IFC International Finance Corporation World Bank Group

GSMA Green Power for Mobile

In partnership with the Netherlands

ibs

IBS Tower – Indonesia – Feasibility Study

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Contents

Country Background

Indonesia is an archipelago country that counts more than 17,000 islands from the west to the east, scattered over both side of the Equator. Indonesia has a tropical climate, with two distinct monsoonal wet and dry seasons. The rainy season is between September to February and the dry season from March to August. Some regions, such as Kalimantan, West Java, West coast of Sumatera, Sulawesi and Papua receive the highest rainfall during the wet season.

The population has reached more than 244 million in 2013[1] with a GDP per capita around US$3,556[2]. Indonesia's economy is driven by manufacturing and agriculture that contributed to over 38% of national GDP in 2013[3].

About IBS Tower

IBS was founded in 2006 as an in-building service provider and rapidly transformed itself into a prominent telecom tower company and operator of shared network infrastructure in Indonesia. It made a major acquisition of towers by end of 2011 and it divested its in-building solution business to focus on the tower business. By end August 2012, IBS was successfully listed as a publicly traded company in Indonesia known IBS Tower (IBST). IBST's assets are strategically deployed across Indonesia where operators need it most, with a focus across Sumatera and Java islands and is today one of the "big four" public listed tower companies in Indonesia.

IBST serves all the telecom operators on their network, and has tenancy ratio of about 1.5 by December 2013.

Overall Context

Telecom Sector

The telecom market penetration was about 40% in Q1 2014 with more than 302 million total connections in the network. The three biggest players such as Telkomsel, XL and Indosat, dominate telecom market in the country, with a total share of about 76% of total connections[4].

GSMA has identified a total 90,669 deployed sites across the country, of which only 5% were green sites[5].

[1] Statistics Indonesia – www.bps.go.id
[2] World Bank – www.worldbank.org
[3] Bank Indonesia – www.bi.go.id
[4] GSMA Wireless Intelligence
[5] GPM Research – Indonesia Market Analysis

Power Supply Scenario

The power and energy are managed by the State Electricity Company (PLN) under the Ministry of Energy and Mineral Resources (MEMR). PLN is responsible for generating, distribution and maintenance of electricity infrastructure whereas MEMR creates policies related to power. For supervision, PLN is supervised by the State Minister for State-Owned Enterprises (BUMN) for daily operations.

Electricity characteristics are different from one island to another island, but we can categorise the islands under three categories: Those experiencing:

1. Reliable grid: along Java and Bali islands and the other major/capital city in Indonesia. The outage is between less than 4 hours a day.

2. Unreliable grid: in rural areas, outside Java and Bali islands, with average outages per day between 4-8 hours.

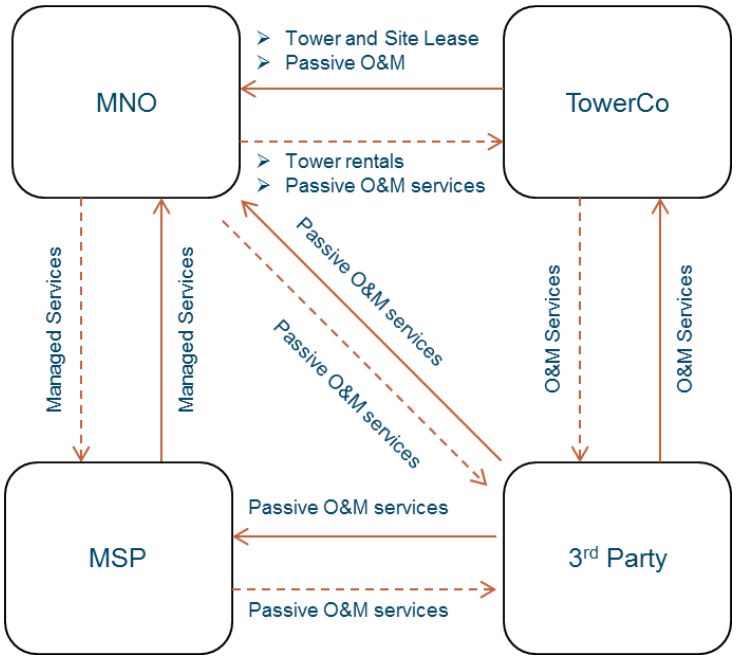
3. Off grid: Off grid locations are usually located in remote rural areas or Small Islands.

Operation Challenges - IBST

In the current situation, IBST's client's demand is mainly on tower infrastructure lease and maintenance, hence it has few activities in power related operation and maintenance. Power engineering and planning are still largely managed by the Mobile Network Operator (MNO)'s.

Below figure 1 shows the current business and operations flow relationship between the Tower Company (TowerCo), MNO, Managed Service Provider (MSP) and Third Party.

Figure 1. Current Business Flow



Here are some findings collected during the completion of the Feasibility Study:

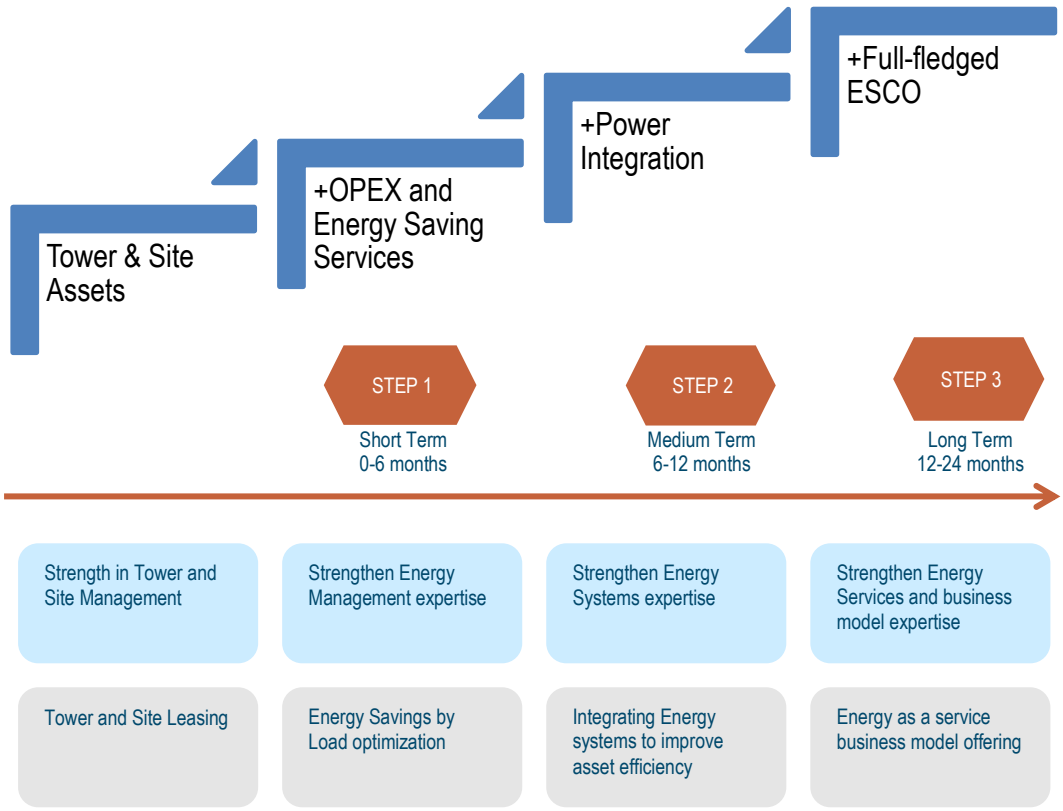
- The majority of the power business is still under the scope of MNO
- IBST has mainly on-grid sites with access to a reliable grid
- In a multi-tenant scenario, the scope of IBST is offering tower infrastructure space and maintenance to all tenants plus to a limited few tenants IBST it also offers power operations and maintenance. Most of the other tenants outsource their power operations to MSP or 3rd party O&M partners
- IBST being a Tower Company serving all telecom operators, has a potential to become a one-stop services provider by offering tower space infrastructure as well as energy services to MNOs

Feasibility Study and Approach

The Feasibility Study has been carried out according to GSMA's Green Power for Mobile (GPM) methodology involving detailed data collection, data analysis, green power model design, business case development, site prioritization and recommendations.

Based on the results of the Feasibility Study, GSMA recommended the following approach to IBST. The recommended approach suggests leveraging the current business model and for IBST to consider future expansion to become an infrastructure end-to-end provider in Indonesia.

Figure 2. Business Model Approach



Network and Data Analysis

Network data collection was the first step of the Feasibility Study: the more complete and accurate the data, the more visibility of the existing network. The collected data, such as site information, power infrastructure, environment, site access, was slightly different from previous GPM Feasibility Studies. Additional information about tenant information and its equipment for each particular site were also included in the analysis.

As of December 2013, IBST has more than 2,104 tower sites across Indonesia with focus on Sumatera and Java islands and for this feasibility study only 1,712 tower sites were analysed. All IBST sites are already connected with reliable commercial grid power and with an average outage of less than 2 hours a day. IBST has 3,178 tenants on their network or about 1.5 for tenancy ratio. IBST has no problem to access their sites.

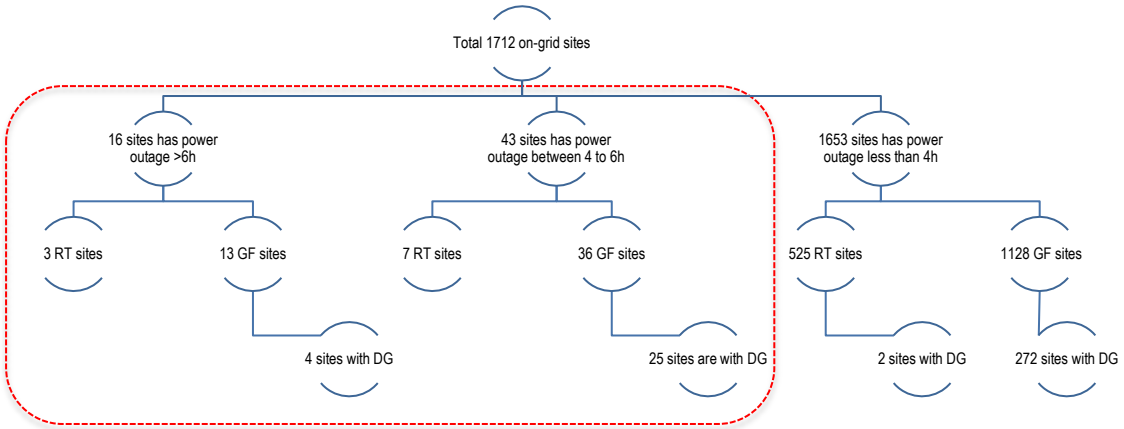
All IBST's sites are connected to reliable commercial grid power so at only 303 sites there is a need for fixed Diesel Generation (DG) configuration as a back up during the power outage (other sites use mobile DG backup systems if needed). There are 1,706 indoor sites require Air Conditioner within IBST's network. The engineering and planning of the power system are managed by the MNO, and IBST only helps to do any connection work needed to connect to the PLN commercial grid..

The feasibility study analysis of the network concluded that Green Power might not be the best fit for the current network. However, an energy efficiency approach, and a future ESCO model approach have been recommended using the results of the Feasibility Study.

Overall Existing Network Analysis

The analysis started by looking at the average outage of the commercial power grid per day. Based on the data available, below is detail tree diagram for power outage characteristic.

Figure 3. Power Outage of The Existing Network



We then analysed the 16 sites with more than 6 hour outage and the 43 sites with 4-6 hour outage, ie a total of 59 sites, to study possible renewable energy designs. The solar radiation is good across the 59 sites with an average 4.83 kWh/m2/day, however the low wind speed makes the wind power solution unattractive

Table 1. Load Analysis

Average loads	1 Tenant	2 Tenant	3 Tenants	>3 Tenants
Telecom load (kW)	1.68	2.61	3.64	4.77
AirCon load (kW)	1.22	1.23	1.21	1.19
Total site load (kW)	2.90	3.84	4.85	5.96

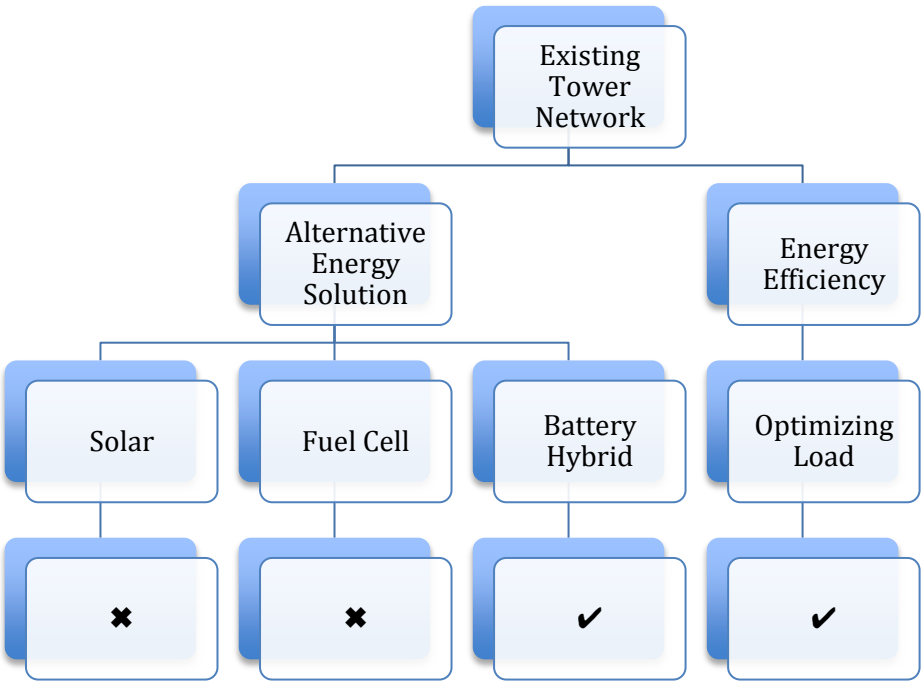
Regarding the load analysis, Air Conditioner electricity consumption has contributed a significant amount of the total site load. On telecom load electricity consumption, the incremental of telecom load is not much significant impact to total site electricity load consumption, because the other tenants are using outdoor type of BTS.

Model Design and Solution

Based on network data, the approach begun by analysing green solution design for both solar, fuel cell and battery hybrid solutions. The result showed that only grid battery hybrid solution was more applicable for this existing network.

The better approach was to focus on optimizing the existing load to get some saving opportunity. The load optimization approach will have two aspects, the first one by reducing AirCon running hour and the second is by integrating power system equipment to get better business model.

Figure 4. Design and Analysis Approach



Energy Efficiency: Reducing AirCon Running Hour

Indonesia has temperature in between 20-35 C with average temperature around 27 C. On this analysis, AirCon usage can be minimized to 18 hours instead of 24 hours running during a day.

So the purposed design and AirCon running hour as follow

Table 2. Design Proposal

Design Model		Proposed Solution	
No. of Sites	**AicCon Load (kW)**	**DC Fan**	**AirCon Controller**
152	2-2.5	48V,48W, 7.60 m3/min	48VDC/220VAC Controller with Timer
980	1.25	48V,48W, 7.60 m3/min	48VDC/220VAC Controller with Timer
547	1-1.125	48V,48W, 7.60 m3/min	48VDC/220VAC Controller with Timer

Figure 5. New AirCon Running Hour

On implementation, the AirCon can be optimized based on temperature controller for on-off purpose or instead to have 2 hours on and 2 hours off, the system can also be designed for 6 hours off during the evenings or night when it is cooler if the equipment is not as sensitive to slightly higher temperatures.

Business Case for AirCon Optimization

By this initiative, IBST has an opportunity to share the money saved from electricity bills by this load optimization with MNO (if IBST pays for the CAPEX costs). The CAPEX and potential saving will describe below.

Table 3. Business Case

Priority	Design Model		Current Monthly OPEX		Monthly OPEX after Energy Efficiency		Saving ($)	CAPEX	CAPEX w/ PMS	Saving Sharing	
	No. of Sites	AicCon Load (kW)	Electricity Usage (kWh)	Electricity Bill ($)	Electricity Usage (kWh)	Electricity Bill ($)				MNO (30%)	IBST (70%)
1	152	2-2.5	428,788.80	60,030.43	370,540.80	51,875.71	8,154.72	30,704.00	213,104.00	2,446.42	5,708.30
2	980	1.25	2,180,855.52	305,319.77	1,960,355.52	274,449.77	30,870.00	197,960.00	1,373,960.00	9,261.00	21,609.00
3	547	1-1.125	992,242.80	138,913.99	893,760.30	125,126.44	13,787.55	110,494.00	766,894.00	4,136.27	9,651.29

Priority	Design Model		ROI	ROI w/ PMS
	No. of Sites	AicCon Load (kW)		
1	152	2-2.5	**0.45**	**3.11**
2	980	1.25	**0.76**	**5.30**
3	547	1-1.125	**0.95**	**6.62**

IBST will have an opportunity to have additional revenue US$36,968.59 per month or US$443,623.08 per year based on this sharing of money from savings concept, with a total CAPEX investment US$339,158.

Energy Efficiency: Power System Integration

Based on this analysis, the second approach is to also provide the passive power infrastructure to the tenant. The purposed design as following

Table 4. Design Proposal

	Load	Proposed Design				CAPEX	Payback Period (Yrs)
		Grid	DG	Battery	Autonomy		
1 Tenant	1.7 kW	Yes	15 kVA	1x300 Ah	6.4 hr	$7,520.00	2.26
2 Tenants	2.6 kW	Yes	15 kVA	1x300 Ah	7.8 hr	$12,040.00	1.76
3 Tenants	3.8 kW	Yes	15 kVA	1x300 Ah	7.9 hr	$16,360.00	1.66

Table 5. Business Case for Power System Integration

	Load	Grid Status	DG	Battery		Contribution of Energy	
				Capacity	Autonomy	Grid	DG
1 Tenant	1.7 kW	Yes	15 kVA	1x300Ah	6.4 hrs	100%	0%
2 Tenants	2.6 kW	Yes	15 kVA	2x300Ah	7.8 hrs	100%	0%
3 Tenants	3.8 kW	Yes	15 kVA	3x300Ah	7.9 hrs	100%	0%

Overall, IBST will be able to offer better SLA obligations if IBST also has greater control over power solutions to all tenant at the same location based on business case above.

Recommendation

The recommendation from GSMA Green Power for Mobile for IBST after conducting intensive Feasibility Study, is as follows:

For Existing Network

- Approach load saving sharing business model to MNO as first step of transformation
- Acquire and share energy assets and offer more power operation and management SLA
- Implement Power Management System (PMS) to control power system in a real time basis

For Future Network

Green power however still be considered for new off-grid site location to generate more revenue on untouchable commercial power connection or for off grid sites where the connection from PLN will take time to implement, By implementing this solution IBST will shift to full-fledged ESCO.

Summary

To conclude the Green Power Feasibility, as follows:

For saving on AirCon running hour, IBST needs to spend US$ 339,158 with return of investment below one year.

Priority	No. of Sites	CAPEX	ROI
1	152	$30,704.00	**0.45**
2	980	$197,960.00	**0.76**
3	557	$110,494.00	**0.95**

And for power system integration, the CAPEX requires about US$15.74 million.

On this analysis, the approach was by providing the passive power infrastructure to tenant. The purposed design as following:

Tenant	No. of Sites	CAPEX	Total	ROI
1 Tenant	1108	$7,520.00	$8,332,160.00	2.26
2 Tenants	419	$12,040.00	$5,044,760.00	1.76
3 Tenants	145	$16,360.00	$2,372,200.00	1.66
			$15,749,120.00	

About the GSMA Association
The GSMA represents the interests of mobile operators worldwide. Spanning more than 220 countries, the GSMA unites nearly 800 of the world's mobile operators with 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in industry sectors such as financial services, healthcare, media, transport and utilities. The GSMA also produces industry-leading events such as Mobile World Congress and Mobile Asia Expo.

For more information, please visit the GSMA corporate website at www.gsma.com. Follow the GSMA on Twitter: @GSMA.

About Mobile for Development - Serving the underserved through mobile
Mobile for Development brings together our mobile operator members, the wider mobile industry and the development community to drive commercial mobile services for underserved people in emerging markets. We identify opportunities for social and economic impact and stimulate the development of scalable, life-enhancing mobile services.

For more information, please visit the Mobile for Development website at http://www.gsma.com/mobilefordevelopment/. Connect with us on Twitter @GSMAM4D

About the GSMA Green Power for Mobile Programme
Green Power for Mobile works to extend the coverage, reduce the cost and minimise the environmental impact of mobile networks by championing renewable energy.

Whilst it continues to serve mobile network operators globally, the programme will place key focus on a number of target markets in Africa and Asia including Indonesia, Bangladesh, Pakistan, Afghanistan, Nigeria, Ghana, Kenya, Tanzania, Uganda, Senegal and Cameroon. With Project Managers based in each of these regions, GPM is well positioned to engage with the industry and address the requirements of these markets.

For more information on the GSMA's Green Power for Mobile Programme, please contact us on greenpower@gsma.com

http://www.gsma.com/mobilefordevelopment/programmes/green-power-for-mobile