger Towercos are likely to choose to develop or enhance their in-house Power-as-a-Service capabilities instead of outsourcing to TESCOs.

Diesel-powered solutions are currently the default power systems for bad-grid and off-grid sites

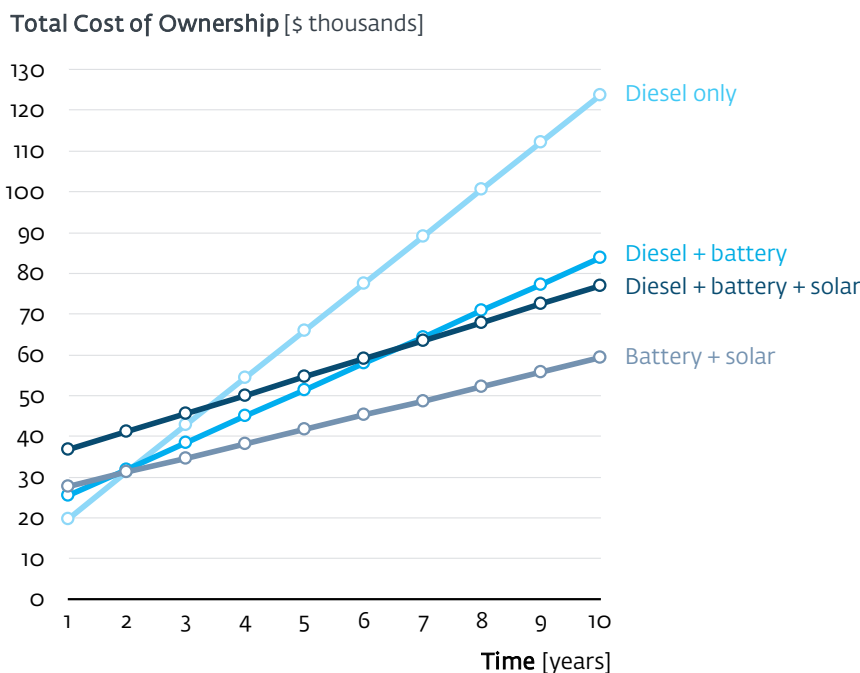
Of the estimated four million tower sites covered in this report, about 85 percent (3.4 million) are good-grid sites with reliable electricity supply. The remaining 15 percent (0.6 million), are either bad- or off-grid sites. Among bad- or off-grid sites, the default power supply system is a combination of diesel generators and batteries, covering an estimated 90 percent of such sites. However, these installations suffer from several cost inefficiencies, including vulnerability to volatility in fuel prices and

fuel shortages, logistical cost and challenges of transporting fuel to sites in remote areas, as well as operational leakages such as diesel pilferage. On top of that, diesel-powered generation is also responsible for high levels of pollution and greenhouse gas emissions.

Solar-hybrid systems have emerged as an economic alternative to diesel-powered sites but uptake is still hindered by high upfront costs

In recent years, alternative power supply systems involving renewable energy have emerged as a potential replacement for legacy diesel generation systems at bad- or off-grid sites. These options are either solar-battery hybrid power generation systems, or diesel-solar-battery hybrids, which are present in 65,000 sites, or about 10 percent of total bad- and off-grid tower sites. While upfront costs for these solarized sites are higher, lifetime Total Cost of Ownership⁷ savings of as much as 50 percent over pure diesel power systems are achievable over a ten-year period (figure 1-3). In fact, it is expected that within three to five years, the cumulative cost of running a solarized site will be lower than that of pure diesel-powered site. There are multiple reasons for this cost reduction: TCO for a diesel-only option increases substantially over the lifetime of the asset, primarily driven by diesel fuel costs, as well as operational cost associated with diesel genset maintenance cost, logistics of diesel, and operational leakages. Despite the strong business case for solarizing a site, the high upfront cost has been a major impediment to MNOs and Towercos in adopting such a solution.

Figure 1-3: TCO of bad-grid and off-grid site power solutions in Asia⁸



“ We are looking at alternative solutions to diesel like solar, but the upfront cost required is still high. ”

Interview excerpt from Towerco with Power-as-a-Service

⁷ The TCO takes into account total lifetime OPEX and CAPEX (including replacement cost).

⁸ Given that the duration for a typical TESCO contract is around 10 years, the TCO is shown over 10 years to indicate clear benefits of solar over diesel-based solutions. Given the lifetime of solar PV assets is around 25 years and that of Li-On batteries are around 10 years, the benefits will be even more significant in the longer term but also subject to diesel fuel price fluctuations.

TESCOs have attracted both MNOs and Towercos as clients

TESCOs have tapped into this opportunity, allowing both MNOs and Towercos to outsource their power solution requirements to power experts and transferring the upfront cost of site modernization to TESCOs. TESCOs engage in long-term contracts with their customers to provide Power-as-a-Service, typically on a monthly fixed-fee structure for about 10 years. TESCOs deploy capital to modernize power systems at the customer's existing telecom brownfield sites or install such solutions at newly-built greenfield sites. The Power-as-a-Service agreement is bound by strict Service Level Agreements (SLAs) to ensure minimum network availability that is based on the site criticality.⁹

The scope for TESCOs can include both brownfield and greenfield sites. In the former, TESCOs modernize and solarize typically inefficient legacy sites, while in the latter, TESCOs can deploy new power solutions. The greenfield site options gives TESCOs more control over the power solution design and reduces the complications of dealing with legacy assets.

Beyond power asset management, TESCOs' scope of work typically includes additional synergistic services such as the supply of power equipment, installation and commissioning, as well passive infrastructure maintenance, such as security or cleaning of sites. TESCOs continue to expand their portfolio of services, adapting it to their clients' needs. In some instances, TESCOs offer a full range of services and position themselves as a Network-as-a-Service provider, especially in rural or remote areas.

The benefits of outsourcing to TESCOs extend beyond cost savings

Outsourcing to TESCOs can deliver a number of benefits for customers (figure 1-4). Outsourcing can result in cost savings for MNOs and Towercos by converting power solution cost into an Operational Expenditure-only (OPEX) cost and reducing dependence on diesel technology. This can also improve cost predictability for MNOs and Towercos through long-term fixed pricing contracts. These cost savings can enable operators to provide affordable digital connectivity services. These outcomes can be enhanced in the long run as TESCOs contribute to future-proofing network infrastructure by offering remote site monitoring and upgrading outdated legacy power systems.

Beyond cost savings and cost predictability, the decision to outsource to TESCOs can also result in increased availability of mobile connectivity for end-users. Cost savings enable MNOs to extend their services in otherwise commercially unattractive areas. Such outcomes can also be achieved thanks to strict uptime requirements embedded in TESCO contracts.

TESCOs have the potential to deliver benefits to unconnected communities and to the regional economy

TESCOs' attractiveness can also be assessed through their development impact. TESCOs can contribute to increased access to mobile connectivity for unconnected communities in rural areas when serving bad-grid and off-grid areas with a low population coverage or a nascent TESCO market segment.

Key benefits to communities include increased access to quality mobile connectivity through improved penetration rate of mobile telephony or broadband. In remote rural areas previously considered unprofitable, TESCO investments and network deployment can result in energy saving alternatives for mobile or tower operators, which brings opportunities for increased communities' coverage of mobile telephony or broadband.

⁹ Site criticality (importance of the site could be determined based various factors, for example, revenue per site, types of customers served) determines different levels of SLAs, determining the type of solution used and frequency of visit by the team

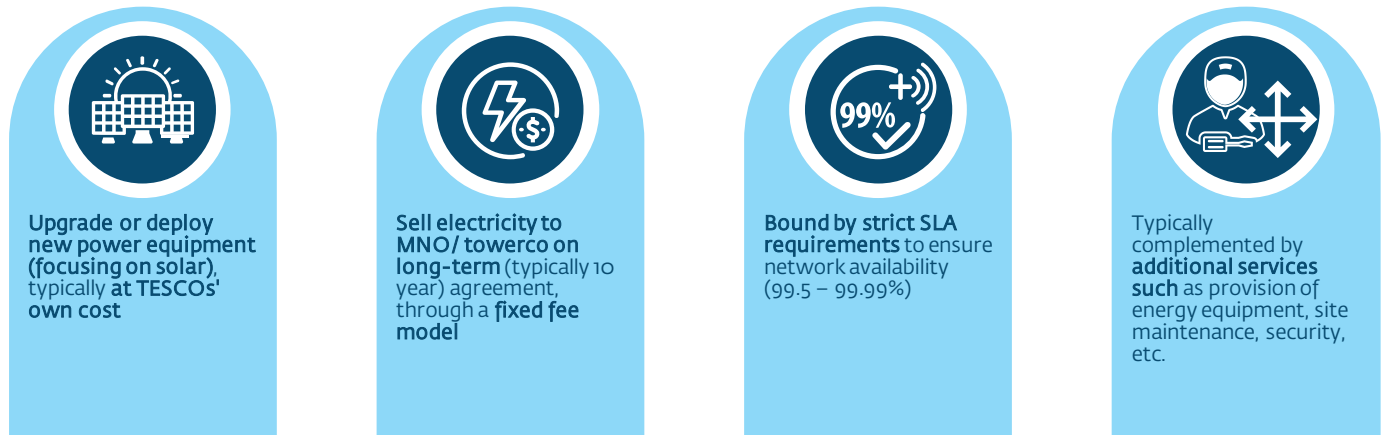
In areas with low mobile connectivity, TESCO investments can generate great benefits that far outweigh costs due to the potential that access to internet has in promoting GDP growth and employment. This impact is especially visible in low-income countries or regions with high level of informality or unemployment. Furthermore, the commercial viability of the TESCO's business model can trigger replication by new entrants, offering the possibility of a market-wide propagation, which could further increase benefits to more stakeholders.

TESCOs can contribute to environmental sustainability

In a context where telecommunications rely on fossil fuels, TESCO investments that enable large-scale use of green power solutions like solar PV systems, offer the possibility of significant greenhouse gas savings, thus contributing to environmental sustainability. Further, TESCO investments can also promote environmental sustainability of the market for mobile connectivity by inducing competition, which then results in innovation in power consumption, and a wider adoption of sustainable power solutions by mobile operators.

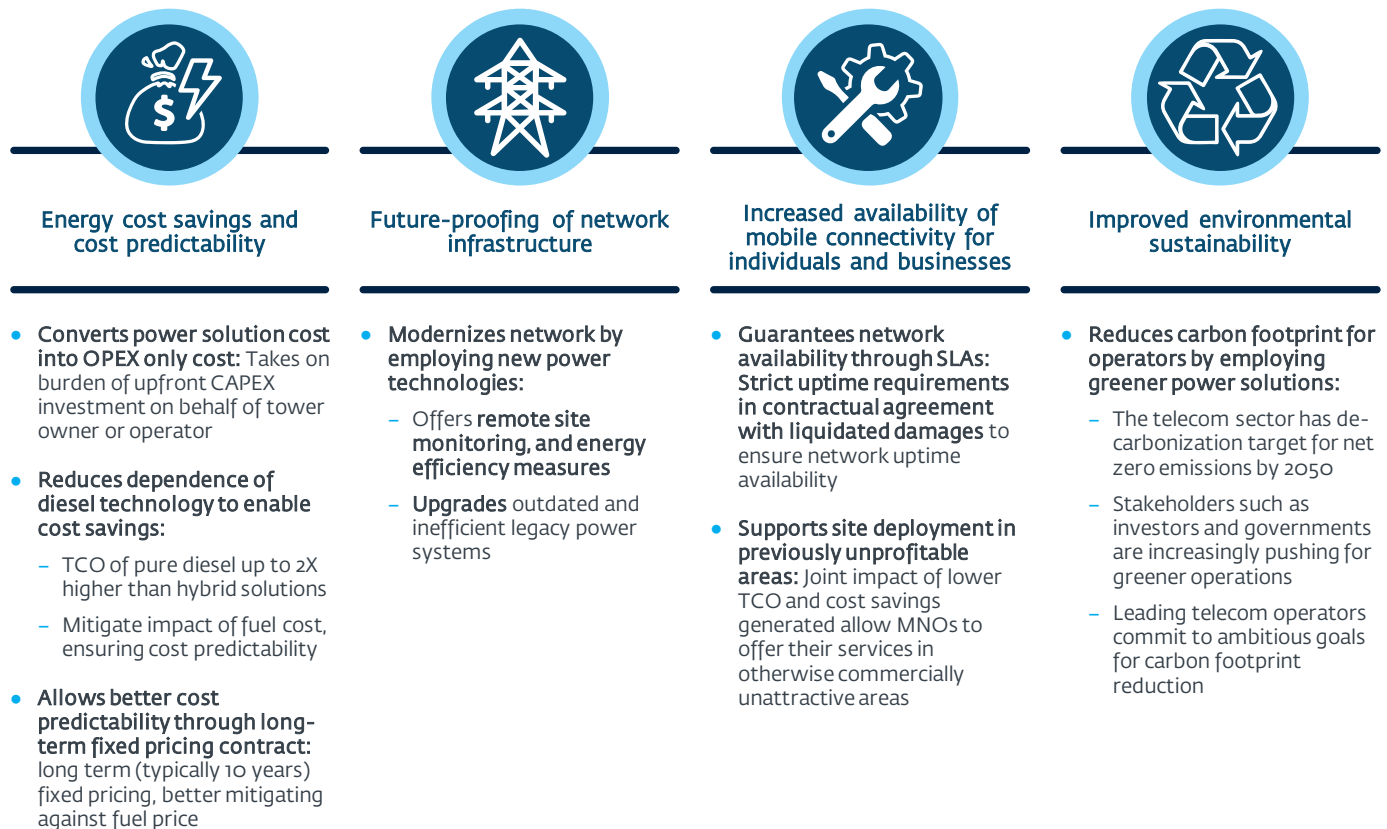
Figure 1-4: Typical scope of services of a TESCO and its benefits to MNOs or Towercos and other stakeholders

Core activity of a TESCO



Benefits to MNOs or towercos

Benefits to stakeholders

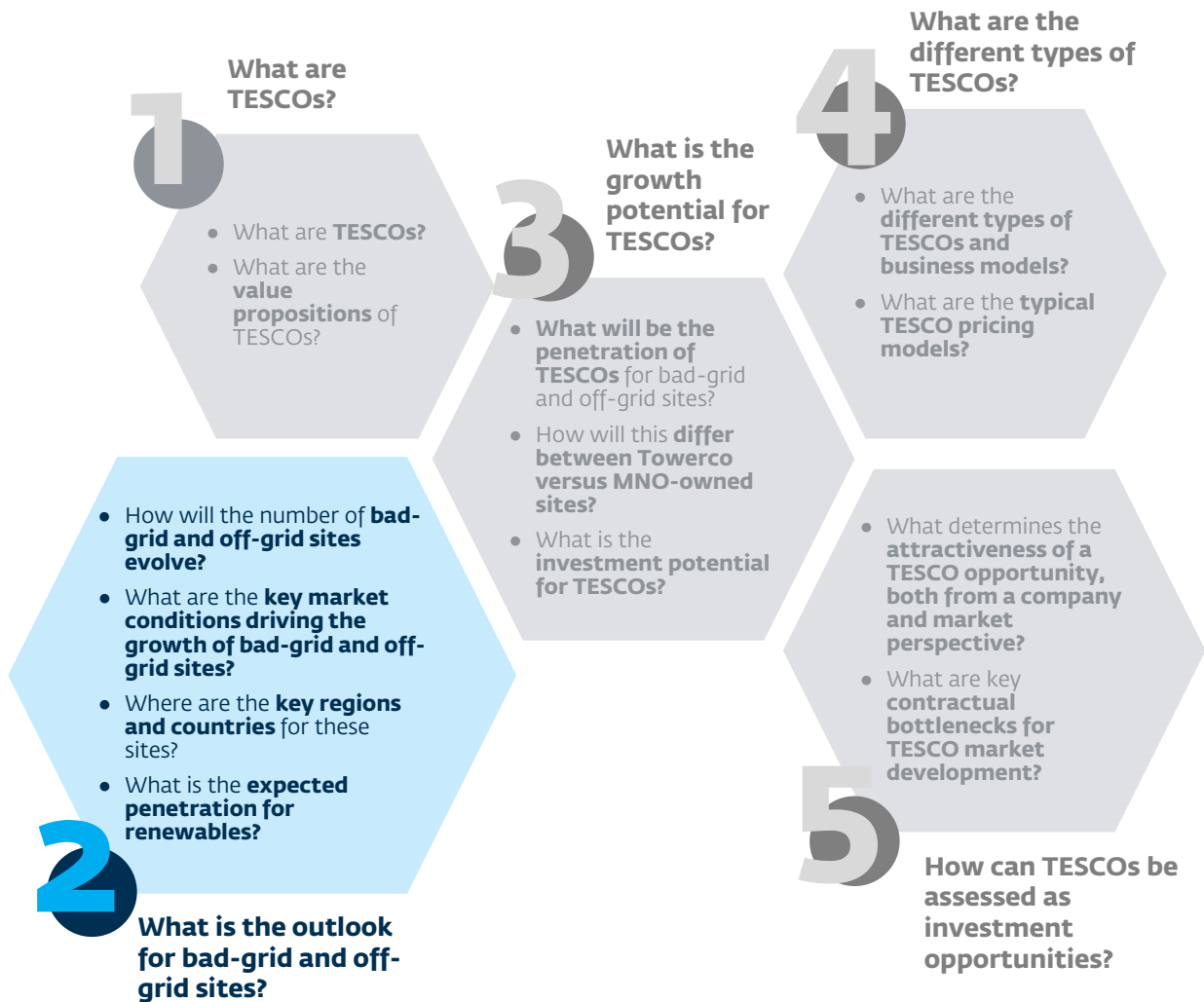


Chapter 2

WHAT IS THE OUTLOOK FOR BAD-GRID AND OFF-GRID SITES?



2. WHAT IS THE OUTLOOK FOR BAD-GRID AND OFF-GRID SITES?



2.1 Telecom towers growth forecast

Number of towers expected to increase by 1.4 million in the next 10 years

Between 2019 and 2030, the number of telecom sites in the six assessed regions is expected to increase from around 4.0 million to 5.4 million, growing at a rate of 2.7 percent per year (figure 2-1).

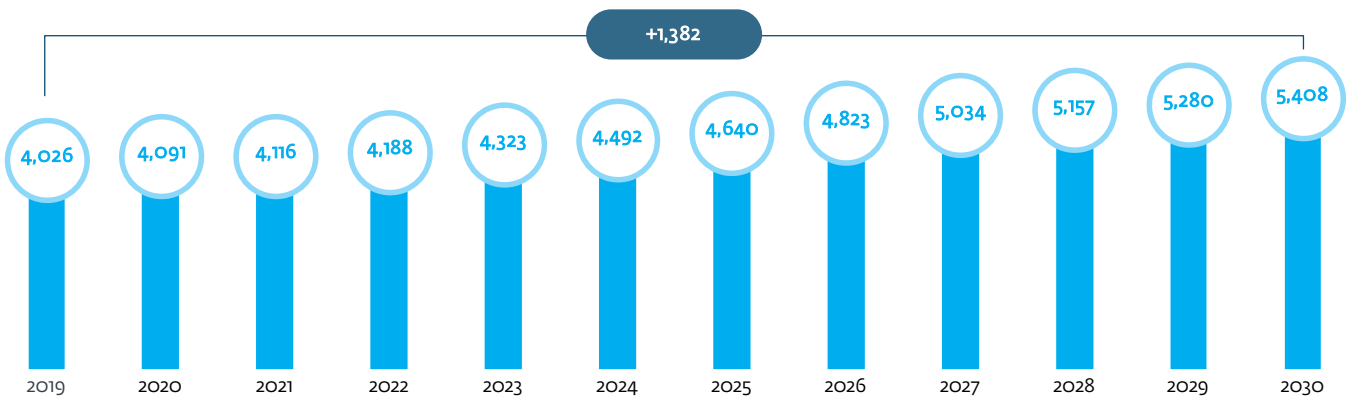
Drivers of the growth in the number of telecom towers include:

- **Rise in mobile penetration:** While most regions already have more than 100 percent mobile subscription penetration, SSA and SA still have mobile penetration below 80 percent, providing much headroom for growth in line with rising per capita incomes.
- **Technology evolution and network densification:** An increase in points of presence is required as data consumption grows from the proliferation of connected devices and video streaming. This is expected to be further driven by the

transition toward newer technologies which have a lower coverage radius. In particular, 4G network densification is likely to have a large short-term impact in emerging markets.

- **Expansion of telecom networks into rural and remote areas:** Telecom operators are expected to increasingly deploy sites in remote and lower population density areas as urban penetration reaches saturation. Most countries also include mandatory network coverage obligations for MNOs to deploy sites in these areas.
- **Rise in tenancy ratios** is expected due to increased sharing of passive infrastructure and growing penetration of independent Towercos. Tower sharing can drive the reduction in deployment costs, giving MNOs faster time to market. MNOs are faced with increased competition and compressing margins, incentivizing CAPEX optimization. Similar dynamics are also at play for power assets. Infrastructure sharing has also gained support from telecom regulators, with tower sharing being mandated or encouraged in some markets.

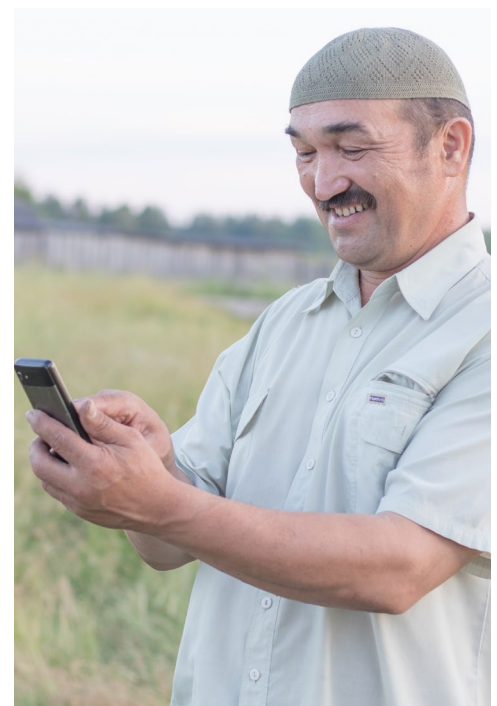
Figure 2-1: Forecast of number of telecom towers in the markets within the scope of this report¹⁰ (thousand sites)



2.2 Forecast of bad-grid and off-grid sites growth

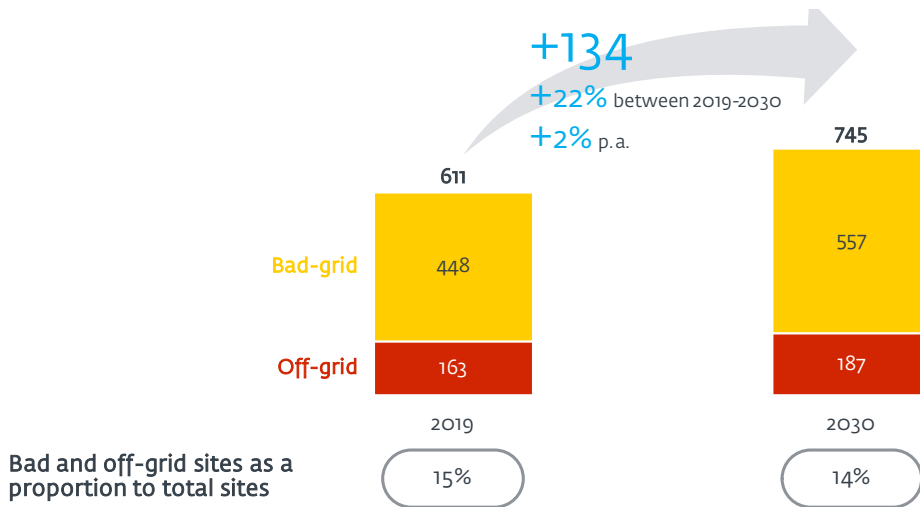
Number of bad- and off-grid sites to increase by 134,000 over the next 10 years

Given that the number of bad- and off-grid sites as a proportion of total sites is expected to remain stable at around 15 percent in the next 10 years, a significant proportion of the 1.4 million new telecom towers is expected to result in new bad-grid and off-grid sites. Bad-grid sites will lead the increase, rising from 448,000 in 2019 to 557,000 in 2030, while off-grid sites will increase more modestly from 163,000 to 187,000 during the same period (Figure 2-2).



¹⁰ The scope of this report includes SSA, MENA, LAC, SA, EAP and EAC.

Figure 2-2: Number of bad-grid and off-grid sites, 2019–30 (thousand sites)



SSA, SA and EAP to drive bad-grid and off-grid site growth

The number of bad- and off-grid sites in SA, EAP and SSA leads the other regions of the world by far (figure 2-3). In 2019, SA had 222,000 bad- and off-grid sites, EAP had 179,000 and SSA had 115,000, which accounted for 36 percent, 29 percent and 19 percent of bad- and off-grid sites, respectively.

Grid improvements would mean that some existing or new bad-grid and off-grid sites could also be converted to good-grid sites, or bad-grid sites respectively. For example, in SSA, the rate of growth in telecom towers to meet growing mobile penetration in poor grid areas is expected to far exceed the rate of power grid improvement. This discrepancy will result in an additional 89,000 new bad- and off-grid sites by 2030 (figure 2-3). SA and EAP will add 27,000 and 16,000 bad- and off-grid sites respectively, by 2030. In 2030, SA is expected to have 250,000 bad- and off-grid sites, making up the largest share of globally bad-grid and off-grid at 34 percent. This share is followed by SSA at 205,000 bad-grid and off-grid sites (27 percent of global bad-grid and off-grid sites), and EAP at 195,000 sites (26 percent of global bad-grid and off-grid sites). For EAP, growth is expected to be driven by emerging Southeast Asian economies such as Myanmar, Indonesia and the Philippines. By 2030, the proportion of bad- and off-grid sites within SSA and SA are still expected to make up a significant proportion of total sites in the region at 55% and 29%, respectively (figure 2-4).

Figure 2-3: Number of bad-grid and off-grid sites by region, 2019–30 (thousand sites)

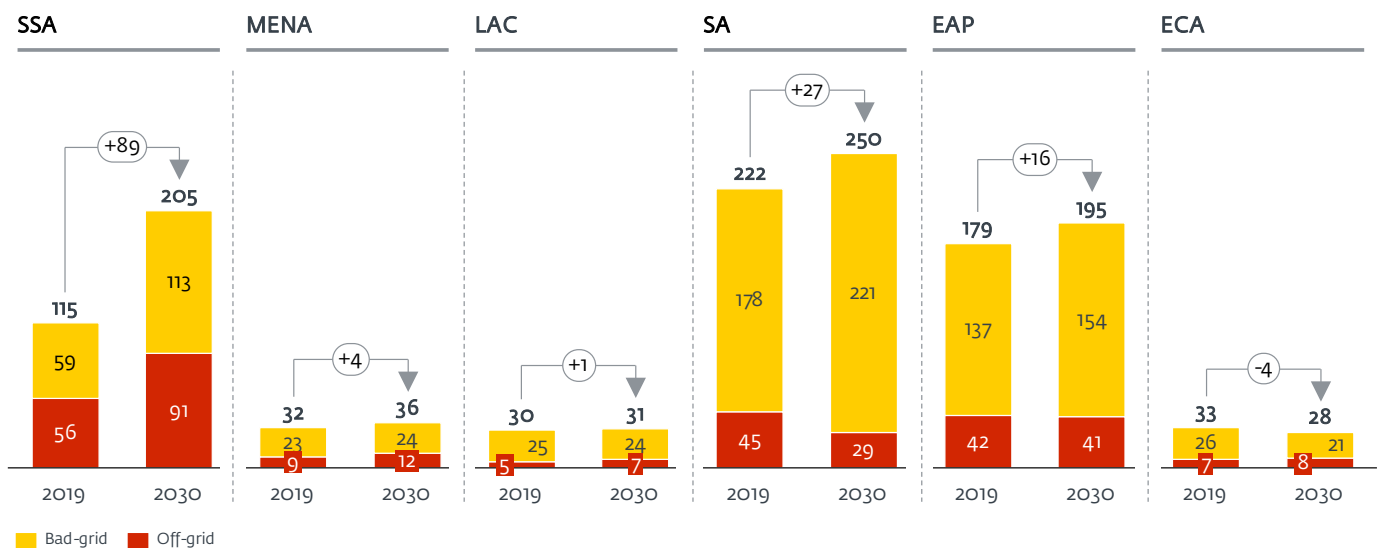
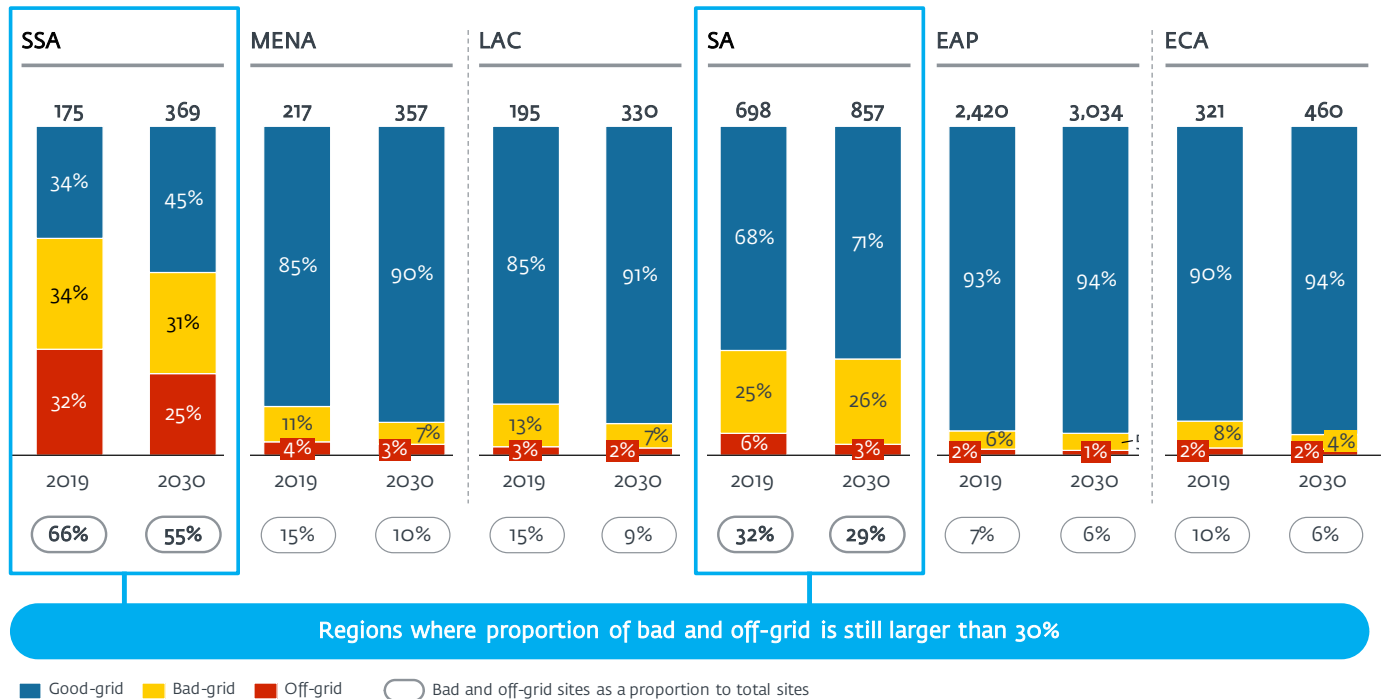


Figure 2-4: Proportion of bad-grid and off-grid sites of total sites by region, 2019-30 (thousand sites)¹¹



The growth of bad- and off-grid sites in each region is impacted by a multitude of trends in the telecommunications and power sectors:

- Universal Service / Rural Obligations will drive mobile coverage in unserved and underserved areas:** As network coverage and urban penetration reach saturation, MNOs will be required by regulators to roll out new sites in rural areas and areas with lower population densities to meet population coverage commitments and ensure mobile coverage equity.
- Improvements in grid availability and reliability:** As emerging markets move towards universal electrification, continued investment is expected in the sector, in line with The United Nations Sustainable Development Goals (SDG7). An increase in grid connections will reduce the proportion of off-grid sites. As grid quality improves, some bad-grid sites will also be converted to good-grid sites.
- Tower sharing supports network deployment in rural areas and reduces infrastructure required:** Tower sharing enables economic rollout in areas that are not otherwise viable by reducing CAPEX duplication across MNOs. Such areas have a higher proportion of bad-grid and off-grid sites.

“ In this region (SSA), we expect the number of off-grid sites to grow, given the large number of new sites required. The quality and reliability of grid connected sites will still remain highly uncertain – significant investments will be required to improve grid conditions.

Grid connectivity has not improved in the region, in fact, in some countries, grid quality has deteriorated.

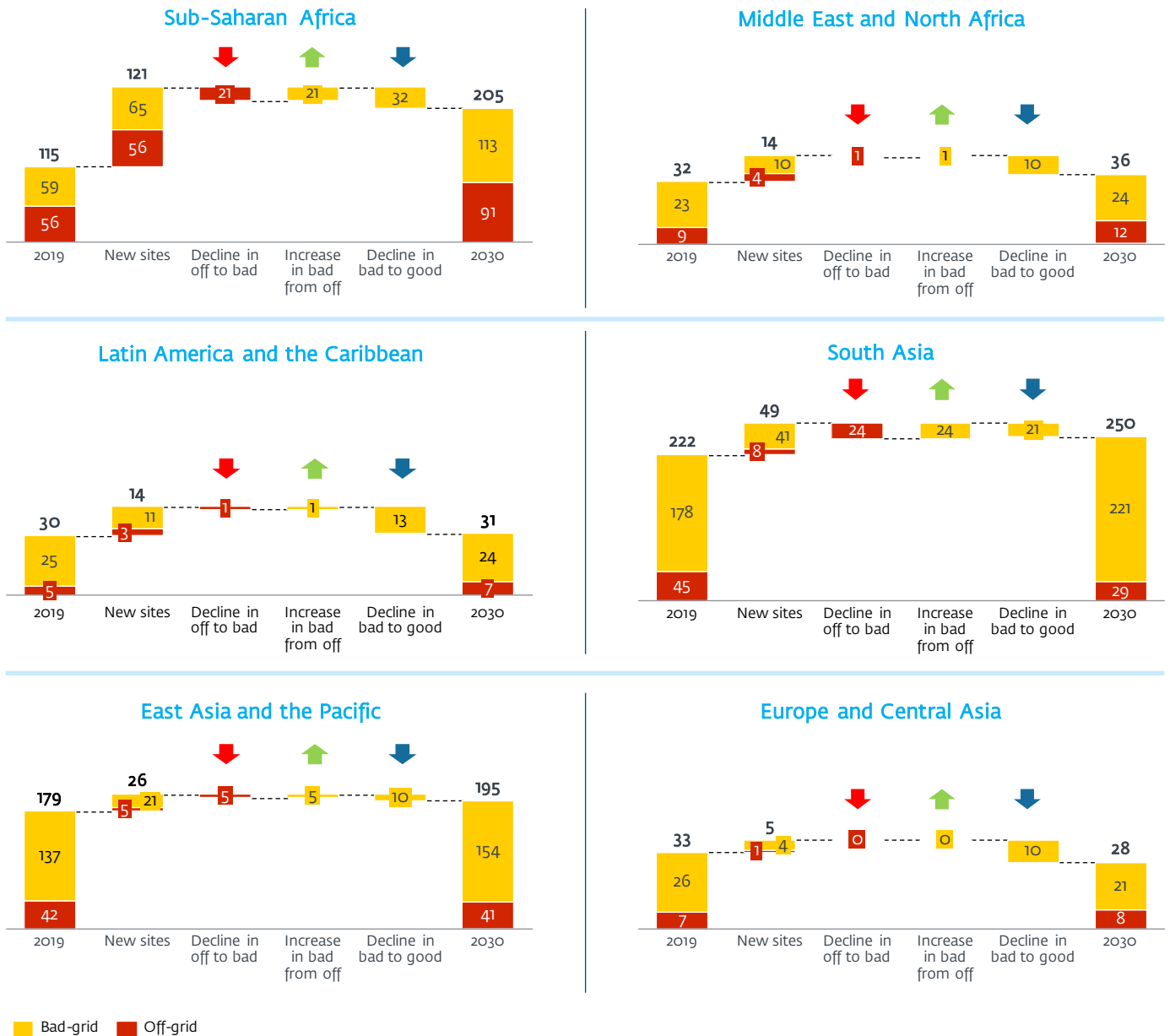
Interview excerpts from MNOs

Figure 2-5 illustrates the impact of the conflicting trends driving the growth in bad-grid and off-grid sites. Taking SSA as an example, the number of new bad-grid and off-grid sites is expected to more than double in absolute terms by 2030. However,

¹¹ Totals may not sum up due to rounding.

as grid connectivity improves, some off-grid sites attain grid connection albeit with poor reliability. This decreases the number of off-grid sites while increasing the number of bad-grid sites. On the other hand, some bad-grid sites are also likely to see improvements in grid reliability as investments in the power sector continue, resulting in the conversion of these sites to good-grid. An overarching trend that would drive down the number of new bad-grid and off-grid sites is the expected increase in tenancy ratio, as tower sharing is expected to facilitate a more cost-effective and swifter rural network roll-out.

Figure 2-5: Gross addition and net addition of bad-grid and off-grid sites, 2019-2030 (thousand sites)



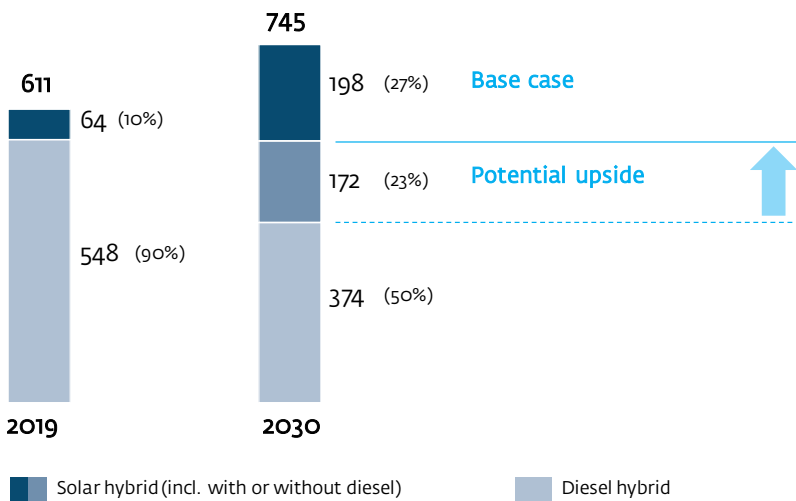
2.3 Adoption of renewable energy solutions

Penetration of renewable energy solutions at bad-grid and off-grid sites expected to increase from 10 percent today to 27 percent by 2030

In 2019, approximately 64,000 sites, or just over 10 percent, of the 614,000 bad-grid and off-grid sites incorporated solar PV (photovoltaic) solutions. Given the ready availability of solar irradiation at bad- and off-grid sites, as well as the improving commercial business case for the adoption of solar energy, the potential for additional renewable energy penetration is high. Nevertheless, there remain operational, technical and organizational limitations in converting diesel power generation to alternative technologies. In a base case scenario, it is estimated that renewable energy penetration will rise from 10 percent today to 27 percent by 2030 (figure 2-6). In an upside case, penetration could rise up to 50 percent. Under the base case, the number of bad- and off-grid sites using renewable energy solutions is expected to triple from 64,000 in 2019 to 198,000 by 2030.

In terms of regional split, EAP, SSA and SA are expected to account for over 34 percent, 29 percent and 24 percent of sites with renewable power solutions by 2030 respectively. Unsurprisingly, these are also the regions with the highest number of bad- and off-grid sites (figure 2-3 and figure 2-4).

Figure 2-6: Power solutions at bad-grid and off-grid sites, 2019–30 (thousand sites)



“

With good solar PV resources and poor grid availability, [as well as] a growing mobile market, there are a lot of opportunities to solarize sites in SSA. Other markets with good opportunities include specific countries in Southeast Asia where connecting [to]the grid is difficult and diesel fuel logistics are challenging.

Interview excerpts from MNOs

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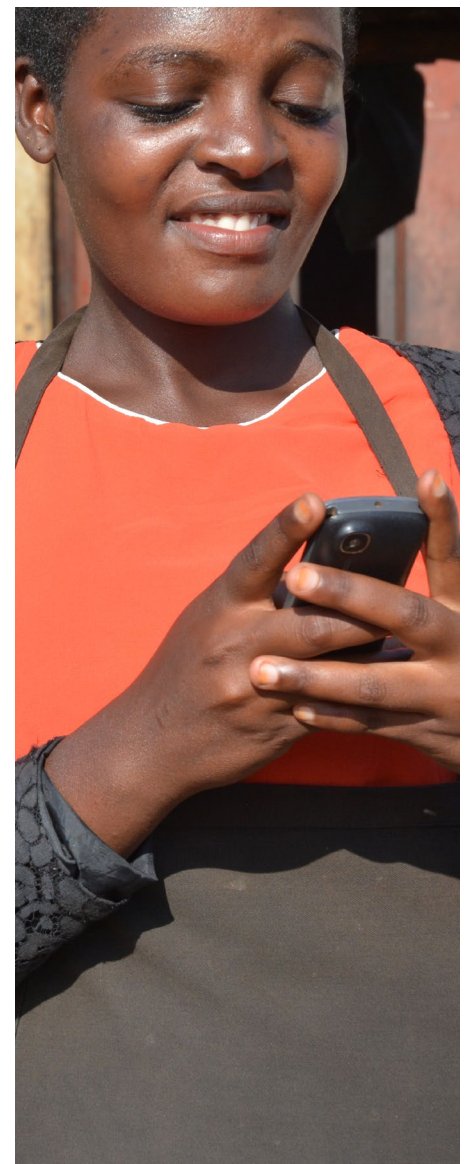
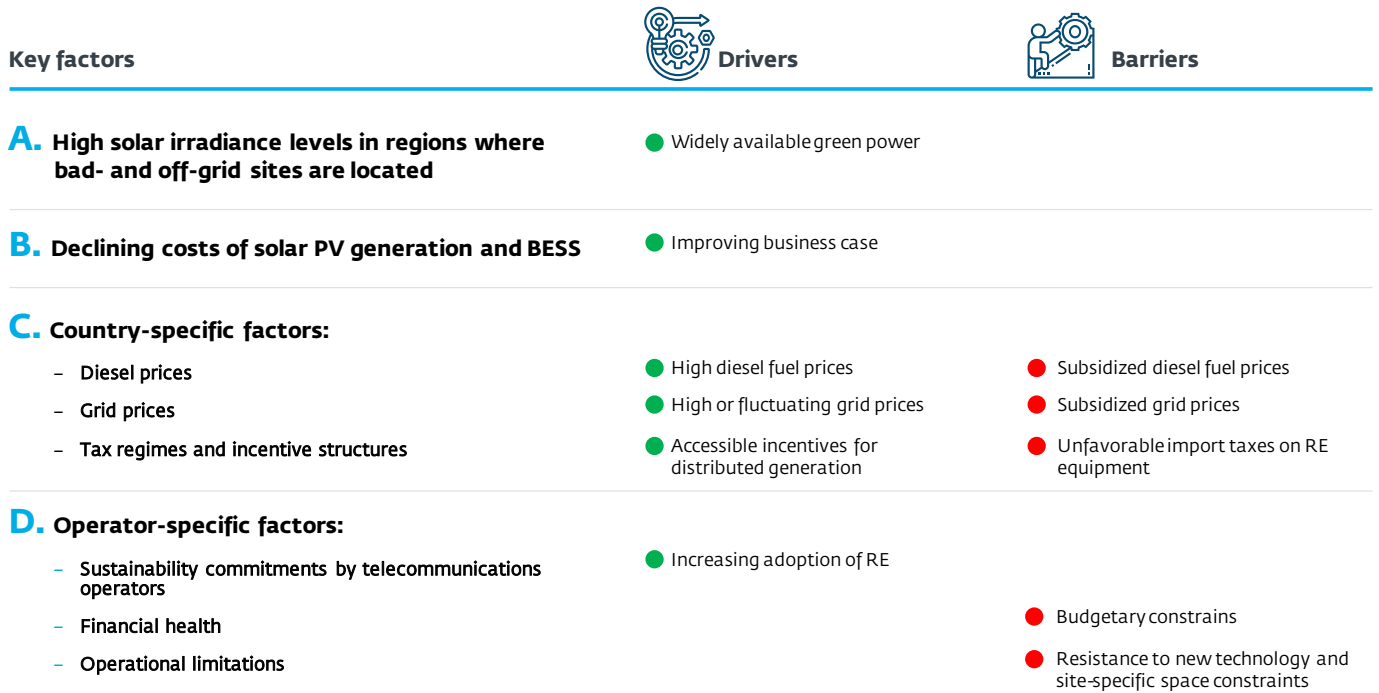


Figure 2-7: Key factors influencing the penetration of renewable energy solutions



The four factors impacting the penetration of renewable energy solutions in figure 2-7 are detailed below.

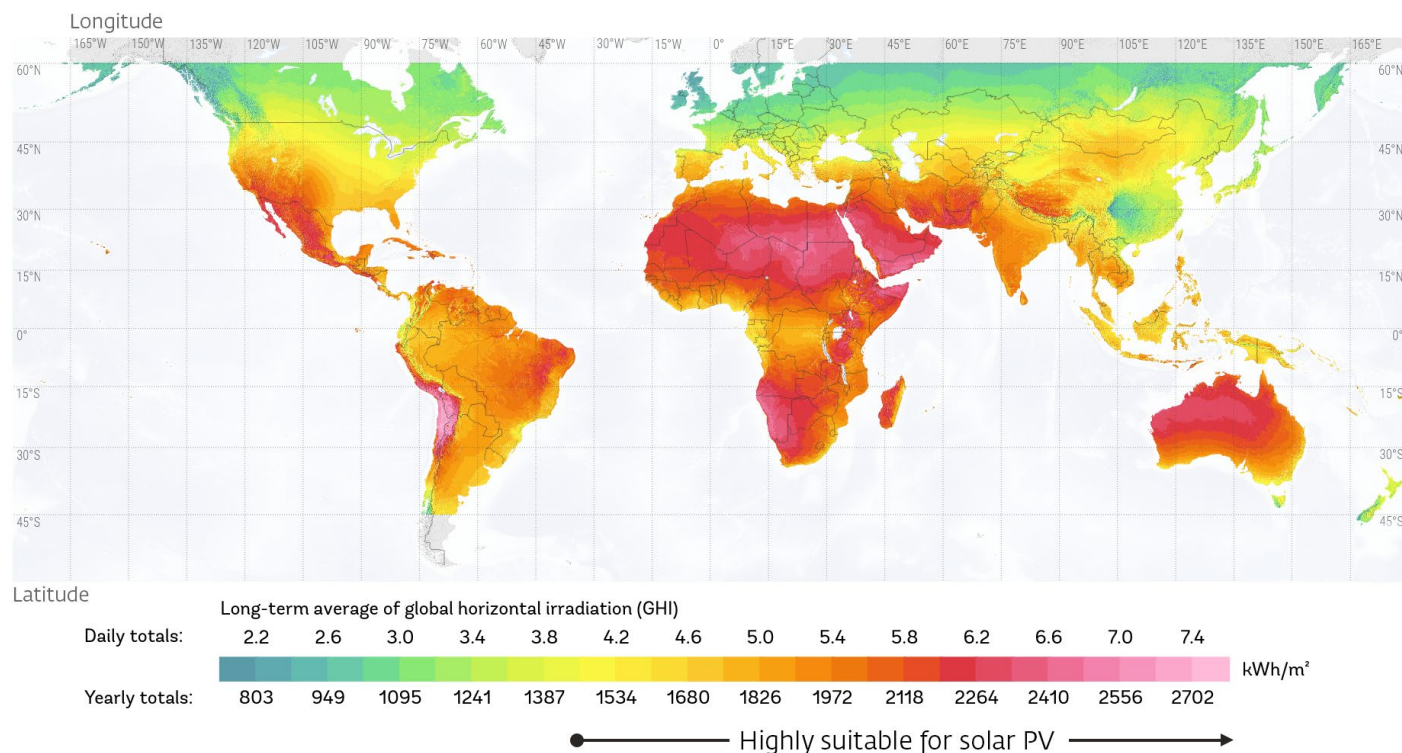
A. High irradiance levels in regions where bad-grid and off-grid sites are located solar

Solar PV is expected to remain the most commercially viable green alternative to diesel power generation

Solar availability is generally strong across SSA, MENA, LAC, SA and parts of EAP closer to the equator (figure 2-8). As such, solar irradiation is generally strong for most regions, especially in emerging markets, making distributed solar generation a viable alternative to grid connection.



Figure 2-8: Global horizontal irradiation¹²



With its widespread availability and comparative ease and rapidness in deploying, solar energy is currently considered the most viable alternative to diesel power generation. Especially in emerging markets, solar power provides an ideal solution to address grid challenges in remote and hard to reach sites due to a higher degree of system autonomy that can be achieved when paired with battery energy storage systems. While the space requirements of solar PV panels could limit the scaling up of solar energy generation on space-constrained sites, solar-battery hybrid systems (without diesel generators) have proven to be highly cost effective¹³ in remote and low-power requirements sites. These cost savings are achieved not only through eliminating diesel fuel consumption, but also by reducing the number of site visits required for maintenance. (A single site visit in highly remote areas can cost up to hundreds of dollars).

In sites with higher power loads or space constraints, such as urban areas, as well as in areas where cloud cover is frequent and rainfall is high, solar energy is typically used in combination with diesel generators and battery energy storage systems to ensure power reliability and system autonomy. Battery energy storage systems serve a dual purpose of reducing the running hours of diesel and hence diesel fuel consumption, as well as smoothening out the power variability of solar energy. In addition, by incorporating an additional source of power generation, diesel-run hours can be substantially reduced,¹⁴ allowing a lower frequency of site visits for maintenance and refueling purposes, while increasing the lifespan of diesel assets.

¹² Global Solar Atlas 2.0 published by World Bank, funded by ESMAP, and prepared by Solargis, accessed at: <https://globalsolaratlas.info/download/world>

¹³ Country and site specific, and can be commercially attractive if it meets both requirements of having plentiful solar resources and relatively high diesel fuel cost.

¹⁴ Where existing diesel generators are in place, they usually still have to be run minimally for O&M purposes

B. Declining cost of solar PV generation and battery energy storage systems

Cost of solar energy generation has fallen rapidly due to both the lower cost of solar PV panels and improved unit efficiency

Solar energy generation has witnessed rapid cost reductions of over 80 percent in the last 10 years. This rapid decline is due to a combination of economies of scale, technological innovation and a high degree of competition among PV manufacturers. Manufacturing costs of solar PV modules have declined with increasing scale and improving technology, while manufacturing costs have fallen as production has shifted towards lower-cost countries. Due to technological advances, each PV module is also capable of producing a higher energy output, leading to better unit efficiencies. Technology innovation is also bringing down the cost of inverters. This cost decline is expected to continue with growing global adoption, as well as with expected technological advances to further reduce equipment costs and improve unit efficiency. Hence, solar PV is expected to remain as one of the cheapest green technologies with proven long-term reliability for distributed generation.

Lead acid batteries remain the main storage technology used in telecom sites, but declining prices, high energy density and better cyclic life will drive strong growth in lithium ion batteries

Currently, over 80 percent of all batteries at telecom sites are still supported by lead acid chemistries. However, lithium ion batteries have experienced strong growth due to steep declines in prices recently, driven by innovation in automotive batteries.

Lead acid batteries have the benefits of being relatively affordable, able to withstand harsh conditions with minimal maintenance, and highly tolerant to overcharging. However, they have relatively short lifespans, are slow to charge, have lower energy densities, and are extremely prone to theft due to high second-hand value. In contrast, lithium ion batteries offer the benefits of quick charging times and high energy densities. Because of their low recycling value, lithium ion batteries are less prone to theft. They also have a better cyclic life than lead acid batteries. With its fast-charging properties, lithium ion performs well in poor grid connected locations with frequent but short outages, such as in India. In addition, the high energy density of lithium ion batteries makes their use highly attractive at space-constrained sites, such as urban areas where land acquisition and costs are challenging, potentially offsetting the higher upfront cost.

“

We expect the price for solar PV systems to decline even further; this will spark further interest and investments into renewable energy.

Interview excerpt from MNO

”




In addition to solar, other green power alternatives, such as fuel cell technology, microturbines and hybrid solar and wind power generation are being considered, with limited adoption to date

Fuel cell technology is being explored and is particularly attractive for being less vulnerable to theft than diesel alternatives. (In some regions, diesel fuel and asset theft are major contributors to network outages and high asset replacement costs). Like solar energy, fuel cells also require limited maintenance and are suitable for powering sites in remote locations. As fuel cells for telecom sites are typically powered by hydrogen or ammonia, this requires a fuel supply chain ecosystem in place, which has been one of the challenges for adoption in emerging markets. Given the limited extent of commercialization of fuel cell technology today, upfront cost for fuel cell technology remains high, but trials for the use of fuel cell at telecom sites are being conducted.

Another technology being explored is the use of microturbines, small combustion turbines used for energy generation. Microturbines have the benefit of flexibility in fuel usage (gas, hydrogen or biomass from waste), enabling the use of cheaper and less carbon-intensive fuels. They are compact, lightweight and have few moving parts, reducing maintenance costs. However, microturbines have yet to see large-scale commercial adoption with the technology still in the testing phase, and only small-scale trials are being conducted.

Telecom operators in the market have also experimented with hybrid solar and wind power generation (depending on site specific conditions), as they seek new ways to reduce costs and improve reliability from the intermittency of solar power. Nevertheless, such new technologies are currently in pilot stages, and have yet to see mainstream commercialization. Figure 2-9 below provides a detail comparison of the pros and cons for each alternative technology to diesel power generation.

Figure 2-9: Comparison of alternatives to diesel in power generation

Technology	Pros	Cons
Diesel	<ul style="list-style-type: none"> • Lower upfront cost • Most common technology and existing workforce are already trained to operate equipment 	<ul style="list-style-type: none"> • Least environmentally friendly option coupled with noise pollution • Exposure to fuel price fluctuation and diesel pilferage • Fuel logistics and maintenance cost can increase significantly in remote regions
MOST VIABLE TO DISPLACE DIESEL		
Solar 	<ul style="list-style-type: none"> • No carbon emissions when used as a standalone • Low maintenance • Reduction of solar module prices 	<ul style="list-style-type: none"> • Power intermittency based on site and weather conditions, requiring backup solutions, diesel generator and batteries • High capital cost • Requires large space
Fuel cell 	<ul style="list-style-type: none"> • Can continuously generate electricity and does not require storage solutions • Requires less maintenance as no moving parts in equipment • Reduced environmental concerns • Fuel theft-proof 	<ul style="list-style-type: none"> • Fuel supply, requires hydrogen / ammonia distribution • No ecosystem in place, esp. in emerging markets • Quality of fuel, i.e. impurities impacts performance and durability • High capital cost • Requires large space
Wind 	<ul style="list-style-type: none"> • Complements solar to reduce power variability of renewable resources • No fuel required and limited O&M required 	<ul style="list-style-type: none"> • Geography dependent • Power intermittency based on site and weather conditions • High capital cost
Microturbine	<ul style="list-style-type: none"> • Clean fuel flexibility enables cheaper and less carbon intensive non-diesel fuels to be used • Simple and hence lower maintenance costs; lightweight, compact and portable • Lower CAPEX than other eco-friendly alternatives 	<ul style="list-style-type: none"> • Operational performance yet to be tested

C. Country-specific factors

Despite global cost reductions in solar, country-specific and operator-specific drivers impact the business case for solar

Country-specific drivers of the business case for solar include:

- Cost of diesel fuel:** The business case for solarizing a telecom site is highly dependent on fuel cost. For example, Mali, a land-locked country, has a diesel fuel price of around \$1.1 per liter, making the case for weaning off diesel consumption very attractive. Diesel subsidies may dampen the business case for solar, despite the additional operational cost for diesel, such as diesel pilferage and logistics for diesel refueling and transportation at remote sites. Countries with low fuel costs include Angola and Sudan, where diesel can cost less than \$0.30 per liter.
- Availability of incentives for renewable energy equipment:** Certain renewables equipment classes benefit from tax waivers, in order to support national renewable energy targets or de-carbonization targets. For example, countries with supportive import duties for small-scale renewables equipment include Guinea and Mali, where distributed renewables power generation is expected to be a key pillar of universal electricity access. However, incentives and tax policies are subject to revisions based on national policies and agendas, such as boosting renewable energy supply to meet targets, or in contrast, implementing of safeguard duties to protect domestic industries.
- Grid tariffs and regulations for distributed energy generation:** Subsidized grid tariffs may hinder the development of distributed solar PV generation. On the other hand, solar PV on bad-grid sites can mitigate against high grid tariffs and insulate the user against fluctuating grid prices. Availability of net-metering policies could offer distributed power generation an alternative source of revenue in selling excess electricity back to the grid. For example, such opportunities exist in Nicaragua, where grid prices are generally high and rules for net energy metering are in place. In Myanmar, distributed power generation includes selling power to communities through mini-grids to support national electrification targets.

“

Taking into account full CAPEX (import duties, transportation cost, taxes) and OPEX (diesel fuel and potential subsidies, grid prices), each market has a very different business case for solarizing sites

Interview excerpt from TESCO

”

D. Operator-specific factors

Telecommunications operators' sustainability commitments will drive renewable energy adoption

The telecom sector has set ambitious targets to reduce its carbon footprint. This includes the pathway to reduce greenhouse gas emissions developed by industry association GSMA in partnership with the International Telecommunication Union and the Global e-Sustainability Initiative, which targets a 45 percent emissions reduction by 2030 and net zero emissions by 2050.

These industry-wide norms have cascaded down to most major multinational MNOs and Towercos, which have individually set sustainability targets which will lead to de-carbonization transitions in their local operating companies (figure 2-10). Meeting these ambitious targets will require transitioning to renewable energy generation not only at tower sites, but also in powering their adjacent operations, such as buildings and data centers.

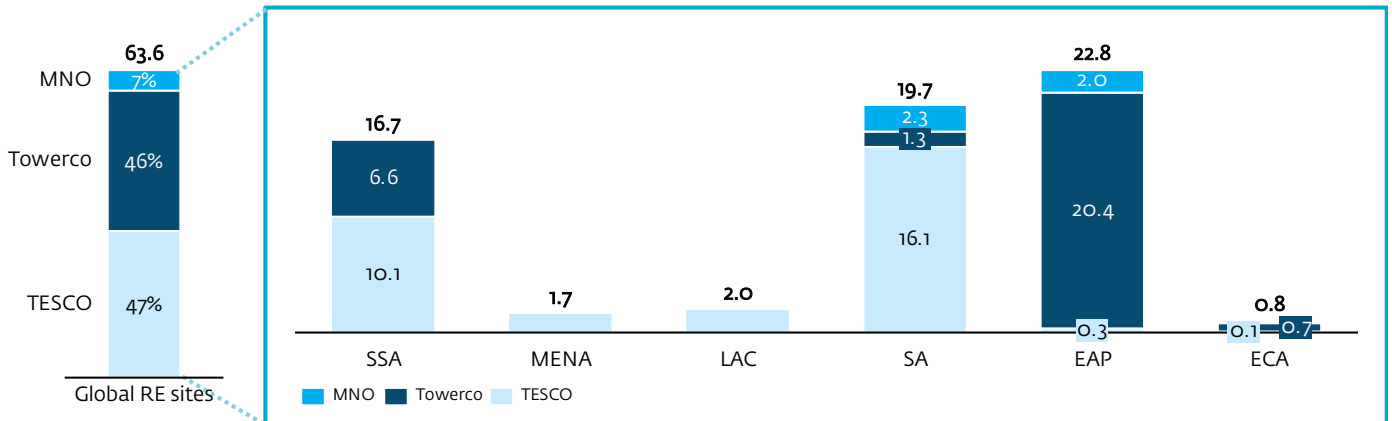
Figure 2-10: Selected MNOs and Towercos with sustainability targets

MNOs	
MTN	Net zero emissions by 2040 and 47% average reduction in absolute emissions (tCO ₂ e) for scope 1, 2 and 3 by 2030
Orange	50% of power from renewables by 2025; Net zero carbon emission by 2040
Telefonica	100% power from renewables and net zero emissions by 2030
Telenor	50% reduction in CO ₂ emissions in Asian operations and 100% reduction in CO ₂ emissions in Nordic operations
Vodafone	100% reduction in Scope 1 & 2 emissions by 2030; Net zero carbon emission by 2040 (100% reduction in Scope 1, 2 and 3 emissions)
Zain Group	5-25% reduction in GHG emissions by 2022, varying by opco
Towercos	
American Tower Corporation	60% reduction of Scope 1 fossil fuel consumption and greenhouse gas emissions in Africa and India by 2027
edotco	"Going Green" key pillar in sustainability efforts
Helios Towers	Sustainable Business Strategy that supports UN SGD Goals; Emissions reduction target to be set in 2021
IHS Towers	Align with UN SDG Goals, including renewable solutions for towers and sites
Indus Tower	Diesel free by 2021

TESCOs play a critical role in supporting MNOs and Towercos to reach their sustainability goal

While independent TESCOs today own or manage the power equipment at only one percent of total telecom sites, this share represents 47 percent of global renewable powered grid sites (figure 2-11). Approximately 10 percent of all bad- and off-grid sites today incorporate renewables solutions. These renewables efforts on telecom sites have been conducted either in-house by MNOs or through Towercos with Power-as-a-Service or TESCOs. TESCOs are already working in partnership with MNOs and Towercos such as Orange, Airtel, MTN, MPT, American Tower Corporation (SA), Phoenix Tower International (LAC), and are likely to become indispensable partners of MNOs and Towercos in achieving their sustainability targets.

Figure 2-11: Breakdown of global RE asset ownership by region (thousand sites)



However, other operator-specific drivers could also hinder solar adoption at telecom sites including:

- Budgetary constraints:** Priorities in deploying CAPEX are a major consideration for telecom operators. Given the higher upfront investment required for solar PV compared to traditional diesel-based solutions, solarizing sites are often a lower priority than network and infrastructure upgrades, especially for financially-constrained telecom operators.
- Resistance to adopting new technology:** Diesel generators have historically been the dominant power generation technology for bad- and off-grid sites. Employees at all levels may be resistant to change, especially when it requires new expertise. New technology also requires O&M staff to be retrained to ensure solar sites are maintained correctly. While solar O&M is technically easier to manage than diesel generators due to the lack of moving parts, site management retraining is still required for on-the-ground teams.
- Ease of deployment depends on type of sites:** Due to the space and size requirements of solar plants, it may be easier to incorporate solar energy during the design stages at greenfield sites than to retrofit existing sites with solar equipment.

“
While we are cognizant of our environmental impact and try to reduce our diesel consumption, financial priorities and considerations need to support our core services, and not investments in power supply.”

Interview excerpt from MNO

“
Resistance to adopting new technology is a key challenge – the teams are already trained to maintain diesel sites and need to be retrained to ensure solar sites are maintained correctly.”

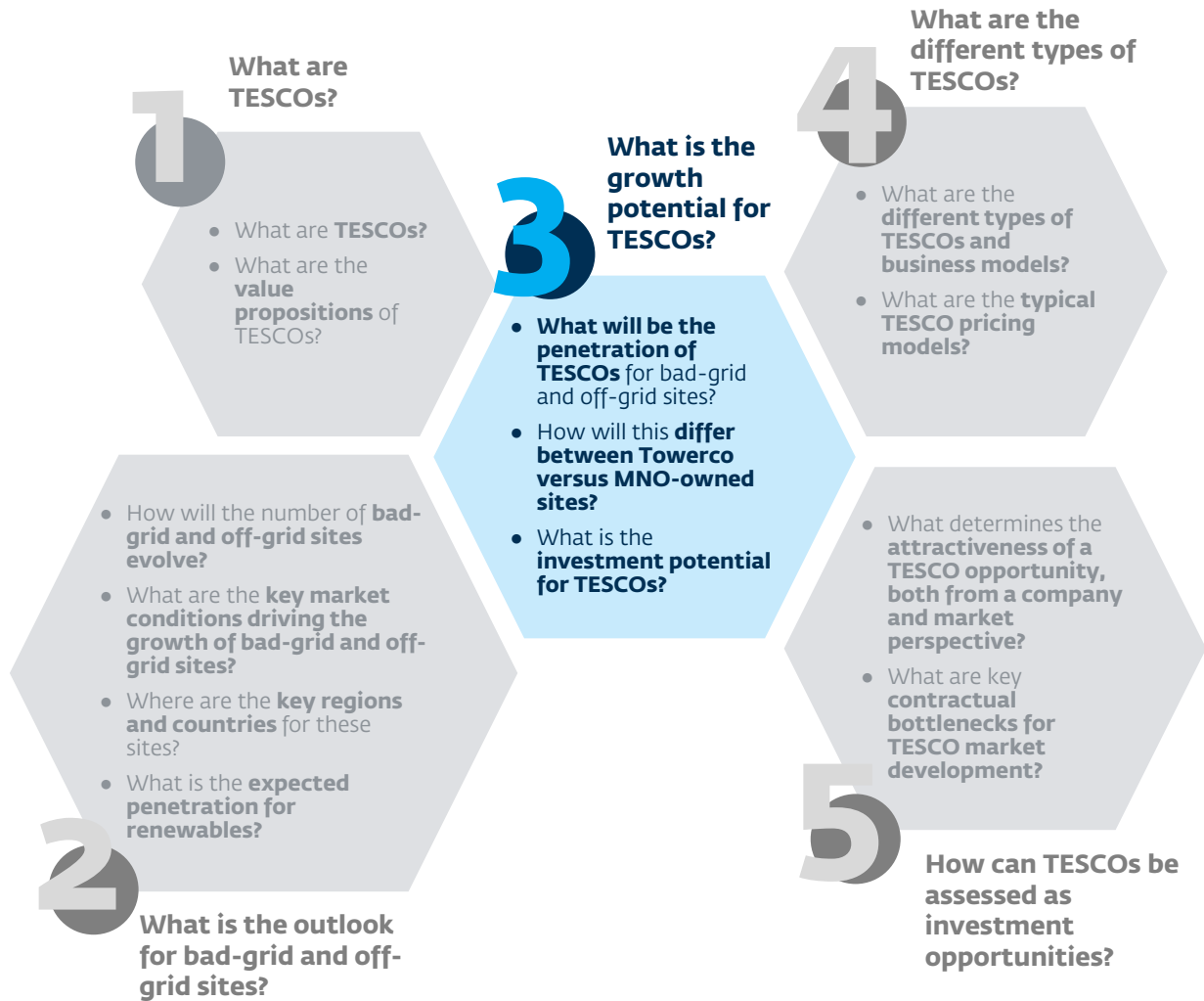
Interview excerpt from Towerco with Power-as-a-Service

Chapter 3

WHAT IS THE GROWTH POTENTIAL FOR TESCOS?



3. WHAT IS THE GROWTH POTENTIAL FOR TESCO?



3.1 Current TESCO market overview

There were 42,000 TESCO¹⁵ sites in 2019, with SSA and SA making up 86 percent of total sites

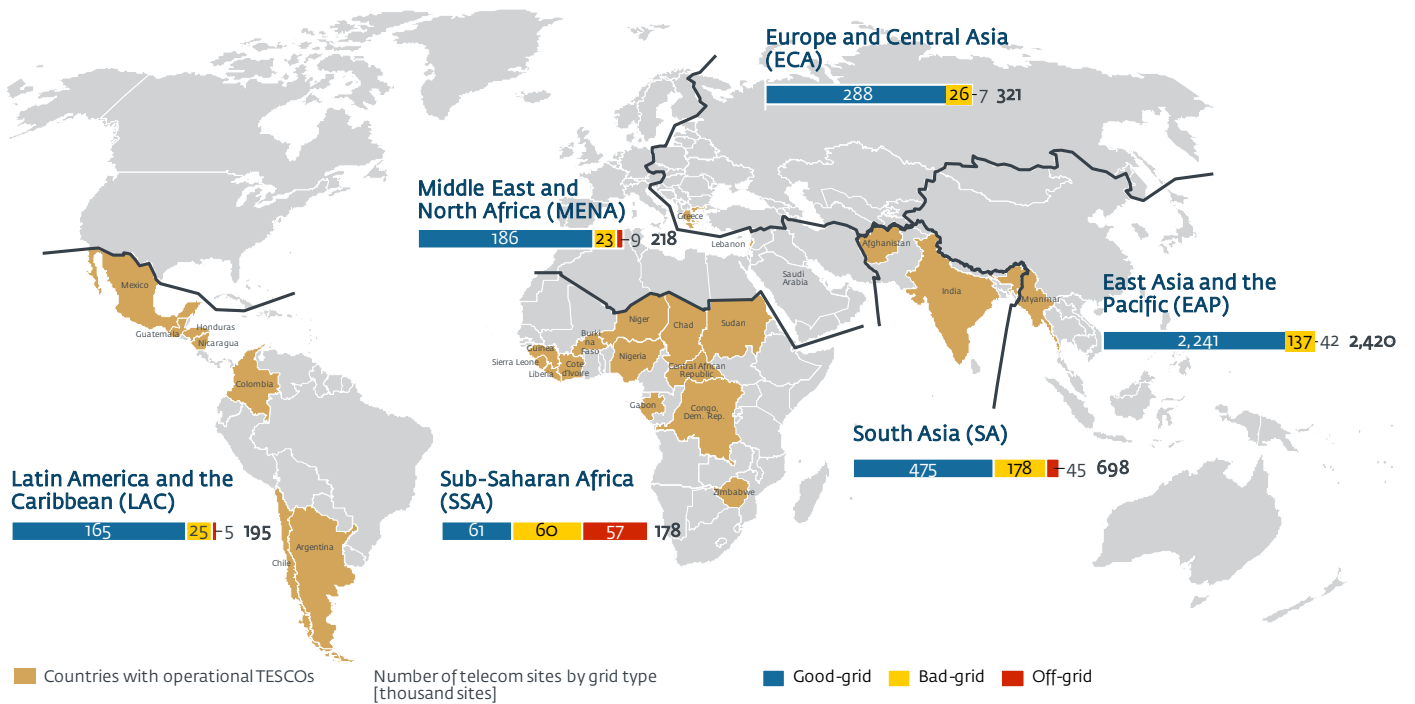
In 2019, there were approximately 42,000 TESCO sites in 26 countries within the six regions of this study. The majority of TESCO sites today are concentrated in SSA and SA, which account for 48 percent (20,200 sites) and 38 percent (16,100 sites) of all TESCO sites respectively (figure 3-1 and figure 3-2).

¹⁵ Towercos with Power-as-a-Service are not independent TESCOs as they do not serve other companies beyond the scope of their own towers

Figure 3-1: Split of TESCO sites by region in 2019



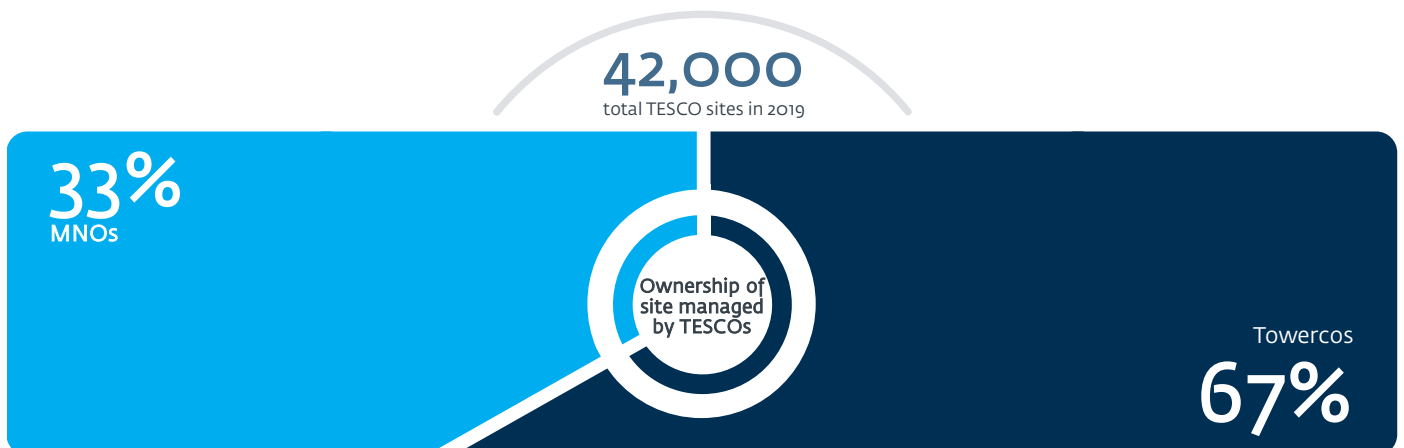
Figure 3-2: Overview of grid split by region and TESCO activity in 2019



Towercos make up the majority of TESCO customers

Of the 42,000 TESCO sites, the majority (67 percent) are currently owned by Towercos (figure 3-3). In recent years, TESCO growth has been driven by MNOs, as opposed to Towercos.

Figure 3-3: Overview of ownership of site managed by TESCOs (percent of sites)



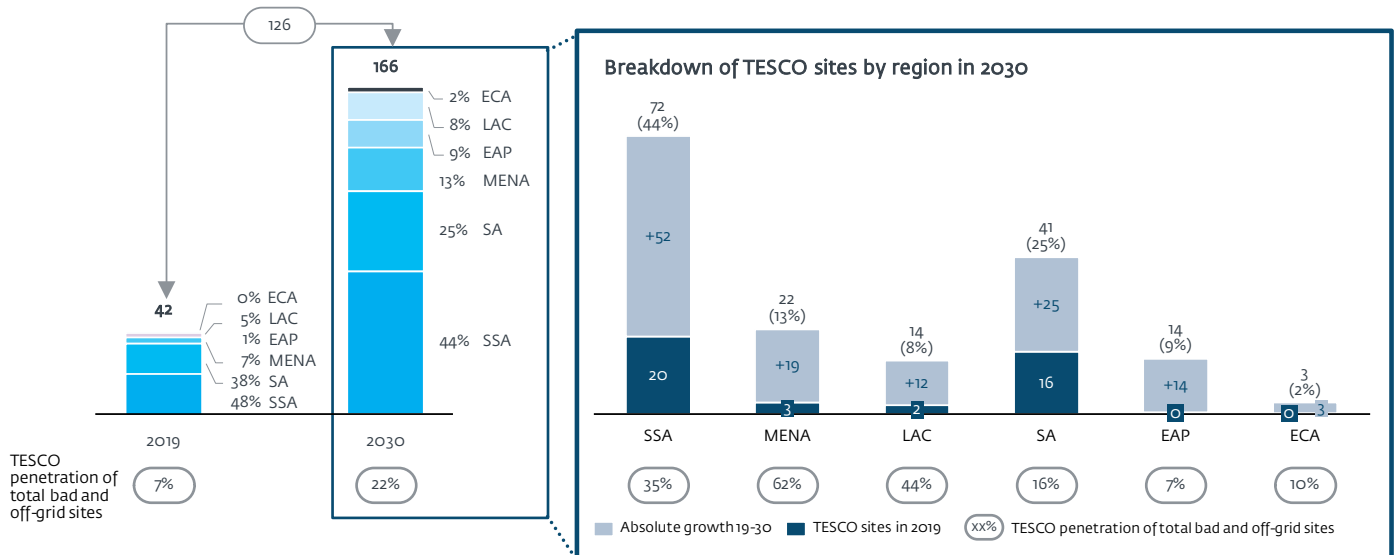
3.2 TESCO market forecast

Number of TESCO sites expected to quadruple from 42,000 to 166,000 by 2030

While the number of bad-grid and off-grid sites is expected to increase by just 22 percent between 2019 and 2030, the number of TESCO sites is expected to increase by nearly 300 percent. This growth represents a rise from 42,000 TESCO sites in 2019 to 166,000 such sites by 2030. The changes reflect TESCO penetration among total bad- and off-grid sites growing from 7 percent in 2019 to 22 percent in 2030 (figure 3-4).

On a regional level, SSA and SA lead in the number of current TESCO sites, and are also expected to be the largest contributors to the increase in TESCO sites. SSA will continue to be the largest market for TESCO sites in 2030 with a total of 72,000 sites (44 percent of TESCO sites), followed by SA at 41,000 (25 percent of TESCO sites) and MENA at 22,000 (13 percent of TESCO sites).

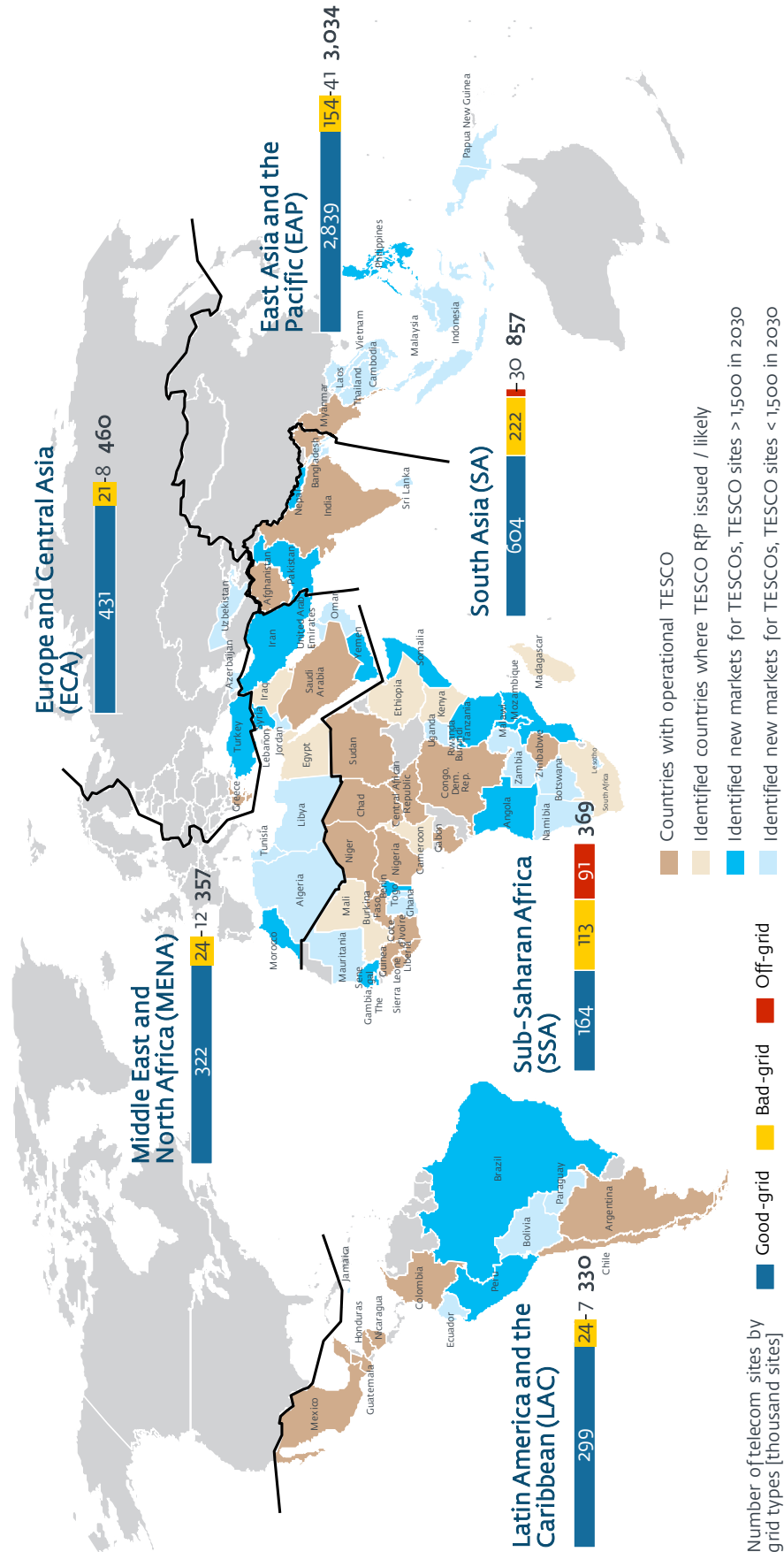
Figure 3-4: TESCO sites by region (thousand sites)



Number of countries with operational TESCOs could increase from 26 to 83 by 2030

In addition to the 26 countries with operational TESCO sites today, another 57 countries could be new markets for TESCOs by 2030 (figure 3-5). These markets are identified as viable TESCO target markets because they have a sufficient number of bad-grid and off-grid sites which meet the minimum scale required to profitably provide TESCO services. These nations also receive a sufficient level of solar resource to enable solar-powered solutions by TESCOs.

Figure 3-5: Overview of potential TESCO markets in 2030¹⁶



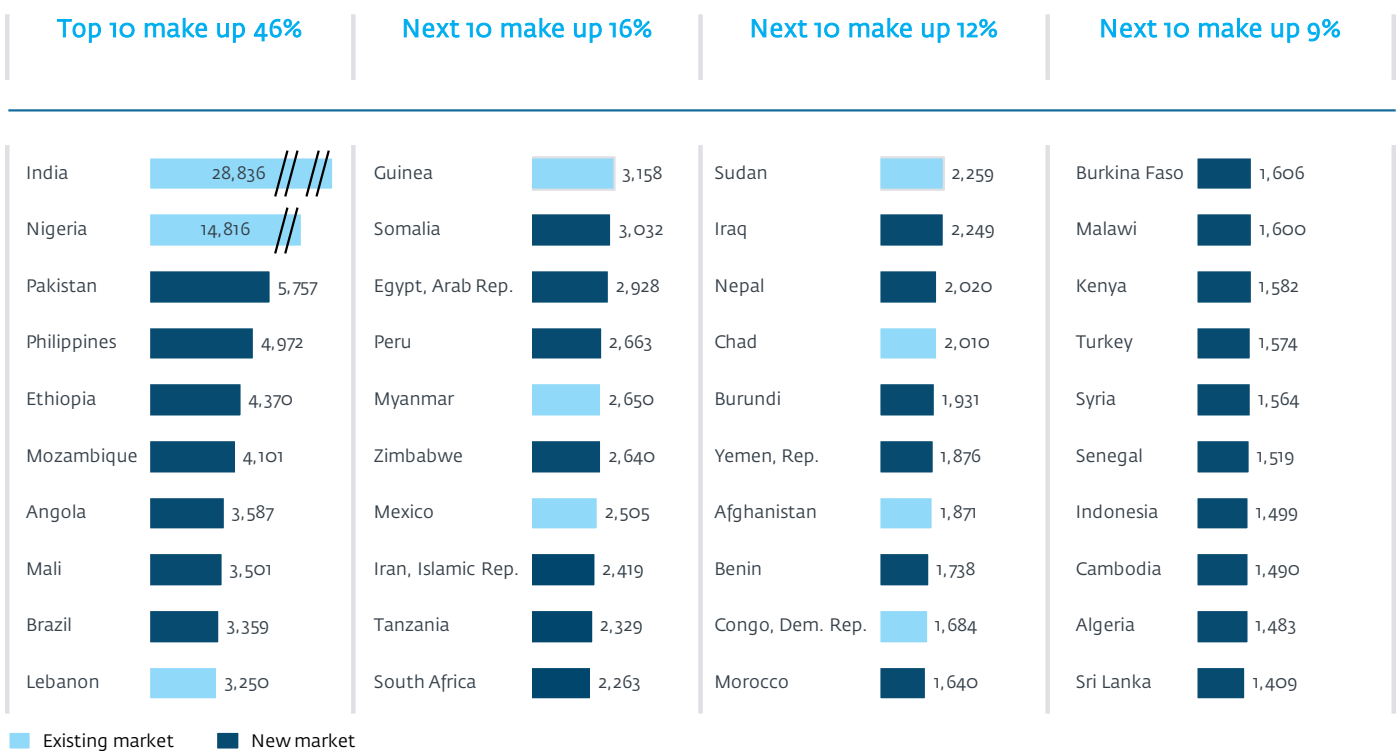
¹⁶ Totals may not sum up due to rounding

Ten countries are expected to account for nearly half of the TESCO market. The top 40 TESCO countries are expected to make up 80 percent of the TESCO market

Despite the increasing number of countries expected to have TESCO sites, a significant proportion of TESCO sites will still be located in a few countries. These are large emerging economies with fast-growing mobile penetration, where growth in new towers is expected to exceed improvements in the power grid network.

In 2030, India is expected to remain as the top TESCO market, accounting for 17 percent of all TESCO sites, while Nigeria will come in second at 9 percent. Altogether, the top 10 countries will account for 46 percent of all TESCO sites (figure 3-6).

Figure 3-6: Top 40 TESCO markets by 2030 (number of sites)



The level of penetration and growth of TESCO sites across the world have been assessed on a country-by-country basis. TESCO penetration is determined by four key drivers, based on key findings as discussed in earlier chapters:

- **Forecasted towers growth on bad-grid and off-grid sites:** As discussed in Chapter 2.1 and Chapter 2.2, bad- and off-grid tower growth in each country is determined by the expected increase in mobile penetration and expansion in network coverage, coupled with expected improvements in the power grid, taking into account the typical rate of grid improvements in such emerging markets.
- **Commercial attractiveness to solarize telecom sites while converting CAPEX cost into OPEX:** As discussed in Chapter 2.3, the business case for solarizing sites is a key consideration for a TESCO. In particular, a key driver for improving the business case for a TESCO is the diesel arbitrage opportunity in each country. In addition, MNOs can convert these power solution CAPEX cost into OPEX-only cost, which is especially attractive given heightened competition and continued compression of margins faced in the industry.

- **Presence of MNOs with de-carbonization targets:** As discussed in Chapter 2.3, MNOs have explicitly committed to achieving environmental sustainability and de-carbonization targets. These MNOs' green commitments will drive renewable energy and de-carbonization transition in the local operating companies and are likely to see greater rates of site solarization or serve as testbeds for clean technology.
- **Presence of towercos with Power-as-a-Service:** Given that Towercos with Power-as-a-Service are potential competitors for TESCOs, countries that are highly attractive for the TESCO model will also resonate with Towercos offering Power-as-a-Service. As such, countries with existing Towercos with Power-as-a-Service may see slightly muted TESCO growth.

Countries with moderate grid connectivity also offer opportunities for TESCOs, largely driven by urban penetration saturation, driving network coverage expansions to rural areas

Beyond SSA and SA where a high proportion of bad-grid and off-grid sites remain, certain parts of LAC and EAP, already have relatively high mobile penetration and grid connection. However, as urban penetration reaches saturation in these regions, MNOs' last leg of rollout typically aims to meet population coverage commitments and hence they will extend coverage to rural and lower population density areas. This will result in an increased number of sites built in rural, poor grid connectivity areas, even in countries with moderate grid coverage.

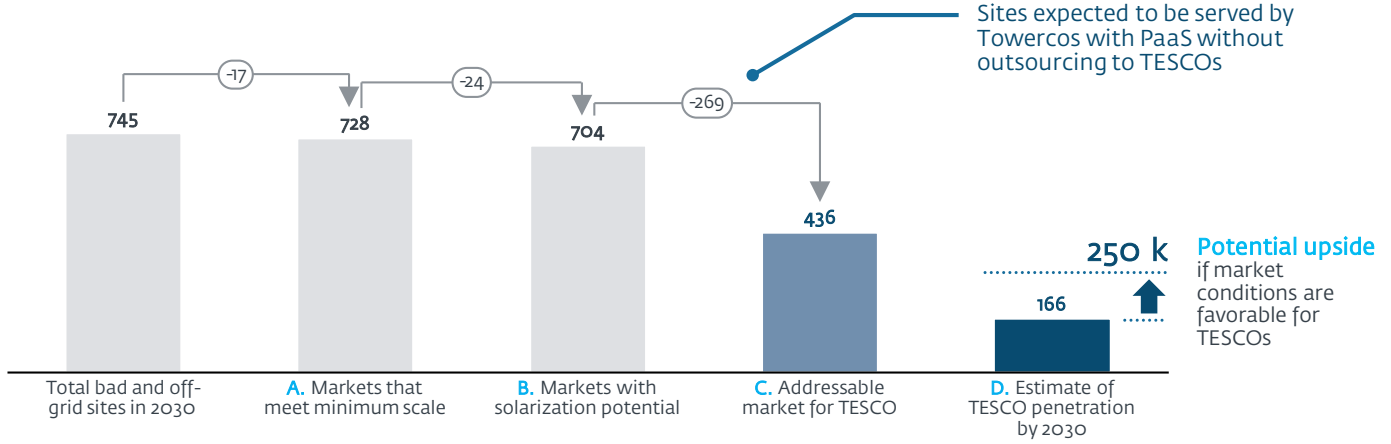
MNOs and Towercos in these regions have indicated willingness to engage third parties offering Power-as-a-Service (TESCOs) as grid connectivity becomes a bigger challenge in their operations. However, it is noted that in such regions, there is a greater challenge for a TESCO in achieving scale or maintaining high levels of site density, as these sites could be limited, or highly dispersed across the country.

3.3 Site forecasting methodology

Determining the TESCO penetration rate allows this market assessment to move from the total number of bad-grid and off-grid sites to the number of TESCO sites. This requires an understanding of four key drivers (figure 3-7):

- Minimum scale:** Bad-grid and off-grid sites must be located in markets that meet the minimum scale required. These markets are defined as having a minimum of 500 bad- and off-grid sites or having issued Request for Proposals (RfPs) for TESCOs.
- Solarization potential:** Markets must be further narrowed down to countries with sufficient solar resources and land to enable solarization of tower power supply.
- Competition with towerco Power-as-a-Service:** The proportion of sites expected to be served by Towercos under Power-as-a-Service arrangements without outsourcing to TESCOs are excluded from the total addressable market.
- Penetration within total addressable market:** Penetration rate can be affected by factors such as conversion rate of clients, solar take-up rate and contract bankability.

Figure 3-7: Forecasted addressable market for TESCO and penetration, 2030 (thousand sites)



A. TESCOs require a minimum of 250 to 500 bad-grid and off-grid sites per market for commercial viability

Interviews with TESCOs have indicated that a minimum of 250 to 500 bad-grid and off-grid sites are required for a TESCO to consider entry into a market. A smaller number of sites would typically result in insufficient profitability.









Many factors affect the commercial viability of markets for TESCOs:

- **Economies of scale:** A larger scale provides stronger negotiating power for TESCOs during equipment procurement, allowing them to negotiate for better prices, as well as better financing terms; in addition, fixed costs incurred for O&M can be optimized and spread out over a larger number of sites.
- **Scope for future market growth:** A market is more attractive if there are opportunities to scale up beyond existing contracts, either through the same clients or additional clients.
- **Site density:** The cost of maintaining a network falls as site density increases, due to economies of scale from optimization of O&M cost and activities.
- **Administrative barriers to entry:** There is a need to offset the fixed investment cost that goes into entering a new market and setting up a new business.

This criterion leads us to exclude, for example, countries such as Cabo Verde, Comoros, Djibouti and Equatorial Guinea as likely TESCO markets.

There are immediate opportunities present for TESCOs, with MNOs in various countries already having issued RfPs for TESCO services. In particular, countries with identified or upcoming RfPs include South Africa, Ethiopia, Mali, Iraq, Kenya, Egypt, Madagascar and Cameroon (figure 3-8). As evidence of the growing acceptance and scaling up of the TESCO business model, RfPs issued by MNOs in these countries exceed 1,000 sites.

Figure 3-8: Countries with TESCO RfPs issued or likely to be issued¹⁷

Company issuing RfP	# of sites in RfP	Bad-grid and off-grid sites in country, 2019 [# and % of total bad and off-grid sites]			
Vodafone	1,400 sites	1		South Africa	10,494 (35%)
Ethio Telecom	1,200 sites	2		Ethiopia	6,197 (77%)
Orange	1,800	3		Mali	4,326 (72%)
N/A	N/A	4		Iraq	4,219 (29%)
Safaricom	1,200	5		Kenya	3,639 (48%)
Orange & Etisalat	1,000 sites (Etisalat)	6		Egypt, Arab Rep.	2,906 (12%)
Orange	N/A	7		Madagascar	2,045 (89%)
Orange	300	8		Cameroon	1,994 (65%)

B. Solar availability is strong across almost all the countries that meet the minimum scale required for TESCO entrance

Given that the business model of TESCOs largely relies on solar as alternative power generation source to reduce diesel consumption, potential TESCO sites must also be located in regions that receive sufficient solar irradiation for solar energy generation. Of the 728,000 sites in markets that meet the minimum scale requirements, 704,000 are also in markets that receive sufficient solar irradiation.¹⁸ For example, countries with weaker global horizontal irradiance where solar power generation on site would be more challenging include, the Democratic People’s Republic of Korea, Hungary, Poland, the Republic of Korea, the Russian Federation, and Ukraine.

C. TESCOs’ penetration assumptions take into account competition from Towercos with Power-as-a-Service

Currently, TESCOs’ customers include a mix of MNOs (33 percent of total TESCO sites), Towercos not offering Power-as-a-Service (2 percent of total TESCO sites), as well as Towercos with Power-as-a-Service (65 percent of total TESCO sites). It is anticipated that this breakdown will be reversed in the next 10 years, with MNOs representing the largest TESCO customers in terms of number of sites.

¹⁷ Data collated from TowerXchange publications, October 2020.

¹⁸ Defined as global horizontal irradiance of 4.0-7.0 kWh/m²/day.

MNOs can decide between maintaining operations in-house, outsourcing power solutions to Towercos, or outsourcing TESCOs

A fundamental decision facing MNOs is whether to retain or divest ownership of their tower assets. Once the towers are sold, the contractual agreements between MNOs and Towercos could be on a: i) cost pass-through model, or ii) performance or efficiency-based model. Where the cost of powering the sites is passed through with the MNO being responsible for it, Towercos have little incentive to improve operational metrics. Not divesting the towers, on the other hand, leaves the MNOs with having to address power issues themselves and continuing to incur associated CAPEX. A TESCO can step in as a specialized partner to relieve the MNO of power infrastructure, engineering, procurement and O&M challenges, while allowing the MNO to focus investments and efforts on its core service provisions and optimize CAPEX allocation. The TESCO then assumes the CAPEX of the power assets, typically with a contract that incentivizes them to reduce OPEX, improve operational metrics and drive constant innovation, while helping MNOs reach their sustainability targets. Through TESCO contracts, MNOs can also achieve mid- to long-term predictability of energy costs. The attractiveness of this latter feature is, however, highly dependent on the local operating environment economics, such as tax regime, fuel cost, grid prices, and can act as an incentive or deterrent to entering into long-term energy contracts with TESCOs.

In contrast, working with a Towerco which offers Power-as-a-Service is the preferred route for MNOs which have divested their towers or are otherwise looking for a simple solution. The scale and geographic presence of many Towercos provide MNOs with increased comfort that they will deliver on their contractual obligations. Towercos with Power-as-a-Service may also offer solutions for MNOs looking to adopt a full Network-as-a-Service model of outsourcing both tower and power solutions. TESCOs are themselves expanding their portfolio of services to reach beyond pure power provision, often building on an existing portfolio of O&M services which may present attractive propositions. This is especially the case in rural or remote areas, where cost savings can be significant when one party manages all the services of a telecoms site. Towercos' appetite to tackle such areas depends on their respective strategies and local market dynamics.

Figure 3-9 below summarizes the key considerations for an MNO for selecting a site power solution provider, as informed by the interviews with MNOs conducted for this study.

“

We have tried a do-it-ourselves approach to power management, but we are not a power solution expert – this is where a TESCO comes in.

Interview excerpt from MNO

”

Figure 3-9: Considerations for MNOs in selecting power solution providers

Key considerations	Preferred power provider		Rationale
1 MNO retaining ownership of towers	Towerco with PaaS	TESCO	MNOs which have a strategy of retaining ownership of towers will not divest to towercos
2 Elimination of power systems CAPEX	Towerco with PaaS	TESCO	Both towercos with PaaS and TESCOs can bear upfront CAPEX cost of power systems, providing PaaS over a long-term contract
3 Reduction of site OPEX	Towerco with PaaS	TESCO	TESCOs use hybrid solutions to reduce dependence of diesel technology to enable cost savings
4 Improvement in uptime	Towerco with PaaS	TESCO	TESCOs have PaaS agreement bound by strict SLAs
5 Long term predictability of energy costs	Towerco with PaaS	TESCO	TESCOs allow better cost predictability through long-term fixed pricing contracts
6 Innovation in power solutions and monitoring systems	Towerco with PaaS	TESCO	TESCO's full control over energy management shifts approach toward a TCO approach, and are willing to make investments in new technology
7 Environmental commitments	Towerco with PaaS	TESCO	TESCOs have a stronger incentive to move to RE, given fewer legacy assets
8 Negotiation power	Towerco with PaaS	TESCO	MNOs have greater say during negotiations due to scale and supply demand imbalance
9 Network-as-service	Towerco with PaaS	TESCO	Towercos can offer one-stop shop solution (single vendor management) for MNOs looking to outsource all aspects of site operations
10 Geographical coverage	Towerco with PaaS	TESCO	Towercos or TESCOs (through their parent companies – O&M or energy groups) have wide geographical presence
11 Achieving scale	Towerco with PaaS	TESCO	MNOs which have strategy of divesting towers in the short term do not want to be tied down to long-term energy rates

Stronger value proposition

Towercos are both customers and competitors for TESCOs and there is a mixed perception of a TESCO's value addition to Towercos

Towercos without Power-as-a-Service are seen as potential customers for TESCOs in areas where the Towercos want to retain a traditional Towerco business (real estate only model), but still be able to provide MNOs with a full suite of services without getting into operational complexity of power solutions. For these Towercos, there is an incentive to outsource the power assets to TESCOs in order to reduce CAPEX requirements. This allows them to focus efforts on tower deployment, while transferring power solution risks to a third party.

While Towercos with Power-as-a-Service could generally be seen as competition to TESCOs, today they are the largest customers by number of sites, albeit under different contractual models versus MNOs (guaranteed savings model vs. fixed price contracts, as further discussed in the following chapter). Depending on the level of competency in power solutions, Towercos have very different motivations for outsourcing power solutions to TESCOs, as outlined below and in figure 3-10.

Key considerations for Towercos include:

- **Existing level of integration of power solutions with towers' O&M activities:** This typically depends on the Towerco's history in operating under challenging grid conditions. Some Towercos have developed in-house power capabilities alongside tower management in a synergistic manner that makes it difficult to decouple power and tower management operations without losing the synergies.

- **Ability to develop in-house competence in solar hybrid power solutions:** A key factor in a Towerco's decision to outsource power to a TESCO is the perceived ability of its in-house team to develop strong and specialized competence in power asset management, especially in managing the transition from diesel solutions to solar-powered solutions.
- **Access to capital and willingness to retain power asset ownership:** Some Towercos see their key value proposition as having access to low cost of capital, and hence core competence in managing both tower and power assets. These Towercos typically expect to retain the ownership of power assets, leaving limited value addition for TESCOs to take over CAPEX of the assets.

Figure 3-10: Key considerations for Towercos offering Power-as-a-Service in engaging TESCOs

Key considerations for towercos offering PaaS	Towercos who view power solutions as a core competency that cannot be decoupled from existing activities	Towercos who prefer to let go of having to manage challenging power operations but retain the assets	Towercos who prefer to let go of having to manage challenging power operations and modernization cost	Towercos who want to offer PaaS to MNOs but not get involved in challenging power operations from the start
1 Existing level of integration of power solutions with towers O&M activities	✓ Existing long-term presence in countries with challenging grid conditions and have since developed power solutions as key value-add for MNOs	✓ Decouple only selected sites (typically the most challenging sites) from existing portfolio	✓ Decouple only selected sites or focus on greenfield sites for TESCOs	⊗ New towerco with greenfield sites
2 Ability to develop in-house competence in solar hybrid power solutions	✓ Proven ability and willingness to modernize sites for renewables; developing in-house capabilities for power design	⊗ Outsourced to power experts for solar hybrid sites	⊗ Outsourced to power experts; own PaaS activities are diesel-based solutions and limited competency in solar based solutions	⊗ Greenfield sites can incorporate full solar model with relative ease; Outsourced to power experts
3 Good access to capital and intention to retain power asset ownership	✓ Sees towerco's main expertise is managing assets with very good access to capital, and hence limited value proposition for TESCOs to take over CAPEX of assets	✓ Deploys own capital for power assets	⊗ Leverage on TESCOs to take on upfront investment in solar systems	⊗ Leverage on TESCOs to take on upfront investment in solar systems
Power solutions conducted	Towerco maintains power solution in-house Sees TESCOs as competition in PaaS offerings	TESCO Offers PaaS but power operations outsourced	TESCO Offers PaaS but has limited competency to manage new hybrid tech. solutions	TESCO Offers PaaS to MNOs but outsources the entire power value chain

By 2030, MNOs are expected to represent the largest share of TESCO customers

By 2030, the growth in the TESCO market is expected to be driven by MNOs as well as Towercos without Power-as-a-Service (figure 3-11). The number of sites for which MNOs are the customer is expected to increase by 19 percent per year to about 91,000 by 2030. This growth will be driven by MNOs that do not partner with Towercos and are looking to reduce their involvement in owning power assets. Typically, these are MNOs which see towers as a strategic asset that they want to maintain control over or have outsourced towers but are unsatisfied with the lack of flexibility in arrangements they have with Towercos.

Additionally, the number of sites for which Towercos without Power-as-a-Service are the customer is expected to increase

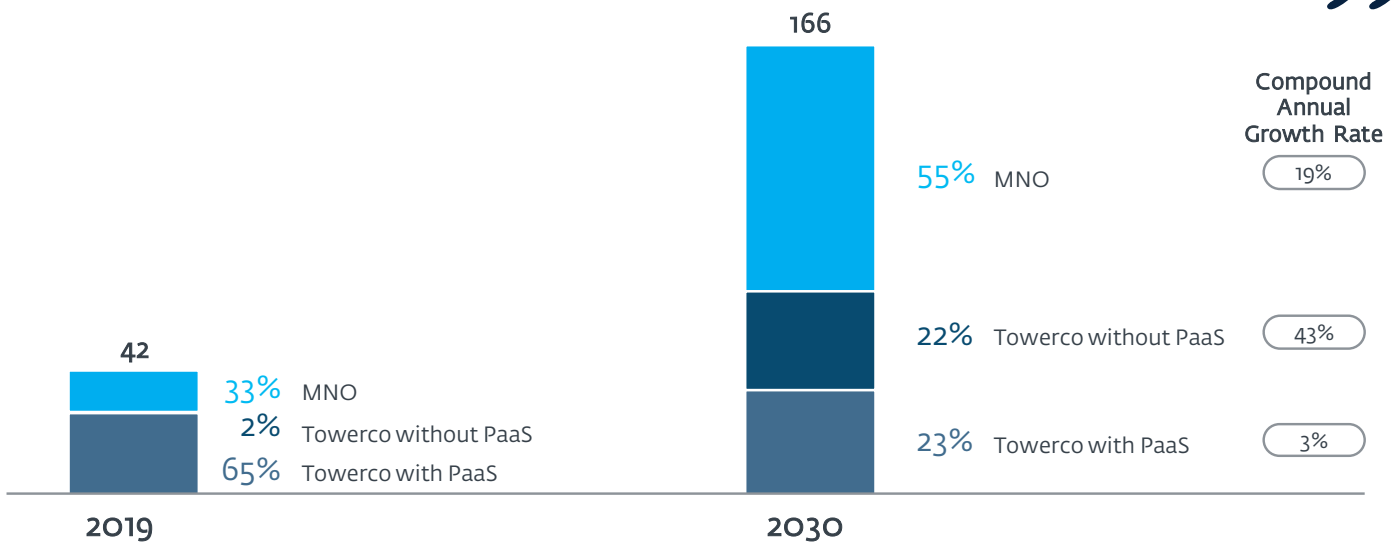
by 43 percent per year to approximately 37,000 sites by 2030. This growth will be driven by sites in greenfield markets where Towercos look to offer a full range of services but without direct involvement in the power operations. Greenfield sites allow TESCOs to have greater control over the power solution design from the start without complications arising from asset condition audits or price negotiations surrounding legacy assets. As upfront costs for power solutions are typically 30-40 percent higher in greenfield than brownfield sites, Towercos are often also keen to transfer this CAPEX cost to TESCOs.

Towercos with Power-as-a-Service will continue to remain likely customers for TESCOs, albeit at a lower growth rate.

“
Towercos with Power-as-a-Service entered the SSA market about 10 years ago when TESCO services were not available. Now with TESCOs being more mainstream, newer Towercos have the option of not getting involved or existing Towercos have an option to exit the challenging power operations in these markets.

Interview excerpt from TESCO

Figure 3-11: TESCO site growth by customer (thousand sites)



Box 1: Deep-dive into power-sharing

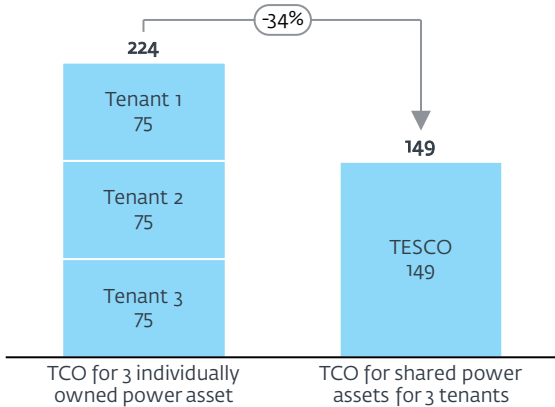
Aggregating assets in multi-tenanted sites can unlock economies of scale – Towercos could be key partners for TESCOs

Today, power assets at multi-tenanted tower sites are primarily owned and managed by individual MNOs, (with the exception of Towerco sites where Power-as-a-Service is offered). This ownership model results in significant duplication of CAPEX for power assets which could be eliminated via shared power systems. TESCOs have the opportunity to act as an aggregator of power assets for multi-tenanted sites to reduce power cost for MNOs while increasing revenue per sites for the TESCO.

Some TESCOs already have power-sharing elements as part of existing contracts with MNOs operating at multi-tenanted Towerco sites. These arrangements have demonstrated power-sharing can be a highly feasible arrangement which does not require excessive operational complexity. Nevertheless, the currently low penetration rate of power sharing highlights substantial room for growth.

While complications can arise from consolidation of power assets in brownfield sites where equipment is already in place with the added complexity of negotiating and reaching agreements with all tenants on shared power services, there could be an opportunity to partner with independent Towercos that do not intend to develop in-house power capability.

Illustrative TCO for power asset per off-grid site [\$ thousands]



Through power sharing, the TCO of power assets can be reduced by more than 30 percent largely driven by economies of scale.

Economies of scale can be achieved as CAPEX requirements are reduced due to shared equipment, while operating expenditure required to service each additional tenant is also minimal due to operational synergies accrued such as shared site visits.

“

Currently, assets on Towerco sites are individually owned by each MNO – there is a high level of power asset duplication – some efficiencies could be attained from an operational point of view, as well as from a shared asset perspective.

This will also allow TESCOs to achieve economies of scale with higher power loads per site, allowing TESCOs to optimize their prices, offering better rates per kWh.

Interview excerpt from MNO

”

D. Approximately 40 percent of the total TESCO addressable market is expected to be captured by 2030

The addressable market for TESCOs is defined as the number of sites in markets meeting the minimum scale required, receiving sufficient solar irradiation and taking into account potential competition from Towercos with Power-as-a-Service offerings. This addressable market is estimated at 436,000 sites (figure 3-7). Of the total 436,000 sites, approximately 166,000 sites (38 percent) are expected to be penetrated by TESCOs by 2030, with potential upside of up to 250,000 sites if market conditions are favorable.

Factors affecting the penetration rate include:

- **Rate of converting clients:** Contract negotiations may take a number of years, especially in open tenders for a large number of sites, and hence affect the rate at which TESCOs can acquire new sites. In addition, MNOs require time to adjust to operational changes by outsourcing operations that have traditionally been conducted in-house.
- **Speed of solar adoption:** The TESCO penetration rate is also influenced by the degree of acceptance of solar technologies in each market. Management in some markets may be resistant to adopting unfamiliar technology, or they may be taking a wait-and-see approach with regard to further reductions in the prices of solar technology.

- **Contract bankability:** In a nascent TESCO market where contract standardization is still not prevalent, the terms negotiated by the TESCO and their clients influence the type of financing they can attract. Suboptimal contract structures could limit TESCOs' ability to quickly scale operations.
- **Market complexity:** Other factors relating to individual markets may affect the ability of TESCOs to conduct operations and impact the speed of deployment or contract negotiations, for example, security concerns in conflict zones.

3.4 Growth strategies of TESCOs

Scalability of the TESCO model

TESCOs can undertake a number of strategies to scale up both in existing markets and internationally (figure 3-12).

First, there is room to grow by serving more sites in the tower portfolios of existing clients in the same country. Operational synergies can be achieved by maximizing the utility of on-the-ground field teams to serve as many sites as possible with minimal idle time or travelling time between sites. This is typically conducted through negotiating to serve dense site clusters or diversification of business loading field staff where the same teams may conduct multiple services on nearby sites.

Second, TESCOs can target new customers on existing sites, serving multiple tenants to reduce duplication of power assets between MNOs, while increasing revenue per site for the TESCOs (Box 1). Given Towercos' mandate of increasing co-location, TESCOs partnering with Towercos have the added benefit of serving sites that are multi-tenanted.

Third, TESCOs can acquire second anchor customers in existing countries of operation. This type of acquisition enables economies of scale in terms of equipment procurement, financing and site operations, depending on distribution or overlap of sites. MNOs in countries where TESCOs are already serving their competitors risk falling behind on cost competitiveness.

Finally, beyond in-country expansion, a key growth avenue for TESCOs is international expansion. When bidding for overseas contracts, TESCOs would be able to differentiate themselves from competitors by demonstrating their substantial expertise in running TESCO operations in challenging markets.

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We can have stronger negotiation power when we centralize procurement to negotiate for better pricing and flexible payment terms.

Interview excerpt from TESCO

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TESCO credentials (proven ability to maintain or improve uptime) are important for operators to be convinced on our capabilities and be a long-term partner for their network

Interview excerpt from TESCO

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Figure 3-12: TESCO growth areas

TESCO growth areas	Synergies	Scaling up	Scaling up
		LOCALLY	INTERNATIONALLY
 Growth towers portfolio of existing client increases in same country	Operational synergies from existing on-the-ground field team able to serve more sites per vicinity	✓	
 Support sites that are multi-tenanted	Optimize resources of business development team to develop RfPs and pursue new customers	✓	✓
 Acquire second anchor customer in the same country	Attain economies of scale on equipment procurement to optimize upfront cost and obtain more favorable equipment financing terms	✓	✓
 International growth through multiple contracts	Mobilize knowledge transfer and experience for power O&M, both locally as well as across markets	✓	✓
	Develop credentials for on-the-ground experience in challenging environment	✓	✓

Box 2: Scope for renewables beyond serving bad-grid and off-grid sites

With the TESCO market in its nascent stages, the focus of the business model remains concentrated on bad- and off-grid segments. Without a doubt, these are segments where TESCOs can have the highest value creation, given the growing energy challenge faced by MNOs and Towercos in these markets. As grid connectivity improves, renewable energy generation remains a value addition to customers in support of their sustainability targets, especially in the reduction of scope one and scope two emissions. Scope one emissions are emissions produced from directly-owned generation sources, while scope two emissions include those produced from purchased electricity.

Aside from reducing diesel consumption from bad-grid and off-grid sites, access to distributed renewable power can allow reduced grid reliance not only in markets with high grid prices, but also in markets where national power capacity is highly dependent on fossil fuels. The latter contributes to the scope two emissions for MNOs and Towercos.

Support for MNOs in these cases can extend beyond on-site renewable energy generation, into utility-scale renewable energy systems and on-grid corporate power purchase agreements (PPAs). In fact, MNOs have indicated interest in a third party to set up such an arrangement with the MNO. This is especially the case in markets with reliable grid connection and strong opportunities for incorporating utility scale renewables into MNOs' operations. However, in most emerging markets, such regulations are yet to be well-defined or even addressed.

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We would be interested in a party that can help us navigate through the complications of utility scale solar corporate power purchase agreements so we can purchase clean energy through the grid.

Interview excerpt from MNO

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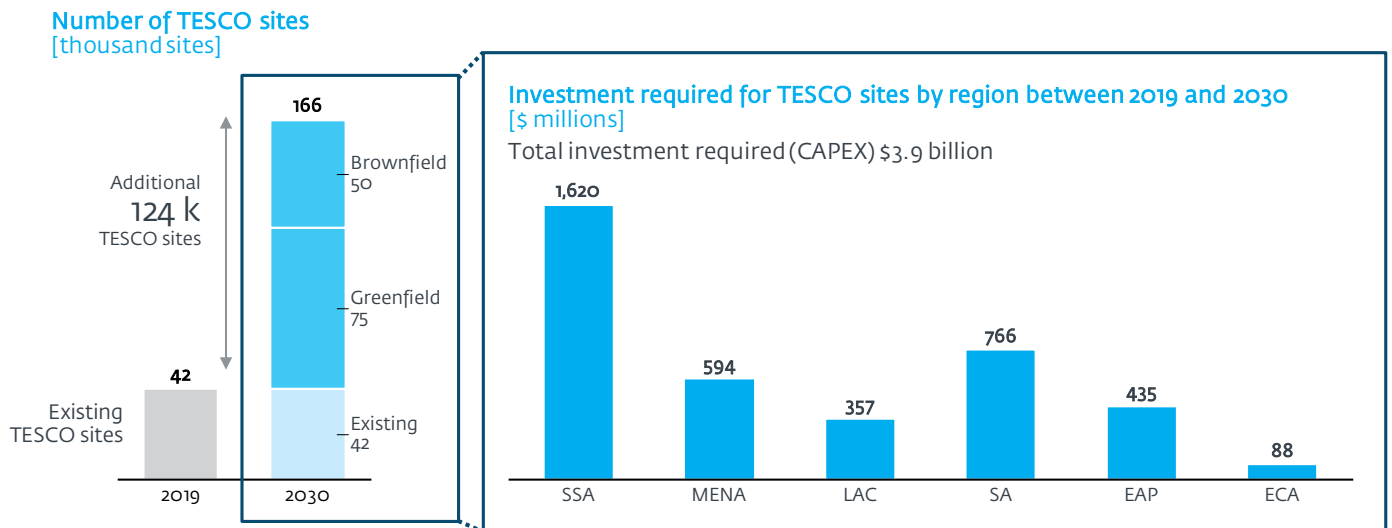
The investment requirement for new TESCO sites is \$3.9 billion by 2030

The total investment required for new TESCO sites between 2020 to 2030 is estimated at \$3.9 billion. SSA is expected to require the biggest investment for new TESCO sites at \$1.6 billion, followed by SA, at \$0.8 billion. New TESCO sites are likely to be driven by greenfield sites incorporating renewable energy, which will usually require higher upfront investment cost, at an average of \$35,000 to \$50,000. On the other hand, brownfield sites are expected to cost 30-40 percent less than greenfield sites, depending on the existing condition of the asset.

Growth in greenfield sites is expected to be driven by (i) new site growth with existing clients, and (ii) expansion by Towercos with Power-as-a-Service into greenfield markets in partnership with TESCOs. The preference for greenfield sites is driven by the fact that it allows TESCOs to have larger control over power solution design upfront with minimal complications, for example, asset condition audit and price negotiations of legacy assets, thereby easing the negotiation process as well as the deployment of power solutions. The ability to solarize brownfield sites is also dependent on existing site location, which could be limited by shade, land or space availability or other factors.

Even under conservative growth assumptions, the capital needed to reach the collective de-carbonization goals of the telecom industry is significant. Market forces, new business models and new market participants are coming together to improve the commercial viability of investments which target rural, remote or otherwise bad-grid and off-grid locations. The IFC is committed to bridging the digital connectivity gap and combatting climate change in these predominantly unserved and underserved areas and stands ready to work with industry partners and financiers to implement the required investment program.

Figure 3-13: Investment required for TESCO sites by region in 2030 (\$ millions)

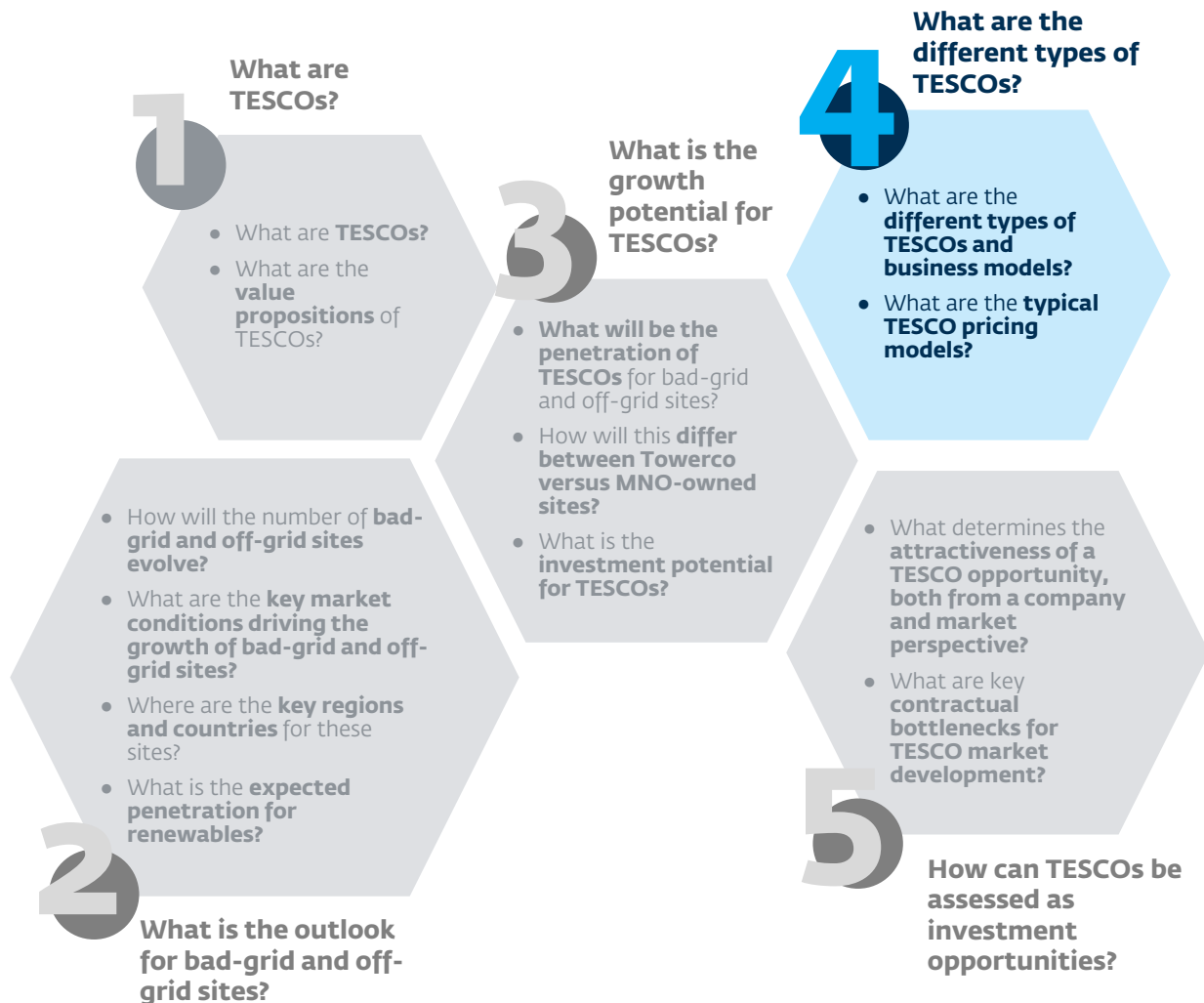


Chapter 4

WHAT ARE THE DIFFERENT TYPES OF TESCOS?



4. WHAT ARE THE DIFFERENT TYPES OF TESCO?



4.1 Types of TESCO operators

There are four primary types of TESCO operators, categorized by the adjacent services they provide

TESCOs can be vertically or horizontally integrated with a range of adjacent services to reap synergies along the value chain. Our survey of the current landscape of TESCOs reveals four distinct types of operators (figure 4-1):

- A. TESCOs integrated with O&M service providers:** These operators provide O&M services for passive telecom infrastructure, with core expertise in performing on-the-ground operations at telecom sites.
- B. TESCOs which also operate as power producers:** These operators are in the business of providing electricity for applications ranging from large scale industrial power in sectors like mining or process industries, or smaller scale distributed power generation sites. The TESCO model can either be the core focus of the business, or an extension of their current service portfolio to a new industry.

C. TESCOs integrated with power equipment manufacturers and/or system integrators: These operators manufacture and supply power generation equipment to telecom operators and have begun moving down the value chain to operate these equipment on a Power-as-a-Service model.

D. Pureplay TESCO players: Unlike other TESCO players which began with other services and then moved into the TESCO business, these pureplay operators have usually been set up with the dedicated purpose of providing TESCO services.

Figure 4-1: Type of TESCO players and typical scope of works in adjacent services

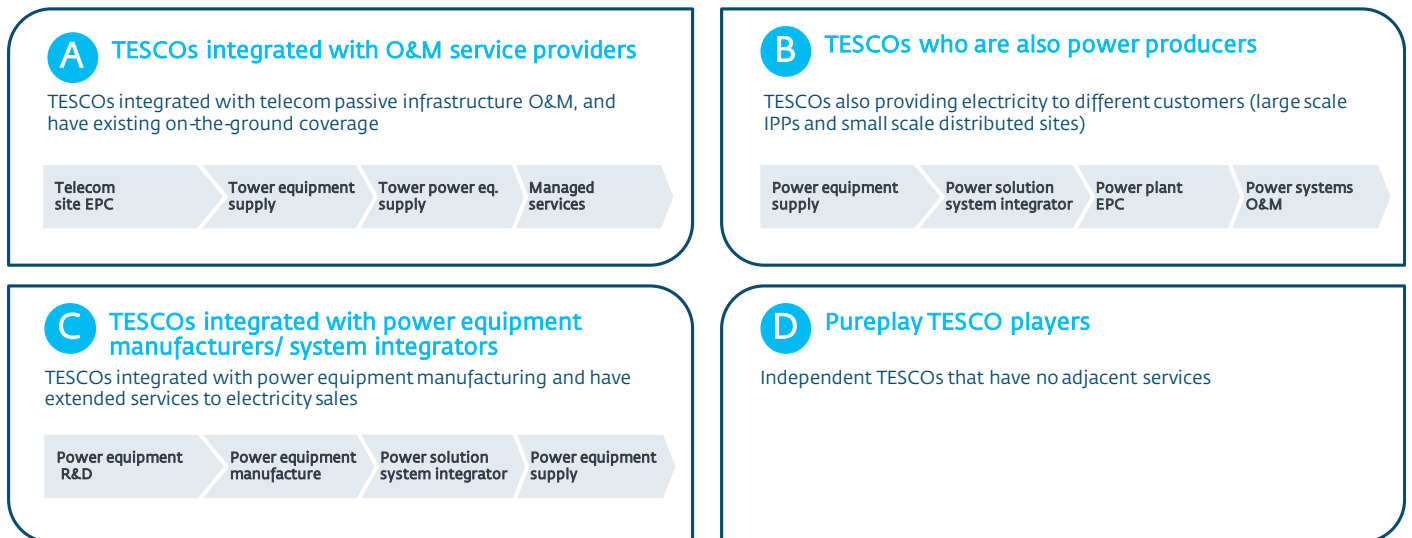
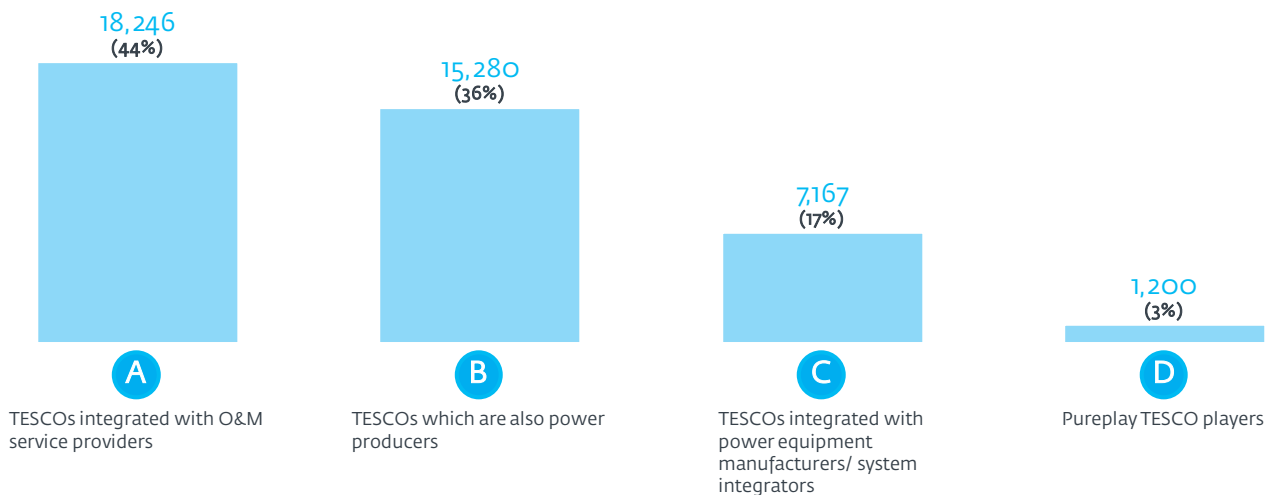


Figure 4-2: Number of TESCO sites by type of TESCO business model¹⁹



¹⁹ As of October 2020.

TESCOs vertically integrated with O&M service providers and TESCOs that are also power producers are the most common type of player

TESCOs integrated with O&M service providers are the most common type of TESCO player, having close to 44 percent share of the market. This group is followed by TESCOs which are also power producers, with 36 percent market share. Finally, TESCOs integrated with power equipment manufacturers or system integrators have a 17 percent market share. Pure TESCO players are the least common, with just three percent of the market (figure 4-2).

The key success factors for a TESCO are optimizing site technology coupled with a strong focus on efficiency, operations improvement, and investment in people

For a TESCO, the most important goal is to optimize energy costs and prolong the power asset's lifetime. Therefore, the key success factors for a TESCO are (i) optimized technology and (ii) efficiently run O&M power assets.

Optimizing technology includes optimizing the solar PV and storage solution, improving the generator fuel efficiency through appropriate power asset design and sizing, and introducing remote monitoring systems (RMS) to track energy consumption, monitor site activities and identify potential faults without the need for physical site visits (boxes 3 and 4).

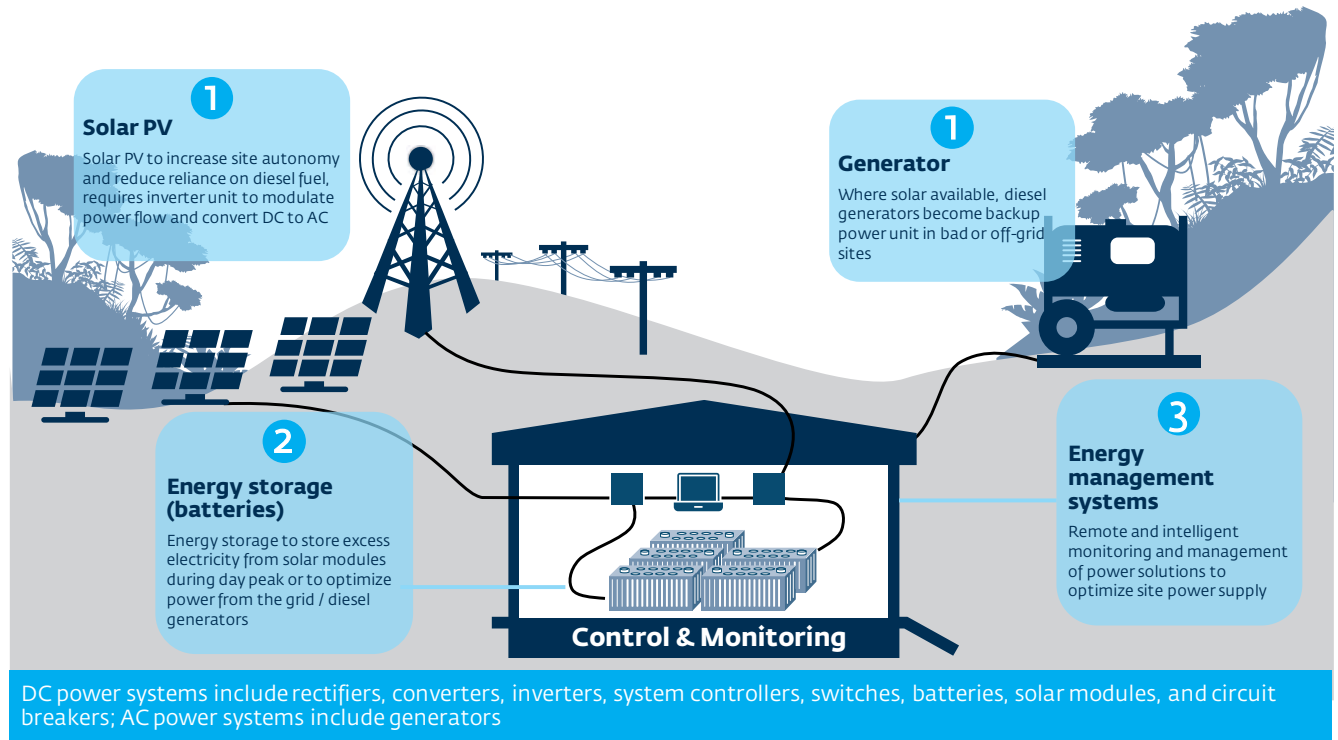
Efficient O&M of power assets includes:

- Developing field management expertise to optimize the number of site visits required and effective coordination of on-the-ground teams.
- Having trained personnel and energy management expertise to be able to predict equipment failure and therefore optimize preventive maintenance and spare part management and avoid repeat site visits.
- Identifying faults remotely to ensure technicians are equipped with the right tools and equipment spare parts and avoid visits that could be handled remotely.
- Having comprehensive security systems in place to reduce diesel and battery theft.



Box 3: Deep-dive into how TESCOs optimize technology

Technology stack at a typical telecom site includes energy generation, batteries and management systems



Technologies that will be found at a typical TESCO site include generation equipment consisting of solar PV modules (also depending on site's suitability for solar) coupled with diesel generators as power source. Batteries store excess energy to enable peak load balancing, with the charging and drawdown of batteries optimized and controlled by energy management systems. Some TESCOs will design the power solutions themselves, especially where unique site conditions require customized solutions. Other TESCOs may purchase containerized plug-and-play equipment, which is then integrated with the TESCO's energy management platform to enable rapid deployment to TESCO sites.

TESCOs seek proven technologies with the lowest total cost of ownership (TCO)

With strict Service Level Agreements (SLAs) with customers and long-term contracts, TESCOs need to have a high degree of confidence that the technologies deployed will result in a lower TCO, as well as higher level of reliability than legacy power equipment. As a result, TESCOs prefer to opt for mainstream technologies which are easily available, with proven durability and the lowest cost possible. In addition, battery manufacturers typically commit to a guarantee of cycles for batteries used for TESCO applications and hence reduce the equipment failure risks. Hence, it is expected that moving forward, solar PV and battery energy storage systems will still be the main alternatives to diesel used in TESCOs energy generation.

New technologies in the market, such as solar combined with wind power generation at the telecom tower, and fuel cells, are microturbines, now being introduced on a trial basis. The long-term viability of such solutions has yet to be tested in the market for mainstream adoption. It is expected that as these technologies mature and their costs decline, new opportunities will open up for TESCOs to incorporate these options into their power solution offerings.

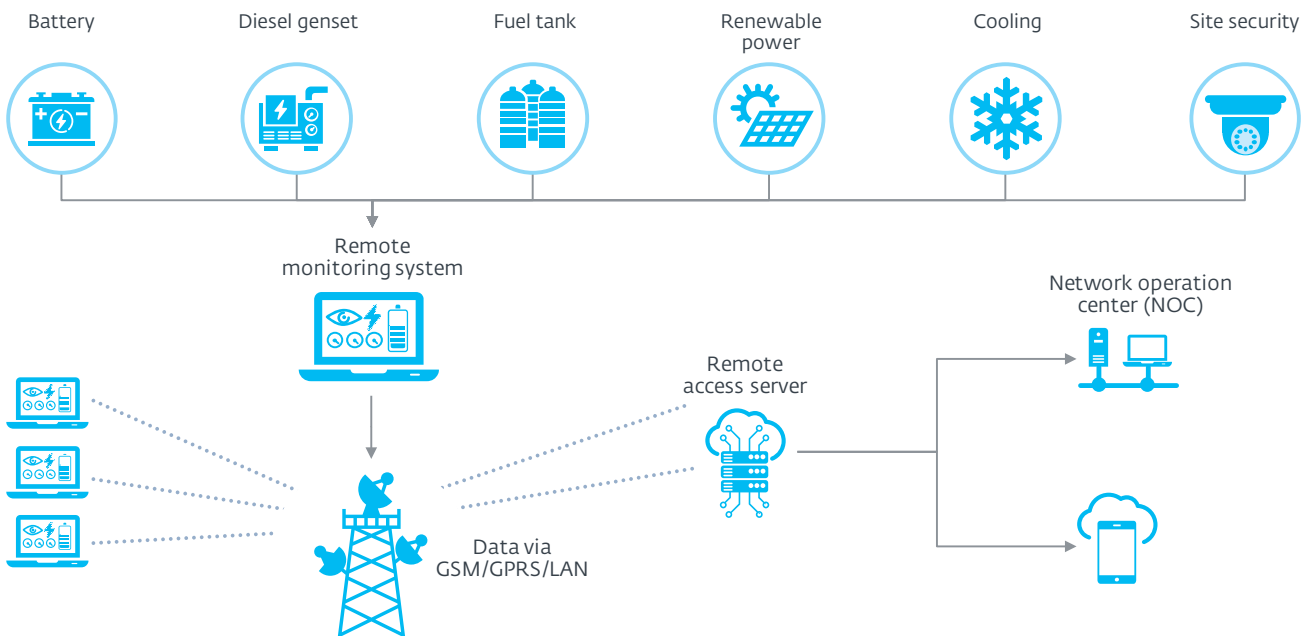
Box 4: Deep-dive into Remote Monitoring Systems (RMS)

RMS help to monitor and control site activities remotely to reduce physical site visits

Through the addition of intelligent connectivity with software and remote sensors at base stations or other infrastructure sites, RMS provide real-time information, management, and control of an entire site's power infrastructure. For example, RMS can provide critical information such as fuel consumption and theft alerts, grid availability, consumption patterns and energy usage of various power sources, while also providing control of battery parameters.

RMS allow batteries to be designed with deeper capacities for longer deployments. RMS technology also allows operators to identify faults remotely and ensure technicians are equipped with the right tools and equipment spare parts for repairs. Additional algorithms can also be put in place to predict equipment failure and optimize preventive maintenance.

Typical RMS set-up



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RMS can reduce by around 35 percent the amount of site visits: 25 percent of site visits are identified as a no-fault visit that could have been avoided, 10 percent of site visits are duplicated due to lack of informed knowledge of fault, resulting in lack of proper tools to address the solution; each site visit can cost \$300-400.

Interview excerpt from RMS provider

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MAWE NA ZONA,
NAGO!

WE HAVE
REDUCED
OUR PRICES!

ZONA
MONEY
OFFERS

K.8
K.15
K.25
K.35

4.2 TESCO business models

A. O&M service providers can achieve strong operational synergies in the TESCO business

TESCOs integrated with O&M service providers typically manage a large number of telecom sites on passive infrastructure O&M contracts. Consequently, such TESCOs can benefit from existing on-the-ground coverage across geographies and economies of scale in O&M.

The integration of TESCO and O&M services provides an array of benefits. In particular, TESCOs integrated with O&M service providers have shown the ability to scale up the TESCO business quickly by leveraging existing passive infrastructure O&M. Existing site presence also allows them to retain insights into the conditions of legacy power equipment, enabling better equipment audit and pricing. It also facilitates power asset deployment due to the familiarity of local operating conditions

Significant operational synergies can be extracted from their existing passive infrastructure O&M contracts, including:

- Using existing field teams with strong on-the-ground familiarity and knowledge
- Maximizing the value addition of each site visit by combining both TESCO and O&M activities into a single site visit, which would incur only a marginal cost
- Leveraging in-house expertise in O&M activities, such as optimizing equipment spare parts and reducing theft
- Having a proven track record to operate and service telecom sites in challenging rural environments
- Integrating both TESCO and O&M services, providing customers a single point of contact for managing external vendors and accountability

The core competency of an O&M service provider in achieving cost savings through optimizing operations and prolonging the life of an asset is highly aligned with the core efforts required by a TESCO to succeed.

Nevertheless, the shorter term of passive infrastructure contracts, typically three years, is shorter than TESCO contracts of around 10 years. This poses a risk in decoupling of some of the synergies identified, in case the duration of the O&M contract is not aligned with the TESCO contract duration.

B. TESCOs integrated with power production benefit from expertise in solar-powered systems and can provide a full range of energy supply

TESCOs that are power producers not only supply power to telecom towers, but, depending on their strategy, also to commercial and industrial customers, as well as residential customers or entire communities. Such a model is referred to as the Anchor-Business-Community (ABC) model (see box 5). These TESCOs can either be small scale distributed power producers, or larger scale independent power producers. They may operate power plants ranging from utility-scale plants to mini-grids used for rural electrification where telecom sites are typically the anchor clients. Being renewable energy players (largely solar), the core advantage of such players is the familiarity and capability in solar PV systems power design.

In addition, small-scale distributed power players could benefit from synergies if the tower site also powers other tenants. As they already have distributed power licenses, distributed power players face fewer administrative hurdles in also acting as

a TESCO. However, this model would add to operational complexity of the distributed power players which would need to manage the requirements of numerous power off-takers. Distributed power players that also provide community power for rural electrification could also lose access to subsidies for rural electrification once they take on commercial telecom sites as anchor clients.

Large-scale independent power producers do not enjoy significant operational synergies in operating a TESCO model with their existing large-scale power plant activities due to the different consumption profile of the off-takers. Telecom operators require secure and reliable power throughout the day with very stringent SLA standards, coupled with site-level knowledge and O&M capabilities to manage the uptime of hundreds or thousands of remote tower sites.

These operational requirements are a stark difference from the typical business model required to manage large-scale power plants. Large-scale power producers may thus require additional time to adapt their operational capabilities to the needs of telecom sites. Some players have shown the ability to build this up organically, while others have opted to outsource this operational component.

C. Power equipment manufacturers can leverage the TESCO model as a form of equipment financing and have strong power solution technical competencies

The key competencies of power equipment manufacturers include equipment R&D and manufacturing of specific components such as diesel gensets, primary and backup power systems, and power electronics. Various power equipment suppliers have also developed plug-and-play systems specifically for use on bad-grid or off-grid sites.

A key benefit of integrating TESCO services and power equipment manufacturing is that it allows equipment manufacturers to leverage on the TESCO model as a form of equipment financing, driving power equipment sales and diversifying into an additional source of recurring revenue. In addition, power equipment manufacturers typically have R&D capabilities, offering opportunities to incorporate innovative technologies into the TESCO sites.

TESCOs that are tied to the technology of in-house power equipment need to ensure that their core competency remains technologically relevant in order to retain their competitive edge. In addition, some flexibility in deploying a third-party power equipment that could be more cost effective or suited to the specific needs of the sites would be required by such TESCOs.

Importantly, there is a potential divergence on incentives for such a TESCO in optimizing site assets, given that its core business model is the sale of power equipment.

D. Pure TESCO players specialize in the TESCO model

Pureplay TESCO players do not have separate business segments to leverage on for business synergies. Such players have shown the capability to develop in-house capabilities for power O&M, and typically obtain their power equipment via partnerships with energy systems integrators. Pure TESCO players are also technology agnostic, having the advantage of being able to switch between power equipment suppliers based on site requirements and technology advancements and have shown strong flexibility in adapting to the working conditions and demands of various customers. However, pureplay TESCO players will either need to develop their capabilities organically or partner with local O&M operators as they scale across different markets.

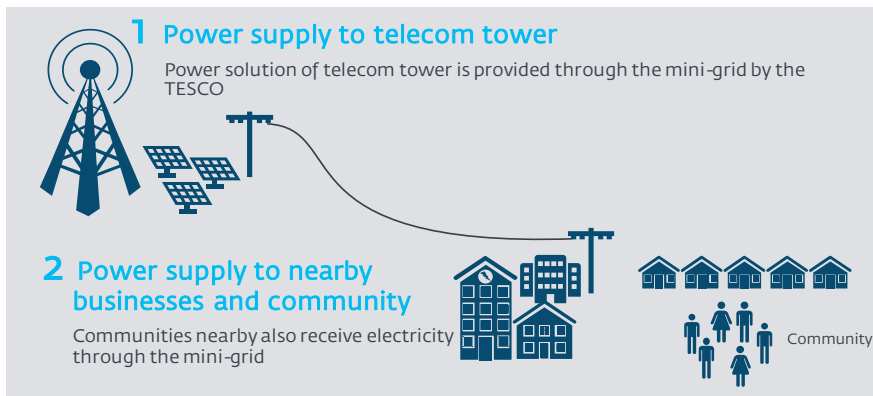
Box 5: Deep-dive into the Anchor-Business-Community (ABC) model

ABC allows tower owners (MNOs and Towercos) to support the community needs by being an anchor customer

Under the ABC model, the telecom tower's power is provided through the mini-grid by the TESCO, which also powers nearby villages. Tower operators can benefit from an improved corporate social responsibility image by serving village households and reducing carbon footprint. MNOs can also benefit from the boost in mobile money revenues from within the community.

The TESCO benefits from such an arrangement by leveraging on the telecom tower as the anchor tenant for the mini-grid to provide a long-term stable and recurring demand profile. On the other hand, business and communities allow the TESCO to access a potentially higher margin business, and serve as a growth avenue for the TESCO to capture the growing electricity needs of such communities. The economies of scale achieved from scaling up allow a lower average cost of electricity, further supported by the lower likelihood of tower vandalism, given the integration of the model within the community.

Mini grid set-up



In the ABC model, it is key for the TESCO to set up its power plant outside of the tower compound. This is in contrast with a pure telecom as anchor client model where power assets are typically located within the tower compound itself. In this situation, the TESCO will need to ensure access and ownership of power assets (mini-grid power plant) beyond the term of the contract with the telecom anchor client. This requires an additional step of site acquisition to not only house the power plant, but also offers the opportunity to select sites with good solar availability. This is also important to ensure that there is space to scale up solar usage, typically through a modular configuration. However, this would require highly strategic site selection process, in order to complement grid electrification efforts, and could potentially extend the deployment period due to the need to conduct land acquisitions.

4.3 TESCO revenue model

Fixed pricing where the TESCO bears CAPEX cost is the most common TESCO pricing model

There are a number of alternative pricing structures available for TESCOs and their customers (MNOs or Towercos), ranging from a direct pass-through of costs from TESCO to customers, fixed monthly fees where the TESCO bears the CAPEX of power assets, and contracts with savings agreements between TESCO and the customer where the tower owner bears the CAPEX while the TESCO is contracted to run the operations whilst ensuring savings from operational efficiency. Each model is detailed below:

- **Cost pass-through model:** The customer pays a fixed monthly fee for power operations (with or without CAPEX), plus a variable fee which covers all variable energy generation costs, such as utility bills and diesel fuel cost. The customer typically retains some control of power solution design while outsourcing power solution, maintenance and operations to the TESCO.
- **Fixed monthly fee model:** The MNO or Towerco pays a single fixed fee to the TESCO based on a specific matrix of site type such as site load, site criticality, grid connectivity, level of O&M required, which covers all costs for infrastructure, O&M and energy.
- **Savings agreement model:** The MNO or Towerco bears the CAPEX, and the TESCO receives a fixed monthly fee to cover power operations cost, in addition to a bonus payment corresponding to a proportion of variable costs the TESCO saves for the customer.

Among the three models, the fixed monthly fee model is most typical. Under this model, the TESCO bears all costs incurred in power generation and retains any cost savings achieved. Such an arrangement ensures that the TESCO is highly incentivized to maximize cost efficiency. In a competitive market, a portion of these cost savings will also be passed on to the MNO or Towerco. However, while it retains cost savings, the TESCO also bears the risk of uncertainty in evolving generation costs if site conditions change.

A detailed assessment of the pros and cons of each model for TESCOs is presented in figure 4-3.



Figure 4-3: Assessment of typical TESCO pricing structure from the TESCO perspective

Contract type	Contract details	Pros	Cons
Cost pass through	<p>Price = \$x per month + variable energy cost</p> <p>Fixed cost for CAPEX + variable energy cost (fuel / electricity cost) is pass through to MNO / towerco</p>	<ul style="list-style-type: none"> Minimize energy generation risk for TESCO to support predictable cash flow 	<ul style="list-style-type: none"> No incentive for TESCO to invest in high CAPEX solutions as savings are not accrued by the TESCO – some savings only from O&M perspective
TYPICAL MODEL OBSERVED			
Fixed monthly fee (TESCO bears CAPEX)	<p>Price = \$x per month</p> <p>Fee is constant for specific matrix of site type, e.g. site load, site criticality, grid connectivity, level of O&M required, etc.</p> <p>Fees includes cost for infrastructure, O&M and energy fee</p>	<ul style="list-style-type: none"> TESCOs typically have full responsibility to design and optimize power system to meet specific site requirements to reduce / optimize power generation cost 	<ul style="list-style-type: none"> Set up and bear all capital costs for energy infrastructure, risk of equipment cost fluctuation falls with the TESCO Risk of evolving grid site conditions, e.g. bad grid, that would impact existing power solutions designed for specific backup power requirements – impacting efficiency of system
Savings agreement (Tower owner bears CAPEX)	<p>Price = \$x per month + bonus</p> <p>Similar to OPEX model, except that fees only includes O&M and energy fee, with bonuses for cost savings achieved</p>	<ul style="list-style-type: none"> No need for TESCO to deploy own capital for power solutions; focus is purely on operation excellence to identify savings 	<ul style="list-style-type: none"> TESCO guarantees a fixed amount of consumption / savings to MNOs, bearing the risk if not achieved despite limited control over power solution design / working with legacy assets

Both MNOs and Towercos still face challenges in coming to agreement on a “fair price”

TESCO prices are a major consideration factor in the customer’s decision-making process on whether to outsource to a TESCO. However, MNOs have voiced that due to limited TESCO players in the market, there is still a lack of sufficient benchmarks and transparency on what is a “fair price” proposed by TESCOs. On the other hand, TESCOs have indicated that many MNOs have poor visibility of the actual operational cost of their energy system, resulting in a misperception of high prices proposed by TESCOs. In these cases, the prices could be competitive to actual system costs.

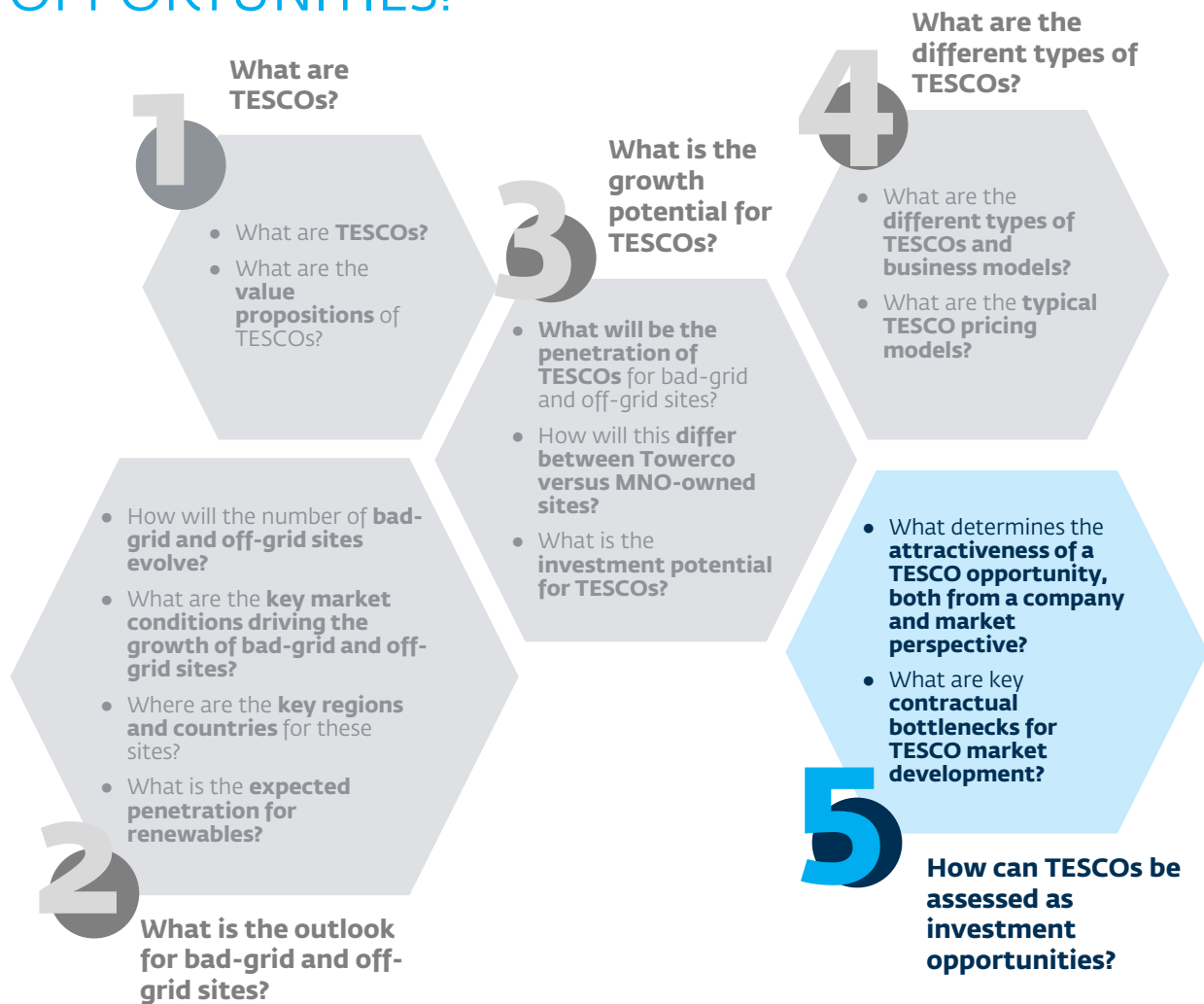
This perceived lack of transparency highlights the importance of energy audits for the operator to understand the cost impact of its energy systems, but also opportunities for operational and cost efficiencies.

Chapter 5

HOW CAN TESCOS BE ASSESSED AS INVESTMENT OPPORTUNITIES?



5. HOW CAN TESCO BE ASSESSED AS INVESTMENT OPPORTUNITIES?



5.1 Framework for assessing the overall bankability of TESCOs

To date, TESCOs have mainly relied on equity funding and concessional debt financing, with little purely commercial financing

Access to financing is essential for TESCOs due to the high upfront CAPEX investments required. Investment costs are recovered progressively through fixed monthly payments during the contract life cycle. TESCOs have sourced funding through various means to date:

- **Group level financing:** TESCOs that have grown from diversification efforts of existing corporations (for example, existing telecom or power companies) have typically relied on group-level financing to support their pursuit of TESCO contracts. In most cases, TESCOs are seen as a means to diversify towards a business model that offers stable, recurring revenue from a good quality telecom client, in a field adjacent to existing corporate operations.

- **Equity and concessional funding:** Independent TESCO operators (TESCOs which did not emerge from existing business operations) have relied on either equity capital from strategic investors, development financial institutions or various types of concessional funding to back their operations. The initial investors who backed TESCO projects saw an alignment with their sustainability strategies or socio-economic development objectives. The investor base is starting to slowly expand, but it continues to be dominated by investors with a longer-term investment horizon or strategic interests. Concessional finance funding sources such as grants or subsidized lending rates are also available in some instances, especially when tied to operations in challenging regions. They are also used in TESCO projects which are expected to have a high development impact.

For investors, the upside benefit from TESCOs is expected to come from margin improvements over time and a diversification of business lines, as opposed to an appreciation in the value of the underlying assets. This could lead to a mergers and acquisitions market, as economies of scale grow in importance as the market matures. This would offer opportunities for investors to monetize their stakes.

In principle, TESCOs can be attractive borrowers for financial institutions

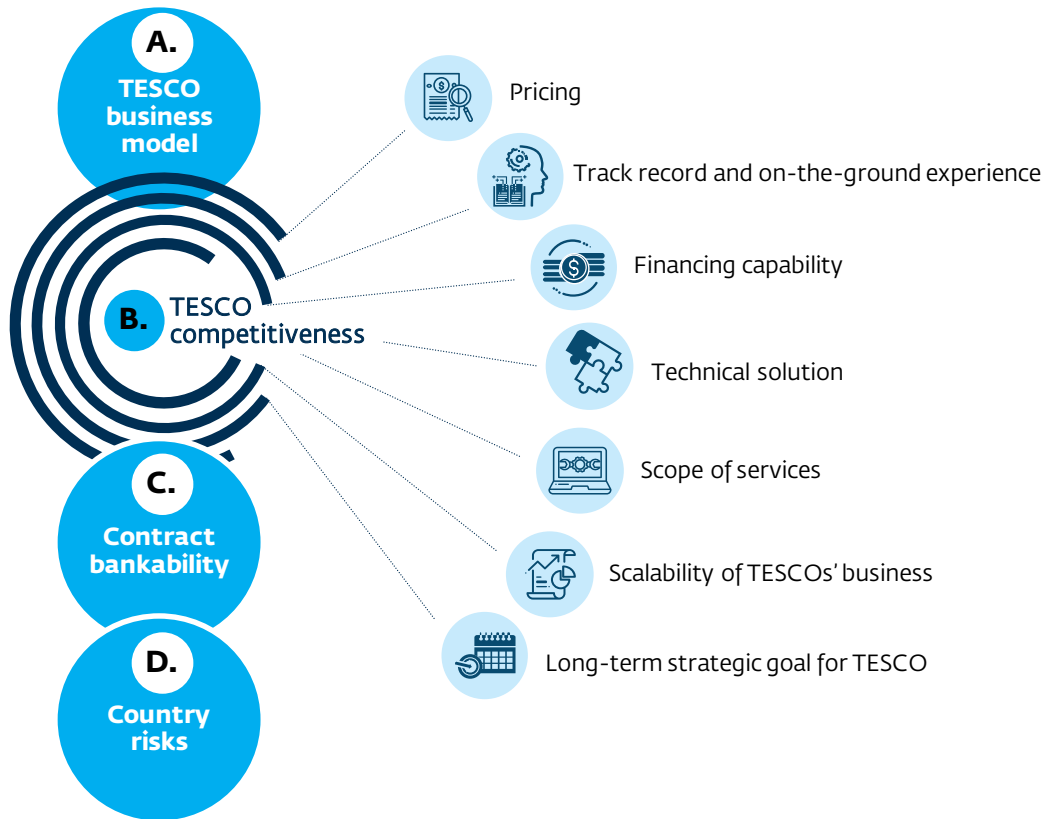
Solid contractual agreements with good off-takers and high Environmental, Social and Corporate Governance (ESG) scores can position TESCOs as ideal borrowers to access credit from financial institutions, including development banks and commercial lenders.

TESCOs are seen as creditworthy because of their long-term contracts with MNOs or Towercos. Given that MNOs and Towercos are themselves large corporations with predictable cashflows, and that power solutions are an essential service for MNOs to maintain site availability, the risk of payment disruption to TESCOs is small. It is extremely important to note that the TESCO industry is still young, with few contracts in place and hence contractual terms have not stabilized yet. In contrast to Towercos which are Real Estate Investment Trust (REIT)-like investments, TESCOs pledge their creditworthiness on the quality of their clients and contract portfolio. The bankability of TESCO contracts is discussed in Chapter 5.2.

TESCOs also enjoy long-term, predictable cashflows at good margins. The TESCO business model of solarizing or hybridizing existing diesel sites has clear commercial benefits, both for TESCOs and their customers, with an expected payback within three to five years. Moreover, TESCOs can offer attractive margins on earnings before interest, taxes, depreciation, and amortization of about 40-50 percent once sites are commissioned. Long-term contracts of around 10 years also offer cashflow predictability for financiers.

Finally, the ESG score of TESCO projects plays a strong role in a financial institutions' evaluation of potential lending or investment targets. With the carbon reductions achieved through substituting diesel generation with solar PV energy, TESCOs would be given a high ESG score, and might even be able to benefit from preferential rates under green financing schemes.

Figure 5-1: Framework for assessing TESCOs' bankability



The attractiveness of TESCO is defined by the ability to create a competitive advantage and prove their ability to scale up

Investors and financiers can assess TESCOs' attractiveness using the framework shown in figure 5-1:

A. TESCO business model

As discussed in Chapter 4, the different types of TESCO business offer various competitive advantages and also risks across different aspects of a TESCO's value proposition. The business model impacts TESCOs' operational strength, their ability to win multiple contracts and scale across different geographical scope, as well as their ability to extract cross-business synergies. It is critical for investors to gain a thorough understanding of these factors as they assess their return expectations from TESCO transactions.

B. TESCO competitiveness

TESCOs' competitiveness in the market is determined by a combination of multiple factors:

- **Pricing:** A key objective for engaging TESCOs is to achieve energy cost savings and improve profitability for the tower operators. Preference for the various pricing models is dependent on the profile of the tower operator. However, across the various models, a typical feature is the incorporation of structures that incentivize the TESCO to optimize operations costs.
- **Track record and on-the-ground experience:** TESCOs with existing operations and proven on-the-ground experience

in managing sites in challenging and remote locations, such as through existing O&M operations in the target country, are viewed favorably. This is due to the existing familiarity with the local operating environment, which is also expected to speed up the deployment of power solutions.

- **Financing capability:** TESCOs also need to show their clients that they have the financial capacity to manage the growth in sites and load throughout the term of the contract. This requires committed investors and alignment of interests, as TESCOs implement long-term projects. Financiers and investors look in turn for a strong balance sheet and credentials to ensure that TESCOs can deliver on project commitments
- **Technical solution:** TESCOs need to show technologically-reliable power solutions to meet or improve uptime requirements, comply with SLAs and deliver on cost savings through operational excellence. In addition, TESCOs are also assessed on their ability to inject new technology and R&D capabilities into their plans. A highly-skilled local workforce is also an essential differentiator, complemented by centralized corporate support functions.
- **Scope of services:** An additional (and optional) consideration for tower operators is to look for TESCOs that can also deliver on site maintenance of passive infrastructure. The advantages for such a multi-service TESCO is that it relieves the pressure and complications of dispersed site maintenance for operator and allows a single point of contact of accountability for the tower operator.
- **Scalability of TESCOs' business:** TESCOs can follow a variety of growth strategies, including growing with the same anchor customer across markets, serving a second customer in existing markets, supporting sites which are multi-tenant or focusing on international growth by securing multiple contacts with various clients. A TESCO's track record in maintaining strategic relationships with key telecommunications companies and delivering a range of good quality services for them is also a key indicator of potential scalability. TESCOs also need to demonstrate capability to successfully replicate the business model across geographies and to diversify their service offering to meet their clients' needs.
- **Long-term strategic goal for TESCOs:** The TESCO model requires long-term service commitments, hence investors will need to evaluate TESCOs' longer term strategic goals. This would include assessing TESCO's project pipeline and their growth strategies. With long business development periods and uncertainties in the negotiation process, a strong pipeline of projects is crucial in ensuring business growth.

“

We look for TESCOs who can decrease our OPEX and achieve zero CAPEX, have strong operational teams, and deliver on site modernization plans and bring in green energy.

Interview excerpt from MNO

”

“

We look for TESCOs with “boots on the ground”, who already understand the local operational environment and have a strong balance sheet.

Interview excerpt from
TESCO financier

”

C. Contract bankability

Scrutiny of key contractual terms is necessary in the absence of contract standardization. Key considerations to assess the bankability of TESCO contracts are detailed in Chapter 5.2.

D. Country risks

Various country-level factors also drive the attractiveness of a TESCO investments. These include the size of market as well as other profitability drivers and macro-risk factors, which are especially prevalent in emerging markets. The country and market risk considerations for TESCOs are explored in greater detail in Chapter 5.3.

Box 6: The development impact of TESCOs

TESCOs' attractiveness can also be assessed through their development impact, including the benefits they deliver to stakeholders and the regional economy. Any systemic market changes which the TESCO can induce along the mobile connectivity value chain is also important.

TESCOs can contribute to increased access to mobile connectivity when serving bad-grid and off-grid areas with a low population coverage or a nascent TESCO market segment

Key benefits to stakeholders include increased access to quality mobile connectivity which is achieved through energy cost savings for mobile or tower operators and by supporting network deployment in previously unprofitable areas, such as remote or mountainous regions. As such, TESCOs' investment can result in increased population coverage of mobile telephony or broadband network, including 3G or higher-speed mobile network. It can also result in increased penetration rate of mobile telephony or broadband as operators pass through part of the energy cost savings to end-users.

The magnitude of these stakeholder benefits depends on the efficiency of the investment and the initial level of access to mobile connectivity in the target countries, relative to other emerging markets. The higher the quantum of impact per dollar invested, the higher the magnitude of the benefits. In general, TESCO investments in countries with relatively low access to mobile connectivity are likely to generate larger stakeholders benefits than investments in countries with relatively high levels of access to mobile connectivity. Given the link between internet access, GDP and jobs, these outcomes have the potential to result in benefits to the economy in terms of GDP growth and employment. This impact is especially visible in low-income countries or regions with high level of informality or unemployment.

Beyond the TESCO, these benefits can also result in systemic market changes along the mobile connectivity value chain, especially in the tower market segment or in the broader market of mobile connectivity. In countries with no or few TESCOs, investments can increase the competitiveness of the market for mobile connectivity by creating or deepening the TESCO market segment through demonstration and replication channels. Successful expansion of the first mover would demonstrate the commercial viability of the TESCO's business model and trigger replication by new entrants, thereby resulting in a market-wide propagation of the stakeholder benefits described above.

TESCOs can contribute to environmental sustainability when scaling up greener power solutions in countries where telecom contributes to a high share of greenhouse gas emissions

By employing greener power solutions, TESCO investment can deliver the social benefit of improved environmental sustainability. In a setting where telecommunications have a large contribution to greenhouse gas emissions due to a reliance on fossil fuels, TESCO

investments that enable large-scale use of green power solutions like solar PV systems can result in significant greenhouse gas savings.

In countries with limited adoption of sustainability practices by mobile or tower operators, TESCO investments can strengthen the environmental sustainability of the market for mobile connectivity. This contribution to sustainability is achieved by inducing competition which then results in innovation in power consumption. First adopters (MNOs or Towercos) of TESCO services typically gain some competitive advantage via reduced energy costs, forcing rival players to adopt similar services, thereby resulting in a market-wide adoption of sustainable power solutions by mobile operators.



Operational hurdles still exist in the TESCO financing process

As the TESCO business model is in its nascent stages, relationships between various stakeholders are still developing and there are a few operational hurdles to receiving financing. First, there is the challenge of misalignment in expectation of financing terms. With few exceptions, TESCO transaction sizes have been relatively small, reflecting the number of initial sites contracted. As TESCOs typically seek full non-recourse financing on a country-by-country basis rather than by bundling them together, these loans can be viewed by many financiers as risky and difficult to structure, especially in the absence of corporate support or that of a good asset base to serve as security.

Second, contractual terms between TESCOs and MNOs or Towercos may not be bankable. TESCO contracts lack standardization, with many clauses up to individual negotiation between TESCOs and clients. (Contractual risk is further discussed in Chapter 5.2. As a result, contractual terms such as termination clauses in case of TESCO default, governing law, achievability of key performance indicators and associated penalties, currency and indexation of prices vary and may pose challenges for financial institutions. However, this can be overcome by involving financiers early on in negotiations between TESCOs and clients to ensure contractual terms are bankable.

Third, procedures in the event of TESCO default need to be established. Both TESCO clients (MNOs and Towercos) and lenders want to ensure business continuity in a downside scenario. For financiers, this also includes recovery of capital. In addition

“

MNOs sometimes make it difficult for a TESCO contract to be bankable. With a capital-intensive cost structure, TESCOs need long-term contracts to recover their costs.

Interview excerpt from TESCO

”

to the typical contractual commercial considerations, two key considerations are security package arrangements for debt financings, and lender step-in rights. The nature of the TESCO business is that assets cannot easily be reclaimed as they are not located at the TESCO's own premise. Consequently, ensuring the sustainability of receivables is key to a bankable contract. In the event of a TESCO default, financiers want to ensure that they can continue to negotiate with the MNO or Towerco so that the contract can be reassigned to another TESCO in such a way that secures the financier's receivables.

5.2 Framework for assessing TESCOs' contractual risks

Scrutiny of key contractual terms is necessary in the absence of contract standardization

Many TESCO clients, especially MNOs, are keen to carry over important lessons from their long-term contracts with Towercos and are taking a cautious approach vis-à-vis their contracts with TESCOs. The terms of the contract, however, are the cornerstone of securing financing for TESCOs and therefore require a balanced risk allocation between the TESCO and their clients. Major clauses such as fee structure, SLAs and penalties, currency and indexation, valuation of legacy assets, termination clause, are key to determining the bankability of a project. As part of this study, a contractual benchmarking exercise was conducted to assess the variation of contractual terms between TESCOs and their clients. The results are summarized in figure 5-2 aggregated from 11 TESCO contracts across two regions.

Investors and lenders are expected to continue paying close attention to the detailed structure of TESCO contracts and it is expected that as the industry grows, the contractual terms will also move towards standardization.

“

The market still lacks structured terms and conditions for dealing with key contractual clauses such as transfer and valuation of legacy assets.

Interview excerpt from MNO

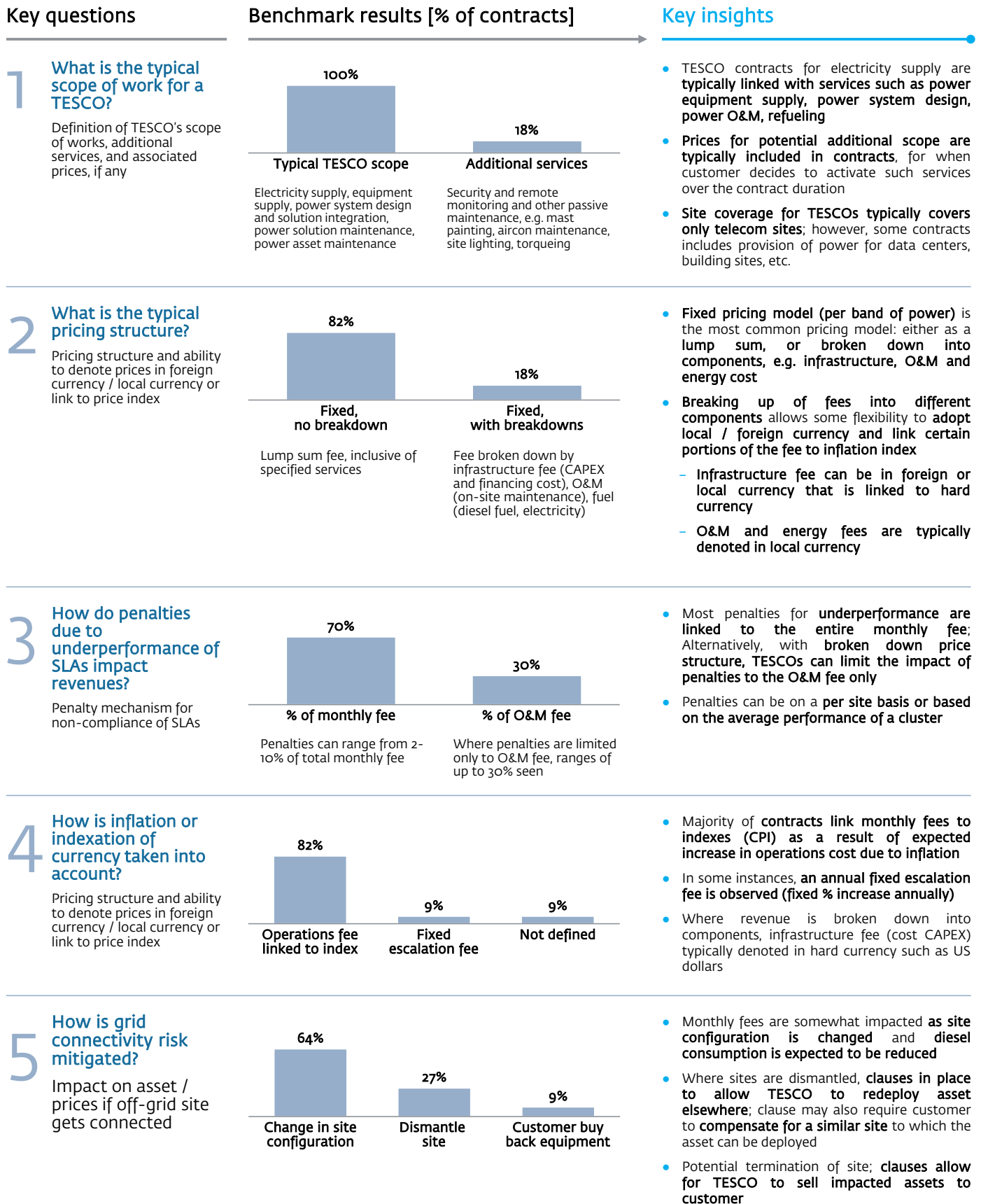
MNOs will always negotiate for prices to be paid in local currency; however we bear the cost of CAPEX in foreign currency.

Interview excerpt from TESCO

”



Figure 5-2: Contractual benchmarks



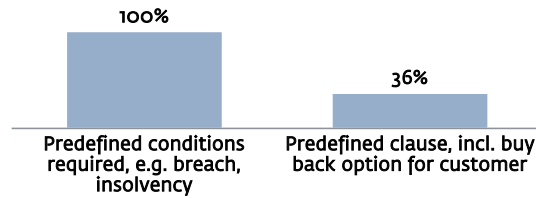
Key questions

Benchmark results [% of contracts]

Key insights

6 What are the rules to trigger termination? Which party can trigger the clauses?

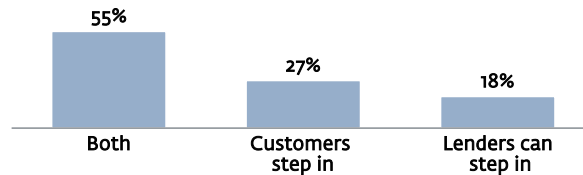
Terms to trigger termination clauses by either party



- In all contracts, predefined conditions are required for termination clause to be activated by either the TESCO or customer, e.g. contract breach or insolvency
- Examples of termination mechanisms:
 - Customer can terminate "for cause" (if TESCO breaches the contract) with "buy back option" where customer purchases power assets from TESCO at fair market value
 - Where the customer terminates without cause, the customer will be liable to pay high termination fees
 - TESCO can also terminate "for cause"

7 What are step-in rights upon termination or TESCO default?

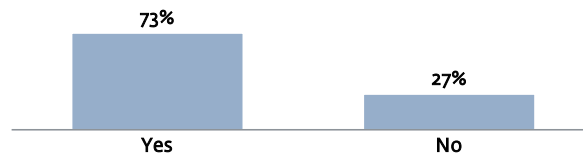
Allocation of step-in rights upon termination or TESCO default



- Customer usually has the step in rights upon default or termination of contract in order to ensure that they can control who takes over the power assets

8 To what extent is relationship with lender detailed?

Restriction for TESCO to create security over power assets



- A minority of contracts do not have any restrictions that allow the TESCO to create security over the power assets

5.3 Framework for assessing TESCOs' country specific risks

Various country-level factors also drive the attractiveness of a TESCO in emerging markets

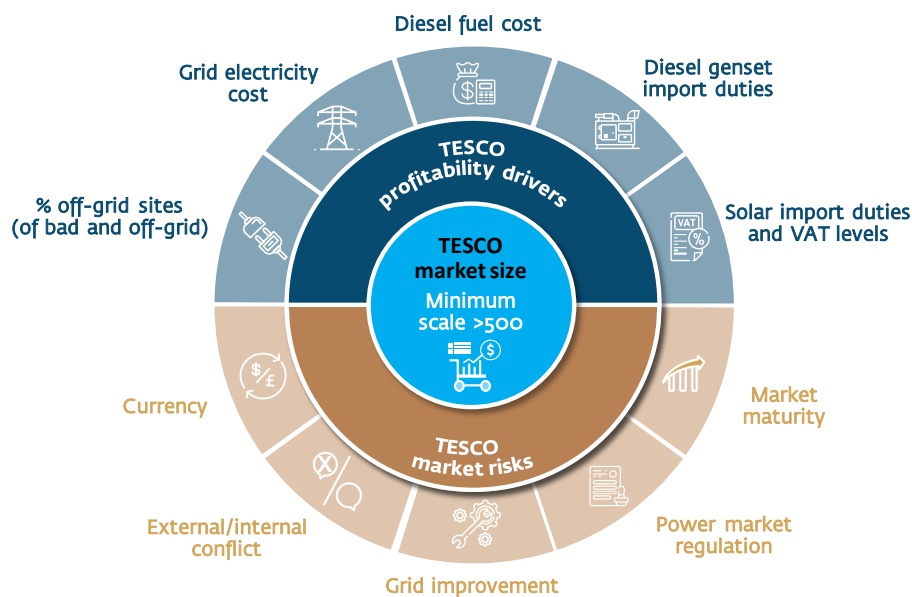
These factors are illustrated in figure 5-3:

- **TESCO market size:** For TESCOs, economies of scale are key to optimize both CAPEX and OPEX cost. Economies of scale would not only allow the TESCO to improve procurement negotiating terms, but also ensure on-the-ground operational efficiency. Hence, the number of bad- and off-grid sites in the country is a key consideration criterion for a TESCO's ability to scale and optimize growth.
- **TESCO profitability drivers:** As discussed in Chapter 2.3, the business case for solarizing sites varies by country, and is driven by the cost of diesel fuel, availability of incentives for production, import and use of renewable energy equipment, as well as existing grid tariffs and regulations for distributed energy generation.
- **Currency stability:** Currency risk is of particular concern due to currency volatility in emerging economies. TESCOs would have to bear a large currency risk as typically CAPEX is paid for upfront in foreign currency. However, fees may be received in local currency, in which case some form of currency hedging would be appropriate.
- **Operational security:** External and internal conflicts make the operating environment for TESCOs challenging, both from a manpower security, as well as operational performance perspective. This requires additional investments and manpower

to account for security of the local teams and assets.

- Improving grid connection and improvement:** Political and economic factors have resulted in uncertainty and delays in achieving national electrification plans. TESCOs will need to include risk mitigation plans, for example through contractual terms, to ensure viability in case of grid expansion.
- Power market regulation:** Emerging markets typically face a lack of long-term clarity in power regulation on rules such as (i) if and when grid-connectivity arrives, and (ii) regulations surrounding decentralized and off-grid power market. In countries requiring a license to operate power generation equipment or to sell electricity, adequate budgetary buffers or contract clauses should also be put in place to accommodate potential regulatory delays that may impact deployment of assets.

Figure 5-3: Key metrics for evaluating country-level risks for TESCOs in emerging markets





Chapter 6

CONCLUSION



6. CONCLUSION

This report holistically assesses the TESCO landscape and presents a quantitative sizing of the addressable market for TESCOs, an assessment of the market outlook, the relationship between the key stakeholders and types of TESCO players, as well as a framework for approaching TESCOs as investment opportunities. These aspects, many of which are industry firsts, aim to address the bankability of TESCOs. The report is intended as a call to action for further market development, especially in light of urgent connectivity needs and climate change mitigation requirements in underserved regions of the world.

In an ever-growing, energy-hungry telecommunications sector, TESCOs can be a catalyst for a transition towards renewable power generation at telecom sites. TESCOs are putting forward a value proposition to industry stakeholders, government counterparts and end users themselves which goes beyond cost savings. As the digital divide continues to grow, TESCOs offer a way to bridge the gap between those who have ample digital access and those who do not. While grid availability and reliability are expected to improve in some regions, the demand for telecommunication towers is expected to exceed the rate of power grid connectivity. This growth is driven by the continued increase in mobile penetration and network densification, coupled with the push to increase mobile coverage in unserved and underserved areas. Today, TESCOs own or manage nearly half of renewable powered telecom sites globally, yet this is a small fraction of the total present and future need. The scalability of the TESCO business model is not without its challenges. TESCOs must demonstrate excellence in multiple areas, including telecom know-how, general site management, energy expertise and deployment of cutting-edge technology solutions. As with any nascent business model, the TESCOs' ability to overcome operational challenges during this early phase is critical if they are to achieve high degree of degree of market penetration.

The total investment required for new TESCO sites is estimated at \$3.9 billion for the next ten years. The telecommunications industry is starting to come together in order to reach its collective connectivity and de-carbonization goals. New technologies and business models are improving the commercial viability of investments which target rural, remote or otherwise off-grid and bad-grid locations. The collective power of stakeholders to drive successful operational execution can achieve the projected quadrupling of the number of TESCO sites over the next ten years.

ANNEXES



ANNEX A: LIST OF COUNTRIES WITHIN SCOPE

SUB-SAHARAN AFRICA

Angola
Benin
Botswana
Burkina Faso
Burundi
Cabo Verde
Cameroon
Central African Republic
Chad
Comoros
Congo, Dem. Rep.
Congo, Rep.
Cote d'Ivoire
Djibouti
Equatorial Guinea
Eritrea
Ethiopia
Gabon
Gambia, The
Ghana
Guinea
Guinea-Bissau
Kenya
Lesotho
Liberia
Madagascar
Malawi
Mali
Mauritania
Mauritius
Mozambique
Namibia
Niger
Nigeria
Rwanda
Sao Tome and Principe
Senegal
Seychelles
Sierra Leone
Somalia
South Africa
South Sudan
Sudan
Tanzania
Togo
Uganda
Zambia
Zimbabwe

LATIN AMERICA AND THE CARIBBEAN

Antigua and Barbuda
Argentina
Aruba
Bahamas, The
Barbados
Belize
Bermuda
Bolivia
Brazil
Cayman Islands
Chile
Colombia
Costa Rica
Dominica
Dominican Republic
Ecuador
El Salvador
Grenada
Guatemala
Guyana
Haiti
Honduras
Jamaica
Mexico
Nicaragua
Panama
Paraguay
Peru
Puerto Rico
St. Kitts and Nevis
St. Lucia
St. Vincent and the
Grenadines
Suriname
Trinidad and Tobago
Uruguay
Venezuela, RB
Virgin Islands (U.S.)

MIDDLE EAST AND NORTH AFRICA

Algeria
Bahrain
Egypt, Arab Rep.
Iran, Islamic Rep.
Iraq
Jordan
Kuwait

Lebanon
Libya
Morocco
Oman
Qatar
Saudi Arabia
Syrian Arab Republic
Tunisia
United Arab Emirates
Yemen, Rep.

SOUTH ASIA

Afghanistan
Bangladesh
Bhutan
India
Maldives
Nepal
Pakistan
Sri Lanka

EAST ASIA AND THE PACIFIC

American Samoa
Brunei Darussalam
Cambodia
China
Fiji
Guam
Hong Kong SAR, China
Indonesia
Kiribati
Korea, Democratic
People's Republic of
Korea, Republic of
Lao People's Democratic
Republic
Macao SAR, China
Malaysia
Marshall Islands
Mongolia
Myanmar
Northern Mariana Islands
Palau
Papua New Guinea
Philippines
Samoa
Singapore
Solomon Islands
Thailand

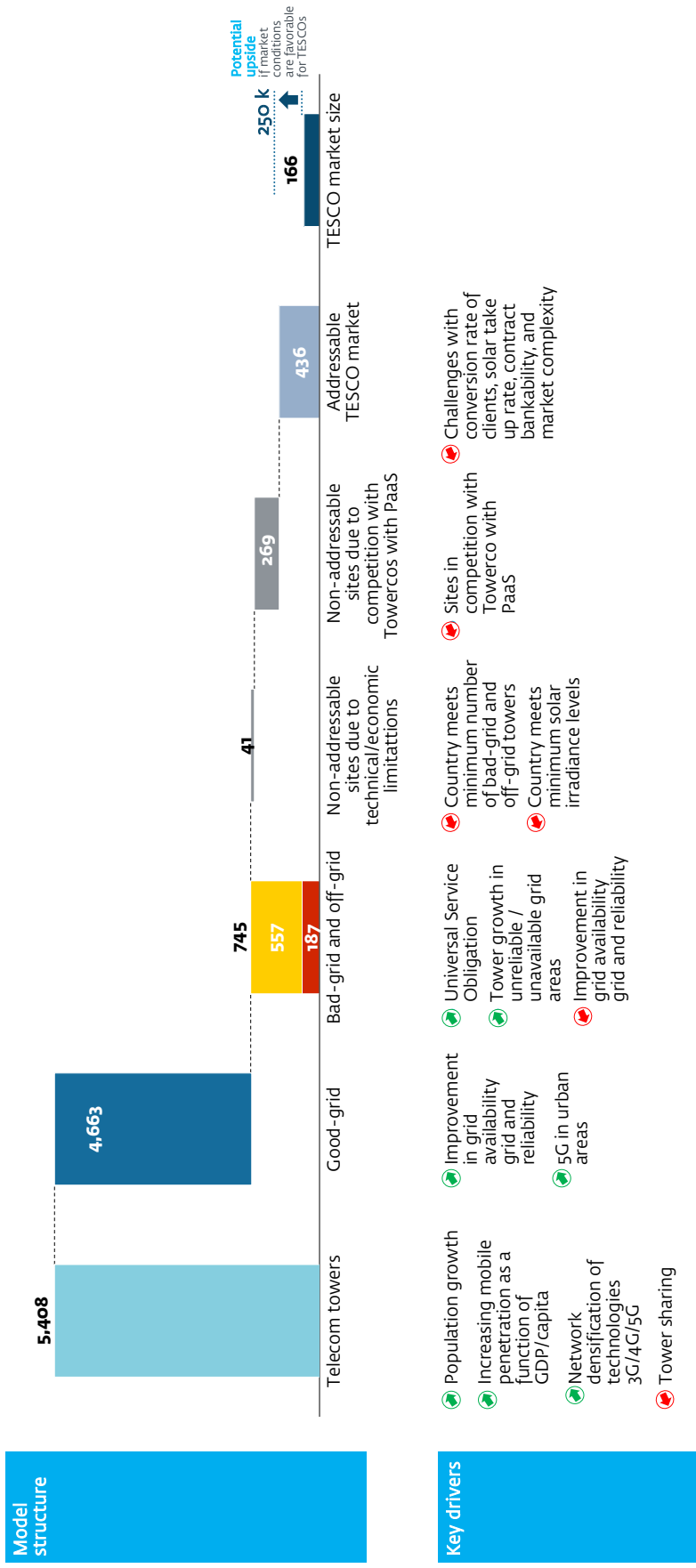
Timor-Leste
Tonga
Taiwan, China
Tuvalu
Vanuatu
Vietnam

EUROPE AND CENTRAL ASIA

Albania
Armenia
Azerbaijan
Belarus
Bosnia and Herzegovina
Bulgaria
Croatia
Czech Republic
Estonia
Georgia
Greece
Hungary
Kazakhstan
Kosovo
Kyrgyz Republic
Latvia
Lithuania
North Macedonia
Malta
Moldova
Montenegro
Poland
Romania
Russian Federation
Serbia
Slovak Republic
Slovenia
Tajikistan
Turkey
Turkmenistan
Ukraine
Uzbekistan

ANNEX B: TESCO SITES FORECASTING METHODOLOGY

TESCO sizing methodology – by country [thousand sites globally in 2030]



ANNEX C: WORLD BANK GROUP (WBG) SOLUTIONS IN SUPPORT OF SUSTAINABLE ACCESS TO COMMUNICATIONS

World Bank Group and digital development

The World Bank Group mission is to end extreme poverty by reducing the share of population which lives in extreme poverty to three percent by 2030 and to promote shared prosperity by increasing the incomes of the poorest 40 percent of people in every country. Its five institutions share this commitment and seek to promote sustainable development (figure C-1).

Figure C-1: World Bank Group institutions



Digital development is a priority for the WBG because it is the foundation for addressing many of the Sustainable Development Goals set by the United Nations. In addition to providing access to information, digital technologies also help overcome remoteness and exclusion and they also enable economic opportunities. WBG institutions draw upon all the resources at their disposal to contribute to the goal of closing the digital connectivity gap and promoting resilient, sustainable and inclusive digital transformation in emerging markets.

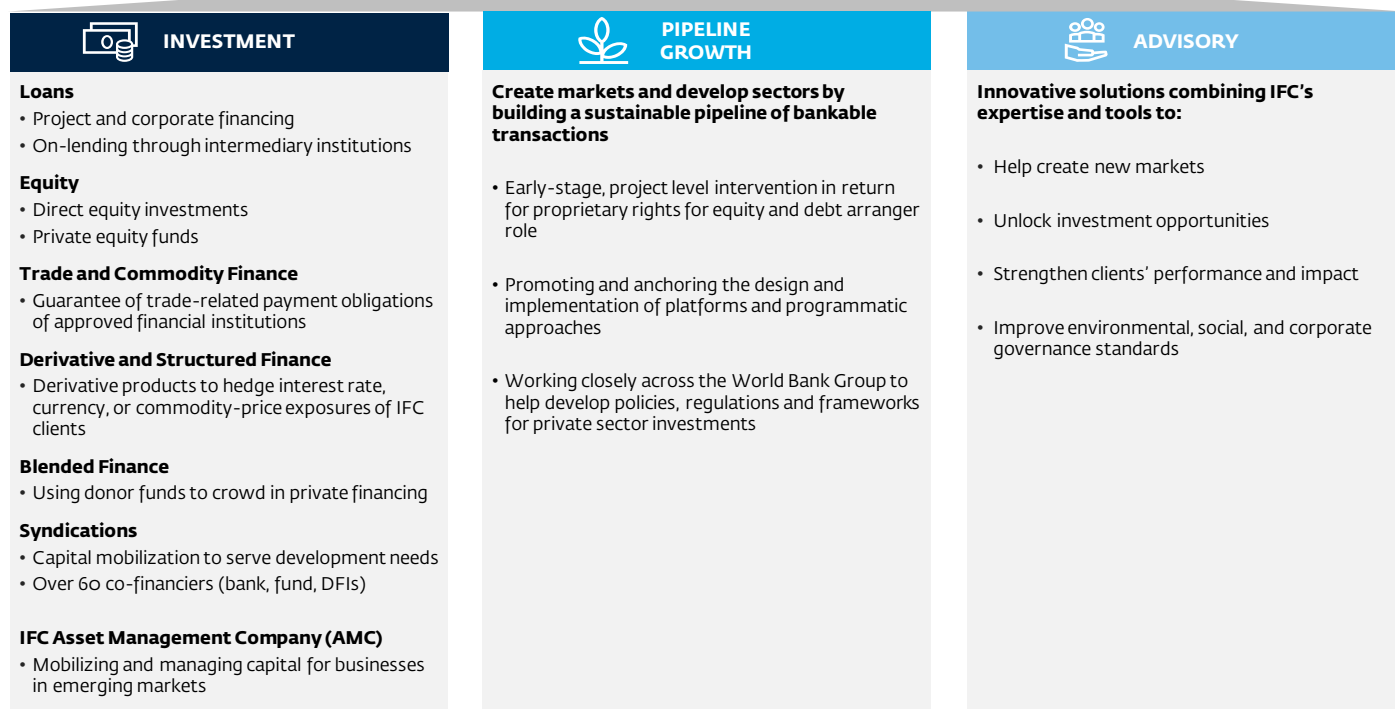
IFC investments in the digital sector

IFC is the largest global development finance institution focused on the private sector in emerging markets. IFC offers a broad range of products, including senior debt, mezzanine, equity, mobilization, project finance in a variety of currencies, together with a deep experience and expertise in project structuring (figure C-2). IFC is the first mover in many geographies and sectors that have been considered too risky by others, thereby creating a strong demonstration effect on other players and a catalyzing effect on sector reforms and market development.

Figure C-2: IFC's solutions

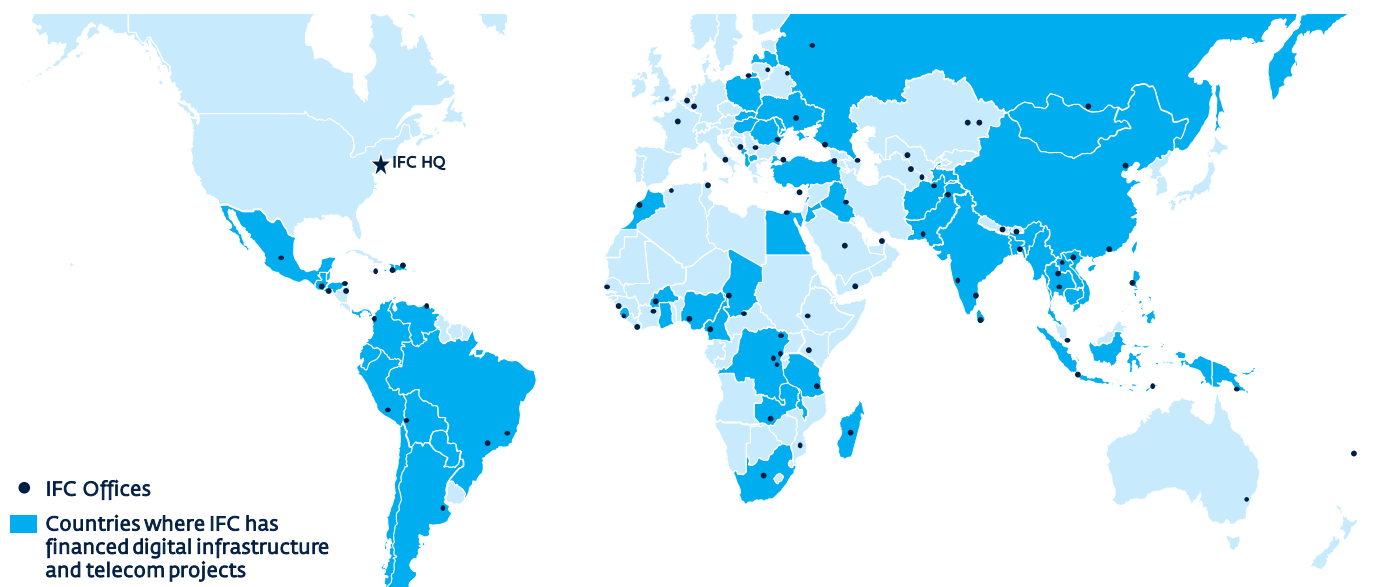
OUR PRODUCTS & SERVICES

IFC offers a wide range of products and integrated solution to increase development impacts for our clients



For decades, IFC has been a leader in the TMT sector in emerging markets, building digital infrastructure, connecting the unconnected, and bridging the digital divide with total investments in the sector of over \$11 billion (figure C-3).

Figure C-3: IFC's investments in digital infrastructure projects



IFC's primary focus in the TMT sector is on the development of mobile telephony, telecommunication towers, broadband networks, data centers and satellite sectors, as well as adjacent segments and supporting infrastructure, such as TESCOs. The latter fits extremely well with IFC's priority of enabling the expansion of telecommunications services to underserved areas. IFC is already an investor in the TESCO space and we seek to further support innovative and cost-efficient energy solutions providers for telecom operators. IFC actively engages in developing a pipeline of bankable deals in this space, provides flexible financing structures, adapted for risky environments and leverages the full portfolio of solutions of the WBG, including blended finance instruments, Multilateral Investment Guarantee Agency (MIGA) insurance products and World Bank financing and technical assistance.

IFC's proactive approach to creating markets and developing projects

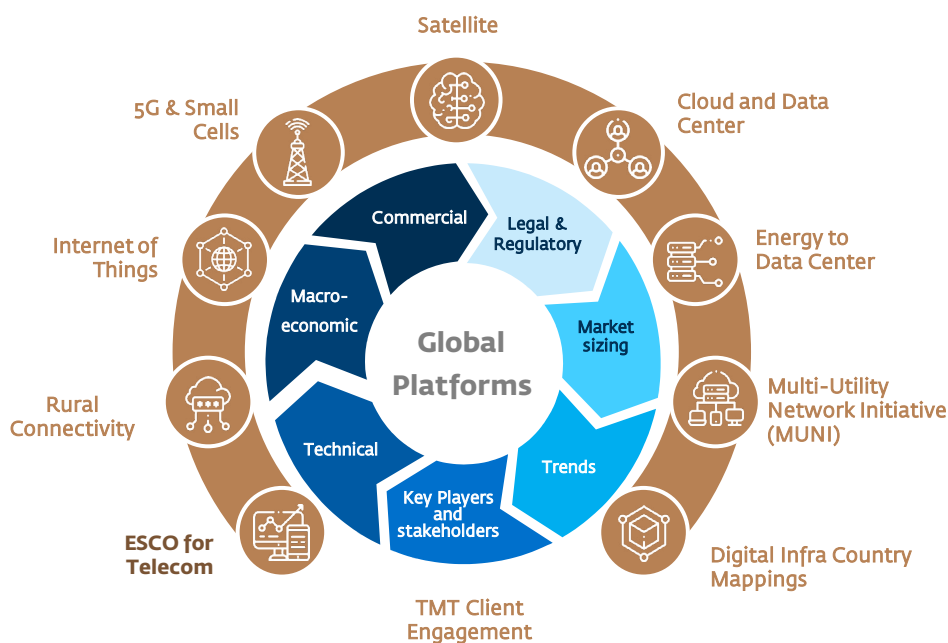
IFC takes a proactive approach to creating markets and developing projects. This involves crafting innovative private sector solutions and providing technical advice to tackle complex project issues and accelerate project feasibility and financing of digital infrastructure (figure C-4).

Figure C-4: TMT solutions to create markets and build project pipelines



Through its thought leadership work, IFC also undertakes global studies to comprehensively assess emerging technologies, develop innovative business models and strengthen engagements with private partners in critical TMT subsectors (figure C-5).

Figure C-5: TMT global initiatives to create markets



Blended finance solutions offered by IFC

Helping the commercial success of such first-generation TESCO projects is important to the long-term sustainability of the sector, which can deliver significant development impact in terms of digital inclusion and mitigating climate change. The WBG can offer a variety of financing and de-risking instruments to enable and crowd-in financing for TESCO projects. One such instrument includes blended finance, where concessional funds are invested alongside commercial funds to mitigate specific investment risks and help rebalance risk-reward profiles of pioneering private sector investments that are unable to proceed on strictly commercial or market terms.

Customized blended finance co-investments can be structured to address market and macro uncertainties facing first-generation TESCO projects and catalyze commercial financing for subsequent projects. Concessional funds can be structured in the form of debt, equity or guarantee products to unlock a bankable financing structure and reduce the credit risk of co-investments from commercial financiers or DFIs. In some cases, blended finance may be utilized to support local currency financing, especially critical in countries where local capital markets are not available to fund long-term local currency investment. When considering the use and structuring of any blended finance solution, IFC follows a disciplined approach in line with the DFI Enhanced Blended Concessional Finance Principles for Private Sector Projects to maximize impact and minimize potential market distortions through the use of concessional resources.

Political Risk Insurance Solutions from the Multilateral Investment Guarantee Agency (MIGA)

The MIGA, a member of the WBG, aims to promote cross-border investment in developing countries by providing political risk insurance to investors and lenders. MIGA provides an umbrella of deterrence against government actions that could disrupt projects and assists in the resolution of disputes between investors and governments.

The Political Risk Insurance solutions offered by MIGA are shown in figure C-6.

Figure C-6: MIGA Political Risk Insurance Solutions

Covered Risks	Covered Projects
<p>Transfer and convertibility restriction</p> <ul style="list-style-type: none">• Inability to convert or transfer dividends or debt service due to FX restrictions	<p>Eligible investments</p> <ul style="list-style-type: none">• Cross-border from one member country (developed or developing) into another developing member country• Greenfield investments or existing investments
<p>War and civil disturbance cover</p> <ul style="list-style-type: none">• Destruction of assets or interruption of business due to political violence• Includes acts of terrorism and sabotage	<p>Investment types</p> <ul style="list-style-type: none">• Equity; Shareholder loans (up to 90% cover)• Loan guarantees (up to 95% cover)• Non-shareholder loans (up to 95% cover)
<p>Expropriation cover</p> <ul style="list-style-type: none">• Government nationalizes or otherwise makes it impossible to operate a project• Includes coverage of regulatory risks such as tariff adjustments that render projects unviable	<p>Value Added</p> <p>Strong pre-claim management</p> <ul style="list-style-type: none">• Management of risks at pre-claim level (About 145+ pre-claims among over 900 projects. Two (2) claims paid for expropriation, Eight (8) for war and civil disturbance)• Leveraging the World Bank Group network
<p>Breach of contract cover (for infrastructure projects – PPPs)</p> <ul style="list-style-type: none">• Failure of government to honor obligations under contractual agreements and subsequent failure to honor arbitral award (e.g. PPA, Concession Agreement)	<p>Strong risk appetite</p> <ul style="list-style-type: none">• Operates in challenging markets, including fragile states• Longer tenors (up to 20 years)

MIGA has already issued guarantees for TESCOs against the risks of transfer restriction, expropriation, and war and civil disturbance and seeks to further extend its support to facilitate additional projects in some of the riskiest markets.

World Bank (IBRD) regulatory assistance

The WBG is strongly committed to enabling affordable broadband access for all and works closely with governments around the globe to strengthen the sector policy and regulatory environments and address critical digital connectivity gaps. The WBG promotes the development of inclusive digital economies through technical assistance, loans, grants and partnerships, including public-private partnerships.



Creating Markets, Creating Opportunities

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Washington DC 20433 USA

www.ifc.org/tmt