Next-gen infraco
Unlocking new business opportunities

Click here to navigate
# Table of contents

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>07</td>
<td>Executive summary</td>
</tr>
<tr>
<td>17</td>
<td>Indian telecom tower industry overview</td>
</tr>
<tr>
<td>23</td>
<td>Exploring new opportunities - what lies ahead for tower companies</td>
</tr>
<tr>
<td>31</td>
<td>Evaluating the play of tower companies in adjacent business segments</td>
</tr>
<tr>
<td>67</td>
<td>Monetization of existing assets - an immediate opportunity for tower companies</td>
</tr>
<tr>
<td>77</td>
<td>Shared digital infrastructure provider - a potential future opportunity for tower companies</td>
</tr>
<tr>
<td>81</td>
<td>Recommendation and initiatives to enhance ease of doing business</td>
</tr>
</tbody>
</table>
The Indian mobile industry and its closely tied mobile tower industry has undergone a period of unprecedented market restructuring. In the span of a decade, India went from an 18-player market in 2008 to a mature four player market in 2019. The price-based competition has also led to stretched balance sheets for telcos. Telecom operators are keen to divest non-core assets to pare these high debts and bring in more opex efficiency.

Against this backdrop, the disarmament of India's carriers' passive infrastructure continues. The majority of carriers had already carved out or monetized their passive infrastructure. The remaining operator-captive towers, and majority of operator-owned tower companies, have been sold or are now coming to market. While the market consolidation will have a short-term impact on tenancies, results should be positive for the Indian market in the long term, leading to healthier competition, wealthier players and an overall more sustainable environment. Also, India has been experiencing an unprecedented jump in data demand as a function of the sharp decline in data tariffs, driven by the decline in data pricing and availability of affordable smartphones.

To support this burgeoning data growth, MNOS across the country have ramped up their spending on 4G and site densification. The consumption pattern has also shifted from data being an urban phenomenon, to mass market adoption of data services, leading to increase in demand for infrastructure support.

The importance of fiber connectivity to create a high-performing, dense urban network, which is able to sustain the level of data growth has become paramount. Infrastructure ramp ups will be necessary to support the data needs to a bandwidth hungry consumer. The future technologies also demand infrastructure build-outs at massive scale. 5G has moved from being a buzzword to a strategic advancement expected in the next four to five years.

In this seismic shift, plenty of opportunities are arising for tower companies to move their attention from a macro tower focused business, to additional revenue streams such as fiber, small cells, data centers, Wi-Fi and smart cities and beyond. Globally, tower companies are already reaping the results of these new areas of investment and the business case has proved to be successful for multiple global infrastructure companies (infracos).

With this backdrop, EY has drawn out the future business landscape for Indian telecom towers industry, and done an in-depth study on the new opportunities which have already started to gain ground. With the high industry momentum, and government’s push on infrastructure growth, the future is promising for the telecom infrastructure sector.

**Acknowledgements:**

EY report development team:

Gaurav Kapoor, Kanika Kakar, Pranjal Bhatnagar, Ridhi Sharma, Siddharth Sharma, Shreya Sood, Swati Mahajan
Executive summary

The telecom towers industry has played a pivotal role in the unhindered growth of India’s telecom sector. Indian tower industry has been one of the pioneers in infrastructure sharing globally, which has resulted in significant operational efficiency and capex saving for telcos. The business of building, buying and leasing of macro towers has proven its merit over the years, and has created an investible proposition for tower companies in India. Currently, Indian tower companies (towercos) are amongst the largest telecom infrastructure companies across the globe.

Currently, 71% of tower portfolio in India is held by telecom infrastructure providers that are directly controlled by telecom operators or are independent tower companies. Only 28.8% of the sites are telco captives. Portfolios of independent tower companies are further expected to grow as telcos continue to divest their tower assets to pare their debts and focus on core service delivery.

While the tower lease model for infrastructure providers has flourished over the past decade, the transformation witnessed by the telecom industry is opening new business avenues and revenue streams for towercos.

Changing dynamics of the Indian telecom sector

The Indian telecom market has shrunk from a 10-12 player market to a mature four player construct. The carrier neutral towerco business model, which hinged on tenancy addition, has limited prospects in a mature market with lower number of players. The growth of macro sites is expected to be modest in the coming years, majorly driven by capacity expansion for data services for 4G services in the immediate term, and later for 5G launch.

The telecom market has also undergone a significant transition, moving from a voice centric to a data heavy consumption pattern. Factors such as aggressive data pricing, 4G roll outs by operators, decline in handset costs and availability of relevant content have contributed considerably to this data deluge.

The Indian telecom industry is today characterized by high data demand and the market is expected to witness a 5x increase in mobile data traffic during 2018-24. This burgeoning data need has given rise to the demand for new infrastructure and services. New generation technologies such as 4G, 5G and IoT require formidable network performance, which has triggered the need for a diverse infrastructure mix.

Towercos today are well positioned to expand their infrastructure portfolio, by tapping into adjacencies to cater to the changing needs of the telecom industry. Across the globe, telecom infrastructure players are witnessing a transition from just macro tower sites, to inclusion of small cells, fiber and Wi-Fi solutions. Countries such as the US, Indonesia and China are already seeing infracos diversify into these new assets and services.

Figure: India tower ownership split (as of October 2018)
Monetization of adjacencies
Fiber: Fiber is a fast-growing infrastructure asset class which is gaining attention as fiber demand in India is increasing at a rapid pace. Deployment of large amount of high frequency 4G and 5G spectrum needs a fiber backhaul. Telcos’ ambition of frequency 4G and 5G spectrum needs Deployment of large amount of high frequency 4G and 5G spectrum needs a fiber backhaul. Telcos’ ambition of frequency 4G and 5G, is also contributing to increased on telecom infrastructure, especially BharatNet’s and Digital India’s focus would boost the demand for fiber lay buildings and enterprise customers would boost the demand for fiber lay outs. Government initiatives such as BharatNet’s and Digital India’s focus on telecom infrastructure, especially fiber, is also contributing to increased fiber deployment.

Towercos are well positioned to address the fiber opportunity, with their existing experience of managing distributed infrastructure assets. Certain use cases that have towers as the central piece of network architecture, are already gaining traction. On the forefoot is site fiberization, as it enhances backhaul and increases the valuation of the core tower assets, giving towercos increased control. Small cells: Coverage and capacity have long been called out as the prerequisites for high speed data networks, especially with the advent of 4G and 5G. Network densification has already begun in metros with 4G network roll outs, and will further increase with 5G and IoT use cases. Globally, towercos are already adding small cells to their inventory of site typologies – mostly functioning as site acquirers, with the small cells themselves owned by telcos. A bigger opportunity lies where towercos acquire and own their small cells, and offer fiberized small cell sites to the telcos. Public Wi-Fi: Owning and maintaining distributed assets gives towercos a synergistic playing field in Wi-Fi. Despite significant growth in mobile data traffic, Wi-Fi penetration in India has remained dismal. Towercos have an opportunity to penetrate this market. They can choose a host of business models - providing Wi-Fi equipment and operations and maintenance (O&M) to clients, or becoming a neutral host public Wi-Fi provider. The latter will need active infrastructure deployment which is subject to license conditions.

Internet of Things (IoT): The IoT ecosystem is expected to grow at a rapid pace with the advent of 5G. IoT connections in India are expected to grow at a CAGR of 32% over 2017-2023 to ~423 million connections. This presents a unique opportunity for towercos to position themselves as the infrastructure providers for the IoT ecosystem. From deployment and maintenance of sensors, to entering the application and hardware value-chain, towercos can explore multiple business directions, based on capability and skill set enhancement.

Smart cities: India’s smart city initiative has opened a new avenue of growth for infrastructure providers. Digital infrastructure forms the backbone of the smart city initiative and towercos are well positioned to create and maintain this infrastructure. The Indian government’s Smart Cities Mission, which was launched in 2015, aims to create 100 smart cities in the country. Towercos in the country have already jumped on the smart city bandwagon and are keen to make most of this opportunity. In most cities, purchasing right of way (ROW) is expensive and one key revenue opportunity in smart cities comes from gaining rights to the street furniture and an easy ROW. Under the public private partnership (PPP) model, towercos can build the communications infrastructure for the city and in lieu use the ROW and site rights for mounting their own infrastructure for revenue generation. Leading Indian towercos have already entered smart city projects.

Data centers: In line with the capex to opex conversion model supported by towerco’s traditional business of tower rentals, data centers is a potential area of business which aligns with this model. Upfront high capex investments by towercos in data centers, to lease out space for colocation or to provision of managed hosting services, is a prospective business model. With the increase in data consumption, data centers are witnessing a steep growth trajectory - data center market in India is expected to grow at 8.4% CAGR from 2018-2023.

Monetization of existing assets
Co-location of data center on tower sites for edge computing
Monetizing site structures for advertising
EV charging points
Field maintenance (L1)
Providing space for warehousing and cold storage
Power-as-a-service

New technology/business model
Shared digital infrastructure provider

3. TowerXchange

The availability of reliable power and possession of distributed sites makes towercos well suited to provide EV charging infrastructure.

In the long run, there is an opportunity for tower companies to play a much larger role in the ecosystem by becoming a shared digital infrastructure provider. This role would include management and sharing of active elements along with passive infrastructure. By assuming the overarching role of a shared infrastructure provider, the tower companies can offer wholesale services to digital service providers, who in turn can focus on their core business. This opportunity would be subject to regulatory approvals and a much more evolved ecosystem.

Opportunities aside, ease of doing business remains a prime concern for all infrastructure projects in the country. Delays in getting approvals from municipalities, lack of uniform charges and clearances for ROW and multi-body regulatory approvals and a much more evolved ecosystem.

This opportunity would be subject to license conditions. Pertinent that ease of doing business is addressed for faster infrastructure roll outs. To expedite the creation of robust telecom infrastructure and to fulfill the agendas of Digital India, it is pertinent that ease of doing business is treated as a priority.

In this scenario, it has become important for towercos to explore new opportunities and diversify their business models. The immediate proposition for towercos is to expand their service offerings beyond tower based real estate, and capitalize their tower sites for hosting other services/infrastructure. With distributed, power backed, and increasingly fiberized sites, towercos can explore revenue streams that exploit this dispersed real estate advantage.

Apart from tapping on the above adjacencies, an immediate proposition for towercos is to monetize their existing assets. Towercos can expand their service portfolio beyond tower based real estate and include provisioning other services on their tower sites. With distributed, power backed and increasingly fiberized sites, towercos can explore revenue streams that exploit this dispersed real estate advantage.

A potential business stream includes setting up of edge computing on tower sites by deploying micro data centers near the network edge. With steady power supply and ready backhaul, tower sites can support edge data centers closer to the user, reducing the need to send backhaul data traffic to a centralized hub.

The location advantage of towercos also renders them fit for serving as storage, warehousing and delivery centers for various businesses. With availability of power and air-conditioning, even perishable goods storage can be explored as a business stream. As e-commerce companies are trying to penetrate deeper into remote and rural areas of Indian market, distributed location of tower sites can be leveraged for storage as well as collection point for goods ordered online.

Tower structures can also be monetized for out of home advertising, with placement of billboards on towers/ monopoles. Another service proposition beyond vertical real estate is the provisioning of primary and backup power. This innovation is well established by the “powerco towercos” (towercos offering power management solutions) of Sub-Saharan Africa and Southern Asia region. As towercos have significant expertise in managing energy assets, they are well-positioned to provide power-as-a-service.

With advent of electric vehicles, towercos can play an important role in this upcoming opportunity and unlock a new revenue stream.
### Assessing the opportunity landscape for towercos

Opportunities such as fiber and small cell have already gained traction globally for towercos and have significant potential in India.

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Assessment</th>
<th>Challenges</th>
<th>Heat-map</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiber deployment and backhaul through fiber and microwave</td>
<td>Tower fiberization, Intra-city fiber, Fiber to the curb, National long distance</td>
<td>RoW, Pricing of intra-city and NLD fiber, Regulatory approval for microwave</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>Small cells deployment with 4G/5G</td>
<td>Small cell sites deployment</td>
<td>Site acquisition and RoW</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>Wi-Fi</td>
<td>Neutral host Wi-Fi provider</td>
<td>Monetization</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>Internet of Things</td>
<td>Build-operate-maintain IoT network + installation</td>
<td>Capability enhancement, Workforce management for large scale sensor deployments</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>Smart cities opportunity</td>
<td>Digital infrastructure deployment + platform and application provider</td>
<td>Revenue models</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>Data center deployment</td>
<td>Build and operate data centers (co-location)</td>
<td>Market in nascent stage, Capability enhancement</td>
<td>1 1 1 1</td>
</tr>
</tbody>
</table>

Source: EY analysis

Long term opportunity subject to capability enhancement

### Monetize existing assets

Opportunities such as IoT and EV charging have significant potential, but depend on ecosystem development and market maturity.

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Assessment</th>
<th>Challenges</th>
<th>Heat-map</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field maintenance (L1)</td>
<td>Level 1 field maintenance</td>
<td>Currently under the purview of OEMs</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>Edge computing (micro data centers)</td>
<td>Co-location and managed services</td>
<td>Market in nascent stage</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>Out-of-home advertising</td>
<td>Static billboards, Digital billboards</td>
<td>Complex approvals, Limited opportunity</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>Warehousing, collection point for goods</td>
<td>Space for warehousing and cold storage at tower sites</td>
<td>Limited opportunity</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>EV charging</td>
<td>Use power at sites for providing EV charging</td>
<td>Underdeveloped infrastructure</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>Power management as a service</td>
<td>Power management for other industries</td>
<td>Capability development</td>
<td>1 1 1 1</td>
</tr>
</tbody>
</table>

Source: EY analysis

Long term opportunity subject to capability enhancement
Next-gen infraco - Unlocking new business opportunities

Sources: Ministry of statistics and programme implementation, Worldometers, Ministry of market research India, Arizton Advisory & Intelligence, Industry inputs through primary interviews, EY analysis

Detailed assumptions for the market assessment models

For infrastructure business in India with high capital intensity and high interest rates it is assumed that:

• Revenue generated should be ~30%-35% of cumulative capex per year
• EBITDA margin should be ~50%-60%
• EBITDA should be ~20% of cumulative capex per year

Underlying assumptions for the new business opportunities

Tower fiberization

• 100% of the multi-tenancy towers will be fiberized by 2023; and 33% of the single tenancy towers will be fiberized by 2023
• Route kilometres of fiber per tower at ~1.0-1.5 km
• Total number of urban households (2011): ~78 million (As per Census 2011)
• Growth factor taken as 1.2% to calculate the number of households in 2023
• Number of SEC A +SEC B urban households (2023) at ~30 million as per Government sources
• Towers requiring microwave for transmission is estimated at 50% of fiberized towers in 2023
• Microwave per tower assumed to be 1
• Wi-Fi access points calculated accounting for public spaces - hotels, hospitals, restaurants, college/university, railway stations, airports, metro stations, malls, amusement parks, cinema halls, museums and monuments; and commercial buildings for the calculation of number of access points
• Mobile data subscribers in 2018 at 507 million and 1105 million in 2023
• Data usage per subscriber 10GB in 2018 and 15 GB in 2023
• Data traffic in tier1/tier 2 cities accounts for 85% of total data traffic in 2018 and 75% in 2023
• Estimated average data capacity per site per day in tier 1/tier 2 cities at 600 GB in 2023

Fiber to the curb (household/ commercial building)

• Total intra-city fiber estimated for 2018 at ~100,000 - 150,000 route KM (excludes fiber laid for tower fiberization and fiber to the building)
• Intra-city fiber estimated to grow two fold (2x) by 2023 as per government’s fibre growth estimates
• Total NLD fiber estimated at 500,000-600,000 by 2023
• Towers requiring microwave for transmission is estimated at 50% of fiberized towers in 2023
• Microwave per tower assumed to be 1

Intra-city and NLD fiber

Microwave

Wi-Fi/IBS (neutral host Wi-Fi provider)

Edge computing (micro data center deployment)

Data center

Outdoor small cells

Data center

Edge computing

Addressable market and investment analysis of select opportunities

Table: Addressable market and investment analysis of select opportunities

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Overall addressable market</th>
<th>Towerco market share (% in 2023F)</th>
<th>Towerco opportunity market</th>
<th>Towerco investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiber deployment and microwave</td>
<td>405 b - 480 b</td>
<td>35% - 45%</td>
<td>150 b - 220 b</td>
<td>450 b - 660 b</td>
</tr>
<tr>
<td>Tower fiberization</td>
<td>150 b - 155 b</td>
<td>55% - 90%</td>
<td>85 b - 140 b</td>
<td>250 b - 410 b</td>
</tr>
<tr>
<td>Fiber to the curb</td>
<td>65 b - 75 b</td>
<td>25% - 30%</td>
<td>15 b - 20 b</td>
<td>55 b - 65 b</td>
</tr>
<tr>
<td>Intra-city fiber</td>
<td>65 b - 100 b</td>
<td>25% - 30%</td>
<td>20 b - 25 b</td>
<td>60 b - 75 b</td>
</tr>
<tr>
<td>National long distance</td>
<td>110 b - 130 b</td>
<td>20% - 25%</td>
<td>25 b - 30 b</td>
<td>70 b - 90 b</td>
</tr>
<tr>
<td>Microwave</td>
<td>15 b - 20 b</td>
<td>30% - 40%</td>
<td>5 b - 8 b</td>
<td>15 b - 20 b</td>
</tr>
<tr>
<td>Small cells (outdoor small cell deployment)</td>
<td>55 b - 70 b</td>
<td>60% - 70%</td>
<td>35 b - 40 b</td>
<td>110 b - 125 b</td>
</tr>
<tr>
<td>Wi-Fi/IBS (neutral host Wi-Fi provider)</td>
<td>45 b - 50 b</td>
<td>30% - 40%</td>
<td>15 b - 20 b</td>
<td>45 b - 60 b</td>
</tr>
<tr>
<td>Edge computing (micro data center deployment)</td>
<td>35 b - 40 b</td>
<td>30% - 40%</td>
<td>10 b - 15 b</td>
<td>35 b - 45 b</td>
</tr>
<tr>
<td>Data center</td>
<td>130 b - 135 b</td>
<td>5% - 10%</td>
<td>5 b - 15 b</td>
<td>20 b - 40 b</td>
</tr>
<tr>
<td>Total</td>
<td>670 b - 775 b</td>
<td>2,050 b - 2,300 b</td>
<td>215 b - 310 b</td>
<td>660 b - 930 b</td>
</tr>
</tbody>
</table>

Source: EY analysis

Caveats

- Assets of new entrant not considered on a shareable level for these projections.
- Shift in technology can have significant impact on the projections. Revenue assessment does not take technology risks into account.
- Business forecasts are subject to investment potential by telcos. EY has not independently validated the future business health of the telecom industry.
- The forecasts have not taken into account any future new towerco hive-offs or any potential deals of the future.
- Limited availability of reference data for new opportunities due to absence of current business models for the same.
- Assessment of the business opportunities have been done as per industry trends. The future business directions/ ownership of telco assets such as fiber, microwave, Wi-Fi access points, small cells, IoT infrastructure not validated with telecom players.
- EY has relied on primary survey for revenue estimates. EY has not independently validated forecasts and adequacy of the same taking into account the sensitivity analysis.
- Potential impact of any Forex risks has not been accounted for.
- Any future consolidation or entry of a new player in the telecom market may impact the revenue projections.
- The revenues are estimated using the principal operational guidance from the current business plans of a long term capex to opex conversion models. There may be variations in operational efficiency of the new opportunities.
- EY has not considered the regulatory barrier for the current assessment.
- Future regulatory changes or changes in terms of license conditions may impact the projected revenues.
- 5G launch, scale of availability and pace of ecosystem development may impact revenue projections.
- Competitive landscape has not been assessed in detail for any of the revenue projections.
India telecom tower industry overview

Sector landscape and industry growth

The telecom sector in India has witnessed a remarkable growth over the last two decades and has contributed significantly to the socio-economic development of the country. Currently, India is the second largest telecom market with over a billion wireless subscribers. The unprecedented success of India’s telecom sector is attributable to the wireless growth backed by a robust tower infrastructure industry which has played instrumental role in bridging the digital divide and facilitating ubiquitous mobile connectivity.

India today is at the cusp of digital revolution driven by paradigm shift in usage pattern from voice to data centric services, propelled by roll out of 3G/4G services, increasing penetration of smartphones and affordable data tariffs. Going forward, emerging technologies such as 5G, augmented reality, virtual reality and internet of things (IoT) are set to redefine the communications landscape communication in the country. The government has also embarked on an ambitious Digital India Programme to transform the country into a digitally empowered society. It seeks to provide digital interface between the government and citizens to provide a plethora of e-governance services including healthcare, education and banking which would ride on ICT infrastructure. With communication and connectivity at the heart of Digital India vision, telecom infrastructure providers are poised to play a critical role.

Overall subscriber base

<table>
<thead>
<tr>
<th>Year</th>
<th>Overall Subscribers (m)</th>
<th>CAGR (2015-18)</th>
<th>3G/4G Subscribers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>310</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>530</td>
<td>4.9%</td>
<td>98%</td>
</tr>
</tbody>
</table>

4G device base expansion driven by increase in economical 4G devices

Source: TRAI, Nokia Mbit Index 2019, Nokia Mbit Index 2016, media articles

4G data consumption fueled by 4G device penetration, falling data prices and growing digital ecosystem

Source: TRAI, Nokia Mbit Index 2019, Nokia Mbit Index 2016, media articles
Telecom towers industry transformation

Over the years, Indian tower industry has laid strong foundation of growth for the telecoms sector and has supported the sector in keeping pace with the technology advancements. India was one of the pioneers in passive infrastructure sharing, pooling in towers and bringing in passive infrastructure sharing model - providing integrated neutral host platforms for the telecom players - has found success in the market. It has not only led to capex and opex efficiency through optimal utilization of infrastructure for telecom operators, but has also facilitated faster time to market and affordable services for end users.

The business model of towercos currently depends on the long-term contracts, known as the master service agreement (MSA) with telecom operators. Under the terms of the agreement, the towerco provides access to its sites to all its tenants on non-discriminatory basis for installing active infrastructure. The MSAs contain significant exit penalties which hedge the towerco’s cash flows against risk of premature winding up of tenancies. The agreement is economically viable for telecom operators as they are able to leverage economies of scale with declining rentals and share energy cost for the towers.

Currently, 71% of the tower portfolio in India is held by telecom infrastructure providers that are directly controlled by telecom operators or are independent tower companies. Going forward, telecom operators are expected to further divest their tower portfolios triggered by stressed financials.

The ongoing price wars in the telecom industry has resulted in debt ridden balance sheets and is tapering the top line of telecom operators. The gap between the sector debt and overall revenue continues to widen - telecom industry’s overall debt has spiraled to INR 4.7 trillion, while the gross revenue has declined to INR 2.5 trillion in FY18. In the current scenario, operators are keen to reduce stake in tower subsidiaries, or divest their captive tower assets, to pare their debt and focus on their core business. Going forward, independent towercos are expected to own majority of the towers in the market as tower leasing results in higher operating efficiency for the telcos.

5. TowerXchange Issue 23
Over the last decade, the tower industry has been on a consolidation spree. The on-going mergers are expected to create two to three strong independent towercos followed by smaller towercos. The consolidation underway in the tower industry is expected to bring in more stability in the market with scale and synergy benefits and would also enhance the ability of the towercos to invest in new opportunities.

Changing industry dynamics bring in new opportunities and challenges for towercos

With the fast-paced growth in the telecom sector, the model of tower industry to lease the space at tower sites to multiple operators on a long-term contract had flourished. Capital had flowed into towers on the assumption that there was a minimum secured return due to long term lease contracts. The tower industry had witnessed promising growth with number of towers increasing from around 250,000 in 2008 to 506,746 in 2018. The tenancy ratio had jumped from 0.9 in FY08 to 2.13 in FY18 (ending March 2018). The sector’s overall operating margin was in the range of 43%-44% in the past four-five years (ending March 2018) majorly driven by rental and energy margins expansion.

However, the dynamics of the telecom sector are changing. The recent restructuring in the telecoms market has led to mergers and exits. The India telecoms market has shrunk from 10-12 player market to a mature “3+1” player market. With lesser number of players, the need for new tower sites in the short run will be limited.

On the flip side, the introduction of 5G will add impetus to tower sites growth in the medium run. It will also bring growth in form of non-traditional small cell sites, which would be needed for network densification to meet 5G standards.

With this transition in the industry outlook, towercos are aligning their business priorities with the changing sector needs. New business models and revenue streams have opened for towercos globally and Indian infrastructure market is ripe to explore these diversified business streams.

Figure: Projected growth in the number of radiating sites

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of radiating sites (towers + small cell) in Tier 1/Tier 2 cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>3,34,048</td>
</tr>
<tr>
<td>2023F</td>
<td>6,90,625</td>
</tr>
</tbody>
</table>

8. “Speeding ahead on the telecom and digital economic highway,” EY, 2015
9. DoT
11. “Towerco consolidation no offset to margin dial-down,” CRISIL, October 2018
12. “Towerco consolidation no offset to margin dial-down,” CRISIL, October 2018
Consumptions patterns have changed radically for the Indian telecom consumers in the past 3-4 years. From a voice dominant market, there has been a clear shift towards data centric usage patterns. The Indian market is expected to witness a 4x increase in mobile data traffic during 2018-24. Multiple factors have contributed to this shift in demand toward data.

One of the key drivers has been the decline in tariffs. In the recent past, data tariffs have come down due to competitive forces, making mobile broadband services affordable especially for residents in rural India. This has led to a much larger scale of adoption of data services.

Figure: Data traffic forecasts

India mobile data traffic- (exabytes per month)

<table>
<thead>
<tr>
<th>Year</th>
<th>2018</th>
<th>2024F</th>
</tr>
</thead>
<tbody>
<tr>
<td>India data traffic per active smartphone (GB per month)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>3</td>
<td>6.8</td>
</tr>
<tr>
<td>2024F</td>
<td>12</td>
<td>15</td>
</tr>
</tbody>
</table>

Source: Ericsson Mobility report

Telecom sector evolution opens new opportunities for towercos

In addition, decline in smartphone prices has played an important role in driving data consumption amongst masses. Smartphone subscriptions is gaining pace and is expected to account for 64.7% of total mobile subscriptions by 2023.

Figure: Decline in data tariffs

India has witnessed steep decline in data tariffs in the past few years

INR269/GB in 2014 to INR19/GB in 2018

Bundled plans with unlimited voice, large data allowances

Source: IDC, GSMA, Nokia, Media articles

In addition, decline in smartphone prices has played an important role in driving data consumption amongst masses. Smartphone subscriptions is gaining pace and is expected to account for 64.7% of total mobile subscriptions by 2023.

13. Analysiis Mason
Operator investments in 4G has been another important factor in driving data adoption. Over the past two years, Indian operators have invested heavily in their 4G networks. India has leapfrogged from 2G to 4G and with this fast-paced transition, the infrastructure requirements have also become more sophisticated. Availability of advanced networks delivering high speed data has also played an important role in data uptake.

Availability of digital content has contributed to the data demand. Content consumption is growing amongst Indian users. Video has become a primary contributor accounting for 65% to 75% of total mobile data traffic. Adoption of video has been majorly driven by increase in availability of vernacular content with 93% of the time spent on videos in Hindi and other regional languages.

Social media apps have been gaining traction. On an average, an Indian consumer spends 200 minutes per day on apps. Of this, 38% of time is being spent on social media and communication.

The growth in data demand, along with the roll out of 4G and impending launch of 5G, has changed the infrastructure requirement for telcos. High speed data services are fueling the need for a denser network along with increase in fiber penetration. In the coming years, telecom infrastructure will comprise of not only macro tower sites, but also small cells, fiber, wi-fi and in building solutions (IBS) solutions.

Further, technology evolution expected with the transition to the next generation will pose new requirements for infrastructure. 5G requires gigabit speeds to be delivered to the consumers; hence, each mobile site (both macro and small cell) will need to backhaul multi-gigabit throughputs to the aggregation network. The launch of 5G mobile networks will significantly affect both the wireless side and the wireline side of network infrastructure. The formidable network performance goals of 5G - for latency reduction (from 50ms to 1ms) and speed from 100 Mbps to 10Gbps - would heavily predicate on the availability of fiber, and a majority of it, to the cell sites.

The bandwidth intensive applications such as IoT/M2M and AR/VR will demand network densification which will entail the deployment of small cells and this will make the network more heterogeneous. These small cells will further require fiberization due to operational complexities of using microwave backhaul.

Source: #Broadband2022 -Unlocking a trillion dollar digital economy, EY; A billion screens of opportunity, EY; Nokia Mbit Index 2019

14. “Reimagining future of M&E in India, EY-FICCI, 2018”
15. “#Broadband2022 - Unlocking a trillion dollar digital economy,” EY, 2018
Business model evolution

Over the years, towercos have gained extensive experience in managing distributed assets. Their current business model has helped them build core assets and strengths that can be further leveraged for revenue gains. The physical assets - site location, tower structures, power backed sites, air-conditioning and fiber - can be cross-leveraged for varied use cases. Further, the towercos have well established relationships with telecom operators, experience in managing long terms MSAs and the know-how of RoW clearances processes. These skills and assets taken together, give towercos a unique value proposition to broaden their portfolio.

As towercos explore higher revenue streams, they can follow a multi-dimensional approach. The infrastructure demands of the sector are evolving and towercos can leverage their expertise to explore adjacent opportunities that fit in with their core competency. Business streams such as fiber, small cells, Wi-Fi, smart cities, IoT and data centers are some of such opportunities. Additionally, they can explore utilizing their physical assets and skills for generating new revenue streams. This would majorly entail colocation of other infrastructure on their sites and extending their service expertise to other sectors.

Changing industry priorities opening up opportunities for new business models

- Conversion of capex to opex based business model
- Necessity to sweat assets more efficiently using the shared model
- Evolution in technology with 5G and IoT
- Increase in data usage and the advent of AI, analytics, AR/VR
- Low latency demand for new infra requiring infrastructure upgrades
- Rising need for faster data processing near the location where data is being generated
- Need for efficient energy business models

Towercos across the globe are already exploring ways to evolve their businesses by tapping on the adjacencies by diversifying asset class and migrating into new services. The most common asset class diversification has been fiber and small cell rollout.
An Indonesia based towerco strengthening its value proposition in adjacent business segments

The towerco has diversified beyond traditional tower business to build comprehensive portfolio comprising of fiber, DAS and microcells solutions

- ~5,000-6000 towers
- ~3000 km fiber optic network
- ~40 indoor DAS sites with ~50 tenants
- ~500-550 microcell poles

Indonesia based towerco's portfolio

As of November 2018

Growth pillars of towerco

<table>
<thead>
<tr>
<th>Continued co-location on existing portfolio</th>
<th>Prudent build-to-suit roll out</th>
<th>Monetization of fiber assets</th>
<th>Expansion into new segments</th>
</tr>
</thead>
</table>

Key strategic developments

1. In 2012, entered into fiber market with acquisition of a Indonesia based fiber optic network provider
2. Completed pilot project of fiberization of ~3,300 homes in 2017
3. Signed partnership with a leading global technology services company to provide cloud and data center services to enterprises in Indonesia

Increasing revenue contribution from non-conventional tower business (microcell poles+fiber)

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>9M18</th>
</tr>
</thead>
<tbody>
<tr>
<td>6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Towerxchange, company investor presentation
The demand arising from the impending data growth and telco ambitions around 5G roll-outs have significantly increased the need for telecom infrastructure, especially fiber. The global fiber optics market was valued at around US$2.75 billion in 2016 and is expected to reach approximately US$3.72 billion in 2022, growing at a CAGR of slightly above 5.2% between 2017 and 2022.

Figure: Global growth in fiber consumption vis-à-vis IP traffic growth

Also, with the bandwidth requirements of the high definition content and data heavy applications, the need for fiber will increase exponentially.

Fiber connectivity is key to create a high-performing, dense urban network able to sustain the level of data growth experienced in India. In comparison to copper cables, fiber delivers much higher bandwidth, which has become extremely vital for supporting burgeoning data traffic.

Globally, it has been witnessed that fiber requirements grow exponentially as we move from one generation to the next. For instance, in moving from 3G to 4G and FTTH, fiber deployment increased by almost 4.5x\(^1\). Another surge in demand is expected with the launch of 5G services\(^2\).

**Towercos are well positioned for the fiber opportunity**

High speed data networks (such as 4G/5G) demand fiberized sites for backhaul. For operators to remain competitive, it is essential that backhaul is efficiently managed. Fiberization of towers had already been initiated during 4G deployment phase and 5G would necessitate 100% tower fiberization. If tower companies want to unlock new revenues from fiber, their ability to acquire or lay fiber will be crucial. Government programs such as BharatNet and Smart Cities are also adding to the demand for fiber deployment. Robust inter-city and intra-city fiber networks have already been deployed in India and would continue to add to the demand due to replacement cycles and densification of network.

Given that operators have disparate plans, for enterprise, indoor, fiber to the tower and for FTTH/B, a centralized approach from an independent towerco will be more suitable from a deployment standpoint. Further, as telcos continue to function in a highly competitive environment, fiber assets hive-offs are being considered as a potent route to go asset light.

Hiving-off the telco’s fiber assets into separate units - on similar lines as tower hive-offs - will make it easier for the telco to use the assets more efficiently and even monetize them in the future. Such a move would make the operating company asset light, increase its ability to leverage and open the units to monetization.

Currently, the leading Indian telcos have already made announcements of fiber unit hive-offs, and others may follow suit. This will open an opportunity for towercos to consider acquiring these assets from telcos. As telcos start to consolidate core assets and offerings, tower owned and managed fiber assets for leasing can emerge as a potent model. Additionally, towercos can explore provision of centralized fiber O&M for the laid networks.

The strong business case for towercos in the fiber space is visible from some of the global moves by tower infrastructure providers. Towercos stand to tap a significant revenue stream from deploying fiber-fed small cells. For instance, tower companies in the US and Indonesia have already started offering both fiber and small cells to telecom service providers.
Case study

A US based towerCo is repositioning itself as a fiber company and has made strategic acquisitions to strengthen its fiber assets.

**Current tower assets of the towerco**
The towerco owns, operates and leases more than 40,000 cell towers in every major U.S. market.

**New focus area – fiber**
The towerco is repositioning itself as a fiber provider (focused on the small cell opportunity).

**Strategy behind the acquisitions**
Fiber acquisitions serve two main business lines: small cells and other enterprise and adjacent wholesale opportunities.

**Breakdown of towerCo’s site rental revenues (as of December 2018)**
- Fiber: 33.9%
- Tower: 66.1%

**Note:** Fiber includes both fiber and small cell solutions

**Following its acquisitions, the towerco has emerged as one of the larger fiber U.S. network operators.**

**Strategy behind the acquisitions**
Over the period of last two years, the towerCo has purchased eight fiber operators. It has rights to approximately 60,000 route miles of fiber, with a presence in 21 of the top 25 metro markets of the US.

**Figure:** India lags behind global peers in terms of tower fiberization

**Figure:** Demand drivers for fiber growth in India

**Aims to increase fiberization curve in India to 60% by FY22**

**Source:** Media articles, analyst report

**Source:** EY analysis

**Breakdown of towerCo’s site rental revenues**

- Fiber: 33.9%
- Tower: 66.1%

**Note:** Fiber includes both fiber and small cell solutions

**Strategy behind the acquisitions**
Over the period of last two years, the towerCo has purchased eight fiber operators. It has rights to approximately 60,000 route miles of fiber, with a presence in 21 of the top 25 metro markets of the US.

**Additional information:**
- The towerco earns more than 40,000 cell tower in every major U.S. market.
- The towerco is repositioning itself as a fiber provider (focused on the small cell opportunity).

**Figure:** Demand drivers for fiber growth in India

**Aims to increase fiberization curve in India to 60% by FY22**

**Source:** Media articles, analyst report

**Source:** EY analysis

**Breakdown of towerCo’s site rental revenues**

- Fiber: 33.9%
- Tower: 66.1%

**Note:** Fiber includes both fiber and small cell solutions

**Strategy behind the acquisitions**
Over the period of last two years, the towerCo has purchased eight fiber operators. It has rights to approximately 60,000 route miles of fiber, with a presence in 21 of the top 25 metro markets of the US.

**Additional information:**
- The towerco earns more than 40,000 cell tower in every major U.S. market.
- The towerco is repositioning itself as a fiber provider (focused on the small cell opportunity).

**Figure:** Demand drivers for fiber growth in India

**Aims to increase fiberization curve in India to 60% by FY22**

**Source:** Media articles, analyst report

**Source:** EY analysis

**Breakdown of towerCo’s site rental revenues**

- Fiber: 33.9%
- Tower: 66.1%

**Note:** Fiber includes both fiber and small cell solutions

**Strategy behind the acquisitions**
Over the period of last two years, the towerCo has purchased eight fiber operators. It has rights to approximately 60,000 route miles of fiber, with a presence in 21 of the top 25 metro markets of the US.

**Additional information:**
- The towerco earns more than 40,000 cell tower in every major U.S. market.
- The towerco is repositioning itself as a fiber provider (focused on the small cell opportunity).

**Figure:** Demand drivers for fiber growth in India
Tower fiberization is expected to witness a steady growth in the future. Especially with India’s 5G launch anticipated in 2023, fiberization rates are expected to surge from 2021 onwards.

Figure: India tower fiberization forecast

<table>
<thead>
<tr>
<th>Year</th>
<th>% of tower fiberized</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>20%</td>
</tr>
<tr>
<td>2018</td>
<td>25.0%</td>
</tr>
<tr>
<td>2019f</td>
<td>33.7%</td>
</tr>
<tr>
<td>2020f</td>
<td>42.4%</td>
</tr>
<tr>
<td>2021f</td>
<td>51.0%</td>
</tr>
<tr>
<td>2022f</td>
<td>59.7%</td>
</tr>
<tr>
<td>2023f</td>
<td>68.4%</td>
</tr>
</tbody>
</table>

Source: EY analysis

Note: Fibre demand is estimated based number of towers to be fiberized and incremental fibre required to fiberize a tower

### Microwave backhaul provision by towercos

- Microwave antenna - used for point-to-point connections as an alternative to a fiber backhaul link are currently owned and provided by the tenant operator
  - Microwave transmission involves large antennas, often requiring a specific location in terms of height and direction
  - With heavy microwave antennas, having one set of microwave dishes rather than four could free significant Exposed

Towercos can offer shared transmission to existing tenants as part of the initial deal - acquiring transmission assets as well for leaseback, with a view to upgrade or replace those assets to support multiple tenants

The mode of transmission - fiber or microwave would be decided by towerco

Such a model is subject to regulatory approvals

### B. Government led fiber programs

**BharatNet for facilitating fiber roll-outs**

For deeper digital penetration in rural areas, the government took the BharatNet initiative to link each of the 250,000 Gram Panchayats (GPs) of India through optical fiber network. The project initially was structured around laying incremental underground fiber to link the GPs.

The BharatNet project evolved with the launch of Digital India in 2015. Progressing from laying down of optical fiber, to creating the seamless connectivity backbone, the erstwhile National Optical Fiber Network (NOFN) was renamed as BharatNet in 2016. A modified approach for Bharat Broadband Network Limited (BBNL) was approved by Cabinet in July 2017.

In the modified strategy, the most important aspect is the involvement of states along with Central Public Sector Undertakings (CPSUs) and private sector in implementation of the project. Further, special emphasis has been laid on provision of services. The Cabinet has also approved last mile connectivity model for the GPs.

**Erstwhile: NOFN**

1. Initiative to trigger broadband revolution by providing connectivity till GP level
2. 250,000 GPs were intended to be covered in NOFN
3. 220,000 km of duct was to be laid down to provide last mile connectivity
4. At least 100 Mbps of bandwidth was committed to be provided at GP
5. Committed timeline of two years to lay down the fiber till GP level
6. INR 200 billion was estimated to be the total project outlay

**Now: BharatNet**

BharatNet is a project of national importance, with a highly scalable network infrastructure to provide on demand, affordable broadband connectivity of 2 Mbps to 20 Mbps for all households and on demand capacity to all institutions, to realise the vision of Digital India, in partnership with States and the private sector.

1. Initiative to provide on demand and affordable connectivity to all households and institutions
2. 250,000 GPs are intended to be covered under BharatNet
3. On demand connectivity of 2 Mbps to 20 Mbps for all households
4. INR 785.1 billion is estimated to be the total project outlay
5. Four implementation models: state led, center led, private led, PPP led

**Phase I of BharatNet**

- Connect 100,000 GPs from BHQ via OFC
- Service opened in 59,124 GPs
- The implementation of the project was only through three CPSUs namely, BSNL, RailTel and PGCIL
- Connectivity to GPs was only by laying underground OFC

**Phase II of highlights**

- Connect 150,000 GPs using optical mix of underground/ aerial OFC, radio and satellite
- Cabinet approved last mile connectivity model for GP.
- Connectivity through Wi-Fi, and the operation and maintenance (O&M) of the entire 250,000 GPs
- Implementation through states, private sector besides CPSUs as in Phase-I

**Phase III of BharatNet**

- Building redundancy of network
- Futuristic network with ring topology to be used between districts and blocks, and blocks and GPs
- Targeted to be completed by 2023

State led BharatNet initiatives

As a part of phase II, eight states - Chhattisgarh, Gujarat, Jharkhand, Andhra Pradesh, Maharashtra, Tamil Nadu, Odisha and Telangana - are implementing BharatNet project under state-led model and MoUs have been signed with the states.

Figure: Best practices from state led fibre programs

Underutilization of extensive fiber infrastructure laid under BharatNet program emerging as a key concern

BharatNet is facing challenges regarding efficient utilization of the infrastructure. It is imperative for all the state-level bodies to come together and run an on-ground awareness programme at panchayat level to enlighten people regarding usage and maintenance of the infrastructure.

In addition, public-private partnership needs to be encouraged to bolster communications infrastructure across the country. The terms of use needs to be streamlined and cost structure should be made rational so that private players find it favourable to lease bandwidth of BharatNet infrastructure to provide broadband services. This is imperative to ensure effective utilization of the laid fiber.

Source: Media articles

National digital communications policy (NDCP) 2018 - emphasis on fiber infrastructure

NDCP 2018 has laid significant emphasis on fiber deployment in the country suggesting multiple improvement initiatives to boost fiber connectivity in India. Viewing fiber as the backbone of high speed connectivity, the government has taken important initiatives.

Implementing a “Fiber First Initiative”

- Accord telecom optic fiber cables the status of public utility
- Promoting collaboration models involving state, local bodies and private sector for provision of shared duct infrastructure
- Facilitating fiber-to-the-tower program to enable fiberization of at least 60% base stations
- Leverage existing assets of the broadcasting and power sector to improve connectivity, affordability and sustainability
- incentivizing and promoting fiber connectivity for all new developmental construction
- Making requirement for telecom installations and the associated cabling and in-building solutions mandatory in all commercial, residential and office spaces by amending National Building Code of India (NBC), through Bureau of Indian Standards (BIS)

Establishment of a National Digital Grid

- Create a National Fiber Authority
- Establishing Common Service Ducts and utility corridors in all new city and highway road projects and related elements
- Creating a collaborative institutional mechanism between center, states and local bodies for common RoW, standardization of costs and timelines and removal of barriers to approvals
- Facilitating development of open access next generation networks

Source: Media articles

21. National Digital Communications Policy - 2018
### C. Fiber demand from FTT/B segment in India

The fiber optic industry currently in India is characterized by significant capacity on trunk and national long distance (NLD) routes, but there is very little capacity in the access routes. Fiber-to-the-home/building (FTT/B), forms a minuscule proportion of an already limited fixed broadband access user base. FTT/B penetrations rates in India remain exceptionally low.

However, operators are chalking out huge expansion plans for FTT/B roll out across the country. The cumulative capex investments in the country are expected to grow by a six-year CAGR of 32.5% to reach US$10.3bn in 2023 from US$1.9bn in 2017.

**Figure: Comparison of cumulative FTTx capex investments and expected CAGR of FTTx capex during 2017-2023**

### D. Data center related fiber growth

Data center build-outs continue to grow, driven by the increase in bandwidth demands and changes in network architectures. As a result, time-to-market needs for the data center production environment continue to compress. Data rates of 10 Gb/s and higher are now common place in the modern data centers, easily exceeding the capability of electrical interconnects on copper cabling.

With the longer reach and reduced electromagnetic interference, fiber optic adoption is increasing for data centers. India’s data center market is growing at a rapid rate and is expected to further feed the demand for fiber. Carriers can now offer multi-gigabit speeds to any location served by fiber. More than 90% of Fortune 1,000 data centers use fiber channel as the de facto standard for storage networking.

### E. Fiber demand from common infrastructure

Inter-city fiber and intra-city fiber is the most mature fiber network in India. Telcos have laid down this fiber and all major operators are sharing their fiber infrastructure. Operators typically share fiber for redundancy purposes or to offer services in difficult terrain.

BharatNet also includes building up of the common fiber infrastructure, and phase three of the program envisages building in redundancies as well in the fiber network, to make it more robust.

**India fiber demand forecast**

Backed by the mentioned growth drivers, fiber demand in India is increasing at a rapid pace and represents a strong opportunity for towercos. The overall fiber deployment in the country is expected to increase at a CAGR of 13.6%, from 1.5 million cable kilometers in 2018, to 2.8 million cable kilometers in 2023.

Wireless, FTTx and common infrastructure would be the major contributors to fiber demand. The fiber growth is expected to go up 2020 onward, with expected launch of 5G in 2023.

**Figure: Optical fiber cable deployment (’000 cable km)**

**Summary of demand drivers**

- **Common Infra**
  - BharatNet
  - Government projects like ASCON and NFPS
  - Incremental fiber to support smart city
  - Commercial + public (data usage by organizations; residential MDUs + SDUs (demand for home broadband))
  - Fiber required for increasing data centre racks
  - Growth and replacement of intercity fiber
  - Growth and replacement intra-city fiber

- **Data Centers**
  - Data Center
  - Fiber required for inter-data center

- **FTTx**
  - FTT/B
  - Fiber required for SDUs (demand for home broadband)

- **Wireless**
  - Tower fiberization
  - Small cells fiberization

**Source:** Analysys Mason

---

22. Analysys Mason


Neutral host FTtx: Potential opportunity for towercos

Towercos can consider becoming a neutral host for fiber deployment - enabling them to play a larger role in the value chain. While the current regulatory regime does not allow this provision for towercos, future policy reform may open up this potential opportunity.

Neutral host FTTx: Potential opportunity for towercos

Towercos can consider becoming a neutral host for fiber deployment - enabling them to play a larger role in the value chain. While the current regulatory regime does not allow this provision for towercos, future policy reform may open up this potential opportunity.

Advantages of neutral host model

1. **Increased take up rates**
   - Customer has multiple service provider options, leading to increased uptake
   - Multiple service providers (including neutral host provider) are involved in promotional activities, leading to increased awareness and adoption

2. **Infrastructure sharing**
   - Reduction in overall CAPEX per service provider

3. **Specific expertise can be leveraged by Service providers**
   - Specific expertise (understanding of FTTx technology, local market understanding enabling building access) can be leveraged for faster time to market

FTTx neutral-host model: Services and payment flow

End user → Service provider (telecom operators, ISP, MSO)

Service and content feed to neutral host → Neutral-host infrastructure provider

- Annual maintenance charges for infrastructure
- One time refundable security deposit for ONT
- One time provisioning charges
- Monthly fixed charges per home served
- Monthly variable charges (% of ARPU)

Service and content feed to neutral host → OSP Ring → Distribution point → Street cabinet

Service and content delivered over neutral host infrastructure → End user

Payment for service delivery: Broadband, IPTV, Voice, VoD

Issues and challenges:
Non-uniformity in RoW policy continues to impede telecom infrastructure roll out

Establishment of the telecoms infrastructure in India is accompanied by challenges of RoW, that largely stem from fragmented and non-uniform policies adopted by various states and local bodies.

The Gazette Notification on RoW issued by government in 2016, is an effort to expedite the deployment of underground (fiber cables) and over-ground (telecom towers) infrastructure. In May 2018, DoT brought infrastructure providers in category-1 (IP-1) under the ambit of RoW rules. However, these new rules are yet to bring benefits to the Indian telecoms infrastructure sector due to lack of clarity and implementation delays.

Revised RoW rules

- Simplify the grant of RoW permissions by making it transparent and time bound process
- Developing an electronic application portal within one year of roll out of the rules
- Single window clearance for application
- Designation of nodal officers for appropriate authorities
- Rationalisation of administrative expenses across the country (to a maximum of INR1,000 per km for fiber and a maximum of INR10,000 per application for overhead towers)
- Fast-tracking decision on RoW permits to within 60 days after application

Category | Challenges | Key recommendations
--- | --- | ---
RoW: permissions while laying telecom infrastructure | Policies of the state governments are not aligned with the central guidelines, resulting in delays in roll-outs | Need to create collaborative institutional mechanism between centre, state and local bodies for common RoW mechanism as envisaged in NDCP 2018
| Lack of defined processes, permissions and approvals during the awarding and execution stage of project impacts timelines | Single window clearance by leveraging digital to bring transparency
| RoW process requires permissions from varied authorities including electricity, gas, sewage, Railways, NHAI, forest authority causing delays and cost inefficiencies | Set up a central or state level agencies or a task force to oversee the implementation of RoW rules
| RoW process requires multiple NOCs and documentation | Seek a status update on the state tower policies from states
| States have imposed varying restrictions on installation of towers near hospitals, airports, defence establishments, etc. | Consult concerned departments (e.g. urban development/IT), advise state representatives to follow DoT guidelines for formulation of respective tower installation policies
| Sealing of towers and disconnection of electricity at tower sites | Establish common permissions processes for all utility purposes - water, electricity, gas pipes and fiber
| Delays in provision of Standing Advisory Committee on Radio Frequency Allocation (SACFA) clearances to tower companies and mobile operators | Incentivize utilities infrastructure like power, water, gas to include ducts and optical fiber networks as part of the new infrastructure
| | Process on priority all pending SACFA applications

Source: Media articles, NDCP 2018, TRAI consultation paper responses, primary research and EY analysis
### Category: Challenges

- **Execution:**
  - Inefficient and uncoordinated digging and maintenance impacts roll out time and life span of fiber
  - Adhere to Geographic Information System (GIS) systems and “call before you dig” and “dig once” policies.
  - In line with NDCP 2018, establish common service ducts and utility corridors in all new city and highway road projects, and related elements
  - Ensure that utility corridors and duct dimensions accommodates high count optic fiber
  - Optimise execution via collaboration with upcoming utility and infrastructure projects
  - Define custodian of the utilities map within the nodal agency for ROW

- **Payment/Charges:**
  - RoW charging mechanisms vary across cities/states/municipalities
  - Current RoW process includes multiple levies and high administrative charges
  - A single window for payment clearance with defined timelines to be provided
  - Ensure standardization of rates for the RoW as envisaged in NDCP 2018
  - The government to consider adopting issuance of “letter of credit”

- **Activation and deployment of telecom infrastructure Approvals:**
  - Multiple government personnel currently tasked to approve the same sections of deployment
  - Significant number of human touch points -leading inefficiencies in time, cost and resource
  - Reduction of approvals by empowering government officials to represent various departments
  - An efficient utilization of technology for surveillance and documentation
  - Self-certification to optimize time, resource and cost, Push for audit and high penalty
  - Automate workflow for interdepartmental approvals and partner portal using ERP systems
  - Focus on operating from standards and strong SLAs
  - A transparent vendor selection criteria to be followed

### Key Recommendations

- Adhere to Geographic Information System (GIS) systems and “call before you dig” and “dig once” policies.
- In line with NDCP 2018, establish common service ducts and utility corridors in all new city and highway road projects, and related elements.
- Ensure that utility corridors and duct dimensions accommodate high count optic fiber.
- Optimise execution via collaboration with upcoming utility and infrastructure projects.
- Define the custodian of the utilities map within the nodal agency for ROW.
- A single window for payment clearance with defined timelines to be provided.
- Ensure standardization of rates for the RoW, as envisaged in NDCP 2018.
- The government to consider adopting issuance of “letter of credit”.
- Reduction of approvals by empowering government officials to represent various departments.
- An efficient utilization of technology for surveillance and documentation.
- Self-certification to optimize time, resource and cost. Push for audit and high penalty.
- Automate workflow for interdepartmental approvals and partner portal using ERP systems.
- Focus on operating from standards and strong SLAs.
- A transparent vendor selection criteria to be followed.

Source: Media articles, NDCP 2018, TRAI consultation paper responses, primary research and EY analysis.

---

### Status of alignment of state policies with RoW rules 2016 (progress in states)

<table>
<thead>
<tr>
<th>Policies notified and aligned</th>
<th>Existing policies under discussion</th>
<th>No uniform policies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S.no.</strong></td>
<td><strong>State</strong></td>
<td><strong>Notified date/ Cabinet Approved</strong></td>
</tr>
<tr>
<td>1</td>
<td>Jharkhand</td>
<td>4 December 2015</td>
</tr>
<tr>
<td>2</td>
<td>Rajasthan</td>
<td>6 February 2017</td>
</tr>
<tr>
<td>3</td>
<td>Tripura</td>
<td>6 September 2017</td>
</tr>
<tr>
<td>4</td>
<td>Odisha</td>
<td>14 September 2017</td>
</tr>
<tr>
<td>5</td>
<td>Haryana</td>
<td>6 October 2017</td>
</tr>
<tr>
<td>6</td>
<td>Assam</td>
<td>16 February 2017</td>
</tr>
<tr>
<td>7</td>
<td>Maharashtra</td>
<td>17 February 2018</td>
</tr>
<tr>
<td>8</td>
<td>Tamil Nadu</td>
<td>18 February 2018</td>
</tr>
<tr>
<td>9</td>
<td>Arunachal Pradesh</td>
<td>10 May 2018</td>
</tr>
<tr>
<td>10</td>
<td>Uttarakhand</td>
<td>15 June 2018</td>
</tr>
<tr>
<td>11</td>
<td>Uttarakhand</td>
<td>13 September 2018</td>
</tr>
<tr>
<td>12</td>
<td>Meghalaya</td>
<td><strong>GO only (detail policy is under discussion)</strong></td>
</tr>
<tr>
<td>13</td>
<td>Tamil Nadu</td>
<td><em>Government Order</em></td>
</tr>
<tr>
<td>14</td>
<td>Bihar</td>
<td></td>
</tr>
</tbody>
</table>

*GO only (detail policy is under discussion)  
**Aligned with RoW policy 2016 (except the fees and other charges)  
***Cabinet approved on 10 December 2018, policy will be effective from 15 January 2019

Source: Voice & Data
Case study

Best practices on ROW access from across the globe

**Single window clearance**

In Greece, the EETT (Hellenic Telecommunications and Post Commission) assumes the role of a one-stop licensing body, whereby applications are filed electronically and subsequently forwarded to the various competent authorities and agencies for concurrent issuance of the relative authorizations or approvals.

The final approval is then issued by the EETT. The competent authorities are required to respond back to the EETT through the e-portal within four months.

**Concept of shot clock**

In the US, under “shot clock” rules employed by the FCC, there is a deadline of 90 days for local government bodies to process applications for co-located facilities, and deadline of 150 days for new tower construction.

If timelines are not met by the local governments, the siting proponents have a prima facie argument that the local authority is in violation of the US Communications Act.

**‘Call before you dig’ policy**

In the US, both federal and state laws require excavators to notify the respective utility companies before undertaking any operation involving digging, trenching, demolishing, boring, or any other earth-moving operation. The FCC has designated 811 as the national toll-free number for all local ‘Call Before You Dig’ phone centers throughout the US. Other country examples include Australia, Singapore, the UK and Canada.

Gujarat Gas Limited, India’s gas distribution company, follows this approach to avoid any damages to their natural gas pipelines.

**‘Dig Once’ approach**

The objective of Dig Once approach globally is to have all major infrastructure programs install an underground fiber link when building or renovating roads, railways, pipelines, utility infrastructure and energy distribution channels. When fiber installation is coordinated with a road or utility project in urban environments, there are 20% cost savings.

**Free RoW access saving deployment time and cost**

Austria provides for free RoW access without an authorisation on public property and in relation to private property, free ROW under conditions of inter alia existing line expansion or existing line unable to jointly use.

Germany allows operators of public telecom networks to use thoroughfares free of charge and requires timely update of the infrastructure database.

In the Netherlands, municipality must provide operators free access to their infrastructure and promote sharing and coordinate upcoming civil works to minimize civil disruption.

Network transformation with next generation technologies: Hetnets

The telecom networks are advancing towards hetnets - layered and denser networks - to support the data surge. Globally, mobile data traffic is expected to increase five-fold between 2018 and 2024. With the increase in data traffic, telcos are supplementing their macro networks with small cells.

Small cells are low-powered wireless access points that can be deployed indoors or outdoors to improve coverage and add targeted capacity. The advantages of small cell deployment include closing coverage gaps at low cost, better customer experience, low subscriber churn and suitability to urban use as they can be attached to street furniture. Telecom operators have already started deploying small cells with the rollout of 4G services in dense urban areas.

Going forward, small cell deployment will increase exponentially, as they would form a critical component of the 5G network. The transition to 5G unlocks a gamut of new uses cases in critical application areas, such as remote surgery in healthcare, autonomous vehicles in transportation and remote control of heavy machinery in manufacturing. These use cases would require high throughput and an ultra-reliable low-latency network, which stipulates the need for heterogeneous networks comprising of both macro cells and small cells.

Traditionally, mobile networks have been based on spectrum bands ranging from 700MHz to 2.6GHz with certain regional differences. However, for 5G services higher spectrum bands have been proposed globally comprising of cm-Wave and mm-wave spectrum, which have significant variation in the maximum cell radii. The very low maximum cell radii for proposed 5G spectrum bands underpins the need for densification of network with large number of small cells.

**Figure: Small cell varies on the basis of environment and capacity/coverage requirements**

Source: Qorvo, EY analysis

25. Ericsson Mobility report, June 2018
Next-gen infraco - Unlocking new business opportunities

48

leasing a tower. The small cell revenue is expected to be mix of rental, service and management fees.

Towercos’ know-how in securing contracts with municipalities for small cell sites will enable them to strengthen their value proposition. They can aggregate sites in the municipalities which can be leased further to telecom players for 5G densification.

Opportunity for towercos to play central role in small cell deployment

Globally, telecom operators have been facing challenges in deployment of small cell roll out due to strict permission requirements, high site acquisition and backhaul cost and a lack of internal capacity to coordinate the rollout at several sites. This opens up an opportunity for towercos to develop a value proposition for telcos to deploy small cells that offers faster time to market and cost efficiency.

Telecom operators can smoothen the process and ease off the burden by collaborating with towercos for small cells. To capitalize on this opportunity, towercos should focus on developing operational capabilities to provide service level agreements for small cell deployments at competitive costs. Before entering a small cells segment, towercos need to understand the network economics of the small cells as it is a volume rather than a value business. The business may generate a fraction of the revenue generated by a leasing a tower. The small cell revenue is expected to be mix of rental, service and management fees.

Towercos’ know-how in securing contracts with municipalities for small cell sites will enable them to strengthen their value proposition. They can aggregate sites in the municipalities which can be leased further to telecom players for 5G densification.

Figure: Propagation of different 5G spectrum bands

<table>
<thead>
<tr>
<th>Potential 5G spectrum bands</th>
<th>Maximum cell radii</th>
</tr>
</thead>
<tbody>
<tr>
<td>700MHz-2.6GHz</td>
<td>Tens of kilometer</td>
</tr>
<tr>
<td>3.5/5GHz</td>
<td>Approximately 1 kilometer</td>
</tr>
<tr>
<td>24.5-27.5GHz/31GHz (cm-Wave)</td>
<td>Hundreds of meters</td>
</tr>
<tr>
<td>70-80GHz(mm-Wave)</td>
<td>Tens of meters</td>
</tr>
</tbody>
</table>

Figure: Small cell business models

Small cell fiberization to fortify position of towercos

In most instances, small cells would require fiber, as microwave backhaul would limit the performance. Towercos can explore provision of fiberized small cells as it would position them as an integrated player. In accordance with time to market consideration, towercos can either deploy their own fiber backhaul or partner/acquire independent fiber companies to provide small cell fiberization.

Providing fiber backhaul for small cells will reinforce the investments by towercos in this space as 5G will require high bandwidth for fronthaul as well backhaul links. This would also increase revenue share for towercos in the small cell rental market significantly as they will have considerable pricing power. It is a viable proposition as provision of site and backhaul together enables cost sharing among multiple operators and these cost savings can be further passed on to the telecom operators.
Case study

US based towerco aggressively expanding into small cell deployment and provisioning of fibre backhaul solution

The towerco positions itself as an end-to-end solution provider, involved in supplying sites, small cell equipment and fiber backhaul.

| 40,000+ towers | 65,000+ small cells supported by | 65,000+ route kilometer fiber |

The towerco is focusing on accelerating its efforts to expand its small cell business.

Aggressively scaling up small cell business
Pipeline of small cell nodes for 2019-2020 stands at 35,000, up 40% y-o-y
Emphasis on multi-tenancy
30% of small cell sites have more than one tenant

Small cell business significantly contributing to overall revenue

Of the US$280m organic contribution to site rental revenues expected in FY19, towerco management expects ~5% growth from towers, ~20% growth from small cells and ~5% growth in fiber solutions.

China based towerco is strengthening its position in small cell segment to play a pivotal role in densification of network

In 2017, China based towerco set up its small cell business unit to support telecom operators to densify their networks. It provides site space, including towers, poles and other infrastructure resources to telecom operators and hosts their small-cell equipment.

China based towerco has ventured into different business lines:
- Macro cell on ground and roof tops
- DAS in building, large areas and venues
- Small cell in cities
- Other services including Trans-sector site application and information business (TSSAI) – hosts different types of devices on sites

Comparing 2017 operational revenue of China based towerco from different business lines (RMB millions):

- Macro Towers: 66,828
- DAS: 1,284
- Small Cell: 257
- TSSAI: 169

Small cell business contributes 0.37% of overall China based towerco's turnovers in 2017.

Source: Towersxchange, China Galaxy International
Small cell deployment proliferating in India

Currently, small cell deployments in India are majorly led by 4G densification to cater to increasing demand of data. From 2023 onwards, the rollout 5G services is expected to commence which would contribute to large number of small cell deployments to support increasing bandwidth requirement for new use cases.

Outdoor small cell deployments in India expected to reach 250,000 by 2023

Source: EY analysis

Issues and challenges:
Cost and RoW issues hampering proliferation of small cells

Small cell deployment requires approval for site acquisition, negotiation of fees with municipal corporations or other government bodies and availability of suitable backhaul and power at site. It should be noted that business economics of installing small cells varies from that of a macro tower, since a number of small cells are required to provide the same coverage as by a macro tower. The deployment of a macro tower goes through a planned process to choose a site location that has suitable power and backhaul. The small cells would typically leverage urban infrastructure where it would be challenging to ensure availability of power and backhaul to large number of small cells in a cost-effective manner. The requirement for multiple approvals increases the time to roll out small cell sites.

Additionally, the current regulations do not allow deployment of small cells using existing street furniture due to restrictions imposed by local bodies on the Discoms as they are not allowed to realise commercial revenue using existing public infrastructure.

For faster deployment, the approval process for small cells needs to be streamlined as well as standardized at the city, state and national levels to reduce time and cost to activate a small cell. Simplified rules are required to allow access to the existing street furniture and other sites to install small cell equipment.

Case study: Best practices on small cell deployment

In the US, time and cost have emerged as key concerns for small cell roll-out. As per telecom carriers it takes almost 18 to 24 months to deploy small cells, of which majority of the time (~18 months) goes in obtaining permits for installation of the equipment. Citing these issues faced by the telecom carriers, recently FCC has come up with new regulations to create an enabling environment to speed up small cell deployment.

Key steps:
- **Shortening time of approvals**: Local government required to process approval for installation of small cells on existing structures within 60 days and for installation on new pole buildouts within 90 days
- **Capping of fees**: Local governments can charge non-recurring fee of US$500 for an initial application fee covering up to five small cells with the application of each additional small cell thereafter to cost US$100; non-recurring fees for new infrastructure is capped at US$1,000. Recurring fees, including RoW access fees, are capped at US$270 per small cell per year. The local bodies can levy higher fees, given they demonstrate that the fees are a reasonable approximation of costs incurred.

In-building solutions gaining prominence

The burgeoning data traffic has made it imperative to lay necessary infrastructure to increase capacity of the networks. In the light of the fact that 80% of data traffic originates or terminates inside the building, in-building solutions (IBS) are gaining traction.

IBS provides indoor coverage using a series of hubs/equipment which distribute the signal to several antennas. It facilitates better quality of services, enhanced coverage, efficient usage of spectrum and reduces the load on macro sites. The introduction of 5G services and proliferation of IoT services is further expected to increase the demand for IBS.

Favourable operating environment facilitating IBS

In October 2017, the Telecom Commission approved sharing of in-building infrastructure among telecom operators.

NDCP 2018 aims to amend National Building Code of India to mandate telecom installation and IBS in commercial, residential and office spaces.

Source: Media articles, NDCP 2018

Towercos are well suited to play pivotal role in IBS. They can enter into a contract with building owners to get access to the location and build neutral host IBS infrastructure which can cater to multiple operators. Subject to regulations, IP-1 players can deploy neutral host IBS infrastructure.
**The Wi-Fi opportunity**

The proliferation of public Wi-Fi hotspots continues to be a missing link in India’s communication infrastructure. A robust public Wi-Fi network would provide significant boost to the government’s flagship programs of Digital India and Smart Cities; as the success of these programs predicated on ubiquitous connectivity, digital inclusion and affordable infrastructure.

The government’s aim of making internet connectivity available to the masses, will need support from Wi-Fi deployments. Moreover, at high-traffic venues like airports, stadiums, universities, and transit hubs, etc. the demand for mobile data far exceeds the capacity of cellular networks. Data-hungry consumers and bandwidth-hungry devices can place a burden on wireless networks, causing decreased performance and slow connection speeds due to network congestion. In such scenarios, a public Wi-Fi network is more suitable to meet the demand.

As Wi-Fi network operates on unlicensed spectrum, provision of Wi-Fi services is a relatively faster and cost-effective way to connect the unconnected, in comparison to deploying traditional communication infrastructure. Infrastructure cost stemming from installation of individual infrastructure. Infrastructure sharing model can be extended for Wi-Fi deployment as well, bringing significant opex and capex efficiency for the telecom operators.

Government initiatives to proliferate broadband through public Wi-Fi networks

- A state owned company plans to deploy 100,000 Wi-Fi hotspots across the country; working with a global internet company on the Express Wi-Fi project for proliferation of Wi-Fi services: plans to provide voice over Wi-Fi services through carpet Wi-Fi network.
- Indian Railway owned telecom company deployed Wi-Fi facility at more than 800 stations and caters to 8 million unique users per month; worked with a US-based Internet giant to equip 400 railway stations in India with high-speed internet facility.
- IIT Bombay running Gram Marg rural broadband project to provide broadband connectivity services across 25 villages; developed test beds using TV white space technology and spectrum in unlicensed 5.8GHz band.

**Government’s initiatives in driving proliferation of broadband through Wi-Fi networks**

**Current scenario of Wi-Fi networks in India**

- The proliferation of public Wi-Fi hotspots continues to be a missing link in India’s communication infrastructure. A robust public Wi-Fi network would provide significant boost to the government’s flagship programs of Digital India and Smart Cities; as the success of these programs predicated on ubiquitous connectivity, digital inclusion and affordable infrastructure.

**Lack of monetization models has been one of the key factors hindering the growth of public Wi-Fi in India.**

- As Wi-Fi network operates on unlicensed spectrum, provision of Wi-Fi services is a relatively faster and cost-effective way to connect the unconnected, in comparison to deploying traditional communication infrastructure in remote and rural areas.

**India is still in an early deployment phase in terms of public Wi-Fi services proliferation and adoption, with just about 50,000-60,000 Wi-Fi hotspots.**

**Potential revenue from public Wi-Fi networks**

- Potential revenue streams can be explored to monetize public Wi-Fi

**Multiple revenue streams can be explored to monetize public Wi-Fi**

The towercos can monetize public Wi-Fi by distributing service set identifier (SSIDs) for Wi-Fi access point to multiple stakeholders to leverage the services for various uses cases. The revenue for Wi-Fi can be realised by the stakeholder from multiple streams such as bundled data packs, voucher sale, advertisements on Wi-Fi networks, and provision of local content.

**Towercos as neutral host Wi-Fi providers**

In order to meet the demands for higher quality wireless service in dense traffic venues such as stadiums, shopping malls, and airports, telcos are always looking to improve and expand coverage. For such use cases, a third-party player can provide shared infrastructure that supports multiple operators at the same location, making the business model profitable for venue owners, telco, and the neutral host Wi-Fi provider.

Towercos are well-suited to play the role of a neutral host in Wi-Fi deployments. This would help telcos avoid considerable cost stemming from installation of individual infrastructure. Infrastructure sharing model can be extended for Wi-Fi deployment as well, bringing significant opex and capex efficiency for the telecom operators.

**Table: Potential revenue opportunities from public Wi-Fi networks (as per survey - EY)**

<table>
<thead>
<tr>
<th>Type of location</th>
<th>Potential revenue opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hospital</td>
</tr>
<tr>
<td>MDO/Bundled data packs</td>
<td>Y</td>
</tr>
<tr>
<td>Ad-funded Wi-Fi</td>
<td>Y</td>
</tr>
<tr>
<td>SSDI Others</td>
<td>Y</td>
</tr>
<tr>
<td>Infranet (managed services)</td>
<td>Y</td>
</tr>
<tr>
<td>Location funded Wi-Fi</td>
<td>Y</td>
</tr>
<tr>
<td>RoW benefits and building permissions</td>
<td>Y</td>
</tr>
<tr>
<td>Branding benefits</td>
<td>Y</td>
</tr>
<tr>
<td>Voucher sale</td>
<td>Y</td>
</tr>
<tr>
<td>Local content Sale</td>
<td>Y</td>
</tr>
<tr>
<td>International roaming</td>
<td>Y</td>
</tr>
<tr>
<td>Enterprise clients</td>
<td>Y</td>
</tr>
</tbody>
</table>

**Source:** EY analysis

---


IoT technology is currently at a nascent stage in India, but it is steadily becoming an indispensable part of communication infrastructure. IoT connections in India are expected to grow at a CAGR of 32% over 2017-2023 to ~423 million connections led by advancements in semi-conductor technologies and decline in the cost of sensors. The government’s Make in India initiative has the potential to further bring down hardware costs.

A number of factors are expected to fuel IoT growth in India. Among the key drivers, innovation in product offerings, increasing operational efficiencies and focus on greater customer experience will be critical. In addition, thrust on evolving partner ecosystem, maturing IoT solutions, increase in network coverage and data speeds would also provide impetus.

Build, operate and maintain IoT network

By its very nature, IoT refers to myriad use cases, customer interfaces and technology standards. The network and device performance requirements of IoT use cases such as smart metering and street lighting are quite different from those required for connected car solutions and home automation services. Therefore, a new generation of technologies is emerging that are sensitized to needs of specific IoT services. In this context, low-power wide area networks (LP-WAN) are gaining prominence and have emerged as viable alternative to traditional wireless technologies to cater to IoT applications which require very low bandwidth and low power consumption so that the battery life span of the IoT device can last several years.

While, rolling out LPWA network such as NB-IoT or LTE-M that uses licensed spectrum bands, would require just software/hardware upgradation of existing base stations, deployment of network on other LPWA technologies in unlicensed spectrum bands such as LoRa/Sigfox need building of entire network from scratch. Globally, leading telcos have already started rolling out their LPWA networks in both licensed as well as unlicensed bands at a steady pace.

The towercos can venture into building IoT networks in unlicensed bands by collaborating with IoT technology providers and install LPWA base stations and related hardware on their sites. The telcos can in turn lease coverage from the towercos and use it along with their licensed LPWA technology network to support a wide range of IoT uses cases and scenarios.

Capability enhancement

Developing new capabilities is at the heart of moving up the value chain. Depending on connectivity services alone may limit the revenue pie for the towercos, therefore they can also explore developing capabilities for entering deeper into IoT value chain such as hardware, applications and analytics.

Sensor maintenance and deployment

As part of IoT network, a number of sensors are being deployed to collect and transmit data. The towercos can play an important role is provisioning, maintenance and de-installation of sensors. Sensor maintenance is synergistic with towercos’ capabilities of leveraging the Tower Operations Center (ToC) for real-time remote monitoring and maintenance of distributed assets.

Towercos can explore penetrating into growing IoT market to earn additional revenue by adopting different business models.

Figure: IoT connections in India (million)

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2018F</th>
<th>2019F</th>
<th>2020F</th>
<th>2021F</th>
<th>2022F</th>
<th>2023F</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAGR</td>
<td>32%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: EY analysis

Figure: IoT value chain

- Hardware
  - Modules and objects
  - 25%
- Network
  - Equipment, cloud, OSS/BSS
  - 20%
- Connectivity
  - 5%
- Platforms
  - 15%
- Professional services and applications
  - Solutions, integration, operations and analytics
  - 35%

Source: EY analysis

Types of low-power wide area (LPWA) networks

<table>
<thead>
<tr>
<th>Narrowband-Internet of Things (NB-IoT)</th>
<th>Long-Term Evolution for Machines (LTE-M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on low data rates</td>
<td>Highest bandwidth of any LPWA technology</td>
</tr>
<tr>
<td>Ideal for simpler static sensor applications</td>
<td>Suitable for higher end applications with higher data transmission needs</td>
</tr>
<tr>
<td>Wide coverage</td>
<td></td>
</tr>
<tr>
<td>Faster response time</td>
<td></td>
</tr>
</tbody>
</table>

LoRa
- Perfect for single-building applications
- Longer battery life than other LPWA technologies
- Useful for tracking assets on the move

Sigfox
- Lowest cost radio modules
- Works well for devices that transmit infrequently
- Supports a wide coverage area

Source: Media articles

30. EY analysis

India Smart City Mission - targets and status

India has embarked on an ambitious journey with the Smart City Mission (launched in 2015), that aims to build 100 smart cities in the country. The initiative is being operated as a centrally sponsored scheme (CSS) with a total outlay of ~INR 480 billion over five years, to be funded by GoI32. The implementation of smart city involves the incorporation of a special purpose vehicle at city level, under the companies Act 2013, with both state/UT and urban local body having 50:50 equity shareholding. The tangible results of smart cities mission are expected to be visible by 2021-23.

Smart City objectives

- Managing infrastructure using big data
- Collaboration across agencies using cloud
- Real time response system using mobile
- Enhanced security through efficient emergency response
- Better city planning

Government envisages project completion for selected 100 cities by 2021-23

2015

Smart City mission launched

Smart Cities mission aims to provide a better quality of life, sustainable environment and smart IT solutions to citizens

2016

60 Smart Cities selected

- 20 Smart Cities selected in January 2016
- 13 Smart Cities selected in May 2016

27 Smart Cities selected in September 2016

2017 - 18

40 Smart Cities selected

- 30 Smart Cities selected in June 2017
- 09 Smart Cities selected in January 2018
- 01 Smart City selected in June 2016

Figure: India Smart City Mission - 100 smart cities

Figure: Smart city opportunities for towercos

- Public address system
- LED lighting
- Street video surveillance
- Mobile apps
- Wi-Fi broadband hotspots
- Environment sensors
- EV charging points
- Fiber connectivity

Digital infrastructure backbone for smart cities

Physical/Hardware layer

- ICT infrastructure which can support multiple B2B use cases such as remote surveillance, smart lightning, environment sensors, etc.

Communication layer

- Connectors
- M2M platforms/ device management

Application layer

- Data/Big data storage
- Application platform
- Analytics

Source: EY analysis

The smart city vision will be achieved by marrying ICT infrastructure with existing city infrastructure to drive sustainable development and optimize resource consumption. With digital infrastructure at the core of the smart cities, telecom infrastructure providers can tap on the business opportunity presented by smart cities.

One critical part of smart city projects will be the development of scalable models for smart cities by integrating digital infrastructure with the existing infrastructure including highways, railways and buildings. Towercos already have the experience of managing such infrastructure assets. Venturing into platform development for smart cities would enable the towercos to diversify their revenue streams.

In addition, towercos can enhance their expertise in-house or via partnerships and enter the application layer of smart cities for a larger play.

Building street furniture for smart cities

An important advantage for towercos in smart city projects is getting access to locations for deploying telecom infrastructure. For instance, smart poles form an integral part of smart cities’ street furniture and can be used to host telecom equipment. Towercos participating in smart cities can also convert existing street elements such as street poles, light poles and traffic lights into smart poles.

Apart from mounting telecom infrastructure, the smart pole can also be monetized by hosting equipment for other services such as LED lights, CCTV cameras, Wi-Fi access points, public address system, SoS/emergency call box, billboards, EV charging points and environmental sensors. Based on user adoption, these services can open new revenue streams for towercos.

Another advantage for towercos from smart city participation is priority access to RoW permissions. In most cities, purchasing RoW is expensive and clearance processes are time consuming. Smart city projects would enable towercos to get easy RoW permissions. This would in turn allow them to roll out tower sites and lay fiber with a faster time to market.

The towercos can further extend deployment of smart street furniture across 700+ digital districts32.

Figure: Smart city architecture and role of towercos

Source: Ministry of Housing and Urban Affairs, Media articles

Sensor deployment and maintenance

Smart devices equipped with sensors will be core to smart city solutions such as smart lightning, smart parking, smart energy management and remote surveillance. The towercos can extend their capability of sensor provisioning and O&M for IoT solution deployed as part of smart cities as well.

Figure: Leading Indian towercos have ventured into smart city market with deployment of smart poles

Indian towerco1

Partnered PPP model

Vadodara Municipal Corporation

Deploy 450 smart poles in Vadodara

- Poles to be equipped with smart billboards, CCTV cameras, environmental sensors, provision of public Wi-Fi
- They are connected through fiber
- Enable installation of 4G services by telecom service providers
- Smart services integrated to command and control center to provide real-time monitoring and control

Indian towerco2

Partnered PPP model

Bhopal Smart City Development Corp. Ltd

Deploy 400 smart poles in Bhopal at an investment of INR 6.9 billion

- Poles to be equipped with environment sensors, EV Charging Points, surveillance cameras, digital signage system and WiFi access points
- Towerco2 to deploy 200 kilometres of optical fiber network to connect poles
- Smart poles will work as mobile sites - to be leased to telecom service providers
- Setting up a control and command center for the management of components of the project

Source: Media articles

Asia based towerco building smart city infrastructure in Sri Lanka

A leading towerco in Asia has initiated deploying “smart lamp poles” in collaboration with road development authority in Sri Lanka.

Features of smart lamp poles

1. Energy efficient telecom infrastructure solutions
2. Design is sleek, camouflaged, green and blend well with town-planning for modern metropolis cities
3. Equipped the poles with CCTV surveillance cameras, smart and solar powered street lighting to ensure efficient energy management, and an integrated advertising space

The company has successfully rolled out smart lamp poles in Colombo and is replicating same model in Jaffana

Spain based towerco enhanced its smart city proposition through deployment of data management platform

Spain based towerco unveiled the “Smart Brain platform” to manage smart city deployments through provision of access to urban infrastructure by standardizing the data gathered from various sources.

Key features

- Platform captures the data provided by IoT sensors and other sources and integrates transport of information through its communication infrastructure
- Comprises of a modular design IT infrastructure with open standards and a series of cloud applications that enables data exchange
- Enables the data to be used simultaneously by different users such as citizens, public authorities, social interest groups, distributors and developers
- Access to the Smart Brain platform is available via APIs
- Facilitates real-time decision making by providing holistic view of the city and enabling top to bottom management of information

Source: Analysys Mason, media articles
**Smart city implementation challenges and issues**

The challenges for developing smart cities can be overwhelming. From augmenting existing city infrastructure to the timely clearance of projects, the challenges include managing projects, scheduling resources and working in a multi-vendor environment.

A number of issues have contributed to the slow progress. Since the majority of the smart cities involve transforming existing cities, retrofitting legacy infrastructure is a challenge. Delays in the clearance and approval of projects, lack of coordination between different stakeholders, poor financial health of urban local bodies and lack of investments in capacity building are some of the other key challenges.

Meanwhile, there remains a gap in financing, which is expected to be addressed through funding from municipal bonds, value capture financing and private participation. Public-private partnerships (PPPs) are expected to make a substantial contribution towards bridging the funding gap.

- **Financing smart cities:** Each selected city receives INR 5 billion from the center for implementing projects, while an equal amount on matching basis is contributed by urban local bodies of the state. This is only part of the project cost and the balance funds are mobilised from private sector through public-private partnerships (PPPs). The total proposed investment for 100 smart cities is expected to be INR 2,050 billion. A key challenge is ensuring this level of financing as majority of project need would move through complete private investment or through PPPs.
- **Availability of master plan or city development plan:** Most of the cities don’t have master plans or a city development plan, which is the key to smart city planning and implementation. Currently 70-80% of Indian cities don’t have one.
- **Retrofitting existing legacy city infrastructure to make it smart:** There are a number of latent issues to consider when designing the smart city plan. The integration of existing legacy systems to achieve citywide efficiencies can be a significant challenge.
- **Providing clearances in a timely manner:** For timely completion of the project, the clearance process should be streamlined. An online process can facilitate the same and ensure clearance in a time-bound manner.
- **Dealing with a multivendor environment:** Another major challenge in the Indian smart city space is that the software infrastructure in cities contains components supplied by different vendors. The ability to handle complex combinations of smart city solutions developed by multiple technology vendors would be crucial.

Source: Media articles

---

**Data center**

The data center market is poised to witness robust growth at a CAGR of 8.4% over 2018 to 2023 due to exponential growth in data traffic driven by rising internet penetration, smartphone adoption, consumption of social media and other digital services. Adding to the momentum is adoption of emerging technologies like big data analytics, AI, IoT and blockchain as well as migration towards cloud-based business models by local and global enterprises. Moreover, increasing complexities within IT infrastructure brought about by virtualization and consolidation, coupled with cost constraints has motivated enterprises to embrace third-party data center services. Sectors such as telecom, IT, BFSI and e-commerce have been significantly contributing to the demand for data center services.

Government led digital initiatives are also playing a critical role in data center deployment in India. At the heart of these initiatives is Digital India, where the government has been investing on migrating the existing traditional service offerings to digital platforms resulting in surge in data.

Another important initiative was introduction of draft Personal Data Protection Bill in June 2018 requiring personal data to be stored within the country. This bill once enforced is expected to give a significant boost to data center development in India as the enterprises would be prompted to invest in local data center facilities.

Data center services primarily comprise of colocation and managed hosting services. Colocation refers to leasing space in racks with provision of basic infrastructure such as power, cooling, physical security services, and network connectivity. On the other hand, in managed hosting, the data center operator extends the benefits of colocation and provides dedicated hardware such as servers, and related IT maintenance and support services on lease to the customers.

The towercos can explore the opportunity of entering into data center space as there are synergies in the business model of a towerco and a data center service provider. Both are capital intensive businesses, and depend on leasing capacity to enterprises. Additionally, expansion of towercos into fiber would provide them an edge in establishing data centers as fiber connectivity has become a critical enabling factor.

The area of towercos play would majorly be in shared infrastructure offering based on colocation services. In the long term, they can explore building the server hosting capabilities to extend their share of the pie. Given that the operation of a data center business is

---

**Figure: India data center market (US$ billion)**

![India data center market (US$ billion)](chart)

**Source:** Arizton Advisory & Intelligence

---


a service rather than just provision of infrastructure, a towerco will need to make certain structural changes to act as a data center service provider.

The data center business is in line with capex to opex conversion model followed by towercos in their traditional business of tower rentals. The towercos can venture into a full-fledged data center business by enhancing their capabilities in this space.

Figure: Synergies between towerco and data center service provider
Distributed tower sites are valuable assets held by towercos which can be tapped for revenue opportunities without incurring substantial additional capex.

**Edge computing and micro data centers at tower sites**

With the surge in data usage and high bandwidth applications, it has become essential to bring computers and storage closer to the customers. In such a scenario, deploying micro data centers near the network edge would be essential as it reduces the need to send backhaul data traffic to the centralized hub. Moreover, with emergence of low latency and high throughput applications such as high-speed video, augmented reality/virtual reality (AR/VR), autonomous driving, robotic surgery and other mission critical communications apps, edge computing technology is gaining momentum.

In this context, tower sites with distributed and widespread location network, are well suited to co-locate edge computing infrastructure. It opens avenues for the towercos to add new revenue stream by leasing the space at their sites for data centers. The placement of micro data center at tower sites depends on the network design, geographic location and surrounding population.

The combination of distributed real estate assets with edge data centers would bring in additional benefits such as the ability to handle local content consumption, enable communication among devices locally and manage processing of computations at relatively faster rates. This unlocks the prospects for real-time applications with richer and immersive experience for end users.

The towercos can also venture into investing in micro data centers and deploying them on their sites for edge computing. This would enable the towercos to sell new services to customers with stringent latency needs such as content delivery network providers and cloud providers which support edge specific applications. Telecom operators are another potential consumer for micro data centers as legacy wireless network architecture has cloud interface at regional level resulting in long distances travelled by the traffic. Therefore, micro data centers at tower sites can also be leveraged for enabling localized cloud-RANs.

Monetization of existing assets - an immediate opportunity for towercos

**Key attributes of towers**

- Consumer location proximity
- Reliable power supply and security
- Ready access to backhaul
- Emerging as favourable proposition to co-locate data centers

US based tower infrastructure companies are venturing into edge computing by leasing space for micro data center deployment on their tower sites.

**Source:** Media articles, company website

<table>
<thead>
<tr>
<th>Towerco A</th>
<th>Towerco B</th>
</tr>
</thead>
<tbody>
<tr>
<td>US based towerco invested in an edge compute infrastructure provider to diversify into edge computing</td>
<td>US based communication infrastructure investment firm entered into edge computing through its investee companies - a towerco and a data center services provider</td>
</tr>
</tbody>
</table>

**Assets of towerco**
- Towerco A: 40,000 towers, 60,000 route kilometer fiber
- Towerco B: More than 266,000 owned and managed sites nationwide, including wireless and broadcast towers, rooftops and other site locations

**Lease space and power to edge computing vendor at its tower sites to install micro data centers**

**Bringing cloud closer to consumer by combining distributed tower site locations with edge data centers**

**Target customers for edge computing**
- **Content provider**
  - Store tailored content for region it serves
  - Reduce data transportation cost
  - Enhance user experience
- **Cloud provider**
  - Improve performance by bringing computing closer to consumer
- **Telecom operator**
  - Support smart city networks
  - Network virtualisation
  - Deploy cloud RAN
  - Support 5G use cases

**Monetizing structures for advertising**

Out of Home (OOH) advertising is another potential opportunity for towercos to expand their revenue streams. The towerco sites are well suited to leverage their distributed locations at highways or densely populated areas to co-locate billboards for advertising. They can venture into digital advertising space by installing digital billboards at remote locations for displaying government announcements.

**Power-as-a-service**

Energy cost is one of the principal cost component for the towerco industry – constituting ~35% of total revenue of tower industry. One of the key reasons for high energy cost is increasing usage of diesel generators (DGs) as back-up due to unreliable electric grid supply at multiple sites – telecom industry is one of the leading buyers of diesel after the Railways and is estimated to spend INR90 billion annually to consume ~2 billion liters of fuel. The DGs do not make a viable solution due to their high operating cost and significant greenhouse gas (GHG) emissions.

Over the years, towercos have gained considerable expertise in energy management space as they have experience in managing and optimizing energy costs in different topographies, climates and grid power availability scenarios. In this backdrop, towercos are in a compelling position to place themselves as energy/power management solution providers. They can explore the opportunity of providing power-as-a-service.

**Figure: India OOH advertising revenue (US$ million)**

**Out of Home (OOH) advertising is another potential opportunity for towercos to expand their revenue streams.**

**Out of Home (OOH) advertising is another potential opportunity for towercos to expand their revenue streams.**

**Figure: Tower industry cost structure**

**The tower industry has been working towards implementing energy management solutions that are environment friendly. The targets set by TRAI to reduce the carbon emission by the telecom sector as 30% by 2019-20 and 40% by 2022-23, assuming the base year as 2011-12**, has given impetus to adoption of such solutions.

**The towercos have been actively taking steps to manage their energy costs by adopting hybrid solutions comprising of renewable energy technologies, energy storage solutions in addition to DGs and electric grid supply to power their sites.**

---


Renewable energy:

Back in 2012, the industry adopted the renewable energy service companies (RESCO) model to promote usage of renewable energy solution for reducing greenhouse gas (GHG) emissions. RESCO is an off-grid decentralized energy based power generation and distribution model which uses renewable technologies such as solar, biomass, wind to generate energy at hub location and feeds that to the tower sites. The collaboration between towercos and RESCO have gained traction to reduce usage of diesel and move towards sustainable model of controlling energy costs. Through these alliances, the leading towercos have successfully deployed renewable energy solutions at their sites.

Energy storage:

Efficient energy storage solutions as an alternative to diesel generator have also gained momentum in the industry. The usage of energy storage solutions has evolved over the years. The towercos have been actively deploying various energy storage solutions such as lithium-ion batteries (Li-ion), valve regulated lead acid (VRLA) batteries, lead-acid batteries, flow batteries, thermal energy storage solutions and protection circuit module batteries. Of all the battery solutions, lithium-ion batteries (Li-ion) batteries has gained widespread usage in the industry due to their compact size, quick charging and slow discharge properties.

Figure: Schematic diagram of hybrid solar power telecom tower

Source: Greenomics World

Case study

Asian towerco diversifies into energy management space

An Asian towerco purchased energy assets of 1,250 telecommunication tower sites from a telecom operator in Myanmar to manage energy on these sites. The towerco aims to evolve from just “tower” service provider to “tower+power” service provider. The deal enables the towerco to maintain and operate the overall power management system which will eventually optimise energy systems across sites.

Key features of the deal

1. Optimize energy management and energy pass through management
2. Remote monitoring of energy assets facilitating real-time resolution of assets
3. Enable sharing of energy assets among the tenants - increasing energy efficiency and reducing carbon footprint

Source: Media articles, TowerXchange
Key initiatives by the government to promote EV adoption in India:

- Under the National Electric Mobility Mission Plan 2020 (NEMMP) scheme, a total estimated subsidy worth INR 140 billion is planned to be invested in creating infrastructure and promoting the use of environment-friendly EVs.

- In 2015, the Government of India launched Faster Adoption and Manufacturing of Hybrid and Electric vehicles (FAME) scheme for a two-year period at an approved outlay of INR 7.95 billion. It has been further extended with total outlay increased to INR 8.95 billion till March 2019 or till the time an inter-ministerial committee on funding for the FAME-II scheme is reached.

- Under FAME-II, the government is planning to extend financial support of INR 5.5 billion for five years, which will provide subsidy to all types of EVs including two-wheelers, three-wheelers and four-wheelers, besides setting up charging infrastructure. FAME-II is expected to provide incentives such as exemption from paying road tax, registration fee and parking charges for various categories of electric and hybrid vehicles.

- The government is taking steps to build robust electric charging infrastructure:
  - It plans to set up EV charging stations at every 25 km on highways and roads. Additionally, it plans to set up at least one station on each side of highway every 100 km for long-range and heavy-duty vehicles.
  - It aims to implement deployment of charging stations in two phases. In the first phase, the government plans to set up EV charging stations in mega cities with a population of 4 million over the next one to three years. In the second phase, the government aims to cover cities such as state capitals and union territory headquarters.
  - The government stated that no license will be required for setting up of public charging station. The stations will need to meet certain charging requirement infrastructure. The charging station can obtain access to electricity from any power company through open access system.
  - It allowed setting-up of private charging stations in residential areas.

The towercos are well-suited to provide EV charging infrastructure. They can leverage their distributed location of sites and reliable access to power backhaul to tap this opportunity and realize new revenue stream.

Electric vehicles (EV) have witnessed an unprecedented global interest in recent years and are emerging as one of the most promising alternate powertrain technologies with zero tailpipe emissions and long term economic viability. India, too, is actively considering EVs to reduce India’s excessive dependence on oil imports and curb pollution levels.

The Indian EV market is at a nascent stage with EVs forming less than 1% of overall vehicle sales. The market is now seeing a renewed interest and engagement on the back of government’s target of EVs to contribute 30% of vehicle sales by 2030. Currently, the EV industry is majorly dominated by e-rickshaws and two-wheelers. The transition to EVs is necessary for the Indian automotive industry to continue to retain its foothold and gain additional ground as the world shifts its axis towards EVs.

40. "Overview of the India Warehouse Housing Industry," CARE Ratings, 16 October 2018
42. "Electrifying India: building blocks for a sustainable EV ecosystem," ET, May 2018
44. "Electrifying India: building blocks for a sustainable EV ecosystem," ET, May 2018

Space for warehousing, cold storage and collection points for goods

Warehousing and cold storage are crucial links to the supply chain and logistics industry. Overall, the warehousing market in India is highly fragmented with ~90% of the warehousing space controlled by unorganized players. The distribution of warehouse is concentrated in metros and bigger cities - 60% of modern warehousing capacity present majority in top six cities namely Ahmedabad, Bangalore, Chennai, Mumbai, National Capital Region (NCR) and Pune due to presence of industrial activity.

Given India is an agrarian economy, cold storage warehouses play a critical role in the value chain. However, the uneven distribution of warehouses has resulted in the persisting of ~15% of agricultural produce as cold storages is near consumption rather than near farms11.

The towercos are well-suited to provide space for warehouses and cold storage by leveraging their existing land assets at distributed location with reliable power supply, security and air-conditioning. This would unlock opportunity for them to earn additional revenue by capitalizing on their existing assets.

Collection point for goods:

Rural e-commerce market is another area which has significant potential. It is expected to grow to US$10 billion-US$12 billion by 2021. The towercos can play a pivotal role by facilitating the e-commerce players to reach rural areas by providing them access to their distributed locations for storage as well as for collection of goods ordered online.

Field maintenance

Downtime on telecom network is a cost concern and creates outages for operators and subscribers. However, the risk of failures and outages at sites due to poor or malfunctioning equipment may be drastically reduced when the condition of the infrastructure is closely monitored and tracked on an ongoing basis.

While some outages involve solving relatively complex issues, which can be supported only by a network engineer, others require limited knowledge and skill to troubleshoot basic issues/problems at the tower site. This category of support referred to as L1 typically includes individuals that have limited technical expertise. L1 level maintenance needs a field personnel that can implement basic, documented break-fix tasks along the lines of following an instruction manual.

L1 level field management can be easily outsourced to towercos. With their field force already managing at the hardware side of tower infrastructure, this can be a synergetic addition to their area of work.

The current arrangement with multiple site visits by a diverse set of personnel for passive and active infrastructure maintenance, comes with its pitfalls. For instance, overlapping site visits results in cost inefficiencies as well as site owner inconvenience.

Outsourcing L1 support to towercos, has several benefits:

- Cost savings due to sharing of field visit costs
- Improved synergies and turn around time by improving productivity
- Telcos can leverage on this field force to cost-effectively manage fibre, Small Cells, Wi-Fi and other future network elements
- Address issues arising from site owner inconvenience caused by multiple interfaces and field visits

Benefits for telcos

- Cost savings due to sharing of field visit costs
- Improved synergies and turn around time by improving productivity
- Telcos can leverage on this field force to cost-effectively manage fibre, Small Cells, Wi-Fi and other future network elements
- Address issues arising from site owner inconvenience caused by multiple interfaces and field visits

EV charging points

Electric vehicles (EV) have witnessed an unprecedented global interest in recent years and are emerging as one of the most promising alternate powertrain technologies with zero tailpipe emissions and long term economic viability. India, too, is actively considering EVs to reduce India’s excessive dependence on oil imports and curb pollution levels.

The Indian EV market is at a nascent stage with EVs forming less than 1% of overall vehicle sales. The market is now seeing a renewed interest and engagement on the back of government’s target of EVs to contribute 30% of vehicle sales by 2030. Currently, the EV industry is majorly dominated by e-rickshaws and two-wheelers. The transition to EVs is necessary for the Indian automotive industry to continue to retain its foothold and gain additional ground as the world shifts its axis towards EVs.

40. “Overview of the India Warehouse Housing Industry,” CARE Ratings, 16 October 2018
42. “Electrifying India: building blocks for a sustainable EV ecosystem,” ET, May 2018
44. “Electrifying India: building blocks for a sustainable EV ecosystem,” ET, May 2018
A leading German telecom operator is leveraging its infrastructure for building EV charging stations

A leading German telecom operator plans to use its nationwide infrastructure for phone and internet distribution to provide EV charging services. The company aims to transform 12,000 of its fixed line and cable distribution boxes across country into EV charging stations.

**Key features**

- Converting existing telecom infrastructure for EV charging points
- Boxes are being fitted with required charging and measurement hardware
- Charging station will provide one or two charging points that can charge vehicles up to 11KW
- Plans to use renewable energy sources for additional energy requirement for EV charging network

Source: Media articles, TowerXchange
Towercos can explore playing a larger role by becoming a shared digital infrastructure provider, which entails active infrastructure sharing also. By assuming the role of a shared infrastructure provider, the towerco will take sole responsibility of network infrastructure and provide wholesale services to digital service providers. In turn, the digital service providers can focus on managing the marketing, providing retail services to the end consumers and handling customer services.

Shared infrastructure provider business model brings in reduction in operating costs by avoiding duplicate infrastructure by multiple service providers. It enables portfolio rationalization by decommissioning redundant sites, consolidating the asset base and optimizing the backhaul infrastructure. The current regulatory environment does not allow towercos to take the shared infrastructure provider business path.

**Figure: Shared digital infrastructure model**

<table>
<thead>
<tr>
<th>Shared digital infrastructure provider</th>
<th>Digital services provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owns, deploys and maintains passive and active infrastructure essential for digital service providers</td>
<td>Lease network capacity from shared infrastructure providers</td>
</tr>
<tr>
<td>Builds the common network infrastructure that can be leveraged by multiple service providers</td>
<td>Compete in the retail market and provide voice and data services to customers</td>
</tr>
<tr>
<td>Charges fees to service provider for leasing network capacity on a mutually agreed model</td>
<td>Responsible for branding, marketing, pricing, retail sales and distribution, customer service, customer billing, innovation/product development</td>
</tr>
</tbody>
</table>
French telecom operators plan to deploy shared 4G network to ensure there are no coverage gaps

The telecom operators in France have come together to deploy 4G network to plug network gaps. The roll out plan aims to bring 4G coverage to more than 10,000 towns and villages which are currently being served by either 2G or 3G networks.

**Investment and targets**

- Each of the telecom operator to install 5,000 masts and antennas
- Jointly ensure network coverage along 30,000 km (19,000 miles) of rail tracks
- Telcos plan to invest Euro 3 billion to roll out 4G network in black spots across the country to ensure there are no coverage gaps by 2020

Source: Arthur D Little, Media articles, EY analysis
Recommendation and initiatives to enhance ease of doing business

Ease of doing business remains a prime concern for all infrastructure projects in the country, and especially for broadband infrastructure roll-outs. To be able to expedite creation of robust telecom infrastructure needed to fulfil the agenda of Digital India and bridge the digital divide between disparate economic classes, it is important that ease of doing business is treated as a priority to create an enabling environment.

<table>
<thead>
<tr>
<th>Category</th>
<th>Key recommendations</th>
</tr>
</thead>
</table>
| Expediting RoW permissions | • Setting up of single window clearance and time-bound processing of applications  
• Ensure standardisation of rates for the RoW as envisaged in NDCP 2018  
• The government to consider adopting issuance of “Letter of credit”  
• Reduction of approvals by empowering government officials to represent various departments  
• Ensure efficient utilisation of technology for surveillance and documentation  
• Promote self-certification to optimize time, resource and cost. Push for audit and high penalty  
• Automate workflow for interdepartmental approvals and partner portal using ERP systems  
• Establish common permissions processes for all utility purposes - water, electricity, gas pipes and fiber  
• Process on priority all pending SACFA applications.  
• Focus on operating from standards and strong SLAs  
• Timeline of the project should start post permissions like RoW and approvals |
| Enhance coverage inside buildings and public spaces by installation of in buildings solutions and Wi-Fi hotspots | • As envisaged in NDCP 2018, mandated provisioning of spaces and ducts in all commercial, residential and office spaces for installation of telecom infrastructure and the associated cabling and in-building solutions by amending National Building Code of India (NBC), through BIS |
| Make India future ready with a robust communication infrastructure for provisioning of technologies like 5G, AI, etc. | • Reclassify common telecom / digital infrastructure under a single umbrella  
• Promote sharing of telecom infrastructure among telecom service providers on the infrastructure deployed by IP-Is  
• Streamline the deployment and site clearance processes for new infrastructure such as small cells, Wi-Fi |
| Enhancing ease of doing business for the telecom infrastructure providers | • Need to create collaborative institutional mechanism between centre, state and local bodies for common RoW mechanism and removal of barriers as envisaged in NDCP 2018  
• Consult concerned departments (e.g., urban development/IT), advise state representatives to follow DoT guidelines for formulation of respective tower installation policies  
• Set up a central or state level agencies or a task force to oversee the implementation of RoW rules  
• Endorse on-ground implementation of infrastructure status benefits to infrastructure providers  
• Improve the availability of grid-based power for telecom towers |
Next-gen infraco - Unlocking new business opportunities

**Category** | **Key recommendations**
--- | ---
Ensure protection of critical telecom infrastructure by imposing stringent penal | - In line with NDCP 2018, take measures to reduce the vandalism and address security issues across layers including physical infrastructure, cyber-physical infrastructure, hardware and network elements
- Impose stringent penal actions for damage to critical assets
- Adopt proactive steps such as “dig once” and “call before you dig” to safeguard the laid fiber
- Optimize execution via collaboration with upcoming utility and infrastructure projects
- Set up of Common GIS platform for management of utilities
- Define custodian of the utilities map with the nodal agency for RoWs being the central pillar
- Ensure the utility corridors and duct dimensions accommodate high count optic fiber

Optimal utilization of government laid fiber infrastructure (BharatNet) | - Encourage public-private partnership to bolster communications infrastructure
- Streamline terms of use and make cost structure reasonable
- Run on-ground awareness programmes at panchayat level to enlighten people regarding usage and maintenance of the infrastructure

Smooth implementation of Smart city projects | - Ensure timely provision of financing for smart city projects
- Streamline clearance processes

Source: TAIPA, media article and TRAI

---

**Glossary**

| **AR/VR** | Augmented reality/virtual reality |
| **BBNL** | Bharat Broadband Network Limited |
| **BIS** | Bureau of Indian Standards |
| **CPSU** | Central public sector |
| **CSS** | Centrally sponsored scheme |
| **DG** | Diesel generators |
| **EV** | Electric vehicles |
| **FAME** | Faster adoption and manufacturing of hybrid and electric vehicles |
| **FTTH/B** | Fibre-to-the-home/ building |
| **GHG** | Greenhouse gas |
| **GP** | Gram panchayat |
| **IBS** | In-building solutions |
| **IoT** | Internet of Things |
| **IP-1** | Infrastructure providers category-1 |
| **Li-ion** | Lithium-ion batteries |
| **LP-WAN** | Low-power wide area networks |
| **MSA** | Master service agreement |
| **NCR** | National capital region |
| **NDCP** | National digital communications policy |
| **NEMMP** | National Electric Mobility Mission Plan |
| **NLD** | National long distance |
| **NOFN** | National Optical Fiber Network |
| **OHH** | Out of home |
| **PPP** | Public private partnership |
| **RESCO** | Renewable energy service companies |
| **RoW** | Right of way |
| **ToC** | Tower operations centre |
| **VRLA** | Valve regulated lead acid |
Our offices

Ahmedabad
2nd floor, Shivalik Ishaan
Near C.N. Vidhyalaya
Ambawadi
Ahmedabad - 380 015
Tel: + 91 79 6608 3800

Bengaluru
6th, 12th & 13th floor
"UB City", Canberra Block
No.24 Vittal Mallya Road
Bengaluru - 560 001
Tel: + 91 80 4027 5000
+ 91 80 6727 5000
+ 91 80 2224 0696

Chandigarh
1st Floor, SCO: 166-167
Sector 9-C, Madhya Marg
Chandigarh - 160 009
Tel: + 91 172 331 7800

Chennai
Tidel Park, 6th & 7th Floor
A Block, No.4, Rajiv Gandhi Salai
Taramani, Chennai - 600 113
Tel: + 91 44 6654 8100

Delhi NCR
Golf View Corporate Tower B
Sector 42, Sector Road
Gurgaon - 122 002
Tel: + 91 124 443 4000

3rd & 6th Floor, Worldmark-1
IGI Airport Hospitality District
Aero City, New Delhi - 110 037
Tel: + 91 11 4731 8000

4th & 5th Floor, Plot No 2B
Tower 2, Sector 126
Noida - 201 304
Gautam Budh Nagar, U.P.
Tel: + 91 120 671 7000

Hyderabad
Oval Office, 18, iLabs Centre
Hitech City, Madhapur
Hyderabad - 500 081
Tel: + 91 40 6736 2000

Jamshedpur
1st Floor, Shantiniketan Building
Holding No. 1, SI Shop Area
Bistupur, Jamshedpur - 831 001
Tel: + 91 657 663 1000

Kochi
9th Floor, ABAD Nucleus
NH-49, Ernakulam
Kochi - 682 504
Tel: + 91 484 433 4000

Kolkata
22 Camac Street
3rd Floor, Block ‘C’
Kolkata - 700 016
Tel: + 91 33 6615 3400

Mumbai
14th Floor, The Ruby
29 Senapati Bapat Marg
Dadar (W), Mumbai - 400 008
Tel: + 91 22 6192 0000

5th Floor, Block E
Nikon Knowledge Park
Off. Western Express Highway
Goregaon (E)
Mumbai - 400 063
Tel: + 91 22 6192 0000

Pune
C-401, 4th floor
Panchshil Tech Park
Yerawada
(Near Don Bosco School)
Pune - 411 006
Tel: + 91 20 4912 6000
About EY

EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. For more information about our organization, please visit ey.com.

Ernst & Young LLP is one of the Indian client serving member firms of EYGM Limited. For more information about our organization, please visit www.ey.com/in.

© 2019 Ernst & Young LLP. Published in India.
All Rights Reserved.

This publication contains information in summary form and is therefore intended for general guidance only. It is not intended to be a substitute for detailed research or the exercise of professional judgment. Neither EYGM Limited nor any other member of the global Ernst & Young organization can accept any responsibility for loss occasioned to any person acting or refraining from action as a result of any material in this publication. On any specific matter, reference should be made to the appropriate advisor.

RS1