

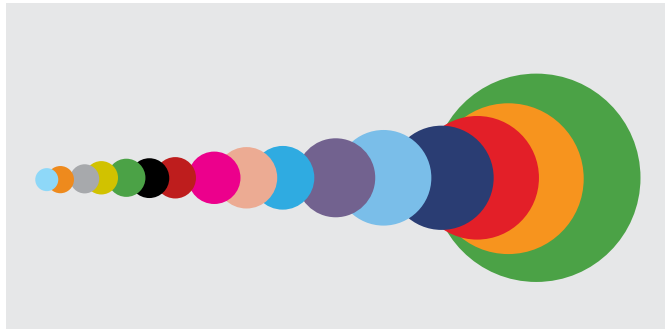


Your exclusive guide to Asian towers



TowerXchange Asia Dossier 2019 | www.towerxchange.com

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About TowerXchange

Founded in 2012, TowerXchange is your independent community for operators, towercos, investors and suppliers interested in EMEA, CALA and Asian towers. We're a community of practitioners formed to promote and accelerate infrastructure sharing. TowerXchange don't build, operate or invest in towers; we're a neutral community host and commentator on telecoms infrastructure.

TowerXchange produces a monthly newsletter and quarterly journal, both available to subscribers, which cover industry news and provide deep insights into telecoms infrastructure worldwide. We also host annual Meetups on each of four continents to bring together the leading tower industry stakeholders.

TowerXchange was founded by Kieron Osmotherly, a TMT community host and events organiser with 21 years' experience, and is governed with the support and advice of the TowerXchange "Inner Circle" – an informal network of advisors. TowerXchange was acquired by Euromoney Institutional Investor PLC on December 1, 2017 ■

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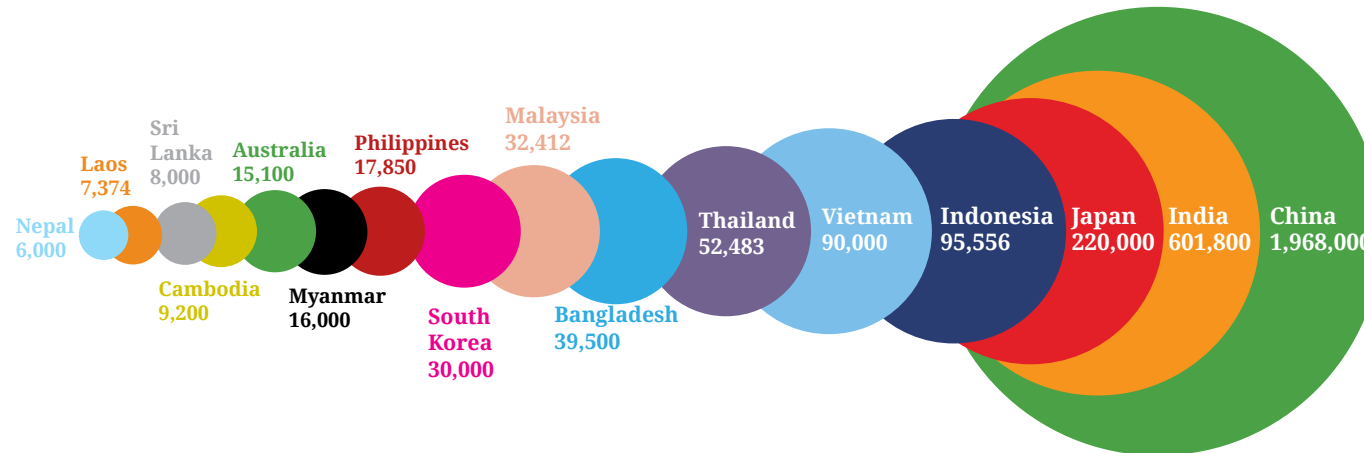
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TowerXchange's analysis of the independent tower market in Asia



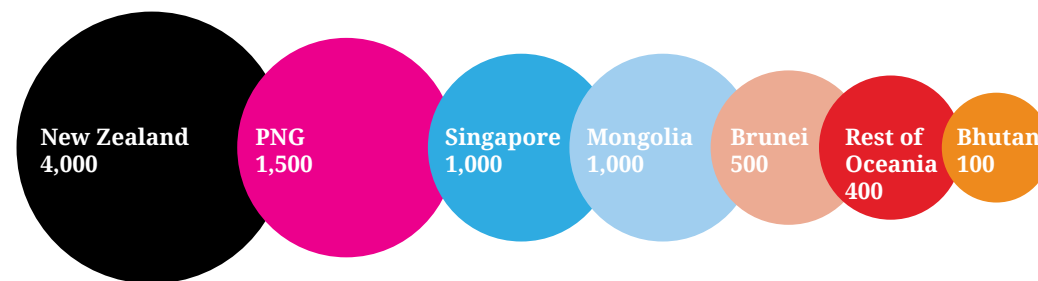
In the Philippines, Dito is entering the market and DICT is still finalising the terms of the common share tower policy, while some towercos – including American Tower and edotco – have already signed agreements with MNOs and local partners and deployment could start imminently. In the meantime, Bangladesh's future is still up in the air, with negotiations between towercos and MNOs at a standstill.

Selected Asian tower market size comparisons, Q3 2019



Last but not least, 5G is starting to become a reality in more advanced markets such as Malaysia and Japan, where MNOs are actively pursuing tests and early deployments. 5G is expected to shake the Asian mobile and infrastructure industries even further, with MNOs likely to feel more financial pressure than ever before due to pricey spectrum auctions and the needs of technology adoption, while towercos are revisiting their portfolios of products to stay relevant at this time of continuous changes.

Asian tower markets with <5,000 assets



Source: TowerXchange

The Asian telecom infrastructure landscape is offering plenty of news in terms of strategic M&A activities, the opening of new markets as well as innovation efforts towards 5G. While the merger between Telenor and Axiata has been called off, the one between Indus Towers and Bharti Infratel has

been delayed but is still in the cards and is likely to further reshape the tumultuous Indian market. Indonesia has resumed M&A activities too, with Indosat divesting 3,100 towers to Protelindo and Mitratel and analysts expecting more news in the near future.

Australia

Last year, Telstra made the headlines when the operator announced the carve-out of its non-mobile-related assets including data centres, fibre, copper, subsea cables, poles and more into a separate infraco as part of a restructuring plan called Telstra2022 that aims at streamlining the company's operations and reduce its opex.

This year, it is all about 5G. Last December, Dense Air, Mobile JV (a joint venture between TPG Telecom and Vodafone), Optus Mobile and Telstra paid over US\$ 600mn for the 350 slots offered in the 5G

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spectrum auction in the 3.8GHz band, and all operators have now started the transition to 5G. All the operators now are testing and deploying 5G, although Huawei's block might cause some delays.

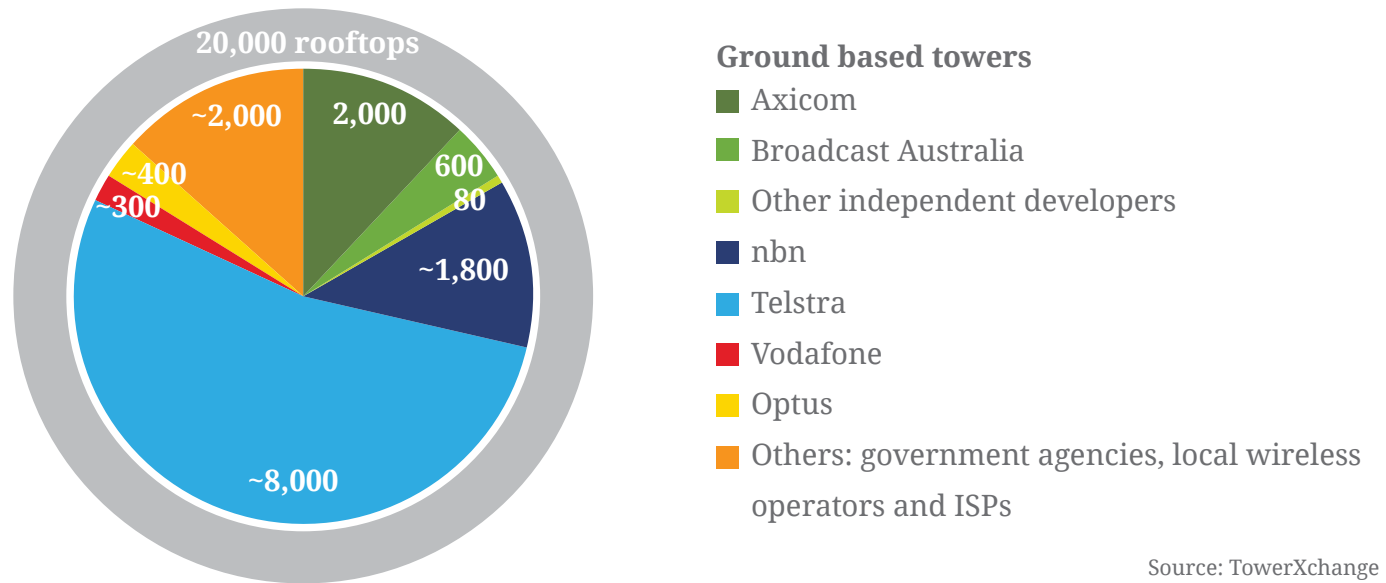
Telstra, Ericsson and the Commonwealth Bank are reportedly working together and exploring the different possibilities for 5G deployment. The market leader has been switching on its 5G technology since August and has already deployed its 5G network across ten cities, aiming to expand its coverage to 35 over the next 12 months.

Optus has a few 5G sites and is partnering with technology leader Ericsson to build at least 60 more in the upcoming months.

Both towercos and MNOs will need to work together to raise the necessary investment for 5G networks deployment while exploring further collaboration and sharing initiatives on small cells, base stations hotels and fibre. Leading towerco Axicom is exploring new technologies and its CEO Graeme Barclay has publicly confirmed that the company is already increasing capacity in existing sites while investing in small cells and new solutions such as power, fibre, cabins, and BTS on a shared access and shared cost model.

The "traditional" tower landscape remains pretty much unchanged with Axicom (formerly Crown Castle), Broadcast Australia and a handful of smaller independent towercos owning around 2,600 towers and a further 1,800 towers having

Estimated site count for Australia



been recently erected by nbn, the Government-owned new broadband network.

Bangladesh

The tower market in Bangladesh has been officially opened since 2018, when four towercos received licenses to operate in the country (edotco Bangladesh, Kirtonkhola Tower Bangladesh, AB Hightech Consortium and TASC Summit Towers). Since then, a few more international players have decided to get involved in the game via cooperation agreements and joint ventures.

However, towercos and MNOs have so far failed to reach definitive agreements on how to successfully

cooperate for the deployment of telecom infrastructure across Bangladesh. In fact, beside edotco – who owns 10,000 towers following the transfer of assets from sister company Robi – the other licensed towercos haven't been able to add new towers to their portfolios via either build-to-suit or sale and leaseback deals. On the other hand, since the licenses were awarded, MNOs have been forbidden from deploying new sites by themselves.

In a country in desperate need for more infrastructure and better coverage, this standstill is indeed a crucial problem. In fact, with networks already maxed out, MNOs were keen to build as many as 3,000 new sites in the mid-term to improve QoS.

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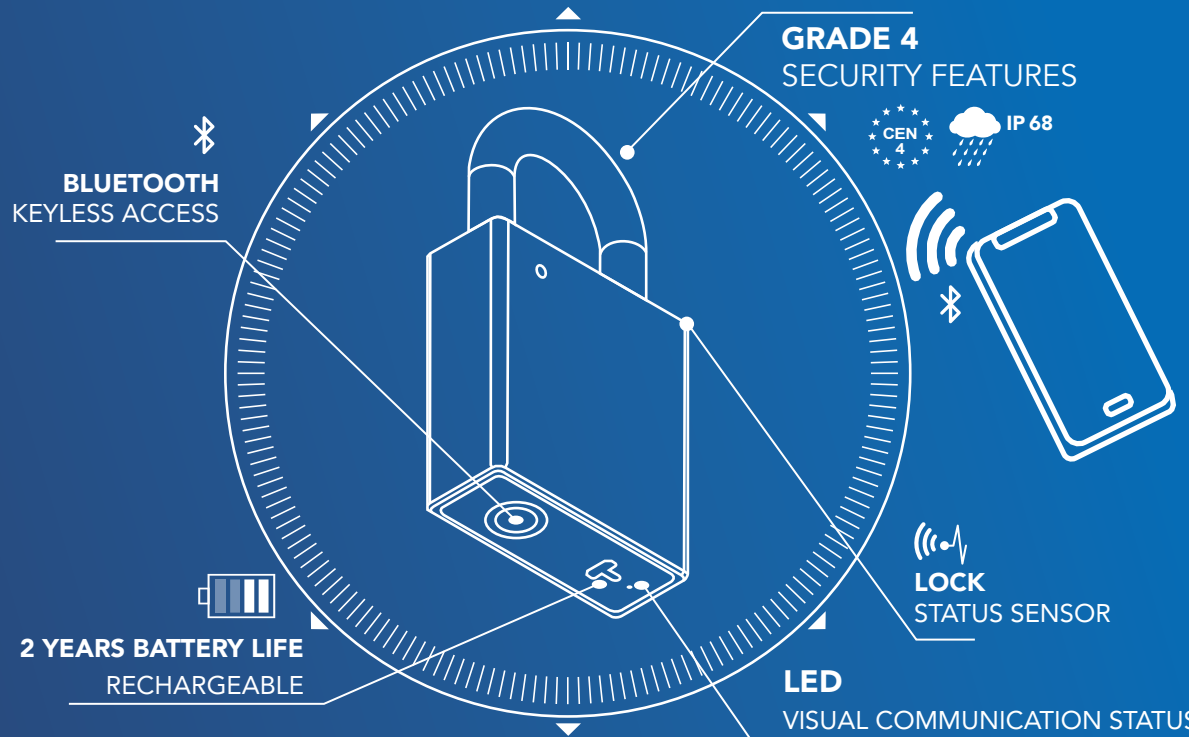
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Key tower deals in Asia 2008-2019 (excluding carve-outs)

Year	Country	Seller	Buyer	Tower count	Deal value US\$	Cost per tower US\$	Deal structure
2019	Indonesia	Indosat Ooredoo	Mitratel & Protelindo	3,100	\$452,000,000	\$145,000	SLB
2019	Thailand	True Move	Digital Telecommunications Infrastructure Fund	778	\$512,000,000	N/A	SLB
2019	Laos	Mekong Tower Company Ltd. (MTCL)	edotco				Acquiring 80% stake
2018	Myanmar	PAMEL	TPG	1,300			Company acquisition
2018	India	Idea Cellular	American Tower	9,900	\$592,700,000	\$59,868	SLB
2018	Indonesia	Komet Infra Nusantara (KIN)	Sarana Menara Nusantara (SMN)	1,400	N/A	N/A	Company acquisition
2018	India	Vodafone India	American Tower	10,200	\$592,900,000	\$58,127.45	SLB
2018	Indonesia	Providence (KIN)	Protelindo	1,400			Company acquisition
2018	India	Reliance Communications	Reliance Jio	43,000	\$3,750,000,000		Asset acquisition; still to close**
2017	Indonesia	PT Sampoerna Telekomunikasi Indonesia (STI)	PT Inti Bangun Sejahtera (IBS)	371	\$31,000,000	\$83,557.95	SLB
2017	India	Nettle Infrastructure (Bharti Infratel)	Secondary share sale on BSE and NSE	39,211	\$402,000,000		Sold 3.65% (6.75 crore shares)
2017	Pakistan	Towershare (Tazanite Tower)	edotco	700	\$88,900,000	\$127,000	Company acquisition
2017	India	Ascend Telecom Infrastructure	IDFC Alternatives	5,222	\$91,200,000		Acquiring 33% stake
2017	India	Bharti Airtel (Infratel)	Nettle Infrastructure Investments (Bharti)	90,255	\$1,061,500,000		Acquiring 11.32% stake
2017	India	Bharti Airtel (Infratel)	KKR/CPPIB consortium	90,255	\$951,600,000		Acquiring 10.3% stake
2017	Australia	Southern Cross Austereo	Axicom	56	\$9,500,000	\$169,643	SLB
2017	Malaysia	edotco Group	Kumpulan Wang Persaraan		\$100,000,000		Acquiring 5.4% stake
2016	Malaysia	edotco Group	Innovation Network Corporation of Japan		\$400,000,000		Acquiring 21.5% stake
2016	Malaysia	edotco Group	Khazanah Nasional Berhad		\$200,000,000		Acquiring 10.7% stake

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Key tower deals in Asia 2008-2019 (excluding carve-outs)

Year	Country	Seller	Buyer	Tower count	Deal value US\$	Cost per tower US\$	Deal structure
2016	Vietnam	VNI (SEATH)	OCK Group	1,972	\$50,000,000	\$25,355	Company acquisition
2016	Indonesia	XL Axiata	Protelindo	2,500	\$250,000,000	\$100,000	SLB
2016	India	Viom Networks	American Tower	42,200	\$1,180,000,000		Acquiring 51% controlling stake
2015	Myanmar	Digicel MTC	edotco	1,250	\$221,000,000		Acquiring 75% controlling stake
2015*	Australia	Crown Castle	MIRA-led consortium	1,772	\$1,600,000,000	\$902,934	Company acquisition
2015	India	KEC International	American Tower	381	\$13,000,000	\$34,121	Company acquisition
2014	Malaysia	KJS	YTL Power Int'l	309	\$15,000,000	\$48,544	Company acquisition
2014	Indonesia	XL Axiata	STP	3500	\$460,000,000	\$131,429	SLB
2013	Indonesia	Hutchison	STP	300	\$68,000,000	\$226,667	SLB
2012	Indonesia	Hutchison	Protelindo	503			SLB
2012	Indonesia	PT Central Investindo	Protelindo	152			Company acquisition
2012	Indonesia	Indosat	Tower Bersama	2500	\$519,000,000	\$207,600	SLB
2011	Indonesia	Infratel	Tower Bersama	595			Company acquisition
2010	India	Essar Telecom Infrastructure	American Tower	4450	\$432,000,000	\$97,079	SLB
2010	Indonesia	Hutchison	Protelindo	1482	\$165,900,000	\$111,943	SLB
2010	India	Aircel	GTL Infrastructure	17500	\$1,800,000,000	\$102,857	SLB
2009	India	Viom Networks	QTIL	18000	\$2,407,000,000	\$133,722	Company acquisition
2009	India	Transcend Infrastructure	American Tower	327	\$23,000,000	\$70,336	Company acquisition
2009	India	XCEL Telecom	American Tower	1730	\$170,000,000	\$98,266	Company acquisition
2008	Indonesia	Bakrie	STP	543	\$34,000,000	\$62,615	SLB
2008	Indonesia	Hutchison	Protelindo	3692	\$500,000,000	\$135,428	SLB

*Crown Castle Australia (now Axicom) transaction excluded from totals and averages as it not a natural comp for the other S and SE Asian transactions

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Terms and conditions remain the stickiest points for both BTS and SLBs. The QoS is indeed one of the key pain points in Bangladesh as MNOs are demanding 99.5% uptime but towercos are guaranteeing 98%, which would lead to unacceptable downtime. Local sources report that logistic challenges are being analysed and negotiations around SLAs are particularly complicated due to the characteristics of the local market, weather conditions and operational hurdles. Other contentious points include the duration of lease contracts, with MNOs not keen to commit for long timeframes.

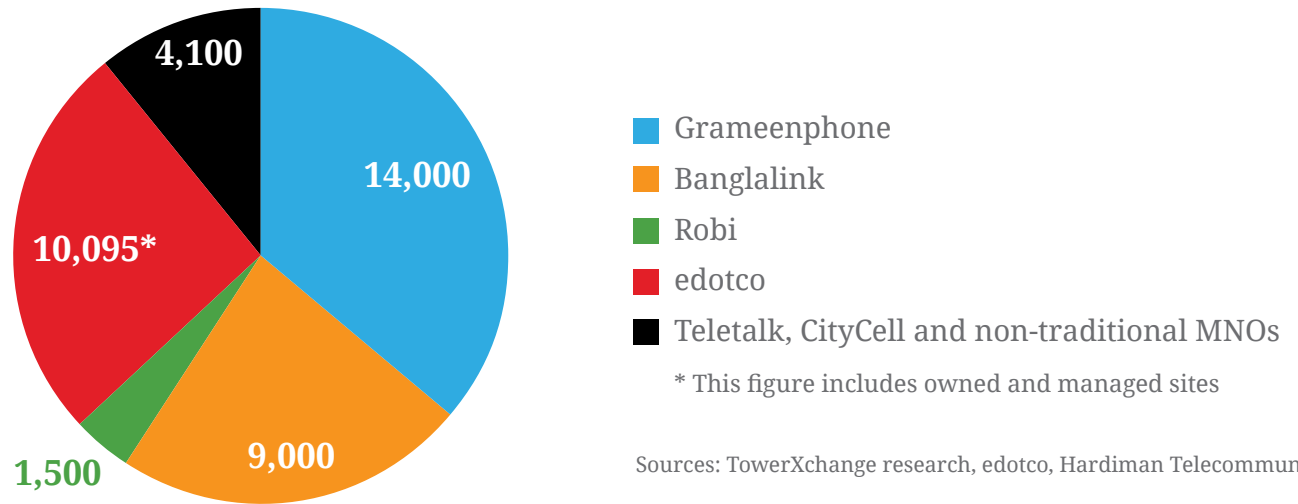
On the MNO front, worrisome news come from Robi and Grameenphone who are still dealing with the ongoing dispute related to unpaid dues found during BTRC's audits. In a recent twist, the Government has approved the appointment of administrators by the BTRC to oversee the MNOs' operations. For the time being, the two MNOs are also unable to buy equipment or perform maintenance on their networks.

Cambodia

Cambodia is home to 16.4mn people and according to the Q418 data from GSMA Intelligence, 126% SIM penetration rate and 20.6mn mobile connections. The market features six MNOs – Cellcard, Metfone, SEATEL, Kingtel, Cootel and Smart – and just under 10,000 towers.

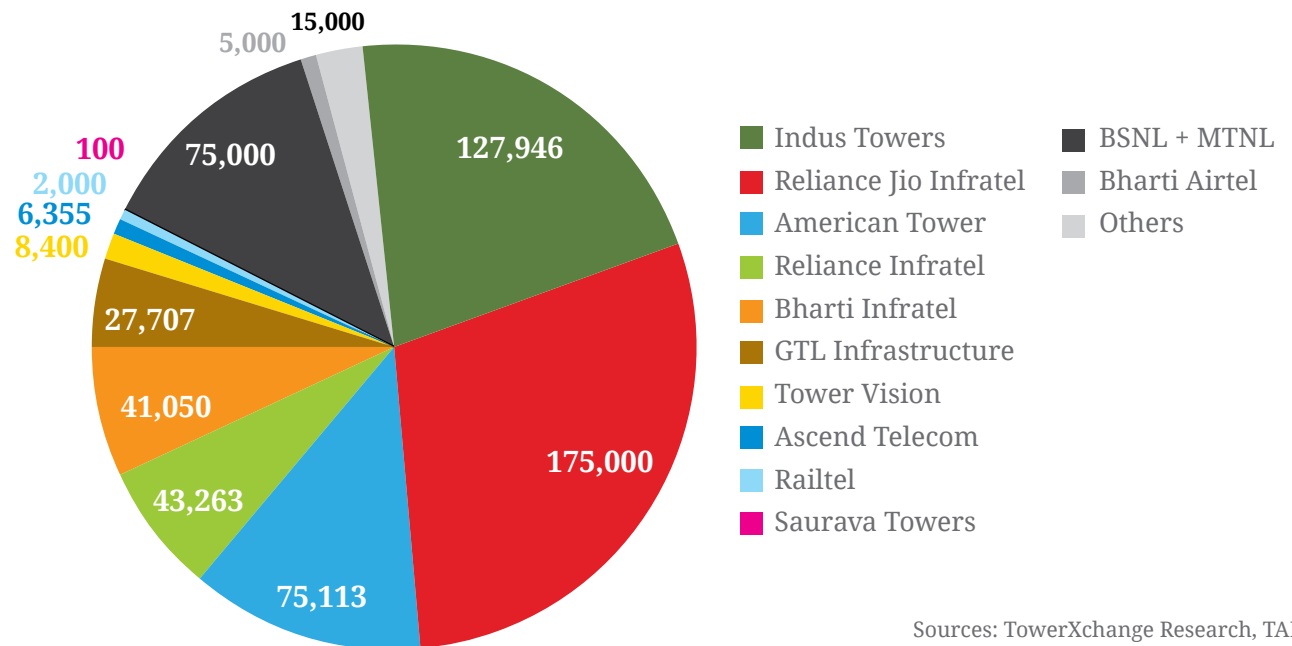
The establishment of Chinese-backed MNOs Seatel, Kingtel and Cootel is creating a very competitive environment that will drive new deployments, and

Estimated tower count for Bangladesh



Sources: TowerXchange research, edotco, Hardiman Telecommunications

Tower ownership in India today



Sources: TowerXchange Research, TAIPA, PwC

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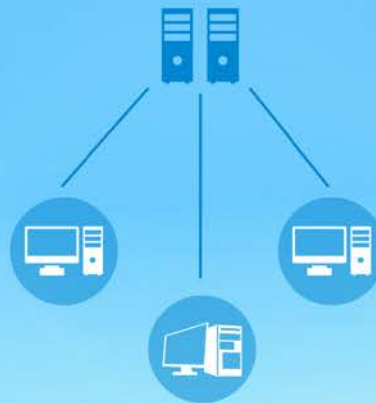


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market experts expect around 200-300 new towers to be built in Cambodia per year until 2021, also thanks to the emergence of 5G. In addition, MNOs are now revisiting their strategies and are finally contemplating a sale of their assets to towercos.

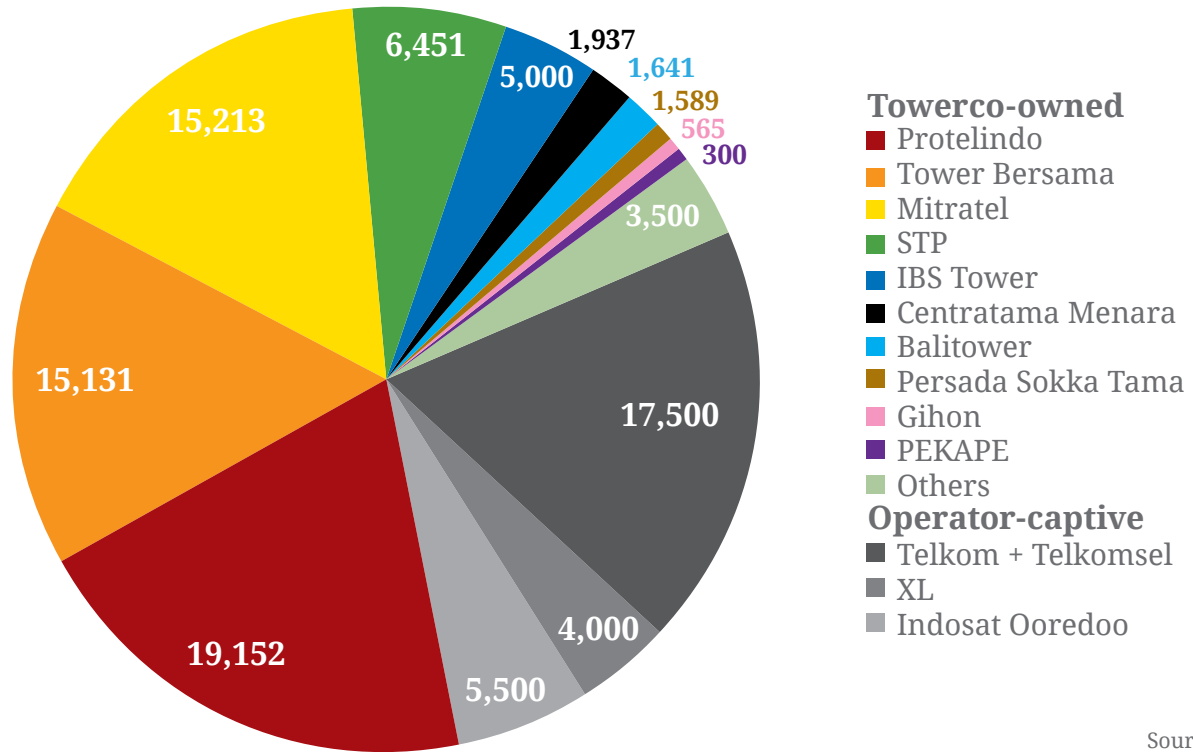
The rapidly expanding Sihanoukville, which has become one of the fastest-growing cities in Asia, and the growth of casinos and online gaming businesses in the city has attracted the attention of many Chinese investors, especially since these new businesses are massively driving new data demand and increasing the need for new infrastructure. Moreover, China Tower is expected to make an entrance and regional investors from Malaysia and other neighbouring countries are also looking at the Cambodian tower market.

For the time being, two towercos are active in the market. edotco made an entrance in 2018 with the acquisition of 325 sites from SEATEL and now owns and/or manages 3,623 towers across the country. Local tower builder Camtowerlink also has a modest footprint in Cambodia. Both edotco and Camtowerlink are offering IBS, small cells as well as camouflaged solutions in the country.

India

While the Indian MNO and towerco landscape has been considerably reshaped over the past couple of years, with less active players and hopefully more potential for growth in sight, India is still dominated by a huge growth in data demand especially from relatively small towns

Estimated tower count for Indonesia



Source: TowerXchange

and rural areas that have been lagging behind in terms of coverage. Many key players consider the worst behind them but the market has undergone a radical makeover that has left nearly nothing untouched and tenancy ratios have been severely impacted with many towers now operating with a single tenant.

Revenue streams for towercos are changing, with many of them now involved in providing het-net solutions and - to a certain extent - fibre while working to optimise their opex and adopt efficient

energy solutions and monitoring systems. On the M&A side, the planned merger between Indus Towers and Bharti Infratel is still making the headlines. While the deadline for the completion of the merger was set to October 24, the deal is yet to be finalised due to some missing government approvals. The merger should still go through in the near future, but its delay causes immediate concerns with regards to Vodafone Idea and its plans to divest its stake in the merged entity. In fact, the cash-strapped MNO holds 11.15% in Indus Towers and was relying on a quick exit in order to





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finance its much-needed network expansion, which has been put on hold due to its financial struggles.

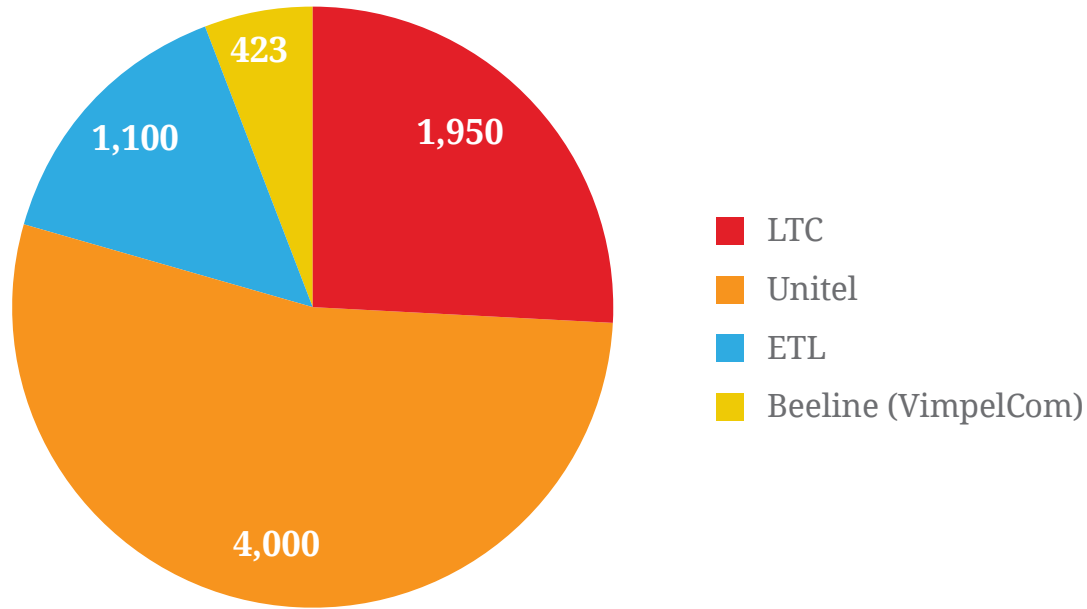
As part of its monetisation plan, Vodafone Idea has recently finalised the demerger of its fibre assets, which got transferred to a new unit – Vodafone Towers Ltd. The MNO is likely to seek a buyer for the assets, which have been valued at approximately US\$450mn. The move follows the demerger strategies of Reliance Jio and Bharti Airtel. In fact, Jio carved out its fibre and tower assets into two separate business earlier this year and Bharti Airtel did the same with its optical fibre, which is now part of a subsidiary called Telesonic Networks.

In the meantime, Reliance Jio added 103mn subscribers over the past year, with a churn rate of 0.74% - well below the industry average – and is now (as of October 2019) serving nearly 350mn customers nationwide. The MNO is also number one in terms of highest 4G availability (97.8%), followed by Airtel (89.2%). Vodafone Idea still leads in terms of number of subscribers (375mn) in spite of losing nearly 5mn customers in August alone while Airtel sits in third place (327.9mn).

Questions remain as to whether Vodafone Idea can sustain its leading position without heavily investing in network upgrades to match the offers of its two rivals.

Last but not least, bankrupt Aircel has recently fired most of its remaining employees (approximately 1,000 out of 1,229) in a desperate move to keep

Estimated tower count for Laos



Source: TowerXchange

operating and be able to sell its assets at a good price during the ongoing insolvency process. Aircel is one of the many parties hit by the restructuring of the Indian telecom landscape.

Indonesia

Indosat Ooredoo has recently announced the sale of 3,100 sites to Mitratel and Protelindo for a combined price of US\$452mn. Further, we can expect more similar transactions in the country as private equity firms with investments in the tower sector are now looking for an exit. MNOs are also eager to monetise their assets in order to release some financial pressure and gear up for imminent 5G investments.

Organic growth has picked up over the last couple of years, and the increase of data demand, a populated MNO landscape and new 4G rollout plans from Indosat Ooredoo and Hutch - who are expanding outside Java - will continue driving demand for new sites and co-locations in the country, where towercos build 3,000-5,000 towers, rooftops and infill sites per year. Tenancy ratio growth compares favourably to many other global tower markets, with around 0.13 tenants added per tower per year.

We expect towercos to continue improving their value proposition through new services and revenue streams such as fibre and small cells following a strategy initiated by Protelindo and STP. Specifically, Protelindo is set to explore VSAT



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cellular backhaul and mini-data centres through its subsidiary iForte. Microcells and other street furniture are also a big focus for towercos.

Additionally, there have been rumours of a potential opening of the tower sector (currently closed to foreign investors) and representatives from the U.S. Government as well as international developers have met with the government to discuss the matter.

Japan

Japan is one of the most sophisticated mobile markets in the world. Traditionally, towers have been seen as a source of competitive differentiation and the initial interest in carving out a towerco a few years ago tailed off. However, the arrival of Rakuten, the country's fourth operator, and the new government strategy could completely shift Japan's telecom infrastructure market. Japan's executive is pushing MNOs to reduce their prices and has already released some initial guidelines for infrastructure sharing, which could eventually open the door for infrastructure players.

Japan is famous for having the fewest number of subscribers per tower in the world – reportedly around 500 – suggesting a staggering tower count of around 220,000 for a nation of 127mn people and a landmass of just 378,000sq km.

Earlier this year, the Ministry of Internal Affairs and Communications (MIC) approved the allocation of frequency bands for 5G advanced

Asia's leading towercos by tower count*

* excluding China

Towerco	Countries	Total count
Reliance Jio Infratel	India	175,000
Indus Towers	India	127,946
American Tower	India	75,113
Bharti Infratel	India	41,050
edotco	Bangladesh, Cambodia, Malaysia, Myanmar, Pakistan, Sri Lanka	29,924
GTL Infrastructure	India	27,707
Protelindo	Indonesia	19,152
DIF	Thailand	16,059
Mitratel	Indonesia	15,213
Tower Bersama	Indonesia	15,131
Tower Vision	India	8,400
STP	Indonesia	6,412
Ascend Telecom	India	6,451
IBS Tower	Indonesia	4,077
OCK Group	Malaysia, Myanmar, Vietnam	4,066
ASEAN Towers (IGT + Golden Towers)	Myanmar, Vietnam	3,625
Axicom	Australia	2,000
Railtel	India	2,000
Centratama Menara Indonesia	Indonesia	1,937
Apollo Towers	Myanmar	1,800
Balitower	Indonesia	1,589
Pan Asia Majestic Eagle	Myanmar	1,300
Persada Sokka Tama	Indonesia	1,012
Sacofa	Malaysia	1,000
27 further towercos with <1000 sites	Various	6,027

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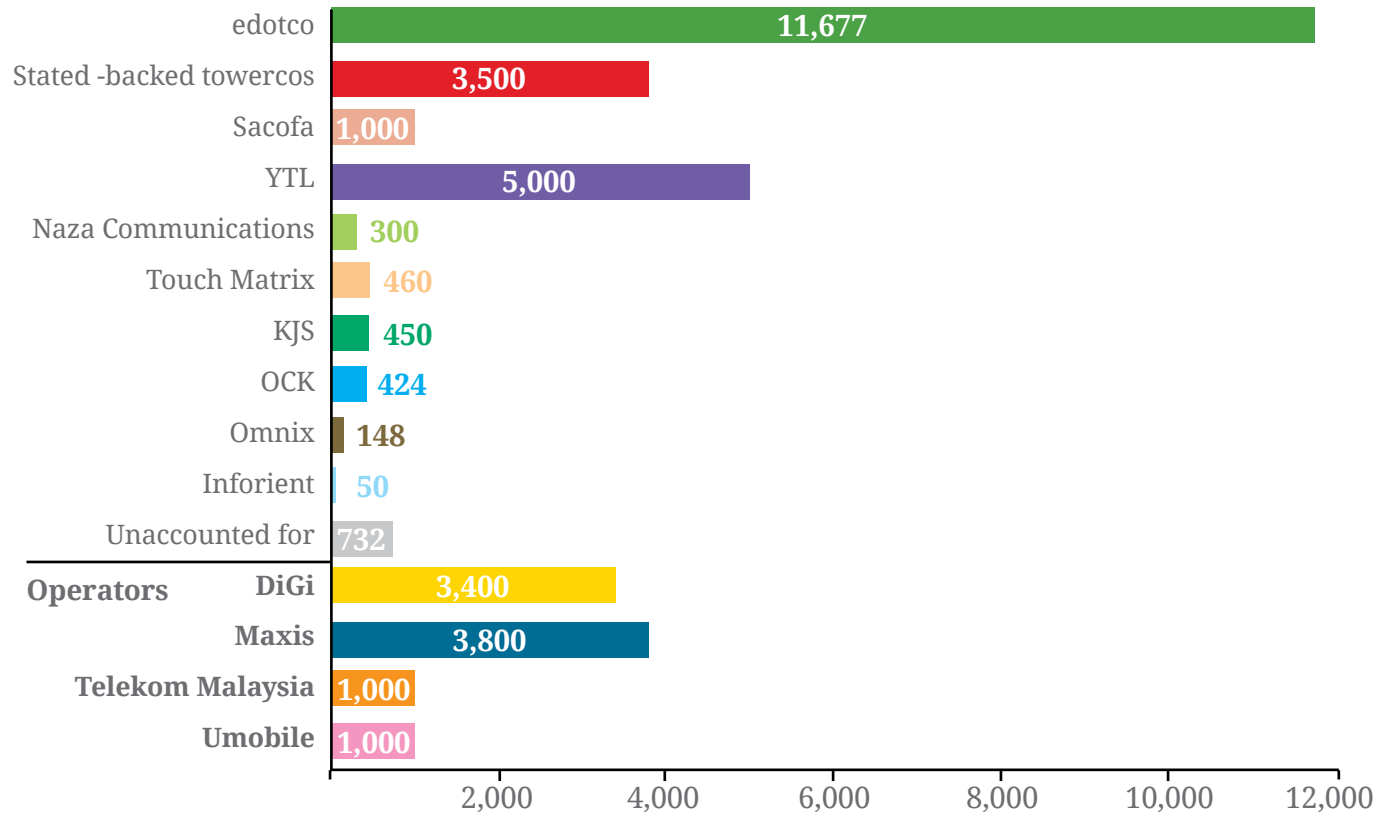
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Estimated tower count for Malaysia

Source: TowerXchange



services to the four MNOs-NTT DOCOMO, KDDI (au), Softbank Corp and new entrant Rakuten Mobile. The MIC also published its approvals relating to 5G BTS deployments for all four companies. All four MNOs aim to commercialise 5G services in 2020 and will invest US\$14.4bn in the five-year deployment phase.

The country's three leading MNOs are believed to have each added up to 30,000 microcells and small cells as infill sites. TowerXchange understand

several tower companies are trying to establish themselves in the Japanese market, but to date their penetration remains negligible.

Laos

In 2018, Laos opened up to towercos, with the national government and local firm Click Lao Marketing and Consultancy signing an agreement with China Tower Corporation (CTC) to establish the Southeast Asia Tower company. According to local

news sources "the Southeast Asia Tower Company will mainly be engaged in the construction, maintenance and operation of communication towers, base stations, power supplies and other supporting facilities, as well as that of indoor distribution systems and transmission systems in Laos."

In February this year, edotco presented a filing at the Bursa Malaysia announcing its entrance into Laos via the purchase of an 80% stake in local entity Mekong Tower Company Ltd. (MTCL). The filing stated that "...the Laos tower market is expected to undergo intense growth in tandem with a national drive towards 4G adoption, with an estimated demand of no less than 5,000 towers over the next 3 years."

The country is home to four MNOs – Beeline, ETL, M-Phone and Unitel – and holds great potential for growth with only 80% SIM penetration and 5.6mn mobile connections (and 7mn inhabitants). The estimated count for the country is 8,000 sites but this figure is likely to go up thanks to the newly launched towerco activities.

Malaysia

After ending talks of a potential merger with Telenor, Axiata Group is now targeting other potential alliances and acquisitions in both Malaysia and Indonesia.

edotco now owns / manages over 11,000 towers in Malaysia, following the initial carve-out of



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4,000 sites from Celcom (Axiata). State-backed and independent towercos own a further 3,500 while OCK, YTL, Naza Communications and Omnix run portfolios ranging between 5,000 and 150 sites.

There are an estimated 22,682 towers now in Malaysia, representing almost 2,000 mobile subscribers per tower. A new ground based tower in Malaysia costs around RM300,000 (US\$69K).

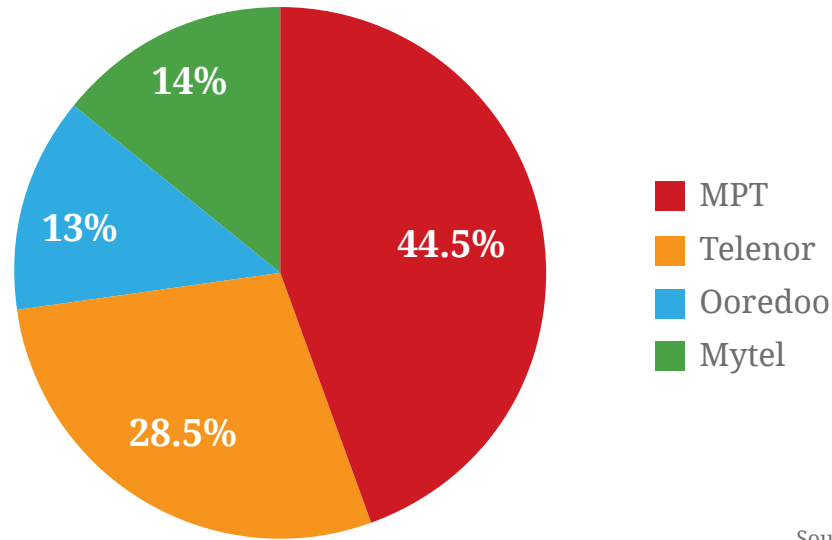
5G is a top priority for the government, who has created a 5G taskforce to support the transition and help the industry with its rollout. MNOs are now building new sites and fiberising their towers while trying to figure out whether partnering with pure fibre players, other MNOs or towercos, while towercos remain cautious about fibre integration in a very populated fibre landscape.

It has been estimated that an additional 8,000 structures may be needed in Malaysia for 4G and with operators exploring 5G, much of the new demand will be met by microcells, lamp-poles, DAS and IBS.

Mongolia

Mongolia is home to four MNOs – G-Mobile, MobiCom, SKYtel and Unitel – and 4.2mn mobile connections with a population of 3.1mn (GSMA Intelligence – Q418). Following the separation of the telecom and infrastructure businesses in 2013, a few infrastructure providers now run towers, active equipment, fibre and microwave backhaul across the 1.5mn sq km Mongolian landscape.

Myanmar mobile market share Q219



Source: TowerXchange Research plus Company Reports

There are approximately 1,000 towers in the country and more than half are shared. Infrastructure providers in the country include State-owned ICNC, Mobi Network and Sky Network.

Myanmar

With around 62% of sites in the country owned by towercos, Myanmar remains an exciting market in which to do business for entrepreneurial towercos. To date, there are around 16,000 sites in Myanmar. Latest entrant MyTel sealed a build-to-suit deal with MNTI – one of the latest towercos to enter Myanmar – for 400 sites of which 371 have already been built. The operator has already invested more than US\$1bn in infrastructure, including the rollout of 30,000km of fibre-optic cable.

Last year, edotco took over the provision of energy services for 1,250 Ooredoo sites. The deal, which has been discussed in a separate interview with Vijendran Watson, edotco Myanmar’s MD, marked a change in the way the towerco operates in the country offer a tower + power model. IGT overpassed 3,000 towers and will continue its organic growth.

The country is definitely moving towards consolidation and last year TPG finally announced the acquisition of Pan Asia Majestic Eagle (PAMEL). The American investor added PAMEL’s 1,300 towers to its existing portfolio of 1,800 Apollo-owned sites, with an enterprise value of approximately US\$1bn. KPR TOWERS also announced the acquisition of Myanmar Infrastructure Group (MIG) and their 100

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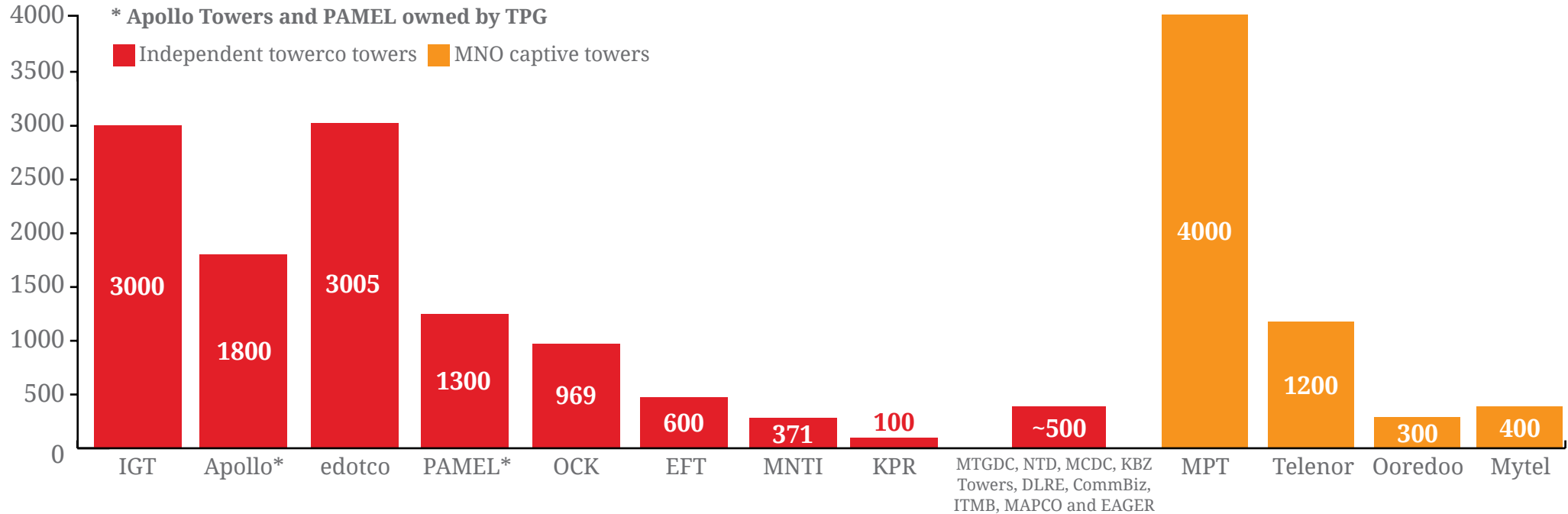
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Breakdown of ownership of the 16,000+ towers in Myanmar

Source: TowerXchange research



towers from majority owners Singapore Myanmar Investco for US\$10.8mn.

Stimulated by the network investment commitments of MyTel, TowerXchange has learned of several new towercos now launching in the marketplace including New Tower Development (NTD), Myanmar Technology Gateway (MTG), MNTH, DLRE, CommBiz, ITMB, MAPCO, MNTI, along with potentially a handful more others.

On average, most of the mature towers that are two-plus years old have a tenancy ratio around 2.0x.

All four operators are currently testing 5G and

regulator PTD estimates that the country could be launching the technology in two to three years.

Grid power is still unreliable even in major cities and power remains the main issue for the industry, with towercos and MNOs relying on gensets and batteries while exploring the benefits of hybrid systems, renewables and lithium-ion batteries to power and cover their operations.

Nepal

Two years ago, Axiata Group closed the acquisition of a majority stake in Nepalese market leader Ncell from TeliaSonera, in a deal believed to be worth

US\$1.365bn. There have been no tower deals in Nepal to date, but this move by the Axiata Group may pave the way for edotco to enter the market in the near future.

Almost two years ago, the Nepal Telecommunications Authority (NTA) published a draft Infrastructure Development and Sharing Regulation, seeking request for proposal from towercos to provide telecom infrastructure services. Although at least eight international firms were interested, the Ministry of Communications and Information Technology (MoCIT) has not issued any license yet. Last summer, NTA threatened to issue an MNO licence to an international player



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due to concerns about the lack of competition and investments in the telecoms market, which is currently dominated by Nepal Telecom, Ncell and Smart Telecom.

Although both NTA and the Ministry of Communications and Information Technology (MoCIT) have been working on different plans to promote infrastructure sharing and the entrance of towercos in the market, we haven't seen any official move so far. In the meantime, Nepal Telecom is building new sites as part of its 4G network expansion.

TowerXchange will be looking to undertake further market studies for a dedicated report on Nepal's telecom infrastructure landscape.

New Zealand

There are early signs of a nascent tower industry emerging in New Zealand, where Spark and Vodafone New Zealand have substantial but ageing tower networks, newer entrants 2degrees have leveraged co-location where possible while building a few hundred towers. 2degrees may have an appetite to sell their towers and partner with a towerco on BTS. Parallel infrastructure is substantial, while the need for improved rural coverage, particularly on the South Island where tourist and agribusiness drive demand, has prompted the government's Rural Broadband Initiative to invest in over 100 towers. A total of around 4,000 macro-towers are supplemented by

around 7,000 rooftop sites, primarily used in the larger cities.

Philippines

After two years of regulatory disputes, Mislattel has finally received its mobile license and the new Filipino operator, who has committed to provide 37% coverage in its first year, has rebranded to Dito Telecommunity. The new entrant, owned by business mogul Dennis A. Uy and China Telecom, is initially investing more than US\$ 2.5bn on the construction of around 3,000 new sites and the company is in advanced commercial and technical conversations with vendors and infrastructure partners, aiming to start its rollout ASAP.

The Department of Information and Communications Technology (DICT) is still set to release the final terms of its common tower sharing policy, which will be the crucial, final step towards the successful creation of a tower industry in the country. The regulator has already signed 22 MoUs with local and international tower providers that aim to be involved in the construction of the 50,000 new sites that Philippines need over the next five years.

In the meantime, incumbents PLDT and Globe are engaging and closing commercial rollout agreements with international and local towercos and none of the operators are currently planning to release any of their assets.

MNOs will continue investing in 4G and 5G deployment as well as modernising existing 3G networks while expanding their coverage to new areas. The big jump in frequency that 5G requires will also drive the deployment of new antenna technologies and urban typologies. Pushed by the new competitor, Globe and PLDT will have to put up more cell towers, antennas, and base stations across the nation, especially in cities where line-of-sight transmissions are more difficult.

Moreover, fibre will present great opportunities for the industry. PLTD's ongoing nationwide fibre-optic rollout program has already set up a number of so-called 'PLDT Smart City' areas.

The entry of a third operator and the tower sharing mandate make the Philippines the must-watch Asian tower market of the moment. There is plenty of potential here, especially if the government is able to come through with significant improvements to permitting approvals.

South Korea

According to GSMA Intelligence, SIM penetration was at 113% among a population of 50.4mn in Q4 2015. South Korea boasts one of the most sophisticated telecommunications infrastructures in the world, cultivating an insatiable demand for high speed mobile broadband among its citizens.

Mobile broadband penetration in South Korea is above 99% and fibre has been widely deployed.

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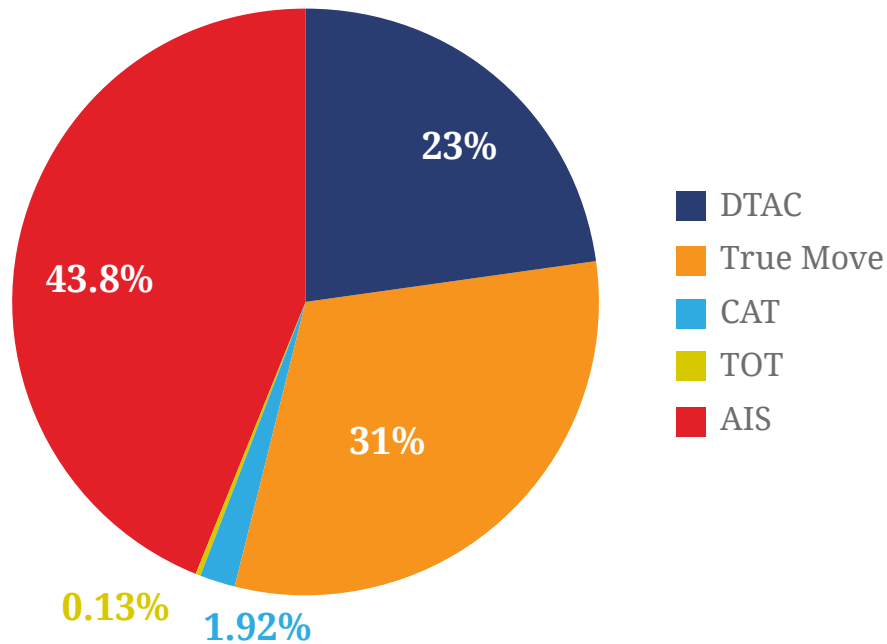
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Thailand mobile market share 2018



Source: TowerXchange

South Korea is a three-operator market featuring SK Telecom, KT and LG Uplus. The Ministry of Science, ICT and Future Planning (MSIP) has tried multiple times over the years to license a fourth MNO, however, failed again in February 2017 as none of the three applicants (Sejong Telecom, K Mobile, and Quantum Mobile) met the criteria.

The Ministry of Science and ICT (MSIT) has revealed that around 260,000 users have signed up for 5G since the three country MNOs launched services. According to the figures provided by MSIT, there are now 54,202 5G base stations in operation across

South Korea. TowerXchange is starting to pick up the first faint signals that towerco activity may be emerging in South Korea.

Sri Lanka

There are approximately 8,000 in Sri Lanka and edotco to date owns 126 sites. It's unclear to date what happened to the nearly 3,400 sites that edotco managed until the end of 2018. High levels of bilateral sharing means tenancy ratios are closer to two than one all over the country. Sri Lanka is now mostly covered with 3G, and 4G is driving need for

cell site densification. Dialog and Mobitel hold all of the 4G spectrum, and any other players that want to offer this will need to engage in RANsharing. There are around 8,000 towers in the country.

Bharti Airtel had been rumoured to be looking at selling its 2,500 towers but seems to have cooled on the idea.

Thailand

With five operators and over 50,000 towers, Thailand could be the perfect tower market but to date, only one company (DIF) acts in the infrastructure industry as a fund with around 16,059 towers and over 1mn km of fibre.

Thailand's #2 MNO True Move has sold 788 telecoms towers, 1,795km of optical-fibre cable and 3,700km of fibre to the Digital Telecommunications Infrastructure Fund. The assets were valued at THN15.7bn (US\$513mn), and True Move will lease back some of the towers and fibre through 2033. True Move also acquired shares in the Digital Telecommunications Infrastructure Fund worth THB4.74bn (US\$154mn), maintaining their stake in Thailand's leading towerco, which had issued new shares, at 30%.

To date, DTIF is the only entity owning towers beyond MNOs. The fund owns over 13,000 towers and 1mn km of fibre.

Recently, the long-term dispute between AIS and

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state-owned TOT has been resolved. The two MNOs had been embroiled in a five-year dispute over the ownership and right to use 13,000 towers, which TOT claimed fell within a build-operate-transfer agreement. The resolution sees a TNB300mn (US\$9.8mn) monthly service fee for AIS to continue using the towers replaced by a ten-year deal in which AIS pays to lease TOT's towers, and TOT uses AIS's space and maintenance services. The deal is reportedly worth THB28bn (US\$915mn).

TOT is also planning to finalise its merger with the other State-run operator, CAT Telecom, by Q2 2020.

In August 2018, an auction of spectrum in the 4G-suitable 1800MHz band took place. However, in spite of much buzz around it, only two operators bid and were awarded just one block each. #1 and #2 MNOs AIS and DTAC took part in the auction and only two of the nine available blocks were sold.

Vietnam

According to the Ministry of Information and Communications (MIC), Vietnam has now 128mn mobile phone subscribers. Although the market is quite mature and saturated, its telecom industry still generated around US\$16.8bn in 2017 (a 7.3% growth YoY) and the local Government is actively promoting the development of telecom technologies and IT initiatives to meet the objectives of sustainable economic growth and international integration. Moreover, the government has recently announced plans to sell large stakes in State-owned

Mobifone and VPTG (which owns MNO Vinaphone) by the end of 2020. MNO privatisation - with a potential entrance of international investment - and the long rumoured sale or carve out of Viettel's towers, could create a whole new and very interesting telecom landscape in the country.

MIC is also preparing the 2600MHz band spectrum auction, which is expected to enhance LTE coverage and capacity across the country. Winning bidders will be required to begin network deployment within 24 months of receiving their spectrum licence, which will notably drive demand for new sites and equipment.

Viettel undoubtedly dominates the game and has around 50% market share with 63mn subscribers. State-owned MobiFone serves approximately 34.8mn customers, followed by VNPT-Vinaphone with 20.5mn. Smaller players Gmobile, with 6mn and Vietnamobile with 3.7mn are trying to increase their piece of the pie and compete with the three giants.

Currently there are an estimated 90,000 towers in Vietnam, and the majority of them remain in the hands of the operators. The towerco ecosystem is still fragmented and there are dozens of very small tower companies owning portfolios of less than 100 sites.

With 2,673 towers as of Q219, we can consider Malaysia-based OCK the market leader. OCK is not planning to build more assets due to mobile market constraints but they are very keen on consolidating

its portfolio and TowerXchange has learned that they are currently negotiating some acquisitions.

Golden Towers and Nisco are the other known towercos of some scale with 350 and 300 towers respectively. The former is now building 100 more towers after closing a BTS deal with MobiFone.

Tenancy ratios is around 1.5 and MNOs do not have plans to sell and leaseback any tower assets and infrastructure sharing among operators is still limited, but there is still much room for growth and positive expectations. Lease rates, which are all denominated in local currency, have grown recently due to inflation and an increase in rental fees. The average cost is VND15mn per month (US\$640 per month), notably lower than Myanmar (US\$900-1500) but still higher than India (US\$550) and China (US\$350).

The market has almost reached its peak in terms of subscribers but everybody across the value chain can find a role in this challenging context. While the government still needs to grasp the benefits of infrastructure sharing, operators can improve their efficiency and relieve their balance sheets by modernising their networks and transferring some responsibilities to towercos. Infrastructure providers can find great opportunities in urban areas, where fibre, 4G and the future deployment of 5G will require significant network investment. Ultimately, vendors can also play a substantial role in this modernisation process by providing more sophisticated monitoring systems and helping both towercos and operators in optimising their assets ■

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Asia heatmap



Legend

- TowerXchange research has not revealed any infracos or towercos to date
- Towercos or infracos active in the market. No recent transactions have taken place and none rumoured to take place soon
- Towercos or infracos active in the market. No current transactions taking place but an attempted tower sale has taken place in the last 3 years or there are unconfirmed rumours of a deal in this market.
- Towercos or infracos active in the market. Rumours of deals confirmed in the market.
- Towercos or infracos active in the market. Deals of significant size have taken place in the last 5 years.
- Towercos or infracos active in the market. Deals have taken place in the last year and more imminent deals rumoured

Note: Russia is covered under Europe; we estimate it to have a 5% towerco penetration and we expect it to be a growth market

Source: TowerXchange



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TowerXchange's who's who in Asian towers - 2019 update

TowerXchange presents an updated A to Z of MNOs, towercos, investors and advisors who are key stakeholders in the Asian tower industry

TowerXchange takes a deep dive into the Asian tower industry, providing an updated (November 2019) edition of its comprehensive directory of the key MNOs, towercos, investors and advisory firms active in the market. Note that stakeholders in the Russian and Central Asian tower markets are covered in the TowerXchange's European who's who.

Keywords: AB Hightech Consortium, Alcazar Capital, Altman Vilandrie & Co, American Tower Corporation, Analysys Mason, Apollo Towers, Ascend Telecom, Asia, Axiata Group, Axicom, BSNL, BTRC, Balitower, Bangladesh, Bangladesh Telecommunication Regulatory Commission, Barclays, Beijing RLZY, Berkshire Partners, Bharti Airtel, Bharti Infratel, Broadcast Australia, CAT Telecom, CITA, CPPIB, Cam Towerlink, Cambodia, Canada Pension Plan Investment Board, Carlyle Group, Centratama, China Independent Tower Alliance, China Mobile, China Reform Corporation, China Telecom, China Unicom, Citi, Common Tower, Delta Partners, Deutsche Bank, DICT, DIF, Dito Telecommunity, edotco, EY, Eco-Friendly Towers (EFT), FMO, Frontier Tower Solutions, Globe, Gmobile, Golden Towers, GTL Infrastructure, Hardiman Telecommunications, Herbert Smith Freehills, Hutchison, IBS Tower, IDFC Alternatives, IFC, IGT, INCJ, ING, India, Indonesia, Indus Towers, Innovation Network Corporation of Japan, Irrawaddy Green Towers, JP Morgan, JTOWER, KIN, Kirtonkhola Tower Bangladesh, KJS, KKR, KPR Consult, KWAP, Kazanah, MIG, MNTC, MPT Myanmar, Macquarie Group, Malaysia, Mitratel, MNTI, MobiFone, Myanmar, Myanmar Investments International Limited, Myanmar National Tele & Communications, National Tower Development, Naza Communications, Nepal, New Silk Route, Nordic Teleservices, North & East Asia, Now Telecom, OCK Group, OPIC, Omnix, Ooredoo, Overseas Private Investment Corporation, PAMEL, PEKAPE, PT, PT Wellington Capital Advisory, Pakistan, Persada Sokka Tama, Protelindo, Providence Equity, Rakuten, Redpeak Advisers, Reliance Communications, Reliance Infratel, Reliance Jio, Reliance Jio Infratel, SACOFA, SEATH, Smart, SREI Infrastructure Finance, STP, Saurava Towers, Singapore, Southeast Asia, Southern Asia, TASC Summit Towers, TOT, Tata DOCOMO, Telenor, Telkomsel, Thailand, Tower Bersama, Tower Vision, TrueMove, Veon, Vietnam, Vietnamobile, Viettel, Vimpelcom, Vodafone Idea Limited, Who's Who, XL Axiata, Yiked Bina

Read this article to learn:

- Who's who of the top towercos active in China, Southern and Southeast Asia
- The history of MNOs' tower transactions across the region
- An introduction to some of the most credible current and prospective investors into Asia towers
- Profiles of the TMT advisory firms with experience of Asian tower transactions

AB Hightech Consortium: One of the towercos licensed to operate in Bangladesh. The company is owned by various local shareholders including ADN Telecom, AB Hightech International, ZN Enterprise, Synergy Logistic and Orange Digital and by foreign shareholders China Communications Services International and Changshu Fengfan Power Equipment Company.

Alcazar Capital: Alcazar Capital Limited (ACL) is an investment advisory firm based in Dubai and focused on private investments advisory and asset management; Alcazar's current portfolio of investments and assets under management exceeds US\$1bn. Alcazar's investments in the tower industry include Irrawaddy Green Towers in Myanmar and Golden Towers in Vietnam.

Altman Vilandrie & Co: AV&Co. has extensive tower industry experience spanning tens of engagements (including Latin America, Africa, Asia, North America, Europe) over ten years, including tower operator strategies as well as tower transaction due diligences. Their recent work has addressed a number of relevant topics such as the impact of small cells, the future opportunity for DAS and the changing role of rooftops.

American Tower: With its headquarters in the U.S., American Tower is to date the largest independent towerco in the world, operating a global portfolio of over 170,000 sites composed of towers in advanced, evolving and developing wireless markets, in the U.S., Central and South America, Africa, Europe, and Asia with its growing presence in India.

American Tower has combined organic with selective inorganic growth in India. In the country, the company's M&A activity began with the acquisition of 1,730 towers from XCEL Telecom for US\$170mn in 2009, continued with the acquisition of 4,450 towers from Essar Telecom for US\$432mn in 2010, and culminated in the acquisition of Viom Networks and their 42,200 towers, announced in October 2015, for US\$1.17bn, taking a 51% stake in the company. In 2018, American Tower sealed two deals with Vodafone and Idea and added 20,100 towers to its portfolio which as of Q219 counts 75,113 pan-Indian towers. Airtel and Vodafone Idea are AMT's main tenants across its Indian portfolio.

Analysys Mason: Analysys Mason are among the 'go-to-guys' for tower market analysis and due diligence on a global basis.

Apollo Towers Myanmar: Apollo Towers runs a portfolio of 1,800+ sites in Myanmar. Ahuja's Tillman Global Holdings and Texas Pacific Group are the majority shareholders of the company, while OPIC (the Overseas Private Investment Corporation) undertook the single largest U.S. direct investment in Myanmar when they invested US\$250mn in the towerco. Last year, TPG acquired PAMEL's 1,300 sites, which created the second biggest tower portfolio in Myanmar, although TPG manages both companies separately. Apollo provides a 'full service' tower and power offering.

Ascend Telecom: Incorporated in 2002, Ascend Telecom is an independent Indian towerco

providing world-class passive telecom infrastructure on a shared, multi-tenancy basis for the mobile services and wireless sector. Ascend Telecom provides site location, design, execution and maintenance of infrastructure for telecom network operators, and is the first Indian company to offer sites with complete passive infrastructure to MNOs, on build-own-lease model (BOL) basis. As of November 2019, Ascend's portfolio included 6,355 towers.

Axiata Group: Axiata is a leading telecommunications group in Asia and has controlling interests in six mobile operators under the brand names of Celcom in Malaysia, XL in Indonesia, Dialog in Sri Lanka, Robi in Bangladesh, Smart in Cambodia and Ncell in Nepal. Axiata also has strategic interests in Indian's Idea and M1 in Singapore. Axiata carved out the first pan-regional towerco, edotco, which operates in six countries to provide optimised, shared telecoms infrastructure, amassing a portfolio of over 31,000 towers and 12,000 km of fibre.

Axicom: Axicom is Australia's leading provider of independently owned wireless infrastructure. The company owns, operates and manages a portfolio of approximately 2,000+ towers in Australia. Crown Castle's Australian subsidiary was renamed Axicom following the U.S. towerco's sale of the business for US\$1.6bn to a consortium including Macquarie Infrastructure and Real Assets, UniSuper and UBS Global Asset Management. In

early 2017 Axicom acquired 56 communications towers from broadcaster Southern Cross Austereo for A\$12.6mn (US\$9.25mn) to expand its footprint.

Bangladesh Telecommunication Regulatory Commission: BTRC was formed on 31st January of 2002, under the Bangladesh Telecommunication Regulatory Act 2001. Its vision is to facilitate connecting the unconnected through quality telecommunication services at an affordable price by introducing new technologies. BTRC has been working on tower sharing guidelines (including a licensing regime), with a draft submitted for final government approval. Additional guidelines in the works include 4G rollout and associated fees. In 2018, BTRC licensed four towercos to operate in Bangladesh as well as handled the 4G spectrum auction.

Barclays: Barclays' global investment banking division offers a leading Technology, Media and Telecoms (TMT) franchise. The TMT team has significant experience representing leading tower operators as well as telecom service providers around the globe on buy and sell side assignments. In this capacity, Barclays has supported its clients in the valuation and/or marketing of tower portfolios as well as the negotiation of various agreements associated with these transactions.

Balitower: Founded in 2006, PT Bali Towerindo Sentra Tbk is a telecommunication tower company that originated in the Indonesian province of Bali. Balitower was listed on the stock market in 2013,

and in 2015 began to expand its footprint outside of Bali, mostly through its partnership with the government of Jakarta, managing the CCTV system in return for rights to exploit the poles as small cell locations. Through year end 2018, its portfolio consisted of 1,589 towers as well as a fibre optic network.

Beijing Miteno Communication Technology:

One of China's leading independent towercos with an estimated 4,500 towers. Miteno also has international ambitions and is an active bidder on tower transactions in Southeast Asia. The company is also a leading tower designer and manufacturer.

Beijing RLZY: Beijing Rui Lan Zuo Yue Technology began operations as a service provider to the three MNOs in China back in the early 2000s, before expanding its business to include tower leasing. It currently has 1000+ assets in its portfolio, which includes a mix of monopoles/towers, rooftops and streetlights.

Berkshire Partners: Berkshire was an early investor in Crown Castle, and currently has active investments in Protelindo (the largest towerco in Indonesia) and Tower Development Corporation in the U.S. and Puerto Rico.

Bharti Airtel: Bharti Airtel is an Indian mobile network operator, and ranks as one of the top four MNOs globally with operations across 20 countries in Africa and Asia. In India, Bharti Airtel carved out its own towerco, Bharti Infratel, and is a partner

in the Indus Towers joint venture towerco. Bharti Airtel initially followed a similar strategy in Africa, creating "Africa Towers" subsidiaries in several countries, before subsequently selling towers in the majority of countries to a variety of African towercos.

As part of the consolidation that has hit all major Indian telecom players and towercos, Airtel has acquired Telenor India as well as Tata's mobile businesses back in 2017. As of Q219, Airtel is the third MNO in India in terms of subscribers behind Vodafone Idea and Reliance Jio.

Bharti Infratel: One of the pioneers of shared telecoms infrastructure, Bharti Infratel was created in 2007 as an independent tower company to provide compelling capex saving opportunities to telecom service providers, while optimally utilising Bharti Airtel's large tower base in India.

Infratel owns and operates 41,050 towers, across eighteen states, and eleven telecom circles, and is still growing. Bharti Infratel also manages Bharti Airtel's 42% stake in Indus Towers which was created as a joint venture between Bharti Airtel, Vodafone and Aditya Birla Telecom to hive off the towers business in fifteen telecom circles.

In 2018, Bharti Infratel and Indus Towers have finally agreed to merge. The merger is expected to create the largest towerco in India and combine the two portfolios and know-how in a giant efficiency and rationalisation effort. The merger is expected to close before year end.

Broadcast Australia: Broadcast Australia owns and operates one of the most extensive terrestrial broadcast transmission networks in the world. With a diverse portfolio of structures ranging from 30m to over 230m masts, and as one of the most mature portfolios, it has the best regional and rural penetration among Australian tower companies across its 622 sites. Servicing not just broadcasters, it provides infrastructure leasing and related services to the majority of the MNOs, NBN Co., as well as other telecommunications players.

It is part of BAI Communications, which provides connectivity solutions in various metropolises in North and South America.

BSNL: BSNL is the State-owned telecommunications provider in India. It is the largest provider of fixed telephony and broadband services with more than 60% market share and fourth largest mobile network operator in India. BSNL has begun the process of carving out its own towerco, and has received "in-principle" approval from the Department of Telecommunications which will establish an inter-ministerial group to work out the capital and organisational structure of the new company, once a market valuation of BSNL's 65,000+ tower assets is carried out. Its merger with the other State-run operator MTNL has long been mooted.

Canada Pension Plan Investment Board:

CPPIB is a professional investment management organisation that invests the funds of the Canada Pension Plan on behalf of its 20mn contributors

and beneficiaries. CPP's tower investments include 10.3% stakes in Bharti Infratel with KKR, bought at US\$951.6mn. It is also part of the consortium led by KKR in talks to buy a significant stake in a combined Bharti Infratel and Indus Towers.

Carlyle Group: Founded in 1987 in Washington, DC, the Carlyle Group is a global alternative asset manager with US\$170bn of assets under management across 299 investment vehicles. In 2012 it acquired ~25% stake in Indonesian towerco PT Solusi Tunas Pratama TBK (STP) for a reported US\$100mn. The firm has been eyeing an exit since 2017.

Cam Towerlink: Established in 2013 in Cambodia by a group of three Malaysian shareholders, Cam Towerlink provides turnkey telecommunications infrastructure solutions for operators, including designing, constructing and operating telecoms towers and small cell sites. One of Cam Towerlink's first projects is to deploy camouflaged telecoms coverage for the first time around the UNESCO protected Angkor Wat temple complex. The company, that provides tower + power, is currently providing services to Smart Axiata, Viettel, Cellcard and Seatel. CTL has ambitious expansion plans and aims to increase its portfolio and expand its footprint into neighbouring municipalities.

CAT Telecom: CAT Telecom is a Thai fixed and mobile network operator, and one of three State-backed companies operating a nationwide network. Thailand's leading MNOs operate their networks

under build-operate-transfer (BOT) partnerships with both CAT and their counterpart TOT, which has led to disputes about tower ownership as the BOT relationships conclude. CAT Telecom and DTAC have been in ongoing discussions to create a joint venture towerco, and transfer 9,000 disputed concession towers into it.

Centratama: PT Centratama Telecommunication Indonesia TBK is a listed towerco providing passive telecoms infrastructure along with its subsidiary PT Centratama Menara Indonesia, formerly known as PT Retower Asia.

As of Q219, the towerco managed 1,937 towers with 1.46x tenancy ratio and 842 in-building DAS sites with 1.87x tenancy ratio.

China Independent Tower Alliance (CITA): The China Independent Tower Alliance was inaugurated on 30 June, 2017, created under the leadership and guidance of the Communications Network Operation and Maintenance Committee (COMC) and in partnership with private towercos, telecom infrastructure builders, equipment and service providers, design consulting firms, academic and research institutes, and more. Its current membership consists of more than 200+ companies and organisations. It also established a provincial presence in Zhejiang this October.

China Mobile: Leading State-owned telecommunications services provider in Mainland China with the world's largest mobile network and

mobile customer base. The MNO reported total customer base of 925mn+ as of Q418. It is listed on both the Hong Kong and New York Stock Exchange (HKEX and NYSE). China Mobile owns 38% of China Tower Corporation, to which all its towers have been transferred.

China Reform Corporation: State-owned fund and asset manager. In October 2015 it injected CNY¥7.7bn (~US\$1.2bn) in cash for a 6% stake in China Tower Corporation.

China Telecom: State-owned telecommunications services provider in Mainland China with the largest fixed-line service. Of the three MNOs in the country, China Telecom is third-ranked, with 303mn+ mobile subscribers as of Q418. All China Telecom's towers have been transferred to China Tower Corporation, in which China Telecom owns a 27.9% stake.

China Tower Corporation: Established in July 2014, China Tower Corporation is the largest towerco in the world with 1.9mn towers. It is owned by China Mobile (38%), China Unicom (28.1%), China Telecom (27.9%) and China Reform Corporation (6%). Its IPO was launched in August 2018 on the Hong Kong Stock Exchange with the raised US\$6.9bn, the largest IPO in last two years. China International Capital Corp Ltd (CICC) and Goldman Sachs were to lead the IPO with other ten cornerstone investors.

China Unicom: State-owned telecommunications services provider in Mainland China, ranked second

behind China Mobile and ranked fourth globally by subscriber base. As of June 2019, China Unicom reported 324mn subscribers. All of China Unicom's towers have been transferred to China Tower Corporation, in which China Unicom owns a 28.1% stake in. Of the three State-owned MNOs in the country, China Unicom was selected along with other SOEs to take part in the "mixed ownership" reform, to bring in additional investments (and potential resources) from private investors such as tech giants Alibaba, Tencent and Baidu.

Citi: One of the world's leading tower transaction advisory groups can be found within the TMT team at Citi.

Common Tower: Common Tower Technologies Sdn. Bhd is an independent tower owner and operator in Malaysia, and is also one of the nation's largest providers of professional site development services to companies in the telecommunications industry. CTTSB owns, operates and manages over 260 tower sites in Sabah following its appointment as the 'State Backed Company' to undertake the TIME2 Project in Sabah since 2005.

Delmec: The tower experts in consultation and engineering, providing global solutions to operators, towercos and regulators on standards, guidance and due diligence for portfolio management. Engaging audit, assessment and analysis for structural enhancement, capacity and maintenance as individual activities or by way of managed services.

Delta Partners: Delta Partners' expertise in tower transactions includes M&As, capital raising, due diligence and strategy support to towercos, telecom operators and investors on network sharing, tower monetisation, transaction execution, structuring and operational streamlining. Most recently, it acted as the sole strategic and financial advisor to edotco on its acquisition of the Towershare portfolio in Pakistan (Tanzanite).

Deutsche Bank: Deutsche Bank provides M&A advisory services as well as financing services in the tower space, including both equity and debt products. Deutsche Bank has been involved in the tower sector on a global basis, successfully executing transactions in North America, South America, Europe, Africa and Asia.

Department of Information and Communications Technology (Philippines): DICT is the primary policy, planning, coordinating, implementing, and administrative entity of the Philippines government that plans, develops and promotes the national Information and Communications Technology development agenda. They are the telecom regulator in the country, now responsible for the common tower share policy that is set to be released before the end of 2019.

DIF: The Digital Telecommunications Infrastructure Fund, formerly known as TRUEGIF or TRUEIF, is a towerco solution created by Thai MNO True. It is Thailand's first telecommunication infrastructure fund which invests in telecommunication

infrastructure assets such as telecommunication towers, fibre optic cable system, transmission equipment, broadband system and/or revenue incurred from the assets, with extensive coverage nationwide. The purpose is to support the sharing use of telecommunications infrastructure, reduce investment redundancy in telecommunication infrastructure and enhance competition among operators to help increase efficiency of network services. The fund was listed in late 2013. The towerco owns approximately 15,271 across Thailand.

Dito Telecommunity: Previously known as Mislattel, Dito Telecommunity is the brand new, third Filipino MNO. The company, owned by local businessman Dennis A. Uy and state-owned China Telecom Corp, has committed to provide 37% coverage at an average internet speed of 27Mbps after receiving its mobile license, and is set to invest more than US\$2.5bn on its rollout over the next few months. The company is in advanced commercial and technical conversations with vendors and infrastructure partners, aiming to build around 3,000 sites over the next year.

Eco-Friendly Towers (EFT): EFT is a subsidiary of diversified Myanmar conglomerate Young Investment Group. EFT secured an order for roughly 700 phase-three towers from Telenor, with ~550 sites built to date. EFT was initially the only towerco able to deploy and manage towers in several Northern Myanmar states, where security can be challenging, but TowerXchange sources

have confirmed that EFT's phase three contract is nationwide.

edotco: edotco is the first pan-regional tower provider in Asia, and is committed to deploying cost-efficient telecommunications infrastructure across the region by enabling competitive access for the industry and connectivity for communities. edotco is a subsidiary of Malaysia's Axiata Group. Through private placements totalling US\$700mn with INCJ, Khazanah and KWAP, Axiata's share is now 62.4%.

With a regional portfolio that includes over 29,924 towers in Malaysia, Sri Lanka, Bangladesh, Cambodia, Pakistan and Myanmar, edotco strives to deliver outstanding operational efficiency in telecommunications infrastructure services and solutions. edotco's tower portfolios in all six countries are managed in real-time at their headquarters in Kuala Lumpur by the state-of-the-art echo monitoring service.

edotco has been growing steadily since its founding in 2012, both organically through tower rollouts across its footprint, and inorganically through acquisitions, and continues to evaluate new opportunities for growth in Asia based on their merits. In 2017, it acquired ~700 towers from Towershare in Pakistan. The towerco's average tenancy ratio across the region is 1.59, peaking at 2.12 in Myanmar.

Etisalat: Emirates Telecommunications Corporation operates in 16 countries across Asia, the Middle

East and Africa. The telecommunications service provider has three opcos in Asia. Pakistani subsidiary Ufone has been exploring the sale and leaseback of its towers for a while now; while there may also be appetite to monetise, carve out or outsource their towers in Afghanistan. Etisalat's Sri Lankan subsidiary retains their towers.

EY: TMT strategy and corporate finance advisory team with extensive experience of advising on tower transactions.

FMO: Dutch development bank 51% government owned, 49% by commercial banks and financial institutions. FMO arranged a subordinated loan of US\$13mn to Irrawaddy Green Towers in Myanmar via its Infrastructure Development Fund.

Frontier Tower Solutions: Founded as an independent tower company by the corporate "parent" of Afghan Wireless Communications Company (AWCC) in 2012, the towerco operated in Afghanistan in the past but has since wound up operations in the country.

Gihon: PT. Gihon Telekomunikasi Indonesia (Gihon) was established in Jakarta in 2001, and has around 867 tenants on 565 towers as of June 2019.

Globe Telecom: Globe is the leading, biggest operator in the Philippines with almost 66mn subscribers. The company's principal shareholders are Ayala Corporation and Singapore Telecommunications. It is listed on the Philippine

Stock Exchange under the ticker symbol GLO and had a market capitalization of US\$3.8bn as of the end of June 2018. Globe is reportedly considering the possibility of carving out and creating its own infrastructure arm as Philippines prepares for a third MNO to enter the market. The company has around 8,000 sites across the country.

Gmobile: Vietnam fourth Mobile Network Operator with 6mn subscribers and 2,000 towers.

Golden Towers: Golden Towers is an independent tower company that operates in Vietnam. The company has around 350 across the country and is set for a big expansion as they aim to build and acquire 2,500 sites in the next two to three years. The towerco has recently closed a BTS deal with MobiFone for 100 new sites.

GTL Infrastructure: GTL Infrastructure is a publicly-listed tower company in India with a portfolio of ~28,000 towers across the country, serving all major telecoms service providers. Founded in 2004 and listed in 2006, GTL Infrastructure began expanding its portfolio in 2008 and acquired 17,500 towers from Aircel. However, the cancellation of 122 operator licenses by the government, slow uptake of 3G and price wars between service providers have left GTL Infrastructure with a heavy debt burden. In spite of the many announcements with regards to its change of ownership, a substantial change is yet to materialise and to date, the towerco is still facing severe financial issues.

Guodong Network: The largest independent towerco in China with a tower count of ~15,000, all through organic growth. Headquartered in Shanghai, it has a nationwide presence in the country and has completed its IPO in 2018.

Hardiman Telecommunications: A unique consultancy equally capable advising on engineering and operational issues as they are on commercial strategy and corporate finance. Extensive experience advising on both the buy-side and sell-side in tower transactions.

Herbert Smith Freehills: International law firm that advised edotco on its transactions with Towershare and Jazz in Pakistan.

Hutchison: Hutchison 3G is an MNO with a presence in multiple countries across Europe and Asia. In recent years, it has been involved in tower transactions in Australia, where some of its assets were sold to Crown Castle Australia (now Axicom), and in Indonesia where it negotiated a sale and leaseback deal of 3,692 towers with Protelindo.

IBS Tower: Founded in 2006 and listed in August 2012, PT Inti Bangun Sejahtera Tbk (IBS) is one of Indonesia's "big four" publicly traded independent tower companies. Starting as an in-building system solution provider, IBS has since focussed its resources on ground based towers, earning it a significant presence in the market. The company owns approximately 5,000 towers as of Q418 and in 2018 embarked in the construction of more than 6,000km of national-scale fiber optic network.

IDFC Alternatives: Private equity arm of IDFC group that manages over US\$3.4bn on behalf of leading institutional investors from across the world. In April 2017 it purchased a 33% stake in Ascend Telecom for US\$91.2mn. The deal involved Rs 365 crore of shares and Rs 220 crore of convertible debentures, as well as IDFC Bank refinancing Ascend Telecom's loans of Rs 620 crore.

Indus Towers: Incorporated in 2007, Indus Towers is a joint venture towerco founded by Bharti Infratel, Vodafone India, Aditya Birla Telecom (Idea) with a portfolio of nearly 128,000 towers. In 2018, the towerco announced plans to merge with Bharti Infratel and create the largest towerco in India and one of the largest in the world (behind Chinese CTC). The merger is currently being delayed and should be sealed in Q419.

ING: Leading Dutch bank with considerable experience of providing debt finance to the tower industry.

Innovation Network Corporation of Japan:

INCJ was launched in July 2009 and is a unique public-private partnership aimed at promoting innovation and enhancing the value of businesses in Japan. It has a market cap of JPY300bn, with the Japanese government injecting JPY286bn and 26 private corporations providing a further JPY14bn. The government will also provide guarantees up to a total of JPY1,800bn for INCJ investments, giving it an investment capability of approximately JPY2,000bn.

INCJ will be established for a period of 15 years. It was part of edotco's private placement in late 2016, investing US\$400mn for a 21.5% stake in edotco. It also invested in IBS firm JTOWER when it first launched.

International Finance Corporation (IFC): The IFC is a member of the World Bank Group, the world's leading DFI. The IFC has invested around half a billion dollars in debt and equity into eight towercos across emerging markets, with an objective to double that total investment by 2018.

In June 2017, it closed its investment in Myanmar towerco Irrawaddy Green Towers (IGT) of US\$95mn (including a parallel loan of US\$42.5mn).

IPT Powertech: IPT PowerTech Group delivers specialised solutions to the power, industrial and telecom sectors in Africa, Middle East and Southeast Asia. The group is recognised as a global leader in the provision of Guaranteed Savings and T-ESCO models, including operating the energy equipment across the footprint of Ooredoo Myanmar.

Irrawaddy Green Towers: IGT is the largest towerco in Myanmar with over 3,000 sites across the country. IGT's sponsors still include Alcazar Capital, plus EPC Investors, M1 Group and Barons Telelink (a local Myanmar company). IGT provides a 'full service' tower+power offering.

Jio: Reliance Jio Infocomm Limited is the brainchild of billionaire Mukesh Ambani, which launched in the fall of 2016 as a 4G LTE mobile network operator

in India. In just over two years, Jio has amassed 350mn customers across India (q219) and was among the main drivers of the major rationalisation and consolidation currently hitting Indian MNOs, leading to mergers between Vodafone and Idea Cellular, as well as Bharti Airtel with Telenor India and Tata.

In 2018, the MNO separated its towers and fibre businesses into two separate entities, with Reliance Jio Infratel now being the largest towerco across India (175,000 sites). The newly created towerco will soon be controlled by Brookfield as part of a 2019 deal worth US\$3.7bn.

JTOWER: Founded in 2012, JTOWER is the sole provider of in-building telecom infrastructure sharing solutions in Japan. Its proprietary in-building Distributed Antenna Systems (DAS) are used in prominent establishments across Japan, including commercial complexes and office buildings, by all three major mobile network operators (NTT DOCOMO, KDDI and Softbank). The system is MIMO-ready active DAS and covers six bands used by the Japanese MNOs.

In late July 2017, JTOWER purchased the IBS component of the SEATH portfolio (120+ IBS in Vietnam) for US\$10.2mn, marking its first expansion outside of Japan; it is also exploring other regional opportunities.

JP Morgan: Leading TMT advisory team with extensive experience in towers, including some

of the landmark transactions. It was the sole placement agent for edotco's transaction with Khazanah, INCJ and KWAP.

Khazanah Nasional Berhad: It is the strategic investment fund of the Government of Malaysia. Khazanah holds and manages selected commercial assets of the Government and undertakes strategic investments on behalf of the nation. It is involved in sectors such as power, telecommunications, finance, healthcare, aviation, infrastructure, leisure and tourism, and property. In December 2016 the fund invested US\$200mn in exchange for a 10.7% stake in edotco.

Kirtonkhola Tower: The towerco is one of the four licensed entities allowed to operate in Bangladesh. The company is owned by Confidence Group.

KJS: KJS is a State-backed towerco created in partnership with the Malaysian state of Selangor. KJS processes all applications related to telecoms in Selangor, and builds and leases telecoms infrastructure to service providers. KJS has built towers, monopoles and lamp poles on private and state agency land in Selangor and owned and operated approximately 500 towers.

Kohlberg Kravis & Roberts (KKR): Kohlberg Kravis & Roberts is a leading global investment firm that manages multiple alternative asset classes, including private equity, energy, infrastructure, real estate, credit and, through its strategic partners, hedge funds. In March 2017, KKR and the Canada

Pension Plan Investment Board (CPPIB) bought a 10.3% stake in Bharti Infratel for Rs 6,193 crore (US\$951.6mn). KKR previously invested in the Indian towerco between 2008 and 2015. Following the merger of Indus and Bharti, KKR and CCPIB will together hold a 6% stake in the newly formed entity.

Komet Infra Nusantara (KIN): KIN as a rollup towerco trading solely in Indonesia, having consolidated the assets of Tara, Komet, Corona, Telematika, and Ida Lombok since 2014. In June 2018, KIN was acquired by Protelindo's mother company Sarana Menara Nusantara.

KPR Towers: Renowned 'tower doctors' – go-to guys for structural and technical due diligence, improvement capex planning, decommissioning and just about anything to do with tower design and maintenance. KPR consultants renamed to KPR Towers in October 2017 and began looking for investment opportunities in Scandinavia, India and Myanmar, where the company is currently finalising a deal to acquire MIG.

KWAP: Kumpulan Wang Persaraan is the second largest pension fund in Malaysia. KWAP took part in edotco's private placement exercise, investing US\$100mn for 5.4% stake in the towerco.

Macquarie Group: Serial towerco investors, with capital at work in Europe within Arqiva and Russian Towers, and farther afield with Axicom (formerly Crown Castle Australia), Mexico Tower

Partners and Viom Networks (now American Tower). Macquarie Capital also has an excellent TMT advisory practice with experience of advising on tower transactions, however, it has recently shifted to focus on its main investments in Asia, rather than advisory.

Myanmar Infrastructure Group (MIG): MIG is a joint venture between majority shareholder Singapore Myanmar Investco (SMI) and Golden Infrastructure Group (GIG). MIG had proved themselves building rooftops and poles for both Telenor and Ooredoo in Yangon, as well as executing a substantial DAS project within Yangon's airport, off the back of which they secured a contract to build 503 towers in phase three of Ooredoo's rollout. MIG had access to the capital markets via SMI's Singapore stock exchange listing. MIG provides a full service tower+power proposition. In October 2016 the sale of MIG to Shining Star International (headquartered in Kunming) for US\$12.7mn was announced; unfortunately a few months later, the deal collapsed. The company is currently being acquired by KPR Towers.

Mitratel: Founded in 1995, PT. Dayamitra Telecommunications (Mitratel) is a wholly-owned subsidiary of PT. Telekomunikasi Indonesia Tbk (Telkom). The company was to be transferred to Tower Bersama Group under an innovative share-swap structure, but the deal was overruled by the Indonesian government in Q3 2015. Mitratel has recently acquired 2,100 sites from Indosat Ooredoo

and its current tower count is 15,213. Mitratel is said to receive approximately 50% of Telkomsel's BTS orders.

MNTI: Small independent towerco created in Myanmar by MNTH after Mytel's irruption. The company closed a BTS deal with Mytel for 400 sites, of which 371 has been already built.

MobiFone: This state-owned operator is the second biggest MNO in Vietnam serving approximately 34.8mn customers. The company owns around 20,000 sites across the country and as all operators do in Vietnam, MobiFone runs the whole operation on their sites, from energy management to fibre deployment.

MPT Myanmar: Myanmar Post and Telecommunications (MPT) is the State-backed incumbent operator in Myanmar, and is also backed by the KDDI-Sumitomo joint venture KGSM. MPT remains the market leader, although its market share declined from 66.6% to 44% from Q4 2014 to now.

In the first half of 2016, MPT started to share its infrastructure with the other MNOs. It has also changed its capex model, shifting to build-to-suit (BTS) with the towercos rather than building through turnkey providers such as Huawei and ZTE. As it awards BTS contracts to various towercos as a test, awarding more orders subject to proven success, MPT was also described as likely to do more co-locations down the road. Since the MPT-KSGM

partnership in 2014, MPT has built approximately 1,200 to 1,300 new towers.

MTNL: Indian State-owned operator currently considering the divestment of its 10,000 tower portfolio as well as a merger with the other State-owned MNO BSNL.

Myanmar Investments International Limited (AIM: MIL): The first Myanmar-focused investment company to be admitted to trading on the AIM market of the London Stock Exchange. MIL was established in 2013. Its largest investment (US\$21mn cost for a 9.3% shareholding) is in Apollo Towers.

Myanmar National Tele & Communications (Mytel): Myanmar's fourth MNO is a joint venture between Vietnam's Viettel and a consortium of 11 local companies (Myanmar National Telecom Holding Public Limited). Mytel received its license in January 2017 and started operations in June 2018, capturing 3 million subscribers on its first three months. Mytel is set to invest US\$2bn within its 15-year license period to deploy and improve its network. The company has already invested more than US\$1bn and has deployed 5,000 Base Transceiver Stations (BTS) as well as rolled out 30,000km of fibre-optic cable.

National Tower Development (NTD): NTD is a new towerco in Myanmar, launching in 2017 to take advantage of the new fourth operator Mytel's network rollout in the country. It also has exclusive

rights to build monopoles and lamp posts in the Mandalay region.

Naza Communications: Formerly known as Premium Radius, Naza Communications is part of privately-held Naza Group in Malaysia. Started in 2014, the towerco is positioning itself to be more than just a site-based asset provider to the mobile network operators in the country, investing in RAN sharing solutions on top of tower leasing.

New Silk Route: New Silk Route is a US\$1.4bn private equity firm that invests in private companies in India, Asia, and the Middle East. Its investments in the telecommunications infrastructure industry include Ascend Telecom in India.

Nordic Teleservices: Founded in 2014, NTS has grown to become one of the leading companies in Myanmar to provide green technology solutions at the lowest carbon footprint in the market for both telecom operators and towercos. NTS specialises in hybrid power solutions, site management and maintenance services for the telecom industry, and are believed to be one of the country's two largest T-ESCOs.

Now Telecom: This niche operator has recently renewed a 25-years franchise to provide fixed wireless, mobile and satellite internet services in the Philippines. Now Telecom only targets enterprises and provides fixed wireless access to different business in Metro Manila using its portfolio of 400 radio antennas that are located in rooftops across the capital.

OCK Group: Founded in 2000 in Malaysia, OCK Group's telecommunication network service provides end-to-end full-turnkey service that includes the design, building and maintenance of telecommunications infrastructure. It was listed on the ACE MARKET of Bursa Malaysia Securities Berhad in July 2012. Since then it has expanded into new markets, including Cambodia, Indonesia, Myanmar and Vietnam.

In Malaysia, OCK owns and manages 424 towers as of Q219. In Myanmar, to date, the Group has completed and handed over 969 sites and is still rolling out its current outstanding orderbook of more than 500 towers. In Vietnam, the Group is currently the largest independent towerco with a portfolio of more than 2,673 sites. As of Q219, OCK owns and operates a portfolio of over 4,000 sites across multiple markets.

Omnix: Omnix was established in 2011 as an independent towerco to meet the operator demand for mobile coverage in urban and suburban areas of peninsula Malaysia. One of its main value propositions is the land bank it secured through government and private site ground tenancy agreements with the Islamic Council in Malaysia, giving it access to highly coveted but difficult to acquire sites. Over the summer it also secured an agreement with the Ministry of Education.

Ooredoo: Ooredoo, formerly known as Qtel, is the incumbent mobile network operator in Qatar, and also has extensive international operations in

Indonesia (Indosat) and Myanmar, where it was one of the original two international operators to receive a license to build telecommunications infrastructure. Indosat served 56.7mn customers while Ooredoo Myanmar 11.1mn as of Q219.

In Myanmar, the company initially chose to retain ownership of power assets when having sites built by third party towercos, outsourcing management of the equipment to ESCO IPT, but recently Ooredoo transferred control of energy management to edotco at their 1,250 sites.

Its Indonesian subsidiary Indosat Ooredoo has recently closed two sale and leaseback agreements with towercos Protelindo and Mitratel. The MNO will be transferring 3,100 on two deals that are expected to generate around US\$452mn.

Overseas Private Investment Corporation (OPIC): The U.S. Government's development finance institution. It mobilises private capital to help address critical development challenges and in doing so, advances U.S. foreign policy and national security priorities. In June 2016, OPIC provided a US \$250mn debt facility to Apollo Towers.

PAMEL: Pan Asia Majestic Eagle Limited (PAMEL, sometimes referred to as Pan Asia Towers or PAT) is currently being acquired by Apollo Towers' majority shareholder TPG. The company initially built 1,250 towers for Ooredoo in Myanmar in phases one and two. Along with Michael Gearon, PAMEL shares management DNA with Indonesia's Protelindo, but remains a distinct entity.

PEKAPE: PT. PERMATA KARYA PERDANA was founded in 2013, beginning operations in mid-2014, with the vision to be a premier telecommunications infrastructure provider in Indonesia. Its mission is to facilitate faster and more economic roll-out of wireless operations throughout Indonesia including countryside and remote areas, as well as urban city centres. Through its partnership with Alfa Mart, one of the leading retailers in the country, PEKAPE is uniquely positioned to offer some of the best locations desired by MNOs for coverage, infill and capacity.

Persada Sokka Tama: The towerco was established in 2006 and has been active mostly in Java and Nusa Tenggara. In March 2019, the PST - which at the time owned 1,017 sites - was acquired by Mitratel.

Protelindo: Brainchild of Michael Gearon and his loyal management team, Protelindo is the largest towerco in Indonesia where they own ~19,152 towers. Over the last two years, Protelindo has significantly improved its scale and credit profile. Its leverage has strengthened through EBITDA growth, enabled by a significant increase in the number of tenancies on its towers.

Protelindo has also begun to diversify into microcell assets and fibre to support the continued organic and inorganic growth of its portfolio. The company acquired iForte in June 2015 along with its 450 microcell towers, seven hotel BTS and 700km of fibre with over 180 PoPs in the city centre and business districts in Jakarta and Surabaya. In

2018, Protelindo announced the acquisition of Providence's backed KIN and its 1,400 towers for a total value of US\$101.7mn. In October 2019, the company has sealed a deal with Indosat Ooredoo for an additional 1,000 sites.

Providence Equity Partners: A global private equity and credit investment firm with more than US\$50bn in capital under management; Providence are communications and media investment specialists. In 2018, Providence sold its stake in KIN to Protelindo and exited Indonesia, in line with its 2017 announcement to exit the Asian market. The firm still owns a 4.8% stake in Indus Towers but following the merger with Bharti, Providence will have the option to either receive cash or shares for 3.35% of its 4.85% stake in Indus, with the balance exchanged for shares. Providence also has capital at work in Brazil with Grupo TorreSur.

Post and Telecommunications Department

(PTD): Part of the Ministry of Transport and Communications, PTD is the telecommunications regulator in Myanmar, responsible for both spectrum and license fees.

PT Wellington Capital Advisory: PT Wellington Capital Advisory (WCA) is a privately-held, fully-independent professional services firm, with offices in Jakarta and Singapore. They assist clients to develop and leverage significant investments in the TMT space within Indonesia and throughout Southeast Asia, with particular

emphasis on opportunities in the rapidly-evolving tower industry.

Q Towers: Independent towerco with ~120 towers and an impressive tenancy ratio of 2.8 in China; one of its backers is a Texas-based hedge fund.

Rakuten Mobile: Last year, Japanese e-commerce giant Rakuten received a license to operate and become the fourth MNO in the country. The company was planning to launch its services in October 2019, but the CEO has confirmed that they won't be offering their services until spring 2020 due some delays on their national network rollout.

Redpeak Advisers: Based in Singapore with a core team of ex-Macquarie Capital staff, including Anupam Garg and Kingston Pang, Redpeak is a boutique corporate finance adviser focused on the TMT sector in the ASEAN region.

Reliance Communications: Reliance Communications (RCom) was an operator part of the Reliance Anil Dhirubhai Ambani Group. In light of the increasing competition and pressure across Indian telecoms, RCom announced its intention to merge with Maxis' Aircel in 2017. The deal was expected to relieve some of RCom's financial pressure and piling debts but it was later cancelled, leading the company to insolvency and to discontinue its voice services.

Reliance Infratel: In an effort to reduce debt, RCom has been trying to sell its ~43,000 towers since late

2015; a period of exclusive negotiations with TPG Capital and Tillman Global Holdings fell through due to a dispute over the valuation of assets. More recently, Brookfield Asset Management was interested in acquiring the towerco's real estate portfolio while Jio is seeking to buy its spectrum and towers. To date though, the company is still dealing with its bankruptcy procedure.

SACOFA: SACOFA is a State-backed towerco providing BTS services and is based in the Malaysian state of Sarawak. SACOFA has over 700 towers across Sarawak, and has signed an agreement with Malaysian MNO U Mobile to expand their network coverage in this state. In addition to its tower portfolio, SACOFA also operates a 950km submarine cable between Sarawak and West Malaysia, and a 4,000km fibre optic trunk network between Kuching and Lawas in Sarawak.

Saurava Towers: Saurava Towers is an Indian towerco founded in 2008, providing managed services and passive infrastructure for telecoms service providers. Services include site acquisition, tower deployment, and site operation and maintenance. The company runs a portfolio of approximately 100 sites in India.

SEATH: The largest towerco in Vietnam was Southeast Asia Telecommunications Holdings (SEATH), itself the product of rolling up three smaller towercos with a reported book value of US\$58.7mn in Q2 2016. SEATH was a holding company owned by VNI (VinaCapital's Vietnam

Infrastructure Limited). According to the company's report from Q1 2015, they had 1,924 towers in Vietnam with a tenancy ratio of 1.2, an EBITDA margin of 54.1% and net margin of 15.2%. In January 2017, the tower portion of the portfolio (1,972) was sold to OCK Group for US\$50mn, with Japan-based JTOWER purchasing the IBS portfolio for US\$10.2mn.

Sino Netstone: Independent towerco in China created in 2013. Headquartered in Beijing, it has an estimated portfolio of about 3,000 tower sites included nearly 1,000 monopoles.

Smart (PLTD): Main and only Globe's competitor in the Philippines, Smart is the second MNO in the country with 62 mn customers.

SREI Infrastructure Finance: SREI Infrastructure Finance Limited is a leading infrastructure financing conglomerate in India, and one of the first companies to lay the groundwork for telecoms infrastructure sharing. Prior to the sale to American Tower, SREI was the managing shareholder in Viom Networks, and merged with associate company Quippo in 2010. Founded by the Kanoria family, Quippo provides construction equipment rental, energy rental, oil and gas equipment rental and telecom tower infrastructure rentals. Quippo is currently exploring tower and telecom infrastructure opportunities outside India.

Solusi Tunas Pratama (STP): Listed on the Indonesian stock exchange in 2011, Solusi Tunas

Pratama's (STP) consolidated its position as the third largest independent towerco in Indonesia with its acquisition of 3,500 towers from XL in December 2014. This followed the acquisition of existing portfolios from other local operators such as Axis, Bakrie and Hutchison. STP started building its own towers in December 2012 to achieve organic growth in addition to acquiring existing portfolios. Shareholders Carlyle and Southern Capital who collectively own ~69% have announced their intention to exit in 2017.

As of Q418, STP owned and operated over 6,451 sites across Indonesia, with a total of 6,412 towers comprising 5,979 macro towers and 433 microcell poles, with 10,492 tenancies, for a tenancy ratio of 1.64x. STP also run two shelter-only sites, 37 indoor DAS networks, and 3,000 km of fiber optic networks throughout Indonesia, including 1,643 km in the Greater Jakarta Region.

TASC Summit Towers: One of the towercos that received a license to operate in Bangladesh. TASC is also the largest fibre operator in the country and have so far connected hundreds of towers to its network. One of the towerco's foreign shareholders, TASC Towers, is mainly active in the Middle East (Jordan, Lebanon and UAE) but has been eyeing opportunities in other regions such as Africa too. TASC Summit lists Summit Corporation Ltd. as local partner and Global Holding Corporation Private Ltd. as additional foreign shareholder.

Tata Teleservices: Tata Teleservices created a joint venture with NTT Docomo in November 2018 and operates in India under the brand Tata Docomo. In October 2017, Bharti Airtel announced the acquisition of Tata Teleservices.

Telkomsel: PT Telekomunikasi Indonesia is the incumbent telecommunications provider in Indonesia, and holds the largest share of the market. Telkomsel has Indonesia's largest and most pervasive tower network, some of which remain on its own balance sheet, some of which have been transferred to wholly owned towerco subsidiary Mitratel. Telkom explored the transfer of Mitratel and its assets to Tower Bersama Group in a unique share-swap deal which was ultimately refused by the government in mid-2015.

Telenor: Telenor is the incumbent telecommunications provider in Norway, and owns networks in twelve countries and has operations in 29 countries including India, Bangladesh, Pakistan, Thailand and Myanmar. Historically, Telenor has tended to partner with towercos rather than sell and leaseback towers. In Thailand, Telenor's subsidiary DTAC is in the process of negotiating a joint venture towerco with State-backed Thai operator CAT Telecom.

In Myanmar Telenor was one of the first foreign operators to obtain a license to build and operate telecommunications infrastructure in this greenfield market, and launched 4G services in the nation's capital Nay Pyi Taw in July 2016.

It has been expanding its 4G services steadily since picking up the 1800MHz spectrum in May 2017 at the price of US\$80mn. It currently has a network of ~7,400 towers, the majority of which are tenancies on private towerco towers, and their network covers roughly 90% of the country's population and townships. It also has retained assets of 1,200 sites, which are predominantly rooftops, which are believed to be up for sale. Total investments in the country are said to be over US\$1.5bn. Telenor Myanmar's subscriber base has grown to ~19mn for Q317, and it holds 40% market share.

Tillman Global Holdings (TGH): Multinational tower and infrastructure investment and operations firm led by Sanjiv Ahuja, former Chairman and co-founder of Eaton Towers and ex-CEO of Orange. TGH has a substantial stake in Apollo Towers Myanmar, which Ahuja chairs, and a joint venture partnership with JC Decaux, giving them the opportunity to locate points of service, particularly small cells, on over 1mn prime locations worldwide.

Tillman Global Tower Solutions: Tillman GTS is a joint venture with Global Tower Solutions, created to tackle both utility scale ground mounted solar solutions, and also to offer financing to or operate Energy Services Companies (ESCOs). Tillman GTS proposes to take the risk, and invest the capex in telecom ESCO projects in Asia and Africa. Tillman is planning to deploy ~US\$700mn of capital for this venture over the next three to five years, either

working to finance contracts for existing ESCOs or building and operating the ESCO themselves with O&M partners.

TOT: State-backed Thai MNO which has entered into discussions with Thai MNO AIS to create a joint venture towerco, but to date no major announcements have been made. Thailand's leading MNOs operate their networks under build-operate-transfer (BOT) partnerships with both TOT and their counterpart CAT, which has led to disputes about tower ownership as the BOT relationships conclude.

Tower Bersama: Based in Indonesia, the Tower Bersama Group comprises several rolled up towercos including PT Tower Bersama, PT United Towerindo, PT Telenet Internusa, PT Batavia Towerindo, PT Bali Telekom, PT Prima Media Selaras and PT Triaka Bersama, all operated seamlessly under one management team. The group's infrastructure extends to Java, Bali, Sumatra and Batam and is currently being expanded into Kalimantan and Sulawesi.

Tower Bersama has steadily grown its tower portfolio organically, as well as through acquisitions of smaller towercos, and with buy and leasebacks with Indonesia's operators. A share-swap to gain control of Telkom subsidiary Mitratel was planned, but was overruled by the government in Q315.

As of Q219, the towerco owned 15,131 sites of which around 60 are DAS networks. With total tenants amounting to 25,459, the tenancy ratio is 1.69.

Tower Vision: Tower Vision is an Indian towerco specialising in the provision of passive infrastructure to the wireless telecommunications industry with expertise in tower rollouts, operation and maintenance. Tower Vision owns and operates ~8,400 sites with a tenancy ratio of 2.0 and offers greenfield towers, rooftops, and in-building distributed antenna systems to MNOs across India. Tower Vision has been rumoured to be a consolidation target for several years.

TrueMove: TrueMove is a State-backed Thai MNO, and one of three companies given a concession to build and operate a nationwide 900 MHz band and 1,800 MHz band network in the 1990s. True has created a separate entity for its tower assets in DIF, an infrastructure fund. To date True hasn't engaged in negotiations with other operators to create a joint venture towerco.

Veon: Formerly known as VimpelCom Ltd., Veon is a leading global provider of connectivity and internet services headquartered in Amsterdam and serving more than 235 million customers. It has operations in Russia, Ukraine, Kazakhstan, Uzbekistan, Kyrgyzstan, Armenia, Tajikistan, Georgia, Algeria, Pakistan, Bangladesh and Italy (as a JV with Hutchison Group).

Vietnamobile: The smallest operator in Vietnam with just 3.6mn customers and around 4,000 towers.

Viettel: Vietnamese military-controlled Viettel is one of the world's most expanding MNOs, having

recently launched operations in Myanmar through Mytel, which became the 10th international market where the company operates. Viettel's overseas footprint extends all the way from Southeast Asia to Africa, and the company has investments in operators in Burundi, Cambodia, Cameroon, Haiti, Laos, Mozambique, Myanmar, Peru, Tanzania and East Timor. Since 2009, Viettel Group has captured more than 90mn customers globally and aims to become one of the world's top ten telecoms companies by 2020.

In Vietnam, Viettel is by far the largest infrastructure player and certainly the biggest 3G and 4G provider with 40,000 macro towers and a total of 67,000 base transceiver stations (BTS).

VimpelCom: See Veon.

Vinson & Elkins: Vinson & Elkins is one of the oldest and largest international law firms, with approximately 700 lawyers located in 15 offices around the world. Its global telecommunications team has extensive experience advising on international telecoms and telecoms infrastructure transactions in numerous countries.

VNPT-Vinaphone: Owned by State-run company Vietnam Posts and Telecommunications Group, VNPT-Vinaphone is the third operator in Vietnam with more than 20 mn customers. The company has 20,000 towers across the country, with a focus on urban areas such as Hanoi and HCMC.

Vodafone: Vodafone Group plc is an international telecommunications company, with headquarters in London, UK. Vodafone owns and operates networks in 26 countries and has partner networks in over 50 additional countries. In India, Vodafone has recently merged with Idea Cellular and created Vodafone India Limited. The MNO is also one of Indus Towers' shareholders. Earlier this year, Vodafone India sold its towers to American Tower. Vodafone also has an opco in Australia, which sold part of their tower portfolio several years ago.

XL Axiata: XL is a mobile operator in Indonesia, and a fully owned subsidiary of the Axiata Group. XL has sought to reduce its tower footprint over the past few years, selling 3,500 towers to STP in 2014, and more recently 2,500 towers to Protelindo in 2016. XL retains a few thousand strategic sites.

Yiked Bina: Yiked Bina Sdn Bhd is a State-backed towerco active in the Malaysian state of Kedah. To date Yiked Bina owns and operates over 200 towers in Kedah, and clients include telecommunications service providers such as Telekom Malaysia, Celcom Axiata, Maxis, DiGi Telecommunication, U-Mobile, Sapura and Wi-MAX operators such as Packet One and YTL Communications.

Zhejiang WanXing Group: A Chinese independent towerco based in Hangzhou City. The company has owned around 700 towers and has its own R&D centre ■

Demand forecasts for passive infrastructure equipment and services in Asia - 2019 update



TowerXchange checks in on demand across six different categories of equipment and services in the fourteen most active Asian tower markets



New Delhi, India

Asia remains the largest and fastest growing region in the world both for investment in telecom tower networks, and for the expansion of the independent towerco business model. Once again, TowerXchange is updating its annual country-by-country review, with a deeper analysis of the products and services required in each market. Please note, Afghanistan and Pakistan are now covered in the MENA edition of this report.

Keywords: Access Control, Asia, Asset Lifecycle Platform, Australia, Bangladesh, Batteries, Best of TowerXchange, Build-to-Suit, Cambodia, Capex, China, Construction, DAS, Decommissioning, Energy, Energy Storage, Fixed Price, Hybrid Power, IBS, India, Indonesia, Laos, Lawyers & Advisors, MNOs, Malaysia, Managed Services, Market Forecasts, Market Overview, Masts & Towers, Meetup Preview, Monitoring & Management, Myanmar, O&M, Off-Grid, On-Grid, Pass-Through, Passive Equipment, Philippines, Procurement, RMS, Sale & Leaseback, Singapore, Site Management System, Small Cells, Sri Lanka, Steelwork, Strategic Consultancy, Thailand, TowerXchange Research, Towercos, Unreliable Grid, Vietnam, Who's Who

Read this article to learn:

- In which Asian countries are a substantial volume of new towers being installed?
- What equipment is being installed on those towers in terms of energy, RMS and access control solutions?
- What has been the progress of small cell, microcell and DAS deployments?
- Who are the leading MNOs and towercos, and what are the prospects for transactions between them?

While gearing up for the sixth annual TowerXchange Meetup Asia, taking place in Singapore, 3-4 December 2019, we offer our readers invaluable insights into the key dynamics of the top Asian tower markets from India to Indonesia, encompassing China, Malaysia, Myanmar, the Philippines, Bangladesh and more.

We're keeping the categories we're reviewing the same as last year, so you can make a like-for-like comparison. We are rebranding one of the categories from its original focus on small cells, DAS and IBS to "Beyond towers" - expanding the scope to include edge computing, fibre, small cells, DAS and IBS.

- **Energy:** our focus in this category is on primary and backup power solutions, energy storage, hybrid and renewable energy solutions for unreliable grid and off grid.
- **RMS, ILM and access control:** is there a need for remote monitoring and access control systems on most towers? Are they connecting to a NOC or to a Site Management or Infrastructure Lifecycle Management platform such as those provided by Accruent, Tarantula or Nexsytone?
- **As a function of the volume of new build,** is there significant requirement for towers and accessories? Or demand for the services of turnkey infrastructure providers in building new towers, decommissioning parallel infrastructure or upgrading existing sites?

- How much demand is there to date for small cells, microcells, DAS and IBS? And what about fibre?
- And finally, is there much prospect for sale and leaseback or towerco consolidation to keep the consultants, lawyers and other advisors busy?

TowerXchange examines the 15 most active Asian tower markets, predicts demand for passive infrastructure equipment and services, and lists the largest towercos and MNOs active in each country. The following matrix is compiled based on hundreds of research calls and meetings with Asia's leading towercos and MNOs in which we've diagnosed their procurement and capex priorities.

Get a deeper understanding of the Asian infrastructure ecosystem and join us in Singapore, 3-4 December for the sixth annual TowerXchange Meetup Asia!

Brief commentary on Asia's less active tower markets:

East Timor: Too small to provide the necessary economies of scale to towercos, therefore TowerXchange has yet to study the market in detail.

Mongolia: In 2013 the government separated telecom service providers from infrastructure providers in the challenging 3mn population, 1.5mn sq km Mongolian market. The infrastructure providers, including State-owned ICNC, Mobi Network and Sky Network, run towers, active equipment, fibre and microwave backhaul. More than half of Mongolia's ~1,000 towers are shared. TowerXchange has yet to study the market in detail.

Nepal: Axiata's acquisition of Ncell from Telia-Sonera may herald the entry of edotco into Nepal. The government is looking to implement a telecom infrastructure provider regime, currently underway and drawing interest from international players. TowerXchange expects to study the market in detail in the coming months.

North Korea: Impenetrable to a Western research firm like TowerXchange, and probably impenetrable to foreign investors!

NG: Digicel seem disinclined to share attractive urban locations, restricting sharing to rural sites in PNG. With no towercos present, there is no impetus for TowerXchange to study the market in detail.


South Korea: No immediate opportunities for tower industry growth, therefore TowerXchange has yet to study the market in detail.


New Zealand: the country could hold interesting opportunities for towercos. Historically, the three New Zealand operators would not share their infrastructure but the government has changed its policy last year as they are very keen on driving infrastructure development in rural and remote areas. That could lead to some action in the local market.


If you have passive infrastructure equipment, services, or small cell solutions, to sell to Asia, then don't miss the 'technology evaluation working groups' and closed-door sessions led by the region's leading towercos and MNOs and hosted at the 6th Annual TowerXchange Meetup Asia on December 3-4 at the Marina Bay Sands, Singapore!


www.towerxchange.com/meetups/asia





Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Beyond towers (incl. Small cells, DAS, IBS, fibre)	Advisors	Towercos	MNOs
Australia	Low	Medium	Medium	Medium	High	Medium	Axicom Broadcast Australia Telstra Infracore Vertel Aird Towers InSite Wireless Group	Telstra Optus Vodafone TPG
	<p>Last year, the country's biggest operator Telstra, which owns approximately 8,000 towers, decided to carve-out all of its non-mobile related assets including data centres, fibre infrastructure, copper, poles and subsea cables into a separate infraco. Telstra's assets are not sufficient to cover clients requirements and the company needs to invest in its improvement.</p> <p>An Australian Federal court is currently reviewing the controversial proposed merger between Vodafone and newest MNO TPG, who has stopped the construction of its network after the country banned its main partner Huawei. The decision will have a massive impact on the telecom landscape and a court denial could force TPG to resume construction of a competitive fourth network, even if the MNO had to incur a premium to change vendors. In the meantime, market leaders Telstra and Optus will continue pushing operational efficiencies and testing 5G implementation.</p> <p>The tower landscape remains relatively static with Axicom, Broadcast Australia and a handful of smaller independent towercos owning around 2,600 towers and a further 1,800 towers having been recently erected by nbn, the Government-owned broadband network.</p> <p>The market is not growing as fast as expected. The country does not have enough tower stock available to meet coverage and capacity needs, and most towerco deals are small build-to-suits.</p> <p>Most of the towercos are initially exploring small cells and getting ready for a future 5G transition. Data storage could also be a natural evolution for towercos in Australia. Rural coverage and the need for remote sites is a potential opportunity for towercos, who are patiently waiting for MNOs to move forward with their network extensions.</p> <p>Grid power remains available in most of the country and backup power sources are not often used, so Australia is not a big priority for tower power vendors. Power is typically a pass-through so MNOs retain responsibility for power.</p>							


Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Beyond towers (incl. Small cells, DAS, IBS, fibre)	Advisors	Towercos	MNOs
Bangladesh 	High	High	High	High	Unknown	High	edotco Bangladesh TASC Summit Towers iSON Tower Bangladesh AB Hightech Consortium	Grameenphone Banglalink Robi+Airtel Teletalk
<p>In August 2018, the telecom regulator BTRC announced its plans to grant four licenses to towercos - namely edotco, TASC Summit Towers, iSON Tower Bangladesh and AB Hightech Consortium. All four companies are majority-owned by Bangladeshi organisations and will seek to rationalise the country's 30,000 towers, with the intent seemingly being to separate the telecom infrastructure from telecom retail businesses.</p> <p>In spite of the nominal change, the towerco sector is failing to make practical moves in the country. In fact, to date no towers have been built by towercos and only edotco owns a considerable portfolio.</p> <p>Recently, the Bangladesh Telecommunication Regulatory Commission (BTRC) has warned Robi and Grameenphone that their 2G and 3G licences could be revoked in light of the dispute over dues that are under scrutiny by the two operators. According to the audits, Robi owes approximately US\$102.5mn and Grameenphone nearly US\$1.5bn. The crisis between the two operators and the BTRC means that they are currently unable to seek approval for any new service and cannot import any equipment necessary for the maintenance of their network.</p> <p>In April 2019, edotco announced its partnership with Zass Energy Services (ZES) to start deploying the very first methanol-based fuel cells in Bangladesh. A move that could open doors to more energy vendors once the other towercos start deploying sites across the country.</p> <p>4G has been introduced in the country in 2018. To date, Grameenphone's network covers 99%+ of the population, with 12,000+ 2G sites and 10,000+ 3G sites, while Banglalink has a portfolio of 5,890 assets, excluding in- building solutions (IBS), which it may add to its planned tower sale process, bringing it up to about 6,000 total. edotco owns and manages a combined 10,095 towers in the country.</p> <p>In spite of the current turmoil, Bangladesh could soon become an attractive destination for tower manufacturers, turnkey firms as well as advisors and legal experts. In fact, towercos are surely eager to acquire portfolios from MNOs as well as taking over any new build in the country - and with an average of 800-1,000 towers going up per year, growth is in the cards in Bangladesh.</p> <p>In terms of energy requirements, the rainy season demands exceptional cell site autonomy which makes Bangladesh a key market for energy, particularly energy storage. edotco has connected over 2,000 of its Bangladeshi sites with its echo monitoring service.</p>								


Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Beyond towers (incl. Small cells, DAS, IBS, fibre)	Advisors	Towercos	MNOs
Cambodia 	Medium	Medium	High	High	Medium	Low	edotco Cam Towerlink	Cellcard/ MobiTel Metfone (Viettel) Smart Axiata Seatel Kingtel Cotel
<p>Cambodia's leading operators, Cellcard, Smart Axiata and Metfone have expanded the reach of their LTE and 4G services and are set to keep extending their networks. Moreover, the establishment of Chinese-backed MNOs Seatel, Kingtel and Cotel is creating a very competitive environment that will drive deployment, and market experts expect around 200-300 new towers to be built in Cambodia per year until 2021, when the emergence of 5G will require new deployment and equipment upgrades. In addition, there is a switch on MNOs' strategy as they are more open to the idea of selling their assets to towercos.</p> <p>The rapidly expanding Sihanoukville, which has become one of the fastest-growing cities in Asia, and the growth of Casinos and online gaming businesses in the city has attracted the attention of many Chinese investors that are massively driving new data demand and increasing the need for new infrastructure. Moreover, China Tower is expected to make an entrance and regional investors from Malaysia and other neighbouring countries are also looking at the Cambodian tower market.</p> <p>Cam Towerlink entered the country in 2016 and is currently involved in its first project: to build towers in and around Angkor Wat in partnership with UNESCO. edotco, which has recently acquired 325 from SEATEL, owns 2,680 towers and manages a further 1,000 MNO sites in Cambodia. The company is planning to deploy around 100 sites in the next six months, while industry experts estimate that the country currently needs 10,000 more sites.</p> <p>Access to grid electricity has expanded in Cambodia to 71.5% but electricity supply is still relatively unreliable and this year, MNOs suffered from major power shortages that impacted their operations and pushed them to explore new back-up alternatives. In addition, 20% of sites are still off-grid in the country. The grid sites are provided both by SOE Electricité du Cambodge and by a range of private microgrids and distributed generation projects. Battery backups are typically installed on all sites, with DG on off-grid, MSC, BSC and hub sites. Power is a pass-through, so MNOs and not towercos remain the buyers of energy equipment.</p> <p>New sites and antennas will be mainly deployed in Phnom Penh, Battambang and Siem Reap, the country's biggest cities, where demand for IBS and urban solutions is increasing.</p>								


Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Beyond towers (incl. Small cells, DAS, IBS, fibre)	Advisors	Towercos	MNOs
China	High	Medium	High	High	High	High	CTC Guodong Miteno Jilin Shuno Bright Financial Leasing Beijing GuoLian ZhengTong Beijing RLZY Zhejiang Longpiao Finance Leasing Beijing Netstone 200+ other independents	China Mobile China Unicom China Telecom China Broadcasting Network
 <p>New tower build continues at a staggering pace in China, creating tremendous demand for steel structures, particularly monopoles, lamp posts / smart poles and rooftop poles. China Tower Corporation (CTC) added 84,000 sites in the last year, bringing their total portfolio to 1,954,000, representing a 96.1% market share. Over 200 independent towercos are also active in China, of which the eight with over a thousand towers are listed in the next column. Independent towercos built around 20,000 towers in the last year. The accelerated rollout of 5G is already a driver of co-location growth: CTC's tenancy ratio is up from 1.44 a year ago to 1.58. CTC is responsible for provision of power systems at its sites, and has created a new subsidiary, Tower Energy, to manage its vast portfolio of backup energy storage systems, and some primary power generation. Tower Energy is already diversifying beyond cell sites to provide energy storage solutions for financial, transportation, medical and electric vehicle customers. Tower Energy has been a pioneer of recycling and re-using lithium-ion batteries from the equivalent of 100,000 electric vehicles. CTC continues to expand into small cells and IBS, their "Social Computer Room" vision can be likened to an edge data centre, while monitoring systems are widely deployed across their portfolio.</p>								


Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Beyond towers (incl. Small cells, DAS, IBS, fibre)	Advisors	Towercos	MNOs
India 	High	High	High	High	High	High	Indus Towers Bharti Infratel Reliance Jio Infratel American Tower GTL Infrastructure Tower Vision Ascend Saurava Towers	Vodafone+India Reliance Jio Airtel+Tata BSNL MTNL Several small players with <4%
<p>India is still undergoing a deep restructuring of its MNO and towerco scenario with a couple of major headlines including the Indus Towers-Bharti Infratel's merger – which should be finalised within the year – and the sale of Reliance Jio Infratel to Brookfield. Additionally, on the MNO front, BSNL is trying to considerably reduce its workforce to rationalise its balance sheet and this might also lead to a tower sale in the future. That said, the industry remains heavily focused on operational excellence. Here are a few key projects from across the Indian landscape:</p> <p>Indus Towers aims at deploying 30,000 smart small cells by 2020. The towerco is developing scalable models for smart cities and deploying what they call “NextGen” sites – aesthetically pleasant, multi-functional towers with an 80-90% lower carbon footprint thanks to their diesel-free power backup solutions. So far, Indus has deployed 2000 NextGen sites across including Delhi and the NCR, Mumbai, Pune, Hyderabad, Jaipur, Kolkata, Bangalore, Mysore, Chennai, Chandigarh, Lucknow and Meerut.</p> <p>In terms of renewable energy, Indus has already deployed solar and biomass solutions across 1,100 sites and plans to scale its renewable programme to cover 50% of all sites by 2021 – a goal in line with its plan to turn into a diesel-free company by the same year. In the meantime, Indus has already halved its diesel consumption and reduced its CO2 emissions by 565mn tons in the past five years.</p> <p>Indus has also started designing and deploying energy-efficient cooling solutions and initiated the indoor-outdoor conversion programme. Another step has been to replace air conditioners with free cooling units (FCUs). Solar-powered cooling units have replaced ACs at sites with a higher active load. Further innovation includes the deployment of batteries using combo or turbo solutions, variable speed diesel generators and more. In terms of batteries, Indus is embracing lithium-ion products. Additionally, Indus is adopting IoT solutions to increase the level of automation and remote management of site-related issues and insights generated through data analytics.</p> <p>GTL Infrastructure is focused on energy and opex reduction too. The company is pushing MNOs to swap their 2G indoor BTS with outdoor ones to reduce the dependence on air conditioning. The towerco is involved in reducing the carbon footprint through various operational initiatives including the deployment of solar, wind and clean energy solutions, free cooling units as well as solar photovoltaic solutions. GTL is opting for lithium-ion batteries as well.</p> <p>Reliance Jio has considerably reduced the use of diesel generators and has installed Lithium-Ion batteries on 80% of its sites. The operator is also working on utilising either solar based solutions (with batteries) or methanol fuel cell systems for the remainder (20%) of its sites with long power outages or completely off-grid.</p> <p>Small cells are widely in demand in India, especially thanks to Reliance Jio's large scale deployment (approx. 150,000 units) and Smart City projects being developed across the country.</p> <p>RMS is widely used in India, as are ILM systems.</p> <p>Seven different ESCOs (ACME Group, Applied Solar, Ardom, Bhaskar Solar, CCE, Pace and OMC) own the power systems at a total of 6,414 sites in India. ESCOs are typically heavy investors in hybrid and renewable energy.</p>								


Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Beyond towers (incl. Small cells, DAS, IBS, fibre)	Advisors	Towercos	MNOs
Indonesia	Medium	Medium	Medium	High	High	High	Protelindo Tower Bersama STP Mitratel IBS Tower Centratama Persada Sokka Tama Balitower PEKAPE Gihon Tower	Telkomsel Indosat XL (Axiata) Smartfren Hutchison Bolt
	<p>Indonesia remains one of the most mature tower markets in the world, with solid tenancy ratios, excellent organic growth, and strong market caps boasted by three major towercos; Protelindo (14,854 towers), Tower Bersama (13,375) and STP (7,000). Additionally, there have been rumours of a potential opening of the tower sector (currently closed to foreign investors) and representatives from the US Government as well as international developers have met with the government to discuss the matter.</p> <p>Many well established private equity firms with investments in the tower sector are now looking for an exit while MNOs are keen on monetising their assets, which will bring plenty of M&A opportunities and could benefit entering towercos while releasing pressure from telcos that will be in a better position to face 5G investments. Moreover, mature towercos are forced to improve their value proposition and looking at new services and revenue streams.</p> <p>Organic growth have picked up over the last couple of years, and the increase of data demand, a populated MNO landscape and new 4G rollout plans from Indosat Ooredoo and Hutch—who are expanding outside Java—will continue driving demand for new sites and co-locations. 5G transition and regulatory restrictions in Jakarta and other urban areas will mean smaller sites, small cells and new technologies, while fibretisation demand from MNOs will continue increasing. Market leaders Protelindo and STP are at the forefront of innovation and both fibre and small cells investments are better positioning them for 4G and 5G transition. Specifically, Protelindo is set to explore VSAT cellular backhaul and mini-data centres through its subsidiary iForte. Microcells and other street furniture are also a big focus for towercos. Indonesian towercos build 3,000-5,000 towers, rooftops and infill sites per year. Tenancy ratio growth compares favourably to many other global tower markets, with around 0.13 tenants added per tower per year.</p> <p>The reliability of the grid in dense urban areas means the opportunity for energy equipment vendors is finite, but there are remote sites requiring significant autonomy, especially on small islands. MNOs are responsible for energy at the macro sites, though end-to-end service is typically outsourced to the likes of Huawei and ZTE, who manage procurement, design, planning, implementation and servicing. We've spoken to RMS and access control vendors with substantial Indonesian contracts.</p>							



Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Beyond towers (incl. Small cells, DAS, IBS, fibre)	Advisors	Towercos	MNOs
Laos	Medium	Unknown	Low	Low	Low	Low	None	LTC Unitel ETL Beeline
 <p>Of the four MNOs in Laos, now three are majority owned by the State. In fact, in addition to LTC and Unitel (of which the State owns 51% stakes), VEON has divested to the Government of the Lao People’s Democratic Republic its 78% stake in Beeline for US\$22mn. #3 MNO ETL was planning an IPO which hasn’t taken place yet.</p> <p>LTC has announced infrastructure upgrades for US\$50mn in 2018, and its plans to take the number of Base Transceiver Stations (BTS) to more than 6,000 (from 5,711 as of Q118). In 2017, the operator invested US\$82.8mn to improve its networks but with 38% 3G and 10% 4G coverage, TowerXchange expects operators to keep investing in their networks over the next couple of years.</p> <p>Laos has a surplus of power generation which they export, so grid availability is good in the country, and new sites can be connected to the grid quickly and efficiently. There are still unannounced outages, so backbone sites have DG and battery backup: 4-6 hours battery backup is standard.</p>								

Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Beyond towers (incl. Small cells, DAS, IBS, fibre)	Advisors	Towercos	MNOs
Malaysia	Medium	Medium	High	High	High	Medium	edotco OCK Omnix Naza Communications YTL Sacofa Touch Matrix D'harmoni KJS Common Tower Infra Quest Yikedbina Perak Asia Space Desabina Others	Celcom (Axiata) DiGi Maxis U Mobile Yes 4G Webe ALTEL Redtone
 <p>Malaysia is one of the most advanced and innovative tower markets in Asia. Towercos own 64% of Malaysia's towers, led by edotco's portfolio of 4,000 towers, 3,500 of which were carved out from from Celcom. A further 3,200 towers are owned by 14 different State-backed and other independent towercos. OCK Group owns ~400 sites and Naza Communications and Omnix Malaysia are also active. There are an estimated 22,800 towers now in Malaysia, representing almost 2,000 mobile subscribers per tower. A new ground based tower in Malaysia costs around RM300,000 (US\$69K).</p> <p>5G is a top priority for the government and they have even created a 5G taskforce that will support the transition and help the industry with its rollout. MNOs are now building new sites and fiberising their towers while trying to figure out whether partnering with pure fibre players, other MNOs or towercos is the best solution moving forward, while towercos remain cautious about fibre integration in a very populated fibre landscape.</p> <p>Innovative leader edotco is exploring new technologies including carbon-fibre structures, multi-tenant small-cells solutions and high capacity antennas for stadiums and public spaces.</p> <p>While around 5% of Malaysia's cell sites are off-grid, data demand has driven the load on some sites beyond capacity, so battery banks are widely used. Demand for infill sites makes Malaysia ripe for the exploitation of street furniture, with DAS and IBS starting to be deployed by edotco and MNOs. edotco has already selected its RMS and site management system, consolidated in their echo service, which is provided to over 3,000 of their Malaysian sites. Both towercos and MNOS also exploring hybrid solutions for their off-grid sites (around 10%) and most of the telco players are gradually switching to lithium batteries in an effort to go greener and reduce theft.</p>								

Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Beyond towers (incl. Small cells, DAS, IBS, fibre)	Advisors	Towercos	MNOs
Myanmar	High	High	High	High	Medium	High	IGT Apollo edotco PAMEL EFT MNTI KPR ATM Towers OCK NTD Myanmar Technology Gateway (MTG) MNTH DLRE CommBiz ITMB MAPCO KBZ (rooftop only)	MPT Telenor Ooredoo Mytel
 <p>Myanmar is one of the most dynamic and interesting markets in Asia, with 62% of the assets owned by towercos.</p> <p>Last year, operators Ooredoo, Telenor and MPT secured 1800MHz spectrum for 4G rollout and the entrance of 4th player Mytel has prompted several local new towercos to launch. Mytel has recently sealed a BTS deal with new towerco MNTI and has already invested more than US\$1bn in infrastructure, including the rollout of 30,000km of fibre-optic cable as well as deploying 5,000 base transceiver stations. Market leader IGT is deploying 300 more towers before the end of the year.</p> <p>Myanmar has one of the lowest electrification rates in Asia. There are around 15,827 towers in the country and almost 75% of them are off grid, with towercos expending between US\$800-1200/month to provide energy in remote locations, where robust primary / backup power systems are needed. Energy storage is therefore an operational priority and the use of lithium-ion batteries is expanding in the country. New operator Mytel is installing lithium-ion batteries in all their remote sites as they guarantee a longer life cycle. Most towercos are exploring renewables, with solar appearing as the most reliable alternative. edotco has recently taken over the provision of energy services for 1,250 Ooredoo including power in its offer for the first time, a trend that other towercos might follow. The Malaysian towerco is actively exploring infrastructure innovations across Asia, and has installed the very first carbon fibre tower in Myanmar, while evaluating the possibility of installing a few bamboo towers using local materials as part of their innovation and sustainability policy.</p> <p>ESCOs play an increasing role in Myanmar, where IPT PowerTech operates the power systems at 2,200 Ooredoo and PAMEL sites, while Voltalia secured an initial 171 site contract with MNTI.</p> <p>Moreover, the huge data boom is also pushing towercos and MNOs to explore small cells, rooftops, street furniture and any kind of urban solutions, most of which will have to be supported by fibre.</p>								


Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Beyond towers (incl. Small cells, DAS, IBS, fibre)	Advisors	Towercos *	MNOs
Philippines 	Medium	Medium	High	High	Medium	High	*Signed MOUs with DICT China Construction ISOC Infrastructures ISON ECP Tower edotco RT Telecom IHS Towers China Energy Equipment Co. Aboitiz InfraCapital Inc MGS Construction Inc. American Tower Frontier Tower Associates Phil Tower Consortium JS Cruz DT Towers Korea's Shinheung ALT Global Solutions Inc. LCS Holdings Inc. China Construction First Group Corp. ACODA Towers CREI Management Services FZE Tamoin Industrial Services Corp. EEI Corp. Tiger Infrastructure Pte. Ltd	Globe PLDT Dito
<p>After two years of regulatory disputes, Mislattel has finally received its mobile license. The new Filipino operator, which is rebranding as Dito Telecommunity, has committed to provide 37% coverage at an average internet speed of 27Mbps in its first year, with an initial investment of more than US\$2.5bn, and the company is in advanced commercial and technical conversations with vendors and infrastructure partners, aiming to start its rollout after the summer. Dito has to build 3,000 sites in less than a year and all key industry stakeholders are patiently awaiting for DICT's to release the common tower policy before making the final move.</p> <p>For now, incumbents Globe and PLDT won't sell any assets but the market will soon bring plenty of opportunities for new builds and network upgrades. The Philippines is one of the most underserved markets in Asia and new MNO Dito—fully supported by China Telecom's financial strength—will be relying on towercos and turnkey providers to fulfil its commitment, while incumbents Globe and PLDT will step up their games to maintain their position on this new, competitive scenario.</p> <p>With exponential data growth and both PLDT and Globe already testing 5G, new infrastructure providers should consider fibre and small cells. Urban areas will be the immediate target for Dito in order to achieve the committed level of coverage, so light poles, smaller sites and urban antennas will be in demand.</p> <p>For now, all three operators will continue focusing on urban areas, but some off-grid solutions and plenty of back up and green power alternatives will be required when they start expanding coverage to more rural and remote areas.</p>								

Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Beyond towers (incl. Small cells, DAS, IBS, fibre)	Advisors	Towercos	MNOs
Thailand 	Medium	Medium	Medium	Medium	Medium	Medium	DIF	AIS DTAC (Telenor) True MY(CAT) TOT
<p>Thailand's #2 MNO True Move has sold 788 telecoms towers, 1,795km of optical-fibre cable and 3,700km of fibre to the Digital Telecommunications Infrastructure Fund. The assets were valued at THN15.7bn (US\$513mn), and True Move will lease back some of the towers and fibre through 2033. True Move also acquired shares in the Digital Telecommunications Infrastructure Fund worth THB4.74bn (US\$154mn), maintaining their stake in Thailand's leading towerco, which had issued new shares, at 30%.</p> <p>To date, DTIF is the only entity owning towers beyond MNOs. The fund owns over 13,000 towers and 1mn km of fibre.</p> <p>Recently, the long-term dispute between AIS and state-owned TOT has been resolved. The two MNOs had been embroiled in a five-year dispute over the ownership and right to use 13,000 towers, which TOT claimed fell within a build-operate-transfer agreement. The resolution sees a TNB300mn (US\$9.8mn) monthly service fee for AIS to continue using the towers replaced by a ten-year deal in which AIS pays to lease TOT's towers, and TOT uses AIS's space and maintenance services. The deal is reportedly worth THB28bn (US\$915mn).</p> <p>TOT is also planning to finalise its merger with the other State-run operator, CAT Telecom, by Q2 2020.</p> <p>In August 2018, an auction of spectrum in the 4G-suitable 1800MHz band took place. However, in spite of much buzz around it, only two operators bid and were awarded just one block each. #1 and #2 MNOs AIS and DTAC took part in the auction and only two of the nine available blocks were sold.</p> <p>While grid power is widely available, electricity continues to become more expensive, fueling appetite for renewables and energy efficiency.</p>								

Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Beyond towers (incl. Small cells, DAS, IBS, fibre)	Advisors	Towercos	MNOs
Singapore 	Low	Unknown	Low	Medium	High	Medium	None	SingTel StaHub M1 TPG Telecom
Sri Lanka 	Medium	Medium	Low	Medium	Medium	Low	edotco	Airtel Dialog (Axiata) Etisalat Hutchison Mobitel

There are no towercos and there is hardly any infrastructure sharing in the mature Singaporean mobile market, but the imminent entry of a fourth MNO may change that and create opportunities for some, although not all, vendor segments. Grid power is reliable in Singapore so energy equipment is limited to simple battery backups. Most of the new sites in Singapore will be IBS, DAS and small cells for infill and indoor coverage. If the fourth MNO is not permitted to share the incumbents' ~1,000 GBTs and ~5,750 rooftop and lamppost sites, then expect some new build, but more likely the new entrant will stimulate infrastructure sharing, and perhaps an opportunity for an independent infraco.

edotco owns and manages a combined 3,400 towers, representing 40+% of the country's 7,500 to 8,000 towers. edotco monitors selected Sri Lankan sites with its echo RMS service. Sri Lanka is reaching the saturation point for the number of towers required to provide coverage. 4G spectrum is available only to Dialog and Mobitel; the remaining operators will need to engage in RANsharing to provide these services. An estimated 1,500 to 2,000 towers or special structures will be required for infill. Grid is at acceptable levels and improving.

Vendor opportunity matrix	Energy	RMS, ILM and access control	Tower manufacture	Turnkey infrastructure	Small cells, microcells, DAS and IBS	Advisors	Towercos	MNOs
Vietnam	Low	Medium	Medium	High	Medium	Medium	OCK Group Golden Towers Nisco Dozens of small local towercos	Viettel MobiFone VinaPhone Vietnamobile GMobile
	<p>Earlier this year, the Vietnamese government announced plans to sell large stakes in state-owned Mobifone and VPTG (which owns MNO Vinaphone) by the end of 2020. MNO privatisation—with a potential entrance of international investment—and the long rumoured sale or carve out of Viettel’s towers, could create a whole new and very interesting telecom landscape in the country. And that will indeed attract the interest from regional towercos and infrastructure investors. Moreover, the Ministry of Information and Communications (MIC) is preparing the 2600MHz band spectrum auction, which is expected to enhance LTE coverage and capacity across the country. Winning bidders will be required to begin network deployment within 24 months of receiving their spectrum licence, which will notably drive demand for new sites and equipment.</p> <p>Market leader Viettel owns and operates around 40,000 sites in Vietnam. Efficiency is now Viettel’s operational priority and the company wants to progressively modernise its network towards automation to take advantage of data and ultimately reduce cost. However, their network was built 15 years ago and integrating new monitoring systems, sensors and data analytics tools into their old equipment is presenting a huge challenge. In addition, any potential tower venture from the market leader will require considerable network upgrades on its single-tenant network.</p> <p>On the towerco front, SEATH owns 2,000 sites and its main shareholder OCK has allocated US\$5-8mn for its expansion, with plans to build 200 to 250 sites per year in the country. OCK may seek to consolidate other members of a fragmented group of around 30 local towercos who between them own ~10,000 towers. Golden Towers’ has around 350 sites across the country, with a big presence in rural areas, where tenancy ratios are lower, which is compensated by cheap land cost. The company is set for a big expansion as they aim to build 2,500 sites in the next two to three years and has recently closed a BTS deal with MobiFone for 100 towers.</p> <p>MNOs, who are now partnering with vendors and infrastructure providers on 5G testing, run the whole operation on their towers, from energy management to fibre deployment. Most of the towers are now made in Vietnam and operators do not require sophisticated energy systems nor hybrid solutions since the grid is very accessible and reliable, but the unstable climate forces MNO to heavily invest in batteries and generators for back up. Viettel relies on gensets and lithium batteries for backup - they do not buy acid lead systems anymore - and modern air conditioning and cooling systems are extensively used to reduce energy consumption. Although numbers are not huge, Viettel has worked with a couple local partners and deployed some solar systems in remote locations to overcome grid inaccessibility. In urban areas, in building solutions and camouflage antennas can bring opportunities to infrastructure providers in the country.</p> <p>JTOWER, an in-building solution (IBS) specialist recently expanded beyond its home market in Japan to Vietnam as it acquired the IBS portion of SEATH for US\$10.2mn. This is said to be the largest IBS portfolio in the country, which included over 120 systems.</p> <p>Organic growth has been limited by the degree of parallel infrastructure, but new spectrum auction, upcoming sector privatisation and 5G rollouts will require plenty of new sites as well as a push in small cells and new urban typologies. Ultimately, vendors can also play a substantial role in this modernisation process by providing more sophisticated monitoring systems and helping both towercos and operators in optimising their assets.</p>							

New business models and new opportunities for towercos



What parameters define towercos' appetite for innovation? And what specific diversification opportunities are they exploring?



By Kieron Osmotherly, CEO, TowerXchange

How do towercos think about innovation? Into which categories of communications infrastructure are they diversifying? While the source for this report was a panel session and roundtables at the TowerXchange Meetup Americas 2019, the insights are applicable worldwide, as all towercos are ordering from the same menu of innovation. For starters, they'd like some non-traditional tenants on their existing towers, plenty of fibre with perhaps a side of small cells for the entree, edge data centres as the icing on the cake.

Keywords: 5G, Amercian Tower, BTS Towers, Bankability, Business Model, DAS, Data Centre, Edge, Fibre, Infill, Infraco, Mexico Tower Partners, Multi-Region, NetEquity Networks, Phoenix Tower International, RANsharing, Research, Small Cells, The Future Network, Towercos

Read this article to learn:

- Retaining investor buy-in: why towercos are inclined to diversify into communications infrastructure opportunities similar to towers
- What is the right kind (and location) of fibre for towercos to be interested?
- How are towercos leveraging small cells and DAS for infill?
- How will towercos respond to the opportunity of edge computing? Provide space or provide service?
- Will towercos engage with active infrastructure and/or enable RANsharing?

This commentary is drawn both from a panel session focusing on new business models for tower companies, held at the 6th annual TowerXchange Meetup Americas (July 9-10, 2019), and also from a round table breakout on a similar topic. As the round table was held under the Chatham House Rule, the sources of insights and quotes are not attributed. However, many remarks from the panel session are attributed to the relevant participant, who we thank for their contributions:

Moderator:

- Isfandiyar Shaheen, CEO, NetEquity Networks, and formerly a Director at MENASA towerco Towershare

Panelists:

- Gonzalo Cornejo, CFO, Mexico Tower Partners (MTP)
- Mariano Gomez, Vice President, Business Development, BTS Towers
- Steven Haymore, Director, M&A and Managing Counsel, Latin America, American Tower
- Don Van Splunteren, Global Vice President of Sales, Phoenix Tower International (PTI)

For the sake of clarity, readers should not assume that non-attributed quotes originated from one or other panellist, because in most cases they didn't.

Introduction: the parameters that define towercos' appetite for innovation

Many of the world's largest towercos have access to substantial cash flows, cash reserves and low cost capital: they have the resources to diversify

beyond ‘vertical real estate’. In many cases, the scope of potential diversification is limited to categories of communications infrastructure that are adjacent to towers; typically business models that are still predicated on generating long term revenues through building or buying then leasing communications infrastructure to credit-worthy tenants.

However, large towercos are cautious about diversifying beyond their core tower business for fear of diluting their focus and adversely affecting their robust valuations. If large towercos are to evolve and diversify, they must retain the buy-in of a relatively conservative base of investors, many of which favour investing in the tower industry precisely because of its laser-beam focus on ‘vertical real estate’ – by which we mean the purity of their investment in masts, towers and rooftop sites for the wireless industry. So large towercos have the resources to innovate, and they are innovating, but they are doing so with caution.

In contrast, smaller, privately funded, independent towercos are sometimes free to innovate and act with more agility and flexibility to embrace opportunities to diversify into adjacent categories of communications infrastructure.

The tower industry has emerged as a more efficient business model for the deployment of capital into communications infrastructure than the vertically integrated Mobile Network Operator. The extraction of towers into specialist infrastructure companies has functioned as a remedy for the overlapping tower networks originally built by

MNOs. Through organic new build and inorganic acquisitions, towercos now own 68.8% of the world’s investible towers and rooftop sites, creating a new infrastructure asset class with a US\$330bn global valuation, creating efficiencies and value by sharing those towers with multiple MNOs, and with other tenants.

The emergence of tower companies has been one of the success stories of the wireless era. But how will towercos sustain their impressive growth and

margins? How do they find comparably stable cash flows, which their investors have gotten used to? And how do towercos ensure their proposition, products and services remain indispensable in an era when networks are being transformed as data demand continues to grow exponentially?

Picking up that theme, Gonzalo Cornejo, CFO of MTP, the leading independent towerco in Mexico with 2,500 sites, asked: “Where is growth going to come from? We have seen lots of opportunities to

A glimpse into American Tower’s innovation program

American Tower has invested a billion dollars into their innovation program. Much of that capital has been deployed into acquisitions focused on provisioning fibre to the tower in five countries to date, but they’re not putting investments into U.S. fibre in the same magnitude as Crown Castle and Digital Colony. American Tower are also exploring opportunities in small cells, smart poles, IoT, energy as a service, and edge data centres. In doing so, American Tower is adapting to meet the changing needs of their clients, whilst plotting a roadmap for the potential future evolution of their business.

American Tower is innovating at a carefully controlled velocity and scale – moving from ideas to proofs of concept to regional pilots. By starting early, making small investments, and doing small acquisitions, American Tower is learning in which adjacent categories of communications infrastructure they can add value, where they don’t add more value than other actors, and eliminating innovations that may prove value destructive.

Designed to position the company for continued success in a 5G world, the American Tower innovation program has three key prongs:

- Leveraging existing assets for additional applications
- Evaluating new communications real estate architectures
- Capturing opportunities to serve new tenants beyond their traditional MNO client base

While American Tower is committed to innovation, that doesn’t mean they’re making a radical shift away from a focus on macro towers, indeed they are explicitly targeting macro tower-like returns on innovation investments ■



Innovation panellists

invest in macro towers in recent years, and into the medium term, but that won't continue in the same rhythm, so where will growth then come from?"

"As wireless operators have evolved in the smart phone era, so our business must evolve," suggested Mariano Gomez, VP Business Development for BTS Towers. "There's plenty of money still to be made in macro sites development, and wireless operators' CTOs have less money than ever for deployment."

PTI owns and operates over 7,000 towers in 14 countries, from the U.S. to Argentina. PTI Global

VP of Sales Don Van Splunteren asked "Where is the technology taking us? Telecom infrastructure depends on how the network needs to be designed, and technology dictates how the network needs to be designed. For example, massive MIMO enabled us to increase capacity, but ultimately created different antenna configurations and different infrastructure needs."

"The questions we are asking about innovation are: in what sectors and in what business models can American Tower add value for our clients?" Asked Steven Haymore, Director, M&A and Managing

Counsel. "We are not always going to be the best company to play in different spaces. So we're thinking about where we can add value, while respecting our shareholders and maintaining fundamentals of the tower industry."

PTI's Van Splunteren echoed Haymore's view "We like the fundamentals of the tower model very much: long term, non-cancellable contracts, the capex intensity, relatively light opex. We want to respect those fundamentals."

What is the right kind of fibre for towercos to be interested?

PTI's Van Splunteren continued: "We like fibre. We would prefer to concentrate on dark fibre, getting a contract, constructing a different model. We're less keen on lit fibre – it's more of a service than passive infrastructure."

With upwards of 30% of cell sites in CALA not yet fiberised, PTI are not alone in investing in FTTT – that has been the focus of American Tower's forays into fibre, albeit focusing to date beyond the U.S., including Mexico and Argentina. During their Q119 earnings call, American Tower Chairman, President and CEO Jim Taiclet said the company had "made some relatively small investments in international fibre... but continue to view U.S. fibre assets as inherently less attractive, due to the extensive availability of competitive fibre supply in the U.S. and the resulting less attractive growth and return characteristics of domestic U.S. fibre."

Panel moderator Isfandiyar Shaheen of NetEquity Networks emphasised the commonalities between towers and fibre: “fibre is a long term asset – futureproof in terms of bandwidth – which like towers provide long term, predictable cash flows. What are the challenges to applying a similar financing construct as we have to towers to a long term asset like fibre?”

“We’re thinking how we can create contracts and business models more similar to the tower industry than what we see in the fibre industry,” said American Tower’s Steven Haymore. “My personal view is that when we look at wholesale, neutral host, fibre providers with long term contracts, if we can setup contract conditions and margins similar to a tower sale and leaseback transaction, we might be able to unlock some capital and resources for the fibre space.”

BTS Towers’ Mariano Gomez added: “A lot of the capability to deploy fibre at scale is determined at municipal level. If they don’t help by providing rights of way, we’re at an impasse.”

Isfandiyar Shaheen called attention the example of Open Fiber, to a joint venture in Italy between energy company Enel and investment bank CDP. Open Fiber is a wholesale only, FTTH infrastructure-as-a-service play, which last year secured EMEA’s largest fibre project finance package (€3.5bn) to facilitate rollout of their ultrafast network. “My personal thesis is to leverage the electrical grid to provide fibre and bridge the digital divide,” added Shaheen.



Mariano Gomez leads the innovation round table

Infill sites: small cells, DAS and other alternate site typologies

The rollout of modern wireless networks using lower and mid-band spectrum has enabled radio network planners to rely on a relatively low number of high sites, primarily the macro towers that form the majority of towercos’ portfolios. But as carriers start to use millimetre wave spectrum for 5G, and as legacy macro networks become overloaded, radio network planners need more sites. And as they need

more sites, interference becomes an increasing problem. As a result, low height, low power densification sites are being added to networks both outdoors and indoors. How must towercos evolve to meet the changing characteristics of today’s radio networks?

Many towercos have diversified into alternate site typologies. For example, at the end of 2018, PTI acquired Syscom Telecom, a company with 80,000 billboard-mounted wireless sites, primarily in the

U.S., but PTI also has 2,000 such sites in Colombia. “Billboards are great infill sites,” said PTI’s Don Van Splunteren, “as they offer low elevation, powered sites, near populations and high trafficked areas. Billboards will be particularly useful as operators start using millimetre wave spectrum and seek to cover smaller distances with smaller search rings.”

As cities become more and more densely populated, and as networks become more crowded, capacities need to increase, and small cells may emerge as a valuable opportunity. But, at an event and in a report focusing on Central and Latin America, it should be noted that there remains a five-plus year lag to the U.S. market, where carriers are actively deploying small cells. CALA is not a completely nascent market though.

“We see demand for small cells, especially in Brazil with Phoenix Tower do Brasil, plus some in Mexico,” said Van Splunteren.

As for who will take the lead when small cells are rolled out in volume in CALA, in the words of one small cell vendor at a round table: “the era of selling small cells to a single MNO has passed. The economics simply don’t make sense if they are not shared.”

DAS continue to be deployed in selected use cases – most CALA towercos have a few DAS in their portfolios. But cost and complexity means we’re seeing less investment in DAS by both MNOs and towercos, and often it’s now the facility owner who pays for the DAS.

American Tower shares early insights into their thinking on the edge

FierceWireless reported on comments made by American Tower SVP Rod Smith at the Oppenheimer investment conference in August 2019.

Smith intimated that the concept of edge computing wasn’t happening quite yet at the base of the towers, “but we think there could be a day where the latency in a 5G network is so important that having that edge computing right at the base of a tower.” American Tower reportedly has already located a number of small data centres at the base of towers, increasing revenue from the sites, although they don’t think this represents true edge computing yet. Smith continued: “The most important thing there is we’re learning about how to deploy these things, we’re learning about the cost of deploying small data centers,” including the power and cooling needs that goes into them so that if edge computing does land at the base of a tower, American Tower will be ready to execute on that ■

Edge

“Everyone has heard about moving service to the edge,” said Van Splunteren. “It’s a great opportunity, and it’s a real estate play: saving on the time and cost of transporting data needs secure space, close to fibre. The FANGs (Facebook, Amazon, Netflix and Google) don’t want one single episode of Game of Thrones sitting middle of the country, they want to bring that closer to the subscriber. We are starting to see the emergence of companies specialising in edge data centres, and we’re starting to get inbound requests regarding our real estate. But it’s still a nascent market. We don’t expect volume for four to five years, until the 5G era.”

“I agree that edge data centres are currently a nascent market,” added MTP CFO Gonzalo Cornejo. “That might give us a couple of years to think which model each towerco would like to see. There’s

a model respecting our fundamentals, wherein we provide white floor space with power and security. Then there’s a model when we provide the whole data centre service, but some of the tower fundamentals are not present: there many different contracts, those contracts are of relatively short duration and higher churn, and there is more exposure to technology. We try to follow the fundamentals of the tower business – we don’t want to get involved in providing service to end users – we want to provide service to MNOs and to the FANGs.”

“American Tower has recently acquired Co-lo Atl in Atlanta,” said Steven Haymore. “We see it as an opportunity to learn about the edge. We want to see it as a potential extension of our focus on passive infrastructure, and we feel we can add value both through capital allocation and operationally. We want to meet the evolving needs of MNOs and of

FANGs in the 5G era. American Tower believes there's a real commercial opportunity to build incremental income from new clients from our existing assets, although it might not be for a while in Latin America."

Experts estimate that adding an eight rack edge data centre to a cell site could add 20KW to the power load – possibly more than the grid can provide. Whilst towercos in the Americas cling to their 'steel and grass' model, and seldom provide energy as a service, co-locating edge data centres at cell sites could be problematic. What will be the uptime targets for edge data centres? It is not yet clear. It may be less than five nines, but it will require the site owner to guarantee power against a Service Level Agreement that would make towerco CEOs' eyes water! And security will have to be similarly robust.

A model response may emerge from China, where Internet giant Alibaba is among the shareholders in China Tower Corporation (CTC). CTC has recognised the concept of the "social computer room" – secure, powered enclosures at cell sites which can enable "intelligent connections" – which sounds a lot like an edge data centre. CTC has carved out a new subsidiary Tower Zhilian to manage social computer rooms, social information, IoT and other new emerging opportunities.

Will towercos engage with active infrastructure?

While there are communications infrastructure companies whose scope extends beyond passive infrastructure, they are to date found

only in Europe (for example CETIN, MBNL and Cornerstone). While towercos may become fully fledged 'infracos' in the long term, deploying both passive and active infrastructure, it is not likely to happen in the near term – at least not in the Americas.

"Getting into active equipment would raise questions about how we're regulated," said one towerco.

"The problem towercos are solving on an ongoing basis is to accelerate deployments, help out with permitting, and unlock efficiencies through co-location," added another towerco. "A broader skillset is required to manage active equipment. If we're talking about just energy, it may make sense, but managing antennae requires a deeper knowledge of frequency engineering – that's a core competency of our carrier clients."

"The potential efficiencies unlocked by managing both passive and active equipment might best be captured at the managed service level," continued the towerco. "Driving toward one site visit."

"We check who the MNO is using as their O&M contractor", added another towerco. "We prefer to have three way conversation and to consolidate site visits for passive and active equipment maintenance where possible."

"Towercos can offer managed services, and energy as a service, but we still put the network up," said

a tier one OEM. "The barriers are the economics and the contracts we have today."

"I don't see us getting into active equipment. Having the active equipment on our books would be an issue for us," concluded one towerco.

"I agree," said another towerco. "Our investments are based on long term contracts – I'm unconvinced how long term an investment in active equipment would be."

RANsharing... or not

One towerco participant at a round table suggested: "we thought would could play a positive disruptive role by enabling active infrastructure sharing. But rent-seeking investors seek bankable contracts with a certain quality of rent – pushing beyond passive to active infrastructure sharing was asking too much from investors. Ultimately our contracts ended up with same penalties against active sharing as other towercos."

Could RANsharing ever become an opportunity for towercos?

"MNOs don't want to share anything!" Said one towerco. "It's been a battle to move the build-to-suit model in Central America – if they were reluctant to share towers, they're going to be even more reluctant to share antennas."

"Turning RANsharing into a bankable contract would be difficult," added another towerco.

Wholesale networks

What role could wholesale 4G and 5G networks play in the future?

ALTÁN Redes is a unique wholesale network – what is it, and how does it make towercos think differently?

Mexico has only three MNOs: dominant market leader Telcel, AT&T and Telefónica, and a lower population coverage than most other CALA countries. Seeking to increase competition and coverage, the government awarded a contract to ALTÁN Redes, which is responsible for the design, deployment, operation and maintenance of Red Compartida, a wholesale network (or ‘carriers carrier’) providing a ‘Connection for All’.

ALTÁN Redes was granted coveted 700MHz spectrum for 4G free of charge, in exchange for an obligation to cover 92.2% of Mexico’s population in five years. Having achieved 30% population coverage by March 2018, Red Compartida commenced commercial operations. The Red Compartida currently covers about 50% of Mexico’s population.

Gonzalo Cornejo, CFO, Mexico Tower Partners explained the implications for towercos. “ALTÁN Redes is effectively a new operator in the Mexican market. While they are a wholesaler, they had no infrastructure at the outset, so initially they’ve leveraged a lot of co-location, particularly in urban areas. They will increasingly focus on build-to-suit as they push into rural areas.”

“

Towercos are thinking about how they need to evolve to solve carriers’ problems, and to support changing radio network designs

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Many towercos report that ALTÁN Redes represents the lion’s share of both co-location and new build in Mexico. And most towercos have reconciled themselves with ALTÁN Redes’ wholesale business model, which is somewhat competitive to towercos’.

Conclusions

Towercos are thinking about how they need to evolve to solve carriers’ problems, and to support changing radio network designs. Whether we’re reporting on TowerXchange Meetups for CALA, Europe, Asia or Africa, there are strong commonalities in towercos’ thinking about innovation. There is a preference to stick close to the proven fundamentals of leasing up communications infrastructure on long term contracts.

But there is also a growing awareness of how cell site owners can leverage their infrastructure to tackle the inefficiencies in cost structures of multiple industries. We’ve seen examples of towercos completing the ‘cold chain’ to bring life-saving vaccines to kids. We’ve seen towercos enable ‘Digital Villages’ and support rural electrification. Reverting to urban environments, the convergence of cell sites and municipal services could enable smart cities: Wi-Fi services, smart lighting, V2I, sensors, CCTV and other public safety applications. PTI enables 911 services in the Caribbean: “the equipment is on 70 towers so far, and it’s usually very light equipment, so it can go on any structures the government wants! We’re conscious that government services and healthcare adds value to our customers, so we’re happy to help,” concluded PTI’s Don Van Splunteren ■

Regional Analysis

TowerXchange initiated its coverage of the Asian telecom infrastructure ecosystem back in 2014, and since then much has changed. From the creation of tower markets in Bangladesh and the Philippines to the progresses made by once-virgin Myanmar in terms of towerco penetration and network deployment, encompassing technology and industry advancements, Asia never fails to deliver exciting news.

In this section, TowerXchange offers its readers updated analyses, editorials and reports on some of the key markets in Asia, including Bangladesh, China, India, Myanmar and the Philippines, as well as the latest findings in terms of data utilisation, efficient energy management and fiberisation plans.

Don't miss:

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Updated snapshots from India, Indonesia, Pakistan and Australia



Insights from leading experts on stage at the TowerXchange Meetup Asia 2018



At the 2018 edition of the TowerXchange Meetup Asia, experts from Protelindo, Aird Towers, American Tower, Ascend Telecom Infrastructure, Bharti Infratel and Pakistan Telecommunication Company Limited took centre stage to discuss the dynamics of their respective markets – representing a pool of very diverse realities in terms of towerco penetration, telecom landscape and overall industry development. Here is a report of key findings from the session.

Keywords: 4G, 5G, Aird Towers, American Tower, Ascend Telecom Infrastructure, Asia, Australia, Bharti Infratel, Co-locations, Consolidation, India, Indonesia, Infrastructure Sharing, M&A, MNOs, Pakistan, Pakistan Telecommunication Company Limited, Protelindo, Sale and Leaseback, Small Cells, Smart Cities, Towercos

Read this article to learn:

- Diversity of business models in Asian towers
- Key dynamics in Indonesia, Pakistan, Australia and India
- Fibre, smart cities and more: innovation in Asia
- Consolidation and returns: managing investors' expectations

Asia is a very diverse tower ecosystem, home to several towerco business models depending on the circumstances that originally prompted the emergence of towercos.

Towercos in India and China for example have been created as the infrastructure arms of local MNOs, and as a mean to reallocate risks and rewards to – at least initially – favour the operators. Indonesia on the other hand is following the North American steel and grass model and is home to a purely independent tower sector with three large towercos and a plethora of smaller infrastructure developers.

Indonesian MNOs expand beyond Java

On the MNO front, the market is quite imbalanced with healthy levels of competition among all of them in Java and Telkomsel playing a dominant role outside of the island. Now XL is expanding outside of Java and leading 4G deployment. All four MNOs are quite aggressive with their 4G rollouts and the migration to the technology is happening faster than originally anticipated. The market is also pushing towards fiberisation with players such as SMN – Protelindo's owners – at the forefront of fibre acquisition and deployment.

The market experienced a couple of slow years in 2015 and 2016 in terms of organic growth, mainly as a result of the delays in some much-awaited regulatory changes. On the other hand, 2017 and 2018 were strong years, driven by XL and Indosat and their expansion plans outside of Java. The two MNOs initially sought co-location opportunities and

are now working with towercos for build-to-suit projects.

Consolidation hindered by expectations

Commenting on the potential for more consolidation among towercos, Steve Weiss from Protelindo, who has recently acquired KIN, noted that more towercos are actually ready to be acquired. The challenge to consolidation is actually represented by the expectations of private equity investors who have sought 20% returns, in spite of currency devaluation. While it is painful to come to terms with this adjusted reality, funds that have entered the Indonesian market more recently tend to have more reasonable expectations and return profiles.

Pakistan still behind

Pakistan remains an underserved market but 4G is leading the growth, with over 35% growth in data subscribers in 2017-2018. However, the market remains considerably behind in terms of data consumption per subscribers, compared to other regional countries.

The market could present strong opportunities for towercos as 95% of its tower inventory remains in the hands of MNOs. In recent years, MNOs have started to outsource new site deployments which could pave the way for tower divestments in the future.

The government has taken an active role in mandating several forms of sharing, both active and passive. In fact, the tenancy ratio across Pakistan is

around 1.25 in spite of the low towerco penetration rate.

Grid still an issue in Pakistan – opens opportunities for renewables

On the operational front, while 98% of the existing towers are connected to the grid, its availability remains a challenge with as many as eight hours per day without electricity in certain areas. This is why MNOs are increasingly relying on solar and wind solutions to power their sites. The push for renewables is also incentivised by the high incidence of thefts of diesel generators and other components.

A new telecom era for India

Shifting to India, the country is experiencing a huge data explosion that is pushing telecom players to further fiberise their sites and urban networks. The real challenge is represented by last mile and intra-city fibre and towercos are currently developing several projects for the government as well as for private players.

While most Indian MNOs are still under financial stress, and dealing with shrinking margins and ARPUs, towercos are studying the commercial model to offer fibre among their products, with India getting close to 30% fiberisation.

The shared feeling among Indian players is that the country is entering into a brand-new telecom era, with consolidation of both MNOs and towercos well underway, a strong governmental push towards universal access as well as innovative moves to promote smart cities, greener sites and beyond.

The Indian government has proven strongly pro-telecom with initiatives such as the 2018 National Digital Communication Policy that aims to facilitate India's entrance in the global digital economy and for which operators as well as towercos will play a pivotal role. The new policy is going beyond the telecom space to serve sectors that could benefit by digitalisation such as healthcare, education, transport and more.

Smart cities are likely to generate additional revenue streams with mobile VAS such as environment sensors, traffic control, CCTV and more all becoming potential customers for smart poles.

Australia still lagging in terms of towerco penetration

In Australia, the 2G network has been finally switched off and the market is leading the way in 5G testing and deployment. With a complex geography and only 25mn inhabitants, coverage is a real challenge in Australia and the market is still quite behind in terms of towerco penetration.

Axicom – originally Crown Castle – is the largest towerco with nearly 2,000 sites. However, with no opportunities for inorganic growth at the moment, towercos are focusing on build-to-suit activities. Some players are also working on innovative initiatives such as the use of utility poles for telecom purposes or small cell deployment, such as Optus who has recently been awarded a small cell contract.

Conclusions

The panel offered a variety of insights into the

Panellists profiles

On stage for an exchange of insights on the state of the market across Australia, India, Pakistan and Indonesia were Tom Andrews, MD, Aird Towers, Sushil Kumar Chaturvedi, CEO, Ascend Telecom Infrastructure, Sachin Naik, COO and Chief O&M Officer, Bharti Infratel, Sudhir Prasad, CEO C&SE Asia, SVP Strategy, American Tower, Moqem ul Haque, Group Chief Strategy Officer, PTCL and Steve Weiss, CFO, Protelindo.

The session was moderated by Jonathan Atkin, Managing Director at RBC Capital Markets ■

dynamics of four very diverse markets. Once again, we were reminded that Asia is not a regional market but a collection of realities at very different maturity stages. While the challenges faced by each country are unique and difficult to grasp during a sixty-minute session, a couple of elements emerged as common trends across most of them.

1. Small cells and other innovations: towercos across APAC have a real opportunity to open a new business channel for themselves as MNOs and governments push towards 5G, fiberisation and smart cities. Questions remain about the viability of the business model but early adopters across various markets are already succeeding in offering more than just towers.

2. 4G overlays (and 5G) drive growth: there is still plenty of opportunities for growth when it comes to reaching strong levels of 4G coverage especially across islands, rural areas and outside major cities. Towercos are playing a pivotal role in cell site densification especially in those markets where MNOs are finding it hard to balance rollouts with

shrinking margins, hence more eager to outsource new sites deployments.

3. Consolidation and returns: the global trend of consolidation – both among MNOs and towercos – is well underway in Asia, with India and Indonesia being two of the most active markets when it comes to combining operations to improve efficiencies and strengthen balance sheets. While the consolidation of MNOs can be delayed – if not stopped altogether – mostly due to regulatory concerns, towercos are experiencing different inhibitors. In fact, in most cases, deals among towercos are relinquished due to the unrealistic expectations of investors, which aren't ready to settle for subpar multiples in spite of the many changes that have affected regional economies (eg. devaluations) over the past few years.

In spite – or maybe in light – of the above considerations, Asia is one of the most exciting regions in the global tower scenario. We are now gearing up for the 6th annual TowerXchange Meetup Asia, taking place in Singapore, 3-4 December. Stay tuned for more news in the upcoming weeks ■

Tower  Xchange

Meetup Asia 2019
3-4 December, Singapore

Meetup MENA 2020
28-29 January, Dubai

Meetup Europe 2020
19-20 May, Barcelona

Meetup Americas 2020
23-24 June, Boca Raton

Meetup China 2020
September

Meetup Africa 2020
13-14 October, Johannesburg

www.towerxchange.com

Unleashing the potential of towerco investment in Bangladesh



Newly licensed towercos poised to re-ignite telecom infrastructure deployment



Dhaka, Bangladesh

This brief market update captures the current state of the restructuring tower market in Bangladesh. The licensing of four tower companies is about to re-ignite new tower build, but the regulator's exploration of the competitive landscape could hinder the emerging sale and leaseback market in the country. Ultimately, the prohibition of tower build by MNOs, and the requirement to unwind their existing co-location agreements by 2023, will precipitate an efficient, towerco-driven communications infrastructure in Bangladesh.

Keywords: 4G, AB Hightech Consortium, Asia, Bangladesh, Banglalink, Build-to-Suit, edotco, iSON Tower, Grameenphone, Kirtonkhola Tower, Lease Rates, Leasing & Permitting, MLA, Market Overview, Network Rollout, New License, Research, Sale & Leaseback, TASC Towers, Towercos

Read this article to learn:

- Why new tower build slowed in Bangladesh in 2018 despite the launch of 4G
- Who the newly licensed towercos are, and when they will start building again
- The costs of the towerco license and revenue share obligations
- The potential impact of the regulator's concerns about the competitive landscape in Bangladesh
- A vision of the future tower market in Bangladesh

New site build in Bangladesh slowed almost to a halt in 2018, but the hiatus was a necessary step in the re-organisation of the tower market. It had become clear that the Bangladesh Telecommunication Regulatory Commission (BTRC) intended to prohibit the country's MNOs from continuing to build their own towers, while uncertainty surrounding the new towerco license regime inhibited towercos from building.

After several draft tower licensing regimes were painstakingly refined over a period of two years, in August 2018, the BTRC announced the four winners of the battle for towerco licenses in Bangladesh: edotco, Kirtonkhola Tower (iSON Tower), TASC Summit Towers and AB Hightech Consortium. By November those licenses had been received. Paperwork for new foreign investors has also created a time lag: FDI licenses are believed to take around four months.

Stakeholders who remain concerned that tower building has not yet resumed in Bangladesh can be partially re-assured: the pipeline of new site build is moving again, now awaiting only the new towercos to negotiate and agree Master Lease / Master Service Agreements with the MNOs; and awaiting the natural lag between permit application, securing permits and breaking ground. Permitting a new site takes several months in Bangladesh, with longer periods required for sites on the border. The new towercos are required to start operating within 180 days of being licensed.

The costs to setup and run a new towerco in Bangladesh are substantial – significantly higher,

for example, than in the thriving Myanmar tower market. Bangladesh's tower license fee is US\$2.97mn, with a US\$2.37mn bank guarantee, a US\$593k annual fee, plus a 5.5% revenue share and a 1% Social Obligation Fund contribution. Fees of this magnitude will of course compromise capital available to deploy into the network, but are obviously not prohibitive, otherwise Bangladesh's four towercos would not have bid for their licenses.

However, a new layer of complexity continues to inhibit maximum investment in towers in Bangladesh. The BTRC are believed to be considering taking action against 'Significant Market Players' (SMP), which could affect Grameenphone, which owns around 14,000 of the country's 35,000+ towers.

Grameenphone has been leasing up their towers on a commercial basis, effectively functioning as the country's largest towerco. With new tower build by MNOs now prohibited, the SMP dialogue, combined with the BTRCs requirement that MNOs roll back all existing co-location agreements by 2023 (there are around 6,500 co-locations currently in Bangladesh) could result in pressure on Grameenphone to divest some or all of their existing towers. With Banglalink believed to be keen to monetise their ~9,000 towers, but with the threat that SMP review could extend to towercos as well, these competitive concerns could distort the investibility of prospective tower sale and leasebacks in Bangladesh.

While some commentators consider appetite and investment in sale and leaseback as a distinct issue

Bangladesh's newly licensed towercos

edotco Bangladesh entered the market in December 2013, via the transfer of ownership of Robi's towers for US\$145mn. To date, edotco owns and manages more than 9,821 sites in the country and has been operating thanks to a no-objection certificate (NOC) while waiting for the licenses to be issued. With edotco Group as foreign shareholder, the firm partners with Greencon Tower for its local shareholding.

TASC Summit Towers Summit Corporation is the largest fibre operator in the country and have so far connected hundreds of towers to its network. One of the towerco's foreign shareholder, TASC Towers, is mainly active in the Middle East (Jordan, Lebanon and UAE) but has been eyeing opportunities in other regions such as Africa too. TASC Summit lists Global Holding Corporation Private Ltd. as an additional foreign shareholder.

iSON Tower Bangladesh (now renamed Kirtonkhola Tower) is part of the iSON Tower group, with operations in Africa, India and the Middle East where they are an established network deployment and managed service provider operating over 10,000 sites. iSON's local shareholder is Confidence Tower Holdings while ECP Tower Singapore is its foreign partner.

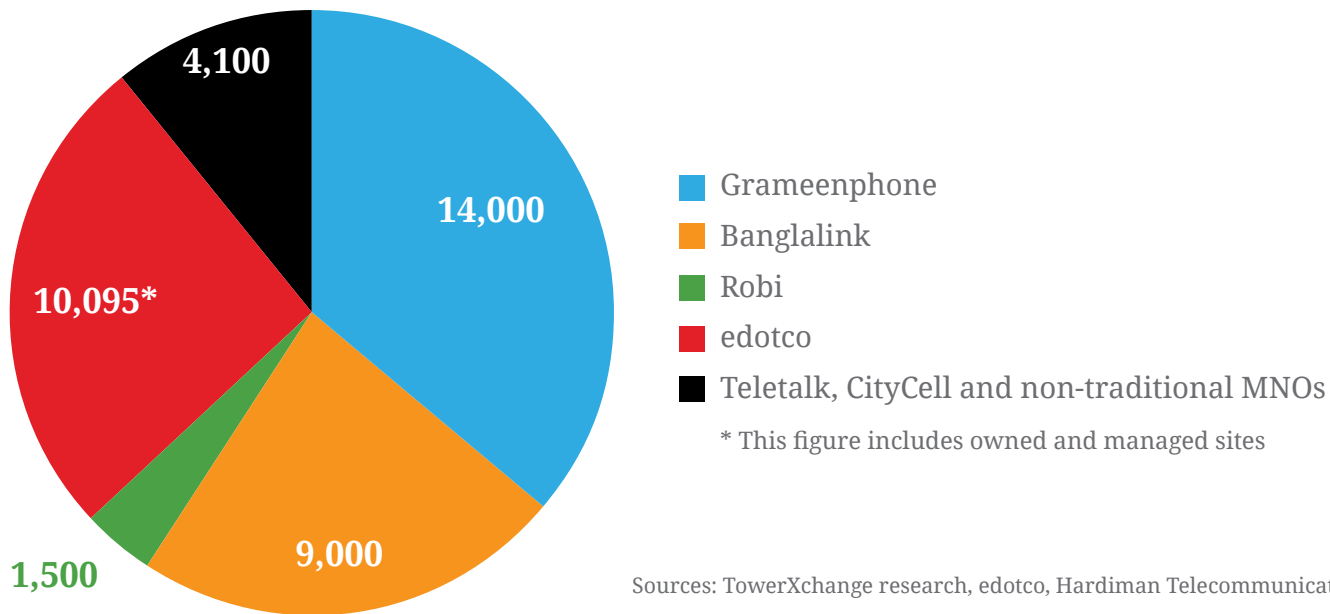
AB Hightech Consortium is owned by various local shareholders including ADN Telecom, AB Hightech International, ZN Enterprise, Synergy Logistic and Orange Digital and by foreign shareholders China Communications Services International and Changshu Fengfan Power Equipment Company ■

from build-to-suit, others consider the two issues deeply linked. If one towerco cannot exceed, for example, 40-45% market share in Bangladesh without falling foul of SMP, then this may prohibit a single towerco from acquiring all the Grameenphone towers, and may also shrink the pool of prospective buyers of Banglalink towers (already narrowed by the license regime and – current – cap on four towercos in the country). Any country's tower market is effectively in competition with other tower markets for capital,

both from strategic investors – towercos – that could invest elsewhere, and from financial investors. If SMP concerns put a glass ceiling on the growth of a Bangladeshi towerco, that doesn't necessarily make that towerco uninvestible, but it may make it less investible.

TowerXchange would contend that the tower market functions most efficiently with a light touch from regulators – including on the issue of competitive balance. TowerXchange would also

Estimated tower count for Bangladesh



Sources: TowerXchange research, edotco, Hardiman Telecommunications

contend that a regulator should be less concerned about a towerco having a significant market share, for example 50% or higher, than an MNO as towers are a ‘natural monopoly’ – the most efficient hypothetical model is a pervasive network of towers with 3-4 tenants on every site and only such overlapping infrastructure as was required for densification. There is no reason a single towerco cannot provide such a network, and certainly no reason that four towercos cannot co-exist with one or two having significantly larger portfolios, especially given that the regulatory has to approve towerco tariffs.

In conclusion, the tower build hiatus in Bangladesh is drawing to an end – we’re now just awaiting contract negotiations and permitting to run their course. But the tower market in Bangladesh will only achieve optimum efficiency, attracting maximum funding to expand and densify the network, if the market can be refined to support the efficient sale and leaseback of existing MNO towers to the towercos. If this last inhibitor can be eased, TowerXchange foresee a relatively swift transfer of over 13,000 MNO-captive legacy tower assets to Bangladesh’s towercos, enabling the towercos to bring new efficiencies to the build, maintenance

and operation of the country’s towers, and to release further efficiencies by decommissioning the country’s many overlapping and naked sites. With 4G being launched in 2018, Bangladesh’s towercos are poised to bridge the digital divide and enable the Digital Bangladesh vision ■

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China Tower establishes new subsidiaries focusing on energy and “intelligent connections”



CTC broadens its positioning to enable the electric vehicle ecosystem, power services, IoT and “social towers”



CTC leaders at launch of Tower Energy and Tower Zhilian

In June 2019, the world’s largest tower company, China Tower Corporation (CTC), created two new subsidiaries to extend a philosophy of smart sharing to energy and “intelligent connections.” In carving out subsidiaries Tower Energy and Tower Zhilian, CTC has created the world’s largest consumer of telecom energy equipment and services, and a landmark new centre of innovation as towercos diversify beyond focusing on sale of “vertical real estate” for the co-location of antennae equipment for MNOs to develop IoT, civil and government services. Naturally, TowerXchange’s Research team are on the ground in Beijing to explain more.

Keywords: 5G, Asia, Batteries, China, China Tower Corporation, Edge, Energy Storage, Infrastructure Sharing, IoT, Lithium-Ion, MIIT, Research, The Future Network, Towercos, Tower Energy, Tower Zhilian

Read this article to learn:

- What is the scale and scope of these new subsidiaries, and who will run them?
- What standby power supply systems are typically used at CTC sites?
- How CTC’s new Tower Energy business is creating and leveraging partnerships in edge computing and EV charging
- The concept of “social towers”, social information and IoT, and how these converge within CTC’s new Tower Zhilian (“Intelligent Connection”) business

On June 26 in Beijing, CTC announced the creation of two new wholly-owned subsidiaries: Tower Energy Co., Ltd. and Tower Zhilian Technology Co., Ltd. Zhilian translates as “intelligent connections”.

Tower Energy Co., Ltd

CTC currently has 1.954mn sites, most of which are equipped with a standby power supply systems to ensure uninterrupted service from the BTS in the unlikely event of mains power failure. This means that China Tower has the world’s largest distributed telecom energy storage system.

Tower Energy will leverage CTC’s extensive experience of managing energy efficient backup power battery banks, its large-scale procurement advantages, its professional maintenance capabilities, and the company’s intelligent monitoring system. As such, Tower Energy’s primary responsibilities will be power assurance and energy services, including both backup and primary power generation, as well as battery charging, power conversion, and energy storage for financial, transportation, medical, and low-speed electric vehicle customers. For example, Tower Energy is developing an electricity exchange service for the express logistics and catering industry to enable low speed electric vehicle battery sharing.

Gao Yunhu, Director of Energy Conservation and Comprehensive Utilization Department at MIIT, said that in recent years, China’s new energy automobile industry has developed rapidly. (The Chinese government uses the term “new energy vehicles”

to represent plug-in electric, hybrid electric and fuel cell electric vehicles). By the end of 2018, the total number of new energy vehicles in China has exceeded three million, and the number of power storage batteries has exceeded 144GWh. The problem of recycling of decommissioned batteries has become more and more obvious. Since 2015, China Tower has taken on this social responsibility. It has pioneered the replacement of lead-acid batteries with decommissioned new energy vehicle batteries. The scale (and use of) decommissioned batteries in 200,000 base sites nationwide has made outstanding contributions to solving the recycling utilisation problem of new energy vehicle batteries.

Tower Energy has already signed cooperation agreements with a number of partners:

- China Post Express
- China Construction Bank
- Shanghai Automobile
- BYDMeituan Delivery
- Yunda Express
- Qianxun SI
- Tencent Cloud

The cooperation agreements cover battery leasing, equipment room power backup, emergency charging, electric vehicles, and the construction of a battery recovery system for automotive energy. New low-speed electric vehicles are to be leased, and existing lead-acid batteries will be replaced by lithium-ion batteries.

Mr Tong Jilu, Chairman of CTC, suggested that Tower Energy was a socialised extension of CTC's power assurance and backup power service capabilities,

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Mr Tong Jilu, Chairman of CTC, suggested that Tower Energy was a socialized extension of CTC's power assurance and backup power service capabilities, and that it further deepened and expanded their capabilities in of power battery management and related resource sharing and maintenance services

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and that it further deepened and expanded their capabilities in of power battery management and related resource sharing and maintenance services.

Tower Energy has registered capital of is RMB 5bn (US\$710mn), and it's Chairman will be Liu Guofeng, who previously served as General Manager of CTC's Operation and Maintenance department.

Tower Zhilian Technology Co., Ltd.

CTC has carved out Tower Zhilian to encompass several key offerings from their business development department in the fields of social information, government services and the Internet of Things (IoT). Essentially the remit of Tower Zhilian will encompass “intelligent connections”, or to use tower industry language, serve “non-

traditional mobile tenants”. Demand for and usage of social information and IoT services are developing rapidly in China, so Tower Zhilian has a large and growing addressable market.

Leveraging the communications infrastructure resources and specialisation capabilities of parent company CTC, Tower Zhilian will accelerate the transformation of “communication towers” to “social towers” by focusing on sensors and services for ecological environment protection, land, agriculture, forestry, security, emergency, transportation, and satellite positioning. Tower Zhilian thus pushes beyond CTC's traditional mobile customer base to provide cross-industry site application and information services, and to serve the national economy and enhance citizen's lifestyles.

Much like Tower Energy, Tower Zhilian announced a raft of cooperation agreements covering site resource leasing, intelligent monitoring and comprehensive informatization with the following partners:

- China Satellite Communication Co. Ltd.
- China Transport Telecommunications and Information Center
- Allystar
- Eastcom
- Yangguang Media Development Corporation (wholly-owned by CNR, China National Radio)

Sun Zhongliang, General Manager of Allystar, said in an interview that with the advent of 5G, the 5G+ Allystar positioning was becoming more and more widely used in unpiloted driving, structural measurement, and the Internet of Vehicles (IOV). As a professional company that provides shared services for society based on CTC's 1.954mn sites, Tower Zhilian has obvious advantages in helping to quickly construct and operate Allystar's high-precision ground basic network.

Based on CTC's messaging at two recent exhibitions, the Tower Zhilian proposition encompasses three groups of services:

Smart sharing: mainly oriented to customers who have intensive requirements for advanced machine equipment room services, and/or a need for high-hanging equipment or sensors using CTC's towers and poles, often at lower elevation than telecom RAD centres.



Smart connection: leveraging the site location and monitoring resources of CTC, the "Smart-connection" brand provides an integrated informatization solution for vertical industries, such as transportation, security protection, underground pipes, and public buildings.

Smart control: combines two types of products: managed device monitoring and maintenance; and social computer room monitoring and maintenance. ("Social computer rooms" appear to be the equivalent of Mobile Edge Computing sites).

CTC Chairman Tong Jilu said cross-industry services

would be enabled by the efficient utilisation of tower site resources and the expanded social sharing space. Whether the past, present, or future, China Tower would firmly grasp the core value of sharing, fulfilling its responsibilities to society, creating value for industry, bringing rewards to shareholders, and cooperating with various industries to create win-win situations.

Tower Zhilian was established with a registered capital of 1bn RMB (US\$142mn). Mr.Yu Zhe, who previously served as the General Manager of CTC's Business Development department, will serve as the Chairman of Tower Zhilian. Yu Zhe said



By Kieron Osmotherly, CEO, TowerXchange

Why CTC remain an important global benchmark

China Towers' peers within towercos and MNOs worldwide should pay close attention to these innovative new subsidiaries.

As ever, China simply offers a greater scale, and a unique appetite for both innovation and social improvement. This creates a unique "proving ground" for the expansion of the "infraco" business model.

- Should infracos engage in providing backup (and occasionally primary) power in good grid markets?
- Is there a role for infracos in the electric vehicle ecosystem, or in peak energy grid load balancing?
- What role will cell sites have in the V2I ecosystem?
- What is the opportunity for infracos to enable smart cities: to convert cell sites into points of service for civilians, enterprises and governments?
- Can the cabinets / "computer rooms" at cell sites be leveraged to provide mobile edge computing capacity?
- How does the product and service proposition of infracos need to evolve for the 5G era?

...And crucially, what are the unit economics of these opportunities at scale?

China Tower operates in a unique context in terms of both scale and business / social drivers. This means China Tower is going to be answering many of these questions before the rest of the world. The rest of the world would be well advised to pay strict attention! ■

What these two subsidiaries tell us about CTC's expanded vision and diverse business model

Since inception five years ago, China Tower has continuously deepened the concept of sharing beyond towers and rooftops. CTC has actively

transformed itself from a focus on industry resource sharing to a focus on social resource sharing, promoting the expansion of a vision of a "telecommunication tower" to that of a "social tower;" high quality, high reliability sites and resources that can be fully and efficiently shared by multiple business and government stakeholders.

Mr. Tong Jilu, Chairman of CTC, said that the establishment of two wholly-owned subsidiaries of China Tower was a pioneering initiative to implement the concepts of innovation, coordination, green, openness, and sharing. Tong also mentioned that the two professional subsidiaries of Tower Energy and Tower Zhilian Technology had been set up to accelerate the strategic layout of "one body and two wings". One body, to integrate towers and indoor distribution services in the communication industry. Two wings, energy services oriented to society, and cross-industry site applications and information services.

Mr. Chen Jinqiao, General Secretary of the Information and Communication Economics Expert Committee at MIIT added that it was estimated that RMB hundreds of billions of investment costs have been saved for the telecom industry, greatly accelerating the efficient construction of the mobile broadband network and creating many intangible values for society. The establishment of two wholly-owned subsidiaries represents the further extension and deepening of the concept of tower sharing in China ■

The new Indian telecom infrastructure landscape



Brookfield to acquire 51% of Reliance Jio Infratel in latest industry twist



Arianna Neri, Managing Director, Asia & Americas

I have struggled to write about India for quite some time as every week, news emerges that will complicate the already tangled web of events affecting the local telecom tower market. But as I look closer, the Indian landscape is finally approaching re-definition, with only a few decisions remaining before the market achieves a “new normal”. Here is an overview of where Indian MNOs and towercos stand.

Keywords: 4G, American Tower, Asia, BSNL, Bharti Airtel, Bharti Infratel, Brookfield Asset Management, India, Indus Towers, M&A, MTNL, Market Overview, Reliance Communications, Reliance Industries, Reliance Jio Infocomm, Reliance Jio Infratel, Vodafone Idea

Read this article to learn:

- The Brookfield-Reliance deal
- The new shape of the Indian tower landscape
- Indian MNOs and their ongoing struggles
- Why India is a good investment

In the latest chapter of the never-ending Indian saga, Brookfield Asset Management and Reliance Industries have finally reached an agreement under which the Canadian fund will invest INR252bn (US\$3.7bn) in the units proposed to be issued by Reliance Industries’ Tower Infrastructure Trust. Said trust holds 51% of Reliance Jio Infratel, the infrastructure entity recently created to own and operate Reliance Jio’s tower assets.

With the move, Reliance Industries looks at deleveraging Jio Infocomm and Jio Infratel’s balance sheets (as well as its own) and at professionalising the latter as an independent tower business.

The agreement has been signed by Reliance Industrial Investments and Holdings, a subsidiary of Reliance Industries, and BIF IV Jarvis India, affiliated with Brookfield and the deal is currently subject to final due diligence and regulatory approval.

Jio: a varied and growing portfolio

Jio Infratel is still developing its 175,000-tower portfolio, which was valued at around US\$5.4bn when carved out. Once completed, the towerco will run the largest pan-Indian portfolio ahead of the combined Indus Towers and Bharti Infratel, with 163,000 sites.

Even before the transfer of assets to the towerco, Jio embarked into an impressive build-out effort. Jio co-located on around 30,000 of 43,263 sites previously owned and later acquired from Reliance Communications, with the rest organically built. Jio

Infratel has announced plans to grow its portfolio to 260,000 sites in the near future (although that figure is believed to include co-location on third party sites).

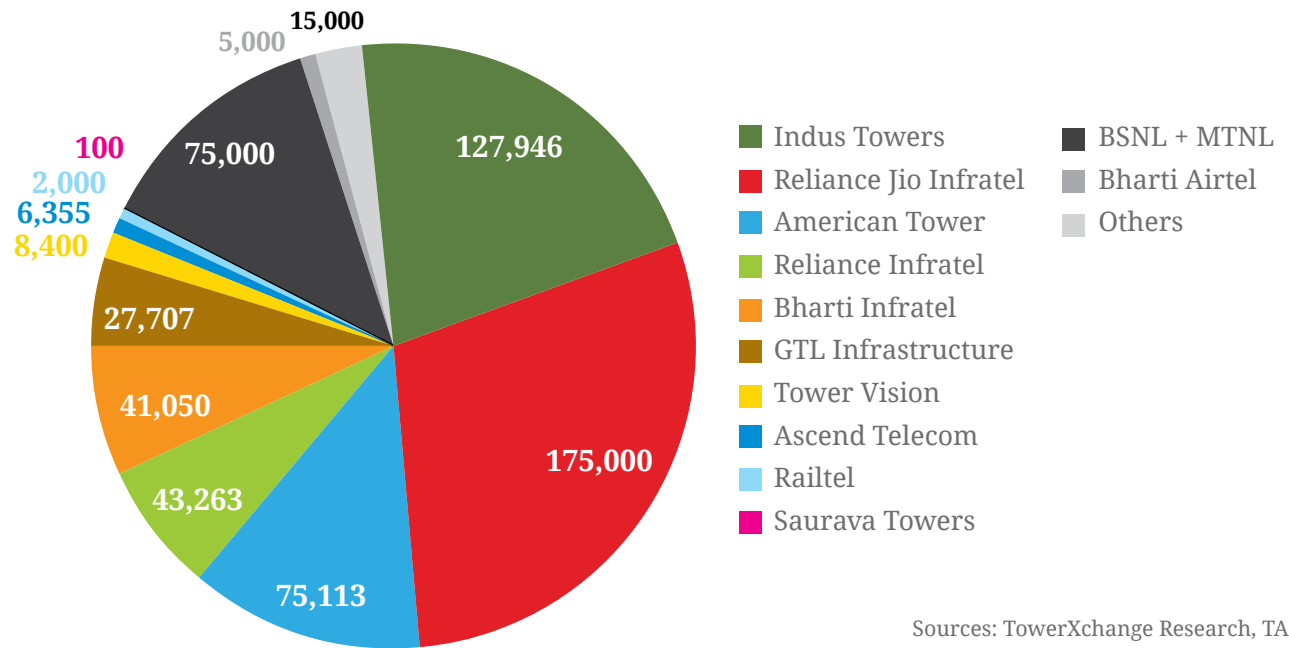
While Jio's growth trajectory has been impressive, it's also been noted that around 40,000 sites that Jio deployed so far are single-tenant lampposts not immediately apt for co-location. This urban portfolio is in prime locations and still enjoys Jio as tenant but the valuation for these assets surely takes into consideration their inability to host multiple tenants.

Indian MNOs still struggling

The Indian telecom landscape is hardly a stable one, with mobile network operators struggling to find the balance between staggering data demand growth and ARPUs that have been declining for years now.

Since the entrance of Jio in early 2016 (soft launched in 2015), with its aggressive price strategy and competitive data offers, the MNO landscape has completely reshaped. Aircel and Reliance Communications both went bankrupt, Vodafone and Idea Cellular merged, Tata Docomo merged with Bharti Airtel and the latter also took over Telenor India. The MNO scenario changed even further, with the acquisition of Hutch by Vodafone, prior to the latter merging with Idea, the merger of Virgin Mobile with Tata DoCoMo, the merger of MTS India with Reliance Communications prior to its bankruptcy and the exit of Videocon, who ceased to operate following its spectrum sale to Airtel.

Tower ownership in India today



Sources: TowerXchange Research, TAIPA, PwC

To date, the MNO landscape sees Jio leading the market with a 31% market share, Vodafone Idea following closely with over 30% share, Airtel at 28% and State-owned BSNL and MTNL at just over 11%. Jio has surpassed Vodafone Idea as market leader this past June, in part thanks to the strategy adopted by Vodafone Idea to set a minimum recharge plan with the goal to eliminate low-revenue users. The plan caused the MNO to lose 67.2mn subscribers since December and triggered an associated increase in ARPU, and in the latest earnings' call, Vodafone Idea CEO Balesh Sharma backed the plan and said the company is "confident of improving churn as well as ARPU."

The stock market didn't see the move as positive, with Vodafone Idea's share dropping over 26% following the earnings' call and analysts are now reassessing their estimates following a mildly optimistic view of the market based on Bharti Airtel's stable Q4 figures.

While Vodafone Idea struggles to sustain its new plan, the two State-owned entities BSNL and MTNL have been under severe financial stress for years now, unable to fight back against brutal price competition.

BSNL has doubled its losses since last year to over

US\$200mn and MTNL has reported losses of around US\$50mn. Both operators have been suffering due to shrinking revenues over the past few quarters and are dealing with extremely high employee costs (BSNL has 166,000 employees and MTNL 21,679) which mean poor revenue-to-wage ratio. In fact, while the average percentage of an MNO's income devoted to employees varies between 3 and 5% for private operators, that percentage hikes to over 75% for BSNL and 87% for MTNL. In a nutshell, it would not be surprising if further changes occur to the Indian MNO landscape and one of the potential outcomes could be the sale or carve-out of assets, including around 75,000 towers, of the two State-owned MNOs, with both options having been discussed for years now.

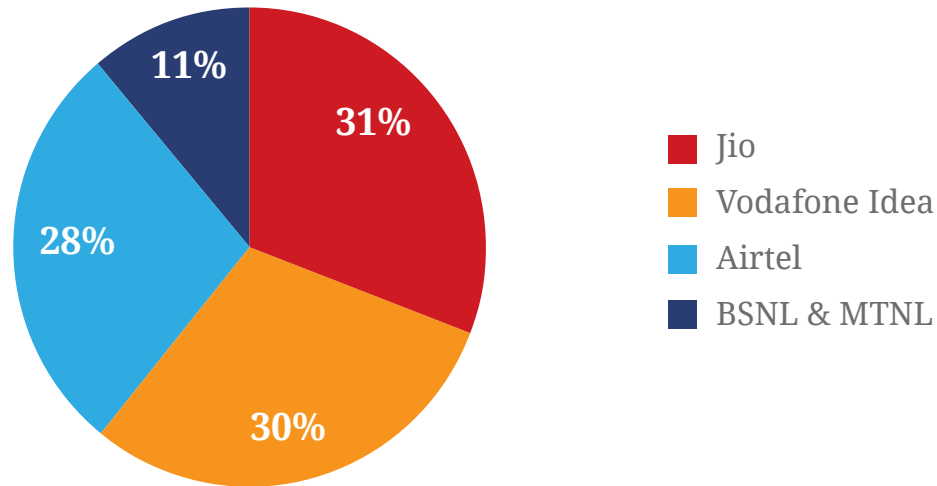
On a positive note, BSNL and MTNL are both actively sharing their towers with other MNOs, with Jio as their main tenant, having rented 8,307 sites from BSNL and 137 from MTNL.

Bharti Airtel has enjoyed a positive last quarter with Bank of America Merrill Lynch upgrading the stock to buy and raising the target price following the MNO's move to increase its tariffs and the IPO of its Africa unit, which has strengthened the operator's global position.

Is Indian infrastructure a good bet?

Bank of America Merrill Lynch's analyst Sachin Salgaonkar was recently cited by the Economic Times of India stating that "Despite muted near term growth prospects of the tower industry, we

Indian MNOs market share - Q219



Source: TowerXchange, Company reports

expect 900mn 4G users on an average consuming 12Gb of data" and that most of the data demand will be met using "towers rather than by small cells or in-building solutions."

In an MNO landscape dominated by a price war, towercos are likely to be in charge of building the majority of towers for the MNOs who hardly have capital and time to invest in their own infrastructure rollout. But the demand for new builds isn't likely to even out the effects that the MNOs turmoil has had on tenancies. In fact, tenancy churn has hit all major entities Indus Towers, Bharti Infratel and American Tower in 2018 and is continuing to do so in 2019.

The merger between Vodafone and Idea Cellular generated more than 57,000 tenancy losses but further churn is expected in 2019 and 2020 (over 20,000), which will be only partially offset by

exit penalties, as recently noted by S&P's Indian research firm Crisil.

The tenancy crisis is one of the reasons why Indus Towers and Bharti Infratel have decided to join forces, with the merger expected to complete before the end of Q319. The process has already received all permissions and is pending only the Department of Telecommunications' approval for enhancement of foreign direct investment limit, as pointed out in a recent analyst call by Bharti Infratel's Chairman Akhil Gupta.

So the new shape of the Indian telecom and tower landscape is made of three solid MNOs, namely Jio, Vodafone Idea and Bharti Airtel, with the fourth State-owned entity still in trouble, and three strong towercos, Jio Infratel, Indus-Bharti and American Tower as well as an array of smaller towercos, many of which are likely to look for a buyer.

In fact, the towerco scenario beside the top three entities is still turbulent. GTL Infrastructure for example, with its 28,000 sites, has reported three years of losses (amounting to a total of 71%). Its revenue has dropped 36% since last year.

Brookfield will get involved in the ownership of Jio Infratel, whose assets see Jio Infocomm as anchor tenant. And this can only be good news since the MNO has been reporting strong financial gains in the last quarter and more than 50% growth in subscribers from last year, having added 116mn users in the past year.

Canadian funds keen to invest in India

Canadian fund Brookfield has been active in India for a decade now, having already invested over US\$10bn across multiple sectors – energy, commercial real estate and now, telecom infrastructure. And it's only one of a few Canadian funds involved in India, including CDPQ, CPPIB and PSP Investments.

The drivers behind investing in telecom infrastructure are well known to many but the attractiveness of India might be less obvious. However, India has been a hotspot for Canadian funds for a few years now and they have good levels of experience and expertise in infrastructure investments.

While investing in Indian towers is not for the faint-hearted, the country presents strong yield and growth opportunities matched with the attractiveness of scale, which aren't easy to

combine in telecom towers. With the current MNO consolidation and associated tenancy churn, it may be a good time to “buy low” in Indian towers. As previously mentioned, the Indian telecom market is experiencing a stellar growth curve of data consumption, which Ericsson's latest Mobility Report predicted will reach 18Gb per month per subscriber by the end of 2024, having reached 9.8Gb at the end of 2018.

Once again, one of the major breakthroughs in the Indian data market was caused by Jio and its generous data plans, which pushed users to finally use mobiles for video streaming and other data-heavy functions. While 5G is not imminent in India, 4G densification and overlay will keep pushing MNOs to stretch their financials and towercos can only benefit from this growth tailwind.

Last but not least, Brookfield has been eyeing deals in Indian towers for at least three years. In 2017, it got very close to acquiring 45,000 towers from Reliance Communications in a US\$1.6bn deal – towers which then got absorbed by Jio – and in 2016, it was reportedly in talks to take over a majority stake in Bharti Infratel. Over the past three years, Brookfield not only negotiated large deals with other key players across India but got a real-life chance at understanding what it means to do business in the country.

While a venture in India is far from a walk in the park, TowerXchange is confident about Brookfield's ability to positively partner with Reliance Jio Infratel and turn the towerco into a force to be reckoned with in the local infrastructure ecosystem ■



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How regulation accelerated tower network deployment in Myanmar - and why the country is still one of hottest tower markets in Asia



PTD and towercos talk growth, consolidation and operational challenges



An audience survey at the 5th TowerXchange Meetup Asia proved again that Myanmar is the most attractive investible tower market in Asia, narrowly edging out Indonesia, India and China. In the last five years, the Myanmar telecom industry has evolved from a single state-owned operator that monopolised an underdeveloped market, to a competitive and diverse landscape, where four operators and dozens of independent towercos are driving infrastructure deployment, generating the highest organic growth rate, and already one of the highest tenancy ratios in the region.

Keywords: 5G, Acquisition, Apollo Towers, Asia, Asia Insights, Build-to-Suit, Co-locations, Delmec, Editorial, edotco, Energy, Energy Efficiency, Hybrid Power, Investors, Ministry of Transport & Communications, Meetup Asia, MNOs, Myanmar, New License, New Market Entrant, OCK, Off-Grid, Opex Reduction, Pass-Through, Post & Telecommunications Department, Regulation, Renewables, Small Cells, Solar, Towercos, Tower People, Wind

Read this article to learn:

- The instrumental role that regulation has played in Myanmar's tower market development
- Insights from key industry players including Apollo Towers, edotco, OCK, PTD and TPG
- What does the future hold for Myanmar's tower industry?
- How are towercos and MNOs collaborating to overcome operational challenges?
- Consolidation and the increasing role of small, upcoming towercos

Telecommunications in Myanmar has come a long way and the government has played an instrumental role in pushing the industry forward. Key institutional reforms, the implementation of a modern telecom law and a transparent licensing process for both operators and tower companies has created a very favourable regime for local and international MNOs, infrastructure developers and investors. The country was again one of the most popular topics at the fifth TowerXchange Meetup Asia, where several panels, roundtable discussions and speakers analysed and highlighted the great opportunities that Myanmar holds.

The evolution of Myanmar's regulatory regime

We were honoured to welcome Mr. Soe Naing, Director at the Post and Telecommunications Department (Ministry of Transport & Communications, Myanmar), who spoke at the event for the first time. Mr Naing provided an eloquent regulatory overview, which dissected how the government has boosted infrastructure deployment and tower sharing with its forward-thinking approach and policies.

Back in 2010, a few political reforms were the initial steps for the liberalisation of the country's telecommunication industry. Then, in 2012, a foreign investment law eliminated several restrictions and paved the way for international companies to enter Myanmar. A Telecommunications Act in the following year, Telenor and Ooredoo's licenses in 2014, and the creation of an independent regulatory body in 2015 were also critical steps ahead of the birth of a competitive and healthy tower market.

In 2013, Myanmar had one operator, less than 7mn phone users and 7,600 km of fibre. Now, the country has more than 52 mn phone subscribers and 68,000km of fibre with an internet penetration of 90%. Liberalisation has seen teledensity increase from 13% to 102.6% today. The reforms have improved internet speed (24 Mbps, second only to Singapore in the region), quality and overall coverage.

Stakeholders have recognised the importance of tower companies as Myanmar has licensed over 40 towercos who have built almost 10,000 towers in less than five years. The regulatory framework has encouraged tower sharing and colocations, has enforced zoning regulation to protect existing towers, and PTD projects tenancy ratios, already around two, to reach 2.5 by 2020. US dollar rents, with inflation related escalators applicable to 100% of rent, and non-cancellable contracts have all contributed to the creation of a highly investible tower industry in Myanmar.

Furthermore, the government has been working closely with the Central Bank and Myanmar Investment Commission, which has enabled the entrance of international investors such as TPG. Now, the Ministry of Transportation and Communication has set very ambitious goals but the industry is still facing several challenges that will require more reform, considerable investment and collaboration across the telecom ecosystem.

What lies ahead?

Mr. Soe Naing perfectly summarised the future objectives for the industry. The government is



Mr. Soe Naing, Director at the Post and Telecommunications Department

already preparing new spectrum allocation to enable 5G deployment, while aiming to establish a fully independent regulator—the Myanmar Telecom Commission. Additionally, the once state-owned operator MPT needs to finalise its corporatisation process, while the telecoms industry has to increase its community engagement in order to continue expanding.

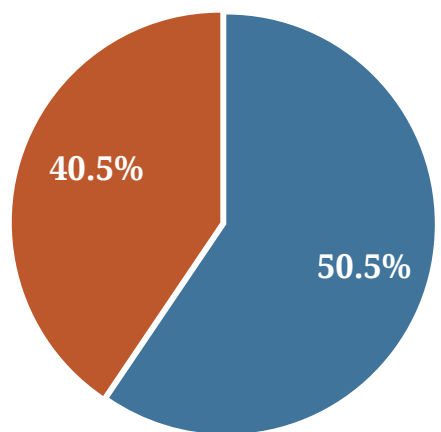
The goals are set but this dynamic market brings plenty of challenges for tower providers, MNOs and vendors. Power continues to be a key issue, with 65% of the towers in remote, off-grid locations, where communities can be reluctant and infrastructure deployment can be logistically

challenging. Data consumption keeps increasing exponentially and 5G will push the industry to look beyond traditional towers and explore alternative technologies and solutions. The government has created a Universal Service Obligation Fund to facilitate investment in rural coverage, while significant progress has been made toward the enablement of mobile financial services and smart cities.

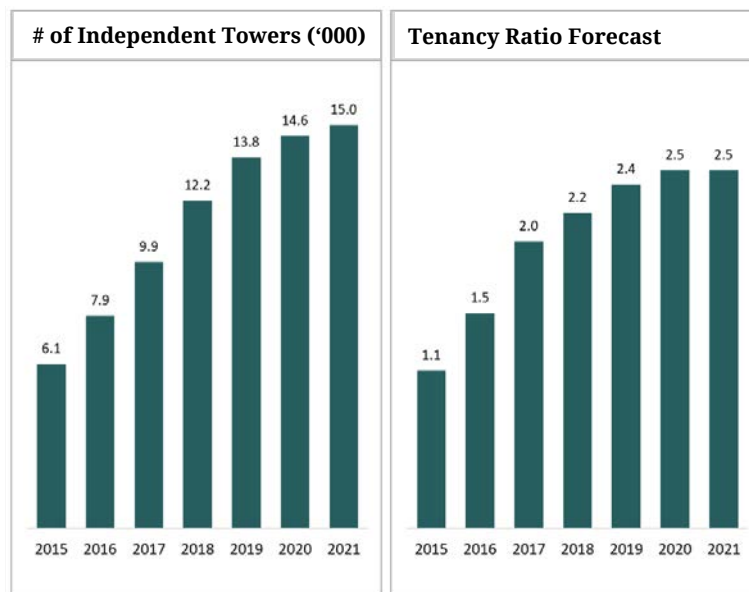
Industry perspectives

Right after PTD's keynote, Myanmar's panel discussion continued the conversation that TowerXchange started back in September, when

Myanmar telecom towers sector – the results so far



■ Independent towercos
■ Mobile network



Source: Company filings, Analysys Mason (2016)

Note: Forecasts based on independent tower companies only (excludes MNO-owned towers)

we travelled to Yangon to explore this evolving market. Representatives from Apollo Towers, TPG, edotco, Delmec, MPC and OCK Yangon took the stage and weighed in on Mytel’s impact, key operational challenges, consolidation and more.

Hardiman Telecommunications’ Paul Carpenter set the scene. He suggested Myanmar now has 16,000 towers, 3,000 rooftops, and 25,400 tenancies, with an average tenancy ratio on towerco sites of 1.74x.

TPG, represented by David Goldstein, has been one of the most active private foreign investors in the market, and in Goldstein words, they are just getting started. The company entered the market through

Apollo Towers in 2014 and consolidated its position as the second biggest tower portfolio with the recent acquisition of PAMEL: “The regulators have done a fantastic job. First, they’ve enabled foreign ownership and led a very transparent, pragmatic privatisation process that created an attractive scenario for us. Now data usage keeps increasing as users consume lots of content on their phones and this growth, plus the new operator, will keep driving the need of towers and tenancies,” Goldstein commented.

2018 has been a very positive year for towers in Myanmar and edotco has had been growing prolificly. The company has added 600 sites and

added 1000 tenancies to its portfolio in the last year. They have done BTS for both Ooredoo and MPT as well as taking over the management of Ooredoo’s energy assets, including power as a fundamental change to the company’s business model in the country. Innovation is in edotco’s DNA and the company has been busy testing ground-breaking solutions such as carbon rooftop poles, and a combined solar and wind power site generating 8kW of power, as well as new builds in remote areas. edotco are also proud to have partnered with Energize the Chain, who they met at TowerXchange in 2016, to commission five sites with the Ministry of Health to aid in the distribution of vaccines.

In a similar move, Apollo Towers has also taken over management of Ooredoo’s energy equipment on their sites. The towerco has been dealing with power for other clients since they entered Myanmar and Ooredoo asked them to apply that expertise, which in the words of Apollo’s Chief Commercial and Strategy Officer Yves Monnier, is very challenging, especially due the high uptime SLAs of certain sites, that sometimes approach 100%. Monnier commented positively on the potential consolidation of power assets, as Mytel’s entrance and PAMEL’s acquisition will allow them to optimise power cost by managing all the assets with a single team.

Equally, OCK has been also working very closely with its main client Telenor in optimising energy consumption in order to reduce opex, which is a pass through model. The Malaysian tower company is increasing its utilisation of solar and wind solutions – increasing from 60-100 hybridised sites



in the coming year. Renewables are reducing MNOs' opex as well as minimising maintenance costs due reductions in genset runtime. While focusing on optimisation and energy saving, OCK has also increased its portfolio and the company is now working with all four MNOs, as mentioned by OCK's Yangon CEO Omer Chappelart.

The demand is there, but does Myanmar have enough capacity? Delmec's CTO, Spencer Crawford-White, who has been studying the market for the last five years, commented: "The market has massively expanded. We are seeing plenty of new infrastructure and less conditional issues but we still identify some limitations. Mostly, there is some redundant, old equipment not being removed

from sites and that could have a negative impact on capacity for and speed of rollout of 5G. We are now working with OEMs on the implications and requirements of 5G. Structures are going to be heavier and bigger, so you need to plan ahead and start preparing your sites for future adoption."

New entrant towercos: competitors or acquisition targets?

The emergence of a number of new, small tower companies and their potential consolidation are critical themes in Myanmar. MPC is one of those emerging players that will also play an important role in the industry. MPC's new CEO Kieran Rabbitt came along and commented on the role they are

playing in Myanmar's tower industry: "We are playing our part and disrupting the industry in a very positive way. We obviously work with lower volumes but we can partner with established companies, while we also aim to collaborate with MNOs to cover hard-to-reach areas. We focus on opportunities that might be tough or too niche for traditional players such as remote, conflictive areas where you need to work closely with local communities," he said. In the case of MPC, they feel they can achieve sustainable margins at a lower rate, able to price as aggressively as some competitors, and hoping to innovate and compete in urban scenarios.

What are the new entrant tower companies in eyes of the most established players? All panellist agreed that the market is big enough to support everybody's existence – at least for now. Myanmar is a competitive, but also friendly environment with considerable growth potential. Both Mandalay and Yangon regions still face capacity issues and are in need of new sites, so there are plenty of new build opportunities ahead.

Unquestionably, the market will consolidate and big fish are very likely to absorb all many of the new small towercos in the next two to three years. edotco and Apollo are committed to Myanmar for the long-term and both companies are eyeing organic and inorganic growth opportunities: "When you merge, as we are just doing at the moment with PAMEL, you learn a lot from the other company and strengthen your team, which helps you in improving your service to customers. Colocations are indeed fundamental but we



still see strong BTS opportunities here,” Monnier commented.

TPG, edotco and MPC highlighted urban solutions, IBS, street furniture and small cells as the future alternative site typologies that will fuel continued impressive organic growth. Delmer’s Spencer Crawford-White added “Smart solutions and lamp post designs are evolving to fit into urban environments. We’re exploring leveraging AI to identify potential locations that offer the necessary elevation, with access to power and fibre. Densification via macro sites will be prohibitively expensive in Myanmar (and beyond) – we need to work together to accelerate dimensioning, planning

and deploying infill sites and co-hosted solutions like BTS hotels.”

Data will keep booming and towercos will need to explore how to better integrate new technologies and solutions to increase coverage and capacity. The industry needs to continue educating the country on the benefits of infrastructure sharing, and investing time and resources in boosting social licenses is fundamental. Power will continue to be an operational headache and the use of renewable energy will increase to help the industry in reducing diesel consumption and energy expenditures. Consolidation is guaranteed and TowerXchange forecast a bustling 2019 in Myanmar. Stay tuned! ■

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Philippines on the brink of independent tower lift-off



Operators and investors are ready, but DICT and towercos still need to take the final step



Pablo Crespo, Head of Research, Asia & Americas, TowerXchange

For the last couple of years, much tower industry attention has been on the Philippines after President Rodrigo Duterte announced his intention of developing a Common Tower Policy for the country. New entrant MNO Dito, who has recently received its license to operate, and the massive need for connectivity and coverage has made the archipelago very attractive for infrastructure developers and investors, but none of them have been able to rollout a single tower yet. TowerXchange headed to the country's chaotic capital to find out what are the plans of the Department of Information and Communications Technology (DICT) and sat down with the MNOs to discuss their views and position towards the imminent emergence of the tower industry in The Philippines.

Keywords: 5G, Aboitiz InfraCapital, American Tower, Asia Insights, Best of TowerXchange, China Telecom, DICT, Dito, Editorial, edotco, Energy, Frontier Tower Associates Philippines, Globe, IHS, Investors, MNOs, Manila, Market Entry, Market Overview, Mislattel, New Market Entrant, PLDT, Southeast Asia, The Philippines, Towercos

Read this article to learn:

- An update on The Philippines' common tower policy and DICT's plans
- The arrival of Dito, its requirements and future impact
- Globe and PLDT needs and strategy
- What are the main challenges and opportunities in the country?

Welcome, Dito

After almost two years of regulatory disputes, a few delays and no little controversy, Mislattel has finally received its mobile license. The new Filipino operator, owned by local businessman Dennis A. Uy and state-owned China Telecom Corp, is rebranding as Dito Telecommunity and will challenge the PLDT and Globe duopoly imminently. The new MNO has committed to provide 37% coverage at an average internet speed of 27Mbps in its first year, with an initial investment of more than US\$2.5bn, and the company is in advanced commercial and technical conversations with vendors and infrastructure partners, aiming to start its rollout after the summer.

Based on the incumbent's numbers and its coverage commitments, Dito has 330 days to build 3,000 sites, which will not be an easy task. Towercos are confident that they can deliver those numbers, while Mislattel hopes that the upcoming tower policy won't stop them from deploying their own towers, as the company plans to also build their sites autonomously and through local turnkey providers to minimise the risk of not meeting the mandated targets. While the industry awaits DICT's tower policy and its terms, Mislattel is encouraging towercos to be ready with their local capabilities while they liaise with Filipino constructors as the rollout start is imminent.

Site acquisition and permitting will be the main challenges, but Dito has already submitted its deployment plan and has asked towercos to start working on that front, as they already know the desired location for their sites. The operator, who

would have wanted to commission its first sites several months ago, aims to begin rolling out in the next two to four months. The 37% of the population that they need to cover would be easier to achieve, and generate higher ARPU, in urban areas, hence the company is expected to target Manila and other populated cities initially.

Unlike the incumbents, Dito is more likely to increase its rollout capex and build at least some multi-tenant towers, which would make the assets more attractive in a potential future sale and lease back, or should the company decide to carve out its own towerco in the medium term.

Although Dito's long-term vision is to own and build all its infrastructure, the company is now negotiating with third-party data centres providers and fibre optic networks, and the government has authorised the MNO to work with the National Grid Corporation of the Philippines (NGCP), who have a vast dark fibre network across the nation. Urban areas are going to be Dito's main target and rooftops will play a critical role in securing that mandated 37% coverage. The operator has also signed a collaboration agreement with the Metro Manila Development Authority (MMDA), which will accelerate urban small cell deployment in the capital, while the telco is also in touch with several passive providers that have access to real state owners across the country's main cities.

The rules of the game

The Department of Information and Communications Technology (DICT) has recently



appointed Sen. Gregorio “Gringo” Honasan as its new Secretary, and former acting secretary Eliseo Rio. Jr will remain second in command as undersecretary for operations while the entity finalise the conditions and details of the common tower policy, which will be decisive in opening the door to towercos and will ultimately allow DITO to fulfil its coverage commitment.

After some rumours and speculation, TowerXchange has confirmed that DICT's new leadership plans to go ahead with the Common Tower Policy and release the final version as soon as possible. In fact, the new secretary held a meeting with key industry

stakeholders on August 7th to clarify previous misunderstandings, hear all the parties involved, and start finalising the policy terms. DICT now wants to include all parties' inputs and needs in a policy that, in words of the institution, should be “fair with everybody's requirements”. As of now, there is no timeline for its final version, but DICT aims to share a new draft in the next couple of months and get a definitive version soon after.

DICT's priority is to develop the necessary framework to ease and accelerate tower deployment in order to drive connectivity in the country, as currently, The Philippines has one of the worst and



most expensive internet services across Southeast Asia. Therefore, DICT will facilitate antennas and small cell rollout across public buildings and is also considering the implementation of tools to measure the quality of service in certain areas, which will help in determining how much more infrastructure is needed.

Whether MNOs will be able to rollout their own towers remains the biggest question. At time of writing, DICT had signed MOUs with 24 potential infrastructure providers and the final number of towercos that will be able to operate in the country is another big unknown. Competition will

be indeed beneficial and a diverse tower market could help Mislattel and the incumbents, but future infrastructure providers should have certain degree of experience and financial strength, as the Philippines' complex geography, its extreme weather conditions and the required initial investment could become problematic barriers for inexperienced players and investors. In addition, too many developers looking for an early buyout could disturb the emerging tower industry operationally and both MNOs and their clients would be ultimately affected.

On a positive note, the government has recently signed the implementation rules and regulations of

the Ease of Doing Business law, a critical move that aims to eliminate bureaucratic barriers in different sectors and which will help both towercos and MNOs in obtaining installation permits. Based on this law, Local Government Units will have to provide permits within certain timescales; otherwise, permits will be automatically approved. Moreover, the government has created a commission that will review its implementation and is planning to release an executive order to both public and private entities to instruct them not to slow down telecom infrastructure deployment.

President's advisor Ramon Jacinto, who is playing an instrumental role in the configuration of the Common Tower Policy, believes that towercos should be responsible for their majority of the upcoming rollout and that MNOs should exceptionally be allowed to build in very specific cases where their infrastructure partners cannot fulfil their requirements.

The reign is over

Both PLDT and Globe will benefit from the entrance of towercos into the country, but the emergence of a third MNO will definitely push them out of their comfort zone.

Neither of the incumbent operators wants to sell any assets now, while both companies are waiting on the DICT's tower policy terms to see whether they would be able to continue building their own towers or whether deployment will be limited to towercos. Currently, most of their towers don't have capacity to host more than one tenant, but the assets would still

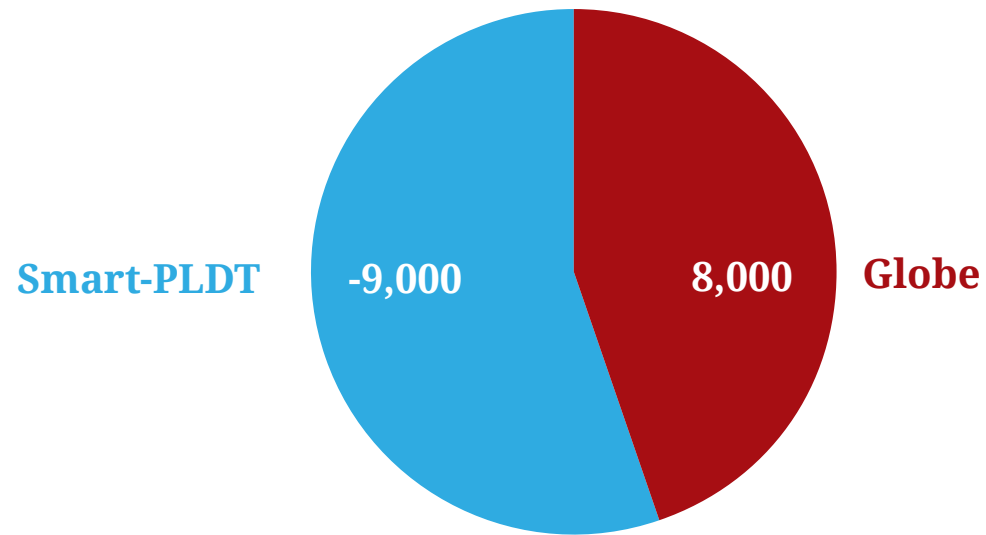
be attractive in a potential sale, as towercos could acquire them, reinforce or decommission the towers and build multi-tenant sites without going through the arduous permitting process.

For the last couple of years, market leader Globe was considering a sale or a carve out of its almost 9,000 towers. However, the company has now put that possibility on hold and will continue its expansion through BTS agreements with towercos in line with the government mandates. The company has signed an MoU for the deployment of 150 sites across the Calabarzon region with edotco and its local partner ISOC, who are currently working together and plan to formalise their joint venture shortly. Globe has also signed another MoU with Aboitiz InfraCapital and Frontier Tower Associates Philippines (FTAP), who have also closed a partnership to develop towers in the country.

With 85 million subscribers, Globe plans to continue expanding coverage across Philippines spread geography, although Cebu, Davao and Metro Manila are the company's main priorities due the high population and increasing demand of those areas. Globe has declared its willingness to collaborate and support the tower initiative, and several company executives have confirmed to TowerXchange that they believe working with towercos is the best way forward. Moreover, the company has been allowing access to its sites to local MVNOs, so Globe is not new to the idea of infrastructure sharing.

Although the percentage of off-grid sites is very low, securing a continuous power supply in certain sites is sometimes challenging, and both operators

Tower ownership in Philippines



Source: TowerXchange

currently rely on gensets for backup. Globe is now moving towards greener alternatives and installing lithium batteries progressively across their sites. The company is also exploring fuel cells and testing some renewable solutions for the future.

For its part, PLDT has declared that they are not willing to share access with rival Globe on their ~9,850 existing towers, but the MNO would consider synergies with the other telcos on new sites. Although PLDT won't be selling any of its assets, the company is also open to the idea of working with towercos in order to reduce capex and drive efficiencies and it is very keen on finding a partner for IBS deployment.

PLDT has been very active in 5G development and the company has recently conducted a test alongside Nokia in Manila, while also doing R&D work with

other telecom leaders, exploring different solutions for the development of 5G technology as the company plans to be ready for its implementation by 2020.

PLDT is also looking at greener solutions and currently evaluating lithium battery installation and renewable energy generation to reduce their costs and carbon footprint in the country.

Demand is quickly growing in the Philippines and the incumbents have a huge amount of spectrum, so they are able to add capacity and offload traffic by adding more equipment to their existing sites. Regardless, the entrance of a new player will affect their market share and both will be forced to improve their services and increase their coverage by deploying new sites in this new competitive scenario.

NOW Telecom: Under the radar

Although not many international developers and investors are aware of its presence in The Philippines, NOW Telecom plans to play a role in 5G development. The company has recently renewed a 25-years franchise to provide fixed wireless, mobile and satellite internet services and the National Telecommunications Commission has awarded them a license to operate.

This niche operator only targets enterprises and provides fixed wireless access to different business in Metro Manila using its portfolio of 400 radio antennas that are located in rooftops across the capital. NOW owns a 3.5 GHz frequency and plans to use it to develop a 5G network that will provide innovative services to businesses in the near term.

The company will not be deploying macro towers, but they will have a considerable need for urban poles, antennas, small-cells and IBS. NOW Telecom is currently looking for an urban infrastructure partner that can ease their deployment, achieve scalability and standardise the technological requirements and setting of their sites in Manila.

Upcoming challenges and opportunities

The appeal of the Philippines seems obvious: we have an underserved virgin market with three MNOs—one of them coming in full force and supported by China Telecom's financial strength. Mislattel needs at least 3,000 towers in the next year and the country has to double the current number of sites to achieve targeted levels of coverage

and service quality. Moreover, the government is building the necessary regulatory framework to push the industry forward, facilitate the entrance of towercos and ensure their successful penetration.

However, towercos will not have an easy path. For decades, the duopoly has made Globe and PLDT very comfortable and unfortunately, the operators are most likely to start giving away the most challenging rollout slots to their infrastructure partners.

Traditionally, permitting has been one of the main headaches, as you require an average of 25 different licenses per site on a process that can take up to nine months. The country has around 50,000 powerful barangays—Filipino local government units—who tend to complicate and delay deployment. The Ease of Doing Business legislation should improve and accelerate the process, but its effectiveness is still to be proven. In addition, the government willingness to welcome towercos is unquestionable, but the Common Tower Policy implementation has experienced several delays and many international investors and infrastructure developers are still waiting on its guidelines before making the final move.

The Philippine archipelago comprises more than 7,000 islands, which makes logistics complex. MNOs are set to continue focusing on urban and more accessible areas, but eventually they will have to expand to rural and remote regions in order to find growth, which will bring operational headaches but also plenty of opportunities in energy and security for experienced and creative towercos and their partners.

Both initial investment and risk are relatively high, and capex will be considerable too. In addition, The Philippines has one of the most extreme weather conditions in the world, with flooding, earthquakes and high winds disrupting operations. Health and security must be prioritised in The Philippines, and that is another reason why experienced and skilled infrastructure developers will be required.

With the exponential data growth and both PDLT and Globe already testing 5G, fibre and small cells should be key elements of towercos' offer in the country. Many buildings in Metro Manila and other urban areas are owned by a few national developers, so it should be relatively easy to partner with them to secure attractive slots than can later host the three country's operators equipment. The government will be facilitating access to public buildings, and billboards will also be an attractive resource for tower companies in urban areas—since Pilipino billboards are famous to be the most robust across the globe due to the aforementioned extreme weather, therefore their structures can easily accommodate microsites and small cells.

The ball is now in DICT's court and the implementation of the policy as well as the appropriate conditions are the final step towards the creation of the new Asian tower market. Although the likes of edotco, American Tower and his, among many other towercos, have already been on the ground in the country, many international players are awaiting on the right policy terms and its implementation before making the final move. The opportunity is obvious, so is the risk, and towercos will need to embrace both ■

Data utilisation is a pressing challenge for towercos in a time of change



Preliminary findings from Analysys Mason's leadership of the data collection and utilisation working group



By Caroline Gabriel, Analysys Mason

TowerXchange are delighted that Analysys Mason has kindly agreed to take over our data collection and utilisation working group. The working group emerged from several successive round tables at past TowerXchange Meetups, initially focusing on remote monitoring systems, then site management and asset management systems, before combining these areas into an holistic discussion of the flow of data from sites into repositories and visualisation platforms. Contributed by Caroline Gabriel, a Principal Analyst at Analysys Mason, this article combined insights gleaned from several vendor and towerco interviews, and from the data collection and utilisation working group meeting moderated by Caroline at the TowerXchange Meetup Europe, April 2019.

Keywords: Analysys Mason, Data Collection and Utilisation, Job Ticketing, KPIs, Multi-Region, Operational Excellence, RMS, Research, Site Management System, Site Visits

Read this article to learn:

- The gulf between aspiration and real world usage of data by towercos
- Why towercos need to understand their assets better
- The opportunity to leverage open frameworks to share data among stakeholders
- The goal of integrating many data sources to drive intelligent operations

The newest TowerXchange working group is concerned with one of the most challenging issues in the industry – data collection and utilisation. At the group's last meeting in London, a lively discussion highlighted some common concerns for many towercos and their software suppliers.

In partnership with telecoms research and consulting firm Analysys Mason, TowerXchange has been conducting interviews with many stakeholders – towercos and suppliers of site management and other software. The aim is to understand the most pressing concerns and objectives to improve data usage and business intelligence, and to start to formulate a framework of best practice.

Initially, a report will be produced outlining the key challenges and solutions, which will be discussed and refined during the working group meeting at the TowerXchange Meetup Americas in Boca Raton, Florida on July 9-10. Then there will be an ongoing process of research, discussion and exchange of ideas, resulting in a rich base of case studies and recommendations on which the members can draw to support their own data initiatives.

There is a gulf between aspiration and real world data usage

The first round of research and interviews revealed that there is a deep gulf between aspiration and real world practice for many companies, and the impact of that on the business will become more serious as challenges multiply. MNO consolidation and the narrowing scope for greenfield expansion will make

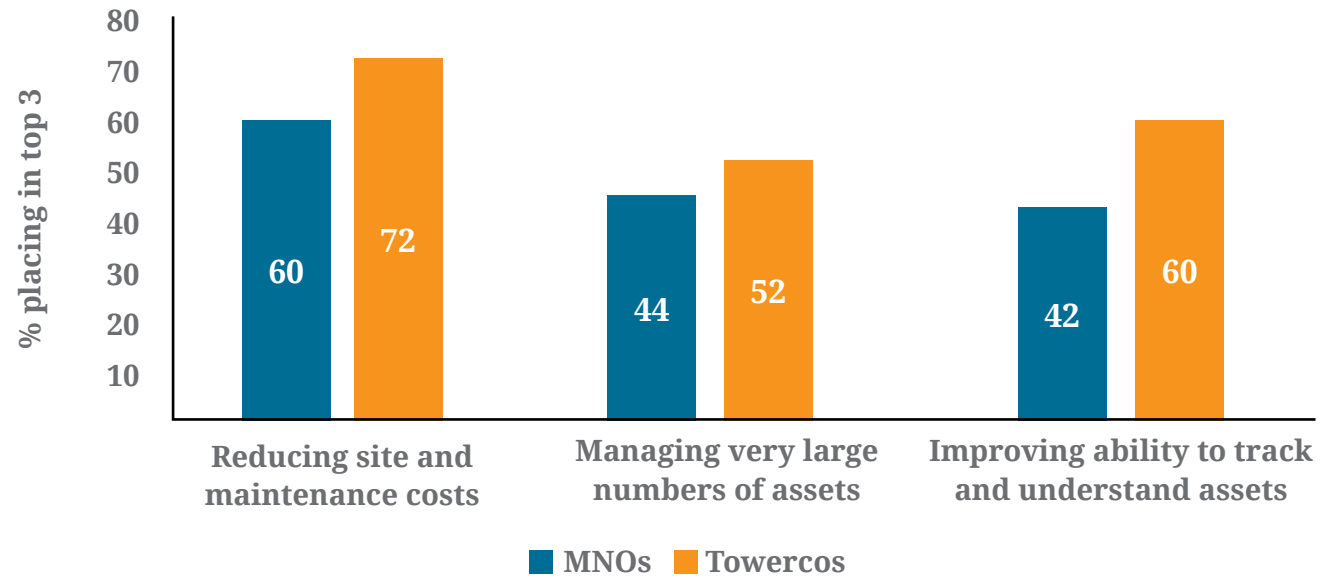
it critical for towercos to operate as efficiently as possible, harnessing all the information from their sites to support intelligent decision-making.

And as new network architectures proliferate, many towercos are considering expanding their business models to cover small cells, edge computing, fibre and added-value services – but with so many additional elements to manage, rich and up-to-date data inputs will be even more essential.

On the aspirational side, the attendees at the working group meeting agreed that there were several areas in which advanced data collection, analysis and visualisation would help them be more competitive and efficient. These were:

- Enabling of near-real time response to problems or to changes in network behaviour, to pre-empt issues which might have a negative business impact.
- Advanced analytics to give towercos the same depth of understanding of their assets that the MNOs often have of their equipment. That would support better decisions in many areas, from M&A to negotiation with tenants. It will also be important to support SLAs with tenants.
- Moving towards predictive capabilities, in terms of planning site additions and upgrades, or for maintenance. This would increase reliability of the infrastructure while reducing site visits and costs.
- Enabling a more automated, reliable way to share data about assets with an increasingly complex set of partners, in an industry where sharing, consolidation and co-investment with new stakeholders are on the rise.

Placing in top 3 challenges re 5G infrastructure



- Eventually, applying future analytics techniques like machine learning to improve planning, operations and transactional decision still further.

All of these will become increasingly important to support the need to combine high levels of automation - the only viable way to operate very dense networks in future – with higher levels of quality of service (QoS).

In reality, though, most companies admitted they were still using Excel as their primary tool, and had significant gaps in their knowledge of their tenants' equipment and even their own assets. Many acquire tower portfolios with very incomplete data about the equipment involved; some only monitor critical sites.

Several highlighted that it has not been traditional for most towercos to invest heavily in IT and data systems, and that has created an intelligence gap between infrastructure companies and their MNO tenants.

Towercos need to understand their assets better

In addition to the business pressures outlined above, this is driving a new level of commitment to invest in core systems for infrastructure management, site operations management and business process management (BPM). Indeed, in a survey of over 40 towercos, conducted by Analysys Mason, the need for improved ability to track and understand assets emerged as the third biggest

business challenge at the start of the 5G era. Asked to name their top three challenges, these issues were most pressing:

- Reducing site and maintenance costs (72% of towercos put this in the top 3)
- Managing a very large number of assets (52%)
- Improving the ability to track and understand the assets (60%)

Better data tools would help to address all these challenges, and make the towercos more ‘MNO-like’ in their detailed knowledge of their assets. Indeed, they have the opportunity to leapfrog stakeholders with strong data functions, by adopting the most modern, best-in-class analytics systems as well as a new breed of smart on-site devices to collect the information.

These smart devices are important to fill the significant gaps in knowledge of the towerco’s equipment, and some new equipment, such as power interface units, come with in-built sensors, while smart meters are helping to automate the billing and provisioning processes for towercos with large power supply businesses.

This is just one of the techniques which could achieve a key objective for towercos – to reduce the number of costly site visits required to identify the equipment on a particular tower. Site visits to ensure every piece of active equipment is recorded and billed for can cost thousands of dollars apiece, so automatic updates on any equipment changes would have an immediate impact on cost as well as aiding future planning.

MNOs have invested more in this to date because they manage more items on a site, while the towercos only have to be concerned with passive equipment, power, and sometimes fibre. As more of them invest in larger and denser networks, and add fibre, edge nodes and even active radio equipment on the sites, their requirement will become almost the same as an MNO’s.

However, smart devices are only one part of the solution. While understanding the assets a towerco has, and being able to monitor them, are big steps forward for many, there is a big difference between asset tracking, and monitoring of their performance – and an even bigger difference between that and proactive trouble-shooting and forward planning.

That will require not just collecting data but being able to visualise and analyse it in a detailed way. Towercos are interested in many emerging methods of doing this. Among those cited were virtual reality/augmented reality overlays of the equipment on sites, for remote monitoring and simulation of different scenarios. Perhaps a shorter term option is to make better use of crowdsourced data on active sites and usage, especially in dense environments like cities. This can provide a useful cross-check with other sources.

Open frameworks would help different stakeholders to share data

While the towercos were open about the lessons they could learn from MNOs, there are also areas where they have better knowledge than their

key tenants. While operators are concerned with tracking network performance and linking that to active network management and to billing, they often lack detailed understanding of the infrastructure underneath, especially if they did not previously own the towers themselves. They are more advanced in analysing and utilising their data, but there are still big gaps in their information.

Ideally, then, there would be more open, consistent ways for towercos and operators to share information, so that each had a more complete and accurate picture as the basis of decision making (while protecting competitive intelligence of course).

Most working group members felt that open frameworks for sharing data would be helpful, and would make it easier to make well informed decisions about the performance and value of an asset, as well as how to monetise it better. In particular, it would be valuable for infrastructure network designs to be integrated easily with the MNO’s radio plan, and to correlate towerco asset tracking with MNO network performance monitoring, so that the relationships between the two could be understood and actions taken.

However, there was also strong consensus that, despite some work on open interfaces by the vendor community, this was a longer term aspiration and the most immediate priority should be to improve the completeness of the towerco’s own data and its ability to analyse it.

Integration of many data sources will drive intelligent operations

The challenge that relates to all of these issues is to integrate and cross-reference every source of data – the towerco’s own or a third party’s – to enable rich, forward-looking decision making and to underpin fully automated management processes. This is the heart of the workgroup’s mission, to accelerate a process which many towercos think is a remote prospect.

One workgroup member said: “It’s like we have connected homes, but no intelligence to combine them. Some people have data on network performance, some on assets, some on power – there is no aggregation or analysis.”

There was consensus that the objectives would not be achieved until every source of data could be combined and cross-referenced – site equipment feeds with foot traffic, plus information from crowdsourcing or from Google and Facebook. That would create a rich knowledge base into which people, or automated systems, could drill down to extract smaller, actionable tiles.

Appointing a chief data officer, with experience in how to structure and integrate data, and the right questions to ask of it, will be a next step for some towercos. But for many, it still seems to be a futuristic step. “We are still getting data collection right, then we can define the KPIs, then refine them,” said one participant. Only after that would

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a chief data officer be able to make a significant difference to the business.

This, then, is the ambition of the working group – to listen to the views and experiences of the towercos and their suppliers; to identify areas of best practice and strong market solutions; to drive a consensus about next steps, in order to ease the path for all operators to evolve into a world of big data and advanced business intelligence ■

Tower  Xchange

Meetup Asia 2019
3-4 December, Singapore

Meetup MENA 2020
28-29 January, Dubai

Meetup Europe 2020
19-20 May, Barcelona

Meetup Americas 2020
23-24 June, Boca Raton

Meetup China 2020
September

Meetup Africa 2020
13-14 October, Johannesburg

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Energy working group report: TowerXchange Meetup Asia 2018



Asia's leading telecom energy buyers discuss renewables, business models, O&M

Introducing the telecom energy buyers

edotco: Represented at the TowerXchange Meetup by over a dozen members of their leadership team, edotco is currently active in six countries (Bangladesh, Cambodia, Malaysia, Myanmar, Pakistan and Sri Lanka), with intent to launch in Laos and the Philippines. edotco currently owns over 18,000 towers and manages a further 10,000. 80% of edotco's towers have outdoor configurations. Around 5% are off grid. edotco is a renowned innovator, and is conducting feasibility studies for renewable energy.

Bharti Infratel: Represented in the working group by their CTO, Bharti Infratel currently has over 40,000 towers. When the imminent merger with Indus Towers, in which Bharti Infratel owns a 42% stake, is complete, the combined entity will own over 164,000 towers across all Circles in India. With such a diverse footprint, power availability and load requirements vary considerably. Bharti Infratel's historical focus has been purely on passive infrastructure, but they are increasingly involved in provision of active infrastructure, particularly within smart city initiatives. Bharti Infratel's wish list? High return on investment solutions, which can be effectively maintained.

Ascend Telecom Infrastructure: Represented in the working group by their CEO, Ascend has 6,200 towers across India. Ascend are green energy pioneers. While energy represents 60%+ of MNO opex in India, energy efficiency will remain their number one priority. Ascend uses business



By Kieron Osmotherly, CEO, TowerXchange who also moderated the group

TowerXchange hosted another productive and insightful energy working group at the 5th annual TowerXchange Meetup Asia in Singapore. Decision makers from four of the region's leading towercos, plus an innovative MNO, shared candid insights into their cell site energy experiences and requirements. Here is a summary from our minutes of the working group. Respecting Chatham House Rules, apart from a brief introduction to the participating buyers, subsequent comments have been anonymised.

Keywords: 5G, Ascend Telecom Infrastructure, Asia, Batteries, Bharti Infratel, Dimensioning, edotco, ESCOs, Energy, Energy Efficiency, Fixed Price, Fuel Cell, GTL Infrastructure, Hybrid Power, India, Indosat Ooredoo, Off-Grid, On-Grid, Opex Reduction, Pass-Through, Procurement, ROI, Renewables, Research, SLA, Site Visits, Skilled Workforces, Solar, Uptime, Who's Who

Read this article to learn:

- A frank assessment of how buyers view current TCO in renewables
- The relative merits of power pass through versus fixed energy cost models
- How O&M skills affect energy efficiency
- Sample costs per kWh off grid in Asia
- Why ESCOs have not taken off in Asia to the extent they have in SSA

analytics to gather data points that provide critical information enabling proactive interventions.

GTL Infrastructure: Represented in the working group by their VP Strategy, GTL Infrastructure owns 27,707 towers in India. They share Bharti Infratel and Ascend Telecom’s green tower objectives, and are seeking win-win risk sharing partnerships with vendors.

Indosat Ooredoo: Represented by their Division Head for Tower Commerce, Indosat Ooredoo introduced their portfolio of 30,000 sites in Indonesia, around half of which are owned, half co-located with towercos. Indosat Ooredoo’s primary divers are also cost-related, driven by falling ARPU and tariff wars, leading to downward pressure on opex, particularly cost of power. Power remains the MNOs’ responsibility in Indonesia, not the towercos’.

The continuing search for return on investment in renewables

“When will the savings justify widespread investment in renewables, particularly solar?” Asked one towerco. “While we quantify savings in diesel reductions, we remain wary when the calculation of ROI is not undertaken across the whole ecosystem: capex, maintenance opex, cost relative to grid,” the towerco continued.

“We’ve trialled renewable energy solutions where the return on investment the vendor modelled in Excel was not achieved in the field,” suggested a towerco.



Esteemed leaders of the Energy Working Group Asia 2018

“A number of factors, including actual opex, seasonal variations, and the impact of Service Level Agreements (SLAs) create legitimate deviations from models,” responded another towerco. “For us the feasibility and Total Cost of Ownership (TCO) of solar is about five factors: load, PV capacity, the batteries, fuel price, and optimising configuration.”

“No-one can justify investing in renewables on an environmental basis only, although reducing the carbon footprint is factored into our TCO calculation,” said another towerco. “What we need are smoother pathways to implementation – it’s the customisation costs that are most harming the TCO.”

Another towerco commented: “We appreciate the efforts, research and development being invested by solution providers. We’re not put off by the variance between modelled and delivered ROI as we appreciate that solutions need customising to the local environment. Our recommendation to vendors would be to spend less time on your spreadsheets and ROI models, and more time on proofs of concept generating live data, based on which you can continue to refine solutions.”

“We are willing to invest in renewables with the right return on investment on a TCO basis,” added another towerco. “The challenge used to be

Cost per kWh off grid

“In Southeast Asia, we’re paying around 56 cents per kWh off grid, inclusive of generation and capex,” said one towerco. “It’s probably much less in India.”

“Yes, we’re paying as little as 10 cents per kWh off grid on a plug and play basis,” added an Indian towerco.

“And we’re probably burning 300-400ML of diesel per kWh,” added another Indian towerco ■

sizing the hybrid system, but we have a good sizing tool now. Ultimately, with hybridisation, batteries typically represent 40-50% of the capex, depending on the degree of desired autonomy. Sizing hybrid is all about energy storage capacity: if you size the solution too small, you burn more diesel, and achieve less autonomy and incur greater risk of downtime.”

“We also do our own design and dimensioning,” agreed a different towerco. “The modularity and scalability of the solution is key to controlling TCO in the long term, as well as the sheer amount of space in the stack.”

“In India, renewable energy vendors targeting cell sites are chasing a moving target,” said a towerco from that country. “As the grid is being extended, more and more off grid sites are being connected. Around 98% of India’s cell sites are now grid connected.”

The same towerco continued: “the telco load is also not a constant, as more tenants are added (or

churn off sites), and as antennae are swapped. Peak and off-peak usage patterns are changing, yet MNOs don’t always dimension to reflect peak demand, which can lead to an upgrade requirement, even on grid.”

The relative merits of power pass through versus fixed energy cost models

A primer for readers that are newer to the tower industry. From an energy perspective, towerco business models fall into three categories:

- Pure ‘steel and grass’ towercos that only provide ‘vertical real estate’ – MNOs retain responsibility for primary and backup power
- Power-as-a-service towercos that take responsibility for power but pass through the cost of that power direct to the MNOs
- Power-as-a-service towercos that take responsibility for power and charge a fixed cost for that power to the MNOs, thus making a margin on energy efficiency gains

The working group discussed the relative merits, particularly of the latter two business models.

“Even with a pass through business model, the MNOs’ primary concern remains opex, and energy is the largest component thereof,” said one towerco.

“MNOs want uptime at the lowest possible cost,” said another towerco. “When power is a pass through, it can cause a misalignment between towerco investment and who it is that benefits from reducing energy costs. Hence MNOs increasingly favour power-as-a-service with a fixed energy cost. It’s a win-win: the MNO caps their rising

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When power is a pass through, it can cause a misalignment between towerco investment and who it is that benefits from reducing energy costs. Hence MNOs increasingly favour power-as-a-service with a fixed energy cost

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energy costs, while the towerco can invest to create margin.”

“We operate a variant on the fixed energy model,” said a third towerco. “We deploy our own capex to improve energy efficiency, and we pass on 40% of savings to the tenants. Nonetheless, the MNO wanted more, despite us taking the risk, putting in the effort and incurring the cost!”

“Towercos are B2B business models, and with that comes an expectation of cost plus pricing,” countered another towerco. “We must stand behind and support our MNO partners’ performance.”

“

Uptime is going to be even more critical if many 5G use cases are proven, such as telemedicine or autonomous vehicles. And 5G antenna also consume 2-3x as much power as 4G. In the 5G era, there will be a need for a ‘new normal’, where all stakeholders share a commitment to, and share the benefits of, lower cost energy

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Why have ESCOs not taken off in Asia to the extent that they have in SSA?

One towerco’s simple response: “we have the necessary in-house knowledge.”

“Regulatory challenges remain a big inhibitor,” added another towerco.

TowerXchange research in late 2018 suggested ESCOs owned and operated the power systems on 6,414 cell sites in India – an impressive total, but a total which has not greatly increased in the last three years. While turbulence in the Indian telecom market offers one explanation, one of the towercos in the working group offered an alternate perspective.

“India’s initial ESCO contracts had room for improvement. They typically assumed a 1.5kW load, but when incremental load was added tenants demanded the same fees despite increasing costs, and the contracts did not always protect the ESCO from having to provide that. In that context, the economics often precluded investment in energy efficiency innovations, and as a result performance against SLAs suffered.” ■

“We can earn bonuses for outperforming our uptime KPIs, and are hit by penalties for missing our SLAs,” said another towerco. “Yet energy vendors don’t pay the price for downtime, which makes us inclined to use only solutions that have stood the test of time.”

“Is there a win-win, gain sharing model to be explored between towercos, MNOs and vendors?”
Asked one vendor.

“Vendors can offer an opex model, sharing gains and sharing risk on SLAs,” commented one towerco. “But most mature towercos have access to lower cost capital than vendors, so we tend to prefer a capex model.”

TowerXchange has also found that mature towercos are seldom receptive to gain-sharing or opex models from vendors. “We like spending money to save money,” the CEO of a large African towerco told us.

There are exceptions of course. For example, several early stage Myanmar towercos formed deep vendor finance partnerships in the first one to two years of the rollout, but in many cases those partnerships were put under strain by the relatively slow payment cycles from MNO to towerco to vendor – and exacerbated by limited access to foreign currency.

“Uptime is going to be even more critical if many 5G use cases are proven, such as telemedicine

or autonomous vehicles. And 5G antenna also consume 2-3x as much power as 4G. In the 5G era, there will be a need for a ‘new normal’, where all stakeholders share a commitment to, and share the benefits of, lower cost energy,” concluded one of the energy working group participants.

Operations and maintenance

Towercos attending the working group adopted a variety of approaches to operations and maintenance (O&M) from retaining skills in-house, to fully outsourcing O&M to third parties. Where did towercos feel the greatest gains were to be found from investing in O&M skills?

“A good O&M team enables effective field trials before new equipment is widely installed, so we can learn the actual performance in the field. We see those gains in monitoring and control,” said one towerco.

Another towerco agreed: “the skillset of the field force is key to bridging the gap between what the vendor promises, and field performance. For example, we use a mobile app to both deliver training modules, and to provide practical support at sites, ensuring our workforce are kept abreast.”

“Diesel pilferage is one area affected by the quality of O&M resources, particularly where you outsource,” added a third towerco. “And there’s always a risk if you award short O&M contracts that there is no incentive for the contractor to invest in training.” ■

Selected soundbytes from the energy working group

“We like fuel cell technology. If we bring a fuel cell to a site, and switch off the DG, it works great. It’s not the fuel cell technology that is the challenge, it’s the fuel supply and logistics.”

“We also like lithium-ion batteries. But any battery is only as good as the Battery Management System (BMS). We had a BMS showing 99% when the cell was actually at 70%, which incurred an SLA penalty, although the penalty was back to backed with the vendor.”

“We have learned the hard way that some technologies are too sensitive to be suitable for India. For example, they must be able to tolerate operation in temperatures in excess of 35°C, and be able to tolerate a lot of dust.”

“I’m sorry but I don’t believe anyone has a solar solution that requires a site visit as infrequently as once every 12-18 months. It’s not the battery cells, the air conditioning filters or anything else that need service – we simply have to clean the PV. Our current service intervals on solar hybrid cell sites are around every 500 hours – best case 1,000 hours.”

Asian towercos instrumental to accelerate fibre deployment



Insights from leading experts at the TowerXchange Meetup Asia 2018



Puja Goyal, Principal - Transaction Advisory TMT, Capitel

The criticality of fibre to the tower in readying markets for 4G and 5G was one of the key themes discussed during the past edition of the TowerXchange Meetup Asia. Puja Goyal, Principal within advisory firm Capitel, shared some insightful considerations on the drivers of fibre deployment during her keynote speech at the event and then moderated an interesting panel on the topic. Here is a summary of key findings from both sessions.

Keywords: 4G, 5G, Asia, Asia Insights, Australia, Backhaul & FTTT, Business Case, Capex, Core Network, Dense Air, EBITDA, Extenet, Fibre, Fibreco, India, Indonesia, Infraco, Infrastructure Funds, Infrastructure Sharing, Insights, Investment, Myanmar, Site Level Profitability, Small Cells, South Asia, Vodafone, Zayo

Read this article to learn:

- Why towercos are well positioned to deploy fibre
- Why 5G still poses more questions than answers
- Fibre architecture and pricing models at a glance
- Towercos and fibre: examples from across APAC

Asian towercos are eyeing opportunities in fibre, with towercos in markets like Indonesia and India more advanced than others but in general, they are still looking for the right formula to successfully invest in this segment. In the meantime, fibre deployment efforts by operators, neutral hosts, small cell players and fibrecons are intensifying, as everyone is gearing up for 5G and striving to enhance the quality of service of existing 4G networks.

New fibre alliances are being formed on a global basis, and the M&A pipeline is healthy. On the operators' front for example, Vodafone has been partnering with Dense Air among others for metro fibre as well as last mile, while independent fibreco Zayo has already acquired multiple fibre networks and small cell player Extenet is actively scouting metro networks and has already added the metro fibre across New York to its portfolio. While the business case for towercos to invest in fibre is there, the game is getting tougher as various specialised players are strengthening their positions.

Given the involvement of so many other stakeholders, why should towercos start deploying fibre?

There are some straightforward drivers as to why towercos should get involved in fibre.

Returns: First of all, fiberised towers ensure better returns than those on microwave and the revenue incrementally grows for fiberised towers utilised as hubs for small cells, 5G and enterprise connectivity

(FTTB). 5G and small cells require fibre so, while fibre as an asset might be less easily replicable than towers and scale harder to achieve, it soon won't be an option but a critical need. Additionally, 5G is expected to increase the tenancy demand by as much as 6x compared to 4G.

Access to capital: MNOs lack the capex availability to invest in fibre while towercos have access to cheaper capital and connections with infrastructure funds. In light of this and their experience in enabling infrastructure sharing, towercos could have a positive influence in bringing the cost of fiberising sites down.

Bundled products: Towercos own and manage tower portfolios and are able to assess the demand for fiberised towers before investing in the deployment. Additionally, towercos can bundle fiberised towers with more products such as small cells and 5G nodes. And they can emulate the tower opex model in their fibre operations and incorporate fibre in their MLAs on a "consumption basis", with bolt-ons for small cell connectivity.

Familiarity with the opex model: Towercos already utilise recurring opex based models and can leverage this know-how in their fibre contracts too. Towercos can charge a monthly opex per pair per km, based on the distance of the tower from the operator's metro fibre ring, or per site with a flat rate for all towers in the city and finally per GB, applying a flat rate on consumption.

Negotiation skills: Additionally, towercos are quite



used to negotiate with real estate providers, and can use those partnerships also to expand their fibre network. They can target a variety of customer segments including large and medium enterprises, small businesses and SoHo (small office, home office).

Towercos still need to define what 5G means to them

Given the above, towercos might seem simply "slow" in embracing fibre but this could also be related to the fact that they are still trying to figure out what 5G means for them. Will 5G simply

entail additional loading or a full new tenancy? Are existing towers able to accommodate 5G equipment at the required height and do they have enough capacity? Towercos need to find correct answers before they can fully embrace the fibre game.

5G planning is essential and that should define the use cases for last mile and metro fibre. But while 5G is still being tested, fibre is already required to improve the quality of service of 4G, which remains a priority for many operators and one of the reasons why fibre is still seen as a competitive advantage.

The opportunities for towercos (perhaps better defined as infracos) to provide fibre extend to areas such as cloud RAN, where fronthaul will require fibre to function and ensure the necessary low latency.

Depending on who deploys fibre, a certain business model and pricing structure apply

The chosen network architecture will depend on the business model and who deploys it.

1) Tower centric fibrecos

Fibrecos focus on connecting business customers and predominantly serve enterprise and data centres with long-term contracts and revenue visibility. They are mostly B2B players providing either metro fibre or including last mile connectivity. Examples include Reliance Jio, Lighttower as well as most towercos.

2) Carrier-neutral fibrecos and / or metro fibre providers

This segment mainly connects operator-captive towers to the access or metro ring. They utilise already connected towers as hubs to deploy small cells and work in both residential and commercial environments. Examples include Eurofiber and operator enterprise businesses.

3) Operator fibrecos

Predominantly focused on connecting residential

“
as MNOs densify their presence through small cells, fibre owners are likely to enjoy returns close to those given by amendment revenue on towers
”

households, thus their deployments depend on household needs, affordability et cetera. Examples include ACT, operator FBB and third-party regional providers.

Similarly, the pricing structure can be adjusted depending on the business model and network architecture with options including end-to-end provisioning with monthly payments per node / small cell, IRU based pricing, bandwidth sale chargeable on a consumption basis or dark fibre monthly opex payments per km with escalators.

The payback of fibre is similar to the tower economics, only the EBITDA is generally a little lower. The upfront yield can be challenging with a single tenant on fibre but usually, when one opts in, the others follow. And as MNOs densify their

presence through small cells, fibre owners are likely to enjoy returns close to those given by amendment revenue on towers.

Towercos can leverage their ability to invest capex at lower cost of capital and can already bundle macro-towers with fibre networks to create attractive pricing options for their clients. Additionally, given their existing relationship with mobile network operators, the MNOs themselves may stop deploying scarce capital into fibre if towercos offer an attractive (and less capital intensive) alternative.

However, towercos shouldn't forget that while there are some similarities with the tower model, fibre deployment is fundamentally different and requires a whole new set of skills and know-how. Towercos being able to skilfully take over fibre projects could be very attractive to MNOs, who have found the efforts to acquire trained manpower quite burdensome and they are likely to prefer to outsource instead. Towercos on the other hand wonder if they should wait for the demand for fibre to ramp up before investing in new manpower and training.

Once they have decided to enter the fibre game, towercos should pick their target segment and business model (B2B or B2C), select a techno-commercial architecture and a pricing structure. The opportunity for organic growth combined with the possibility to expand inorganically by consolidating existing fibre portfolios is creating an attractive scenario for towercos ■

Fibre across APAC: examples shared by the panel

Joining Puja Goyal on stage for the panel, Alka Asthana, CTO at Bharti Infratel, Syed Buland Iqbal, Project Manager – Fibre Deployment, Jazz, Stephen Farrugia, CTO, Broadcast Australia, William Heapy, Director, Planning & Strategy, Axicom, Gayan Koralage, Group Strategy Director, edotco Group, Steve Weiss, CFO, Protelindo and Zhibing Xu, VP of Wireless Small Cell Product Line, Huawei.

Across Asia, fibre reaches 30-35% penetration across a few markets (eg. Indonesia) but in emerging markets such as Myanmar it still sits at 10%. The disproportion with broadband penetration – which generally reaches 70-80% across most Asian markets – is still considerable.

India

In the case of India, the country is home to several fibre players, but sharing isn't common yet. Reliance Jio has pushed fiberisation across its sites to 60%, with the country's average sitting at around 20%. MNOs are swapping fibre pairs with each other but haven't created a scalable sharing system, which only towercos would be able to properly pitch.

While a rationalisation effort would be required in India, with tens of players including government agencies, MNOs and cable operators all actively deploying fibre, parts of the MNO community remain against sharing fibre. An attitude that recalls the inception of the towerco era, when owning a tower portfolio was still seen as a competitive advantage by MNOs.

Indonesia

Indonesia has an uneven distribution of fibre capacity, with upper class areas enjoying relatively reliable access to fibre, especially due to competing cable TV providers. Fibre is still largely owned by operators but there's considerable efforts by towercos such as Protelindo and STP to enter the business. The acquisition of iForte by Protelindo was driven by the desire to acquire the necessary technical skills as well as existing relationships in the fibre sector. Protelindo found that while the effort to acquire a fibreco with a solid track record and credibility was quite complex, the first couple of years delivered great results especially in the corporate market segment.

In fact, at the time of the acquisition, Indonesian MNOs were still focused on squeezing what they could out of the existing microwave, while now they are getting more serious about fiberising towers. Protelindo also found that the returns on building a tower are quite similar to those delivered by fibre, although much depends on whether the project requires digging or aerial deployment.

Australia

In Australia, fibre often isn't shared as it is still seen as a competitive advantage. But MNOs are starting to open up to neutral hosts as they can invest in fibre and pairing out fibre strands for each MNO, without them needing to deploy.

Pakistan

In Pakistan, Jazz for example runs its fibre projects in three different ways. On one hand, the MNO sealed pair-for-pair barter agreements with other operators, it also runs 30-year lease agreements and short-term leases of fibre pairs that last one year ■

Executive Perspectives

In the 2019 edition of the TowerXchange Asia Dossier, readers get access to exclusive interviews conducted with top executives from across the Asian telecom infrastructure industry.

Ascend Telecom shared insightful perspectives on energy management and resource optimization strategies in today's competitive Indian market. Pan-Asian towerco edotco discussed its latest renewable deployment, 5G efforts in Malaysia as well as exclusive details of its data collection and utilisation strategy. Shifting back to India, leading towerco Indus Towers spoke with TowerXchange about its Smart City projects and ongoing innovation efforts, while in-building solution provider Space World presented their success story and future plans. Lastly, readers shouldn't miss Vinson & Elkins' knowledgeable legal insights on how to structure solid tower deals.

Don't miss:

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Green solutions and accurate monitoring crucial to succeed in India



Ascend Telecom on its latest innovation strides and the current state of play in the country



Dr Sushil Kumar Chaturvedi, CEO, Ascend Telecom

India is often in the news for its tumultuous telecom landscape and ongoing consolidation efforts. However, the country is also home to some of the most innovative towercos in Asia, continuously pushing towards green solutions, opex reduction and technology improvements. In this interview, Dr Sushil Kumar Chaturvedi, CEO of Ascend Telecom, shares with our readers exclusive news related to energy management solutions, monitoring advancements as well as an update on the Indian telecom and towerco landscape.

Keywords: 4G, 5G, Asia, Asia Insights, Batteries, Capex, DG Runtime, Data Room, Energy Management, Fibre, IBS, India, Insights, Meetup Preview, Monitoring & Management, NOC, Opex Reduction, Renewables, Site Surveys, Skilled Workforces, Small Cells, South Asia

Read this article to learn:

- An overview of Ascend's latest green initiatives
- The financial and operational benefits of adopting renewable solutions
- The importance of remote monitoring: Ascend's experience
- India's new telecom and infrastructure landscape

TowerXchange: Please re-introduce yourself and your role within the company.

Dr Sushil Kumar Chaturvedi, CEO, Ascend Telecom: I have been the Group CEO of Ascend Telecom since 2012 and have over 35 years of experience in management roles within the telecom infrastructure industry and beyond. In the past, I held senior roles within ORG Informatics, GDSS Inc. USA, BSNL as well as the ITU, where I led telecom development projects for South African countries. Recently, I have been awarded the CEO of the year award for 2019 by the APAC HRD Congress.

TowerXchange: Can you share some of the latest green initiatives adopted by Ascend?

Dr Sushil Kumar Chaturvedi, CEO, Ascend Telecom: Ascend has been a pioneer in green energy initiatives and deployment in distributed telecom infrastructure cell sites. In line with the guidelines issued by the telecom regulator as well as the Government in terms of emission and fossil fuels reduction, Ascend has consciously done accretive intervention in all facets of energy management.

Ascend's bouquet of smart energy comprises of wind chimneys, solar PV, wind turbines, smart grid management as well as efficient storage solutions. We conduct energy audits on every cell site to identify the optimum mix from the bouquet for each site in order to maximise its ROI. We are well aware that "no size fits all", especially given the vast geography of India and its topographic diversity.

Smart Grid management

Grid power is the most economical. Over 98% of our sites run with grid supply and by ensuring the best availability, we are able to draw more than 83% of our energy needs from the grid. Grid power has the least carbon footprint barring renewable energy. Ascend uses a smart tool to monitor the grid availability from source to destination. Grid consumption payments are fully automated to avoid disconnections.

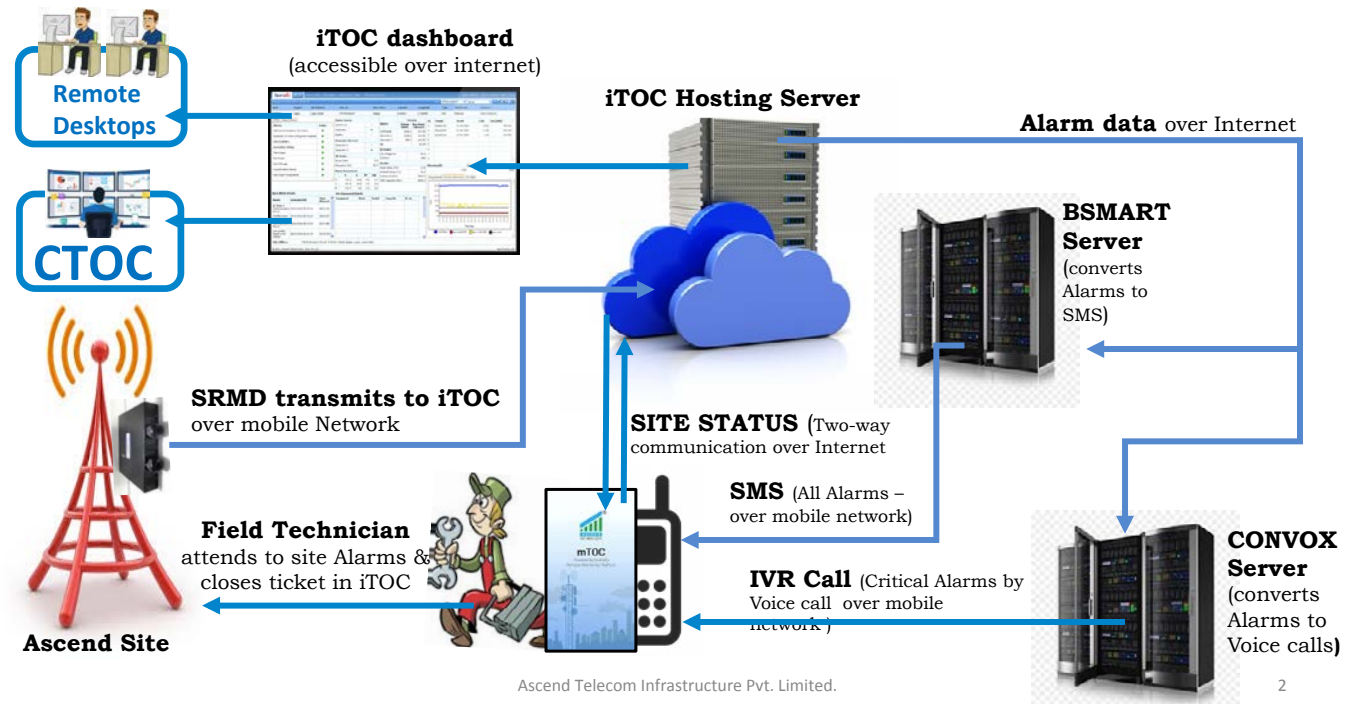
Wind chimneys

These operate with zero power needs. Wind chimneys use natural draught to create a temperature differential in the shelter. They have replaced air conditioners using refrigerating gases like R12 and R22, thereby preventing damage and depletion of the ozone layer. As per the environmental studies conducted by the World Health Organization (WHO), it has been observed that one kg of R22 gas released to the air causes the same damage as two tons (2,000kg) of carbon dioxide. So far, Ascend has been able to replace over 76% of its air conditioner systems with wind chimneys.

Renewable energy Solar PV installations

Solar PVs provide the cleanest form of energy currently known. Ascend has designed systems that pump power directly to their DC power systems, improving energy efficiency significantly by avoiding storage losses and and reducing the huge

SITE REMOTE MANAGEMENT ARCHITECTURE



cost of energy storage. 30% of Ascend cell sites have distributed solar installations and we've been able to achieve a positive ROI in less than 15 months after the initial investment.

Efficient storage management through site automation

An optimal discharge combined with highly efficient charging regimen have enabled Ascend to achieve the best battery life thereby reducing scrapping of batteries to the minimum, on top of the reduction of recycling costs and carbon emissions. Effective battery regeneration programs for VRLA batteries

have increased their lifetime by 30%. Additionally, Ascend has introduced Li-ion and flow batteries in its portfolio. We are able to achieve significant savings by using battery only for auto-changeover between gensets and grid, rather than draining them for load.

Wind turbines

Ascend is actively engaged in field trials with new generation vertical axis wind turbines in small capacity. These turbines are capable of running on low wind speeds and generating power 24/7. Additionally, they can be mounted on towers and

even on smart poles within urban areas.

TowerXchange: By adopting some of the above solutions, what type of savings and emission reductions can a towerco expect in the mid / long term?

Dr Sushil Kumar Chaturvedi, CEO, Ascend Telecom: Mid-term savings from green initiatives accrue with controlled usage of diesel and reduced opex thanks to less maintenance.

In the long term, Ascend saves and makes money by reducing their capex investments by maximising the life of existing assets. Over time, renewable solutions provide cost-free power for a much longer – sometimes over double – the shelf life, with minimal opex. Green programs have shown considerable savings in terms of costs, longer asset lives as well as a drop in our carbon footprint. By leveraging our green portfolio, we can offer MNOs across India a very low Total Cost of Ownership (TCO) and we have become their preferred business partner.

TowerXchange: Can you tell us more about the batteries Ascend is utilising and how the efficiency of batteries has evolved over the years?

Dr Sushil Kumar Chaturvedi, CEO, Ascend Telecom: Early on, Ascend adopted Valve Regulated Lead Acid (VRLA) batteries as industry standards. VRLA batteries have the ability to perform in all weather conditions and provide optimal life when used with



an appropriate understanding of their limitations on the Depth of Discharge (DOD) and specific loading. Ascend has been successfully deriving the highest life from these batteries by dimensioning them optimally across its portfolio and providing the correct operating parameters. For these batteries, we are also able to perform successful regeneration programs to extend their lifecycle.

Ascend has been working closely with leading battery manufacturers in the country, providing crucial feedback on battery behavior, operating

requirements and constraints. As a result of our feedback, they have successfully introduced new design changes such as absorbent gel electrolytes, special electrode structures, shell designs to prevent any premature failures and aptly meet our working conditions. More recently, Ascend introduced flow batteries that have the ability to continuously replenish the electrolyte.

Li-ion batteries have been deployed leveraging their fast charge/discharge cycles, optimal for sites subject to frequent grid failures. As previously

Growing Green with sustainable programs



Ascend - Green Growth Bouquet



Solar PV



Outdoor Cell sites



High efficiency storage



Biogas DG sets



Wind turbines



Wind Energy



Fuel Cells

1

mentioned, we've been able to achieve significant savings by using Li-ion batteries only for auto-changeover between gensets and grid, rather than draining them for load.

Field trials for Nickel-Fe batteries have been planned and I reckon their deployment will happen quickly in light of their promising features.

Ascend's smart energy management tool helps to extend batteries' lives by avoiding deep and frequent discharge. Our system measures battery performance in real-time while proactive maintenance ensures enhanced efficiency, enabling Ascend to offer the lowest TCO to their customers.

TowerXchange: Which other innovations is Ascend exploring in terms of monitoring / maintenance and overall operations?

Dr Sushil Kumar Chaturvedi, CEO, Ascend Telecom:

Ascend has been a pioneer and industry leader in implementing site automation, remote management and innovative technology intervention in the telecom infrastructure industry.

Ascend established its fully automated Central Tower Operations Centre (CTOC), bringing every site under remote surveillance. Remote monitoring devices operate from the sites, communicating with their central servers and pumping all vital

site parameters to the operations teams. We have an in-house developed web-based operations automation management software (ITOC), which provides a real-time interface to the operations and field teams with live data guaranteeing the best uptimes across the industry. Field force is communicated through a fully automated communication portal (MTOC) accessible through mobile platforms even in remote locations.

The extensive analysis of operations and energy consumption data through ITOC analytic engines provides the required guidance to central and field teams on the quality of operations as well as energy status, helping them to finetune all parameters and provide the very best in terms of customer experience.

Ascend uses an App-based training program addressing all site maintenance activities, to keep its workforce always up to date with best in class practices. We are the only IP with an in-house O&M practice, standardised across our entire portfolio.

These technology interventions have helped in fully automating many other functions like site survey, project management, site audits, customer inventory registers et cetera, enabling Ascend to maximise its revenue, while keeping the costs to the lowest. All platforms including the centralized ERP solutions, work seamlessly interfacing with each other and provide the desired levels of operational efficiency, productivity and profits.

TowerXchange: How has the Indian telecom scenario evolved and what does it mean for towercos? Is the environment more competitive and if so, what are towercos doing to remain relevant?

Dr Sushil Kumar Chaturvedi, CEO, Ascend Telecom:

The Indian telecom landscape witnessed a wave of consolidation with a frenzy of M&As and “survival of the fittest”, now finally evolving into an optimum mix of MNOs and towercos.

On the MNO front, exits and mergers brought the number of operators down from ten to four, creating an even more competitive environment and pushing them to look for optimisation and opex reduction. For towercos, this has resulted in some crucial tenancy exits.

MNOs are still under pressure due to a fall in tariff prices and high spectrum management costs, so it's obvious they are looking for maximum savings and TCO optimisation from their infrastructure providers. However, India is hungry for data and while the Government is focusing on initiatives to bridge the digital divide, MNOs need to increase their capacity and coverage. Everyone across the industry is feeling the pressure of the demand for better QoS by subscribers as well as the regulator.

We feel that all the factors above are creating a perfect scenario for tenancy growth and that in spite of the turmoil, the worst is finally behind us. Towercos are focusing on new streams of revenue

to monetise their real estate assets, their real estate assets including data off-loading through small cells, in-building solutions, OLT for FTTH, Wi-Fi hotspots, smart cities, as well as EDC. Fibre backhaul is another significant opportunity, as towercos are realising that fiberised towers are more attractive to their tenants.

I strongly believe that going forward these emerging business segments will significantly contribute to our revenue.

Government is playing a pivotal role with pro-telecom policies, easing the Right-Of-Way (ROW), making some of their buildings and existing infrastructure available to us and budgeting funds to deploy smart cities. The government is also considering deferring spectrum payments – a special initiative to address the financial woes faced by the MNOs.

Overall the sector is looking up, with the Government taking some crucial steps towards the creation of a healthy ecosystem, enabling towercos to create new revenue streams and MNOs to focus on enhancing 4G capacity as well as new deployments.

In the meantime, 5G tests are underway and OEMs are starting to demonstrate a certain degree of readiness, while the Government is preparing for 5G spectrum auctions. 5G will usher a whole new gamut of opportunities for towercos as well as MNOs ■

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edotco on its 1,200 hybrid renewable sites and continuous sustainable efforts



The towerco is championing green initiatives for both on-grid and off-grid sites across its regional operations



Ir Kumari Nalini, Director of Engineering, edotco Group

One of edotco's key missions is to be a truly sustainable towerco and this is reflected by its efforts to implement green solutions across its portfolio. In this interview, Ir Kumari Nalini, Director of Engineering for the Group, shares with TowerXchange insights on the towerco's latest green deployment in Malaysia and regional achievements, as well as considerations on the benefits of investing in renewable solutions and R&D.

Keywords: Asia, Batteries, Business Case, DG Runtime, edotco, Energy Efficiency, Energy Storage, Fuel Cell, Hybrid Power, Lithium, Logistics, Malaysia, Off-Grid, On-Grid, Operational Excellence, Opex Reduction, Renewables, Rooftop, Solar, Wind

Read this article to learn:

- edotco's renewable energy strategy for both on-grid and off-grid sites
- The financial benefits of investing in green solutions
- edotco's commitment to reducing its carbon footprint
- The suitability of renewable solutions to various geographies and climates

TowerXchange: Please tell us about the off-grid sites powered by hybrid renewable energy solutions deployed in Sabah and their characteristics.

Ir Kumari Nalini, Director of Engineering, edotco Group: The hybrid renewable energy solution uses electrolyser-based fuel cells with hydrogen storage, solar panels and lithium batteries. Electrolyser-based fuel cells utilise the excess energy generated from the solar power source to electrolyse water, producing hydrogen and oxygen. The hydrogen is used as fuel to produce electricity to power up telecommunications equipment.

The fuel cell site deployed in Sabah is a successful way to address sites that are hard to access and situated in places with considerable challenges especially for off-grid sites that require frequent diesel refuelling and maintenance.

TowerXchange: Can you describe the "business case" to hybridise these sites versus other power solutions edotco could have opted for?

Ir Kumari Nalini, Director of Engineering, edotco Group: The ultimate business case is to deploy green solutions whenever possible. Championing sustainable solutions is ingrained in our business and if there is an opportunity to equip or complement a site with renewable energy solutions we will do so. We are also committed to reducing our carbon footprint and are consistently looking at innovative designs as well as best practices to do so. Last year, we successfully achieved our target of reducing carbon emissions by 44% through innovative tower designs and best practices, and

closed 2018 with a total of 1,112 green sites across our footprint.

Solar based solutions are the most feasible business case for edotco compared to other renewable options. Implementing an off-grid solar and generator solution gives a Total Cost of Ownership (TCO) approximately 10% lower than the typical off-grid solution of a generator and battery running in alternate mode. We have noticed a slightly better TCO by implementing solar on poor grid sites with generator and batteries.

Fuel cell solutions reduce the carbon footprint drastically although the TCO is comparatively higher. This is mainly due to the high capital expenditure of the solution and methanol availability in a country. The biggest hurdle edotco is trying to overcome is the actual availability of methanol as well as the complex transportation ecosystem. We expect that the TCO will improve when a proper fuel supply chain is developed in the country instead of importing, and more fuel cells are deployed.

TowerXchange: This site is the first of this kind for Malaysia. But can you refresh our memory about the other sites powered by hybrid renewable energy solutions that edotco deployed in Myanmar, Bangladesh and Pakistan? How complex is their deployment?

Ir Kumari Nalini, Director of Engineering, edotco Group: Up to March 2019, edotco has implemented close to 1,200 renewable sites across our footprint, comprising of solar, wind, solar air conditioners,

“

Although fuel cells are new to edotco, we are currently reaping the benefits of 0% downtime at our fuel cell sites. Fuel cells are currently the most successful method which does not require backup generators. They require small footprint, they are lightweight and, most importantly, they are noise free hence ideal for rooftop sites where generator deployment is not allowed

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solar and wind combination and fuel cell solutions. Deploying the right renewable solutions depends on multiple factors such as site conditions, geography, grid availability, land space, tower design and so on. These complexities are common across our footprint, and we regularly conduct feasibility analysis to ensure the right solutions are deployed.

TowerXchange: How reliable are these energy options compared to other off-grid solutions available in the market?

Ir Kumari Nalini, Director of Engineering, edotco Group: Solar implementation is the most established, proven and mature technology in terms of industry acceptance, commercial viability and supply chain resources. The techno-commercial feasibility is a function of many factors such as load, solar capacity, space, electricity and diesel rates and annual solar irradiation. edotco currently operates in countries with favourable levels of solar irradiance so we can safely say solar is a reliable power source in our portfolio.

Wind works best for sites in coastal areas. We are also exploring a solar and wind turbine combination solution as these options are complementary to each other.

Although fuel cells are new to edotco, we are currently reaping the benefits of 0% downtime at our fuel cell sites. Fuel cells are currently the most successful method which does not require backup generators. They require small footprint, they are lightweight and, most importantly, they are noise free hence ideal for rooftop sites where generator deployment is not allowed.

TowerXchange: How many hybrid off-grid sites does edotco run in total, across its regional operations?

Ir Kumari Nalini, Director of Engineering, edotco Group: Around 45% of the total 1,200 renewable sites are off-grid.

TowerXchange: Are more of these sites in the pipeline for edotco across its operations? And if so, where?

Ir Kumari Nalini, Director of Engineering, edotco Group: As mentioned earlier, championing sustainable solutions is a part of our business and we will deploy renewable energy solutions whenever possible.

We consistently look at ways we can improve and enhance the solutions we deploy. For example, we are currently carrying out studies in Bangladesh on the implementation of electrolyser and methanol fuel cells and exploring means to continue optimising capex.

TowerXchange: From an environmental standpoint, what are some of the characteristics of these sites? How green is their footprint?

Ir Kumari Nalini, Director of Engineering, edotco Group: edotco's renewable energy generation accounts for 1% of the total energy requirement, from the 6% renewable energy sites in the energy portfolio.

The electrolyser fuel cell currently implemented in Malaysia produces no CO₂ while the methanol fuel cell has 80% CO₂ savings compared to a typical off-grid alternating mode generator and battery site. For an off-grid site with a diesel generator and battery running alternatively versus a site with a DG, battery and solar there is a carbon reduction of approximately 25%. On the other hand, an off-grid electrolyser fuel cell site gives us 100% reduction of carbon compared to a diesel generator and battery only off-grid site ■

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edotco keeps driving growth and innovation in its backyard



The group's CRO talks new solutions, 5G and recent moves in Malaysia



Wan Zainal, Chief Regional Officer, Malaysia, edotco

2018 has been a successful and dynamic year for edotco at home. The infrastructure innovator achieved a 30% year-on-year growth nationally and the acquisition of Yiked Bina has driven its tenancy ratios up to 1.8x. While the company continued to deploy traditional macro sites, over 50% of its new builds last year were infill lamp-poles and special structures, and they expect demand to keep moving towards new solutions such as small cells, street furniture and fibre integration as the country prepares for 5G transition. In this interview, edotco's Chief Regional Officer in Malaysia Wan Zainal analyses last year's performance, offers his views on the local market and shares some key insights on new solutions and edotco's vision for the near future.

Keywords: 4G, 5G, Asia, Asia Insights, Co-Locations, Construction, edotco, Energy, Fibre, IBS, LTE, Malaysia, Market Overview, Off-Grid, On-Grid, Operational Excellence, Small Cells, Tenancy Ratios, Towercos

Read this article to learn:

- The current state of the Malaysian telecoms and tower markets
- edotco's footprint and strategy in the country
- What are the new solutions that edotco is exploring ahead of 5G?
- Insights into the Yiked Bina acquisition and its benefits
- Operational improvements and the future of connectivity

TowerXchange: Would you introduce the tower market in Malaysia and the role edotco plays in that market?

Wan Zainal, Chief Regional Officer, Malaysia, edotco:

The tower scene in Malaysia is at an interesting phase; while it is a mature industry, the market is still growing with about 1,000 to 2,000 new structures, including street level furniture, being put up every year. This is driven by operators needing to support current 4G requirements and to be 5G-ready, as well as meet the constantly growing demand for higher capacity and speed as data usage increases. More infill solutions will be required in order to meet all these requirements.

edotco owns and manages close to 10,000 towers across the country. We are firm advocates of agile, shareable infrastructure that meets the connectivity and capacity demands. In addition to enabling connectivity through towers, we also fulfill capacity requirements via BTS hotels, in-building systems (IBS) and shareable solutions, allowing for a quick setup of MNOs' hardware as well as providing room for upgrades when needed. Co-location is very much our core value proposition for the industry to help customers reduce cost of network operations and achieve operational excellence.

TowerXchange: How would you characterise the current state of 4G rollout in Malaysia, and how much impact have the newer LTE operators had?

Wan Zainal, Chief Regional Officer, Malaysia, edotco: 4G Rollout in Malaysia has registered rapid growth

in the past few years with the main, established operators claiming coverage of more than 90% of the population. At the same time, the newer LTE operators have been aggressive in deploying new sites to extend their network coverage nationwide.

We believe that this trend will continue for the next few years as the increased demand for high data capacity, especially in densely populated, urban environments, will require more in-fill sites.

TowerXchange: What is the extent of fiberisation of edotco's Malaysian towers, and how does that compare to the other towers in the country?

Wan Zainal, Chief Regional Officer, Malaysia, edotco: One third of edotco's portfolio in Malaysia is already integrated with fibre to provide a complete suite of services to customers, with relevant options to cater to their individual preferences and needs. Overall, the tower infrastructure in Malaysia is 30-40% fiberised.

As it is crucial for the nation to be equipped with the right telecom infrastructure, edotco Malaysia will be looking to fiberise more sites to increase the link capacity and user experience. This will also support the growing demand for capacity and bandwidth in the backhaul system towards 5G readiness.

TowerXchange: 2018 has been a good year in terms of build-to-suit for edotco Malaysia. Are you primarily building for Celcom or also for third parties? Can you give us a sense of the build volumes and how they compare to previous years?

Wan Zainal, Chief Regional Officer, Malaysia, edotco: While Celcom is our anchor tenant and most of our new builds in 2018 were for them, we are seeing an increase in demand from other operators as well. We are an independent towerco and we work with any party who entrusts us to build, operate or manage telecom infrastructure for them.

Malaysia is experiencing high data growth, especially with 5G around the corner. New sites are still required to increase coverage, offload capacity and reduce latency. In 2018, edotco Malaysia grew around 30% year-on-year. However, beyond build volume, an interesting observation was the changing trend for infrastructure type; over 50% of our new builds last year were infill lamp-poles and special structures. We expect this trend to continue.

TowerXchange: What site typologies are you building – for example what is the mix of traditional macro sites versus rooftop poles, lamp-posts, DAS and other innovations like BTS hotels?

Wan Zainal, Chief Regional Officer, Malaysia, edotco: It depends on the project needs, the requirements of the customer and site availability. We evaluate the suitable solutions to deploy based on the brief and desired outcome as well as site acquisition.

For instance, for skyline harmonisation and aesthetic purposes, we would build camouflaged towers or lamp-poles instead of a macro tower or rooftop structures. In remote locations, a traditional 3 or 4-legged tower would still be rolled out. While towers remain important for us to improve

connectivity levels in the country, we are also looking ahead to fulfilling capacity requirements to support the nation's digital goals. We do this through the implementation of cell sites at street level such as panel antennae, small cells and other IBS in various projects, from transportation hubs, to stadiums and even smart cities.

The top three solutions that edotco Malaysia is focusing on aside from the traditional tower solutions are:

1. In-building system (IBS)
2. Lamp-pole solutions
3. Street furniture

TowerXchange: What exactly is a BTS hotel? In what typical scenarios have you deployed BTS hotels and why?

Wan Zainal, Chief Regional Officer, Malaysia, edotco: A BTS (base transceiver station) Hotel is a solution that integrates the benefits of fibre, common antenna and towers. It aggregates fixed and wireless traffic resources into a single location to provide shared network connectivity to the operators. The solution is ideal in townships that emphasise skyline harmonisation for space-constrained areas, while promoting shared infrastructure.

In terms of capital, it provides up to 35% cost savings compared to the deployment of a traditional site. This is achieved via a Plug & Play model, where operators are not required to invest in microwave equipment for backhaul, thus saving on bandwidth lease.

TowerXchange: In terms of other growth drivers, has it been a similarly good year for lease-up in Malaysia? Would you mind telling us about your current tenancy ratio and how you've achieved that success?

Wan Zainal, Chief Regional Officer, Malaysia, edotco: 2018 has been a good year for edotco Malaysia. With the consolidation of Yiked Bina into our portfolio, our tenancy ratio has risen to the 1.8x mark and more operators are experiencing the value proposition of co-location. Kudos to the team's diligence, tenacity and drive to deliver on our commitments to customers.

Our engineers work tirelessly around the clock to ensure the right solutions are deployed on time and thereafter work closely with our customers to optimise within the stipulated deadline, with minimal disruption to service. We are motivated to take on challenging projects and serve our customers with the goal of long-term partnerships. This is our strength that has helped set the benchmark for edotco to lead the industry.

TowerXchange: Congratulations on the acquisition of Yiked Bina! For the benefit of readers who don't know what the State-backed towercos are in Malaysia, please explain the role they play. And can you describe some of the drivers behind the acquisition of Yiked Bina towers?

Wan Zainal, Chief Regional Officer, Malaysia, edotco: States in Malaysia progress at different paces and have different ICT aspirations. To ensure that

telecom infrastructure development keeps pace with the state's vision, they appoint companies that fulfil their requirements and that of the regulators. Typically, state agencies would also hold equity interest in these companies.

In terms of the deal, we are always looking out for growth opportunities both organically and inorganically, and Yiked Bina synergised well with edotco's business and value proposition. The acquisition also enabled our expansion in the northern state with readily available towers.

TowerXchange: For the benefit of suppliers reading this, can you give a quick overview of edotco's Malaysian portfolio in terms of on/off/unreliable grid connectivity, remote monitoring and typical service intervals? And what are your remaining priorities in terms of operational improvement?

Wan Zainal, Chief Regional Officer, Malaysia, edotco: edotco Malaysia's portfolio consists of almost 4,300 owned towers, serving multiple operators in the country. The Malaysian industry has been growing rapidly in terms of infrastructure development and technology advancement in the last 20 years, helped by a stable power grid.

Of our 4,300 owned towers, over 98.5% of them are on-grid, with the remainder being off-grid or with unreliable grid connectivity. We place emphasis on remote monitoring to proactively detect abnormalities at our sites in real time to enable quick response. More than 90% of our sites are

equipped with remote monitoring capabilities. As for service interval, we conduct it on a quarterly basis. Our priorities for improving operations are in four key areas of safety and health, reducing opex to achieve operational excellence, increasing remote monitoring to at least 95%, and focusing on data analytics to increase efficiency of fault detection and improve reliability of service.

TowerXchange: Finally, please sum up your vision for the future of enabling connectivity in Malaysia.

Wan Zainal, Chief Regional Officer, Malaysia, edotco: As MNOs gear towards preparing for 5G, there is a growing need to increase capacity and speed. In order to address this, fiberisation and densification are required. The installation of more IBS to complement macro sites is a solution. We envision greater densification in Malaysia to support the ever-increasing appetite for data consumption. Densification signals the shift to deploying more small cells and innovative structures such as panel antennae instead of traditional sites, especially as infill solutions in urban areas.

This shift to wider use of small cells also enables the country to be prepared for 5G implementation on the horizon, as they are able to support greater capacity and speed required to power the technology. In line with this, edotco is reassessing and improving our engagement with stakeholders such as MNOs, municipal councils, authorities, and landlords as we collectively focus on supporting Malaysia towards achieving the nation's digital goals ■

Data collection and utilisation at edotco



How edotco leverages data to enhance uptime, MTTR and drive tenancy ratio growth



Gayan Koralage, edotco

Innovative integrated communications infrastructure services leader edotco leverages data to focus on four areas: real-time efficient operations; advanced analytics; predictive capabilities and future proofing the company. In this exclusive interview, Director of Group Strategy Gayan Koralage describes the tools they use to collect data, the analyses and insights derived from that data, and the operational and commercial KPIs edotco measure.

Keywords: Access Control, Asia, Bangladesh, Data Collection and Utilisation, edotco, Hybrid Power, Interviews, Job Ticketing, KPIs, Malaysia, Operational Excellence, Opex Reduction, SLA, Site Visits, Tenancy Ratios, Towercos, Uptime

Read this article to learn:

- What tools do edotco use to collect, analyse and visualise data?
- Example insights derived from data analyses
- What are the most important KPIs edotco manages, and what have been some of their success stories?
- Future objectives from big data analytics: RPA, AI, machine learning and moving order generation from being reactive to proactive

TowerXchange: How would you summarise edotco's current data strategy, both operational and commercial performance data?

Gayan Koralage, Director, Group Strategy, edotco Group: Innovation is at the core of our operations, and we have embarked on a strategy that comprises of four focus areas, namely real-time efficient operations; advanced analytics; predictive capabilities and future proofing the company.

This model places a great emphasis on data collection and usage, to drive business efficiencies and operational excellence, enabling us to benefit from smart process automation, advanced data analytics and applications. Our current strategy is aimed at ensuring we receive the most accurate real-time data from our tower assets, further enabling us to drive a business that ensures our operational teams benefit from insights gathered and customers get the best out of the partnership, resulting in a shift from reactive orders to a proactive demand generation model.

TowerXchange: What tools do you use to collect data?

Gayan Koralage, Director, Group Strategy, edotco Group: We have adopted a variety of initiatives and tools across our business that enables our operations systems to be leaner, agile and more cost-effective. Some of the more notable projects are:

Drones: To conduct site surveys, network inspection

alongside assessment for preventive maintenance and revenue assurance. The use of drones' results in faster data collation and report generation, reducing the turnaround time for reports by 35%.

echo RMS: Monitors real-time batteries, rectifiers and generator sets to make sure they are in good working condition. These assets are equipped with sensors that helps us manage our maintenance scheduling.

easi: An asset management platform to help us keep track of our inventory and workforce (our field technicians), ensuring what we have in reality matches what we have in our databases. Currently both echo and easi each have mobile applications, and we plan to merge them next year, along with the workforce asset management system on one cloud-based platform for optimised results.

RAPID: Usage of smart process automation built into our financial system.

TowerXchange: What tools do you use to analyse and visualise data?

Gayan Koralage, Director, Group Strategy, edotco Group: We use tools such as Power BI, MapInfo and, available functions in Microsoft Excel.

Power BI transforms our data into rich visuals for better visualisation. We're able to use such visuals and share insights organisation-wide, enabling our teams with the necessary to work more efficiently. As for MapInfo, it is a geographic information

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The use of drones' results in faster data collation and report generation, reducing the turnaround time for reports by 35%

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system (GIS) software that we use for mapping and location analysis for our tower sites. It helps us visualise, analyse, and interpret data to understand certain patterns and trends.

TowerXchange: How do you translate data into actionable insights? What kind of reports and 'what if' scenarios are you able to run?

Gayan Koralage, Director, Group Strategy, edotco Group: We have a few examples of extremely useful achievable and automated insights, including:

Long-tail analysis: Derived from data gathered, this analysis helps us identify sites with prolonged power outage issues. As such, we can escalate it to the local operations teams to put the necessary

precautionary measures in place. In addition to that, by analysing the data, we are able identify the cause of an incident (i.e. failure of equipment, faulty) hence determining the best way to overcome or avoid an issue.

Monitor diesel readings: Having a thorough view of the diesel readings without being onsite helps us identify generator set inefficiencies and also, detect or prevent theft.

Avoid overbilling: We are able to show a comparison of our AC meter readings against utilities charges. This enables both edotco and the relevant utilities company to study and understand energy billings within a certain site better.

Revenue assurance: Comparison of energy usage at site against our asset register to detect equipment that was installed without permission or not updated in our internal system.

Monitoring of temperature: Real-time temperature reading to reduce energy consumption at site or avoid damaging equipment due to high temperatures.

TowerXchange: What are the most important KPIs you are measuring and managing in terms of operational performance? And can you share some success stories?

Gayan Koralage, Director, Group Strategy, edotco Group: Our most important KPI is uptime. Aside from that, we also look into mean time to repair

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order generation needs to move beyond reactive to proactive – informing customers where sites need to be built with a ready catalogue of structures and location partners for them when they do decide to build

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(MTTR); percentage of sites with theft, vandalism and accidents; site delivery according to service level agreements (SLAs) and percentage of green or hybrid sites among others.

Externally, the above KPIs give us the ability to meet the needs of our customers while internally, it helps us to be more competitive from the perspective of cost, time and quality in terms of the ability to meet and surpass our service level agreements (SLAs). Some of the successes we have attained over the past years include:

- Maintaining energy up time in Bangladesh despite deteriorating grid conditions.
- Over 600 sites with renewable energy, resulting in approximately 25% carbon reduction.

- The construction of more than ten bamboo structures in Bangladesh, the equivalent of 70% carbon reduction per site.
- A 30% reduction of theft, vandalism and other safety risks through the usage of edotco’s smart padlocks and easi asset lifecycle management.

TowerXchange: What are the most important KPIs you are measuring and managing in terms of commercial performance? And can you share some success stories?

Gayan Koralage, Director, Group Strategy, edotco Group: In terms of commercial performance, there are many KPIs we benchmark against however, tenancy ratio of sites alongside lease fee per tenant

per site is the most important measure of our commercial performance.

edotco’s portfolio of towers has a 1.60 tenancy ratio, while the global average is between 1.6 and 2.0. Our tenancy ratio grew from 1.5 in 2017 to 1.60 as of 3Q last year – this is a clear indication of our growth across all six markets we are in.

TowerXchange: Please sum up your personal view of where we are as a communications infrastructure industry today in terms of collecting and utilising big data – and what we should strive to achieve in the future.

Gayan Koralage, Director, Group Strategy, edotco Group: Businesses across all industries need to innovate or risk being left behind. Based on my observations, the communications infrastructure industry has not been adopting big data analytics as quick as they should. Driving value more for customers requires towercos to deepen their presence in the telecoms value chain. This means developing the right competencies and capabilities. Moving forward, we need to be able manage an end-to-end telecoms network autonomously with the use of RPA, AI, machine learning and so forth. Reducing the reaction or response time to a sub-millisecond range is crucial in the era of 5G where low latency and high availability are key. Even more so, order generation needs to move beyond reactive to proactive – informing customers where sites need to be built with a ready catalogue of structures and location partners for them when they do decide to build ■

Indus Towers on its Smart City projects and innovation efforts



The leading towerco talks deployments in New Delhi, green energy initiatives and beyond



Shankar Iyer, Chief Sales & Marketing Officer, Indus Towers

With all the buzz around the imminent merger between Indus Towers and Bharti Infratel, one might forget that India is one of the most advanced telecom markets in Asia and leading the way in terms of Smart City deployments and green initiatives. In this exclusive interview, Shankar Iyer, Chief Sales & Marketing Officer for Indus Towers, shared the recent efforts in terms of innovation, Smart City projects and the importance of collaboration between industry stakeholders and authorities.

Keywords: 4G, 5G, Asia Insights, Business Model, Fibre, India, Indus Towers, LTE, NOC, O&M, Small Cells, Smart City

Read this article to learn:

- Latest from India's Smart City Mission
- Indus Towers' smart poles and their benefits for the industry and beyond
- Green initiatives currently being assessed by the towerco
- Fibre deployment across India: who is involved?

TowerXchange: Can you please summarise your role and responsibilities at Indus Towers?

Shankar Iyer, Chief Sales & Marketing Officer, Indus Towers: I am responsible for sales, marketing as well as new business initiatives for Indus Towers.

TowerXchange: India is at the forefront of Asia's Smart Cities efforts. Could you share an update on what's being done and the progresses in terms of Smart Cities' "creation"?

Shankar Iyer, Chief Sales & Marketing Officer, Indus Towers: Indus Towers is proactively involved in making India's vision of Digital India and Smart City a reality across the country, to enable technology advancements for the benefits of citizen services in urban areas. The Government of India set a series of objectives and pillars for its Smart City campaign focused on sustainability, scalability and inclusivity.

In light of the above, we've been working to create a model that is not only unique and efficient but also sustainable and replicable across all of the chosen Smart Cities in India and beyond. Here is what the three pillars mean and how we are working to realise them:

Sustainability: the goal is to create a self-sustainable model at city levels, ensuring resources are effectively utilised thus generating enough cashflow;

Scalability: the scalable infrastructure should

cater to the requirements of future developments such as IoT applications as well as allowing for more capacity to be available in the future;

Inclusivity: neutral host infrastructure should be the choice - thus allowing citizens to opt for the service providers of their choice to enhance fair competition and inclusivity.

The first RFP that Indus Towers got involved in – and won – is for the New Delhi Municipal Council (NDMC), where Indus successfully deployed 55 smart multi-utility poles capable of hosting smart LED, surveillance cameras, environmental sensors, public Wi-Fi et cetera. Our innovative and intelligent poles are providing network for seamless connectivity and other services and are capable of serving authorities, utility companies as well as citizens across the NDMC area.

TowerXchange: What innovation in terms of smart sites and new site typologies is Indus working on?

Shankar Iyer, Chief Sales & Marketing Officer, Indus Towers: In addition to the core mobile network which needs to function through them, smart poles provide a platform for public Wi-Fi, smart lighting and surveillance. Through these smart poles, we can enable many new applications such as emergency and traffic alerts. In line with our green efforts, smart poles track carbon emissions as well as the levels of pollution around them.

Additionally, these poles have also been experimented to provide scalable solutions,



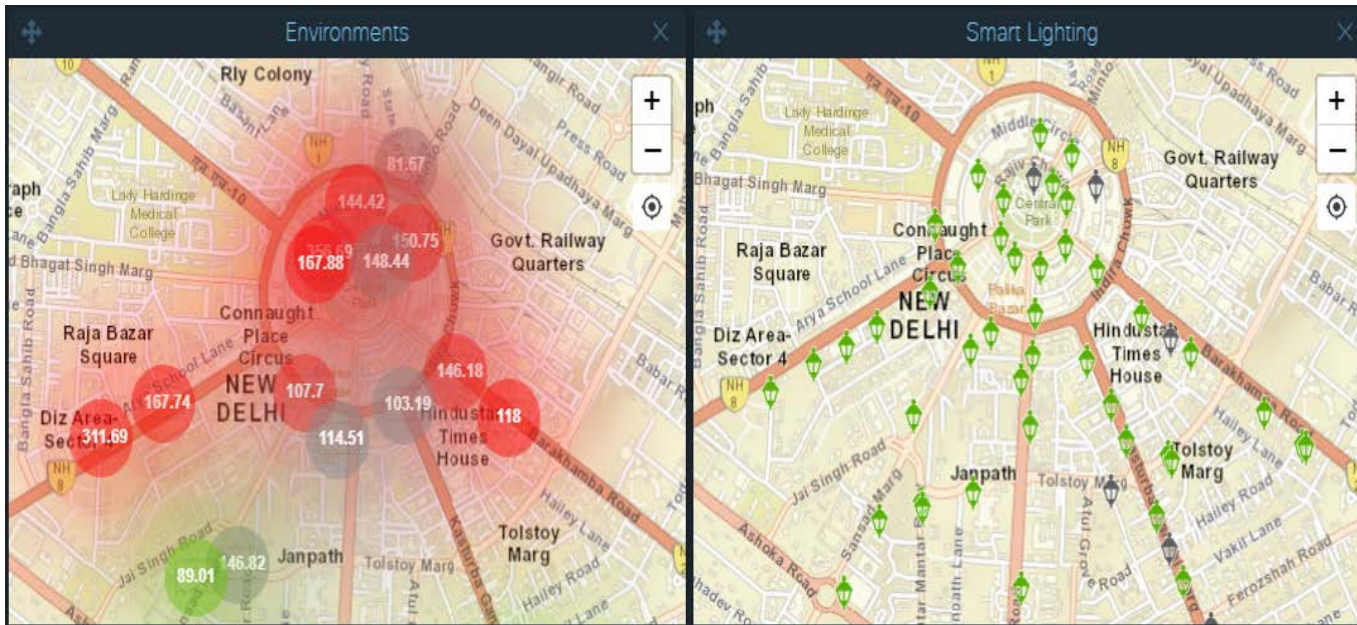
allowing more technology – such as 5G – as well as IoT products, variable messaging displays et cetera.

The project also includes the creation of a Control and Command Centre which allows the authority to monitor the efficacy and efficiency of the solutions and services provided.

We are also working towards an integrated innovative and connected pole, which provides one-stop solution for all future Government initiatives, encompassing 5G, Wi-Fi, IoT, digital advertisement,

EV charging, security and surveillance, traffic control, environment sensors, public announcements and messaging among others.

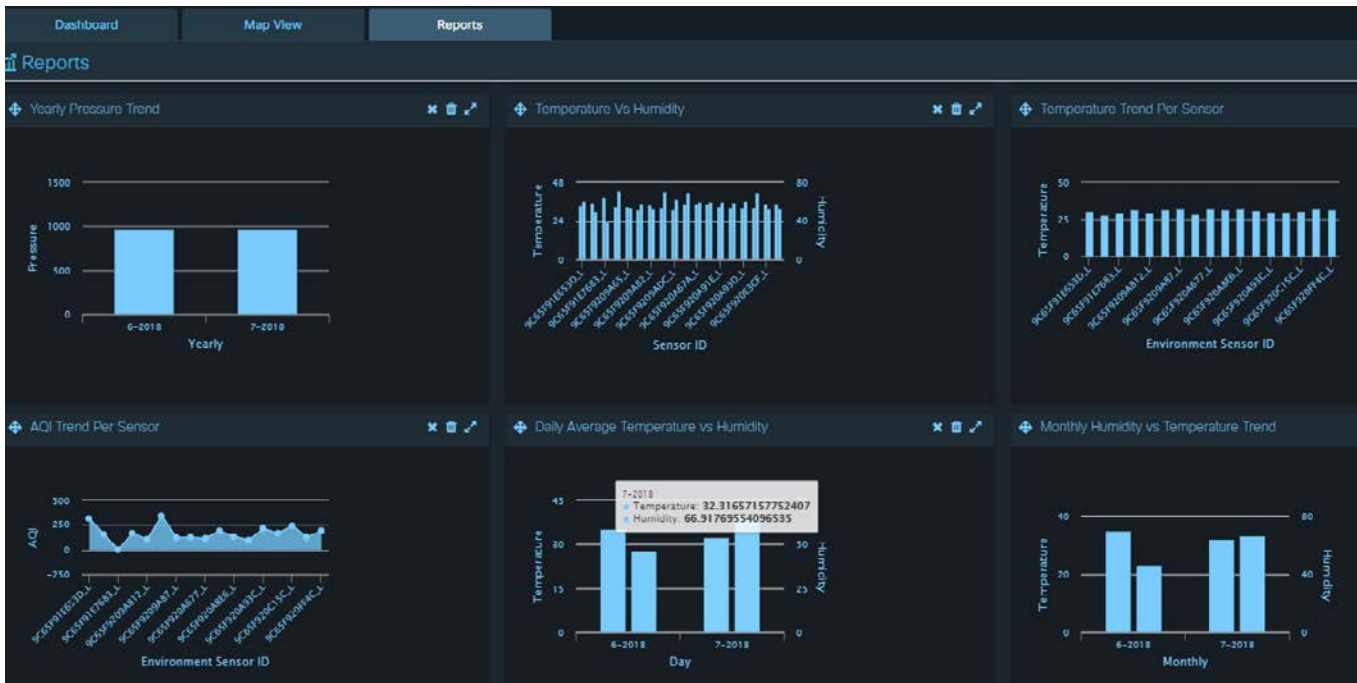
Indus Towers aims at serving Smart City initiatives and supporting the Government to continue pursuing these opportunities. One way to ease the process is to change the underlying model. In fact, up until now such projects have been undertaken via an EPC model and Indus was the first to approach these initiatives with a PPP model. Needless to say, PPP should ease the capital



requirement by the authorities and pave the way for more projects while ensuring partners are selected with a long-term approach in mind.

TowerXchange: Who are the key stakeholders in these initiatives, beyond towercos? Can you clarify how the “Smart City ecosystem” works to our readers?

Shankar Iyer, Chief Sales & Marketing Officer, Indus Towers: Indus Towers’ mission is to serve Smart City efforts by creating a robust digital infrastructure as a backbone, thus enabling telecom service providers, various suppliers of smart infrastructures services, utility companies, new age digital service providers to offer their services to citizens.



As a towerco, we are investing into core elements of “space, power, tower and fibre.” System integrators help to bring all the stakeholders on a common platform to provide a holistic solution to the Government’s mission. It is therefore extremely important that innovators from across multiple industries join the efforts and bring their own expertise to create a new ecosystem of partnerships and collaborations.

TowerXchange: In terms of operational excellence, which green energy efforts are being developed?

Shankar Iyer, Chief Sales & Marketing Officer, Indus Towers: Indus Towers has been and is actively involved in pioneering energy efficiency

initiatives and creating innovative solutions to minimise carbon emissions. One of the first changes we've implemented across our portfolio is to reduce the use of indoor equipment which requires huge power consumption to maintain lower than ambient temperature standard. In fact, as of now, 80% of our portfolio relies on outdoor equipment able to handle high temperatures – a change that considerably reduces diesel consumption as well as our carbon footprint.

Indus has also pioneered and heavily invested into the adoption of Li-ion batteries, to create a sustainable power backup during the periodic disruption in electricity supply. This change has immensely helped to reduce our dependence on diesel for power backup and provided a path to enhance our reliance on greener options.

Indus is also investing into automation of sites, predictable and preventive operational maintenance, new age data analytics as well as weather monitoring, in order to boost our operational excellence and create adequately configured sites.

TowerXchange: Fibre deployment is critical to enable modern networks to function properly. Which players are involved in fibre deployment across India and how are those projects complementing the efforts of leading towercos?

Shankar Iyer, Chief Sales & Marketing Officer, Indus Towers: We are all witnessing operators network transforming to data-centric systems from voice-



oriented network. In that context, it is imperative for the telecom domain to focus on creating a ubiquitous network providing seamless speed, in line with 4G requirements.

The proximity of 5G is also making it imperative for all network infrastructure to evolve from microwave-based networks to fibre-based ones. These aspirations have also been enunciated in the

Government's National Digital Communications Policy (NDCP) that pushes for a drastic improvement of the levels of tower fiberisation, which should go from the current 25% to 68% by 2023.

Over the years, Indian operators and the Government have put a huge effort in connecting cities with fibre and, up until now, they've been the major players involved in fibre deployment across India. Now, the next set of requirements is to penetrate every nook and corner of Indian major cities with fibre and connecting towers and homes.

In light of towercos' existing connection with their towers as well as the surrounding environment, they are definitely well positioned to seize this opportunity. Towercos could further help by bringing in their proven sharing concept to a new era of fiberised towers and thus further support cost reduction for the telecom community and bring more value to the end customer.

Indus Towers is aggressively exploring these business models, with participation and investment in India's Smart Cities Program, and so far, it has achieved a 100% success rate in fiberisation as well as Smart City deployments.

Our final goal is to become a one-stop shop for our customers, including MNOs, digital network companies, Wi-Fi providers and beyond and we understand that fibre is a critical component of our evolution towards becoming a fully operational Next-Gen infraco ■

Space World: a remarkable in-building coverage startup success story



TowerXchange: Please introduce Space World to our readers.

Ankit Goel, Managing Director, Space World:

Founded two years ago in Delhi, Space World is a pan-India, neutral host infrastructure provider focusing on the relatively untapped market of digital indoor solutions. We provide multi-operator solutions and we have strong relationships with all the Indian MNOs. Space World is privately owned and we share our solutions on a non-discriminatory basis.

Space World already has 500+ indoor sites, representing nearly 250mn square feet of covered area, making us the market leaders in India.

My Co-Founder Radhey Raman and I are first level entrepreneurs, and have come from an engineering background with the associated qualifications. We have previously been involved in telecom equipment manufacturing for ten years, but two years ago we realised that the opportunity to provide indoor connectivity was even bigger than we could imagine, with data usage driven by social media. Space World has come out of a traditional family business, and in two years we have already deployed more than 500 sites in India, with our first few international sites getting added to the portfolio in Myanmar.

Space World is self-sustaining, self-funded, and profitable with a strong EBITDA.

Space World is registered as an Infrastructure Provider (IP-1 – the same registration as India's

From zero to nearly Indian 500 sites, and nearly 250mn sqft of covered area, in just two years



Ankit Goel, Managing Director, Space World

TowerXchange can count on the fingers of one hand the number of digital indoor solution startup success stories we have encountered worldwide. But when we find such companies, they tend to be both impressive and instructive. In just two years, Space World has forged a market leading position in the previously untapped Indian indoor coverage market. TowerXchange met with Space World Managing Director Ankit Goel at MWC19 to learn more about their story.

Keywords: 5G, Asia, Best of TowerXchange, Business Model, DAS, Fibre, IBS, India, Infraco, Infrastructure Sharing, Interviews, Multi-Operator, Small Cells, Smart Cities, Space World, Tenancy Ratios, The Future Network

Read this article to learn:

- How Space World is harvesting the 'low hanging fruit' in the retail and institutional markets
- Who pays for indoor coverage in India, the building owner or the MNO?
- How Space World has achieved impressive an impressive tenancy ratio
- The fundamental similarities and differences between the indoor and outdoor neutral host business models
- What technologies are Space World using? And how is fibre connectivity and power provided?

towercos), and we are a member of India's Tower and Infrastructure Providers Association (TAIPA).

TowerXchange: Please describe the addressable market for indoor connectivity in India.

Ankit Goel, Managing Director, Space World: I would break down our addressable market into two broad segments. Firstly retail, such as commercial buildings, malls and office buildings – typically properties of over 500,000 sqft. And secondly institutional – special projects such as providing ubiquitous coverage for multiple MNOs within metropolitan transportation networks, within hospitals, educational Campuses and airports. For example, there are over 100 airports alone in India! Any high density public areas are potential addressable opportunities for us.

It is critical that we understand the different stakeholders in real estate, and are able to identify communities or places of interest within which we can provide our unique connectivity solution.

In terms of new business development, sometimes we proactively source new opportunities, and at the same time we respond to RFPs – including helping potential customers understand their needs and help them draft their requirements.

Space World is riding on India's growth story. Our addressable market includes commercial and residential high-rise buildings, including in Tier 2 and 3 towns (which are sometimes larger than Tier 1 towns). Most cities with a population in excess of 2.5 million will have a metropolitan transport

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India's objective to create 100 smart cities will be dependent on a digital backbone based on digital DAS. And Space World is proud to be India's market leader in digital DAS

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network, and providing coverage on that network is a key addressable market for Space World.

India's objective to create 100 smart cities will be dependent on a digital backbone based on digital DAS. And Space World is proud to be India's market leader in digital DAS.

TowerXchange: Who should pay for coverage indoors, the building owner or the MNO?

Ankit Goel, Managing Director, Space World: We believe that in India the only viable business model is to monetise indoor coverage via the MNO rather than through the realtors. However, our

value proposition to MNOs is a zero capex solution: Space World deploys the capex, and we also reduce the opex by sharing our digital indoor solutions between multiple operators. We're offering an indoor solution that acknowledges and addresses the current and future needs of Indian MNOs. It's almost axiomatic to remind your readers that 70% of mobile data is generated from indoors.

India's MNOs recognise the overall benefits of infrastructure sharing both outdoors and now indoors, demonstrated by the fact that Space World has a tenancy ratio of 2.3 despite having only been in business for two years.

TowerXchange: Congratulations on achieving such a great tenancy ratio! How has this been achieved in such a short space of time?

Ankit Goel, Managing Director, Space World: There was no connectivity in many of the areas we serve, yet they are often densely populated, so often all three MNOs want to be tenants from day one. So while a macro tower is often built initially for just one anchor tenant, in an indoor scenario we often have two or three tenants right from start.

While the tower business is driven by latitude and longitude based search rings, there is no location-based competition indoors – we have exclusive rights within our properties, so the MNOs have no other option but to use our solutions – and they are highly likely to renew their contracts!

TowerXchange: Are your contract structures similar to towercos?

Ankit Goel, Managing Director, Space World: Yes. We typically sign 15 year contracts with fixed annual escalations. Incremental tenancy revenues go straight to our bottom line, so there are lots of parallels to the towerco business model.

TowerXchange: Why aren't the tower companies focusing on indoor solutions – what are the biggest differences in your business model?

Ankit Goel, Managing Director, Space World: Of course we have tremendous respect for the Indian tower companies, for their their growth story, and for their achievements in delivering and sharing the outdoor passive infrastructure on which India's mobile services have evolved. But Space World serves a fundamentally different market.

Space World recognises the criticality of bespoke property acquisition in serving this market. Whereas site acquisition is equally important in towers, the approach can readily be standardised, whereas in the indoor market everything is bespoke and niche.

Another critical differentiator is our key account relationships with both MNOs and real estate companies. And of course, indoor coverage requires unique engineering skills for the management of semi-active equipment.

TowerXchange: What technologies are you using?

Ankit Goel, Managing Director, Space World: We use

custom solutions tailored for each use case, from passive and active MIMO, to passive and active SISO, and small cells.

Understanding the technology is crucial. It's all futureproof – readily upgradeable in no time at all. 100% of our solutions support multiple operators.

TowerXchange: A couple of operational questions – how do you fiberize your digital indoor solutions, and who is responsible for ensuring power availability and uptime?

Ankit Goel, Managing Director, Space World: We typically leverage the operator's fibre outside the building. They bring fibre to the kerb, we bring it inside the building. Backhaul remains the operator's responsibility.

We provide power plants and lithium batteries, with energy costs passed through to the landlord. Uptime is monitored from the operator's NOC. We use zero diesel – we're a very green operation, so we avoid the pitfall of diesel pilferage.

TowerXchange: Can you share details of an example project?

Ankit Goel, Managing Director, Space World: We have just completed the biggest installation of Active DAS in India – a metro tunnel tube project that has just started being used. The highest data traffic anywhere in India is coming from this project, at the peak rush hours as people go online during their journey to and from work.

TowerXchange: Finally, what is your view of the future of communications infrastructure provision in India?

Ankit Goel, Managing Director, Space World: The Indian communications infrastructure provision story is transitioning from a successful but mature story of infrastructure sharing at the macro network layer, to the next chapter focusing on the heterogeneous network layer. Now its all about data. We're moving from traditional to IP-based networks, and the spectrum we're using is completely different.

There has been a blood bath at the operator layer of the Indian mobile ecosystem. We're consolidating from 8-9 to 3-4 MNOs. Some of the remaining MNOs already have distressed balance sheets, even before the acquisition of costly 5G spectrum. To make 5G viable, we're going to need to create smart cities enabled by shared networks. But the scope of network sharing must move beyond passive to passive and active infrastructure.

The economics of smart cities will be completely different. It's all about low latency, fibre connectivity, and creating new capabilities for coverage and high capacity.

At Space World, we are positioning ourselves to be leaders in this new, data-driven economy. We facilitate the most cost-effective data-driven solutions for MNOs, while at the same time adding value to real estate, institutions and society. Connectivity is a lifeline for Indians. It is time to extend that lifeline indoors! ■

UPDATED: The Sale & Purchase Agreements & Master Lease or Service Agreements that underpin tower transactions



A closer look at two important parts of the contractual framework for infrastructure sharing



Jeff Eldredge and Rob Dixon, Partners at Vinson & Elkins

The devil is in the detail – the detail of painstakingly constructed and hard negotiated Sale and Purchase Agreements (SPAs) and Master Lease or Service Agreements (MLAs) that define the main terms in any tower transaction. Jeff Eldredge and Rob Dixon, Partners at Vinson & Elkins, have advised on numerous sale and leaseback transactions in the last few years across Africa, Asia and Europe. Rob and Jeff kindly agreed to meet with TowerXchange and to provide us with an overview of tower sharing SPAs and MLAs.

Keywords: Anchor Tenant Privileges, Due Diligence, Infrastructure Sharing, MLA, Novation of Leases, Regulations, SLA, Service Level Agreements, Transfer of Assets, Vinson & Elkins

Read this article to learn:

- The conditions precedent that need to be fulfilled before assets are transferred
- What happens to towers that aren't transferred in the first close
- Why the real value lies in the MLA
- How critical towers are sometimes treated differently

TowerXchange: What are the key components of a Sale and Purchase Agreement (SPA) in a tower transaction?

Rob Dixon, Partner, Vinson & Elkins: There are of course many components common to all SPAs, but let's concentrate on those components which are unique to towers deals. A key example is the structure and content of the conditions to closing. First, we'll typically have a set of transaction conditions precedent that need to be fulfilled before the deal can happen at all. These would include any over-arching regulatory requirements (for example an operating licence or a competition approval). It's in the tower company's interests, however, to close as swiftly as possible to minimise asset deterioration in the interim period.

Secondly, we'll typically have a set of conditions precedent that need to be fulfilled (or waived) before a specific tower can be transferred. These would normally include good title, satisfactory ground lease arrangements (for example, the right to sub-lease the tower to third party co-locators and to assign leasing arrangements in security) and compliance with regulatory requirements (for example, building permits and environmental consents)... It's potentially a long list!

The buyer will require a certain number of towers before the deal is economically viable. Typically, therefore, the deal will be structured so that closing does not happen unless and until a certain number of towers are ready to be transferred (i.e. the tower-specific conditions precedent are satisfied or waived).

Phased close

It's common practice to have at least two phases of closing a sale and leaseback transaction, giving extra time to finalise documentation for troublesome towers. As Alan Harper, CEO of Eaton Towers explained "With Warid, 90% of the towers were included in the first close, but we take over 100% of the towers whilst the last complicated paperwork is finalized." ■

Jeff Eldredge, Partner, Vinson & Elkins: One key point in the process is the extension of ground lease terms. Towers deals can involve thousands of different parcels of land. Different ground leases will expire at different times, giving uncertainty on future costs. The buyer will therefore seek to have the ground leases extended for a reasonable period as part of the transfer process.

Rob Dixon, Partner, Vinson & Elkins: As a result of that and certain other conditions taking time to satisfy, there are typically a number of closings as the tower-specific conditions are gradually satisfied. In the interim, the buyer might take over the operation of the non-transferred towers on a managed services basis. Different deals are of course structured differently – some deals go further to synthesise the buyer's ownership of non-transferring towers from first closing.

TowerXchange: What happens to any towers for which the CPs cannot be satisfied?

Rob Dixon, Partner, Vinson & Elkins: The treatment

of 'stub sites' depends on the deal. The operator is unlikely to have the ongoing capability (or desire) to maintain and operate the sites so the towerco may agree to manage the sites (with the operator retaining ownership). The buyer is likely to conduct legal diligence on a representative sample of sites so that it has a reasonable idea of the position before signing the deal. The SPA is, of course, only one part of a sale and leaseback deal. It's relatively short-lived compared with the MLA which will often govern the parties' relationship for many years. The MLA needs to be as future proof as possible.

TowerXchange: So tell us about the critical consideration when drafting Master Lease Agreements.

Jeff Eldredge, Partner, Vinson & Elkins: The MLA is where the real value is for the tower company and where most of the real complexity lies in a deal. It's a long term contract (with a significant initial term and then options to renew) and a large value contract. The operator needs sufficient flexibility to manage its needs to deploy and maintain equipment, while the towerco needs sufficient control to maximise the co-location opportunities and create a robust long term revenue stream – that's how they build value. Thus, there's a natural tension that needs to be resolved to everyone's satisfaction. Effective governance mechanisms are important.

The MLA is an umbrella agreement which – traditionally – defines the operator's rights as anchor tenant in terms of leasing space and capacity (wind load) on the transferring towers and

Capacity crunch

Operators err on the side of caution when it comes to reserving capacity on towers for future upgrades. But every square meter the operator reserves is a square meter less for the towerco to sell, and that goes directly to the value of the tower. When it comes to the Master Lease Agreement, "it's important to help operators avoid reserving more capacity than they really need for upgrades", to use the words of one senior towerco executive ■

the towerco's obligations to the anchor tenant in terms of such space and capacity (including the service levels which apply). Different rights and obligations typically apply to different towers. For example, network planners can get very nervous about sharing particularly critical towers with other operators and therefore a small number of the towers might be identified as exclusive to the anchor tenant.

Rob Dixon, Partner, Vinson & Elkins: The service levels for different classes of towers are also likely to vary and be closely negotiated. These will typically be set out in a service level agreement, which may form part of the MLA. The impact of IFRS16 on the way in which tower companies provide services is a key topic. There are also of course other agreements which are important in most towers deals – for example the Build to Suit Agreement – but perhaps all of that is for another time! ■

Tower  Xchange

3-4 December, Marina Bay Sands, Singapore

Meetup Asia 2019



A senior-level networking opportunity with 250 leaders of the Asian telecom tower industry



Photo by Allen Leigh on Unsplash

To discuss your participation, contact Annabelle on +44 7423 512588 or email amayhew@towerxchange.com

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TowerXchange Meetup Asia 2019 – agenda at a glance






Monday, 2 December 2019 | Pre-event vendor briefings

12:00-14:00 Pre-Meetup vendor briefing hosted by edotco Group

An informative session for all solution providers interested in supporting edotco. The leading towerco will offer an overview of its requirements in terms of RMS, structure, small cells and DAS, energy and beyond.

Attendance by invitation only. Contact us if you are interested in joining the briefing.

Day 1 | Tuesday, 3 December 2019

Time	Session
	Breakfast sponsored by  HUAWEI
08:00	Registration and welcome coffee
08:50	TowerXchange's analysis of the Asian telecom infrastructure industry Pablo Crespo, Head of Asia, TowerXchange Kieron Osmotherly, CEO, TowerXchange
09:45	Keynote speech Jose Arturo C. De Castro, Undersecretary for Legal Affairs, Policy, Planning & Finance, Department of Information and Communications Technology (DICT, Philippines)
10:15	One-to-one interview Bimal Dayal, CEO, Indus Towers Kieron Osmotherly, CEO, TowerXchange
10:45	Keynote speech Suresh Sidhu, CEO, edotco Group Sdn Bhd
11:15	Networking coffee break sponsored by 
11:45	Interactive roundtable session I and closed-door vendor briefing
13:00	Networking lunch sponsored by 

Time	Session
14:15	Executive panel discussion: The path towards a shared infrastructure regime in the Philippines Strategic, operational, regulatory and financial considerations on the newest market opening up to towercos in Asia Moderator: Paul Carpenter , Partner, Asia, Hardiman Telecommunications Manish Kasliwal , VP and Chief Business Officer, Asia, American Tower Wan Zainal Adileen , Chief Regional Officer, ASEAN South, edotco Group Devid Gubiani , President, PhilTower Patrick Tangney , Chairman & CEO, Frontier Tower Associates
15:00	Executive panel discussion: Can towercos succeed in Bangladesh? First-hand experiences following the first year of towercos' activities in the country Md. Emdadul Haque , MD, Infrastructure Services, Technology, Banglalink Digital Communications Ltd. Salman Karim , CEO, Kirtonkhola Tower Bangladesh Marc Perusat , Managing Partner, TASC Towers Md. Serajus Saleheen , Director of Sales, edotco Bangladesh Md. Saifur Rahman Khan , Head of Corporate Sales & International Business, Teletalk Bangladesh Ltd.
15:45	Interactive coffee break sponsored by  tarantula Monetizing Towers
16:15	Interactive roundtable session II and closed-door vendor briefing
17:30	End of day one and networking drinks sponsored by  eco enabling connectivity
19:30	Optional: TowerXchange networking dinner (separate registration required)

TowerXchange Meetup Asia 2019 – agenda at a glance



Day 2 | Wednesday, 4 December 2019

Time	Session
08:30	Morning coffee
09:00	<p>Executive panel discussion: Innovation in Asia Balancing new technology requirements, financial investments and finding growth in the path towards 5G in Indonesia, India, Malaysia, Japan and more Moderator: Jon Atkin, Managing Director, RBC Capital Markets Federico Bazzoni, Managing Director, M&A International Coverage, CLSA Ankit Goel, Founder and Managing Director, Space World Anil Chet Karamsingh, Head of Strategic Initiatives, edotco Group Sdn Bhd Sudhir Prasad, COO, American Tower Jacopo Rigamonti, Head of Marketing, Sales & Leasing, Protelindo</p>
09:50	Interactive roundtable session III and closed-door vendor briefing
11:10	Networking coffee break sponsored by 
11:40	<p>Executive panel discussion: What is the future for BTS in Myanmar and beyond? An overview of the latest dynamics, product demand and challenges from leading players active in the country Moderator: Enda Hardiman, Managing Director, Hardiman Telecommunications Omer Chappelart, CEO, OCK Yangon David Venn, CEO, Irrawaddy Green Towers VJ Watson, Chief Regional Officer, Bay of Bengal, edotco Group Sdn Bhd</p>
12:30	Networking lunch sponsored by 
13:30	<p>Executive panel discussion: Where can towercos go next? Could infrastructure players find exciting growth opportunities in Vietnam, Nepal, Cambodia and Laos? Carlos Katsuya, Chief Investment Officer & Head TMT Asia, Europe and MENA, International Finance Corporation (IFC) Carson Wolfer, Director of Mergers & Acquisitions, edotco Group Sdn Bhd</p>
14:30	Live poll
15:00	Interactive roundtable session IV
16:15	Networking coffee break sponsored by CYIENT and end of Meetup



Confirmed panellists and roundtable leaders



- **Anita Anwar**, Director of Property Management, **Protelindo**
- **Jon Atkin**, Managing Director, **RBC Capital Markets**
- **Federico Bazzoni**, Managing Director, M&A International Coverage, **CLSA**
- **Paul Carpenter**, Partner, Asia, **Hardiman Telecommunications**
- **Omer Chappelart**, CEO, **OCK Yangon**
- **Md. Emdadul Haque**, MD, Infrastructure Services, Technology, **Banglalink Digital Communications Ltd.**
- **Enda Hardiman**, Managing Director, **Hardiman Telecommunications**
- **Anil Chet Karamsingh**, Head of Strategic Initiatives, **edotco Group**
- **Sushil Kumar Chaturvedi**, CEO, **Ascend Telecom Infrastructure**
- **Philip Cooper**, **Independent Consultant**
- **Bimal Dayal**, CEO, **Indus Towers**
- **Jose Arturo C. De Castro**, Undersecretary for Legal Affairs, Policy, Planning & Finance, **Department of Information and Communications Technology (DICT, Philippines)**
- **Ankit Goel**, Founder and Managing Director, **Space World India**
- **Tucker Grinnan**, Executive Director, Asian TMT Research, **JP Morgan**
- **Devid Gubiani**, President, **PhilTower**
- **Anil Gupta**, Chief of Supply Chain, **Indus Towers**
- **Tejinder Kalra**, Chief Operating Officer, **Indus Towers**
- **Manish Kasliwal**, VP and Chief Business Officer, Asia, **American Tower**
- **Carlos Katsuya**, Chief Investment Officer & Head TMT Asia, Europe and MENA, **International Finance Corporation (IFC)**
- **Aashish Khadsare**, Commercial Manager, **Apollo Towers**
- **David McKean**, CEO and Founder, **oneCONTINUUM**
- **Kingston Pang**, Managing Director, **Redpeak Advisers**
- **Fahmi Pahlevi**, Head of Technology PMO, **Indosat Ooredoo**
- **Marc Perusat**, Managing Partner, **TASC Towers**
- **Sudhir Prasad**, COO, **American Tower**
- **Gulfraz Qayyum**, Managing Director, **Citigroup**
- **Md. Saifur Rahman Khan**, Head of Corporate Sales & International Business, **Teletalk Bangladesh**
- **Jacopo Rigamonti**, Head of Marketing, Sales & Leasing, **Protelindo**
- **Gregg Rowley**, Commercial & Strategy Director, **Broadcast Australia**
- **Md. Serajus Saleheen**, Director of Sales, **edotco Bangladesh**
- **Radhey Raman Sharma**, Co-Founder and Director, **Space World India**
- **Suresh Sidhu**, CEO, **edotco Group**
- **Amit Sinha**, MD & Global Head of TMT Corporate & Investment Banking, **DBS Bank**
- **Tomy Sudiwiyono**, Head of Tower Operation, **Indosat Ooredoo**
- **Patrick Tangney**, Chairman & CEO, **Frontier Tower Associates**
- **Geoffrey Tan**, Managing Director, Asia-Pacific, **Overseas Private Investment Corporation (OPIC)**
- **Sander Van Litsenburg**, VP Engineering & QHSE, **Protelindo**
- **David Venn**, CEO, **Irrawaddy Green Towers**
- **VJ Watson**, Chief Regional Officer, Bay of Bengal, **edotco Group**
- **Carson Wolfer**, Director of Mergers & Acquisitions, **edotco Group**
- **Wan Zainal Adileen**, Chief Regional Officer, ASEAN South, **edotco Group**



Closed-door sessions and briefings



Designed to enable peer-led evaluation of technologies by tower owners themselves, seats at the central table are strictly reserved for executives from MNOs and towercos or invited event sponsors and exhibitors.

After information gathering from the MNOs and towercos, we invite selected vendors to enter the discussion, succinctly sharing their perspectives and tailored solutions/ product developments to address some of the issues raised. All vendors will be notified prior to the event as to their eligibility to join this session. If you have not been notified, you will be unable to actively participate in the discussion but we invite you to take a seat around the edge of the room to listen to the session. **Please contact Annabelle Mayhew amayhew@towerxchange.com to discuss eligibility.**

Monday, 2 December 2019

Closed-door session: edotco Group briefing

An informative session for all solution providers interested in supporting edotco. The leading towerco will offer an overview of its requirements in terms of RMS, structure, small cells and DAS, energy and beyond.

- edotco's representatives to be announced shortly

Tuesday, 3 December 2019

Closed-door session: Indus Towers briefing on deployment plans, products and services requirements and other vendor opportunities

The largest towerco in India and one of the top in the world will share an exclusive overview of its requirements for the very first time at a TowerXchange Meetup Asia.

- Anil Gupta, Chief of Supply Chain, Indus Towers

Closed-door session: Indosat Ooredoo briefing on rollout strategy, operational challenges and collaboration opportunities

Indonesian MNO Indosat Ooredoo will offer an overview of its deployment and maintenance strategy and share the company's requirements on energy, site equipment, purchase policy and capex reduction initiatives.

- Tomy Sudiwiyono, Head of Tower Planning & Engineering, Indosat Ooredoo
- Fahmi Pahlevi, Head of Technology PMO, Indosat Ooredoo

Closed-door working group: How to identify opportunities and build a business in indoor, public and enterprise wireless

- Philip Cooper, Independent Consultant, formerly Managing Director EMEA Digital Bridge & COO Digital Colony UK; CFO, Apollo Towers Myanmar; Group Commercial Manager, Eaton Towers
- Ankit Goel, Founder and Managing Director, Space World India
- Radhey Raman Sharma, Co-Founder and Director, Space World India

Attendance by invitation only. Contact us if you are interested in joining any of the above sessions. Exact timings TBA.



Interactive roundtable sessions



Country focus

- **Indonesia's changing landscape: prospects of foreign investment, private equity exits and MNO sales**
Kingston Pang, Managing Director, Redpeak Advisers
- **Australia: 5G transition and market overview**
Gregg Rowley, Commercial & Strategy Director, Broadcast Australia
- **Cambodia: the irruption of Chinese investors and future growth drivers**
Phillip Wong, Chief Regional Officer, ASEAN North, edotco Group
- **India: is the market finally moving towards its final shape?**
Jon Atkin, Managing Director, RBC Capital Markets
- **Bangladesh: the complexities of setting up a towerco regime – an update**
Salman Karim, CEO, Kirtonkhola Tower Bangladesh
- **Vietnam: exploring the impact of MNO privatisation and potential carve outs**
Moderator TBA
- **Entering the Philippines: What will be the main hurdles and operational difficulties for emerging towercos?**
Moderator TBA
- **Myanmar: juggling BTS growth and market opportunities**
Moderator TBA

Finance/strategic focus

- **Growth beyond traditional macro towers: the investor's take**
Gulfraz Qayyum, Managing Director, Citigroup
- **Growth vs. returns: what model is more attractive to investors?**
Tucker Grinnan, Executive Director, Asian TMT Research, JP Morgan

- **M&A outlook: what are the latest deals and where are the most attractive opportunities?**
Carlos Katsuya, Chief Investment Officer & Head TMT Asia, Europe and MENA, International Finance Corporation (IFC)
- **Who are the new funds and investors bringing money to Asia and what are they looking for?**
Geoffrey Tan, Managing Director, Asia-Pacific, Overseas Private Investment Corporation (OPIC)
- **Exploring 5G impact: the evolution of networks architecture and towerco deal designs**
David McKean, Principal, oneCONTINUUM
- **Energize the Chain: saving lives through sustainable telecom infrastructure**
Harvey Rubin, Founder & Executive Director, Energize the Chain
- **Raising capital and making a business case for 5G rollout**
Andy Sutrisno, Vice President, Investment Banking Asia-TMT, SMBC
- **Are data centres the next venture for Asian towercos?**
Federico Bazzoni, Managing Director, M&A International Coverage, CLSA
- **Towerco perspective: integrating and monetising fibre**
Moderator TBA
- **Convergence and integration: how are data centres and fibre impacting towercos' valuation and business model?**
Amit Sinha, Managing Director, Global Head of TMT, Corporate & Investment Banking, DBS Bank
- **Exploring Asian untapped markets: regulation barriers, risk and opportunities**
Moderator TBA

Interactive roundtable sessions



- **Navigating Southeast Asia: volatility, currency exposure and main risks**

Moderator TBA

Operational focus

- **Integrating 5G: How can towercos adapt their offer to address MNOs needs and challenges?**

Sander Van Litsenburg, VP Engineering & QHSE, Protelindo

- **Overlays or new architectures: How are towercos and MNOs upgrading their network in preparation for 5G?**

Ir Kumari Nalini, Director of Engineering, edotco Group

- **Cutting down cost and driving efficiencies: optimisation and technological innovation**

Azizee Abdul Aziz, Director of Operations, edotco Group

- **Green initiatives across Asia: success stories and innovation examples**

Ir Kumari Nalini, Director of Engineering, edotco Group

- **The shift from towerco to infraco: succeeding at deploying fibre, small cells and beyond**

Jacopo Rigamonti, Head of Marketing, Sales & Leasing, Protelindo

- **IBS: best practices in deploying indoor solutions across Asia**

Megat Zulkarlai, Director of Business Acceleration, edotco Group

- **Energy management and operational best practices: how to create win-win partnerships between towercos and MNOs**

Dr Sushil Kumar Chaturvedi, CEO, Ascend Telecom Infrastructure

- **Bangladesh's complex operational reality: lessons learnt**

Md. Monowar Sikder, Director of Operations, edotco Bangladesh

- **Optimising land contracts: how do you accelerate the permitting**

- **process and optimize your land lease agreements**

Anita Anwar, Vice President, Property Management, Protelindo

- **Beyond macro-towers: the evolution of digital connectivity towards 5G**

Devid Gubiani, President, PhilTower

- **Exploring Myanmar's operational hurdles: poor grid connectivity, the fixed energy model and other maintenance bottlenecks**

Aashish Khadsare, Commercial Manager, Apollo Towers

- **Understanding 5G requirements: spectrum, new architectures and equipment**

Moderator TBA

- **Reliability and security: what are the best backup power solutions for challenging scenarios?**

Moderator TBA



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Through our operations in developing Asian economies, the Group has established a strong track record in nation building. edotco has progressively invested in industry best practices, providing a broad portfolio of infrastructure solutions and offering value-added services to enhance efficiencies and connectivity for communities. At edotco, we are committed to conducting our business in a responsible and sustainable manner for the benefit of our customers, employees, communities and developing nations.

For more information on edotco, kindly visit www.edotcogroup.com

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Incorporated in April 2016, the company has in a short span of time made major strides and now has several large projects ranging from leading underground metros and airports to large hospitals, corporate parks, educational Institutions, malls and high rise residential and commercial complexes. We offer a suite of innovative solutions which include build-to-suit IBS, advanced SISO/MIMO solutions, outdoor cell sites, outdoor small cells solution et cetera. Importantly, our business model is predicated on deploying our own capex thereby making our customers asset light and significantly bringing down their TCO.

The Space World group also has a presence in Myanmar, which is considered one of the last frontiers for growth in the Asian region, with immense business potential in various segments including energy, telecommunications and infrastructure. We are partnering with the leading MNOs in Myanmar to provide innovative shared infrastructure that lower their investment and improve their mobile coverage and penetration.

<https://spaceworld.in/>

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Siterra, an Accruent Product, addresses the software needs of tower companies to sell co-locations, upgrade capacity, build-to-suit, maintain accurate asset registers, manage maintenance, and collaborate with vendors operationally as well as consolidate and integrate tower-related software technically. Sixteen of the towercos and infracos that TowerXchange tracks are current Siterra customers, spanning 18 countries and five continents. The first version of the Siterra site management platform was released in 2001. 100,000 users later, Siterra has become the industry standard, must-have operating software for tower companies today. Accruent works with its leading towerco customers to jointly develop new features that are deployed regularly through the SaaS platform to constantly improve customer value. Accruent has developed global process standards with local flexibility to pair with best-in-class software functionality.

Accruent's telecommunications division serves some of the world's largest mobile network operators and service providers in addition to tower companies, helping link employees from different organizations in the industry to collaborate to projects. Accruent is the largest independent provider of commercial property management software, serving the telecom, retail, education, healthcare, and corporate markets with over 7,000 customers in 149 countries.

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Our highly specialized and international team of engineers develops world-unique and patented solutions—from the Code Generation System (CGS) and Keypad Key to remote staff management via the mobile App. This modular, and solution-oriented approach sets Acsys International apart from other security solution provider in the market. With presence in 64 countries, our clients are global leaders from different industries, including telecommunications, power, mining, logistics and more.

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America and the Middle East for over 30 years. With the company's headquarters based in Ireland, Delmec provide structural and network solutions, infrastructure builds, steelwork, renewable energy and fibre network builds. Our expertise has led us to become a renowned provider of engineering services to the telecom and utility sectors, specialising in full turnkey solutions from design concept to live on air.

Delmec's reputation can be witnessed in over 40 countries where key services have been provided to a wide range of clients whom many have continually sought the expert knowledge of Delmec for their telecom's needs. Delmec strive to provide services ensuring the client is given the best customer service, maintaining a high efficiency and always to a quality that is highly regarded in the telecom industry with many of our clients stating that Delmec are; The best in the world at what we do.

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GRIDSERVE Sustainable Energy Limited ("GRIDSERVE") is a tech-enabled international sustainable energy business which develops, builds, owns and operates solar energy & battery storage solutions for critical power infrastructure. We are seasoned sustainable energy professionals with roots that started with some of the world's first commercial deployments of solar energy and energy storage over 45 years ago. This rich history of product design, manufacturing and solution provision has

uniquely positioned GRIDSERVE at the forefront of today's hybrid energy marketplace. Today, GRIDSERVE's strong pedigree is responsible for the development, construction and operation of more than a gigawatt of solar energy and energy storage solutions including over 100 utility-scale sustainable energy projects to the UK grid in the last five years alone.

GRIDSERVE has combined best-in-class modular technologies and services to deliver turn-key, dependable, low cost, clean energy for critical power. GRIDSERVE's Solar Energy Centre (SEC12) integrates the world's highest performance and most optimised components to provide maximum efficiency hybrid power systems designed specifically for telecom BTS applications. GRIDSERVE's latest iteration of SEC12 is configured as a modular 'plug-and-play' hybrid power solution that integrates the very latest advances in bifacial solar power, intelligent energy storage, ultra-high efficiency generators, into single systems complete with climate controls and fully controllable, secure, advanced remote monitoring features. GRIDSERVE is accredited to the international quality and environmental standards ISO9001 and ISO14001.

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Tarantula is a proven market leader of telecom site management solutions and a trusted advisor and long-term partner for tower site owners worldwide. With extensive industry knowledge and customer understanding, Tarantula supports and empowers its customers to build profitable and sustainable businesses. Through an end-to-end, purpose-built telecom site portfolio management solution and knowledge-driven services, Tarantula helps telecom site owners to monetize their towers. Tarantula is a vital part of the daily management of more than 300,000 towers and US\$25 billion worth of assets across the world.

Tarantula is owned by Volaris Group, an operating arm of Toronto-based software and services provider,

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Constellation Software Inc. Tarantula's offices are situated in Singapore, Stockholm, London, and Hyderabad.

www.tarantula.net

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ZTE Corporation is a global leader in telecommunications and information technology. Founded in 1985 and listed on both the Hong Kong and Shenzhen Stock Exchanges, the company has been committed to providing integrated end-to-end innovations to deliver excellence and value to consumers, carriers, businesses and public sector customers from over 160 countries around the world to enable increased connectivity and productivity.

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combines local experience with a global knowledgebase constantly striving to achieve inspiring and exacting solutions that make a genuine difference to our clients, the end-users, and society at large. Ramboll works across the markets: Buildings, Transport, Planning & Urban Design, Water, Environment & Health, Energy and Management Consulting.

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We also have significant experience in the negotiation and drafting of sale and purchase, debt and equity financing, master lease, build-to-suit, site management, site marketing and service level arrangements, fibre IRUs and other complex commercial contracts.

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ABLOY

Abloy Oy

Abloy Oy is one of the leading manufacturers of high quality locks, locking systems and architectural hardware and the world's leading developer of high security electromechanical locking technology.

For decades Abloy has delivered security solutions to protect telecommunications sites and assets. At its simplest level, the CLIQ® system eliminates the risks and expense caused by lost or stolen keys. The web managed

system also facilitates financial savings, reduces CO2 emissions and provides significant time saving with 'smart' infrastructure integration, generating a fast pay-back and high ROI.

Abloy operates in all continents and several major companies have chosen ABLOY as their trusted advisor and the solution provider in the rapidly developing and changing telecom industry.

www.abloy.co.uk/en/abloy/abloy-co-uk/solutions1/telecommunications

Exhibitor



Asentria

Asentria provides solutions for mobile network and tower operators to manage power, security, and environmental issues at remote cell sites from their network operations center. Telecom sites are evolving to include many new intelligent subsystem controllers for DC rectifiers, generators, cameras, access controllers, and HVAC.

Asentria securely integrates these sub-systems into our hardware based site controller to present a single interface for management of power, security and environment at remote sites. Beyond simple alarming, Asentria generates data for comparative site analysis and provides remote access to the underlying systems for OPEX reducing cell site optimization.

www.asentria.com

Exhibitor



AVIALITE SDN. BHD.

AVIALITE is specialist manufacturer of LED aviation obstruction beacon (OB) light system used for obstacle marking of telecommunication towers, buildings and transmission lines for aviation safety.

Since 2004, we have been designing and manufacturing aviation lighting system in compliance to the International Civil Aviation Organisation (ICAO) standard. Our lights are robust, reliable, compact and lightweight, providing easier handling and installation. Built to last, we engineer our lights with many special features to match the uncompromising environment that they are used in. We have a strong focus on R&D and can customize customer driven systems and solutions.

Illumination through imagination.

www.avialite.com

Exhibitor



Crossflow Energy

Crossflow Energy Company is a UK-based developer of affordable and reliable integrated energy solutions (IES), providing firm clean power for off and weak-grid applications. With containerised components for security,

Our exhibitors



Crossflow's quickly deployable units focus on reliability, cost-optimised operational services and energy security.

The inclusion of a robust, long life, low maintenance and quiet Crossflow wind-turbine within the IES unit allows for 100% renewable energy generation at an affordable price. Ideal for rapid network extension or technology upgrades Crossflow IES are the ideal option to improve reliability and reduce both energy costs and environmental impacts in remote locations.

www.crossflowenergy.co.uk

Exhibitor



Crowd SiteIntel by M2Catalyst, LLC

M2Catalyst is a big data/business analytics licensor that crowdsources trillions of cell tower, mobile network, device, and application data points from millions of mobile devices.

Our data scientists then utilize proprietary algorithms to generate invaluable actionable intelligence for members of the wireless ecosystem, i.e., infrastructure providers, tower owners, wireless carriers, mobile device manufacturers, and app developers.

www.m2mobileinsights.com/blog/a-r-evolution-in-how-towers-are-valued-and-how-co-locations-are-sold/

Exhibitor



EnerSys

EnerSys® is the global leader in stored energy solutions for industrial applications. We complement our extensive line of motive power, reserve power and specialty products with a full range of integrated services and systems. With sales and service locations throughout the world. Headquartered in the United States, with regional headquarters in Europe and Asia, EnerSys employs over nine thousand people and operates 32 manufacturing and assembly facilities world-wide. This vast infrastructure and over 100 years of battery experience positions EnerSys at the forefront of both manufacturing capabilities and new product development.

<http://www.enersys.com/GlobalLanding.aspx>

Exhibitor



Flexenclosure

Flexenclosure provides sustainable Internet infrastructure – designing and manufacturing intelligent power management systems and prefabricated data centres for the ICT industry. eSite x10 is the world's first power system purpose-built for outdoor telecom sites and to outdoor telecom standards. It is a patented, sealed, tamper-proof unit with passive convection cooling, no filters, no moving parts and it requires no maintenance. eSite x10 is the future of telecom site power.

Flexenclosure is based in Sweden and has additional offices and staff in Canada, India, Ireland, Malaysia, Mexico, Myanmar, Nigeria, South Africa, Sweden, the UAE and the UK.

www.flexenclosure.com/

Exhibitor



HS Engineering and Technology Ltd

HS Engineering and Technology Ltd is one of the leading telcom service provider and products suppliers in Bangladesh, where we offer turnkey solution for telecom power and infrastructure.

We operate an experienced engineering team, allowing us to offer innovative and cost-effective design for our telecom customers. We have developed a group of products for towercos which are environment friendly and allows for smart city beautification while ensuring high quality, low maintenance and easy deployment for 4G and 5G.

We have our own factory for various types of outdoor cab nets as well as our own STEALTH branded Li-ion battery and rectifier. We are also a pioneer in the field of intelligent security lock system, camouflage pole and solar power system.

We have operations in Sri Lanka and a central office in Singapore.

www.hsengineeringbd.com

Our exhibitors



Exhibitor



ITD / ClickOnSite

ClickOnSite is a comprehensive software tool for MNOs and towercos to manage tower sites, rollouts, assets lifecycle & operations at scale. Everyone from the office to the field works on one set of data in real-time, on PC, tablet or mobile. Reports provide business intelligence. BPM automates project management. APIs connect to your other enterprise software.

We have 12,000 daily users across 20 countries. ITD aims to be the #1 provider of software for managing sites and operations in Europe, Africa, Middle East and SE Asia. We are telecoms industry experts making software optimized for the industry!

<http://www.it-development.com>

Exhibitor



NANHUA Electronics Co., Ltd.

NANHUA is an independent enterprise with modern management which is located in Shanghai. We design, manufacture and sell world leading signal, lighting and control products which be applied in industrial areas since 1990, and focusing on aviation obstruction light system for telecom towers from 2007, has full experience in the complete line of cost-effective obstruction lighting and control solutions.

NANHUA products have been proven to be professionally designed and highly reliable.

NANHUA will continue to maintain reliable, safety and simple R&D concepts, combine with the latest technology, commit to developing new products to help customer solve problems and enhance customer value.

www.nanhua.com

Exhibitor



NorthStar Battery

NorthStar is a global leader in designing, manufacturing and deploying a wide range of batteries and energy storage solutions.

Our mission is to deliver reliable and sustainable power to the world. Using advanced technology, our products have been built to ensure longer battery life, lower operating costs and reduced environmental impact.

We maintain a global presence with major operations in Sweden, USA, China and the Middle East and distribution and service centers in Latin America, Europe, Africa and APAC. Visit our booth for more information about our new innovative products including NorthStar ACE™; the future of energy storage management!

www.northstarbattery.com

Exhibitor



Polar Power Inc

Polar Power, Inc. (POLA), designs, manufactures and sells direct current, or DC, power systems, lithium battery powered hybrid solar systems for applications primarily in the telecommunications market. Polar's systems provide reliable and low-cost energy for applications for off-grid and bad-grid applications with critical power needs that cannot be without power in the event of utility grid failure. Our systems integrate DC Generators, Solar PV, DC Air-conditioning, and batteries. Our Hybrid Solar Systems provide reliable power with very low maintenance and operational costs. Our Prime Power DC Generators provide very low fuel consumption, low maintenance with 3,000-hour oil change interval and long generator life. Our Backup DC Generators provide compact, lightweight, minimum fuel storage providing long reserve.

www.polarpower.com

Exhibitor



SerEnergy

SerEnergy is a world leading developer and manufacturer of power systems providing primary, supplementary and backup power for telecom and utility applications. With a system based on reformed methanol fuel cell technology, SerEnergy is able to provide a very compact power generation system that does not generate harmful emissions, noise or vibrations. At the same time, the power system is a front runner in terms of low maintenance

Our exhibitors



requirements while being environmentally friendly. With headquarters in Aalborg, Denmark, SerEnergy is the largest methanol fuel cell manufacturer worldwide with a production capacity up to 25MW (5000 units) per year.

<http://serenergy.com>

Exhibitor



SiteSee

SiteSee is a deep tech innovator, that delivers real business benefit to cell tower owners. SiteSee has developed an innovative end to end solution for cell tower infrastructure auditing using Artificial Intelligence (AI). The solution provides automated audit reports on tower equipment and condition assessment of the tower asset. For the first time, Telco infrastructure companies can audit and inspect the entire portfolio of assets without the need for humans climbing the towers. The implications of this paradigm shift in infrastructure management has come just in time for the costly 5G rollout.

www.sitesee.io/

Exhibitor



STULZ GmbH

Since 1947, the STULZ company has evolved into one of the world's leading suppliers of air conditioning technology. With focus on precision air conditioning units, chillers, humidifying systems, service and facility management, this division of the STULZ Group achieved

sales of around 450 million € in 2016. Since 1974 the Group has seen continual international expansion of its business, specializing in air conditioning for data centers and telecommunications installations. STULZ employs 2,400 workers at ten production sites and 21 sales companies worldwide and cooperates with sales and service partners in over 140 other countries. Current annual sales are around 1,300 million euros.

www.stulz.com

Exhibitor



TECNOELETTRA

TECNOELETTRA is an Italian Company, globally recognized as high quality manufacturer of controllers and innovative solutions in power supply applications. TILS is the brand of TECNOELETTRA for Telecom Market. TILS means Telecom InverterLess System, is a unique complete package composed by Controller, PMG alternator and all components for variable speed system, for Hybridize your generator or BTS directly.

TILS is your answer if you want to:

- Hybridize your existing BTS without huge investments and using the existing generator
- Build a Smart Hybrid generator
- Have a real remote control and vision of your fleet

We are your partner if you want to save money in terms of green energy, maintenance and fuel.

BE DIFFERENT

www.tecnoelettra.it

Exhibitor



Valmont® Structures

Valmont® Structures earned its global leadership position through engineering expertise, manufacturing process honed over time and a reputation for product durability that is decades in the making. The reliability of your network can't afford anything less. No matter how your wireless network grows and changes over time, Valmont offers the structures to evolve with it. We supply self-supporting towers, guyed towers, portable and monopole towers as well as our industry leading SitePro1 components. Valmont also has the most robust selection of engineered small cell solutions for any application. At Valmont we are building structures for the next generation of communications.

www.valmontstructures.com

Exhibitor



vHive

vHive is the global software provider to enterprises, accelerating their continuous digital transformation, enabling them to make better decisions based on accurate field data and analytics. vHive is the only software solution that enables enterprises to deploy autonomous drone hives to digitize their field assets and operations. From mission planning and execution to data processing and analytics, vHive enables non-expert users to fly low-cost, off-the-shelf drones and successfully complete surveys of any shape or size. vHive works with some of the world's largest tower companies, successfully



digitizing thousands of towers, generating accurate, measurable 2D, 3D, 360 degree and analytics results for both engineering and for inspection. vHive ensures the safety of your staff, reduces operational costs by an order of magnitude, generates new revenue opportunities like never before.

www.vhive.ai/

GS Yuasa



GS Yuasa is a Japanese company formed in 2004 by the merger of two large 100 year old battery manufacturers, Japan Storage Battery and Yuasa. At US\$3.5B in sales, GS Yuasa is one of the worlds largest battery manufacturers. GS Yuasa manufactures a full line of technologies including lithium, lead acid, nickel metal hydride, and nickel cadmium for the automotive, industrial, and specialty battery markets. Especially for Telecom market, we have developed a 48V lithium ion battery module that has outstanding cyclic life and charge acceptance that can reduce the runtime of generators and the total cost of ownership of telecom base stations. With 37 affiliates in 17 countries, GS Yuasa has a worldwide presence operating under the GS Yuasa, GS, and Yuasa brands

<http://www.gs-yuasa.com/jp/index.asp>

Hardiman Telecommunications



Hardiman Telecommunications Ltd. was established in 1994. We are a boutique consultancy specialised in

strategy development, due diligence assessment and valuation support.

Our clients include major TowerCos, private equity funds, corporate finance / advisory and investment functions of leading banks, and telecommunications carriers. We are particularly active in end-to-end support of mergers, acquisitions and divestitures. All of our staff have held profit-accountable positions with global telecommunications carriers, manufacturers and systems integration houses prior to joining us.

This allows full support of clients across the continuum from technology through to market effectiveness, spanning engineering, commercial strategy, financial structuring and proven operating methodologies.

www.telecoms.net



Meetup Asia 2019

3-4 December, Singapore

www.towerxchange.com/meetups/meetup-asia

Tower Xchange

Meetup Asia 2019
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Meetup MENA 2020
28-29 January, Dubai

Meetup Europe 2020
19-20 May, Barcelona

Meetup Americas 2020
23-24 June, Boca Raton

Meetup China 2020
September

Meetup Africa 2020
13-14 October, Johannesburg

www.towerxchange.com

ABLOY: Helping MNOs and towercos to achieve operational excellence



TowerXchange: Please introduce your company, your footprint and how you fit into the telecoms infrastructure ecosystem in Asia.

Site security solutions for greater flexibility, transparency and efficiency



Pauli Jormanainen, Regional Director - Asia Pacific, Abloy

Securing telecom sites has never been more important as they are increasingly considered a part of critical national infrastructure. Network coverage and reliability of services is key in the battle for customers between network operators. In the meantime, big tower companies acquire more sites as operators want to financially secure their ability to compete. Sabotage, internal theft, vandalism and the changing shape of the infrastructure are challenges telecom site owners face in today's world. In this interview with TowerXchange, Pauli Jormanainen, Abloy's Regional Director for Asia Pacific, shares his views on how intelligent security solutions can help towercos and MNOs to overcome these critical challenges.

Keywords: Abloy, Asia, Access control, Fencing, Interview, MNos, Operational Excellence, Opex Reduction, Outdoor Equipment, Regulation, Shelters, Singapore, Site Visits, Rooftops, Southeast Asia, Towerco, Urban vs Rural

Read this article to learn:

- ABLOY's footprint and client base
- Market dynamics in Asia's telecom industry
- Top security issues faced by MNOs and towercos
- Cutting-edge solutions for MNO and towerco operational excellence

Pauli Jormanainen, Regional Director - Asia Pacific, Abloy: Abloy has decades of experience in working with different critical infrastructure segments globally, especially with telecommunications customers. We have established a position of a trusted advisor among operators, system integrators, solution providers and tower companies globally. Long experience and vast number of telecommunication customers have made Abloy not only their high security access control solutions provider of choice but a partner to telecom players to build up the most suitable solution to create value and fast pay-back.

Our product and service range is capable of securing any application, from smallest cabinets or remote site gates to large corporate headquarters. We understand that different access and locking points have their own unique security requirements and conditions that need to be met. We provide solutions that can combine electromechanical and mechanical systems, management software, installation services, training, support and future updates – everything after a thorough and professional consultation to design cost effective and efficient solutions based on the individual requirements and operational model of each customer.

Abloy is represented in over 90 countries globally

and almost all countries in Asia & Pacific, from Japan to New Zealand and from Mongolia to Sri Lanka. Local distributors are supported by Abloy's own offices from China, India and Singapore as well as naturally by our main office in Finland. As Abloy is part of ASSA ABLOY, global leader in door opening solutions, our presence is extended by ASSA ABLOY offices in Hong Kong, Australia, New Zealand and beyond.

TowerXchange: Who are your main clients? And how does the demand change between operators and towercos?

Pauli Jormanainen, Regional Director - Asia Pacific, Abloy: Our clients are mainly mobile network operators and tower companies but in certain markets we serve solution providers too. There is a huge demand for flexible and auditable access solutions for a variety of assets from operators and towercos requiring site efficiency and long term high security solutions. There is a growing trend for solutions integrating site and service management systems with access control systems. These types of integrations help tower companies and MNOs to better monitor the service level of their subcontractors as well as create savings with more efficient operations.

The basic demands for solutions between the operators and tower companies are the same but the requirements are different when a single operator is occupying the site or the site

is shared by multiple operators. The higher the number of MNOs on a site, the more flexible the system must be. We have seen a lot of mergers and operators selling their towers to tower companies – and we expect more sharing activities in the near future.

TowerXchange: How does the demand for security solutions differ between different countries across the region?

Pauli Jormanainen, Regional Director - Asia Pacific, Abloy: The top security challenges faced by our customers are unauthorised access to sites, high running costs and theft of materials or information. Vandalism poses an additional threat for clients.

In certain countries there is a real need for security solutions. In fact, MNOs and tower companies face high expenses when rekeying or replacing locks and losses with stolen equipment and wiring. There are two types of scenarios: first, our clients need to monitor and control access to their sites and our solution gives them the ability to determine who actually has entered a site; secondly, our clients need to reinforce their existing security system. In these cases, Abloy can offer stronger locks which cannot be easily broken and we've also worked with cabinet manufacturers to create integrated cabinet locking solutions.

In places like Hong Kong, Macau or Singapore, we serve clients to secure their rooftop sites,

where access requirements are different than in traditional telecom sites.

TowerXchange: How do you find security issues vary between rural and urban areas?

Pauli Jormanainen, Regional Director - Asia Pacific, Abloy: The security issues between the rural and urban sites differ greatly. We have realised that there is a higher degree of theft in rural areas than urban areas. Sites in rural areas are powered by diesel generators and the theft of diesel and batteries is a major headache for industry players across the world. Due to the fact that rural sites are usually outside of populated areas, anything of value (gensets, batteries, copper et cetera) is vulnerable to theft. In areas affected by theft, the demand for reinforced security systems is very high.

TowerXchange: How does your offering differ from others in the market?

Pauli Jormanainen, Regional Director - Asia Pacific, Abloy: We are an established global company with 110 year track record in protecting critical infrastructure. Our PROTEC² CLIQ is a proven solution with over 1,000 customer worldwide, 400,000 cylinders and 400,000 keys already delivered and in use. Over 2,000 telecom sites worldwide have been secured with our high security solutions. We are also the only company who has introduced a product progression plan. This means clients can install a mechanical

solution with the intention of upgrading these products to electromechanical products in a later phase.

PROTEC² CLIQ is the only product in the market where one solution combines the benefits of electromechanical and mechanical solutions – providing double security. The CLIQ CONNECT feature on keys provides flexible access rights and logs event data of attempted openings at any situation, whether you are working at an online or offline location. As extra level of security, we have the ABLOY PROTEC² mechanical platform backup to electronic key controlling system. So if ever your electronic system is compromised your assets remain secure with the mechanical platform backup. Our extensive product range provides complete solutions from padlocks and cylinders to door closers and electric locks to secure and protect our clients' any facilities, infrastructure and assets.

Access management administration systems are available from our trusted cloud service providers or customers can choose to internally host all related systems. Access management can be performed and data utilised also in third party systems with the help of software integration. Our professional network of distributors and sales offices is there to make sure our customers get the best possible experience and value with our solutions. We are also proud to say our products are made in Finland, where ABLOY brand is recognised as the most valuable brand in 2018 ■

See you at our future events!

Meetup Asia 2019

3-4 December, Singapore

Meetup MENA 2020

28-29 January, Dubai

Meetup Europe 2020

19-20 May, Barcelona

Meetup Americas 2020

23-24 June, Boca Raton

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13-14 October, Johannesburg

Tower  Xchange

www.towerxchange.com

Accruent's SaaS site management solution delivers for towercos



Siterra helps optimise key tower management tasks, and the service is constantly evolving to meet client needs



Jason Day, VP of Telecom, Accruent

Accruent's Siterra provides a platform much like a dedicated ERP for towercos and MNOs – they are experts in helping clients clean up and organise their data, making the solution ideal as companies scale their operations across multiple regions and countries. In the latest of a series of interviews exploring the capabilities of Siterra, TowerXchange focuses on the merits of using a native SaaS platform, and on data accuracy and standardisation, critical to accelerating time to market for tenants, and critical to driving tenancy ratio and valuation growth for the towerco or MNO.

Keywords: Accruent, Americas, Asia, Asset Lifecycle Platform, Asset Register, Capacity Enhancements, Central America, Europe, Infrastructure Lifecycle Management, Infrastructure Sharing, Job Ticketing, KPIs, Monitoring & Management, Multi-country Partner, NOC, O&M, Operational Excellence, RMS, Site Level Profitability, Site Management System, Siterra, South America, Transfer Assets, Who's Who

Read this article to learn:

- Accruent's position in the telecom ecosystem and global footprint
- How Siterra helps manage the full tower site life cycle
- How Siterra enables working with subcontractors
- The benefits of a SaaS site management platform

TowerXchange: Please introduce your company – where do you fit in the telecoms infrastructure ecosystem?

Jason Day, VP of Telecom, Accruent: We have developed an enterprise-class Software as a Service (SaaS) product for tower companies which encompasses the full site life cycle from site construction to co-location and the decommissioning of towers. Our software facilitates efficient operations and drives strong revenue growth for tower operators and managed service providers.

Think of us as an Enterprise Resource Planning (ERP) provider for tower companies and MNOs. We have the capacity to manage the entire ecosystem that surrounds tower infrastructure.

Co-location is one area we have a special focus on; most tower companies want to increase their co-tenancy ratio. What makes our company unique is that it has the capacity to manage the entire process from marketing through to fulfilment and operational management.

TowerXchange: The first question our readers will want to know is 'how proven is your solution in the field?' Can you please tell us about the performance of your solution the field – who is using it and what results have been achieved?

Jason Day, VP of Telecom, Accruent: Our solution has strong credibility in the market. Thirteen of the top 121 tower companies listed by TowerXchange are already current Accruent customers. At present, we

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by handling data in a digestible manner, tower companies and MNOs can make towers available on the market faster and more cost efficiently, thereby increasing tenancy ratios

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cleans up and standardises data. It puts data into a much more efficient site-centric format, which makes it easier for MNOs and tower companies to buy, integrate and market their assets. What's more, by handling data in a digestible manner, tower companies and MNOs can make towers available on the market faster and more cost efficiently, thereby increasing tenancy ratios.

TowerXchange: How does your solution help manage different stakeholders within the tower supply chain from tenants to subcontractors?

Jason Day, VP of Telecom, Accruent: The solution can help tower companies handle leads and administration models. In addition, the asset register and customer portal integration that sits at the heart of Siterra's colocation solution can be used to provide up-to-date information on colocation. For example, a tower company may wish to inform an MNO of open towers that are available for rent. They will be able to do this through our portal.

Our solution can also be used to support contract and service provider management. In fact, Siterra uses a permissions-based model. If an operator or tower company wants to give a contractor or service provider access to the system it can do so very easily. The contractor or service provider can then carry out a task and post a photo to provide proof that the project has been completed. Siterra offers sophisticated tools for project managers to efficiently review work submitted for accuracy and quality. What's more, the system has built in security features so that each contractor's access and

visibility is limited to only the assets, tasks, and sites that are necessary for their work.

TowerXchange: How can your SaaS platform be configured to adapt to different towercos' unique business processes and workflows?

Jason Day, VP of Telecom, Accruent: We are constantly developing and upgrading our platform to suit the needs of tower companies. As things currently stand, Siterra provides for more than 90% of tower companies' needs straight out of the box. The remaining 10% can be easily configured on the platform so customers can adapt it to meet their specific requirements. We come to the engagement with our customer with best practices available to immediately drive efficiency based on our knowledge of the industry.

We've also developed many feature requests in partnership with our clients. A client will typically come to us with a request for a particular feature. Once we have developed that feature we will incorporate it into later versions of our platform so that other customers can take advantage of it.

Thanks to our focus on long term partnerships and successful product co-development, we've been able to create a stable platform for tower portfolios. However, we notice that many companies in the market continue to invest in custom software. We feel that this is a failed strategy because, over the long term, companies end up wasting IT resources and limiting the potential to make long term efficiency gains.

operate in twelve countries across five continents and have a particularly strong focus for 2016 on Europe and Central and Latin America. We are constantly adding new portfolios for our current customers and carrying out implementations in multiple countries.

At first, many of our clients purchase our solution to use it in a particular territory. However, once they have the solution installed, they realise that they can achieve operational efficiencies by rolling it out across all of their countries and portfolios, and we can support them in this endeavour. If a company wants to roll out our solution to multiple countries, we can help them standardise processes including reporting, colocation, license management, project management, vendor management, and inspection management.

One of the selling points of our solution is that it

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With some solutions on the market, users tend to become beholden to professional service teams after deployment. That's not the case with Siterra. Once a customer has bought the solution and implemented it, they're up and running. They don't need to constantly check in with our professional services department

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TowerXchange: How can a robust approach to asset registers and asset lifecycle management improve the valuation of tower assets?

Jason Day, VP of Telecom, Accruent: The main benefit comes in being able to understand the condition of the assets and the inventory associated to those assets. Being able to keep track of inventory is a benefit, particularly for large, international tower companies. Smaller companies, on the other hand, are looking to maximise their tower valuation for strategic buyers. That's exactly where the site-centric focus of our software comes into play.

Our platform can provide complete access to maintenance records, site information and pictures of site equipment. This makes it extremely useful for strategic buyers and companies that are seeking to sell their assets.

For example, it isn't really feasible for a strategic buyer to use manpower to inspect four thousand

towers when purchasing a portfolio. By using Siterra, buyers and sellers can perform clean searches without digging through files and records to get access to the right information. We find that most buyers and sellers prefer to use Siterra to carry out the portfolio valuation process – at the end of the day our system reduces acquisition risk for acquirers and improves return on investment for sellers.

TowerXchange: Please sum up how you would differentiate your solution from your competitors?

Jason Day, VP of Telecom, Accruent: Our annual product investment is larger than most of our competitors' revenues – that in itself differentiates us from our competitors.

On top of this, Siterra is a SaaS platform, so we have benefited from the shift towards cloud applications. Unlike many other solutions on the market, our SaaS

application was not built from scratch based on an on-premises application – all of our incremental investments have been to enhance its functionality. Total costs for the customer can escalate quickly if a solution needs to be re-built over time or requires extensive support. That's why it makes much more sense to purchase a proven SaaS solution like Siterra.

With some solutions on the market, users tend to become beholden to professional service teams after deployment. That's not the case with Siterra. Once a customer has bought the solution and implemented it, they're up and running. They don't need to constantly check in with our professional services department. Of course, our professional services and customer teams are always available if needed, but we are strongly of the opinion that our customers should not be dependent on us for their daily business needs.

There's also a huge amount of functionality built into Siterra that allows customer system administrators to modify workflows, create new reports and manipulate site data on a large scale within the administration console. Users don't need to receive any code or help from Accruent to make these changes.

In summary, our market share, our investment, and our product functionality significantly outweigh our competitors' products, and over the last fifteen years, we have successfully brought the best of the best when it comes to industry best practices and knowledge ■

Enhanced security and operational efficiencies through improved access control



An interview with leading access control provider - Acsys

TowerXchange: Please can you describe some of the limitations of mechanical locks and keys?

Rani Ariss, Vice President Sales EMEA, Acsys: There are several limitations in the use of mechanical locks and keys; keys can be copied, lost and forgotten or unreturned and the cost of replacing the lock is often higher than the lock itself. In managing keys, operators need to employ numerous amounts of workers who require training and the wrong keys can be given to the vendor. With traditional mechanical lock and key there is no way to prevent collusion, and users can forget to close sites (intentionally or not).

Regular audits need to be undertaken to ascertain the amount of keys in use and the keys' location and the management of keys and locks requires dedicated space and security. Managing keys on weekends or during an emergency is a problem as staff will not be present, it is critical to be able to respond quickly to downed sites but if access is prevented in the absence of keys then the only way is to cut the locks which will require a lock replacement and sites can stay unsecured for quite some time

When keys are copied it is difficult to detect when a theft or loss occurs and with picking and bumping there is no proof of break and entry and as such there are high insurance premiums. The result of these inefficiencies is that some vendors eventually make their own copies of the keys to gain access.



Poor access control can not only lead to security concerns but it can also have a significant impact on a company's operational efficiency and bottom line. In this interview, we speak to leading access control system provider, Acsys, to understand how the telecom tower industry has been affected by poorly managed access control and discuss the advantages that mechatronic locks can bring to the sector.

Keywords: Access Control, Acsys, Africa, Health & Safety, Job Ticketing, KPIs, Logistics, Masts & Towers, MLA, MNOs, Monitoring & Management, NOC, O&M, Operational Excellence, RMS, Site Level Profitability, Site Surveys, Site Visits, SLA, Towercos

Read this article to learn:

- Limitations with mechanical locks
- Challenges in controlling access to NOCs
- The importance of access control in enforcing SLAs
- How mechatronic locks can contribute to increased efficiency
- Safety and security benefits afforded by mechatronic locks

TowerXchange: In relation to controlling access and NOCs, what are some of the operational challenges faced?

Rani Ariss, Vice President Sales EMEA, Acsys: The NOC deals with a complex set of equipment that is scattered around a region and is impossible to control efficiently with mechanical locks. The NOC also deals with a large amount of vendors, who are responsible for site maintenance. It is hard for the NOC to respond efficiently to emergencies as they don't know where the vendors are located and false alarms can cause disorder.

Access to the NOC is impossible to control. Vendors are requested to do maintenance and only do it when they are able to do it, not necessarily when the NOC has requested that they do it. When sites are down it can be difficult to find the vendor, the NOC then needs to call other support to get someone to the site

The NOC is looking for a solution whereby tickets are issued and acted upon as quickly as possible in a first phase. In a second phase the NOC needs to know when the vendor has arrived, what he has done, whether the problem is fixed and when he has left the site. NOC operations need to rely solely on the vendors assertions

TowerXchange: What challenges can poor access control systems have on SLA implementation and adherence?

Rani Ariss, Vice President Sales EMEA, Acsys: MNOs and towercos will have SLAs in place with their vendors to regulate site maintenance. These SLAs have escalation clauses that dictate when a vendor should arrive on location. It is hard for the NOC to see when vendors are going to the sites and if they completed the job correctly making SLAs redundant.

The lack of data prevents an operator from setting operational KPIs to benchmark the performance of the various vendors between each other. The fact that there is no or little data from the performance on the SLA also means that the NOC and operator need to rely on the vendor to obtain performance information which creates a conflict of interest. SLAs fees are being paid when the services that need to be provided aren't being carried out. Vendors invoke the problems of collecting and returning keys as a valid reason for non-compliance with SLAs.

TowerXchange: What are the advantages of implementing mechatronic locks for remote site management?

Rani Ariss, Vice President Sales EMEA, Acsys: Mechatronic locking systems cannot be picked/bumped, hacked, copied or corrupted in any way. Telecom customised software enables the NOC to manually or automatically control where users can go, for how long wirelessly and in real-time with minimal cost.

Mechatronic solutions allow the NOC to control precisely what assets can be opened and when. All keys and locks memorise the last thousand actions giving an incorruptible record of the user's actions, providing the NOC and operator with valuable operational data.

The mechatronic locks combine four important solutions into one system; a wireless and real-time access control system, a high security lock and key solution, a time and attendance solution and a key management solution

TowerXchange: What are some of the basic practical advantages of mechatronic locks?

Rani Ariss, Vice President Sales EMEA, Acsys: The solution is a standard padlock and Euro-Din cylinder configuration meaning that no modifications are required to install them. The padlocks and cylinders can be fitted on all equipment and no maintenance is required. The stainless steel plating prevents corrosion on the padlock body and cylinder and what's more anyone can use the solution.

The operational advantages of using mechatronic locks are instantly visible after deployment and lasting over time, uptime is increased and the solution prevents keys being copied, stolen, lost or unreturned, locks being picked, issues around collecting and returning keys, the requirements for lock and key audits and unauthorised access.

TowerXchange; How do mechatronic locks contribute to increased efficiency?

Rani Ariss, Vice President Sales EMEA, Acsys:

Users can service more sites in one day and a user's position and length on site is controlled and monitored. The NOC can have a real-time view of site status looking at the number of sites, which sites have guards and are they present or not, which site is in need of maintenance and for what reason and which and how many vendors are on the site.

By implementing mobile apps, the NOC is now able to receive real-time site information and user performance, such as when did the user receive the task, accept the task, arrive on and leave the site. This system can also monitor what the user did on the site (watermark GPS pictures) and can also receive information on whether the user closed the locks after leaving the site.

This data has significant value to determine SLA adherence because the tower owner can now see exactly what is happening on their site. Being able to understand who is going where and for how long means that the owner can make smarter business decisions. Data collected by mechatronic locks gives concrete undisputable data on whether the vendor has been meeting the SLAs. Furthermore upon additional analysis of the data, site operators can create and negotiate more suitable SLAs using the information collected.

TowerXchange: How do mechatronic locks increase site and user security and reduce theft?

Rani Ariss, Vice President Sales EMEA, Acsys: With regards to safety and security, as the NOC knows who is on the site and for what reason, in the case a vendor does not request a locking code (because of a fall or injury) the NOC is able to act on that.

In relation to thefts, most thefts are caused by people who had a mechanical key at one stage and copied it. The mechatronic keys can have an embedded feature that monitors where the key is being used, if the user tries to fraudulently use the key three times, the key will automatically block themselves thereby forcing the user to go back to the NOC or programmer to update his key.

TowerXchange: What information can be collected to monitor behavioural patterns and how does this translate into more cost effective operations?

Rani Ariss, Vice President Sales EMEA, Acsys:

The NOC will be able to download the access logs stored on the key through programmers and study what sites or assets were accessed and when, how long the vendor spent on each site, whether the user tried to access sites or assets without authorisation and on which day, time or location.

By collecting data on user performance the

NOC and operator are now able to obtain site maintenance benchmarks which in turn allow them to set KPIs for certain tasks.

In addition, mechatronic locks allow for increased flexibility. When a technician is unavailable, another can be called as a substitute with no wasted time or resources. A temporary access can be instantly granted 'on the fly' for a site normally outside of this technician's work zone.

By collecting data on behavioural patterns, the financial department is also able to control how much time was spent on site by users, thereby gaining a better control over payment of billable hours to vendors.

TowerXchange: How will the data that mechatronic locks provide influence the way in which the telecoms sector works?

Rani Ariss, Vice President Sales EMEA, Acsys:

Using the data that mechatronic locking systems provide effectively will lead to more efficient access policies, enhanced SLA agreements and increased productivity. The data collected does not only benefit the site owner, but is also valuable for tenants and vendors. The data helps build relationships between the ecosystem by aiding their understanding and giving evidence of site activities. The more a database is built and the further it is integrated the more valuable it becomes to its users ■

Ensuring RMS systems work in the field



How Asentria bring extensive expertise in trials to ensure a solution is fit for purpose

TowerXchange: Please can you introduce Asentria and their portfolio of solutions for the telecom sector - what is the company's origins?

Jon Baars, Director of Sales and Marketing, Asentria: Asentria is a thirty year old hardware manufacturer based in Seattle, WA USA. We began by designing and manufacturing hardware devices to integrate to PBX (voice) switches, and deliver alarm and telemetry data. Telecom operators began to use our devices for different purposes than just for PBX. The US military was also an early user. We began to transition to working more specifically with US-based mobile network operators to monitor their remote locations; power, security, and environmental issues at cell sites primarily. We have installations with two US based MNOs with approximately ~10,000 sites apiece currently in operation, and other worldwide networks with hundreds or thousands of sites deployed. Our current customers refer to us as part of "cell site optimisation" efforts. It is far beyond just alarming now.

TowerXchange: What is Asentria's go to market strategy?

Jon Baars, Director of Sales and Marketing, Asentria: We are used in many different telecom networks; rail or highway projects, oil and gas, utilities, and others. Our focus, however, is on MNOs and tower companies. There is a large amount of upfront integration and support necessary in order to get the most sophisticated projects up and running. The primary product we sell is hardware, but there is

Asentria, with over 100,000 sites in operation have become an integral part of their customer's cell site optimisation efforts. Bringing extensive experience from working on fully operating networks, Asentria's application engineers understand what is essential to get a network up and running successfully and cost effectively, with proper trials fundamental to this process. Asentria's Jon Baars examines why RMS projects can often fail and explains where Asentria's successful track record in such projects stems from.

Keywords: Asentria, Monitoring & Management, O&M, Operational Excellence, RMS, Site Level Profitability, Site Surveys, Skilled Workforces, Who's Who



Read this article to learn:

- How Asentria has evolved into more than just a hardware supplier
- The number of sites using Asentria systems in operation worldwide
- The mistakes many companies make in selecting an RMS system
- How trials and selection processes should be designed to minimise the risk of failure
- What differentiates Asentria from its competitors

also a large component of services and integration that go with that hardware to get a project up and running within the operational environment of a large network operator. With larger network operators, the projects really never end, it is more of a partnership. We seek large networks as the large scale enables us to devote significant upfront time to integration, proof-of-concept, and rollout plans. We help people who are motivated to solve a variety of operational issues at those sites optimise their sites. We're broadening the geographic scope of our market seeking these large networks and the people responsible who want to make their networks better.

TowerXchange: The first question our readers usually ask of any vendor in the RMS category is “how proven is your solution in the field”?

Jon Baars, Director of Sales and Marketing, Asentria: We have over 100,000 sites in operation at this moment. The largest deployment we have had was approximately 18,000 sites at its peak for a US based MNO; it was a pretty sophisticated solution. Our hardware device was in a smaller cabinet, and we allowed wireless (EDGE) access to the cabinets, and enabled them to reboot individual -48VDC powered devices within the cabinet. The initial goal was to reduce truck rolls and mean time to repair, but the solution evolved to where we were managing many other things at the site; antenna tilt, managing power usage, and general network troubleshooting. Our current largest ongoing project is for a US based MNO, and it is more focused on issues tower owners would be concerned with; power, security,

“

We have installations with two US based MNOs with approximately ~10,000 sites apiece currently in operation, and other worldwide networks with hundreds or thousands of sites deployed. Our current customers refer to us as part of “cell site optimisation” efforts. It is far beyond just alarming now

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and environmental monitoring and integration to all the various sub-systems at the site. We “flatten” all this data into a usable form so that operational decisions can be taken. We are doing a project for hundreds of sites in the Middle East primarily for security purposes. We have a current project in the EU for what will eventually be thousands of sites that is based primarily on wireless modem access to sites.

TowerXchange: Why do you think it is that RMS projects often fail?

Jon Baars, Director of Sales and Marketing, Asentria: At this point, we have a lot of experience in what is actually being done successfully and cost-effectively.

We expect to do a trial for any large network; go to a site and deploy our solution so we test our assumptions and prove that we work. Sometimes decisions are made regarding an RMS system solely based on paper RFQ document. It is difficult for us to know what exact solution we would propose until we actually go to a few sites. We expect to go to one site, then move on to deploying to a few sites, testing our deployment documents, and then support the process as it moves on to a broader deployment. As previously mentioned, we look at this as an ongoing process.

Trials are a must; it is very difficult for us to come up with realistic pricing until we can agree with the customer what the solution is. Very rarely do

we decide in advance what the solution is, and the scope of the solution doesn't change during the trial phase. If we had our preference, there would be an initial request for information phase, where some broad data could be given by the RMS vendors. A short list of vendors could be created and some small budget could be dedicated to getting the short-listed vendors to come do a trial at a small number of sites. Using this method, I think failures would be much more rare. Everyone could agree in advance of a large rollout what was to be delivered and the RMS vendor could deliver a much more accurate price based on a promised solution.

TowerXchange: Finally, what differentiates Asentria from other RMS providers?

Jon Baars, Director of Sales and Marketing, Asentria: We have a lot of experience doing these systems. We expect every large project to run through a trial phase and we have application engineers whose job is to successfully create these trials. People in this application engineering role have generally worked on many other fully operating networks, and have a very good idea of what the standards are that are necessary to get a network up and running. We are aware of what other network operators are doing successfully and cost-effectively, and we will push to make our trials model the ideas that others are currently making work. We bring a lot of value at the trial phase, just for the opportunity to show what our solutions can do. We have a broad, flexible, and high quality product, and have thirty years of experience successfully implementing these projects ■

See you at our future events!

Meetup Asia 2019

3-4 December, Singapore

Meetup MENA 2020

28-29 January, Dubai

Meetup Europe 2020

19-20 May, Barcelona

Meetup Americas 2020

23-24 June, Boca Raton

Meetup China 2020

September

Meetup Africa 2020

13-14 October, Johannesburg

Tower  Xchange

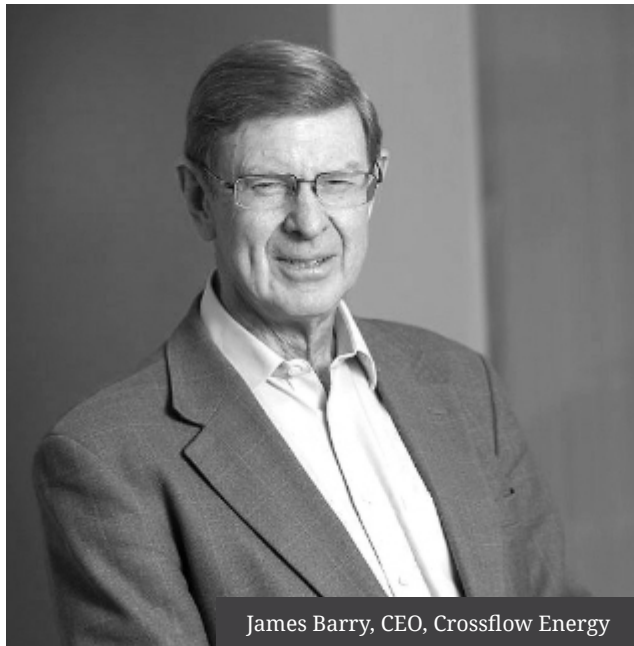
www.towerxchange.com

Cut out the diesel with this hybrid solution



TowerXchange: Please introduce Crossflow Energy – what is the origin of your unique technology and what problem are you solving for the telecoms sector?

Crossflow Energy combine solar, wind, storage and diesel in a tidy package that delivers cost-effective power for cell sites



James Barry, CEO, Crossflow Energy

Crossflow's Integrated Energy Solutions (IES) is a combined wind turbine, solar pv, battery and diesel back up unit which promises significant cost savings for telecoms operators. By allowing for 100% non-diesel powered uptime, Crossflow believe they can reduce your energy costs by 20-30% while reducing the need for site visits. With a prototype going live in the Caribbean and promising results already, Crossflow offer a new solution for the global telecom towers industry from out of South Wales.

Keywords: Batteries, Community Power, Crossflow Energy, ESCOs, Energy, Energy Storage, Hybrid Power, Microgeneration, Off-Grid, Renewables, Solar, Unreliable Grid, Wales, Who's Who, Wind

Read this article to learn:

- What is unique about Crossflow's Integrated Energy Solution
- The advantages of a module design
- The power rating for the combined wind/pv/battery/diesel set
- How Crossflow can reduce emissions and diesel use 100%
- How they deliver 20-30% cost savings

James Barry, CEO, Crossflow Energy: Crossflow IES are specifically designed to deliver clean, reliable energy in remote, off-grid applications. The IES comprises a robust specialised Wind Turbine, and Energy Management System (EMS) to combine multiple energy generation and storage assets to optimise clean power delivery. By incorporating a wind turbine the IES has the capability of delivering 100% clean energy. The Crossflow IES has been successfully commissioned at the Company's test site in South Wales; we are focused on moving towards achieving a rapid roll-out of the technology, with initial market demonstrators agreed with a key Mobile Network Operator (MNO) Anchor Customer in the Caribbean. At present some 1 million MNO towers rely on diesel generation (entirely or significantly) for network reliability; Crossflow IES units can move such remote locations to 100% clean energy with potential for significant cost savings by MNOs.

TowerXchange: The first question our readers will want to know is 'how proven is the solution in the field' – please tell us about the performance of your solution in the field – who is using it and what results have been achieved?

James Barry, CEO, Crossflow Energy: The Crossflow Pre Production Prototype (PPP) IES has been successfully commissioned at the test site in

South Wales and we are currently preparing to install the first commercial trial project at a MNO telecommunications tower site in the Caribbean. The empirical data obtained from the PPP IES bears out the Computational Fluid Dynamics (CFD) predictions for the turbine and we are achieving a power curve and efficiencies in line with expectations; we are also able to monitor and operate the IES unit remotely to ensure correct rotor head alignment in relation to wind direction and the various arms of the IES – wind, solar pv, battery storage and stand-by diesel generation – are integrated ensuring continuous clean energy supply to the designated IES load.

TowerXchange: What’s the sweet spot for your solutions in terms of grid availability and the load your solutions can support? How would it handle a tower with multiple tenants?

James Barry, CEO, Crossflow Energy: The IES unit is designed to be able to deliver firm power on a continuous basis and is particularly suitable for remote, off-grid locations, or those where the grid supply is intermittent and unpredictable. The addition of a robust and reliable wind-turbine to the IES unit helps enable the unit to generate 100% clean energy and greatly increases the time interval between service visits and reduces (or in some cases removes) the requirement for diesel replenishment visits.

The initial PPP IES unit is based on a wind turbine rated at around 7kW, but we have also developed the design for a smaller, self-yawing turbine with

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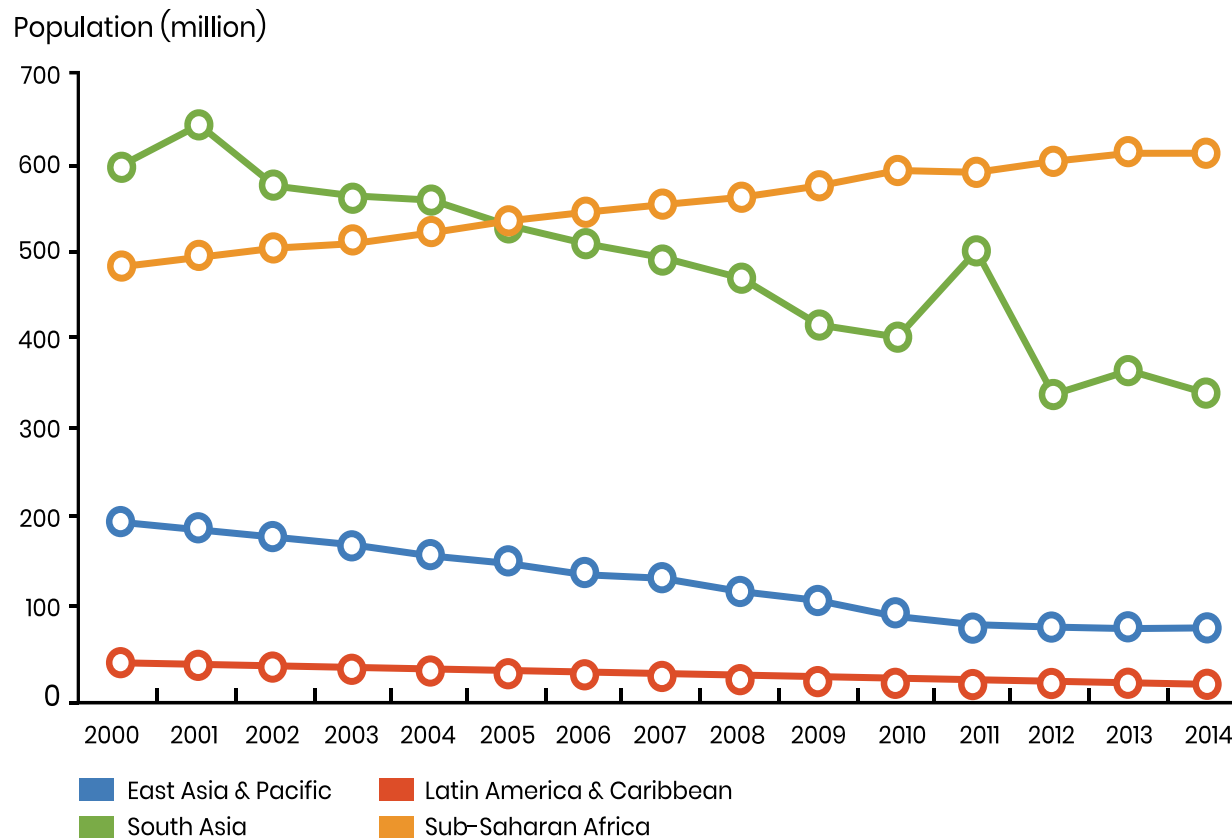


rated power of around 3.5kW. The IES with the larger turbine would typically be sized to deliver continuous firm power at around 4/5kW (depending on wind and solar irradiation) which should be suitable for MNO telecommunication towers, but could also meet the power requirements of a number of other remote power delivery requirements – avoiding the need to install diesel generation and meeting long-term power requirements at reduced cost. The actual power delivery can be adjusted using sophisticated software modelling techniques to optimise the IES

configuration to meet load demand. For remote sites requiring a smaller load the 3,5kW turbine configuration would be considered offering firm power in the 1.5/3kW range. Where wind conditions do not justify installation of a turbine the IES unit can be installed on a solar pv and battery basis.

For towers with multiple tenants there is obviously scope for the installation of two or more wind-turbines and adjusting the size of the solar pv and array and battery storage. We have also done detailed design for a 15kW rated turbine but the

Figure 0.3 Sub-Saharan Africa is not keeping up with population growth for electricity access
(Trends in population lacking access to electricity, 2000-2014)



Source: Data from IEA and World Bank 2017

ability to ground assemble and erect without use of cranes would be more challenging – we believe that remote assembly and erection without the need for heavy lifting gear and cranes is a key advantage of the Crossflow design.

TowerXchange: How many hours of sunshine and what wind resource is necessary for your

renewable energy solution to start to become a viable option? Tell us about the reliability and autonomy of your solution.

James Barry, CEO, Crossflow Energy: We use specific software packages to evaluate the energy profile at each site and the expected components – solar pv, wind and storage. One advantage is

that given the modular nature of the IES unit it is possible to adjust the generation and storage components based on actual performance and load requirements to optimise the unit. It should be stressed that as the intention is to provide ‘energy-as-a-service’ the detailed configuration is an issue for the IES owner not the power user who will be expected to enter into a long term power purchase agreement so will have known and predictable costs which are designed to offer a significant discount relative to the cost of diesel generation to ensure continuous power. The PPP IES has been installed and commissioned and we are in the process of detailed analysis and performance testing at present.

TowerXchange: How does the total cost of ownership of Crossflow Integrated Energy System compare with traditional diesel-oriented energy solutions over an eighteen month, three year and five year scenario?

James Barry, CEO, Crossflow Energy: This is a very site specific question as so much depends on the full cost of diesel generation (including losses, transportation costs, service visits et cetera) but we would expect to be able to offer an ‘energy-as-a-service’ package which ensured continuous clean power (with diesel generation back-up) at a cost which would offer power purchasers a cost saving in the region of 20/30% against current fully costed power requirements on a longer term basis. In addition surplus power would be available to support surrounding communities’ power needs for unit charging, internet access and making the move to greater use of electrical power.

TowerXchange: What is your capacity and appetite to offer energy as a service to reduce up-front capital investments?

James Barry, CEO, Crossflow Energy: The Crossflow business approach is based on either direct sale of the IES unit or energy as a service offering where the Anchor Customer is seeking to reduce front end Capex.

TowerXchange: How scaleable is your solution for rapid roll-out and consistent maintenance in areas with less experience of wind energy?

James Barry, CEO, Crossflow Energy: The Crossflow turbine has been specifically designed as ‘robust, agricultural engineering’ and is intended for rapid roll out at multiple sites with remote monitoring and control capability; fundamental to the design is simplicity and long service intervals. The wind turbine is a combined hybrid lift/drag design so operates at relatively low tip speed ratios and cannot overspeed in high wind conditions – the design allows for ‘energy spillage’ in high wind scenarios to allow for ongoing generation in such conditions and ‘end-on’ parking in severe storms to reduce loading. In the case of very extreme weather (hurricanes etc) it is also possible to lower and protect the turbine and bring it back into operation immediately post the event. The majority of service activity would be carried out using locally trained staff. The long service intervals and the potential for 100% clean energy productions are key elements in terms of developing an offering which is capable of providing firm power at lower costs than



would be the case for diesel generation supported infrastructure.

TowerXchange: Community power and minigrids are often seen as “next steps” for those providing cell site energy solutions, what is your proposition for rural electrification?

James Barry, CEO, Crossflow Energy: This is core to Crossflow’s business focus and the combination of firm power for Anchor Customers and the spin off benefits of mini- grids is the real focus – we see the use of spare power by communities being symbiotic with the roll out of internet and communication services ■

IoT and data analytics to reduce towers opex and improve efficiency



Cyient's innovative monitoring and automation system to reduce cost and human intervention



Ravi Jesupaul, VP and Global Delivery Head, Communications, Cyient

Founded in 1991, Cyient have been providing engineering and operations management services to towercos and telecom clients for more than two decades. Now, the company has successfully designed and implemented an IoT solution that allows towercos to remotely monitor and automate several maintenance processes, which has helped infrastructure providers to reduce cost and improve their operational efficiency. From its brand new Tower Operations Centre (TOC) in India, the company is monitoring their clients' passive infrastructure assets all across the globe.

Keywords: Asia, Asia Insights, Cyient, Energy Efficiency, Health & Safety, Managed Services, Monitoring & Management, Opex Reduction, Passive Equipment

Read this article to learn:

- An overview of Cyient and their 26-year long activities
- What can Cyient's IoT solutions do for towercos and MNOs?
- How does Cyient translate data into operational savings and efficiency?
- Can towercos improve on site safety and reduce human intervention?

TowerXchange: Please introduce Cyient to our readers.

Ravi Jesupaul, VP and Global Delivery Head, Communications, Cyient: As an organisation, Cyient provides engineering, manufacturing, geospatial, network and operations management services to global telecommunications and industrial leaders. We focus on delivering high quality products, services and solutions that can help our clients in leveraging the power of digital technologies as well as opening market opportunities and gaining a competitive advantage against their competitors.

From quieter flights and safer train rides to a more reliable energy supply, we provide comprehensive and complementary solutions to our clients to help them to achieve their operational and business goals. We have been working with different customers across the telecoms value chain since 1991.

TowerXchange: Congratulations on the opening of your IoT-enabled TOC in India! Tell us about the technologies you are using to improve uptime while reducing opex.

Ravi Jesupaul, VP and Global Delivery Head, Communications, Cyient: Thank you very much. This initiative was born to solve some of our clients' main operational challenges while using IoT technologies to improve their operational efficiency.

We have developed a very unique architecture that enables communication between sensors as well as an integrated, cloud-based analytics engine, which extracts and examines tower passive assets data for

actionable insights. This innovation generates an increased tower uptime with 24/7 live monitoring of passive network assets while minimising operational costs.

TowerXchange: How do you translate monitoring data into actionable intelligence? And how does this all connect back to improving the efficiency of field operations?

Ravi Jesupaul, VP and Global Delivery Head, Communications, Cyient: The data sent by the sensors attached to the passive assets of the towers is used to monitor their health through a managed service center, which is providing 24/7 remote surveillance to all sites across the world.

Our tower centre engineers control and monitor the assets data and oversee all operational aspects including power, environmental factors, battery levels and fuel level in generators through the different IoT sensors that are installed in the towers. Then, all that information is transformed into actionable intelligence using the cloud-based analytics engine.

We ensure that the field technician receives the right data at the right time so he can quickly resolve any possible issue. With this system, towercos can move from a reactive to a proactive maintenance model, which ultimately will improve their overall operational efficiency.

TowerXchange: What hardware does your solution stack include? Do you have sensors deployed on sites, or is the data collected from embedded

systems in the cell site equipment and access control systems?

Ravi Jesupaul, VP and Global Delivery Head, Communications, Cyient: The solution includes different simple hardwares such as multiple sensors, our unique EdgeX gateway that we internally developed and a very simple cloud infrastructure system

We cannot collect data from existing embedded systems but we deploy new sensors along with our field engineering team at the cell sites, which acts as the physical touch point by collecting and feeding assets information to the gateway device. Then, the gateway device pushes and presents the data to the software application and finally uploads that information to our cloud platform, where it will be ultimately analysed and transformed into actionable intelligence.

TowerXchange: Under what circumstances can cell site monitoring be fully automated, and at what point does it need human intervention?

Ravi Jesupaul, VP and Global Delivery Head, Communications, Cyient: The assets management monitoring can be fully automated by leveraging the IoT technology. We can remotely monitor and control all the physical assets using live data and there is no need of human intervention. Our customers are now able to reduce the frequency of regular field force inspections such as fuel checks, pilferage, battery health, et cetera.

The monitoring happens in real-time and the alarms can be classified on priority levels to

address different issues based on their urgency or importance. However, we cannot completely eliminate human intervention, which will be required when an incident or event occurs. For instance, if a battery is not functioning, it would need to be replaced by a field force technician. Likewise, when an antenna tilted more than the permitted tolerance, operators can execute corrective actions.

TowerXchange: Our readers will always want to know: who is using your IoT-enabled monitoring solution?

Ravi Jesupaul, VP and Global Delivery Head, Communications, Cyient: We are working in partnership with our existing customers in Europe and Australia in developing this solution. We have successfully executed proof of concepts in the customer's innovation labs, and now, we are executing the field trails.

TowerXchange: How would you differentiate your solution from alternative providers of cell site monitoring and control?

Ravi Jesupaul, VP and Global Delivery Head, Communications, Cyient: We have developed a comprehensive single panel solution that takes into account all the challenges of tower companies. Cyient TOC platform includes consulting, IoT software/hardware development and deployment, field implementation - including installation and commissioning - and the managed services along with the ticketing system to monitor the assets remotely. This is an end-to-end solution and the uniqueness of our approach ■

How to value towers and rooftops



TowerXchange: Please re-introduce Delmec for readers unfamiliar with your company.

The structural, contractual and commercial factors that determine the lease up potential of towers and rooftops



Damien Kelly, Regional Business Manager, Delmec

Whether you are buying or selling towers, or simply trying to better understand how to get the maximum value from retained towers, it is essential to create and maintain an accurate asset register. But the value of a tower extends beyond its wind load capacity – location and the proximity and utilisation of nearby towers are also impactful. TowerXchange spoke to our old friends Delmec to understand how they audit towers.

Keywords: Asset Register, Capacity Enhancements, Construction, Decommissioning, Delmec, Due Diligence, How to, Interview, Masts & Towers, Multi-Region, Site Surveys, Strategic Consultancy, Valuation

Damien Kelly, Regional Business Manager, Delmec: Delmec has been a primary component in the telecommunication industry, not only within the infrastructure area but also providing advanced telecom solutions for Africa, Europe, Asia, America and the Middle East for over 30 years.

With our headquarters based in Ireland, Delmec provide portfolio management, telecom infrastructure consultancy and full infrastructure builds. Our expertise has led us to become a renowned provider of engineering services to the telecom and utility sectors, specialising in full turnkey solutions from design concept to live on air. Our reputation can be witnessed in over 40 countries where key services have been provided to a wide range of clients whom many have continually sought the expert knowledge of Delmec for their telecom's needs. In Delmec we strive to support our customers to optimise value from their tower assets by demonstrating where we can help them increase revenue, reduce costs and/or build business sustainability through our portfolio of services

TowerXchange: What are the principle drivers of value in telecommunication towers?

Damien Kelly, Regional Business Manager, Delmec: There are a number of key elements that add value to a portfolio. Obviously, the overall aim is to accommodate more operators onto the structure,

Read this article to learn:

- What are the principle drivers of value in telecommunication towers?
- How to create and maintain an accurate telecom infrastructure asset register
- What factors determine the structural capacity, and lease up potential, of telecom towers and rooftop poles?
- When towers are being sold, how are they audited?
- The relative merits of tower climbs versus drones and 3D scanning technology

although we feel that accurate data on the structure is paramount to not only its value, but also its lifespan. Similar to buying property, or a car, having detailed data on the tower can vastly increase its value. To begin with, data on the tower from a structural view can determine the additional spend required to accommodate additional equipment. In order to establish this element, we work with our clients to determine the current position of their structures and future revenue potential. We can provide our clients with a capex position should space be leased on their structure. By carrying out this work, our client has every opportunity to maximise their potential revenue from that structure.

Aside from the tower, the infrastructure on the compound is a vital element to the value of the site. Free space in both the compound and the shelter needs to be taken into account to support additional tenants on the site. For example, space on a compound for data centres could be considered which can increase the sites revenue potential. Items such as the equipment in the shelter and power equipment will provide a lot of detail for potential buyers on how efficient the site is and how much it will cost to run. During our due diligence assessments, we record a lot of detail on these items, our clients want to know the condition of these, the availability for more tenants to be added and the efficiency of the equipment.

Security is another component on the site that needs to be addressed. This is a major factor for rooftop sites, providing details on how easy the site is to

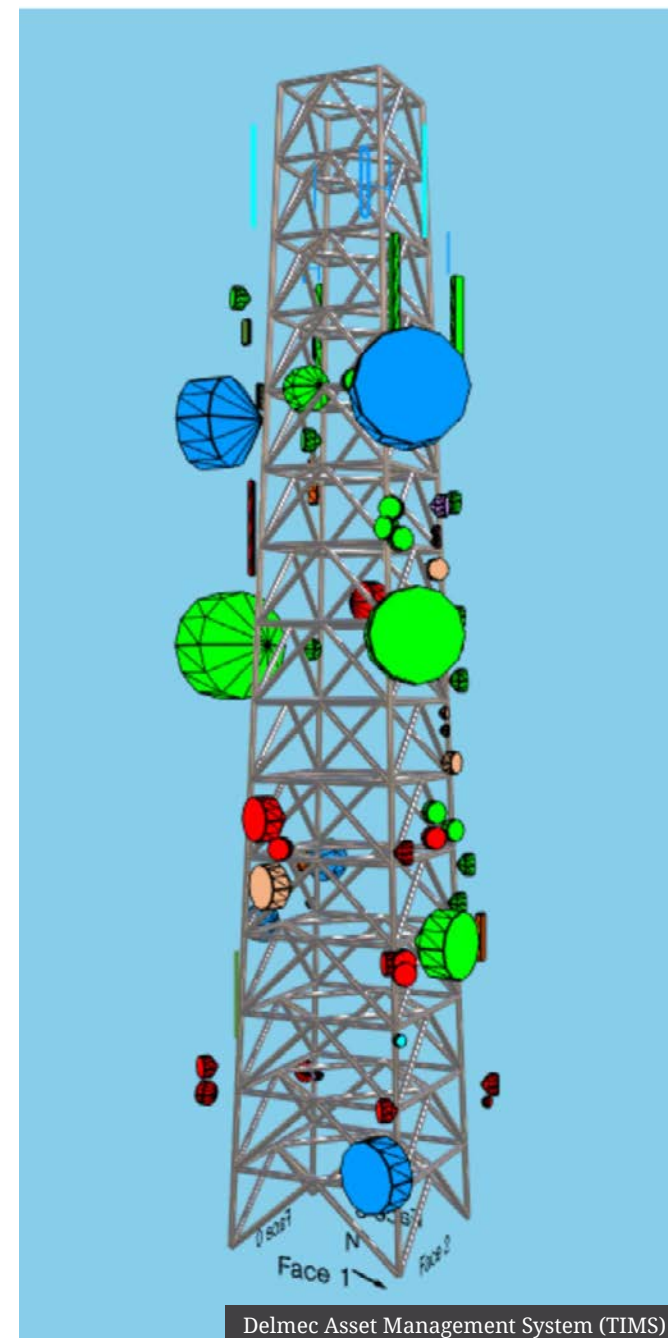
access by the public. Again, during our assessment, we go into detail around security and provide our clients with a view on the level of security with a site from both site entrance and shelter entrance. It's widely known that fuel theft is an issue for a lot of tower owners, therefore the more secure this element is alone, can greatly impact the value of a site.

Another element we look at is competing towers in the area. The items above demonstrate the value of a site, however the surrounding or competing sites needs to be considered. We look at details of the towers in the surrounding area, providing as much details as possible factoring this element with its revenue potential. So in essence, critical factors for the tower, compound and equipment all need to be taken into account while valuing the site as a whole.

TowerXchange: How would you describe the accuracy of typical telecom tower asset registers? And how do you both improve and, crucially, maintain the accuracy of asset registers?

Damien Kelly, Regional Business Manager, Delmec: From what we've seen, typical asset registers lack the functions that are essential to the people who need them.

The key to a good asset management tool is to capture the data that is beneficial to the portfolio, as with all data registers, the information contained in it needs to be maintained. When we are asked to review data on a portfolio, we typically see



Delmec Asset Management System (TIMS)

very limited data on the structure itself. Having a portfolio of thousands of structures with detailed information on each one is instrumental to a tower owner.

Our asset management tool TiMS [Telecommunication Infrastructure Management System] was developed with our customers in mind and is constantly being upgraded to enhance functionality. Like any database, the information that is entered into the system needs to be vetted. A database is only as powerful as the information contained in it, therefore we focus on ensuring our clients have accurate data. In Delmec, all our field staff are kept up to date with our TiMS database, this ensures all critical details of a client's portfolio are accurate. This data can be used to make key business decisions and any inaccuracies can be detrimental. Asset registers should not only capture current data but also store historic data that would be beneficial to potential operators and capture due diligence procedures for future revenue sites.

TowerXchange: What factors determine the structural capacity of telecom towers and rooftop poles?

Damien Kelly, Regional Business Manager, Delmec: The structural capacity of any structure has certain key factors that determine its suitability to accommodate additional tenants.

Location plays a key role in its capacity. Initially, a structure is designed using certain loading parameters which can differ depending on the

application for the structure. For example, when a structure is being designed with a specific environment in mind, possibly a high wind speed region, in an exposed environment located on a hill or mountain, this can lead to an extremely high wind loading. The high loading reduces the structural capacity of the structure, increasing the failure potential. For these applications, a specific type of structure needs to be used which is usually much stronger, in turn increases the cost of the structure. Alternatively, if these factors were changed to a lower wind speed, flat ground with reduced exposure, the structure would not need to withstand such high loading meaning that a stronger or more expensive structure isn't required. Location plays a major role in determining the capacity of a structure, and it affects both telecom towers and rooftop sites.

Another factor to consider is the equipment on the structure. Naturally, the more equipment on a structure, the greater the loading. However, it can be confused with equipment weight, rather than physical size. The actual area of the equipment plays a crucial part in the capacity of a structure, an increased panel area will apply a bigger load to the structure, reducing the capacity. Placement of equipment on a structure is vital to maintaining its capacity, among other elements. For our clients, we aim to maximise their revenue potential by providing consultation in this area by understanding the mechanics behind it.

Lastly, the makeup of the structure itself. There are many different variations of structures, from

panel configuration to the type and size of members used. These variations have a major impact on the suitability of the structure, even variations in future upgrading costs of the structure. Within our Design Department, we always try to offer our clients a very economical solution when upgrading their towers.

On the subject of strengthening towers, there are clever solutions that can be developed to reduce both the material and labour costs of an upgrade. Rooftop sites/poles can bring their own set of complications when assessing structural capacity. The aforementioned considerations will all be key factors when determining capacity, however due to the nature of a rooftop pole, one must consider the how the pole is connected to the rooftop itself. Again, we try to develop clever solutions to allow our clients to keep costs down while maximising their revenue potential.

TowerXchange: What commercial and contractual factors affect the lease up potential of a given cell site?

Damien Kelly, Regional Business Manager, Delmec: Reverting back to the some of the points in the previous question, there are lot of factors from the tower/equipment, and even the locality of the site. Focusing on the tower, elements such as cost to accommodate the additional equipment can be a major factor. The payback of strengthening a tower to accommodate another tenant may be excessive which will increase the fee for hosting on a tower. Aside from the tower, the compound

may also need to be prepared to accommodate more tenants. In cases where the tenants cannot be accommodated without extending the physical size of the compound, both commercial and landlord contractual factors come into play.

Looking at the technology on the site can bring another set of factors. With the upcoming onboarding of new 5G technologies, tower owners need to be aware that this will not totally eradicate the previous technologies immediately. Tower owners will need to cater for both new and old technologies and, depending on the environment, this could mean that a tower can have multiple technologies all at once. Among the impacts on tower, power and compound itself, the commercial and contractual factors will be heavily affected.

Tower owners need to review their competing towers also, they need to know what is currently on those towers, and also what are the future potential co-locations for that site. How likely is the population to grow in future years and what may be required in terms of technology and estimated users if it does grow? With the influx of new technologies coming onboard, long term leases need to take these instances into account in order to both maximise their revenue and protect their business.

TowerXchange: What impact do EMF regulations have on tower lease-up potential and valuations?

Damien Kelly, Regional Business Manager, Delmec: We've seen a lot of cases where the element of EMF and safety around EMF regulations may not have

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With the upcoming onboarding of new 5G technologies, tower owners need to be aware that this will not totally eradicate the previous technologies immediately

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been a subject of thought for additional tenants or in the initial site acquisition. More so within rooftop sites, EMF levels can play a major part in accommodating more tenants or incorporating newer technologies. For current technologies, the EMF levels need to be addressed when considering more equipment on a site or for general maintenance on a site. I.e. whether they are to a level that requires the site to be turned down or switched off completely while workers are on the site. Obviously, these instances will have an effect on the value that the operators are willing to pay for

the site. Furthermore, for upcoming technologies, the long-term view on what effect the next gen technology will have on EMF levels needs to be addressed. The value of some urban sites may be dramatically reduced if they cannot accommodate a technology or frequency. Again, with the current influx of new and old technologies coming onto sites, any potential acquisitions need to review this aspect in great detail.

TowerXchange: When towers are being sold, how much opportunity is there to audit structures in the portfolio?

Damien Kelly, Regional Business Manager, Delmec: For a lot of new site acquisitions, the idea of having the time available to audit each site in detail, i.e. a full tower climb assessment, is not something realistic. The majority of site acquisitions would consist of a ground based due diligence check. This would provide enough detail on the overall site to potential buyers, albeit a small percentage of sites. Ideally having a full suite of audit documentation, design documentation and historic records of each site is very much recommended by us, in most cases this is not available. A lot of new site acquisitions depends on ground based technical assessment (potentially with a small number of tower climbs) and a lot of statistical assessments to give the best valuation possible.

TowerXchange: What proportion of sites can you typically audit, what does that audit consist of, and how long does it take?

Damien Kelly, Regional Business Manager, Delmec: We can carry out audits/inspections with various scopes. For the acquisition of a new portfolio, we tend to carry out either a due diligence audit or a full structural audit. With the full structural audit, you would typically take details of the full structure down to a bolt grade. This will allow our clients to assess the actual capacity of their structure, however for larger acquisitions, we typically carry out a percentage check.

When we're approached to carry out some due diligence work, we will review what information we are provided. This is usually very limited and will consist of tower location, height and possibly type. We will carry out physical site visits on possibly 5-10% of the portfolio at specifically selected sites. We create our selection on the best sites that will provide us with the best view of the greater portfolio. If we're carrying out a structural audit, this may take 1-2 days depending on location, or if we're carrying out a ground based due diligence survey, this may be half a day in some cases.

Our due diligence surveys can be very detailed, recording the structure, power, and site maintenance details, also competing towers, site security and the potential for additional tenants. We will then use this detail to provide our clients with an overall view of the potential portfolio. This due diligence report allows our clients to then compare the collated data with that of the MNO's for data validation.

TowerXchange: Does a site audit have to involve a tower climb, or can the process be expedited using drone technology?

Damien Kelly, Regional Business Manager, Delmec: It's really dependant on the level of information that's required from the assessment. A full structural audit will contain the full geometry of the structure, the equipment [tower and ground] and the compound details also. We would always recommend this to assess the towers structural capacity, although depending on what is required, there are other visits which aren't as detailed.

We are currently reviewing certain drone technology solutions on the market, many of which can give you a lot of detail on the site. There are a number of limitations we have found by using drones. For one, correctly assessing the member and bolt details is still a limitation we feel. Some drone technologies have creative ways of assessing this, however due to their precise nature, they would need to be exact to the millimetre. In addition to this, items such as torque checking, grade testing and not to mention the legal limitations in certain countries can hamper the advancements made in this area. Currently we are researching heavily in drone technology but also in 3D scanning technology which has seen major advances in recent years. Drones can certainly benefit site visits and provide a lot of detail on the site, although we have not seen it match the accuracy of a full structural climb down carried out by an experienced team.

TowerXchange: We've seen a few tower portfolios coming to market as a result of MNO bankruptcies. Does a tower with no tenants have any value? Indeed, does it have negative value?

Damien Kelly, Regional Business Manager, Delmec: As the idea of a tower is to generate revenue by selling space, having a structure that has no tenants, in theory will not generate revenue. That said, if the tower is not consuming any power, then the opex is significantly reduced. The asset itself has a value for the owners, although landlord fees and other costs are still present on their balance sheets. To say that a tower without any tenants has no value is technically not accurate. The value to the MNO may not be in the current forecast but may be valuable in later financial periods. We also have to consider non-GSM tenants, where space on the tower could be leased to backhaul providers, which in turn creates value.

Another aspect to consider is why is the tower empty? There are many potential factors such as the cost of accommodating a tenant (rectification, maintenance, etc) or the cost to decommission the tower may be extensive, whereas the tower owner may leave the tower idle until such a time where a decision needs to be made on the asset. The long-term outlook for the tower needs to consider new technologies, population growth and other potential uses for the tower in different locations. MNOs need to expand their knowledge on the use of the structure itself. We have seen some of our clients dismantle certain towers and then splitting them to use on other smaller sites such as rooftops or in locations where the wind loading may be less severe resulting in an increased structural capacity ■

Backing up Asian towers: EnerSys®' sophisticated battery solutions



Supporting the rapidly evolving tower industry with bespoke backup solutions

TowerXchange: Please introduce EnerSys®, your footprint and your offering to the Asian market.

Dave Cowgill - Senior Director Marketing, Engineering & Quality, Asia, EnerSys®: We are the global leader in stored energy solutions for industrial applications. We manufacture and distribute reserve power and motive power batteries, battery chargers, power equipment, battery accessories and outdoor equipment enclosure solutions to customers worldwide.

EnerSys® offers an extensive portfolio of premium flooded and sealed batteries to serve the telecom industry. This portfolio of batteries offers design features such as exceptional performance, long life, compact footprint, high energy density, and ease of installation. Our batteries are ideally suited for a wide range of wireline and wireless telecom applications, including central office and outside plant. We also offer outdoor equipment enclosure solutions.

In Asia, EnerSys® has a comprehensive infrastructure with a company presence in seven countries and 18 local offices for sales, applications and logistic support.

TowerXchange: How does your experience in Asia differ from the other markets you operate in?

Dave Cowgill - Senior Director Marketing, Engineering & Quality, Asia, EnerSys®: The European and North American markets are very

With operating costs becoming a key issue for tower owners, choosing the right backup power solution is an increasingly important task. With variables in location, climate, budget, maintenance and deployment, choosing the right battery and cooling options to keep the total cost of ownership (TCO) to a minimum can be tricky. EnerSys® talk us through their experiences in the Asian market and how they work with customers to choose the most efficient solutions to meet their requirements.



Keywords: 5G, Asia, Batteries, DG, DG Runtime, EnerSys®, Energy, Energy Efficiency, Fuel Cell, Hybrid Power, Interview, Meetup Preview, Off-Grid, On-grid, Operational Excellence, Opex Reduction, Renewables, SLA, Solar, Unreliable Grid, Uptime, Who's Who, Wind

Read this article to learn:

- EnerSys®' offerings for global and Asian tower owners
- How the Asian backup power market differs from the rest of the world
- Backup power considerations for on-grid, unreliable grid and off-grid
- Case study demonstrating TCO savings up to 55%

established and have relatively reliable power. In Asia, of course it is very different and we see a wide variation in the operating conditions and power reliability across the region. This in turn means we have to develop customised solutions that are uniquely suited to the conditions and requirements of particular customers and geographies.

TowerXchange: What are the considerations that tower owners need to keep in mind when choosing a backup solution in on-grid, unreliable grid or off-grid environments?

Dave Cowgill - Senior Director Marketing, Engineering & Quality, Asia, EnerSys®: Each of the scenarios listed presents their own unique challenges to the backup power system as well as opportunities for cost savings and minimising TCO.

For on-grid systems, the main consideration is typically how to maximise battery life whilst also minimising the power usage on the tower. For this we would typically propose reducing or completing disabling the cooling system and using a backup battery specifically designed for operations at high temperatures. The new EnerSys® SBS XL is ideally suited for this and using our TPPL technology has a life expectancy of ten years at a temperature of 35°C.

On the other hand, off-grid systems have been successfully powered for some time now by a hybrid mix of batteries, diesel generators and increasingly some kind of renewable energy source (solar, wind et cetera). This kind of system brings unique

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Off-grid systems have been successfully powered for some time now by a hybrid mix of batteries, diesel generators and increasingly some kind of renewable energy source (solar, wind et cetera). This kind of system brings unique challenges to the battery system and our research has shown that the lowest operating costs can only be achieved by using the full capacity of the batteries on a daily basis to minimise diesel genset runtime

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challenges to the battery system and our research has shown that the lowest operating costs can only be achieved by using the full capacity of the batteries on a daily basis to minimise diesel genset runtime. This means the batteries need to have the capability to cycle deeply and recharged quickly – something that our tried and tested SBS EON range has been specifically designed for.

Finally, in unreliable grid environments towers are typically supported by a combination of batteries and diesel gensets. The random reliability of the main system means batteries have little time to recharge from the power grid and that generators need to run every day to either support the tower once the batteries are discharged and/or recharge the batteries themselves.

The key challenge here is therefore how to minimise the runtime of the diesel gensets that are one of the biggest contributors to the tower operating costs – typically far more than the cost of batteries. For this kind of application our new SBS XC range is ideal as it combines an outstanding fast charge capability with the ability to achieve an exceptional number of cycles; the modelling work we have done shows it can give tower owners TCO savings in the range of 30 to 50%.

The most effective TCO savings will depend very much on the site operating conditions and power reliability. However, choosing a battery that is designed for the site conditions can definitely deliver TCO savings to tower owners. The highest savings typically come from reducing the cooling

load on the tower or from reducing or even eliminating the runtime on costly diesel generators – and the key enabler to this can be choosing the optimum battery solution.

TowerXchange: Can you share a case study illustrating how you helped your clients achieve desired outcomes?

Dave Cowgill - Senior Director Marketing, Engineering & Quality, Asia, EnerSys®: Our most recent work has been looking at potential TCO savings for a tower owner in an extremely unreliable grid environment. In this instance, each tower is usually equipped with at least 600Ah of battery back-up, but even that is not enough to cover for the many power outages in an average 24-hour period.

Typically, the batteries are completely discharged within eight to ten hours a day, meaning the diesel generator needs to be run for the remaining 14 to 16 hours of every day. This is obviously bad from an environmental perspective, noisy for the community nearby and of course it involves significant costs related to the fuel, maintenance and service of the genset.

After assessing the application, we realised that the perfect solution would be a battery that has both an outstanding fast charge capability and excellent cycling. We already knew that our TPPL technology had the potential for industry leading charge acceptance, so we decided to optimise its design even further.

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The highest savings typically come from reducing the cooling load on the tower or from reducing or even eliminating the runtime on costly diesel generators – and the key enabler to this can be choosing the optimum battery solution

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Our target was to design a product able to maximise its recharge while the power is on, enabling the battery to be ready for the next outage. If enough recharge current is available, it's even possible to design a system that relies totally on battery backup on a standard day. The result of this work is our brand new SBS XC range that we have just launched.

Based on the load details that were provided to us by the tower owner, we estimate that TCO savings of up to 55% can be achieved compared to traditional lead acid batteries.

TowerXchange: Looking forward, what do you think will be the power priorities for Asian tower owners as 5G and network densification requirements increase?

Dave Cowgill - Senior Director Marketing, Engineering & Quality, Asia, EnerSys®: The 5G standards are still not agreed, but the evolving

infrastructure needs seem to be trending towards a larger number of smaller, but more dense tower sites. We expect this to drive demand for new, innovative power solutions.

TowerXchange: Can you give us some insight into EnerSys®' vision for the future and how you will fit into this evolving market?

Dave Cowgill - Senior Director Marketing, Engineering & Quality, Asia, EnerSys®: We believe experience in providing power backup in mobile communications is very important. The mobile network has a critical dependence on available power and backup regardless of the reliability of the local grid. EnerSys® is a powerful solution provider and a trusted partner in backup power solutions. Hence we are in a unique position to use our experience and unique technology solutions to help and continually support tower companies to backup their mission critical equipment in the most cost-effective way ■

Enough is enough: why you shouldn't put up with poor rectifiers any more



Why do rectifiers perform so poorly in developing markets?

You wouldn't keep a car which kept breaking down, so why do so many tower owners battle on with sub-par rectifiers?



In an industry where towercos are spending as much as 60% of their opex on fuel consumption, capex-heavy investments such as deploying solar power or switching from lead acid to lithium batteries can help them to make gains and improve margins as they decrease their reliance on an unpredictable fuel supply chain. However, as much as towercos might spend on their power systems, they have still had to put up with unreliable rectifiers which have struggled to cope with the dust, heat and humidity at many locations. According to Mattias Karlsson, Vice President eSite at Flexenclosure, as many as 20% of rectifiers can fail each year in off grid and poor grid locations across Africa, Asia and the Middle East, adding costs through downtime, replacements and man hours across the maintenance cycle.

Towercos, particularly those in emerging markets, are under two competing pressures: the need to offer a reliable service to their tenants – to meet SLAs and to create resilient and robust networks – and the downward pressure on pricing driven by huge leaps in data consumption with static or declining ARPUs. This pressure to deliver uninterrupted uptime while at the same time needing to drive down opex, is forcing towercos to re-evaluate their operations and maximise performance.

The environment at sites in much of Africa and parts of Asia and Latin America is tough: they are typically hot and dusty, often with high humidity. To make matters more difficult still, the electrical environment – both from poor grid supply and from diesel generators – is very inconsistent, with ageing gensets often producing damaging voltage spikes.

Keywords: Africa & ME, Batteries, Burkina Faso, Capex, DG Runtime, ESCOs, Energy, Energy Storage, Flexenclosure, Fuel Security, Lithium-ion, Off-Grid, Opex Reduction, RMS, ROI, Rectifiers, Renewables, Risk, Skilled Workforces, Solar, Unreliable Grid, Uptime

Read this article to learn:

- Why rectifiers aren't performing in developing markets
- How the industry has been coping with poor rectifier performance to date
- What solutions can make a difference
- How a sealed system can deliver results for off grid and poor grid sites

To date, most of the rectifiers in the market have been designed for indoor, on-grid use in developed markets like Europe or the USA and have been designed under the assumption that they would be working with a high quality and consistent power supply – something which simply doesn't exist in most developing nations. They're also often being repaired or maintained by field teams who lack the appropriate specialist training. If towercos can't rely on rectifiers to get uninterrupted DC power it has an immediate effect on uptime, meaning their bottom line is hit by both the cost of replacement

or repair and penalties imposed by their tenants as part of their SLAs. Even if a failure doesn't lead to downtime, it will result in higher operational costs as batteries and generators won't be performing optimally, creating a lot of pain for the site owner.

Mattias Karlsson thinks the problem comes from how telecoms infrastructure has evolved. 'Telecoms first rolled out in Europe and the US in nice and reliable on-grid areas, and that's what the technology was developed for. When wireless communications rolled out in less developed countries, the suppliers in those markets tried to create the illusion of a safe indoor setting by putting low cost indoor rectifiers inside a cabinet. The fact is though that even protected by a cabinet, these rectifiers simply aren't robust enough for the more extreme operating environments that their cabinets were put in. But with no alternative available, towercos had no option but to accept the situation and try to push away the pain of dealing with rectifier failures to their suppliers.'

Why hasn't a solution been found before?

Rectifiers are delicate bits of kit in terms of power generation, more prone to falling foul of the local climate than batteries or gensets. With cabinetry offering limited protection, the scope of solutions to address the problem was also limited so nothing much changed.

In addition, the problem was perpetuated by the way that RFPs and many procurement functions were set up. With no accepted alternative in place,



RFPs based around traditional power systems requested the same elements and configurations that had always been used and didn't leave much room for innovation in terms of the whole power system. And introducing something completely new would take time to find acceptance in slow moving supply chains.

The result was that towercos had no alternative but to accept poor rectifier performance as the status quo. With the available solutions having been created for other environments, expectations were low in terms of how fit for purpose they could be. However, Flexenclosure has been working to change this. 'No one really looked at sub-Saharan



conditions – and then encased the electronics in a totally sealed box, thus creating a true outdoor product which will never be exposed to dust or humidity and is completely tamper-proof. Their eSite x10 site power solution is designed to address fluctuations in voltage, varying environmental conditions on site and is purpose built for the market.

‘People have tested so many brands and types of rectifier and they all fail in the same way, so why should they trust us?’ challenges Karlsson. ‘They need to see how radically different our solution is. If we think back to the days of rotary dial telephones, if someone had come along then and said ‘you don’t need that any more, here’s an iPhone’ we would never have believed it. But that’s what we’re doing with our eSite x10 as it’s so fundamentally different to how site power has been done in the past. We’ve completely overcome the technology issues. The challenge now is to help towercos in developing nations understand that they really don’t have to put up with second-best anymore.’

Where is it working?

‘In the three years since we launched eSite x10 and started to deploy it across Africa, the Middle East and Asia, we’ve had zero failed rectifiers. It is deployed in around 20 countries now and we’ve had no failures in that entire time,’ stated Karlsson.

Operationally, around 20% of rectifiers in off-grid and poor grid locations are replaced every year, so

Africa with a view to designing and building solutions specifically for that market,’ says Karlsson. ‘So that’s exactly what we’ve done. We solved a problem that towercos in developing nations face every day, with a solution specifically designed for them and the very difficult environments in which they operate.’

What’s the solution?

Thanks to Flexenclosure’s extensive experience working in off-grid and poor grid areas, there is now a much better solution for this. They redesigned every component from the ground up – specifically to withstand the harshest possible

Flexenclosure's initial findings support their belief that the eSite x10 solution could completely change the game in terms of rectifier performance.

But that's not all – when Flexenclosure works with a towerco, their eSite x10 systems connect to a server and their built-in eSite Tools RMS collects data which can support customers in optimising their power performance at a site level. Flexenclosure has found ESCOs in particular have understood the benefits of the eSite Tools offering as they seek to further optimise their operational spend.

'We worked with an ESCO in Burkina Faso, across different sites with batteries or solar depending on grid availability, and then used our eSite Tools RMS data to optimise the settings not for the network as a whole but for each and every individual site. This ability to monitor and fine-tune performance at a site level will make a big difference, not just to fuel consumption or maximising battery life, but to an ESCO's overall profitability,' added Karlsson.

Site data: an added benefit

While the eSite x10 is maintenance free, with no filters or fans to maintain, it can also drive down maintenance needs for the rest of the site by improving operational performance. One major benefit of such a robust rectifier is that it can significantly improve the efficiency of a site. 'In a standard system, the rectifier can only harvest power from the grid when the supply is good, whereas eSite x10 can safely and effectively harvest any available power regardless of how bad the grid

is. This can mean that at some sites a genset isn't needed at all,' says Karlsson.

Flexenclosure has patented its own inbuilt ATS, which protects the system and makes intelligent decisions about when to switch between grid and genset power. It can also log all grid parameters so it's possible to track exactly how the grid is behaving. This is a powerful tool for towercos or operators when they're negotiating with their grid power supplier, as they can show what they're actually receiving versus what they are paying for.

'Customers want reliable site data,' says Karlsson. 'We can show in real time how the grid is performing and the data we collect can help site owners make important decisions for investment in battery capacity. eSite Tools not only measures ROI on our x10 system, but on the peripheral equipment they already have, meaning we can offer solid data analysis which will help overall site planning decisions. We see towercos asking for this kind of information, and the transformative power of our optimised data and reports where it's implemented.'

As with all cutting-edge technology, Flexenclosure anticipates it will take some time for this solution to change the mindsets of towercos and operators who have been working in the same way over the last two decades. But with the evidence speaking for itself, there's no doubt that the eSite x10 will change the game in terms of improving the reliability and efficiency of tower power across off-grid and poor grid locations worldwide ■



Meetup Asia 2019

3-4 December, Singapore

Meetup MENA 2020

28-29 January, Dubai

Meetup Europe 2020

19-20 May, Barcelona

Meetup Americas 2020

23-24 June, Boca Raton

Meetup China 2020

September

Meetup Africa 2020

13-14 October, Johannesburg

www.towerxchange.com

GRIDSERVE steps up innovation with enhanced modular hybrid energy solution



The new SEC12 will be even more secure, reliable and flexible

TowerXchange: Please re-introduce yourself and GRIDSERVE to the TowerXchange community.

Richard Hallas, General Manager – Telecoms, GRIDSERVE: With all the growth and exciting developments that have taken place over the last year with GRIDSERVE, a re-introduction is well warranted! Group progress continues at breath taking pace with major industry-defining achievements being posted across all three of our product solution verticals.

GRIDSERVE made headlines earlier this year by being the first company to crack genuine subsidy-free solar projects at scale in the UK. The technical and commercial landmark innovations that have led to this pioneering position have been further fortified by the fact GRIDSERVE will end the year as the market leader for installed hybrid solar in the UK, the first one in my home town, with over 60mWp of the most advanced bifacial hybrid solar farms being developed, constructed, and in commercial operation.

This sector benchmarking was made further compelling by the announcements of GRIDSERVE's Electric Forecourts programme. With the first site of 100 further sites announced and now going into construction in Braintree, Essex, these flagship projects are set to revolutionise renewably powered electric vehicle charging infrastructure. The UK government rubber stamped GRIDSERVE's bleeding edge innovation efforts with a £5mn grant through its Innovate programme, and we remain really excited about commissioning Braintree for public use in April 2020.

GRIDSERVE turned a lot of heads when they brought the SEC12, their elegant turnkey plug and play solar hybrid energy solution, to TowerXchange last year. Attendees were impressed, but also gave GRIDSERVE a wealth of feedback to further enhance their offering. General Manager of Telecom Richard Hallas and his team will be demonstrating a new iteration of their SolarEnergyCentre at TowerXchange Meetups in Africa, Asia and MENA in the coming months. We spoke to Richard to find out what's new.

Keywords: Africa, Asia, Batteries, Dimensioning, Edge, Energy, Energy Efficiency, Energy Storage, ESCOs, Fuel Security, GRIDSERVE, Hybrid Power, Installation, MENA, Renewables, Solar, Vendor Directory



Richard Hallas, General Manager – Telecoms, GRIDSERVE

Read this article to learn:

- How GRIDSERVE's flexible, modular approach enables their system to be sized and specified to the site location
- The specific steps GRIDSERVE has taken to improve security
- How GRIDSERVE has made it easier to ship and install their systems
- How GRIDSERVE stand ready to enable innovations such as co-locating EV charging stations or edge data centres with cell sites

Our Telecom and Remote power division has come to the party in a big way when it comes to the ambitious development pace that grips the company and its commitment to critical power improvements. This year's TowerXchange shows will introduce an entirely new and enhanced version of the SEC12 that was so successfully toured with TowerXchange last year. We have supercharged the systems DNA with upgrades to just about every feature and are confident the market is going to be really impressed with how we have listened and responded in such timescales.

And as for me, I'm coming up on my first year with the group and what a year it's been – I was brought on to take a lead on all activities related to telecom and remote power for GRIDSERVE and I'm over the moon at the progress we have been able to chart as a team. GRIDSERVE is a fast paced and dynamic environment, but I've been given the autonomy needed to really catalyse our development processes and this combined with my personal experiences over decades within the industry and that of my colleagues has all contributed to the strong pedigree of delivery that we have been able to achieve. If this is where we managed to navigate thus far, it makes for a thrilling next passage for this division of the company.

TowerXchange: GRIDSERVE made a huge impact when you brought the SolarEnergyCentre (SEC12) to the TowerXchange Meetups in Africa and Asia last year, and MENA earlier this year – how did attendees respond to the product and your proposition?



Richard Hallas, General Manager – Telecoms, GRIDSERVE: GRIDSERVE generated massive support for the SEC12 during and post the Africa, Asia and MENA TowerXchange events. We enjoyed some really first-class interactions with key stakeholders in the market and this invaluable discourse quickly became the foundation for our ongoing development and solution optimisation programme.

Security, reliability and flexibility have been the top three driving points we took from the previous TowerXchange events, and we have now incorporated major design advances into our next generation product. I am really looking forward to exhibiting the new version solution because we really have addressed these three key areas without

compromise. The results from our commercial, technical and logistical innovation will really move the needle. We are also very excited to unveil the latest iteration of the SEC12 in a new and innovative way to show how at GRIDSERVE we think very differently from other suppliers and draw on the powerhouse we have as a company for invention and design.

TowerXchange: GRIDSERVE is renowned for listening to your clients: what kind of feedback did the MNOs and towercos who saw the SEC12 at TowerXchange give you?

Richard Hallas, General Manager – Telecoms, GRIDSERVE: GRIDSERVE continues to address

attendees' requirements and many of the enhancements within the new SEC12 model are as a direct result of clients' requests for specific features and capabilities.

Speaking more to the aforementioned focus being on security, reliability and flexibility; with security we have seen and heard first-hand the issues of battery and diesel theft, along with solar panel security, and made significant changes to further address these.

Reliability has been taken on from all angles to make sure we are using matched and compatible products and taking advantage of the features and functionality of each piece to ensure longevity and maintainability to a level where an annual routine check of the system is all that is needed.

One of the biggest concerns we hear is around the sizing of a unit for a site location. Many systems out there have fixed sizes that result in a site having to be matched to a system, rather than a system being match to the site requirements and conditions. With the flexible and modular approach that we have spearheaded it is possible to select the power core, solar module, and battery size depending upon the load requirements, site size, and solar possibilities, and all of these can be quickly ascertained from basic site information. We have a matrix selection where the 'pick and pack' of the new SEC12 elements can be simply performed, resulting in a standard system approach but with scalable modules. This way there is a focus on providing what product mix is needed and not what 'one size fits all' system is available.

TowerXchange: Can you tell us about some of the specific improvements you've been able to make in terms of security?

Richard Hallas, General Manager – Telecoms, GRIDSERVE: This latest version of the SEC12 includes exponential enhancements in security which include features such as 6-point heavy duty locking systems, concealed hinges, anti-intrusion door brackets, double lock protection cover, internal battery 6mm box with top cover locking system... the list goes on and on!

As well as the physical changes we have introduced, there are software changes too regarding sensors for anti-tampering of fuel and doors, through to options of CCTV and audible warnings that can be added. You will see on our system there are no external bolts or even heads of bolts, and a plinth that locks in the units. All anchor system connections are internal and not accessible from the outside of the unit. We will continue to enhance and upgrade security with each subsequent version and further develop the software and features around advanced reporting of issues.

TowerXchange: I also understand you have made substantial modifications enabling the product to be more easily shipped and installed as a site – what can you tell us about that?

Richard Hallas, General Manager – Telecoms, GRIDSERVE: The SEC12 is designed to be modular and highly mobile. We will be able to deploy the unit to site and deploy / commission within a day – this is a game-changer!

The unit is also specifically designed to support shipping container packing density optimisation, so we can reduce shipping costs and logistics cost in general.

Having a system which can be split down into modules allows more options for site delivery and reduction in the need for Hiab lifts and special delivery requirements. Designed with the remote deployment requirement in mind, we are able to address issues for an island site in Indonesia or a hilltop site in Uganda and not pass the issue to the installation company, but have the foresight to design for end to end deployment.

TowerXchange: We're starting to see MNOs and towercos looking beyond cell site energy to explore how else they can support businesses and communities around towers. What can the SEC12 v2 do beyond providing power?

Richard Hallas, General Manager – Telecoms, GRIDSERVE: The SEC12 is an ideal platform to provide Edge Datacentre capabilities in parallel to the provision of power to off-grid telco and towerco sites. The possibilities are vast for businesses and communities once reliable power is available. Innovations at the nexus of the food, energy and water systems are part of the development strategy for the SEC12. We are already prototyping air to water generator systems run 100% from an SEC12, from here we are progressing hydro and aquaponic systems to address the needs of the developing world where we are already active with the telecom provision of power.

How GRIDSERVE can enable the convergence of cell sites with EV charging and Mobile Edge Computing infrastructure

TowerXchange: Towercos are exploring opportunities to diversify beyond provision of towers and power. For example, China Tower Corporation has setup a new subsidiary, Tower Energy, to explore opportunities to get involved in EV charging and battery sharing. As pioneers of EV forecourts, how does GRIDSERVE see the potential convergence of EV charging and telecom infrastructure?

Richard Hallas, General Manager – Telecoms, GRIDSERVE: Yes, this is where GRIDSERVE really stands out from the pack!

We are ideally placed to leverage the SEC12 platform to expand provision of power beyond the BTS and the dependant infrastructure to include EV charging capabilities for emerging markets as well as developed sectors. It could be that electric motorcycles or bicycles are the growth vehicle in the developing world, and we already have the designs for incorporation of charging stations for these in to the SEC12. GRIDSERVE's market leading experience in the EV sector ensures that this solution will be relevant and a key revenue growth engine.

TowerXchange: Another diversification opportunity towercos are exploring is Mobile Edge Computing. If a towerco wanted to host an eight rack, micro data centre at a cell site, it's been estimated that might add a 20KW load to the site, with an uptime Service Level Agreement that would make most towerco executives' eyes water! How would GRIDSERVE respond to such requirements for high availability remote power?

Richard Hallas, General Manager – Telecoms, GRIDSERVE: The SEC12 is an ideal platform for the creation of an off-grid Edge Datacentre.

The racks will leverage the new SEC12 control system and monitoring to provide a managed solution, in addition to colocation capabilities. Having the ability to integrate multiple power sources; grid, solar, wind, hydro, battery, genset, gives the capability for 'Always On' power. As a group we design, implement and own and operate systems with high dependency requirements and multi-megawatts of battery and power provision, so we are very comfortable with 20kW. The principles are the same; the design for redundancy and accurate reporting and diagnostic capabilities. It's a challenge we relish the opportunity to discuss further with towerco executives, come and see what we have in place now and for the future! ■

TowerXchange: Please sum up your vision for the SEC12 – how do you differentiate it from other, plug and play hybrid power cubes?

Richard Hallas, General Manager – Telecoms, GRIDSERVE: The SEC12 is uniquely placed to address telco and towerco's off-grid power requirements via a highly resilient (solar, storage, genset) design which incorporates a

comprehensive control and monitoring system, specifically designed to address the regulatory and compliance obligations of the telecommunications industry.

We are not a power cube but a power core made up of selectable modules which are picked and packed depending upon site requirements. The resulting system gives a standard look to a highly modular

approach. This way we don't have a standard power cube model but have gone the additional layer where each part of the power core has the flexibility of design to scale as needed, and what we can call the wrapping of the system is all standard. Having an engineering design team that creates a productised system of parts and not a productised system allows for much greater flexibility and savings ■

GS Yuasa: More than 100 years of power storage expertise



The Japanese battery manufacturer discuss its philosophy and varied solutions for the industry



GS Yuasa was founded in 2004 but its history goes back more than 100 years when two Japanese energy storage experts joined forces and became one of the biggest battery providers for the global telecoms industry. From lithium batteries to lighting equipment, the company provides a wide range of power and storage solutions to towercos and operators from all across the world and its international footprint expands across 19 countries.

Keywords: Asia, Asia Insights, Batteries, Capex, Energy, Energy Efficiency, GS Yuasa, Lithium-Ion, Off-Grid, Opex Reduction, Passive Equipment

Read this article to learn:

- An overview of GS Yuasa's history and international footprint
- GS Yuasa's portfolio of solutions
- Acid lead versus lithium batteries: selection criteria
- Key differentiators of GS Yuasa' products and services

TowerXchange: Please introduce your company. Where do you fit in the telecoms infrastructure ecosystem?

Akira Iwata, Manager, Industrial Batteries & Power Sources Business Unit, GS Yuasa international Ltd: GS Yuasa was founded 14 years ago when GS and Yuasa, two companies with 100 years of history, merged. We manufacture and supply batteries, power supply systems, lighting equipment and other special electrical equipment to different clients including MNOs, towercos, data centres, renewable energy providers, security systems and other specialised segments such as submarine, aircraft and satellites providers. We operate all across the globe and have 39 offices in 19 different countries.

For our telecommunications clients - mainly towercos and MNOs - we provide all kind of energy equipment including lead-acid batteries, lithium-ion batteries (LIB), nickel-cadmium batteries (Ni-Cd) and different power supply systems.

TowerXchange: What are the main challenges that your telecom clients are facing and how are you addressing them?

Akira Iwata, Manager, Industrial Batteries & Power Sources Business Unit, GS Yuasa international Ltd: When it comes to batteries, there is always a battle between capex and the performance level of the mobile network. Battery prices are now getting lower, but unfortunately the performance of some lower priced products has not reached the quality

that most customers expect. Lower capex tend to lead to higher opex.

We have been receiving positive feedback from our clients, who are satisfied with our batteries' performance, even though prices are slightly higher than other solutions in the market. Our products aim to provide a lower, long-term opex to our customers. Moreover, we aim to decrease the cost of our products as much as we can by reducing manufacturing processes expenditures while maintaining and delivering high quality services.

TowerXchange: What are the main characteristics of your solutions and how does its cost and performance compare to that of traditional VRLA batteries?

Akira Iwata, Manager, Industrial Batteries & Power Sources Business Unit, GS Yuasa international Ltd: We identify two types of tower sites based on their grid accessibility: sites on good grids versus sites connected to unreliable power sources. We always aim to provide an optimal solution and based on the site grid accessibility we install lithium-ion or lead-acid technologies.

MNOs are increasingly demanding solutions to provide backup power to sites with poor grid connectivity. In those instances, lithium-ion batteries provide notable advantages as they have a superior cyclic performance and charge quicker. On the other hand, traditional VRLA have a lower cost and their capabilities have been demonstrated during the years. Therefore, they are a very good backup option on sites with good grid access and provide great cost efficiency and reliability.



TowerXchange: What warranty and after sales support do you offer?

Akira Iwata, Manager, Industrial Batteries & Power Sources Business Unit, GS Yuasa international Ltd: Our main concern is always quality. As a manufacturer, gaining the trust of our customers and retaining it is critical. Based on our historical record, I can say that the manufacturing defect ratio of our products is extremely low and that is the best guarantee we can offer to our clients. On the other hand, we also have a deep understanding of the current market requirements and their need of a long-term unconditional guarantee. This is all very challenging for us because the environmental conditions of each client and each site are different, but we are always open to discuss the optimal warranties, conditions and after sales support on a case by case basis.

We believe in providing a high level of reliability and after sales support during and even after warranty period so that we can help our clients maintaining a high quality service.

TowerXchange: Please sum up how you would differentiate your solution from your competitors.

Akira Iwata, Manager, Industrial Batteries & Power Sources Business Unit, GS Yuasa international Ltd: I am quite sure that 100 years of history differentiate us from our competitors.

As mentioned earlier, GS Yuasa Corporation has evolved from two companies engaged in the development and manufacture of storage batteries in Japan with a long history: Japan Storage Battery Co., Ltd. and Yuasa Storage Battery Co., Ltd. (later Yuasa Corporation) established in 1917 and 1918 respectively. Ever since their beginnings, these two companies have continuously honed their skills and played a major role in the advancement of battery technology. Aiming for further progress, the two companies merged their management in 2004. In 2017, GS Yuasa Group employed more than 15,000 people at 39 bases across 19 countries.

Looking back upon this history, many milestones come to mind. Our batteries served to power the



telecommunications equipment that supported the development of wireless communications in the early 20th century. In the starting days of industrialisation, when power generation equipment in Japan was still rudimentary, auxiliary batteries were an important product category, and lead-acid batteries for automobiles helped to accelerate the post-war motorisation. The founders of both companies placed greater emphasis on innovative thinking and a spirit of challenge, which became the driving force to create products that helped to resolve social issues of the time. This history and thinking forms GS Yuasa Group's DNA and is reflected in our products.

Secondly, we massively invest in research and development and all our products are produced



in our own facilities. We have a wide range of different products so we are able to provide a personalised, optimal solution for each case while guaranteeing the best cost and quality. Recently, we have launched our SLR line of stationary lead-acid batteries for large-capacity power storage systems, featuring super long life and world leading cycle life performance. In addition to the existing 1000Ah SLR-1000, we have introduced the SLR-500 model in 2017. Furthermore, we are conducting extensive research for the development and improvement of LIB solutions by exploring how to increase the reliability, safety and energy density of medium and large-sized batteries. We are exploring materials for next-generation positive and negative electrodes aiming to improve their capabilities for automotive, submarine, aircraft and spacecraft applications ■

Tower  Xchange

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September

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13-14 October, Johannesburg

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Why are Digital Indoor Systems necessary for 5G?



Huawei on DIS implementation and 5G network evolution



Indoor coverage is one of the main strategic and operational challenges for MNOs and with the arrival of 5G, enhancing indoor capacity is becoming even more critical. As traditional DAS systems will not be able to support many 5G indoor applications, Huawei has developed LampSite, a Digital Indoor System (DIS) that improves user experience while cutting down ownership and operational costs. The company, who has been at the forefront of 5G innovation globally, presents the benefits of this new technology and explores how towercos can better prepare for 5G integration while diversifying their offer.

Keywords: 4G, 5G, Asia Insights, Capex, DAS, Digital Indoor Systems, edotco, Huawei, LambSite, MNOs, O&M, Towercos

4G has changed people's lives, but 5G is set to change societies. This new technology provides basic data services and further extends telecom industry boundaries by allowing and supporting more applications for our day-to-day activities, business and industry development. Its integration will positively influence people's life, making work and travel more convenient and intelligent, using robotic meal delivery, automatic driving and remote VT among many other applications. 5G can also help industries to improve efficiencies, implement smart, automated production systems and optimise technology use.

5G delivers a much better user experience than 4G due to its high data rate and low latency. 5G's data rate is ten times faster than 4G, so it takes only a few seconds to download an HD movie on a 5G network. In addition, 5G can achieve a typical end-to-end (E2E) latency of 5–10 ms, far shorter than the approximate typical E2E latency of 50–100 ms in 4G.

Following the finalisation of the 3GPP Release of 15 standard for 5th Generation (5G) mobile communications and the issuance of 5G licenses in various countries, 5G deployment is now accelerating internationally¹.

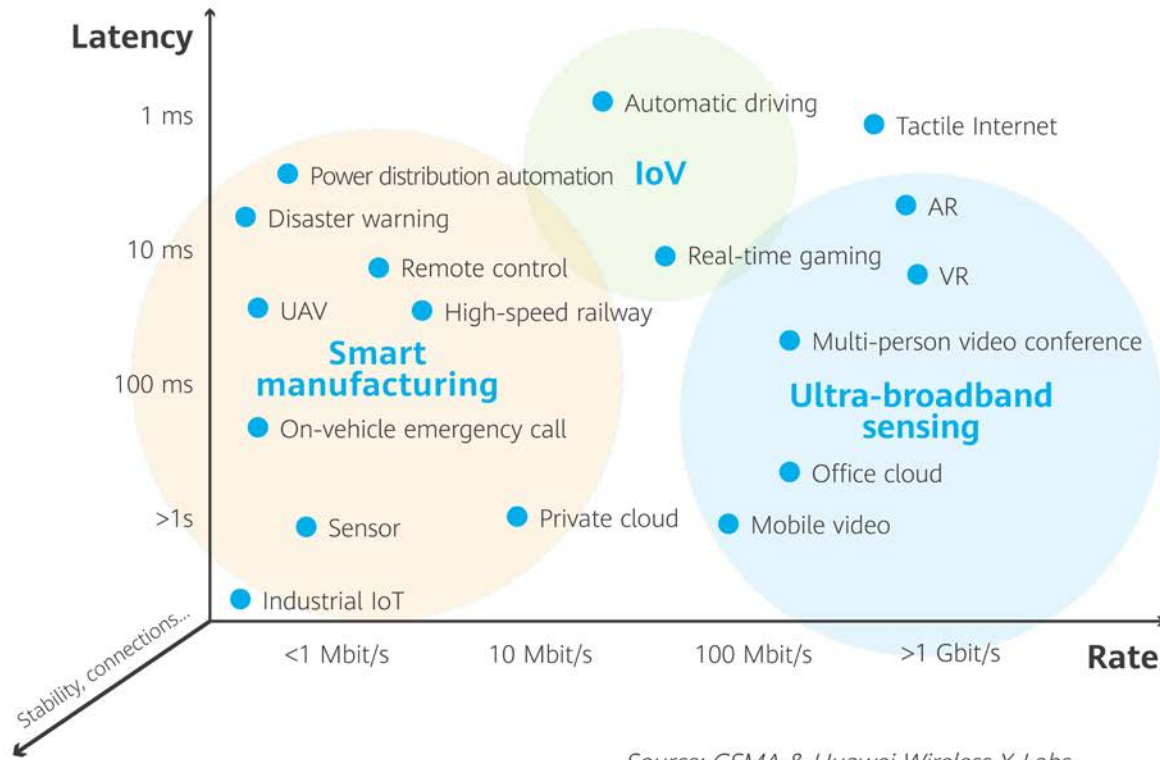
The importance of indoor systems deployment for 5G

Most people spend more than half of their time indoor every day. Statistics show that more than 70% of 4G services are used indoors and industry predictions confirm that this percentage will

Read this article to learn:

- 5G requirements and indoor applications
- The benefits of Digital Indoor Systems over DAS in 5G integration
- Why towercos should integrate DIS on their services
- Huawei's unique approach to indoor coverage

Figure 1 5G network scenarios and performance requirements¹



Source: GSMA & Huawei Wireless X-Labs

Ultra-broadband sensing

VR, AR, video conference, mobile video, etc.

IoV

Automatic driving, remote driving, fleet cruising, etc.

Smart manufacturing

Remote control, high-speed railway, power distribution automation, sensor, etc.

New scenario exploration

Wireless healthcare, smart port, smart agriculture, smart mining, smart scenic spot, etc.

surpass 80%. 5G will usher in the possibilities of home VR, holographic communication and HD mobile office services, boosting indoor user demand. However, 5G will increase the gap between outdoor and indoor user experiences, as higher bands will be used. Outdoor C-Band or millimeter wave signals are unable to deliver intensive indoor coverage or offer a satisfying indoor experience due to more serious penetration loss².

From 2G to 5G, the outdoor antenna technology has evolved from single input single output (SISO) to

Massive MIMO (64 input 64 output), while for most indoor systems, the antenna system is remaining in SISO. The MIMO capability for indoor system already lagged behind the MIMO capability of the terminal, as 5G devices already support four receivers. The experience gap between indoor and outdoor has been further widened.

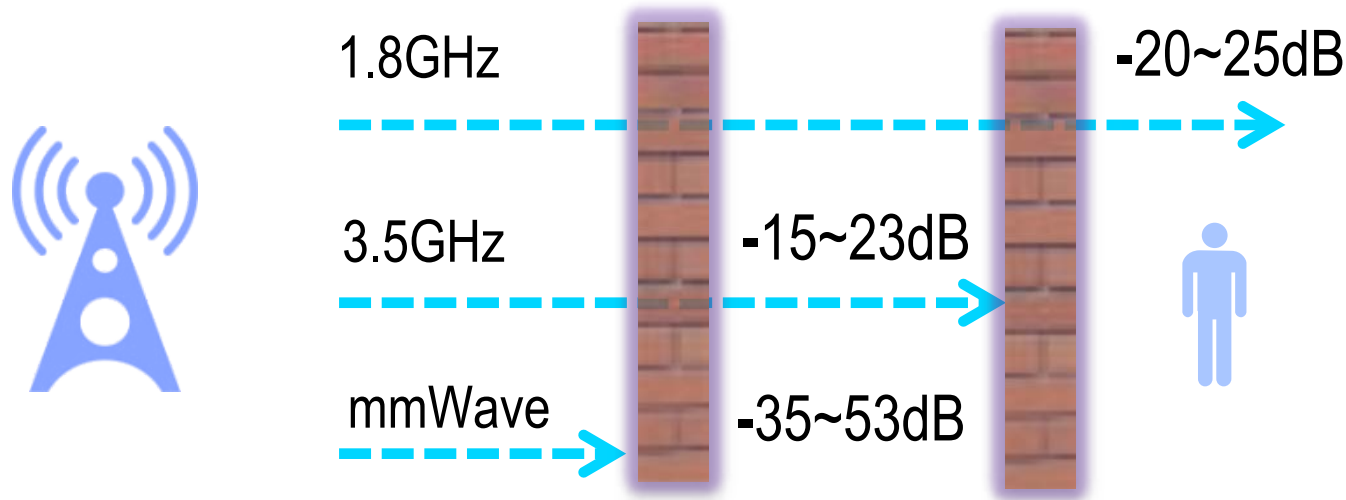
According to statistics, more than 90% of user complaints are related to indoor applications and experiences, hence an independent and MIMO supported indoor system is urgently required to

narrow the experience gap between outdoor and indoor.

Should towercos invest in indoor coverage?

On one hand, building an independent Indoor System will undeniably require a considerable investment from MNOs, who are dealing with a lot of financial pressure. Sharing access to a third party indoor system will reduce the total cost of ownership (TCO) for MNOs. Towercos can help their clients and strengthen their position by

Figure 2: Penetration loss at different spectrum bands



including these type of solutions in their offerings, also allowing MNOs to reduce their capex while preparing for 5G integration.

On the other hand, building owners are increasing their demands and prices, so sharing access to DIS can help in reducing leasing cost. Moreover, many owners are open to the integration of sharable indoor systems to avoid duplicate equipment and construction on their facilities. Indoor systems present a great opportunity for towercos as they can improve their indoor coverage services, satisfy their clients' needs and diversify their offer.

Indoor 5G service requirements and network construction suggestions

In the 5G era, we will see many more indoor scenarios for users. Different service requirements lead to diverse network construction requirements. In order to keep up with the booming and diversified 5G services, a network with flexible capacity needs to be adequately prepared. New 5G networks not only need to meet the changing volume requirements of services as time and areas vary, but also must cope with rapid surges in traffic.

Indoor Digitalisation: the vital shift for 5G-readiness

The conventional distributed antenna system (DAS) solution is unsuitable for 5G-oriented evolution. Firstly, existing DAS can't support C-band or higher frequencies. Secondly, the capacity expansion and reconstruction of DAS requires intricate and lengthy

Figure 3: Indoor system needs consider 5-10 years' demand

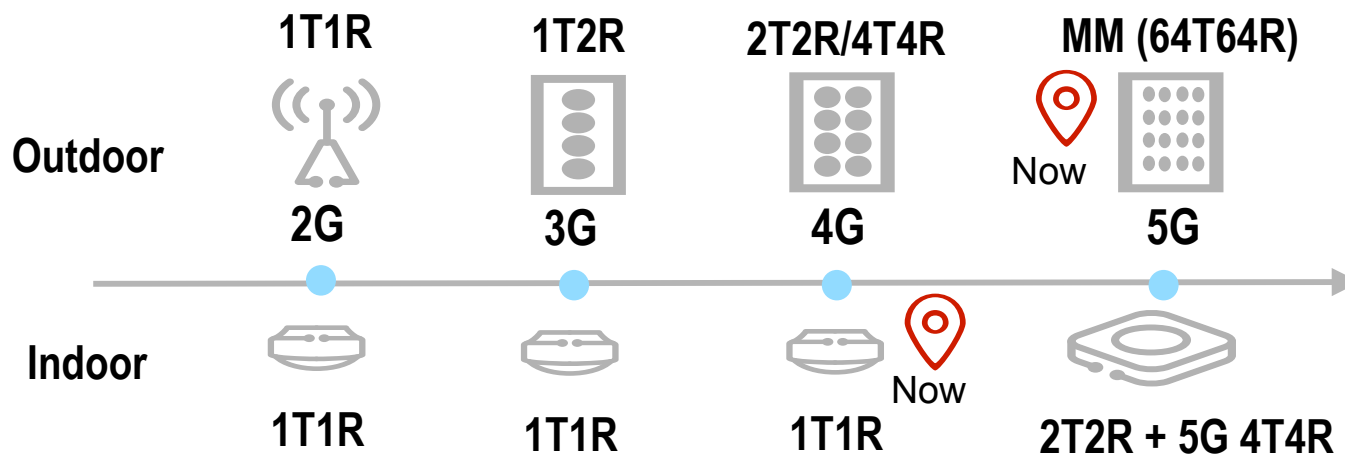


Table1 Relationships between various services and bandwidth/latency¹

Typical 5G Service	Bandwidth (Edge Rate) (Mbit/s)	Latency (ms)	Service Scenario	Indoor Scenario
Cloud VR 720p	20	50	Entertainment, education, marketing, healthcare, tourism, real estate, engineering, social networking, and shopping	Stadiums, airports, stations, shopping malls, office buildings, residential areas, subways, and campuses
Cloud VR 1K	50	20		
Cloud VR 2K	150	10		
AR	150	5	Family, healthcare, industry, social networking, sports, and games	Stadiums, shopping malls, offices, residential areas, campuses, and hospitals
4K 2D	25	20	Education, entertainment, social networking, security, and healthcare	Stadiums, airports, stations, shopping malls, office buildings, residential areas, subways, campuses, and hospitals
4K 3D	50	20		
8K 2D	100	20		
8K 3D	200	20		
MBB access	300	20	Remote live broadcasts, such as games, parties, and press conferences	Stadiums, airports, stations, shopping malls, offices, residential areas, subways, campuses, and exhibition halls
IoV	N x 10	5	Remote vehicle diagnosis and control	Airports, stations, shopping malls, and hospitals
Industrial control	10	1	Production line control and power system control	Factories, industrial parks, etc.

engineering procedures and secondary site visits. Thirdly, DAS does not support real-time visualised management as it uses passive devices. Therefore, DAS is an unsuitable solution for the imminent arrival of 5G.

Digital Indoor Systems (DIS) provide a scalable, flexible and efficient approach to indoor coverage, which can be deployed now while also providing a smooth path to 5G and to future waves of use cases⁴. In addition, it can also provide us full visibility of the system’s status and health, allowing us to identify and often fix problems remotely.

Longer-term investment plans for indoor sites and site acquisition/management difficulties will drive the adoption of DIS, especially through infrastructure sharing. DIS, which offer a smart and efficient solution over DAS, can create new opportunities for towercos to increase revenue while reducing total cost of ownership (TCO).

Bringing efficiencies to DIS rollout

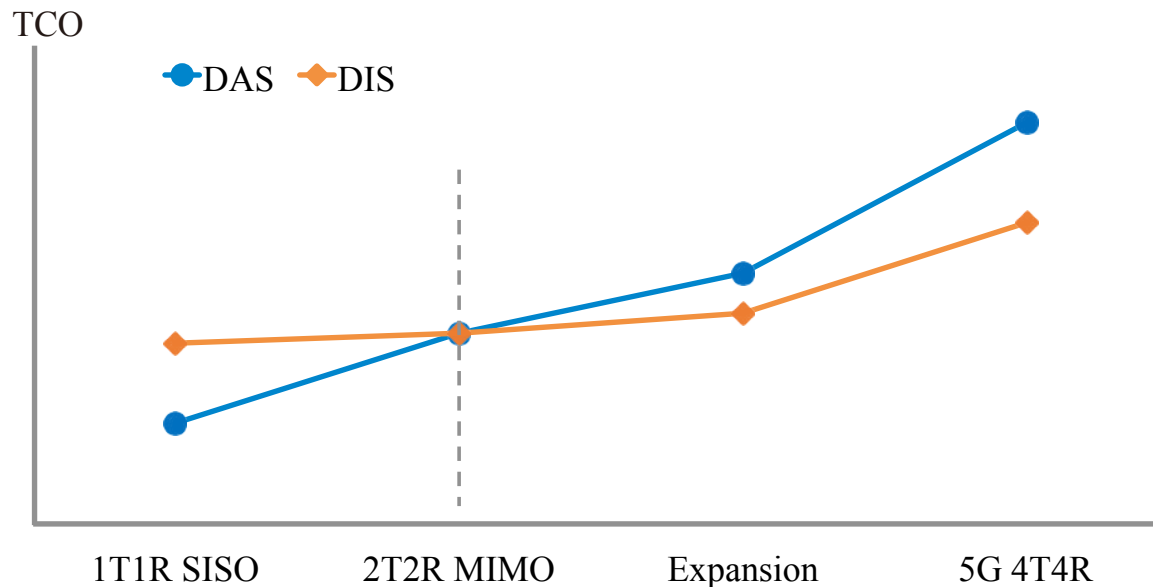
LampSite is Huawei’s Digital Indoor System (DIS) solution, which compared with DAS has simpler architecture, higher capacity, flexible capacity management capabilities and end-to-end visible O&M possibilities.

1. Simpler and 5G-oriented architecture: LampSite only has 3 layers: BBU, RHUB and the pRRU. One pRRU only needs one optical/electrical hybrid cable to support 4T4R in C-Band. Compared with a traditional DAS system, which needs four

Figure 4: Comparison of DIS versus DAS⁵



Figure 5: Comparison of DIS versus DAS



cables and passive elements to support 4T4R, LampSite has a simpler architecture and delivers higher performance.

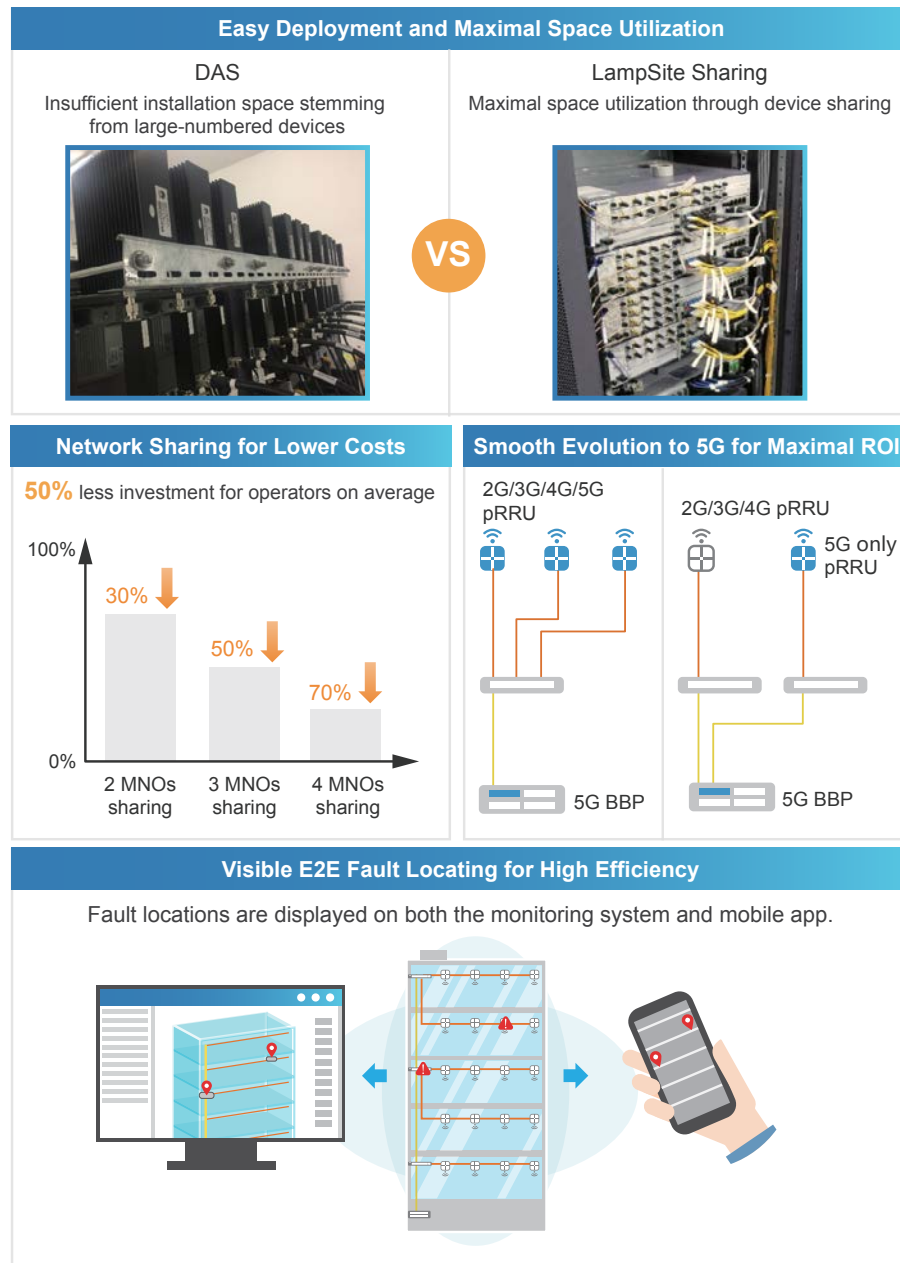
2. Flexible capacity management: LampSite can be easily configured remotely based on traffic requirements. When the traffic is not heavy, several pRRUs in one building can be configured as one cell. When the traffic increases, you can split the original cell into several cells to provide higher capacity without re-cabling work.

3. Highest integration level: Huawei LampSite can support four MNOs. Each MNO can use four frequencies simultaneously, using just one pRRU as each frequency supports full band instantaneous bandwidth (IBW). LampSite supports both RF feed in mode and Huawei BBU feed in mode, which can save 50% space of the equipment room when two MNOs are using BBU feed in mode.

4. End-to-end visible O&M: pRRU, RHUB and BBU can be monitored remotely by Element Management System (EMS). Faulty equipment can be displayed on both the monitoring system and mobile app, which improves the O&M efficiency.

Huawei DIS can be currently found in various landmark buildings around the world including airports in Istanbul and Johannesburg, the Metro in France, Dubai's Mall, Lakhta Center in Russia as well as in many World Cup stadiums in Qatar. By Q3 2019, Huawei had distributed more than 480,000 units of 5G pRRU.

Figure 6: Huawei can help towercos build the DIS more efficiently



DIS is expanding across Asia

We are seeing an exponentially increasing demand for DIS in Asia and we have already integrated this technology in several venues across the continent including the Shatin to Central Link (SCL) of Hong Kong’s Mass Transit by HKT and in airports with high passenger flow in Thailand, Indonesia, Singapore and the Philippines. There are also many shopping malls such as the Marina Bay Sands and Central World Thailand that are using our DIS solution to enhance indoor coverage.

Many towercos in Asia Pacific have carried out DIS proof of concept (PoC) studies and we have collaborated with edotco in Bangladesh and Myanmar, PT Mac, THB and MJA in Indonesia and PLA in Vietnam. We are also testing DIS in Sri Lanka and Cambodia. In all those deployments, DIS are helping to manage the capacity scalability needed on short notice to ensure all relevant data is captured ■

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Are you paying enough attention to your data?



With a presence in Ho Chi Minh City, ITD/ClickOnSite brings data collection and utilisation closer to Southeast Asia's towercos and MNOs

TowerXchange: Can you please reintroduce ITD and your ClickOnSite product to TowerXchange readers, and tell us a bit about your background in telecoms?

Jerome Perret, CEO, ITD/ClickOnSite: Absolutely, always good to remind readers of the ClickOnSite basics.

In the 90s and early 00s the founders and management of ITD managed tower rollouts in Europe, Africa, Middle East and Asia. From that experience we realised how technology can make tower rollouts and maintenance of site infrastructure much more efficient. As a result, IT-Development SAS was founded, and we created ClickOnSite, our flagship product for managing infrastructure assets.

As time goes on, we continue to add layers of business logic for elements such as project management, reporting and search, atop the comprehensive database and document management system. And, of course, our APIs interface to integrate other enterprise software.

TowerXchange: How has the ClickOnSite product evolved in the past year since we last spoke to ITD, which new capabilities does it feature?

Jerome Perret, CEO, ITD/ClickOnSite: Our product dashboard is driven by features our customers tell us they need, combined with our extensive knowledge of the telecom industry. For example, we made an integration for IFRS16 compliance months



ClickOnSite

Made by telecom people for the telecom industry, ClickOnSite offers some unique features, such as its low-cost methodology to MNOs and towercos across multiple regions. In this exclusive interview, Jerome Perret, CEO of ITD, offers TowerXchange's readers an updated overview of ClickOnSite's characteristics while exploring the latest trends from the industry in terms of data collection and utilisation – an analysis that is becoming increasingly fundamental to succeed for MNOs and towercos worldwide.

Keywords: Asia, Asset Register, Change Management, ClickOnSite, Data Room, ITD, Job Ticketing, KPIs, Meetup Preview, Monitoring & Management, Operational Excellence, RMS, Site Management System, Southeast Asia, Vietnam

Read this article to learn:

- ITD/ClickOnSite's early days and latest innovations
- The company's geographical expansion and advantages for its customer base
- The range of features ITD/ClickOnSite offer: the evolving importance of data
- How to find value in the data companies collect and track

before it became a topic in the press because we knew from our industry experience that there will be a big need for it.

We have added great functionality to ClickOnSite this past year, items that we are proud of from a technical standpoint, and excited about, for the benefits they bring to companies and their staff. These include:







- ClickOnSite Mobile app
- Full-featured Project Management Office (integrated with BPM, task tracking + reporting)
- Executive dashboards
- Global search
- Lease contracts management (IFRS16)
- User usage analytics
- Simplified ClickOnSite user permissions management

Listing a lot of new features reminds me to mention that adding features to ClickOnSite does not add complexity. In fact, we do low-code development, which means we reduce the need for developer intervention in implementation or configuration with the customer. This makes implementations significantly faster, which of course means lower costs all around, and also less headaches.





TowerXchange: When looking at establishing a presence in Asia, why did you choose Southeast Asia rather than India or China?

Jerome Perret, CEO, ITD/ClickOnSite: While the size and characteristics of the Indian and Chinese




Our clients use the ClickOnSite Mobile app for:

 Acquisition	 Acceptance
 Asset inventory	 Fuel logs
 Failure reports	 Work orders

Optimized tasks:

 Geolocate your technicians	 Fill in checklists
 Take/upload images	 Scan barcodes

Product Features:

 Fully configurable	 Offline data capture
 Easy to use	



markets are attractive, we decided to open our office in Vietnam, and focus on customers across Southeast Asia in light of a few considerations.

First of all, the net-net is that we see a strong need among the MNOs and towercos in the region to move away from Excel. In fact, many players are now shifting from a rather simplistic set of processes towards a digital transformation of their operations. Our company culture is entrepreneurial and dynamic, and that fits well to rapidly growing companies in smaller countries, which is also one of the reasons behind our success across Africa.

Also, ClickOnSite as a product and licensing model

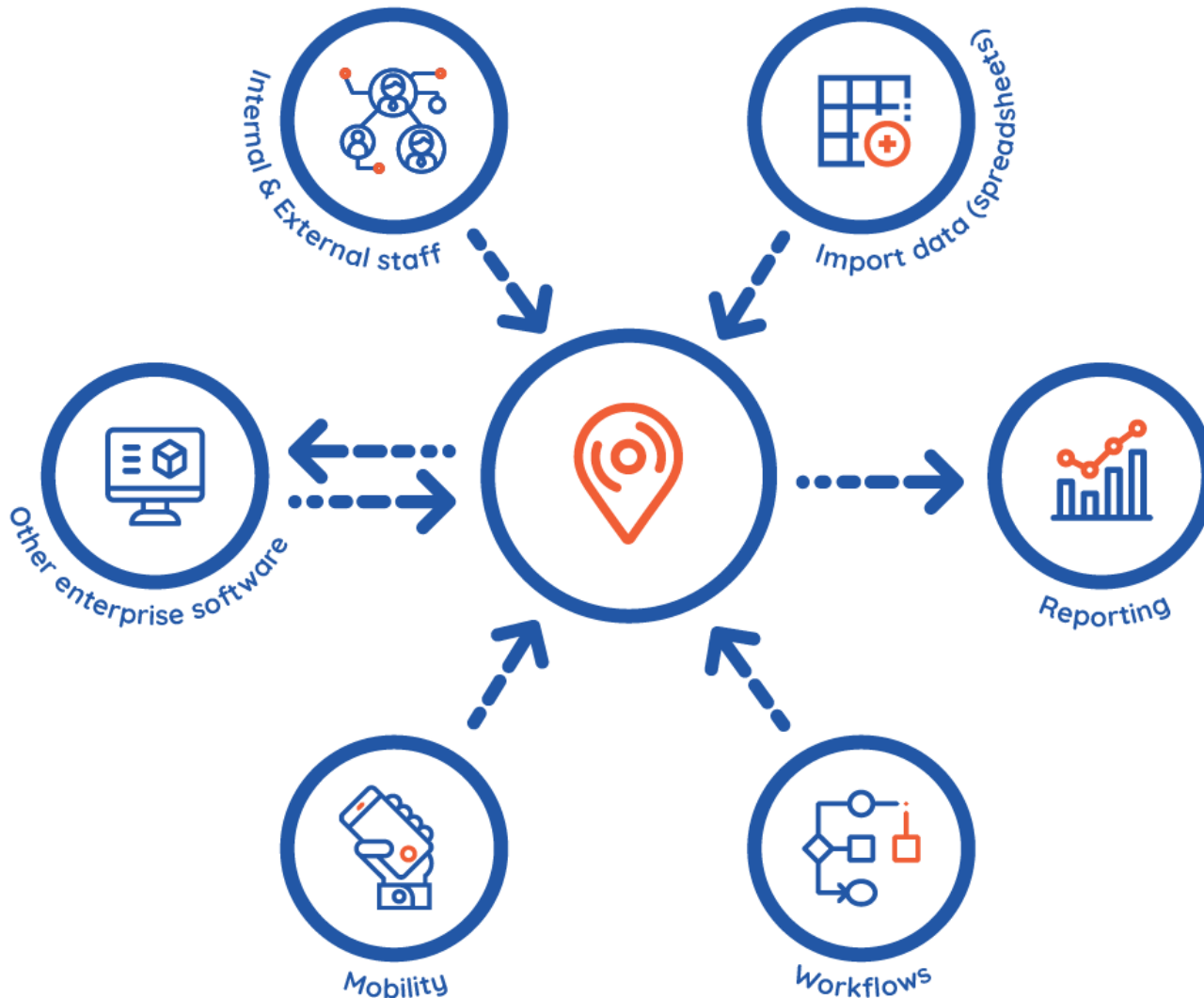
is suited for fast-moving operations, just like MNOs in Southeast Asia. We have chosen to focus and make ClickOnSite the best tool for managing rollouts and passive infrastructure and ease the way for integration with other specialised tools (RMS systems, IFRS16) via API.

Accordingly, ClickOnSite is priced to allow MNOs and towercos to use the parts they need and to add elements as they grow. They do not have to pay for an unwieldy ERP solution of which they will only use 50% of the functionalities.

We are in the final stages of signing contracts with our second and third towerco customers in Asia. As



Centralized storage of all your company data in real-time.



much as I'd like to announce it in this interview, the ink won't dry for a few days yet.

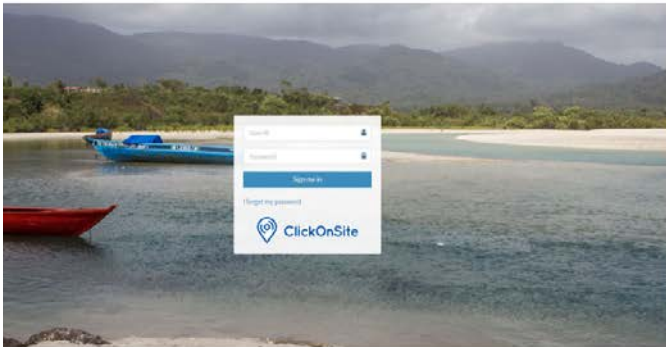
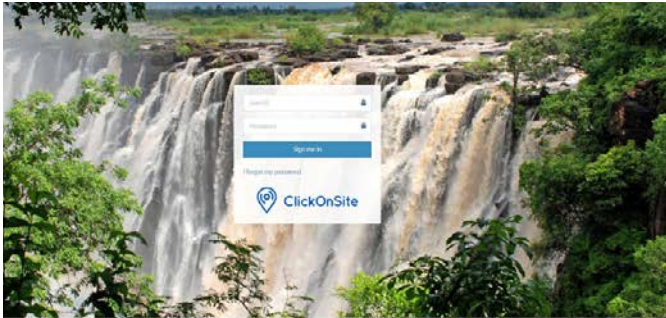
An equal consideration for choosing Vietnam has to do with supporting customers – it wasn't just about making sales!

Vietnam has a lot of talented developers and technicians. Among the big benefits of having a strong development team in our Ho Chi Minh City office include direct customer support without the limitations of time zones and business trips. Additionally, our Vietnam team starts working six hours before our European technical staff, which allows us to increase and improve our level of customer care worldwide.

TowerXchange: How do you ensure that your solution is correctly implemented and used optimally in the field?

Jerome Perret, CEO, ITD/ClickOnSite: By nature, we are a company that believes in being close to our customers. From the start we are always engaged, listening to our customers' issues and needs and understanding their operations so we can optimise ClickOnSite for them. When we implement ClickOnSite for a customer, we do much more than just make software work, we set the stage for the digital transformation of their processes and way of working.

Our customer churn rate is negligible and one of the key reasons for that is our emphasis on delivering excellent, hands-on service and support. This means in-house training at our clients' premises to ensure proper knowledge and skills transfer.



The mission of our travels and subsidiaries is to bring ITD/ClickOnSite closer to our clients, allowing us to offer top service in terms of support, implementation and change management related to site infrastructure management and digital transformation of operations. Additionally, we host ClickOnSite user workshops for customers to stay up to date with the latest features and to share best practices with each other.

All these activities are supported in the Asia through our Ho Chi Minh City office. As I mentioned earlier, we hire local developers, project managers, BPMN specialists, which makes for interesting international opportunities for the local telecom professional community. To us, being successful as

a company means that beyond our own success, we are able to guarantee our customers and partners' success.

TowerXchange: Geographically, Asia is very spread out. How do you handle customer support over such a large and diverse area?

Jerome Perret, CEO, ITD/ClickOnSite: Providing active, engaged support is great but equally important is that ClickOnSite is easy to use and implement from the start.

In terms of user interface, ClickOnSite is intuitively designed; it can be used with minimal training. The interface on the screen is “responsive”, so it can

be used on any device – being that a PC, tablet or smartphone.

Technology-wise, as I mentioned earlier, we do low-code development, which means that 90% of the needs of each client can be configured by a business analyst, rather than coded by a developer. This tactical and practical benefit is part of our strategic vision to make ClickOnSite low-impact to use and high-impact in delivering results.

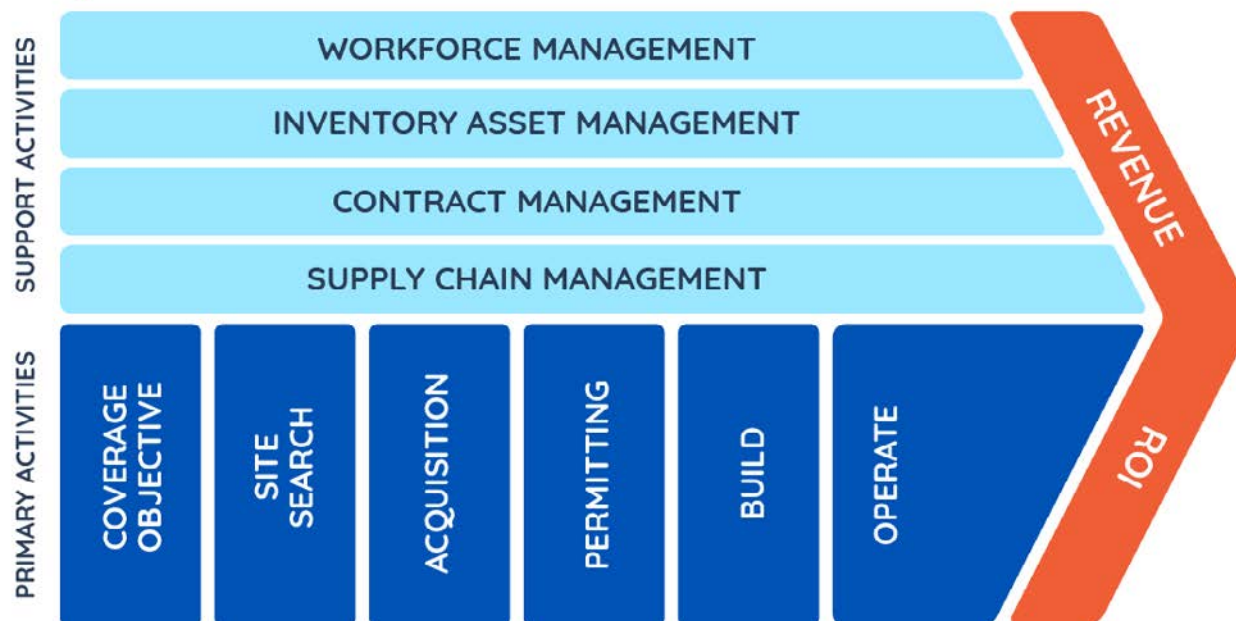
The ClickOnSite mobile app is very easy to configure and use even without training. Creating new forms tailored to a company's needs is simple and it works offline too.

TowerXchange: You recently went through a new round of fundraising, what was the investment for and is going to change for current and prospective customers?

Jerome Perret, CEO, ITD/ClickOnSite: In terms of product, ClickOnSite is full-featured and mature. This round of funding is focused on speed and scale of bringing ClickOnSite to customers. It will primarily be used to improve our proximity to existing customers and extend to new territories. We also aim at growing our sales team and improve the speed and quality of ClickOnSite implementations.

We will reinforce and expand our local presence in South East Asia and Africa from our offices located in Ho Chi Minh City, Abidjan and Johannesburg. Part of the effect will be higher visibility in the regions, but also continued top-notch customer

ClickOnSite Value Chain



support. We are investing in training programs for customers, and we are hiring managers with extensive experience.

We are putting special emphasis on growing our sales team to increase conversations with prospects about ClickOnSite. Simply put, we are adding people to let more companies than ever know how ClickOnSite can help them. Hopefully everyone in the industry will notice our raised profile.

TowerXchange: ITD targets both MNOs and towercos, and you offer your solution as both SaaS and on-premise, can you explain why your product is particularly well suited to the needs of your different customers?

Jerome Perret, CEO, ITD/ClickOnSite: The requirements of each MNO and towerco depend on the specific countries where they operate and each single market presents its own characteristics. To respond to this need, ClickOnSite can be broken out into tenants; in fact, each customer can divide the system into as many tenants as they need, to cover different requirements.

On a related note, some customers prefer to have their enterprise applications hosted on-premise within their own IT environment. ClickOnSite can be hosted that way or it can be hosted full SaaS, or as a hybrid of the two. In other words, we can mix and match the hosting model to optimally fit the company's needs, structure and constraints.

TowerXchange: Our Data Collection and Utilisation Working Groups have raised lots of ambitions for using data better, what concrete steps have you seen taken in making the passive telecom tower industry more data-driven?

Jerome Perret, CEO, ITD/ClickOnSite: We are strong believers in the power of data to inform and strengthen business decisions. ClickOnSite helps unlock the data related to towers so that MNOs and towercos can use the information to optimise their businesses.

One of the key ClickOnSite benefits that we highlight is that everyone from the office to the field works on one set of data in real-time. No silos, no copies over on someone's hard drive. This level of accuracy and transparency is a big leap forward for MNOs and towercos compared to using Excel, or a database which is not updated in real-time.

That said, as it has been commented by participants in the working group, the first task is actually having accurate passive infrastructure data. ClickOnSite makes it very easy to import existing data, or add them from the field, for example through the ClickOnSite Mobile app. Also, because ClickOnSite is interoperable with other enterprise software through APIs, it can combine information from multiple sources within the same organisation – for example, infrastructure data together with remote monitoring system (RMS) data.

But to get very technical for a moment about accuracy, the underlying data model of ClickOnSite ensures that a standardised and single source of

data is used in the system, therefore across the company. No more need to try and decide which of two data points is the correct or which one is more recent. The ClickOnSite reporting module makes it easy to create reports across multiple data points and presents the results graphically. Lastly, ClickOnSite features dashboards offering a real-time KPIs' overview.

We are excited about the data analysis behind ClickOnSite's PMO (Project Management Office) module. Using a combination of data and reporting, MNOs and towercos can analyse their processes and identify inefficiencies or optimisation areas in their workflows.

Circling back to the topic of the Data Collection and Utilisation Working Groups, we applaud TowerXchange for putting this group together. It is a vital topic for the industry and we are sharing our expertise and experience with MNOs and towercos in a forum that even includes our competitors, for the benefit of the industry as a whole. Data collection and usage is extremely relevant to assess how efficiently MNOs and towercos run their businesses - this is just the start of a trend that will be very important in the coming years.

TowerXchange: Please sum up how you would differentiate your solution from your competitors?

Jerome Perret, CEO, ITD/ClickOnSite: Most site infrastructure solutions and tools available in the market are either very simple – hence a little more

than a database – or overly complex – part of an ERP system not even made for telecoms. Given our hands-on history rolling out and managing towers, we know what core functionalities MNOs and towercos need to streamline their work and remain efficient at scale. The differentiators boil down to three areas:

Technology

- Future-proof technology
- Low-code methodology which keeps costs low and speed high

Features

- Business logic layers that use the underlying data, for example BPM driving the workflow to automatically distribute tasks
- Reporting and data mining to use your data to make decisions
- Our CTO is a search expert: the search capabilities built into ClickOnSite are world-class

Service (Partnership)

- Buying a great tool like ClickOnSite is one thing but easing its adoption and correct use requires a unique skillset, and as “telecom people making software for telecom customers”, ITD is ideally situated to facilitate that for its global portfolio of clients.

The last differentiator is time and money: we typically come in at about half the price of our competitors and are able to offer a much quicker product's set up, which is approximately two months for a towerco ■



Meetup Asia 2019
3-4 December, Singapore

Meetup MENA 2020
28-29 January, Dubai

Meetup Europe 2020
19-20 May, Barcelona

Meetup Americas 2020
23-24 June, Boca Raton

Meetup China 2020
September

Meetup Africa 2020
13-14 October, Johannesburg

www.towerxchange.com

Power HF provides innovative telecom energy solutions on a turnkey basis worldwide



Insights into leading power system provider's experiences in China, India, Myanmar and Africa



Power HF Chairman David Xu meets TowerXchange CEO Kieron Osmotherly

Power HF, a leading power system innovator from China, has exported their innovative diesel gensets, hybrid power units, and energy storage solutions all over Asia and Africa. Their equipment has proved efficient and reliable on tens of thousands of cell sites in India, Myanmar, North and Sub-Saharan Africa. More than just a power system manufacturer, Power HF also offers end-to-end services, from civil works, installation and construction, to maintenance. Power HF has also successfully entered the fuel cell market in China. TowerXchange met with Chairman David Xu to learn more about the company.

Keywords: Batteries, CTC, China Tower Corporation, DG Runtime, Data Centre, ESCOs, Energy, Energy Efficiency, Energy Storage, Fuel Cell, Hybrid Power, O&M, Power HF, RMS, Who's Who

Read this article to learn:

- An introduction to Power HF's product range and production capacity
- Power HF's end-to-end turnkey solution capabilities
- Insights into Power HF's work with China Tower Corporation, and CTC's preferred model for cell site energy
- Power HF's impressive credentials as an exporter: examples from India, Myanmar and Africa
- Power HF's appetite for ESCO business models

TowerXchange: Please introduce Power HF.

David Xu, Chairman, Power HF: Founded in 1920, Power HF is a world class manufacturer of engines and diesel gensets, with a particular focus in telecom on innovations in hybrid generation, energy storage and fuel cells. Power HF has produced over two million engines, has annual production capacity for 150,000 engines and 15,000 gensets, and we are one of the largest exporters of gensets in China.

We have been serving the telecom industry since 2006, supplying gensets in the range of 10-2000 kVA. We produce variable speed gensets and the Eazy Hybrid power system with embedded fuel and remote management system designed to meet telecom standards, which can reduce DG runtime by over 70% for off grid or bad grid scenarios.

Apart from being a product supplier, Power HF also provides services on an end-to-end, turnkey solution basis. For example we provide installation, construction and maintenance services to telcos and towercos in India and Myanmar for RF and infrastructure equipment.

Power HF provides services to MNOs like Reliance Jio, Vodafone, Safaricom, Telenor, Ooredoo, MPT, Airtel and also to leading tower companies like edotco, IGT, OCK and Eaton Towers to name a few.

Power HF is also undertaking it's first foray into the IDC market, which is booming in China.

TowerXchange: What has been the nature of your work with China Tower Corporation (CTC), and what can you tell us about their power strategy for their cell sites?

David Xu, Chairman, Power HF: CTC produces their own standardised site designs from steel structures to cabinets. They are generally compact, integrated designs to save land and power.

CTC prefers to use commercial grid power during off peak periods when the rates are half price or less, cycling the battery banks during peak daytime hours. CTC also uses renewable energy sources like solar, fuel cells and is increasingly replacing lead acid with lithium-ion batteries. Power HF along with CTC are piloting recycled EV batteries for their usage at cell sites. Given the high availability of grid power in China, backup gensets are typically only deployed on critical sites.

It is expected that CTC will invest in modernisation and up gradation of cell sites after the successful IPO.

“

We started exporting our power systems to India 12 years ago, and have shipped 38,500 units to the country, the majority of which are still operating, which is testament to our quality and service... In Myanmar, we can proudly say that more than 20% of the towers have Power HF equipment

”

TowerXchange: What are Power HF's priority export markets?

David Xu, Chairman, Power HF: Our primary focus is on developing countries with large populations in Asia such as India, Pakistan, Bangladesh, Myanmar, Sri Lanka, Philippines and Indonesia.

We started exporting our power systems to India 12 years ago, and have shipped 38,500 units to the country, the majority of which are still operating, which is testament to our quality and service.

We have supplied more than 600 units of our Eazy Hybrid power system with remote management to Eco Friendly Towers in Myanmar, and more than 2,000 gensets to OCK, IGT and edotco. We recently won best supplier award from edotco. In Myanmar, we can proudly say that more than 20% of the towers have Power HF equipment.

In Africa, we have supplied to Eaton Towers, Safaricom and Vodafone Egypt.

TowerXchange: Does Power HF have an appetite to provide your end-to end turnkey services under an Energy Services Company (ESCO) contract?

David Xu, Chairman, Power HF: We are discussing ESCO models with some towercos interested in becoming powercos. Since this is at a very nascent stage of discussion and also involving some uncertainties, we are still exploring the nuances of the business.



TowerXchange: Please summarise Power HF's value proposition for towercos and MNOs.

David Xu, Chairman, Power HF: Power HF is a well-established, internationally proven partner to the telecom industry. We manufacture a range of world-class power systems to meet any telecom requirement, from 10-2000 kVA diesel gensets to advanced hybrid power units, energy storage solutions and fuel cells. We also provide turnkey solutions to the telecom industry for network deployment.

Sustainable quality and commitment to delivering on time are two pillars of the success story of Power HF ■

Strategic approach to deliver outstanding total cost of ownership



How Ramboll offers much more than just steel structures



K. Suresh Babu, Business Development Director, Ramboll



Thomas Brink Laursen, Business Development Director, Ramboll

With over 70 years' experience in the telecom industry, Ramboll has become a trusted partner to the sector, working side by side with clients to better develop customised solutions which address long term holistic network requirements. TowerXchange speak to Ramboll to find out more.

Keywords: Africa, Asia, Capacity Enhancements, Construction, India, Masts & Towers, Network Rollout, Ramboll, Urban vs Rural, Who's Who

Read this article to learn:

- Ramboll's history, expertise and geographical coverage
- Why the company opts for a customised approach for clients
- Developments with Ramboll's Rapid Deployment Units
- How Ramboll work with clients to focus on long term solutions over quick fixes
- Ramboll's Smart City solutions

TowerXchange: Please can you introduce Ramboll to TowerXchange readers.

Thomas Brink Laursen, Business Development Director, Ramboll: Ramboll was founded in Denmark in 1945, and today we are approximately 14,000 employees globally. Aside from Telecom, we provide consultancy services within Buildings, Transport, Planning & Urban Design, Water, Environment & Health, Energy and Management Consulting. Our presence is global with especially strong representation in the Nordics, the UK, North America, Continental Europe, Middle East and Asia Pacific, and we have 300 offices in 35 countries. As a provider of telecom consultancy we seek to become a trusted knowledge partner to our clients, offering technical support throughout the project lifecycle. Our client base includes tower companies, operators, vendors, contractors, investors and other parties.

TowerXchange: On the spectrum between an "off-the-shelf" and "completely customised" method to designing and supplying towers, where does Ramboll sit? What is the reason behind this approach and what are the main capabilities that you have to support this?

K. Suresh Babu, Business Development Director, Ramboll: Market conditions and demands differ depending on clients and geography, and it is Ramboll's experience that customised solutions provide maximum value to our clients. This not only relates to towers, but generally to all our services. We need to find the most cost-effective solutions

for each of our clients, and therefore we need to consider each project as unique. In Ramboll we take advantage of having been in the telecom business for almost 70 years, and with optimised processes and advanced expertise supported by our advanced in-house software, it is possible for us to provide highly optimised designs within short timelines.

TowerXchange: There is strong demand for low cost and rapid deployment towers at present in Africa – how has Ramboll been supporting and servicing this demand, what solutions do you have and perhaps can you share some projects that you have been involved in?

Thomas Brink Laursen, Business Development Director, Ramboll: In Ramboll we put a lot of effort into innovation and continuous development of new concepts and solutions to the market. Rapid deployment solutions have been requested by the market for some years now, but due to higher cost, these solutions have not been implemented in the scale we would have expected. We have recently modified our concept for our Rapid Deployment Units (RDUs) and have a complete model site for RDUs, which we believe is the right solution for this demand. Our RDU designs are being deployed in the African market, and we believe it will span to more projects in the coming years.

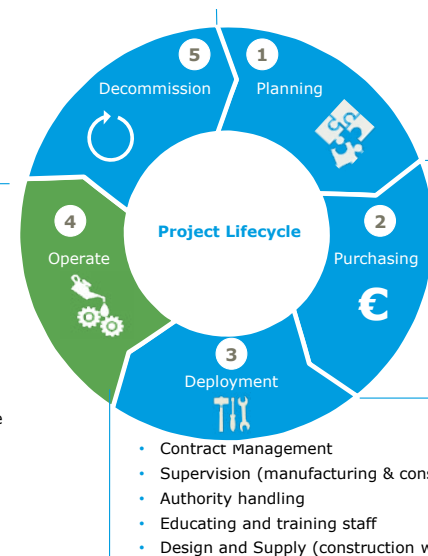
TowerXchange: When upgrading towers for the addition of tenants there can be a lot of inefficiency in the suggestions made by consultants, can you share some examples of where Ramboll has helped clients develop a more cost-effective solution.

RAMBOLL CAN SUPPORT IN ALL PHASES OF A PROJECT LIFE CYCLE

Ramboll Services areas:

- Execute Decommissioning / Site Retirement Plan
- Evaluate site life cycle and learnings

- Software Solutions
- Asset management programs
- Operation and Maintenance Planning
- Perform condition assessments
- Focus on optimal utilization of sites
- Risk Assessments
- Validation and Upgrade
- EMR



- Design of smart City Solutions
- Design of Masts, Towers & Monopoles
- Site design (Model sites)
- Technical Due Diligence
- Design requirement specifications
- Provide site specific designs

- Identify solution providers and suppliers
- Collect supplier information on size, products, competencies etc.
- Approvals and Negotiation
- Supply chain management

- Contract Management
- Supervision (manufacturing & construction)
- Authority handling
- Educating and training staff
- Design and Supply (construction with partners)

- **Project Excellence:**
- Over the years Ramboll has experience an increased demand for project excellence, as projects are becoming increasingly complex.
- Ramboll has a dedicated and methodized project management approach, which is commonly used across Ramboll.

RAMBOLL ■ CAPEX Phases ■ OPEX Phases

Thomas Brink Laursen, Business Development Director, Ramboll: It is correct that several of the solutions implemented on sites today are inefficient and do not consider long-term sustainability. Providing a cost-effective solution is to a large extent about communication. There is a need to discuss the goal amongst the stakeholders as there is a risk of optimising the solution on the basis of the wrong parameters if this discussion is not included in the process. Upgrading towers should be a strategic consideration where the tower portfolio is looked upon as a whole. The strategic decision should be taken by combining technical and commercial knowledge. Ramboll is a knowledge partner to our clients, and it is always Ramboll's aim to talk

strategy before deciding on concrete solutions.

For instance, after discussions with one of our trusted clients, who was executing a strengthening project on several existing towers in Africa, we understood that the overall aim of driving down the cost was not really met, and hence we were asked to investigate the solution. It was clear that the speed of the implementation was quite good. However the overall cost, including the materials, was high. We provided an alternative solution to our client, based on a generic strengthening solution, grouping towers to streamline the manufacturing and supply chain as well as make the implementation easier. It required upfront changes to the solution and



the supply chain, and obviously the initial cost went up due to additional design and management hours. However, including the material and implementation cost, our client saved more than 20% of the initial implementation cost. In addition, we ensured that the towers were calculated in accordance with the latest standards. If our client had not been ready to share their overall challenge and their goals, Ramboll would not have been able to provide efficient support.

We generally believe that more time should be

spent on planning, if our aim is to work effectively and minimise the total cost of a network upgrade. We are obliged to move towards sustainable solutions, and the way we work should mirror that, rather than focus on a short-term quick fix.

TowerXchange: Smart city initiatives and increased requirements for densification in urban areas are fuelling demand for camouflage solutions – can you share some designs/ initiatives that Ramboll has been involved in and how you helped clients fill a brief?

K.Suresh Babu, Business Development Director, Ramboll: As previously mentioned, we put a lot of effort into development and innovation of new concept solutions, and obviously Smart City solutions are also under the Ramboll innovation umbrella. It is important for Ramboll to be in the forefront when it comes to development, and in respect to Smart City solutions we have decided on four focus areas:

Integrated and multi-purpose solution: Telecom cells that can be integrated in smart structures which also serve other purposes like traffic signalling, public security systems, disaster response mechanism etc.

Infill sites: Smart structures at vantage points or along city streets to enhance connectivity and provide faster data.

Aesthetic solutions: Structures that can be functionally designed to suit the aesthetic requirements of a city or the client's need (camouflage)

Counter CO² emission: Integrated multipurpose solution, which is custom-made to meet several demands, with the aim to reduce material and resources resulting in reduced CO² emission

Such solutions can become beneficial not only to our clients, but also to society, as they may have environmental and social benefits too. Some of our concepts have already been manufactured and installed by our clients, and one picture from India can be seen in the accompanying photo ■

Methanol fuel cells making inroads into the telecoms sector



An interview with SerEnergy, provider of silent and emission free power solutions for telecoms



John Lindegaard Kjær, Sales & Marketing Director, SerEnergy

SerEnergy is one of the largest methanol fuel cell manufacturers in the world and a pioneer in powering telecoms infrastructure with this kind of solution. TowerXchange speaks to the company's Sales & Marketing Director, John Lindegaard Kjær to understand where fuel cells can bring real benefits to telecom sites regardless of the grid conditions.

Keywords: Americas, Business Case, Energy, Energy Efficiency, Energy Storage, Fuel Cell, Fuel Security, Hybrid Power, Meetup preview, Microgeneration, O&M, Off-Grid, On-Grid, Opex Reduction, Outdoor Equipment, Renewables, ROI, SerEnergy, Site Level Profitability, Unreliable Grid, Who's Who

Read this article to learn:

- SerEnergy's footprint, activities and production capacity
- The different use cases of fuel cells and comparison with other sources of power generation
- Serenergy's fuel cell efficiencies and space requirements for indoor and outdoor scenarios
- How to install and maintain fuel cells
- The positive impact of fuel cells on emission reduction

TowerXchange: Please introduce SerEnergy, its activities and footprint.

John Lindegaard Kjær, Sales & Marketing Director, SerEnergy: SerEnergy has been in the market since 2006, developing and manufacturing power systems. We focus on the stationary market for backup, supplementary and primary or hybrid power sources. We distribute our systems globally.

SerEnergy's products are based on High Temperature PEM fuel cell technology that improves our clients efficiencies around 40-45%, while reducing cost and replacing conventional, pollutant technologies such as diesel generators.

With a green mindset SerEnergy aims to contribute to the world's transition from fossil fuels to renewable energy, as well as overcoming some of the obstacles within the renewable sector such as flexibility and availability.

Headquartered in Aalborg Denmark, SerEnergy is a leading fuel cell manufacturer. Owned by German company (Fischer Group) we have 2,500 employees, strong financial capabilities and the ability to support our customers globally.

TowerXchange: Fuel cells have not been spoken about much in the TowerXchange Journal, can you explain what grid situations they are most suited to and how extensively they have been deployed?

John Lindegaard Kjær, Sales & Marketing Director, SerEnergy: There are various types of methanol

fuel cell systems, but in general they can be used for backup power, supplementary power or primary power.

Backup power

A lot of customers around the world need to be able to run communications systems at all times, which puts more stress on the reliability of the systems and on grid availability. This means that even if you are based in areas where loss of grid (down time) only happens every second year or less, you still need a backup system that is always able to provide power so that your systems keep running. If you need longer than six or eight hours of backup time, batteries typically become too heavy, space demanding and expensive.

Traditional diesel generators offer longer backup time, but for systems that are not running very often they still need to be maintained, and you need to make several startups per year to make sure they can run in a backup situation. Our fuel cells offer great advantages in those cases, since they are able to be used for both short and long backup time. At the same time, they are more or less self-maintaining and even if they are not in use, the systems are able to be kept in optimal conditions through self-test programs and automatic start-up cycles.

Core telecom sites and security networks are some good examples, and we could also highlight systems located in regions where you often see extreme environmental conditions such as earthquakes or typhoons that cause long grid blackouts.

Supplementary power

In many situations and regions, you need a supplementary power system which is able to take over when the primary power source is not running. The system could run several hours per day or per week. This could be for regions with unreliable grid, but it could also be part of a green installation with solar panels, wind turbines or other energy sources where the fuel cells can ensure that the system is running 24/7. In many parts of the world, especially Asia and Africa, the grid is highly unreliable and in order to keep telecom sites up and running you need either an alternative to grid power or a system that can run several hours a day or per week due to outages. Methanol fuel cells offer an ideal solution to conventional power sources like diesel generators due to low fuel cost and less maintenance requirements.

Primary power

Methanol fuel cell systems are also a great alternative to traditional diesel generators when it comes to providing power for off-grid sites. There are large investments involved in connecting remote sites to the grid, so together with the low operation cost and the relative little investment, the fuel cell system can offer large cost benefits for the customers. Both maintenance and fuel cost are in most cases much lower when operating a methanol fuel cell system if you compare them with diesel generators.

TowerXchange: What advantages do fuel cells offer above other sources of generation?

John Lindegaard Kjær, Sales & Marketing Director, SerEnergy: The fuel cell technology has a number of advantages compared to batteries and diesel generators. First of all, the fuel cell system is a technology that offers up to 70% reduction of CO₂-emissions. Besides that, the fuel cell technology offers several clear advantages compared to diesel generators. Especially in densely populated areas where the surroundings are quite sensitive to noise, vibrations and harmful emissions. Diesel generators will give you all three at the same time, while the fuel cell system can offer you low noise, no vibrations and no harmful emissions due to the nature of the technology. This allows customers to set up the base-stations where the coverage is best, and it also makes it easier to get the required approvals from the owner of the property as well as the authorities.

Fuel cell solutions offer a very compact design per kW. It can be installed in either an outdoor cabinet next to the actual telecom equipment or it can be integrated into an existing indoor solution. In an outdoor solution, the footprint for up to 15 kW is typically not bigger than 1×1 metre including cabinet, modules and tank while in an indoor installation offers an even smaller footprint integrated into e.g. a 19" rack system. Not only is it convenient on existing sites but it also saves money on rental cost and installation.

Our fuel cell system is fully monitorable, not only when it comes to power output but you are also able to monitor the state of the inside of the system e.g. fuel cell stack, reformer et cetera. At the same time

the system is running fully automatically and will be more or less self-maintaining and conditioning. The monitoring system also allows you to monitor fuel levels, state of the grid and alarms making it possible for the customers to respond faster to alarms, service requests etc.

The efficiency of the fuel cell system is another area where it outperforms existing technologies. The fuel cell system is dimensioned according to the exact needs of the customers and it runs at a very high efficiency no matter if it is delivering 30% of its capacity or 100%. The electrical efficiency rate is typically between 40-50%.

Methanol fuel cell offers a cheap fuel source. Methanol fuel cells runs on a blend of water and methanol which is easily accessible in most parts of the world and at low rates. At the same time the use of methanol offers a CO2-neutral alternative to traditional fuels, depending on the source of the methanol.

TowerXchange: How robust is the system and how simple is it to install and maintain?

John Lindegaard Kjær, Sales & Marketing Director, SerEnergy: Fuel cells offers a robust design, meaning that the technology is equipped for the most extreme conditions. The installation of the fuel cell system is quite easy and in most cases, offers more flexible and faster installation options than traditional power sources – like the options for integration into existing enclosure solutions. The fuel cell system is a compact and lightweight design which is a big advantage for base stations with

limited space and also for installations in city areas on rooftop sites, in buildings et cetera.

TowerXchange: What kind of opex reductions can fuel cells provide and how does TCO compare to other sources?

John Lindegaard Kjær, Sales & Marketing Director, SerEnergy: Our methanol fuel cell systems offer low maintenance because they are self-conditioning and maintaining, and the systems can be monitored remotely, resulting in large savings in terms of service cost, unplanned site visits et cetera. As mentioned, previously methanol is a cheap fuel source and, in most cases, and in most parts of the world methanol is cheaper than traditional fuel sources.

TowerXchange: How do SerEnergy differentiate themselves from other fuel cell providers in the market?

John Lindegaard Kjær, Sales & Marketing Director, SerEnergy: SerEnergy was established back in 2006 and has since then worked intensively with the implementation of the technology into stationary applications like telecommunication. That also means that the SerEnergy fuel cell systems have been tested and deployed in many markets and with many customers giving a proof of concept which not many competing companies can match. SerEnergy is committed to serving our customers commercially and technically meaning that we support our customers remotely and locally in a way that not many of our competitors are able to offer ■



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How can Artificial Intelligence help towercos and MNOs?



SiteSee's pioneering AI solution is improving site audits through drones, 3D imagery and automation



Lucio Piccoli, CEO & Co-Founder, SiteSee

Three years ago, Australian start-up SiteSee developed a solution to evaluate tower equipment radiation using drones. After testing it in the United States, the company realised that their initial idea could be turned into a more sophisticated and complete site survey system using Artificial Intelligence. After working with Telstra and other tower owners globally, SiteSee continues expanding an AI solution that provides 3D imagery and helps towercos to inspect towers more efficiently, providing accurate information that ultimately translates into cost reduction and generates new revenues. TowerXchange sat down with SiteSee's CEO and Co-Founder Lucio Piccoli to hear about the company's evolution and the benefits that AI is bringing to towercos and MNOs across the globe.

Keywords: Artificial Intelligence, Asia, Australia, Capex, Health & Safety, Meetup Preview, Monitoring & Management, Opex Reduction, Outdoor Equipment, Site Management System, Site Surveys, Site Visits, SiteSee, Telstra, Towercos, United Kingdom

Read this article to learn:

- SiteSee's journey and solution
- How is AI driving efficiencies and boosting revenue for towercos
- The main inspection and maintenance challenges that tower owners face globally
- Why Telstra and other industry players are betting on AI

TowerXchange: Can you please introduce SiteSee and share your journey with our readers?

Lucio Piccoli, CEO & Co-Founder, SiteSee: SiteSee's journey started three years ago as a start-up business in Brisbane, Australia. Initially, Artificial Intelligence (AI) was not the original focus of the business. Instead, we were focusing on visualisation and radiation hazard (RadHaz) estimation of cell tower equipment.

After developing the world's first Level of Detail (LOD) web-based 3D viewer in 2016, we also developed a Radiation Hazard Analysis (RadHaz) simulation tool for antennas and formulated a repeatable drone-captured images process, which we trialled it in the U.S. market with very little interest. The feedback we received from the U.S. trial pushed us to create an automated audit and assessment system using Artificial Intelligence, hence we pivoted into an AI start-up. The move made sense for us, since we already had lots of data and detailed 3D expertise. Given the commodity nature of cloud computing, AI frameworks and the business benefits that AI is delivering to towercos, SiteSee has seen rapid market penetration not just in Australia but also across the U.S., the United Kingdom and Southeast Asia.

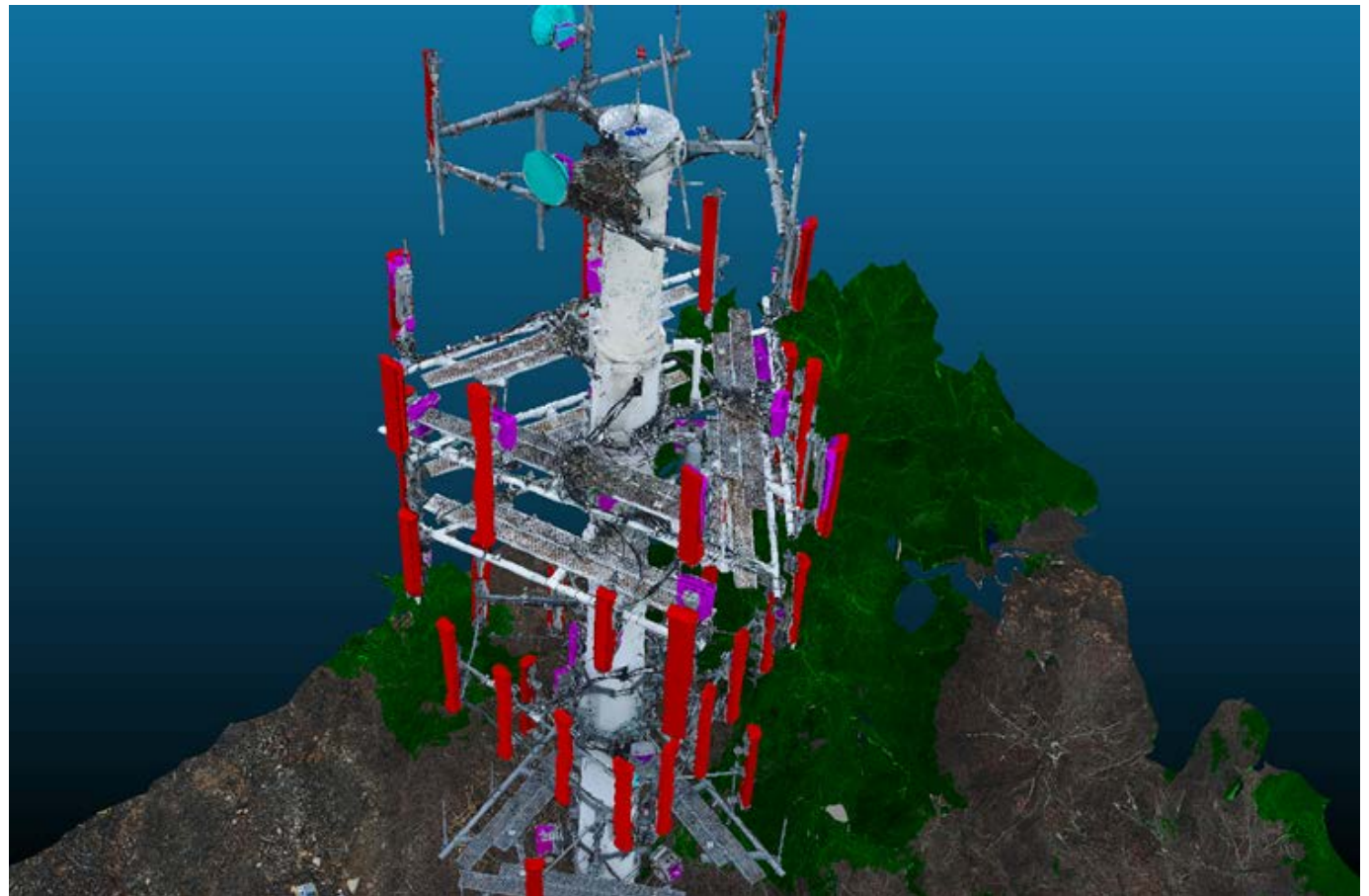
TowerXchange: AI integration is a revolutionary element for towercos and MNOs. Could you explain how SiteSee's process work?

Lucio Piccoli, CEO & Co-Founder, SiteSee: The workflow is end to end, starting with the drone data capture. We provide an programmed drone mission planner that allows customers to capture images automatically. The images are then uploaded to the SiteSee cloud, where the intense computation workflow commences. These workflows include 3D reality model generation and AI for equipment identification and corrosion. Then, we do the final deployment to the web portal via a fully automated process.

TowerXchange: What are the three main challenges that you are helping towercos and MNOs to solve?

Lucio Piccoli, CEO & Co-Founder, SiteSee: Missed revenue, incorrect tower load and high maintenance cost are the three main challenges that we always hear from towercos. All three problems can be solved through accurate, low-cost audits as they are critical for billing, engineering and maintenance operations. Missed revenue opportunities are quickly solved by the automated equipment audit which identifies all equipment on the towers and ensures an accurate MNO billing process.

On the structural side, inaccurate tower loading makes engineering teams nervous and cautious. Having accurate equipment dimension and positions in 3D helps companies to confidently predict tower loading which is a safety matter, first and foremost. This accuracy helps towercos to



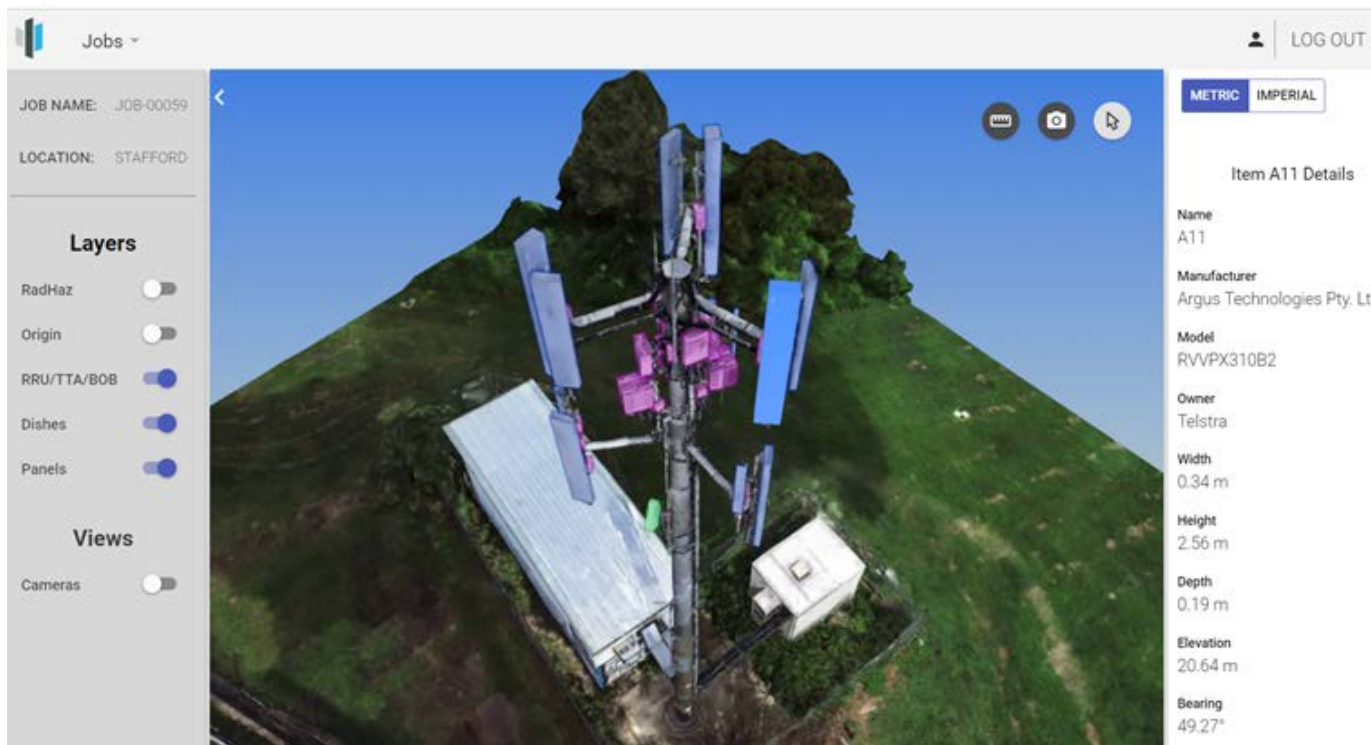
identify unused space, which is particularly crucial in preparation for 5G.

Finally, tower maintenance will never be replaced by drones, but it can be optimised by providing accurate corrosion classification and identification. The corrosion audit allows for desktop reviews and comparisons over time of corrosion behaviour.

TowerXchange: SiteSee started in Australia but has since expanded its operations from India

to the U.S. Could you tell us more about your global footprint and what are some of the key differences between the various markets you serve?

Lucio Piccoli, CEO & Co-Founder, SiteSee: After speaking with tower operators in the U.S., UK, India and Australia, it became very evident to us that global towercos and MNOs work in a rather similar manner when it comes to their tower and asset management. At the end of the day, they



AI to create an automated solution to provide insights to towercos while also reducing the human intervention required to manage a large portfolio of towers and millions of billable assets.

TowerXchange: Who are some of your main clients? Can you share some success stories?

Lucio Piccoli, CEO & Co-Founder, SiteSee: We provide services mainly to towercos but we also have some MNO clients. We have successfully collaborated with Australian operator Telstra, helping the company to identify important antenna installation anomalies thanks to our AI report, which ultimately generated considerable cost reductions.

The key takeaway from this collaboration was the need for Telstra to move to annual tower audits instead of the industry standard of two to five years audit program. The current manual audit process has too much friction as it has become very evident that automation is key to annual portfolio audit scalability, which is delivered through SiteSee’s automated AI.

all want to know what is installed on each of their towers.

In Asia, our main challenge relates to pricing and the comparison with the low cost of human audit procedures currently in use. Our relatively high price point was a major barrier in the adoption of our advanced technology but this is finally changing, as customers are focusing more on value rather than cost.

By adopting our solution, they are now able to make reliable decisions on how to upgrade their sites to 5G. In fact, tower upgrades require accurate

information on every site and what’s installed on each of them. SiteSee is able to provide that level of details and allow its clients to plan accordingly.

TowerXchange: What is unique about your solution in comparison to its competitors?

Lucio Piccoli, CEO & Co-Founder, SiteSee: The unique capability of the SiteSee solution can be simply summarised. We are the world’s first Artificial Intelligent cell tower equipment audit service. We have patents for our Face-Map algorithm that results in 2D to 3D classification. This patent harnesses the power of drones and

SiteSee is currently performing a large-scale audit for a UK-based towerco with complex equipment deployments. The SiteSee solution is providing the information for the “equipment realignment project” of the towerco asset database. The driver is to provide greater revenue from identification of incorrect billing while unlocking tower capability. The program is not yet complete but the results are already providing insights that the engineering and billing teams have been eager to analyse for years ■

Embracing complexity: how Sitetracker is helping infrastructure owners level up their assets



Sitracker's platform can help MNOs and towercos in the race to 5G



Giuseppe Incitti, CEO, Sitetracker

Working with high profile clients like Verizon, Nokia, Cox Communications and Alphabet is testament to Sitetracker's results and usability. Now more than ever, telecom infrastructure owners need to understand and manage their assets to plan, deploy, maintain and grow the value of their portfolios. As the number of points of presence globally proliferates at a huge rate, the processes of construction, colocation and maintenance become increasingly complex. We spoke with Sitetracker CEO Giuseppe Incitti, to find out more about how their solutions can help infrastructure owners manage complexity and position themselves for 5G success.

Keywords: 5G, Alphabet, Asset Lifecycle Platform, Asset Register, Co-locations, DAS, Energy Efficiency, Europe, Fibre, Monitoring & Management, Noka, Operational Excellence, Site Level Profitability, Site, Management System, Site Surveys, Site Visits, Sitetracker, Small Cells, Smart Cities, Verizon, Wi-Fi

Read this article to learn:

- Who Sitetracker are and what they have delivered to date
- Why having control and insight into assets is critical for MNOs carving out towers
- What tower owners need to consider when preparing for 5G rollout
- Which smart city solutions Sitetracker has got up and running

TowerXchange: Please introduce Sitetracker, your company, and footprint.

Giuseppe Incitti, CEO, Sitetracker: Our mission is to power the successful deployment of critical infrastructure. As the global standard for managing high-volume projects, the Sitetracker Platform enables growth-focused innovators to optimize the entire asset lifecycle. From the field to the C-suite, our software enables people to perfect how they plan, deploy, maintain and grow their capital asset portfolios. Our customers are market leaders in the telecommunications, utility, smart cities and alternative energy industries, including Verizon, Nokia, Cox Communications, Alphabet, and Tillman Infrastructure. They rely on us to manage millions of assets and projects representing over \$19 billion of portfolio holdings globally.

TowerXchange: Tell us about your solutions – can you give any examples of what you've delivered in telecoms to date?

Giuseppe Incitti, CEO, Sitetracker: We work with companies across the telecommunication industry, including fibre, engineering, small cell, DAS, and tower companies. Some of our telecommunications customers include Verizon, Cox Communications, ISCO International, and Tillman Infrastructure. Our tower customers, for example, use Sitetracker to manage assets, leasing, co-location, site acquisition, maintenance, and more. So, we're working with leaders in tower construction, site and tower asset maintenance, and site acquisition who have embraced change and are ready to succeed at this inflection point in the telecommunications industry.

TowerXchange: Sitetracker works across many verticals within critical infrastructure. Can you tell us about some of the similarities and differences between telecommunications and other verticals you work in? What does it tell us about the telecoms market?

Giuseppe Incitti, CEO, Sitetracker: We work with other industries, including utilities and smart city companies, which, similar to the telecommunications industry, have very unique challenges that lay ahead. Utilities are looking at issues like load growth and integrating renewable and distributed resources into the grid. These challenges will result in increased project complexity for the utility industry, so that's definitely a parallel between telecom and utilities, but that's not the whole story.

Telecom companies are facing an unparalleled shift in the types of projects needed and how those projects need to be executed. 5G and network densification are completely new challenges that changes the dynamic of the industry. At this critical juncture, it's imperative that industry telecom leaders embrace change. The race to 5G is a uniquely telecom-related challenge.

Explosive growth in mobile data traffic means companies must make an important choice about their operations. The telecom industry is at an inflection point. As our communities become more connected, the volume, velocity, and variety of telecom-related infrastructure projects are exponentially increasing. Leaders in the industry

are adopting purpose-built software to effectively plan, deploy, maintain, and grow the value of their asset portfolios. In order to keep up with the rate of innovation and increasing connectivity, successful companies are improving their operations with technology built for the management of site-based, repeatable projects like new tower construction, co-location, and tower maintenance.

These projects still require roughly the same end-to-end process for planning, deploying, and maintaining assets, including site identification, acquisition, regulatory approvals, design, construction, testing, validation, and more. But, instead of being vertically integrated, mobile network operators are increasingly relying on third-party service providers, who may, in turn, contract-out work to specialists for different project phases. More parties working on a higher project volume means higher complexity, making effective collaboration more crucial than ever before.

Throughout the industry, inadequate technology fails to offer live interaction between project managers and field workers, lacks the agility to handle the increasing variety of projects, and scatters mission-critical information across disconnected systems. We're seeing this across a lot of other industries, too.

TowerXchange: With so many towers in Europe changing hands or being carved out at the moment, where can Sitetracker add value for tower owners?

Giuseppe Incitti, CEO, Sitetracker: There are over 600,000 towers in the Europe right now and, increasingly carriers are selling their towers to independent tower companies. This provides many benefits to carriers, but it does increase complexity by increasing the number of parties involved in co-location and leasing. Carriers must now work more with tower companies. If we had to sum this all up, we'd say that the industry is facing the greatest level of complexity it has ever seen and we believe the only way to navigate the complexity is through finding operational improvements on your way to operational excellence. That's where we add value.

TowerXchange: Tower owners are starting to evaluate their macro assets ahead of the load and support changes which will come into play as 5G rolls out – can you give us examples of some of the things tower owners will need to bear in mind, and how that information can best be used?

Giuseppe Incitti, CEO, Sitetracker: As 5G begins to roll out, tower owners will need to maintain and optimize their towers. Tower owners will need to embrace the changing telecommunications landscape and ensure that the pillars of telecommunication, towers, are in the best shape possible to support 5G. This means rigorous maintenance and upkeep, as well as coming up with new ways to make the most of existing towers.

The second thing I would say tower owners need to think about is how co-location will take place in the future. Some carriers are starting to work together



Effectively manage and monetize the full lifecycle of tower projects



on new builds, investing in the same, shared infrastructure. This means that tower companies could have multiple stakeholders from the outset of a new tower build. Managing complexity like this requires tower companies to embrace new planning and deployment technology in order to adapt to this new era.

TowerXchange: As well as telecoms, you also have a Smart City solution – can you talk to us about the scope of that offering? Do you find it is converging with your telecoms offering as tower companies and Mobile Network Operators begin to move into this vertical?

Giuseppe Incitti, CEO, Sitetracker: So, one example I'll give is LinkNYC. The City of New York partnered

with Intersection to create LinkNYC, a pioneering smart cities program to convert over 7,500 public payphones to kiosks and create the largest and fastest free wifi network in the world. This project lives at the convergence of telecommunications and smart cities. Beyond the challenge of creating an all-new, purpose-built fiber optic network, each kiosk deployment requires approximately 450 tasks, spread across 15 teams, from start to finish. Not only was Intersection deploying kiosks in New York City, but they also took on this project in the UK through their LinkUK program.

In New York, they were able to simultaneously manage over 4,000 kiosk builds effectively in phase one of the project, including coordination across 15 teams and the city government, shorten time to

revenue for a \$500 million opportunity in digital advertising over 12 years, efficiently forecast project completions, and share deployment progress with all stakeholders through dynamic maps.

Intersection recognized that they were embarking on a new, innovative kind of program and needed a correspondingly innovative way to manage it. Sitetracker enabled the entire LinkNYC team — from Intersection's project managers and executives to vendors' field workers and city representatives — to instantly see the status of all of their projects through easy-to-use reports, dashboards, and dynamic maps. Sitetracker keeps the public informed, too: a map of Link locations on LinkNYC's website, showing in real time which kiosks are online and coming soon, is a standard Sitetracker feature.

In addition to this kind of tracking, the LinkNYC team is able to understand the maintenance status of all of their assets and keep a schedule of maintenance projects, ensuring that kiosks kept in working order. The Sitetracker Platform also enables Intersection to perform work management for each of these projects, ensuring that the right people with the right skills are in the right place at the right time.

We see Sitetracker as a solution for companies looking to embrace change, whether that means new types of projects at the intersection of telecom and smart cities or a new way of managing projects to scale with demand ■

Scalable solutions for a converging infrastructure landscape



STULZ is building on a strong pedigree in cooling to offer shelter and edge solutions to evolving customers



Johann Mater, Global Key Account Manager, STULZ

As tower owners face increasing pressures to improve efficiency in their passive infrastructure and prepare for 5G rollout across their networks, STULZ have leveraged their 40 year history in providing cooling solutions for MNOs, towercos, datacentre providers and other infrastructure owners to offer modular, scalable solutions which meet modern infrastructure needs. TowerXchange caught up with Johann Mater, Global Key Account Manager at STULZ, to find out more about how STULZ has seen the market developing and how their new solution will help infrastructure owners avoid costly mistakes.

Keywords: 5G, Air Conditioning, Energy Efficiency, Europe, IoT, Operational Excellence, Outdoor Equipment, Passive Equipmentm Rectifiersm, STULZ, Site Visits

Read this article to learn:

- STULZ's history and credentials in the market
- The dynamics in mature markets driving tower owners to upgrade their passive infrastructure
- The importance of TCO and tangible savings which can be made in efficient cooling solutions
- How STULZ's modular shelter and edge datacentre solutions can help avoid costly missteps

TowerXchange: Please introduce STULZ, your footprint and background.

Johann Mater, Global Key Account Manager, STULZ: STULZ was founded in 1947, and has been providing solutions for mission critical cooling since the 1970s, so we look back to more than 45 years of experience in this area. Though being a family business in the third generation, we are a truly global company, with a footprint in over 140 countries, by which I mean more than just a sales office or box movers: we can cover a full cycle of services, working through tenders, preparing shipments, installing and maintaining equipment in each country where we operate. The further developed idea of this holistic approach can also be found in our claim, which at the same time reflects our philosophy. "ONE STULZ. ONE SOURCE." stands for the comprehensive range of our portfolio – From Room Cooling and chillers to Airhandling Units and self-developed DCIM software to our EDGE solutions called "True Edge".

TowerXchange: STULZ is a global brand, with operations all over the world. Tell us more about the specific dynamics of the European market and what your European clients are looking for?

Johann Mater, Global Key Account Manager, STULZ: For MNOs we've seen a huge increase in demands for mission critical cooling, particularly in terms of hyperscalers entering the European market and changing the way they see cooling requirements. The scale of their needs is much bigger and influenced by ideas we have seen over the last two to three years in America and Asia.

Awareness of the TCO is also becoming more and more important. If you look back five years, all of

the conversations we had were about CAPEX, we were always finding the most effective solutions and training our partners and consultants to look at the TCO but procurement teams were only paying attention to CAPEX. They didn't pay the electricity bills so they had no awareness or personal interest in going for the most efficient units. Over the past couple of years this attitude has changed a lot, the hyperscalers and big datacentres are using so much power that we're talking about a cost difference of six figures in some cases, so it's playing a much bigger role. Europe still has cooling with a raised floor but new ideas are coming from datacentres and we will see this change soon.

TowerXchange: We find European tower owners are starting to pay much closer attention to squeezing operational cost savings/efficiency out of their networks. Tell us how STULZ can deliver measurable results to mature tower portfolios?

Johann Mater, Global Key Account Manager, STULZ: We've worked with European MNOs for many years. Eight years ago we set up a joint development with an MNO partner to help them become the most efficient telecom operator in terms of towers. We provided specialised equipment for shelters with integrated free cooling to cope with efficiency requirements in non-urban areas. Through this joint dev we were able to save up to 95% of energy costs per container by using a unit paid off within half a year. Joint dev allows us to dev what companies really need.

TowerXchange: The European market has changed rapidly over the last five years and 2019 is set to evolve further. Do you see a distinct difference in the way MNOs, towercos and other

infrastructure providers approach the way their portfolios are managed?

Johann Mater, Global Key Account Manager, STULZ: They have always been quite focussed on energy, the awareness was always there, but it's increased recently. I actually don't see a big difference, I see that people are more looking at serviceability and service capabilities, and specialised service is playing a big role as well.

TowerXchange: As 5G rolls out we're going to see new equipment placed on towers and much higher demands placed on the network. How ready do you think European tower infrastructure is, and what advice would you give to tower owners wanting to prepare their networks?

Johann Mater, Global Key Account Manager, STULZ: The challenge with 5G is that there are no fixed parameters and definitions yet. I would really like to see what the speakers say about it at Meetup Europe. Nevertheless, 5G is a great opportunity for us: it's the start of IoT, connected vehicles etcetera, and we are looking forward to creating a future with 5G companies and helping them find the right solutions. With our True Edge system we are perfectly prepared for the requirements of providers and towercos that are specialized on 5G and Edge development. The STULZ portfolio offers everything from cooling on a component level up to turnkey solutions. At the moment, we are just waiting for our customers to give us the go-ahead so that we can start planning and realizing their projects.

When it comes to the demands of 5G, everything is going to change: densities in shelters will increase, telecoms equipment has new requirements, cooling

equipment will need to change. Particularly looking at the energy efficiency trend and evolution of cooling equipment over the last few years – if it's over five years old it might be worth considering new technology. It might even make sense to think about a holistic conversion towards a turnkey solution. STULZ can help with their tools to identify the TCO and ROI of these new systems.

TowerXchange: We're seeing a shift towards infill and convergence between communications infrastructure networks, particularly in urban areas. How has this affected your offering and what can clients expect from you in future?

Johann Mater, Global Key Account Manager, STULZ: Our portfolios starts with cooling solutions from 500W to 2MW, so we can offer anything from watts to kilowatts to megawatts. The full range is there and can be implemented into our turnkey solutions. When it comes to infill and convergence, we have edge solutions so we can go from one solution with fire suppression, UPS backup and cooling up to a full datacentre made of modules. Scalability is important as customers want to start small and pay as you grow. Scalability is a given. We have been working on this solution for the last three years and 2019 is the year when we will bring the whole solution to market. Despite the fast pace of the 5G market, our "True Edge" solutions are scalable and modular, so they are designed to meet the needs of our customers in an ideal way - for every conceivable scenario. By combining the customer's expectation with our expertise, we will be able to customize our solutions to make it fit for their environment – turnkey means you can scale what you like instead of re-inventing the wheel each time ■

Tarantula: swiftly adapting to IFRS 16 and always innovating for its large customer base



Cutting-edge lease modules, critical projects across Asia and more



Anders Smedberg, CEO, Tarantula

Tarantula has a long history of successes in providing towercos across the globe its cutting edge portfolio management solutions. In this interview, Anders Smedberg, who has been recently appointed CEO and Head of Sales for the company, shares with TowerXchange some of the latest addition to the company's product portfolio such as the new IFRS 16-ready lease module and the innovative small cell module as well as insights into some of the most complex projects they have been working on.

Keywords: Asia, Asset Register, Build-to-Suit, Business Model, DAS, Infrastructure Sharing, Job Ticketing, KPIs, Logistics, Monitoring & Management, Operational Excellence, RoI, Site Management System, Small Cells, Southeast Asia, Tarantula, Valuation

Read this article to learn:

- Introducing Tarantula's new Chief Executive Officer
- Tarantula's latest products suitable for small cell portfolios and IFRS 16 standards
- The company's engagement in Asia and examples of latest regional projects
- Why towercos shouldn't manage their portfolios via Excel sheets

TowerXchange: Most of our readers know Tarantula but can you please re-introduce the company, its operations and footprint? And what is your role within the company?

Anders Smedberg, CEO, Tarantula: I joined Tarantula at the beginning of 2018, taking on the dual responsibilities of CEO and head of the Sales team. I have over 25 years of experience in leading telecom, IT, and financial market companies and I was previously working with Ericsson where I was responsible for their BSS portfolio.

At Tarantula, I've been working closely with our customers since I started and establishing contacts in the towerco industry with the aim to secure our position as market leader in the telecom site management software space. Based on the feedback, we have adapted our go-to-market model to suit the market needs of rapid deployment, quick turnaround times and a flexible license model that suit small, medium, and large towercos. The response from the market and customers has been very positive and we already see a steady demand growth for our solution and expertise.

Tarantula was launched more than 15 years ago with the objective of creating site-sharing solutions for the operators and tower companies in the UK. At a time when telecom infrastructure sharing concepts were still considered to be a novelty, we offered web-based solutions with embedded workflows to simplify the process of site sharing. We have come a long way since then, having developed an end-to-end, purpose-built site portfolio management solution for tower

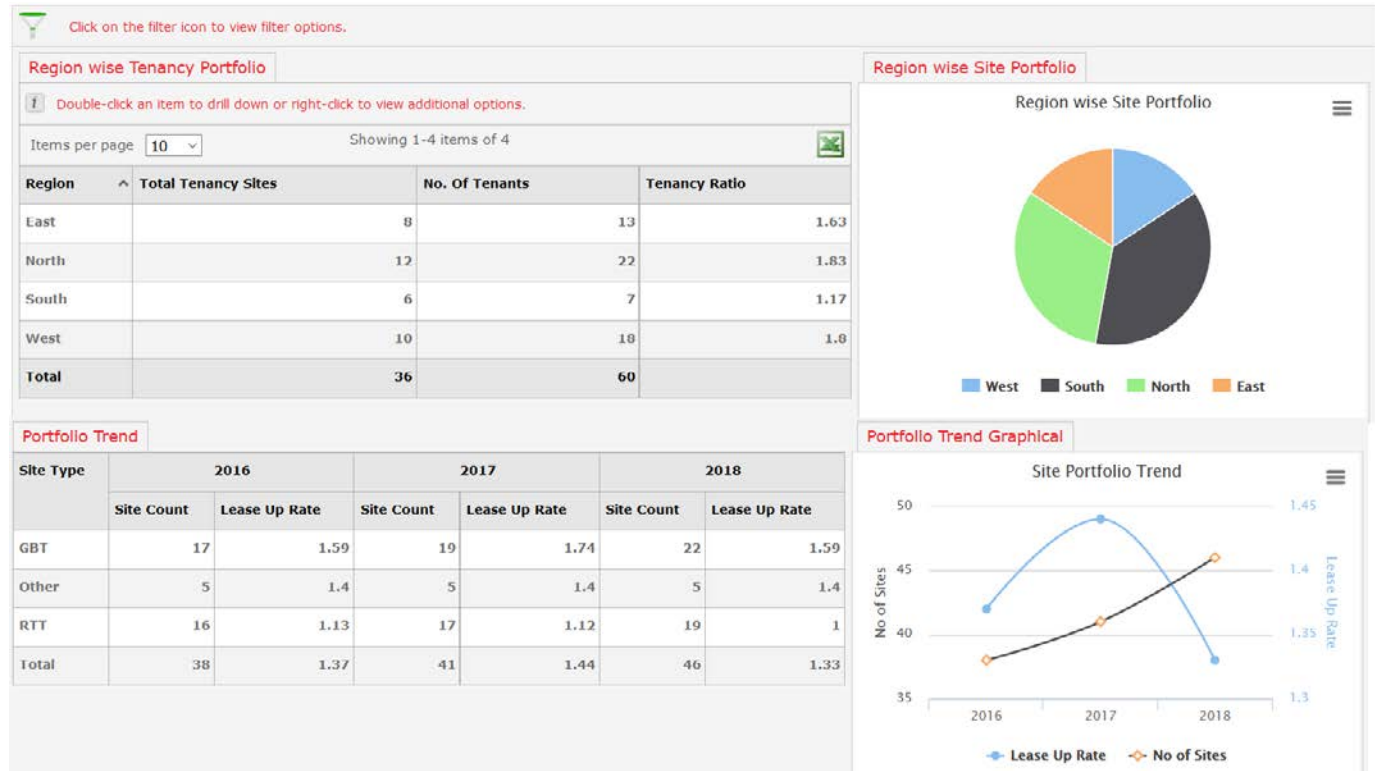
site owners to help them monetise their towers with efficiency and control. Additionally, with our value-based services, we strive to advise and lead our customers to maximise the value of their businesses.

We were acquired last year by Volaris Group, an operating arm of Constellation Software Inc., a Toronto-based software and services provider. The new ownership has opened avenues for us to enter new markets such as South America and Eastern Europe while enabling us to expand our product marketing capabilities. We have offices in Sweden, Singapore, and India while our customer footprint spans 15 countries. Our customers include both towercos that are in the growth phase as well as larger towercos operating in multiple markets with a mature business model.

TowerXchange: What is your latest innovation and product and what should potential customers know about them?

Anders Smedberg, CEO, Tarantula: The most time-critical concern for all infrastructure owners is the new IFRS 16 standard, which comes into effect after 1 January 2019 and will require organisations to include all leasing contracts with a contract term longer than one year on their balance sheets.

With most of our customers operating a large number of lease contracts across their portfolios, it was imperative for us to provide the tools for them to be compliant with this regulation. We have worked closely with our customers to understand the specific requirements of IFRS 16, the relevance



for tower companies and MNOs, and developed an IFRS 16 add-on which will be deployed with our lease module. The add-on will enable our customers to recognise all assets and liabilities for all their leases and quickly move them to the new accounting standard.

The ultimate objective for any towerco is to enable its customers to search, order, and follow the deployment process of their equipment online. We have strengthened this capability in our solution to offer a “theatre booking” system where towercos customers can order tower space by assessing availability online. This is now operational with a couple of our clients already and we are certain

this unique capability will spread across all of our customers.

We have also been working on developing a small cell module for organisations that deploy large-scale small cell deployments. Delivering a small cell module with standardised process templates that can be swiftly configured has been a key focus of this module. We believe this will be well-received by the new and upcoming infrastructure companies especially across mature markets.

We are also keenly aware that with the onset of modern technologies and hardware, most infrastructure owners are striving to keep

operational costs low while harnessing modern tools such as drones to oversee and conduct their field audits. With that end goal in mind, we are setting up partnerships with drone operators and site audit vendors to ensure that the information gathered from the field gets synced back to the central data repository of our platform and gets converted into actionable data.

TowerXchange: Could you give us an update on some of your recent activities in the Asian market? Is there any new project that should be highlighted to our readers?

Anders Smedberg, CEO, Tarantula: We have been focused on strengthening our engagements across the Indian sub-continent as well as in Southeast Asia. Whether it is problem solving urgent issues or deploying new modules, our teams remain driven by a common goal of empowering tower site owners to build profitable and sustainable businesses. We believe that keen engagement from our customer end users alongside regular interactions from our account management and engineering teams can lead to a mutually beneficial partnership with our customers. We are rolling out programs such as user forums and webinars to enable our customers to highlight their ongoing requirements to us as well as share best-practice knowledge with their peers. This initiative has been well received by all our customers.

A major accomplishment for us this year has been the automation of billing for one of the largest towercos in Southeast Asia. Our billing module deployment enabled the towerco to achieve

complete control over their cash flow across multiple markets, with built-in support for multiple currencies, FX conversion, and complex billing mechanisms. Additionally, we also helped the organisation achieve optimisation and streamlining of their existing business processes across all markets through simplification and configuration of the process workflows. This exercise will simplify the daily tasks of most functional groups, helping them to increase their speed to market. Our next objective is to enable the organisation achieve control and visibility of their fixed asset register through a single source of data.

TowerXchange: What are the key markets where you operate in Asia and what are the characteristics of the portfolios that use your solutions?

Anders Smedberg, CEO, Tarantula: Our core markets in Asia are India and Southeast Asian countries including Malaysia and Indonesia. We have a strong local presence in both the Indian sub-continent as well as Southeast Asia, thus allowing us to expand with greenfield as well as mature organisations, in some of the most and least developed nations. We are closely following developments in places such as the Philippines and Bangladesh where the market is opening up for towercos.

We also understand that while most tower companies and MNOs typically follow similar ways of working, they also have unique differences due to the diversity in the region. Our product platform provides a baseline for organisations to get started rapidly with using a professional toolset

for site portfolio management. At the same time, the configurable layer offers a capability to tweak the tool to suit specific business requirements, thus enabling us to provide a flexibility typically not available in most large-scale ERP systems. This flexibility allows us to solve customer problems with the same efficiency, be it for new entrants in the process of rolling out towers in an under-developed market or mature organisations in the process of securing their investments and maximising profitability.

TowerXchange: What would you say to MNOs and towercos who manage their assets via an Excel or a less specialised platform? And how does your solution help manage different stakeholders within the tower supply chain, from tenants to subcontractors?

Anders Smedberg, CEO, Tarantula: Usage of Excel spreadsheets and homegrown project or asset management tools is an all-too frequent phenomenon that we see in all markets, big or small, irrespective of the nature of the infrastructure owner company. Used efficiently and accurately, there is definitely some advantage in managing one's business through one or more simple tools. However, these organisations will reach a stage where the amount of information becomes too massive to be managed in spreadsheets. Alternatively, the information sits in various silos spread across the organisation's functional groups with no alignment or integration between the data streams. As the volume of information grows, discrepancies in data increase, leading to revenue leakage.

This is where having a central repository of all site information can be highly beneficial. We offer the capability to store comprehensive information regarding sites, assets, projects, and contracts in a single, centralised data hub, thus maintaining complete integrity of the data. Moreover, these data streams are interlinked in such a way that the information flows through the entire quote to cash value chain. Additionally, we integrate our platform with third-party tools such that information always gets updated from the appropriate sources. The value of having accurate information over your assets is tremendous, paving the way for a high valuation of the tower portfolio.

Our solution is designed keeping in mind that multiple stakeholders are involved in the management of a site. We can create different user groups to record contract information, capture real-time site data, complete various tasks and generate reports, or provide electronic approvals in line with different processes. This enables towercos to know who is involved in what activity and provides a project contact list with all stakeholders recorded.

We also enable access to contractors and field staff who need limited access to data so that they can perform the tasks assigned to them. The proactive management of subcontractor work with tracking of key milestones increases efficiency so that all stakeholders know what they need to do, what's next, and whether any changes are required.

TowerXchange: How can your solution be configured to adapt to different towerco's unique business processes and workflows?

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Some of our customers that used our solutions for many years were successfully able to not only scale but also sell their businesses at a healthy premium. Examples include VIOM Networks with more than 42,000 towers that sold its tower portfolio to American Tower Corp. in 2016 and KIN Towers with more than 1,400 towers in Indonesia sold its tower portfolio to Protelindo in 2018

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Anders Smedberg, CEO, Tarantula: Our end-to-end purpose-built site asset management solution is built on the foundation of a configuration engine, which provides a highly flexible and time-efficient way of adapting our solution for every customer's business needs. The configuration layer offers an efficient way to configure business workflows, add user-defined data forms, define service level agreements, and generate reports from the same information. Moreover, the configuration is achieved through an easy-to-use interface, eliminating the need for code development and speeding up the time to market for any changes required on the default functionality. A critical part of our deployment for every customer is analysing their requirements and automating their business processes through quick configuration.

TowerXchange: How can a robust approach to asset registers and asset lifecycle management improve the valuation of tower assets? And how has Tarantula contributed to increasing the valuation of assets of some of your customers?

Anders Smedberg, CEO, Tarantula: For a towerco, having complete and accurate knowledge of its assets, being able to know where they are installed and by whom, and tracking a history of the entire asset lifecycle is crucial to get an accurate valuation of its business. Additionally, if the asset data is linked with the master lease agreements as well as the tenancy billing, a clear picture of the recurring cash flow becomes visible. Our product design is centred around these key principles of optimising tower cash flow.

We have witnessed first-hand the benefits of having a robust fixed asset register with end-to-end management of the asset lifecycle. Some of our customers that used our solutions for many years were successfully able to not only scale but also sell their businesses at a healthy premium. Examples include VIOM Networks with more than 42,000 towers that sold its tower portfolio to American Tower Corp. in 2016 and KIN Towers with more than 1,400 towers in Indonesia sold its tower portfolio to Protelindo in 2018 ■

Accelerating and enhancing ROI on new and retrofitted hybrid systems



How TECNOELETTRA combine design expertise and in extensive in the field experience to bring energy savings to African telecoms



Davide Zanichelli, CEO, TECNOELETTRA

Keywords: Africa, Batteries, DG Runtime, Energy, Energy Efficiency, Energy Storage, ESCOs, Monitoring & Management, NOC, O&M, Off-Grid, On-Grid, Opex Reduction, Rectifiers, Renewables, ROI, Solar, Tecnoelettra, Unreliable Grid, Uptime, Who's Who

TowerXchange: Please introduce TECNOELETTRA to our readers

Davide Zanichelli, CEO, TECNOELETTRA: TECNOELETTRA is a dynamic Italian company, globally recognised as high quality manufacturer of controllers and innovative solutions for power supply application. The generator market is our core business where we make almost 80% of our turnover and where we can offer a very wide range of solutions and products.

Since 1985 our vision has always been to approach customer needs with enthusiasm and passion for our job, while keeping our focus on creating a customised solution for the customer.

Our WWT2020 (WorldWideTECNOELETTRA2020) strategy is a vision which has transformed TECNOELETTRA from a family (but always independent) company, to a global organisation that works all around the world, directly or through strategic distributors or local partners, while keeping the same passion with which we founded the company 35 years ago.

All our products are 100% made in Italy and a team of specialised engineers for each application permits us to very quickly develop a customised solution to satisfy every request.

In last six years we have focused our efforts trying to lead the telecoms market and honestly I'm so proud and satisfied with our results today. Our solution for the telecoms market is called TILS (Telecom InverterLess System), and thanks to

Read this article to learn:

- How TECNOELETTRA accelerated from family business to global brand
- The challenges tower owners face in African markets
- Anticipated ROI versus traditional power solutions
- How retrofitting and working with existing systems can deliver hybrid results
- TECNOELETTRA's plans and ambitions for the future

this project we can give incredible benefits and ROI to towercos, service providers and generator manufacturers.

TILS is not only a product, it is a complete solution, a complete package consisting of our HYBRID controller, our PMG alternator and all the components needed to make a DC variable speed hybrid system/generator, plus probably the most advanced remote control of the fleet.

A key point of our TILS controller is the smart-software: behind any function there is the target to keep the BTS alive. It means that in case of an alarm we are not simply shutting down the system, rather the controller looks for a possible solution to bypass the problem and, even with reduced performances, to keep providing energy to the BTS.

TowerXchange: What is TECNOELETTRA's footprint? How important is the African market to you?

Davide Zanichelli, CEO, TECNOELETTRA: Africa is our priority 24/7.

We entered into Africa with TILS, and we are already supplying more than 2,000 BTS sites. Thanks to this experience, I can confidently say that TECNOELETTRA now has very deep in the field experience and the hybridisation of telecom sites is our top priority every day.

From this incredible experience we understood and we saw with our own eyes how important it is to support operations in the field and because of this

we have a team which is always ready to come over to Africa to assist and provide training to people and customers.

We are creating, with success, a strong commercial distributorship and finding new partners in each African country.

TowerXchange: Can you explain which of your products and services are most popular in African telecoms?

Davide Zanichelli, CEO, TECNOELETTRA: Looking back at what we have done in the last six years we can see that there are different requests for different applications. We are still manufacturing a lot of panels for dual DG set installations, using a dedicated controller and integrating in a single panel controllers and ATS. This remains one of the strongest products in TECNOELETTRA's portfolio for the African market and generally for the global telecom market.

But what has become more interesting is our proposal for the hybrid application, where our TILS brand has grown a lot in terms of volume, different configurations and optional availability.

Right now we are present in Africa directly, with our dealers or customers, or through our European and Asian customers which export their product with TILS into Africa.

Our hybrid application offering spreads from components plus panels to practically the full package. We can provide the main components of

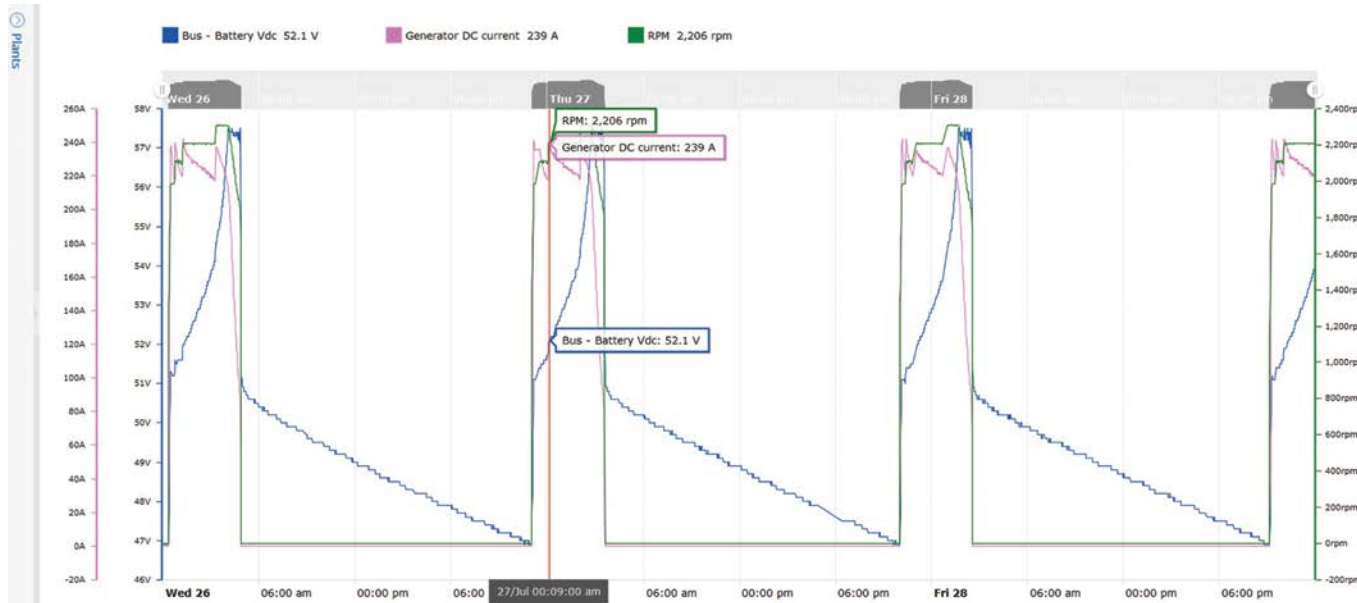
the TILS kit plus control and power panels. In this case the hybrid DG set manufacturer has to add only an engine, canopy and battery bank and the hybrid unit is done. But through our partners we can also propose different configurations of DG sets, from a basic package without a fuel tank and without a battery bank, to an all-in-one product with 1000 litre fuel tanks and battery banks (with both lead or LiFePO4 technology).

Pre-sales and after-sales are two key points in term of service in the telecom market. The pre-sales activity is mandatory to show to our customer that TECNOELETTRA can be the right partner. We can assist the customer in the design of the power station, and we can follow their requests for customisation. Through our after sales service we are close to our customer during the commissioning of their solution, so we can propose training and we can offer 24/7 assistance through our TRM (Tils Remote Management system). One of our most popular services is the analysis of data collected by the TRM (up to 12 months): with this activity we can suggest how to improve the hybrid system's performance in situ, so that the customer can see immediate benefits.

TowerXchange: Tell us about your experiences in African telecoms, what do you see as the main hurdles tower owners need to overcome in the short term? Do you have any case study examples to share?

Davide Zanichelli, CEO, TECNOELETTRA: Hybrid is the answer to a lot of the requests we receive. But hybrid solutions can disappoint if not properly

Figure one: Screenshot from TRM (Tils Remote Management)



sized. We have often seen the wrong combination of DG set power/battery bank capacity/BTS load. It does not make sense to have a small DG set while there is a big battery bank or a high load. As a consequence the DG set will not be able to properly charge the battery and the result of that will be an hybrid unit running 24/7. TECNOELETTRA can share its knowledge and experience, collaborating with service companies, operators or towercos to help design the full power system. Figure one (a screenshot from the TRM) gives you an idea about the performance of a TILS DG set properly sized; approximately five hours of DG set running followed by approximately 18 hours of standby.

One of the quotes that remained in my mind from the TowerXchange 2016 Africa and ME report was:

“Technology is not the biggest issue – people are.” Skills are scarce when it comes to the installation and maintenance of complex distributed generation systems; make them as simple as possible, and training is key. This is absolutely correct. And this is why we have worked to make TILS as simple as possible, removing components that can fail and introducing the concept of “one brain”: our TILS controller is the only device in the hybrid unit that teams on the ground have to learn. There isn’t an inverter like in a hybrid unit, and there are no other devices that have to be programmed or adjusted according to the application. Moreover, the controller can be remotely set to reach the best performance.

We are also aware that the success of our clients is our success. This is why at TECNOELETTRA we

follow our products from the commissioning at the customer site, to the field installation, and even later through the TRM (Tils Remote Management). And this is why we push for the training to all the supply chain team. Maybe different training levels, but training on connections, on settings, on installation and on monitoring are mandatory.

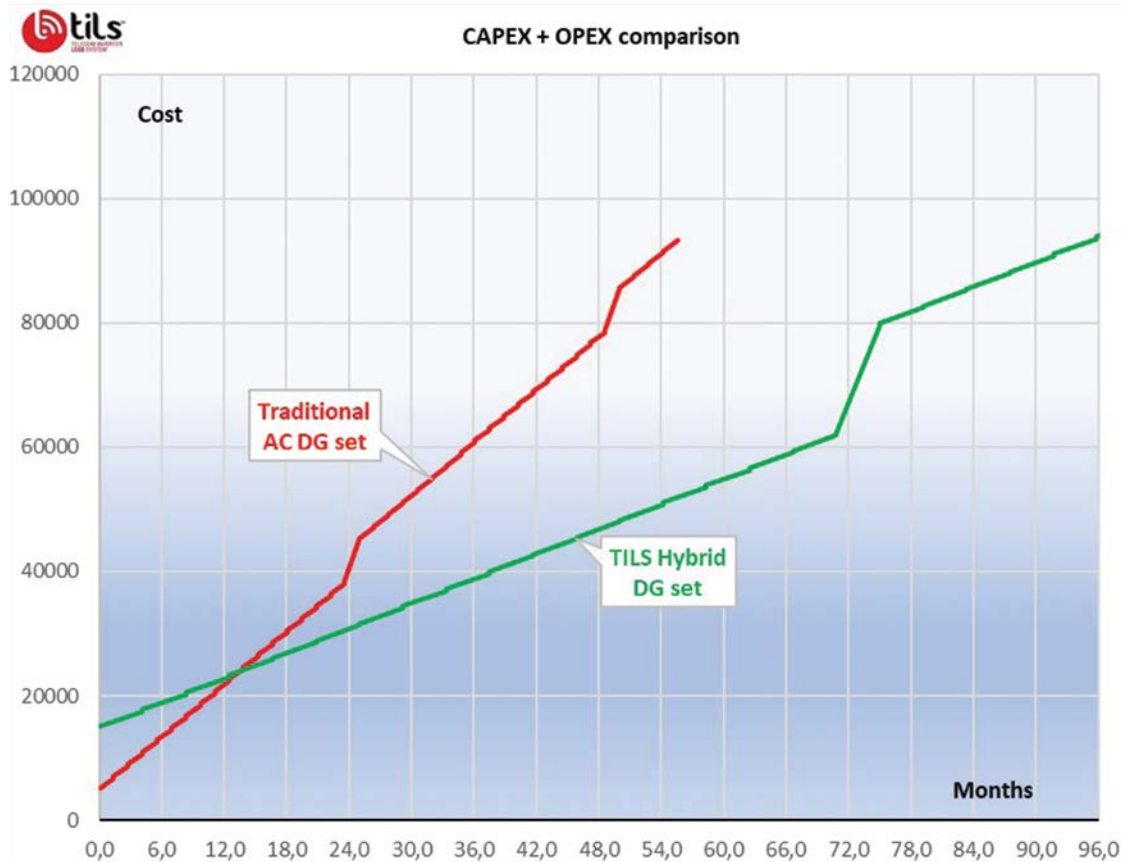
TowerXchange: By optimising equipment and reducing service costs, what kind of ROI can TECNOELETTRA customers expect to see?

Davide Zanichelli, CEO, TECNOELETTRA: The hybrid concept pulls together green energy and OPEX reduction. We cannot forget that the introduction of hybrid units is not only a matter of savings, but it is also a necessity if we want to reduce the ambient impact of the BTS power supply. We have only this world: if the technology allows us to reduce the pollution and the CO2 footprint, it has to be considered.

TILS is a kit created with the clear target of OPEX reduction. There are two levels of savings, one is on the equipment, the other is on the hybrid concept.

TILS uses a high efficiency PMG instead of a traditional AC alternator and uses a simple and with no electronic rectifier bridge instead of an inverter, and works with a variable speed technology to optimise the engine fuel consumption. This is the first step, and even without the hybrid package the TILS DG set can provide interesting benefits compared to a traditional fixed speed AC DG set.

Figure two



But with the integration of a battery pack the TILS benefits are becoming really large. Let's just concentrate on three key data sets obtained from a typical TILS installation (off-grid, without PV):

Fuel consumption: 50% compared a traditional DG set

Service intervals: three times longer than a traditional DG set

Engine life expectancy: three times longer than a traditional DG set.

With the above data and with our "ROI Calculator", a tool we can provide to our customer, we can track performance as per figure two.

As you can see the ROI is around 12 months. Generally, depending on the different installation and fuel cost, the ROI goes from 12 to 24 months.

But since the slope of the two cost lines is quite different, the savings after ROI is achieved are even more interesting, as per figure three.

In this case, after five years (which could be the life of the hybrid unit) the saving is higher than €40,000 for a single installation.

TowerXchange: Can you share TECNOELETTRA's plans for the future? How do you see the African market maturing and what will your role be in this evolution?

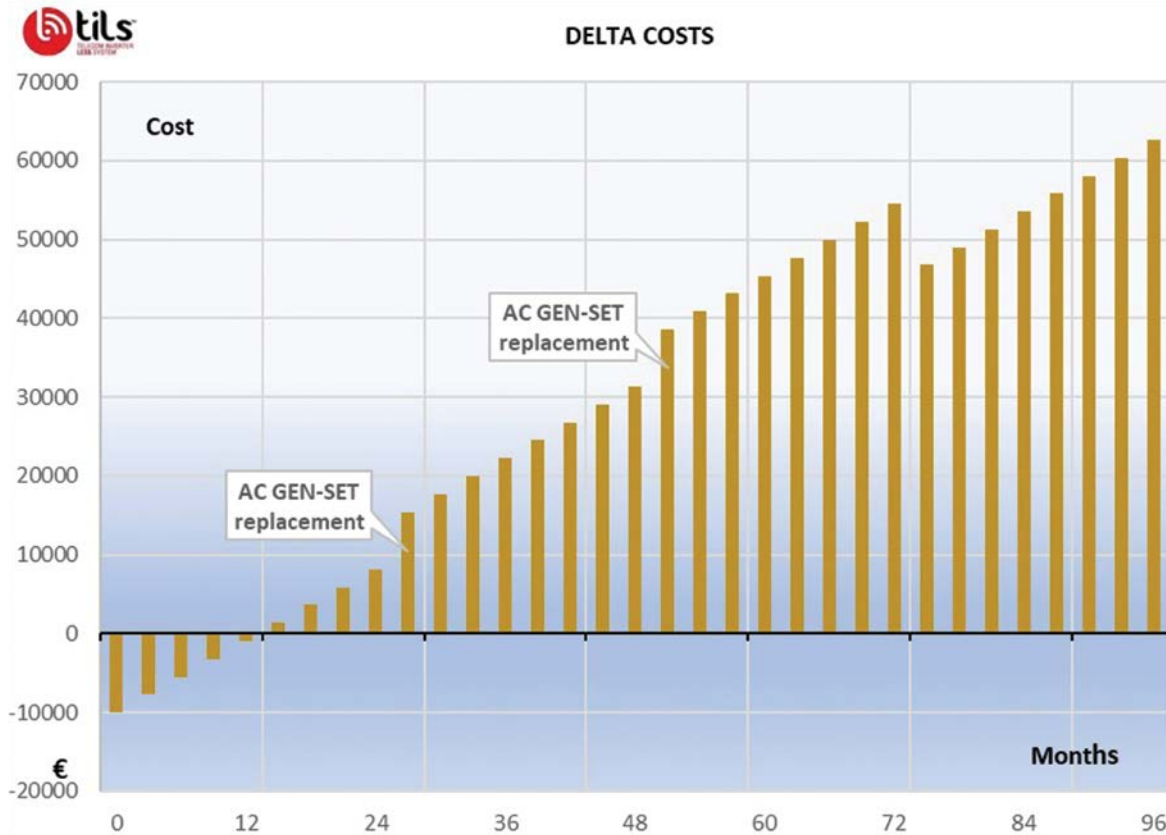
Davide Zanichelli, CEO, TECNOELETTRA: Hybrid technology, if properly sized and installed, can provide a lot of benefits to all the players in the telecom market. But the introduction remains very slow, and mainly remains focused only on new sites.

We think that African market is ready to invest in the hybridization of existing BTS. By this I mean to keep the overall configuration of the power plan, and just introduce the TILS package and a suitable battery bank.

Together with different towercos we have analysed how to integrate a TILS solution in sites still covered by traditional DG sets running 24/7 or running more than 12 hours a day. The cost of the operation can be quickly paid back through fuel saving, engine life extension, and service interval extension.

TECNOELETTRA is ready to assist towercos in this important "retrofitting" operation, starting from the technical integration, moving to the cost analysis and benefits (ROI), passing through all the

Figure three



logistical issues, and ending with installation and commissioning.

We are looking to establish deep partnerships, where companies trust each other. We have to expand the relationship we already have with a lot of our customers: if you have a problem, trust us and we will help you to fix it. Or even better: if you have a project, trust us and we will be at your side to reach your target.

In terms of the maturation of the African market, I think that there is a lot of potential on this continent, but we have to respect the tradition and the work style over here. The opportunities in Africa are everywhere, but we need to not come here thinking we can teach the 'right' way. One thing we feel is critical is training people about our products, another thing is listening and learning from those who know local ways of working better than us ■



Meetup Asia 2019
3-4 December, Singapore

Meetup MENA 2020
28-29 January, Dubai

Meetup Europe 2020
19-20 May, Barcelona

Meetup Americas 2020
23-24 June, Boca Raton

Meetup China 2020
September

Meetup Africa 2020
13-14 October, Johannesburg

www.towerxchange.com

Valmont: 5G creates synergies between multiple infrastructure segments



TowerXchange: Please introduce Valmont and yourself to our readers.

Utility, traffic and lighting sites are just a few of the suitable candidates for 5G rollouts

Jeff Syslo, Business Line Manager, Global Communication Systems, Engineered Support Structures, Valmont Industries, Inc.: Valmont is a public company (traded on the NYSE, ticker symbol VMI) founded in Valley, Nebraska in 1946 and operates in four primary business segments, namely:



Valmont is one of the global leaders in the tower design and manufacturing industry – a sector undergoing radical changes in light of the advent of 5G and its urban densification requirements. In this exclusive interview, Jeff Syslo, Valmont’s Business Line Manager for its Engineered Support Structures unit, shares with our readers unique insights into what 5G means for the infrastructure industry, new types of collaboration and partnerships required to succeed and considerations on the evolution of the site sharing business model.

- Engineered Support Structures
- Protective Coatings
- Irrigation
- Utility Support Structures

Valmont has been providing antenna structures to the global wireless communications industry for the past 70 years. The range of products we offer include all types of structures such as macro-towers, rooftops, monopoles and camouflaged sites. We also supply a full line of network infrastructure components and hardware through our SitePro1 business.

I began my career in the wireless industry over 25 years ago with Valmont and my current role is Business Line Manager, Global Communication Systems. My primary responsibility is growing our telecom segment through developing new markets, new products and expanding our global reach within the industry.

TowerXchange: What’s the company’s footprint and key business areas?

Keywords: 4G, 5G, Americas, Business Model, Capacity Enhancements, Construction, Decommissioning, Infrastructure Sharing, Interview, Loading, Masts & Towers, Meetup Preview, Regulation, Site Surveys, Site Visits, Steelwork, Valmont Industries

Read this article to learn:

- Valmont’s footprint and activities in the wireless industry and beyond
- The evolution of site typology demand and infrastructure sharing approaches
- How 5G is reshaping the industry and creating new synergies
- Which sites can be used for 5G rollouts across urban areas?

Jeff Syslo, Business Line Manager, Global Communication Systems, Engineered Support Structures, Valmont Industries, Inc.: We manufacture products in over 85 different facilities spread across six continents and do business in over 25 countries.

We are a leading producer and distributor of products and services for the infrastructure and agricultural markets. The Engineered Support Structures segment is our key division, which includes products for the wireless, traffic/lighting and transportation businesses. The other three segments are utility structures for the electrical industry, our protective coatings business and irrigation systems for agriculture.

With annual revenue of US\$3bn, we currently employ 12,000 people worldwide and generate 65% of our sales in North America (Canada, U.S. and Mexico) and 35% from other regions around the globe including, Europe, Asia, Africa, South America and Australia.

TowerXchange: How has the demand for traditional macro-towers evolved to new site typologies over the years?

Jeff Syslo, Business Line Manager, Global Communication Systems, Engineered Support Structures, Valmont Industries, Inc.: Every region has its own characteristics and challenges based on population, topography, regulations, et cetera.

North America was one of the first regions to



Decorative small cell light pole

adopt infrastructure sharing and this practice is now very common, but 30 years back, towercos didn't exist and MNOs used to invest in building their own networks. The region is very towerco-centric, but this cannot be said of other markets where we operate, which are just now starting to embrace sharing initiatives. In those markets such as North America, where site sharing is common,

we typically see larger structures due to having multiple operators on the same sites.

4G has been a great testbed for this change as antennas got larger and the capacity increase was great. We've performed many structural analyses, upgrades, reinforcements and, when required, complete replacements. In fact, sometimes it's simply more economical to just replace a site rather than re-engineer it. The increased loading requirements has also led to new products such as heavy-duty antenna mount systems and network infrastructure components.

The aptitude of our customers has definitely changed too. Years back, no one used to build with the idea to future-proof their sites to new technologies and requirements. Now we are working with a different mindset and are fully aware that larger loads are and will be needed.

Nowadays, we are starting to ship 5G structures to China and across North America. These new sites are much stronger to support extra equipment and we are doing everything for the very first time as there's no blueprint for 5G structures.

TowerXchange: What are some of the most innovative sites your clients are requesting these days?

Jeff Syslo, Business Line Manager, Global Communication Systems, Engineered Support Structures, Valmont Industries, Inc.: We have done all types of custom structures depending on

the site location and requirements. Local zoning requirements and regulations dictate what type of structure may be allowed at a particular location.

Our Valmont-Larson division has been providing camouflaged site solutions for over 25 years. Some examples include structures disguised as cacti, all types of trees, highly decorative lamp-posts and architectural solutions on buildings including decorative cupolas, working clock towers and church steeples.

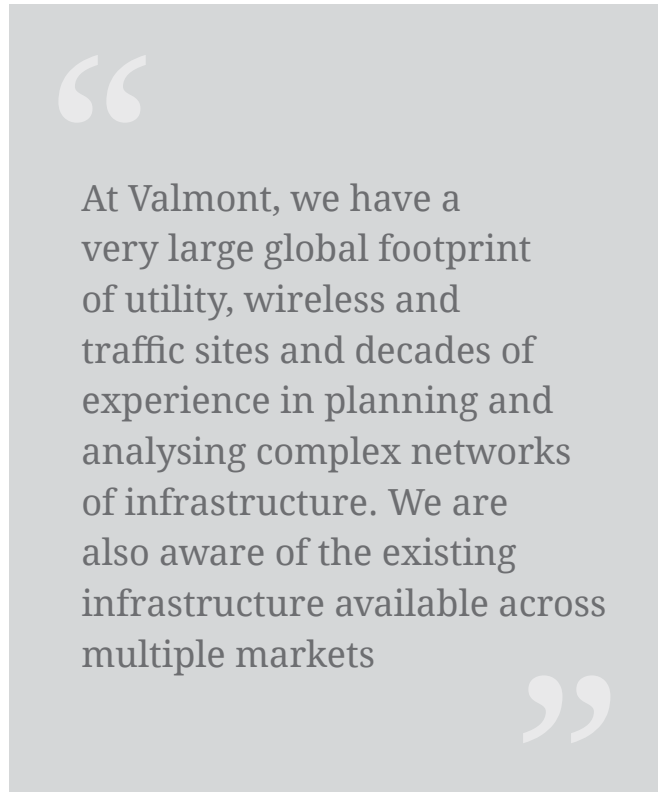
We continue to see increased demand for innovative and creative site solutions. We say if you can dream it, we can build it.

TowerXchange: How do you foresee the advent of 5G to change the demand for your products?

Jeff Syslo, Business Line Manager, Global Communication Systems, Engineered Support Structures, Valmont Industries, Inc.: We are already seeing a demand for new and innovative solutions with the initial rollouts of 5G in Asia and North America.

5G technology, especially in the mmWave frequency bands, creates new challenges and opportunities. This is the biggest business opportunity we've seen in the past 25 years and have a dedicated team solely focused on developing and implementing 5G site solutions.

The volume of new sites will be quite large and we see the need for all types of site solutions. Urban



At Valmont, we have a very large global footprint of utility, wireless and traffic sites and decades of experience in planning and analysing complex networks of infrastructure. We are also aware of the existing infrastructure available across multiple markets

areas will require a high density of sites, with the majority of them being innovative designs such as lampposts, rooftops, street works, et cetera.

We have extensive experience and knowledge with all types of engineered structures such as lampposts, traffic signalling, street works, rail and tramway structures. Many of the 5G sites will be implemented using this existing infrastructure and we have great know-how in these areas.

TowerXchange: Are you seeing synergies between utility towers, lighting sites and telecom towers?

Jeff Syslo, Business Line Manager, Global Communication Systems, Engineered Support Structures, Valmont Industries, Inc.: 5G is forcing the wireless industry and other infrastructure-driven sectors to converge.

With so many sites required, especially in urban areas, MNOs and towercos are looking to utilise as much of existing infrastructure as possible. This includes lampposts and power distribution structures.

At Valmont, we have a very large global footprint of utility, wireless and traffic sites and decades of experience in planning and analysing complex networks of infrastructure. We are also aware of the existing infrastructure available across multiple markets.

Our knowledge and experience in the lighting and utility structures industry certainly give us an advantage. We are able to analyse the existing infrastructure to determine if it is suitable to accommodate a 5G site. If it is, we have products we offer to allow MNOs and towerco to add their equipment.

In cases where the existing infrastructure may be overstressed due to the proposed 5G equipment, we can offer a replacement solution that will match the existing design and aesthetics required.

The level of coordination required among all parties involved in 5G rollouts and planning is great. MNOs, municipalities, towercos, utility companies

and system integrators and more all need to come together. Certain 5G tests currently running across Europe are involving as many as seven different companies at a time... And these are just tests!

Other parties that can come into play include security firms, police units and edge computing companies, as a result of all the different functionalities that 5G enables. In summary, the traditional business model that worked in the past simply won't work with this complex environment.

TowerXchange: Are towercos starting to deploy small cells and DAS? Are they finally positioning as neutral hosts?

Jeff Syslo, Business Line Manager, Global Communication Systems, Engineered Support Structures, Valmont Industries, Inc.: Yes, we are already seeing towercos such as American Tower, Crown Castle and WIG acting as neutral hosts for small cell and DAS networks.

There are several different models that are being utilised and the approach many times is on a case by case basis. I think ultimately the main driver that will continue to push more and more towercos into pursuing opportunities within this space is economics. MNOs simply won't be able to bear the cost of rolling out, managing, owning and operating such networks, especially with the substantial investments required for 5G. There may be new models employed such as consortiums with various stakeholders. The main driver however will be how to decrease and manage costs through neutral hosting ■

See you at our future events!

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Meetup MENA 2020

28-29 January, Dubai

Meetup Europe 2020

19-20 May, Barcelona

Meetup Americas 2020

23-24 June, Boca Raton

Meetup China 2020

September

Meetup Africa 2020

13-14 October, Johannesburg

Tower  Xchange

www.towerxchange.com

The power of choice: power solutions for future networks



As power needs grow and change, Vertiv talks us through the opportunities to excel through innovation

TowerXchange: Please introduce Vertiv, your background and how the company was formed

Eric LeCalvez, Vice President, Strategic Accounts, Telecoms, EMEA, Vertiv: Vertiv leads the design, build and servicing of critical infrastructure. Our technology enables vital applications for data centres, communication networks and commercial and industrial facilities. We support today's growing mobile and cloud computing markets with a portfolio of power, thermal and infrastructure management solutions.

As a business, we have a long heritage within the industry. Formerly Emerson Network Power, we have operated for decades, building our knowledge base and expanding our global footprint to become one of the leading providers of critical infrastructure solutions. Vertiv is a nimble and agile organisation that can take on business challenges with the spirit of a start-up, but with the experience of a legacy brand.

Within Vertiv, we have four separate flagship brands. These are Chloride, Liebert, NetSure and Trellis. Vertiv also recently acquired Energy Labs, a global manufacturer of air handling solutions, and Geist, a global manufacturer of Rack Power Distribution Units. These acquisitions will add complementary capabilities to accelerate growth in Vertiv's key markets - cloud, colocation and edge.

TowerXchange: Can you tell us about your global scope and particularly about your footprint in Europe?



With over 30 years of experience, Vertiv isn't just looking at its past achievements, but is focussing on driving the innovative solutions which will power extensive 5G rollout and densification in European communications infrastructure. In this interview, we ask Eric LeCalvez, Vice President, Strategic Accounts, Telecoms, EMEA, Vertiv, more about the company's experiences in powering urban sites, and find out how he sees power needs and expectations changing in the future.

Keywords: 5G, Air Conditioning, Batteries, Data Centre, Energy, Energy Efficiency, Energy Storage, Europe, Fuel Cell, Hybrid Power, On-Grid, Opex Reduction, Renewables, Small Cells, Solar, The Future Network, Unreliable Grid, Urban vs Rural, Vertiv

Read this article to learn:

- Who Vertiv are and what solutions they offer
- How European power needs are unique
- Potential drivers for renewable power solutions in Europe
- The critical infrastructure needed to support a de-centralised network

Eric LeCalvez, Vice President, Strategic Accounts, Telecoms, EMEA, Vertiv: Given the breadth of our portfolio, coupled with our long heritage, we have built an extensive global presence and can serve virtually all major telecom operators and leading tower companies in Europe and around the world. We provide critical infrastructure and services within telecom access, edge and core, as well as data centre facilities globally.

In addition, we provide a complete range of services to help customers improve the operating performance of their critical infrastructure, deliver capacity expansion and optimise energy costs.

It's safe to say, wherever you're based in the world, or whatever your critical infrastructure need may be, we can help you out!

TowerXchange: What unique challenges and opportunities do you feel European towercos face?

Eric LeCalvez, Vice President, Strategic Accounts, Telecoms, EMEA, Vertiv: Optimisation of colocation sites will be the single greatest challenge for tower companies. Specifically, new site locations in urban areas are faced with the twin issues of delivering higher utilisation from available sites while upgrading them in preparation for 5G. But with any challenge comes an opportunity - managing the critical infrastructure to perform at its most efficient while being largely unable to standardise site consumption is possible with innovation. 5G will drive higher power consumption, mainly due to

“

Power needs are not only growing, they are changing. ICT convergence and network de-centralisation are widening the options on energy topology at site level

”

new antenna technologies, and the harmonisation of sites holistically across the network through management platforms will present a considerable opportunity to make operational efficiencies and performance harmonisation. We need look no further than data from TowerXchange's Europe Dossier 2017 to see the proliferation of European tower companies: over €1.5bn of tower acquisitions (at the time of publication); 44 tower companies active in the Europe region; and 92,732 towers and sites potentially for sale; numbers which suggest there is a great deal of confidence in European tower companies.

TowerXchange: In the recent TowerXchange Tower Power Report, 83% of respondents said they planned to allocate capex to power in the next 12 months. Can you tell us a bit more about why European power needs are growing, and what your recommendations for European tower owners are?

Eric LeCalvez, Vice President, Strategic Accounts, Telecoms, EMEA, Vertiv: Power needs are not only growing, they are changing. ICT convergence and network de-centralisation are widening the options on energy topology at site level. Since energy topology is a topic that is far from being standardised, flexibility in energy topology is recommended to accommodate the broadest range of technology loads.

Looking to the immediate future, the challenge for the next 12 months will be to keep up with increased bandwidth requirements, which will require an update of existing networks from a capacity perspective. Overall power needs are increasing and the recommendation is to survey the sites to frame these needs and identify those sites requiring a power distribution upgrade. Ensuring energy efficiencies are factored into such solutions is vital. To this regard, Vertiv can support telcos by providing Energy Savings as a Service, (ESaaS).

TowerXchange: Renewable and hybrid power solutions are far less common in Europe than in markets like Africa or Asia. Do you see this situation changing in the future? If so, what will the catalyst be for change?

Eric LeCalvez, Vice President, Strategic Accounts, Telecoms, EMEA, Vertiv: Unlike Europe and other developed markets, there are more pockets in Asia and Africa that lack access to conventional utility sources, which has led to them being greater adopters of renewable and hybrid power solutions. But the situation in Europe will certainly change, with environmental considerations providing the catalyst, and renewable and hybrid power becoming more cost-efficient. Monetary considerations like the fluctuation cost of oil will also be a factor.

TowerXchange: Do you think the shift to 5G will have a significant impact on the way infrastructure owners use power and provide backup power for their assets?

Eric LeCalvez, Vice President, Strategic Accounts, Telecoms, EMEA, Vertiv: 5G and its surrounding network elements are allowing architects to frame new models that directly impact power and energy storage. Certainly, there will be a need for a number of different solutions and remote power will be a contender for use in metropolitan areas. In addition, we will see sites with or without battery backup fed by either AC or DC power.

TowerXchange: We're increasingly hearing about



From here on to 2020, we expect to see many more telecom operators testing and trialling 5G

how network architecture will be revolutionised as 5G rollout gathers pace - what's your view on edge computing?

Eric LeCalvez, Vice President, Strategic Accounts, Telecoms, EMEA, Vertiv: The new use cases for 5G, with requirements for higher bandwidth and low latency, will force telecom and solution providers to bring computing power away from a central point to dispersed locations at the 'edge' and closer to the user. This will require new high-density solutions covering both traditional telecom and data communications requirements.

Essentially, edge sites are the result of a great deal of work readying the network for de-centralisation. Pushing application hardware towards the consumer will mean that, depending on the criticality of the site, edge sites will need to

be designed to protect and back-up hardware that is rapidly increasing in thermal density. Besides power requirements, there are also rigorous climate requirements with increased heat load and narrow temperature range limitations to consider. If they are to perform as intended, edge sites will require some serious innovation, not least in the design of their critical infrastructure requirements.

Help is at hand though, with tower companies emerging as essential colocation facilities – not only for radio equipment but for the processes and consumer content generated through the coming phases of digital transformation. Doing such computing locally provides additional benefits of reducing logjams at central data centres/ repositories, increasing the speed at which data is processed and reducing latency. Requiring as little as 100 square feet of space – and increasingly affordable thanks to an increase in out-of-the-box solutions and modular capabilities – there is much to recommend tower companies for edge computing deployment.

From here on to 2020, we expect to see many more telecom operators testing and trialling 5G. However, it is no longer realistic for wide-scale deployment by 2020 as there is still more to be done on next generation telecoms standards. It is quite probable though, that 5G hardware can be deployed running LTE software on it so that, once agreed, 5G could be rolled out relatively quickly. For 5G to work at the speed it's intended to, significantly more optical fibre has to be placed in the ground between sites to move all of the data around ■

vHive's case study: How drones are improving safety and data quality



After two years working with towercos, the company shares its success story and results



Yariv Geller, CEO, vHive

A couple of years ago, vHive revolutionised sites inspection by introducing drones in the tower industry. Now, its software solution has proven its efficiency and the company has been able to help towercos to obtain accurate, high-quality data regarding their assets while reducing cost and minimising risk. TowerXchange sat down with vHive's CEO Yariv Geller to discuss the company achievements and review the benefits that drone-based inspections bring to the telecom infrastructure industry.

Keywords: Capex, Drones, Health & Safety, Meetup Preview, Monitoring & Management, Opex Reduction, Outdoor Equipment, Site Management System, Site Surveys, Site Visits, Towercos, vHive

Read this article to learn:

- The top inspection challenges that towercos face on their sites
- How vHive has helped towercos through drone integration
- How high-quality data translates into efficiencies and optimisation

TowerXchange: About a year ago, you shared with TowerXchange vHive's profile and value proposition to the industry. Could you remind our readers what are the key challenges your software addresses?

Yariv Geller, CEO & Founder, vHive: We have been working with tower companies for the past couple of years and have seen that most of them have been coping with the same challenges. One of their main problems is their revenue loss, which depends on knowing exactly what equipment MNOs install on their towers. It is often very hard for them to keep track of certain modifications on each site. Inaccuracies happen frequently with discrepancies in the number of antennas installed, ancillary equipment that was added, dimensions and locations of equipment installed. And all that translates into revenue losses.

With the significant level of M&A activity in the market, many towers change hands with very sparse and inaccurate information attached to them. The buyer typically relies on inspecting a small percentage of the acquired towers as a sample set, since it is too costly and takes too long to survey each site. This usually translates to a later need to reconcile costs to the seller, to the buyer or to both.

Another challenge is the quality of the data of their assets. Tower companies must have a good understanding of their portfolios in order to be successful. To do so, they rely on their personnel to gather field information, and usually field test

engineers are the ones who put together ground-based information as well as tower climbers who sample data from the sites.

Climbers typically use manual measurement tools and rely on their cell phone cameras. These images are then transferred to an engineer in the office who needs to properly file them, orient them and figure out their location in 3D space. This information is used either to inspect faults or to manually reconstruct the tower's 3D structure from the assorted images – a time consuming and costly process that takes many hours at a significant cost.

At the end of the process, the company generates a limited collection of images that are stored in folders in an arbitrary order after a manual translation of the data to a 3D sketch. Any need for additional data requires dispatching another tower climb, which needs to be scheduled weeks in advance, as tower climbers are a limited resource. The total process cycle from requiring information to field insights takes more than three months on average.

Additionally, towercos have to deal with particular operational challenges. These enterprises require highly skilled professionals to climb on top of their sites and capture data in dangerous places. Challenging weather conditions and tower radiation are relevant risk factors, hence reducing fatalities and accidents during the process is a critical safety concern for all businesses in the industry.



Towercos in turn are frequently fined by OSHA for safety violations. In addition to risk, the cost of training, certification, equipment and high insurance fees of tower climbers is substantial and can reach almost US\$10,000. The Wall Street Journal published death rates among cell tower climbers at 183.6 per 100,000, making it the most dangerous job in America at one point. A minimum of two trained climbers/rescuers working 12-hour shifts must be onsite while performing elevated tower work, further increasing costs.

TowerXchange: Now, you have already proven vHive effectiveness in the field. Could you share

with us what are the main benefits that drones have delivered to your clients?

Yariv Geller, CEO & Founder, vHive: I would like to highlight and explain the main benefits that vHive have been providing to towercos over the last couple of years.

1. Improved revenue: drones give towercos the ability to better capture data on their towers, from many angles and through high-resolution images. With this precise data, they know exactly what equipment has been installed on their tower. Furthermore, this data is valuable to their MNO

customers in two categories:

- Service assurance – the ability to verify proper antenna azimuth, tilt angles and clear line of site to other towers, which ensures that optimal service is achieved;
- Maintenance – the ability to determine equipment issues, corrosion and cabling problems.

2. Opex and time reduction:

- vHive’s scalable solution enables non-expert field personal to operate and control drones with an easy to use software;
- The total time in the field acquiring all the data needed dropped from around four hours to 30-40 minutes;
- The ability to use low-cost, off-the-shelf drones with high, global availability without a substantial capex investment is another major operational benefit.

3. Better field data and faster insights: our solution effectively manages large amounts of data –drones capture gigabytes and terabytes of high-resolution imagery that are integrally transferred to our customers. Towercos improve their productivity, which directly impacts their bottom line by reducing costs and more importantly, by getting a better understanding of their assets for improved billing and new revenue opportunities. With such precise and large amounts of data, towercos can offer their customers new services such as predictive maintenance as well as increase their revenue streams from new services.



4. Improved employee safety: flying autonomous drones to complete tasks eliminate the need to climb towers which, as previously mentioned, is a potentially hazardous operation.

TowerXchange: What is the ROI and other financial results that you have delivered and can entice future customers?

Yariv Geller, CEO & Founder, vHive: Towercos that have been using the vHive software solution reported the following results:

- Data accuracy: tower companies improved the accuracy of their data on installed equipment on their towers. Some reported 5% improvement and identified inaccuracies that were related to the inaccurate count of installed equipment, inaccurate equipment dimensions and ancillary equipment that was installed but not registered. Engineering and Quality teams received much more comprehensive data and reduced cost by 67%;
- Billing on actual assets increased towerco revenues by 1%;
- Costs: the use of autonomous drones enabled customers to lower field survey cost and time by 62%;
- Safety: Enterprise Employee Health and Safety (EH&S) and the Corporate Compliance departments were satisfied that drones could complete tasks without climbers. A drop in work-related fatalities is expected but will be measured over a longer period of time;
- Time: thanks to drones, towercos can perform

inspections even in challenging conditions, which saves them time and once again, zeroes the risk of accidents.

TowerXchange: Understandably, the industry is initially reluctant to deploy new technologies and solutions due their operational complexities. How does the implementation process work for vHive?

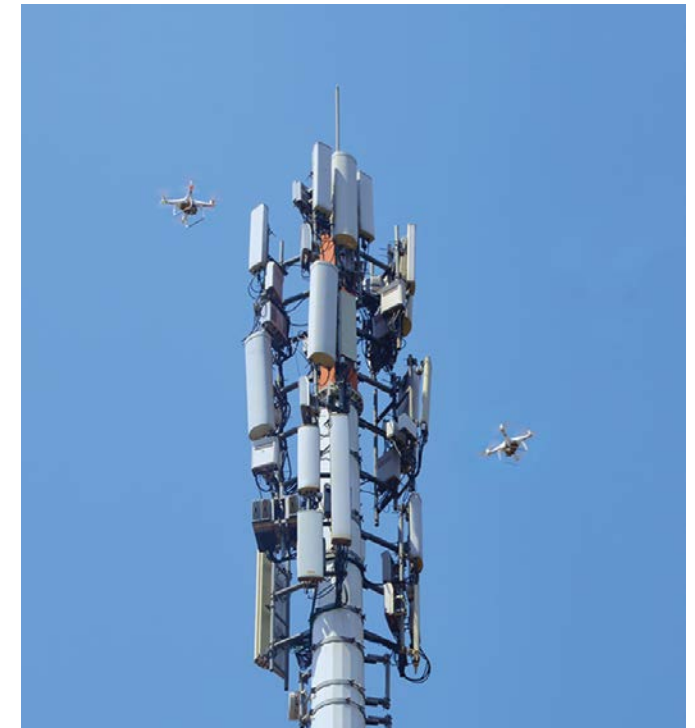
Yariv Geller, CEO & Founder, vHive: Global towercos have decided to adopt vHive's enterprise drone hive software solution due to its easy implementation process and minimal requirements. Seeing the drones in action is an "ah ha" moment for their management. Based on our experience, we see that the following steps are enabling smooth operations and ensuring implementation success:

1. Choose a project lead, usually selected from the network operations, to be responsible for the drone program, who also provides internal and external feedback;
2. Assign drone pilots: the project-lead is responsible for creating a work plan with pre-defined monthly drone-survey targets that are assigned to pilots;
3. Create an annual plan: define the number of drone pilots required to cover the full infrastructure on an annual or monthly basis;
4. Training: New personnel training consists of a

week of general drone training, followed by an online test for flight certification. That week also includes half a day of training and practice on vHive's system. Trained and certified personnel can start surveying towers in the field the following week;

5. Drone purchase: for each field engineer the company needs to buy a drone with three spare batteries;

6. vHive imports all the data related to the towerco portfolio which is then automatically translated into missions in the system, enabling field personnel to merely fine tune mission parameters if needed ■



ZTE's holistic approach to energy management and TCO reduction across Asia



The technology leader on their continuous efforts to improve network energy management



Ma Guangji, VP and GM of Energy Products, ZTE

In this exclusive interview, ZTE explains Asia's evolving network energy requirements, from the current requirements set by 3G and 4G to the challenging and exciting vision of 5G networks. With power requirements set to increase exponentially, the modularity and scalability of power systems become even more critical, and keeping a tight grip on the Total Cost of Ownership (TCO) will require increasing deployment of Network Energy Management systems based on big data analysis.

Keywords: 4G, 5G, Africa, Asia, Batteries, Energy, Energy Efficiency, Energy Storage, Hybrid Power, Lithium-Ion, O&M, Operational Excellence, Vendor Directory, ZTE

Read this article to learn:

- ZTE's energy solutions for communications infrastructure
- What 5G will mean for cell site energy in Asia?
- Why this makes the modularity and scalability of power systems even more critical
- The reducing cost and increasing deployment of lithium-ion batteries

TowerXchange: Please introduce ZTE, particularly in terms of the solutions you propose for tower companies.

Ma Guangji, Vice President and General Manager of Energy Products, ZTE: The ZTE energy product line mainly provides communication energy solutions and integrated data centre solutions. The communication energy offering includes:

- Large power supply for central computer rooms/ data centres
- High voltage DC power supply
- Indoor and outdoor power supply for macro base-stations
- Embedded power supply
- Wall-mounted power supply for micro base station and PAD power supply
- SmartLi series batteries
- Hybrid energy solutions and network energy management solutions

Over the years, tower companies have become important players in the construction and management of mobile communication network infrastructure. We have some cooperation with global tower companies, while China Tower Corporation is also one of ZTE's important customers in our domestic market. The energy sharing and network energy management solutions provided by ZTE help towercos to provide a stable power supply while ensuring the effective management of multi-operator cell sites.

TowerXchange: Can you share some success stories illustrating your experience and scale in Asia?

Ma Guangji, Vice President and General Manager of Energy Products, ZTE: Asia is ZTE's largest and most important regional market. Aside from China, Asia accounts for half of our international sales.

ZTE has in-depth cooperation with Pakistani MNOs TP and Cmpak, Myanmar's KSGM and Mytel, Indonesia's Telkomsel, Indosat and SmartFren, Vietnam's Viettel as well as Ture and AIS in Thailand, Digi in Malaysia and Softbank in Japan among many other regional customers.

ZTE is also one of the most important power solution suppliers of these MNOs on their 2G, 3G and 4G networks and we have developed and provided many power supply and hybrid energy solutions for their networks. In addition, ZTE has carried out cooperative research and planning with these customers in the 5G network power supply field.

TowerXchange: What are the most attractive markets for ZTE in Asia and where do you see the main opportunities for the future?

Ma Guangji, Vice President and General Manager of Energy Products, ZTE: In recent years, the communications industry has developed rapidly in several Asian countries, and nearly every country is an important market that we focus on. With the in-depth coverage of 4G networks and the start of 5G deployment, light asset operations have become popular across MNOs, while towercos are increasing their penetration in various countries as you can see with IGT and Apollo in Myanmar or edotco

in Malaysia and the other countries where the company operates. Therefore, our collaborations and synergies with towercos is the most important and exciting business opportunity in Asia at the moment.

TowerXchange: As Asia evolves from 3G to 4G and eventually 5G, what are the critical considerations for towercos in terms of the changing configuration of antenna on their towers, the weight and power load of that equipment?

Ma Guangji, Vice President and General Manager of Energy Products, ZTE: With the construction of the 4G/5G network, the 2G network will gradually stop operation, and the corresponding antenna system will eventually be dismantled. At the same time, multi-frequency antenna applications mean 3G/4G base stations can share antennas, so the tower load will not increase significantly. With the construction of a 5G network, the power consumption of 5G equipment is greatly increased compared with that of 4G equipment. For example, the power consumption of a single S111 station is about 4,000W. In addition, 5G network construction will first expand on existing 4G sites, so the overall power sites consumption will increase dramatically. The sufficiency of electric capacity, stability and management of site power supply are the main issues to be considered in the future.

Moreover, towerco's service will shift from leasing the previous site space to the energy streamline operation. Energy sharing and co-construction, energy efficiencies, modular capacity expansion

and network management will become critical for towercos.

TowerXchange: How does Asia compared to Africa as a region in terms of maturity, technological requirements and challenges?

Ma Guangji, Vice President and General Manager of Energy Products, ZTE: Compared to Africa, Asia has a relatively rapid population and economic growth and networks are more robust and developed. The region is more matured and more developed from a technological point of view as 5G has been deployed in China, Japan and other countries already. In addition, the grid is often better than many countries in Africa, apart from some specific exceptions, and that helps with tower rollouts. Site sharing and construction of new sites are easier, which create big opportunities for lar-scale rollout.

TowerXchange: How should cell site energy systems be designed in terms of modularity and scalability to accommodate multiple tenants?

Ma Guangji, Vice President and General Manager of Energy Products, ZTE: With the development and construction of the 4G/5G network, especially the evolution from 4G to 5G, and multi-tenant applications, energy systems must be modular and scalable. This mainly applies to the site control management unit, power conversion system, and energy storage system.

Control management is key for any site. Regardless of the increase of power requirements and the increase in tenants, unified control and unified

management systems must be enabled. At the same time, the solution should have the characteristics of multi-system, multi-energy input, hybrid energy control management, meticulous measurement and management of multi-tenants, multi-mode networking, et cetera.

The design of power conversion systems should consider DC distribution modularisation, power unit modularisation, power sub-rack modularisation, and AC input unit modularisation and expansion. The design of the energy storage system mainly considers the hybrid application of batteries, without an external switching unit, the direct mixing of lead acid and lithium-ion batteries, the direct mixing of old and new lithium-ion batteries, and the smooth expansion of the energy storage system.

TowerXchange: Towercos and MNOs increasingly realise that optimising opex is not just about energy efficiency, but about improving cell site autonomy and reducing O&M costs. How has ZTE been able to support TCO reductions?

Ma Guangji, Vice President and General Manager of Energy Products, ZTE: In the past, capex and opex were mainly used to evaluate the energy supply of typical cell sites, and players used to optimise their TCO by selecting various solutions and adjusting their configurations.

In recent years, ZTE's Network Energy Management Solutions have evolved to include six functional modules:

- Network monitoring
- Energy efficiency improvement
- Operation and Maintenance (O&M) management
- Operational management
- Site security
- Asset management

These six modules are based on large data analysis and are business-oriented, thereby helping towercos and operators achieve multi-level and refined energy management of their entire network. The overall efficiency of energy, operation and maintenance of the whole network has been improved, which greatly reduces the total cost of investment.

TowerXchange: Please share ZTE's vision for cooperation with tower companies.

Ma Guangji, Vice President and General Manager of Energy Products, ZTE: ZTE's cooperation with tower companies has a bright and promising future. In China, ZTE has deeply cooperated with China Tower Corporation and has become one of the most important suppliers of energy equipment and solutions since then. At the same time, ZTE has maintained cooperation and joint research on network energy development planning and several innovative topics. Internationally, ZTE has a certain degree of cooperation with Asian, European, African and South American towercos. With the rapid development of 5G construction in the next two to three years, ZTE will further deepen and broaden its cooperation with tower companies and jointly contribute to the development of global telecommunications infrastructure ■

Tower  **Xchange**

Meetup Asia 2019

3-4 December, Singapore

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28-29 January, Dubai

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19-20 May, Barcelona

Meetup Americas 2020

23-24 June, Boca Raton

Meetup China 2020

September

Meetup Africa 2020

13-14 October, Johannesburg

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