IFC International Finance Corporation World Bank Group

GSMA Green Power for Mobile

In partnership with the Netherlands

Greening Telecoms: Pakistan and Afghanistan Market Analysis

Sizing Potential for Green Power in Pakistan and Afghanistan

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Objective

This document aims at identifying and examining the potential for green power deployments in the telecom industry of Pakistan and Afghanistan.

This report analyses Afghanistan and Pakistan's renewable energy resources, their green technology regulations, the current state of green deployments in the sector and the size of the market in both countries. The report presents the number of tower sites and their power situation, as well as an estimation of tower sites' growth. It goes on showcasing the potential opportunities for Energy Service Companies (ESCOs) on outsourcing energy in Afghanistan and Pakistan.

Approach

The Green Power Market Analysis for Afghanistan and Pakistan is based on information gathered using primary data collection through stakeholder interactions and questionnaires. The market analysis report also utilises some generic market data collected through various secondary resources and used as appropriate for analysis.

Definition

GSM	Global System for Mobile Communication
GSMA	GSM Association
OPEX	Operating Expenditure
CAPEX	Capital Expenditure
DG	Diesel Generator
ESCO	Energy Service Company
kWh	kilo Watt hour
MWh	Mega Watt Hour
GDP	Gross Domestic Product
SAARC	South Asia Association for Regional Cooperation
WAPDA	Water and Power Development Authority
KESC	Karachi Electric Supply Corporation
MEW	Ministry of Energy and Power
DABM	Da Afghanistan Bresha Moassassa
SCU	Spinghar Construction Unit
PCU	Power Construction Unit
IPP	Independent Power Producer
WAPECA	Water and Power Engineering Consultancy Authority
NEPRA	National Electric Power Regulatory Authority
AEDB	Alternative Energy Development Board
ANDS	Afghanistan National Development Authority
ICE	Inter-Minister Commission for Energy
ARPU	Average Revenue per User
MNO	Mobile Network Operator
FCU	Fan Cooling Unit
PPA	Power Purchase Agreement
ESA	Energy Saving Agreement
Off-grid site	Telecom Base Station Site which is NOT connected to the commercial Grid power supply
On-grid site	Telecom Base Station Site which is connected to the commercial Grid power supply
Tower Company	A company that manages a part or the entire assets of a telecom tower

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Executive Summary

Currently, the second generation (2G) of GSM is the main mobile technology deployed in both Afghanistan and Pakistan. The GSMA identified 38,452 tower sites, serving more than 63.2 million unique subscribers in both countries. The mobile market penetration in Pakistan and Afghanistan has reached 28.51% and 33.92% respectively.

With electrification rates of approximately 70% for Pakistan and 30% for Afghanistan, the MNOs are faced with constraints to expand and power their networks in off-grid regions. Today, we estimate that more than 7% of the 38,452 sites are located in off-grid areas.

The total number of tower sites is expected to grow to 73,289 by 2016 bringing the total energy consumption for powering these sites to 802.5 million kWh, a considerable increase from the current requirement of 421 million kWh for 38,452 sites in 2013.

The number of off-grid sites will also increase from 2,989 sites to 8,135 sites by 2016 and unreliable-grid sites will grow from 7,812 sites to 16,262 sites in total for both Pakistan and Afghanistan.

There is an immediate opportunity for MNOs to make OPEX savings by converting the 2,435 off-grid sites from 24x7 DG systems to DG-battery hybrid solutions; allowing for OPEX saving of up to USD 18.1 million annually. GSMA also estimates a potential saving of around USD 127.7 million by converting 10,247 problematic sites into renewable energy powered sites, provided a total CAPEX investment of around USD 394.5 million in 2013, and USD 939.3 million for 24,397 sites by 2016.

The ESCO business model presents another opportunity for realising OPEX savings for MNOs. By adopting the ESCO model based on a power purchase agreement (PPA), MNOs will make OPEX savings of around USD 41.6 million year-on-year for 10,801 potential sites as of 2013 and USD104.3 million by 2016. The potential market sizing for ESCOs would be USD 141.9 million with estimated revenues reaching USD 23.6 million in 2013. The market size would reach up to USD 320.5 million with estimated revenue of about USD 53.4 million by 2016 for 24,397 sites.

1. Pakistan/Afghanistan

Afghanistan and Pakistan, two neighbouring countries located in the South Asian region, share their borders with India at the east, Iran at the west, and with Turkmenistan, Uzbekistan and Tajikistan at the north.

1.1 Geographical

Pakistan is divided into four provinces, including Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa, as well as the capital Islamabad. The country has a total population of just over 180 million covering around 796,096 sq. km with a population density 226.3 per sq. km[1].

Pakistan is a member of the SAARC (South Asia Association for Regional Cooperation) countries and the national language is Urdu, although English is also used as an official language. The country lies between Latitude 24^{O} N and 37^{O} N, and Longitude 62^{O} E and 75^{O} E.

Figure 1 Pakistan Map

Afghanistan, a landlocked mountainous country with plains in the North and Southwest, has a land area of 652,230 sq. km with a total population of about 24.98 million people[2]. The country lies between Latitude 29^{O} N and 39^{O} N, and Longitude 60^{O} E and 75^{O} E. Afghanistan's a potential natural resources include coal, copper, iron ore, lithium, uranium, zinc, gold, natural gas and petroleum.

Afghanistan has a total of 34 provinces with Kabul as the capital. The other largest cities in the country are Kandahar, Herat, Mazar-i-Sharif, Jalalabad, Lashkar Gah, Talogan, Khost, Shebeberghan and Ghazni. Pashto and Dari (Persian) are the official languages in Afghanistan and a small percent of Afghans is also fluent in Arabic, Urdu and English.

[1] Pakistan Bureau od Statistic – www.pbs.gov.pk
[2] Afghan Energy Information Centre – www.afghaneic.org

Figure 2 Afghanistan Map

Weather and climate in both countries vary from tropical to temperate. There are four distinct seasons: a cool, dry winter from December through February, a dry spring from March through May and the rainy summer season from June through September.

1.2 Economic

Pakistan is in a better economic condition than Afghanistan, as its GDP per capita shows, reaching USD1,189, whereas Afghanistan's GDP per capita only reached USD542 in 2011. However, from 2008 to 2011, Pakistan had an average GDP growth of 2.96% while Afghanistan recorded a growth of 9.7% over these four years[3].

Table 1 GDP Growth

	Country	2008	2009	2010	2011
GDP per capita (current USD)	PAK	978	949	1,016	1,189
GDP per capita (current USD)	AFG	326	366	456	542
GDP per capita growth (annual %)	PAK	1.59%	3.59%	3.54%	2.95%
GDP per capita growth (annual %)	AFG	3.61%	21.02%	8.43%	5.73%

1.3 Power and Energy

Pakistan has two integrated public sector organizations managing the electricity supply sector: the Water and Power Development Authority (WAPDA) and the Karachi Electric Supply Corporation (KESC). WAPDA supplies power to all of Pakistan except the metropolitan city of Karachi, which is supplied by KECS.

In Afghanistan, the Ministry of Energy and Water (MEW) is responsible for managing, controlling and operating the power sector through five enterprises:

[3] World Bank – www.worldbank.org

1. Da Afghanistan Bresha Moassassa (DABM), is in charge of the generation, transmission and distribution of electricity.

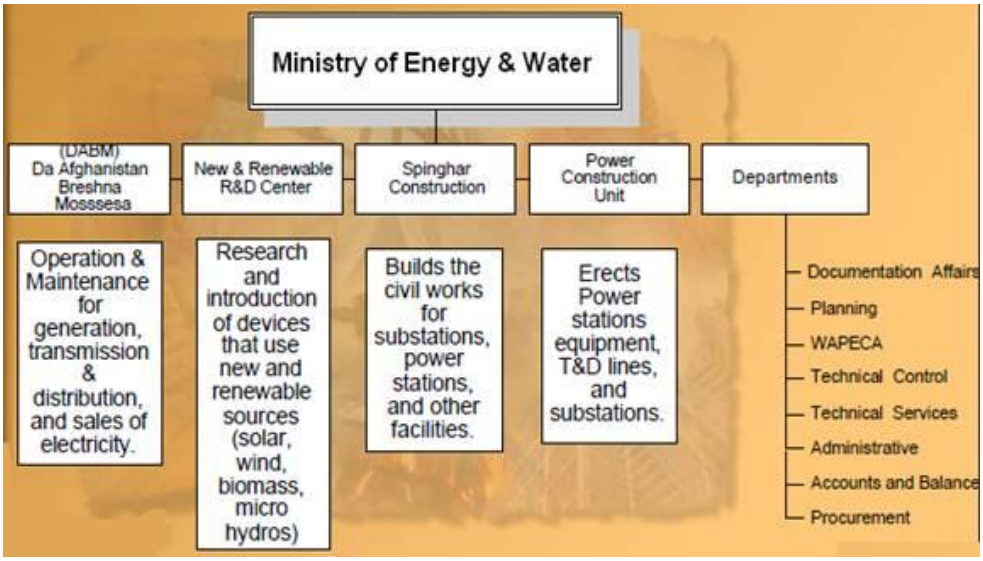
2. Spinghar Construction Unit (SCU), is in charge of civil works for power stations and sub-stations and civil works relating to the power sector.

3. Power Construction Unit (PCU), handles the erection of all electrical works like transmission and distribution lines and sub-stations.

4. The Water and Power Engineering Consultancy Authority (WAPECA) is responsible for design of new generation, transmission and distribution.

5. The New and Renewable Energy Research and Development Centre is responsible for activities to develop of renewable energy.

Figure 3 Structure of Afghanistan Power Sector[4]



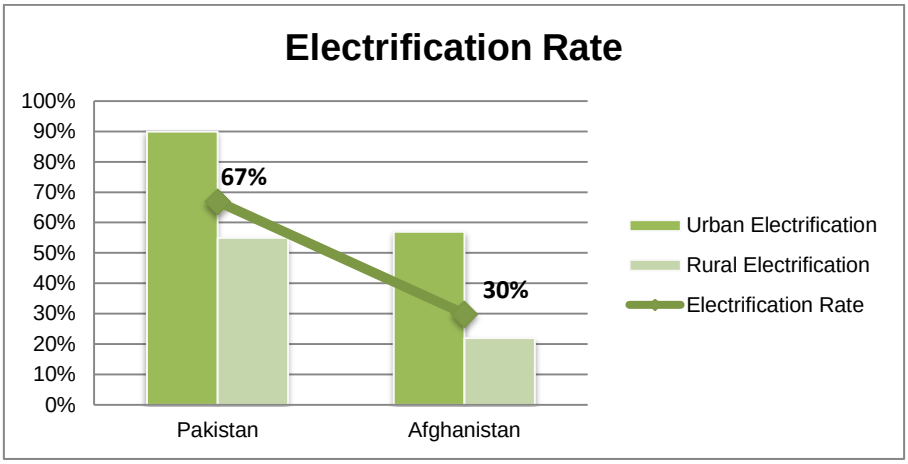
1.3.1 Electricity Infrastructure

Pakistan and Afghanistan are facing acute infrastructure challenges in providing electricity across the countries. With an electrification rate of about 30% and demand-supply gaps, Afghanistan has been forced to import electricity from neighbouring countries such as Iran, Uzbekistan and Turkmenistan.

The urban and rural electrification rates in Afghanistan are below 60% and 30% respectively. Due to economic and embargo issues, the country majorly relies on non-profit funding to increase its electrification rate yet only manages to cover 17% of the gap between demand and supply.

Figure 4 Electrification Rate[5]

[4] Afghan Energy Information Centre – www.afghaneic.org
[5] IEA – www.worldenergyoutlook.org



In Pakistan, the electricity deficit has reached more than 36%. Based on the Ministry of Water and Power, the demand for electricity will continue to rise on average by 7% in the years to come.

Electrification rates in Pakistan's urban area have reached 90% against 55% in rural areas. It has become a problem, infringing on the country's economic growth.

Table 2 Supply vs. Demand[6]

	Pakistan	Afghanistan
Installed Capacity (MW)	15,055	465.30
Demand Capacity (MW)	20,584	545.79
Deficit	36.73%	17.30%

Regarding the sources of power production, hydro and thermal power plants dominate in both countries. Pakistan's hydro power plants contribute to around 68% of the national power production, followed by thermal power plants (30% of national production). The rest of the national production is Nuclear (about 2%)[7].

In Afghanistan, 80% of national power production is generated by hydro power, followed by thermal power (15% contribution) and by diesel power (5%)[8] .

Figure 5 Pakistan Power Productions

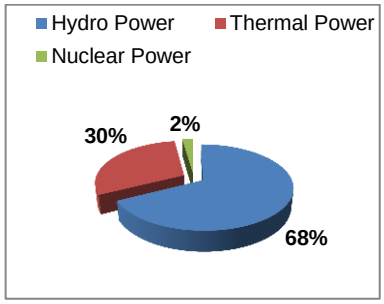
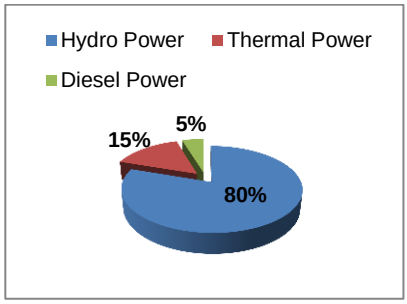


Figure 6 Afghanistan Power Productions



[6] DABS – www.dabs.af and Ministry of Water and Power – www.mowp.gov.pk
[7] Ministry of Water and Power – www.mowp.gov.pk
[8] Ministry of Energy and Water – www.mew.af

1.3.2 Energy Regulation in Pakistan and Afghanistan

Pakistan's National Electric Power Regulatory Authority (NEPRA) and Alternative Energy Development Board (AEDB) play an important role in regulating the country's energy sector. NEPRA takes on the main responsibilities, ensuring fair competition and consumer protection by issuing licenses for power production, transmission and distribution and tariffs. AEDB is responsible for developing the country's medium and long-term promotion policy for renewable energy sources.

In Afghanistan, the Afghanistan National Development Authority (ANDS) manages the complex institutional framework on energy strategy and monitors the implementation. ANDS coordinates with the Inter-Ministerial Commission for Energy (ICE) to formulate the regulation.

The table below presents a snapshot of regulations in the energy sector, with regards to green power for Pakistan and Afghanistan.

Table 3 Power Regulation

Country	Power Sector Visions	Green Regulations
Pakistan[9]	▪ Reduce transmission and distribution loss to below 30%. ▪ Increase the capacity by additional 35,000 MW by 2025. ▪ Give some exemptions to independent power producer from numerous form of taxation (capital gain tax, income tax and turnover tax) and duties.	▪ AEDB has a mandate to make 10% of total installed capacity in the country from renewable energy source by 2015. ▪ Electrification of 40,000 off grid villages through alternative renewable energy sources in the next 5 years.
Afghanistan[10]	▪ Establish 730,000 new connections in the country. ▪ Integrate the energy programme with plans for the new city. ▪ Trade facilitation to encourage energy transfer from Central Asia. ▪ Attract more private investment in the energy sector to extend the grid connectivity (including renewable, natural gas, coal and oil). ▪ Establish market-based tariffs with a clear timetable to phase out subsidies. ▪ Reduce transmission losses to below 20%. ▪ Installed new capacity to be reached 1,019 MW by 2013.	▪ Deploy 10 MW of wind power in the next 5 years and 50 MW of wind power in the next 10 years.

[9] Ministry of Water and Power – www.mowp.gov.pk
[10] Ministry of Energy and Water – www.mew.gov.af

1.4 Telecommunication

1.4.1 Subscriber and Penetration[11]

The GSMA identifies that 63.2 million unique subscribers were registered in Pakistan and Afghanistan as of 2012, with 2.17 SIMs per subscriber for Pakistan and 1.70 for Afghanistan. The Average Revenue per User (ARPU) is about USD4.77 for Pakistan and USD 7.13 for Afghanistan.

The mobile penetration in Afghanistan has reached 33.92%, which is higher than Pakistan's that reached 28.51% by 2012.

Figure 7 Subscriber Growth

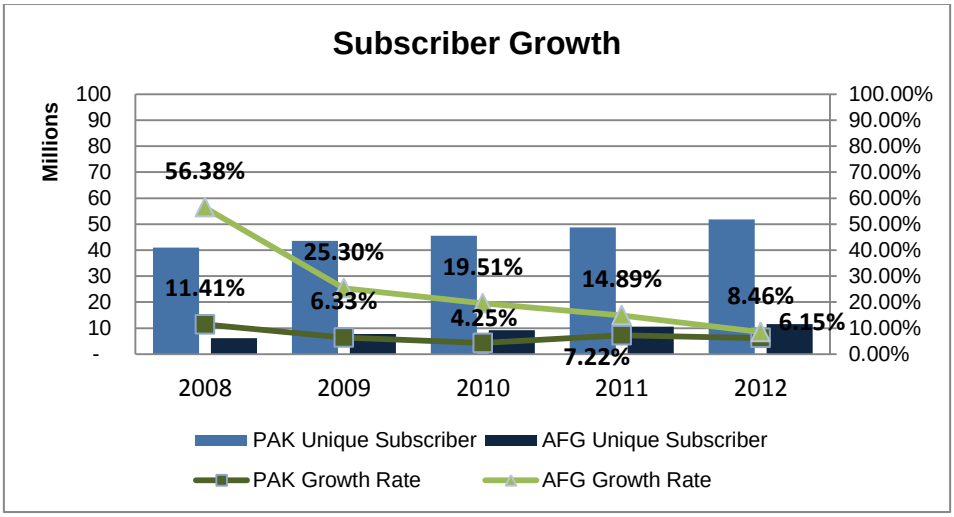
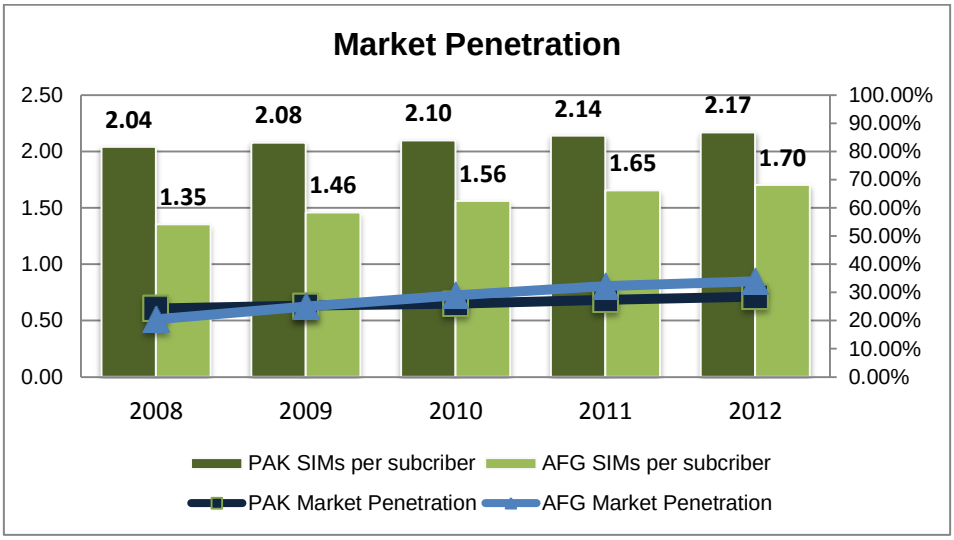


Figure 8 Market Penetration



1.4.2 Mobile Coverage and Network Size

Pakistan, with a total network of 33,160 sites, is ahead of Afghanistan which has around 5,292 tower sites. The mobile coverage based on population is more than 85% for both the countries, reflecting that a lot of land is sparsely populated.

Out of the total number of sites, 41% are unreliable grid sites in Afghanistan whereas Pakistan only has around 17%. Pakistan and Afghanistan combined have around 2,989 off-grid sites, which accounts for about 7.77% of the total sites.

[11] Wireless Intelligence

The number may increase if MNOs expand their coverage in rural remote area.

Figure 9 Network Size[12]

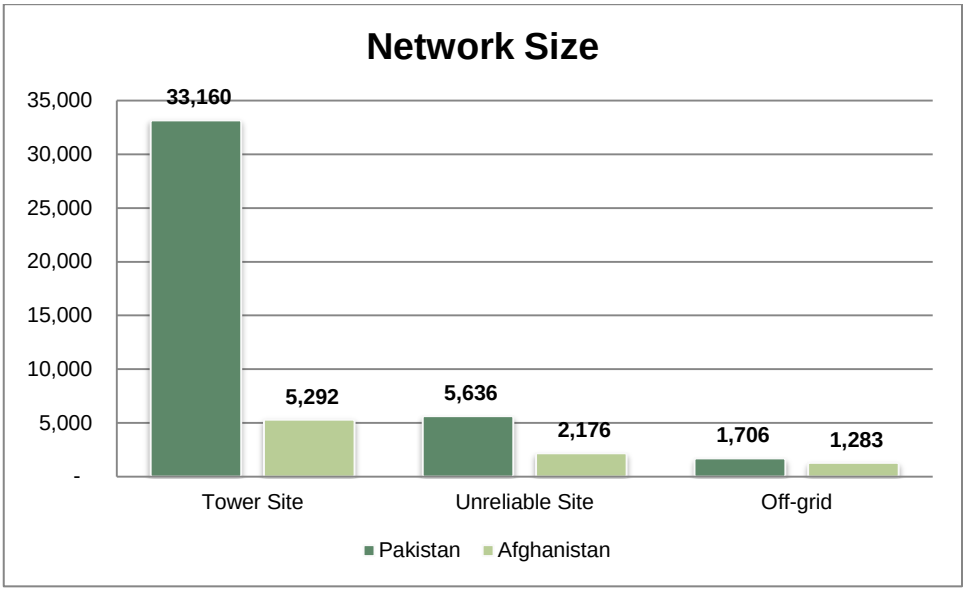
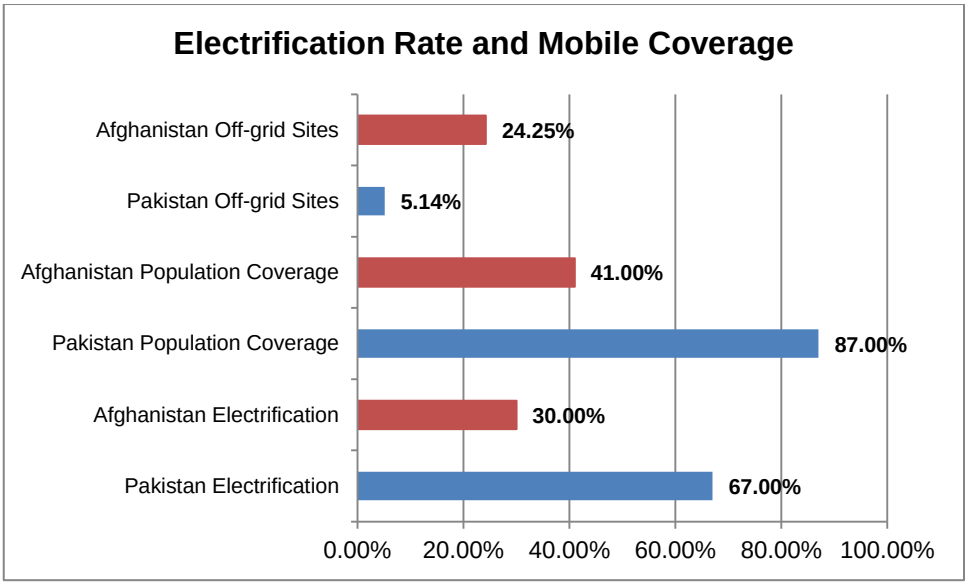


Figure 10 Population Coverage and Electrification Rate[13]



1.5 Eco-system and Fiscal Incentive

1.5.1 Industry Structure

The telecom infrastructure in Pakistan and Afghanistan is represented by MNOs who own the tower assets, as well as by telecom equipment vendors who supply telecom equipment to the sites. The site maintenance is led by managed service providers.

Site sharing activity between MNOs in both countries is a preferable choice to extend their coverage. In both countries, there is no tower company at the moment.

The telecom infrastructure ownership structure is presented below.

[12] GPM Analysis and Research
[13] GPM Analysis and Research

Table 4 Tower Ownership

	MNO	Telecom Vendor	Power Vendor	Manage Services/O&M
Who owns the tower assets?	●			
Who owns the power equipment?	●		●	
Who provides Power equipment & solution?		●	●	
Who manages power?	●		●	●
Who plans the power equipment?	●		●	
Who manages site operations?	●			●

1.5.2 Incentive to Promote Green Technology

To promote green technology, the government of Pakistan has provided some incentives for investors14 in the form of fiscal and financial support. The fiscal incentives for renewable players are as follow:

- No custom duty or sale tax for machinery equipment and spares.
- Exemption from income tax including turnover rate tax and withholding tax on imports.
- Repatriation of equity for IPP along with dividends freely allowed, subject to rules and regulations prescribed by the State Bank of Pakistan.
- Parties may raise local and foreign finance in accordance with regulations applicable to the industry in general.
- Non-Muslim and non-residents shall be exempt from payment of the Zakat[15] on dividends paid by the company.

And the financial incentives:

- Permission for power generation companies (IPP) to issue corporate registered bonds.
- Permission to issue shares at discounted prices to enable venture capitalists to be provided higher rates of return proportionate to the risk.
- Permission for foreign banks to underwrite the issue of shares and bonds by private power companies under the laws of Pakistan.
- Non-resident allowed purchasing securities issued by Pakistani companies without the State Bank of Pakistan's permission.

Afghanistan is still in the early stages of developing a renewable energy policy. The government depends on donor countries to develop the energy sector. While this report was produced, there were no specific fiscal or financial incentive mechanisms in place for renewable energy developments in Afghanistan.

[14] Pakistan Board of Investment – www.pakboi.gov.pk
[15] Zakat is Muslim tax

2. Powering Telecom: Current Approach

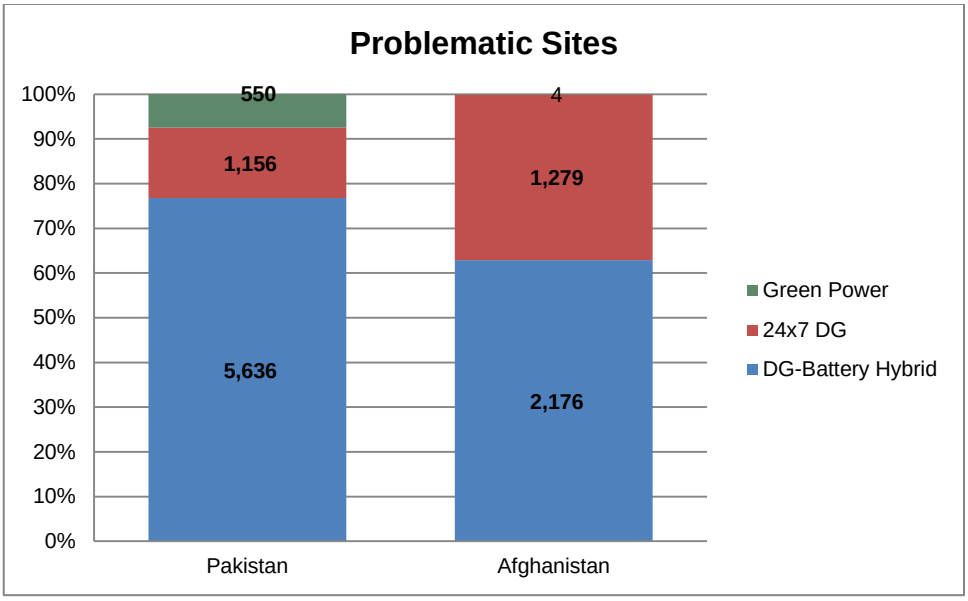
2.1 Current State of Deployment

In the middle of the current energy crisis in Pakistan and Afghanistan, MNOs of both countries are heavily relying on Diesel Generators to power up their telecom sites. OPEX savings are the key driver for MNOs to minimize energy costs on their daily operations by optimizing the life cycle of batteries and converting sites to renewable solutions.

GSMA identifies that around 7.77% or 2,989 of 38,452 tower sites are located in off-grid areas in Pakistan and Afghanistan and around 20% -or 7,812 sites - are unreliably connected to the grid in both of the countries16.

The power solution deployed at the 10,801 problematic sites, with outages of more than 12 hours, is presented below:

Figure 11 Current Power Solution Deployments for Problematic Sites in Both Countries



Note: DG-Battery hybrid solution is using the deep cycle battery technology

In Pakistan, less than 2% of the sites have converted to green sites, while Afghanistan mostly relies on DG solutions. Most of the sites in Pakistan and Afghanistan are using DGs as back-up power, even for grid connected sites[17].

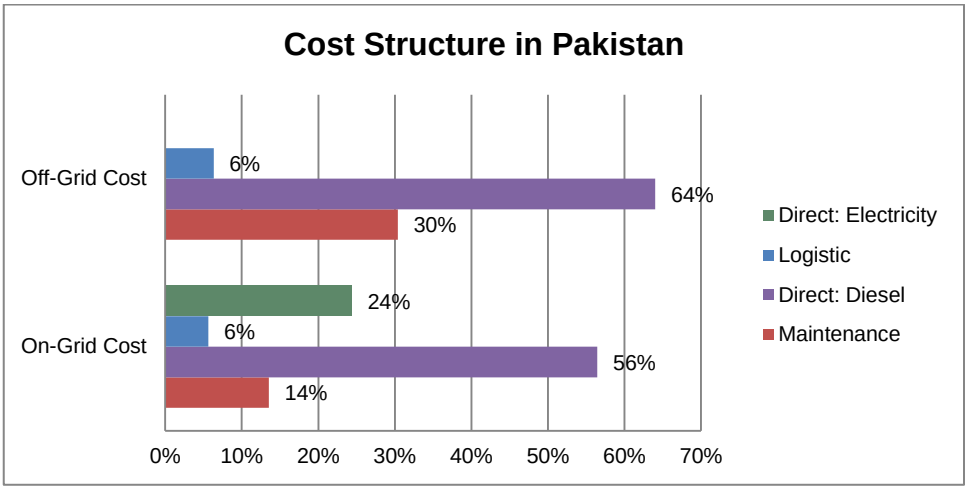
2.2 Cost of Power in the telecom Sector

The reliance on fossil fuel based solutions has increased the cost of powering the base station. The cost structure in the telecom sector can be divided into direct and indirect costs as shown below:

Direct cost	Fuel cost of diesel and electricity.
Indirect cost	Cost of maintenance for the equipment including diesel generator and other power system and overhead, Including logistic.

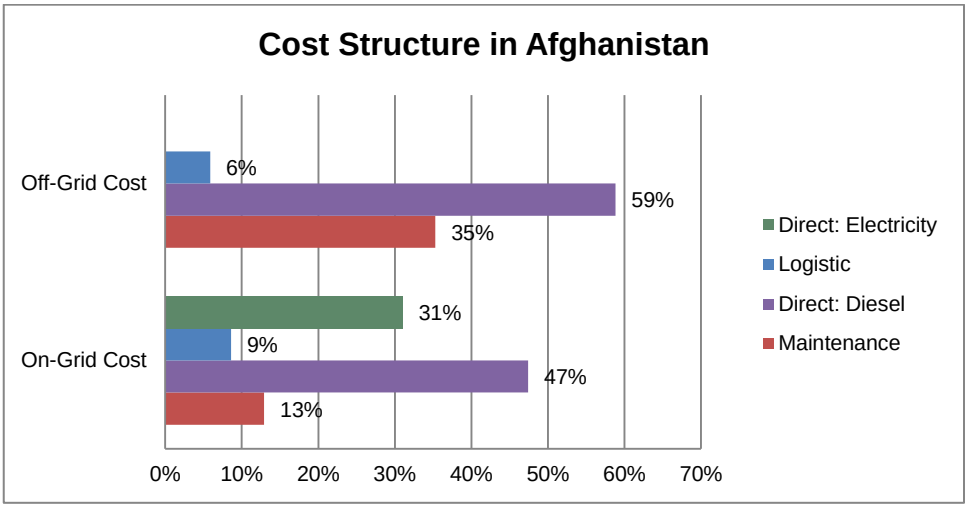
[16] GPM Analysis and Research
[17] GPM Analysis and Research

Figure 12 Cost Structure in Pakistan



The cost of diesel covers most of the overall cost structure in both of countries. In an off-grid scenario, cost of maintenance in Afghanistan is more expensive compared to Pakistan. The on-grid cost structure shows that the cost of electricity in Afghanistan is higher than its neighbouring country, Pakistan. The electricity cost constitutes around 31% of the total cost of powering an on-grid site[18].

Figure 13 Cost Structure in Afghanistan



[18] GPM Analysis and Research

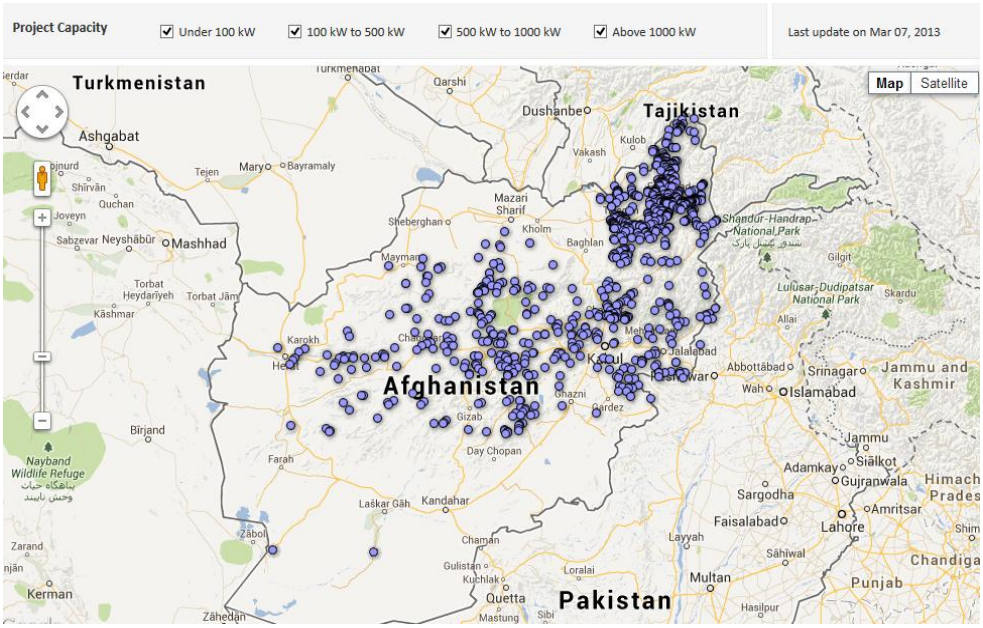
3. Powering Telecom: Green Telecom and Market Sizing

3.1 Green Technology Options

The total hydropower potential in Pakistan has been estimated at over 40,000 MW, approximately 6400 MW of which is actually being exploited. The Northern mountainous region, has the potential for more than 1000 MW of power through micro/mini hydropower systems, but currently less than 1% is being developed.

Afghanistan has a potential hydropower in some provinces such as Kandahar, Nangarhar and Mazar-i-Sharif. A number of mega dams are being built in different parts of the country, which are mainly for irrigation purposes. Micro hydro technology could be used for deploying small hydro turbines to power up the telecom network. So far, the government has completed a 36,656 kW hydro power plant and will increase its capacity to 52,893 kW in the upcoming years19.

Figure 14 Hydropower Plants in Afghanistan



In Pakistan, wind technology has not yet developed, and there are currently no commercial wind farms in operation. Some pilot micro wind turbines are being tested for community use only: a small number of wind plants are deployed in Pakistan (300-500 W) for generation of electricity and roughly 30 wind power installations are being used for pumping water in the coastal regions of Balochistan and Sindh provinces.

The wind speed can exceed 7-8 m/s in some sites along the Keti Bandar Gharo corridor and, most notably, along its 900 km coastline and in the North-West Frontier valleys. Pakistan possesses about 50,000 MW of economically exploitable wind-power[20].

Afghanistan has an untapped wind energy source of about 158,000 MW. The government has deployed 5 wind farms with a total capacity of 200 kW[21].

In Pakistan, the rural population in particular relies almost exclusively on biomass in the form of fuel wood or charcoal for cooking and heating. Conversely, the majority of Pakistan's urban population uses those traditional sources of energy. The country's forest land covers around 38,100 km², but each year local residents

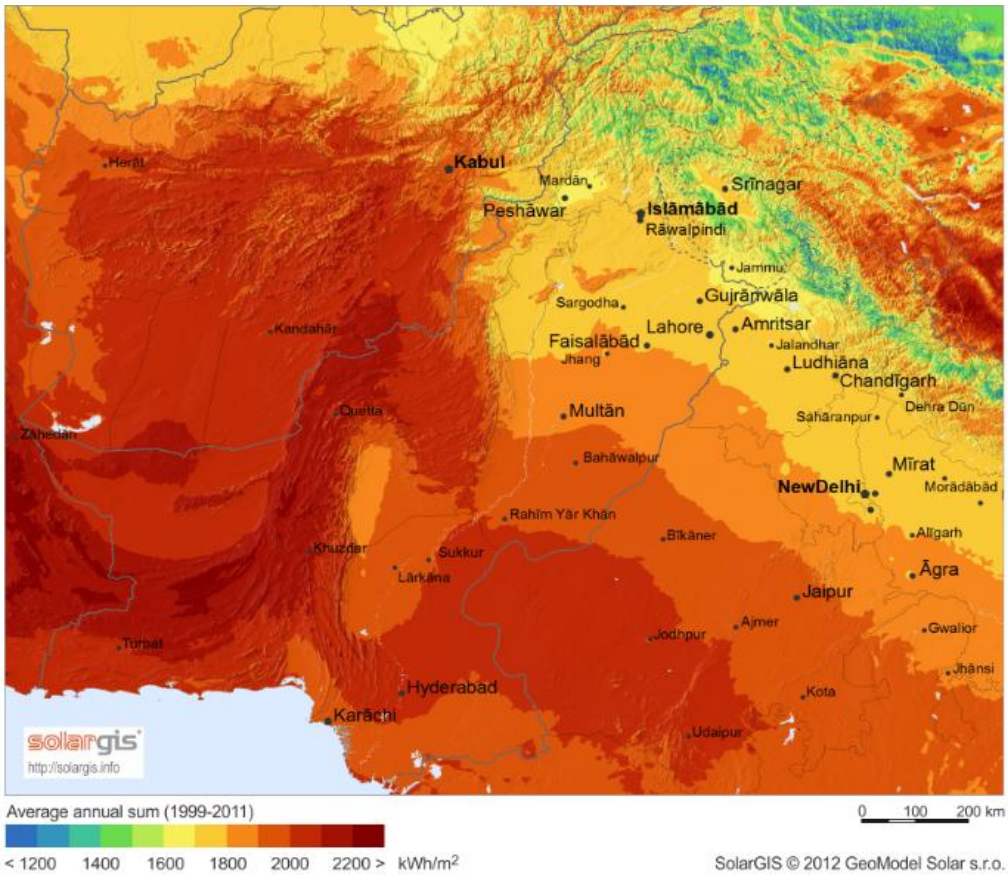
[19] Ministry of Energy and Water – www.mew.gov.af
[20] Ministry of Water and Power – www.mowp.gov.pk
[21] Ministry of Energy and Water – www.mew.gov.af

remove some 1.2 million m² of wood from the forest and use it as fuel22.

The potential of biogas power, from animal waste (cows, camels, sheep or goats), is estimated at about 1,400 million cubic meters, annually. This potential could be used to help build small and medium power plants in villages.

Pakistan and Afghanistan have a very good overall solar-energy potential. The average daily insolation is about to 4-5.3 kWh/m2, and is especially high in the South-Western provinces where the conditions for harnessing solar energy are excellent. The sun shines in the country for about 8 - 8.5 hours daily or approximately 3,000 hours per annum[23].

Figure 15 Solar Radiations in Pakistan and Afghanistan[24]



Although Pakistan has numerous hot springs with temperatures ranging from 30^{O} C to 170^{O} C, no power plants are based on geothermal energy in Pakistan[25].

Natural gas was Afghanistan's export commodity approximately 10-15 years ago. The natural gas production reached 1.77 billion cubic feet from operational gas fields in Chekhcha, Jowzjan, Sheberghan, Sar-e-Pol and Jowzjan Provinces.

The overall context of green choices for Pakistan and Afghanistan is presented below.

[22] Ministry of Water and Power – www.mowp.gov.pk
[23] Ministry of Water and Power – www.mowp.gov.pk
[24] Solar Radiation Map – www.solargis.info
[25] Ministry of Water and Power – www.mowp.gov.pk

Table 5 Green Power Choices in Pakistan

	Solar	Biomass/ Biogas	Wind	Fuel Cell	Pico Hydro
Solution Availability	Very Good	Good	Good	Good	Good
Reliability	Good	Good	Good	Good	Good
Market Acceptance	Good	Poor	Poor	Good	Poor
Supply Chain Readiness	Good	Poor	Poor	Poor	Poor
Stage of Adoption	Commercial	N/A	N/A	Trial	N/A
Resource Potential	Moderate	Good	Low	Good	Low
Barriers to Adopt	- High CAPEX on initial stage - Space requirement	- Supply chain challenges - Unproven operational trial in telecom field - Business model offering	- Low scalability limited to coastal and mountain area - High initial CAPEX	- Supply chain availability for hydrogen or methanol - Suitable only for unreliable sites	- Number of sites near the river flow location - High initial CAPEX - Operational challenges
Risks to Adopt	- Reliability issues due to distance from the nearest O&M hub - Vandalism of battery and panel theft	- Biomass supply and sustainability - Scalability of solution for telecom load	- Operational risk due to wind speed availability - Unreliable power generation due to wind speed characteristic	- High replacement cost of fuel cell	- Operational risks associated with limited knowledge and readiness

Table 6 Green Power Choices in Afghanistan

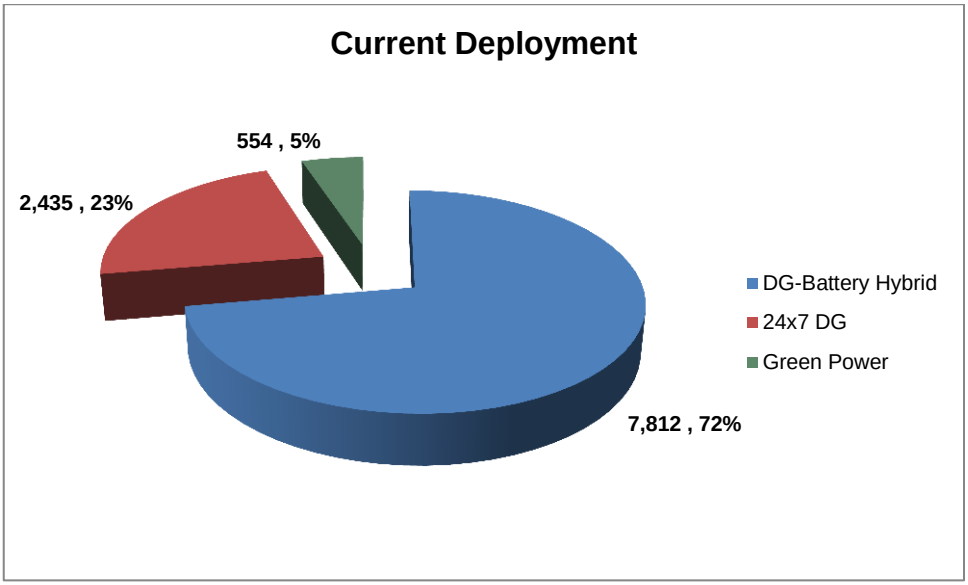
	Solar	Biomass/ Biogas	Wind	Fuel Cell	Pico Hydro
Solution Availability	Very Good	Poor	Poor	Good	Good
Reliability	Good	Good	Good	Good	Good
Market Acceptance	Poor	Poor	Poor	Good	Poor
Supply Chain Readiness	Good	Poor	Poor	Good	Poor
Stage of Adoption	Trial	N/A	N/A	N/A	N/A
Resource Potential	Moderate	Good	Low	Good	Low
Barriers to Adopt	- High CAPEX in initial stage - Space requirement	- Need supply chain for biogas based on animal waste - Vendor availability for biogas solution	- Low scalability, limited to coastal or mountain area - High initial CAPEX	- Supply chain and trial are needed in Afghanistan	- Number of sites near the river flow location - High initial CAPEX - Operational challenges
Risks to Adopt	- Site security and distance challenges	- Continuity of supply chain - Scalability for telecom sector	- Wind speed data before adoption of solution - Security issue for remote area	- High replacement cost of fuel cell	- Operational risks associated with limited knowledge and readiness

Pakistan has reached a commercial level of adoption of solar technology with more than 500 solar sites deployed across the country. However, the commercial adoption of fuel cell power is still being trialled. In Afghanistan, some trials for solar solutions have been made and need more time to move to massive deployments in the telecom sector.

3.2 Market Sizing

GSMA identifies that less than 2% of the total sites of Pakistan and Afghanistan are using green technology solutions. Solar technology is the preferred solution while fuel cell technology is in a trial phase, in Pakistan.

Figure 16 Current Deployment



Based on current deployments in both countries, GSMA has identified that 10,247 tower sites have a potential to be converted to green sites. Of these potential sites, 23% rely on 24 hours DG to power up their base stations and another 72% are running on DG-battery hybrid solutions.

3.3 Potential OPEX Saving

With 10,247 potential sites, MNOs can make significant OPEX savings by implementing green power solutions. GSMA estimates that MNOs can save around USD127.7 million in OPEX annually by going green.

The operators can achieve a payback in 2-3 years on the investment made for deploying the green power, which would require a CAPEX of around USD38,500 per site, with breakdown as follows:

Equipment/Service	Unit
PV solution	6.5 kW
Deep cycle battery	1000Ah
Battery installation and accessories	1 Lot
Civil works & Engineering Service	1 Lot
Power Management & Controller	120 Amp

The total investment requirement is of about USD 394.5 million for the 10,247 potential sites[26].

[26] GPM Analysis and Research

4. Powering Telecom: The Way Forward

4.1 Short Term

MNOs can also make immediate savings by optimizing the DG-battery life cycle for all of their off-grid sites. MNOs usually use deep cycle battery and discharge the battery until the threshold to reduce DG usage on a daily basis. This action would reduce operational costs as well as carbon footprint in their network by implementing energy efficiency initiatives.

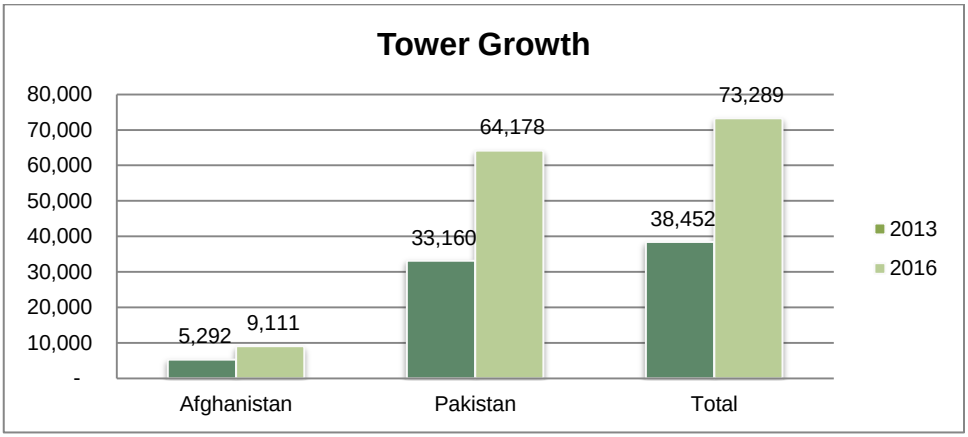
Other short term actions towards energy efficiency could include replacing existing air conditioners with free cooling units (FCU), modernising BTSs from high consumption base stations to low consumption ones, or replacing indoor BTSs with outdoor type BTSs.

GSMA estimates that, by converting the 2,435 sites from 24x7 DG run systems to DG-battery hybrid solutions, the potential OPEX savings will be of more than USD 18.1 million every year.

4.2 Long Term

Regarding the long term strategy, MNOs will have an additional saving opportunity by converting the problematic sites to green sites. GSMA estimates that the number of towers will increase in the next 3 years to 64,178 tower sites in Pakistan and 9,111 tower sites in Afghanistan[27]. The estimate is based on considerations of market penetration growth between 12% - 16%, as well as site sharing trends and a 2%[28] network blocking rate.

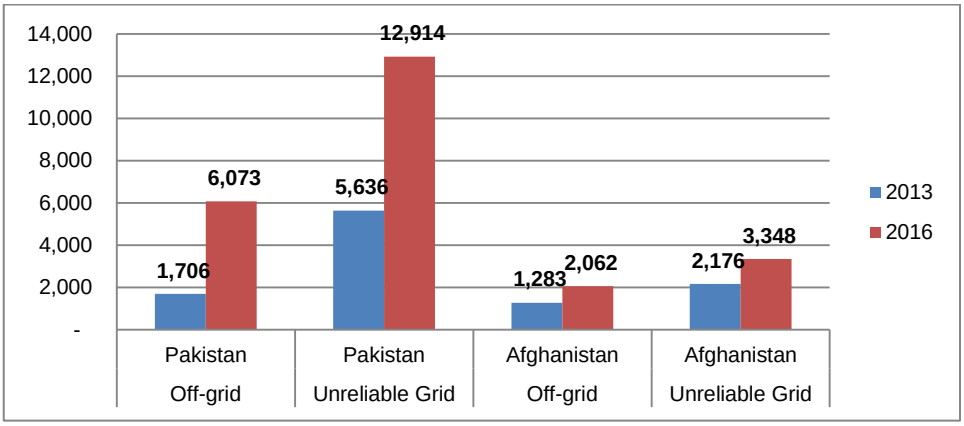
Figure 17 Tower Sites Growth



With the increase in the number of sites by 2016, the number of off-grid and unreliable sites will increase as presented below.

[27] GPM Analysis and Research
[28] 2% blocking rate means the percentage of blocked call that could be accepted in the network

Figure 18 Off-Grid and Unreliable Grid Sites Growth



By converting 24,397 future sites to green power, the OPEX saving opportunity for MNOs is of about USD 314.5 million annually, with a total investment of USD 939.3 million by 2016[29].

4.3 Site Sharing

The site sharing or site leasing business model has become one of the most strategic options for MNOs to reduce their capital cost on infrastructure. Site sharing business models currently follow "one to one swap" deal format, between two operators, which is different from the site leasing business model where MNOs need to go to tower companies to match their BTS planning with the tower companies' infrastructure.

Under the site leasing model, tower companies provide passive infrastructure to support MNOs.

The global emerging trend is for MNOs to try to sell their towers to tower companies and lease them back from the tower companies.

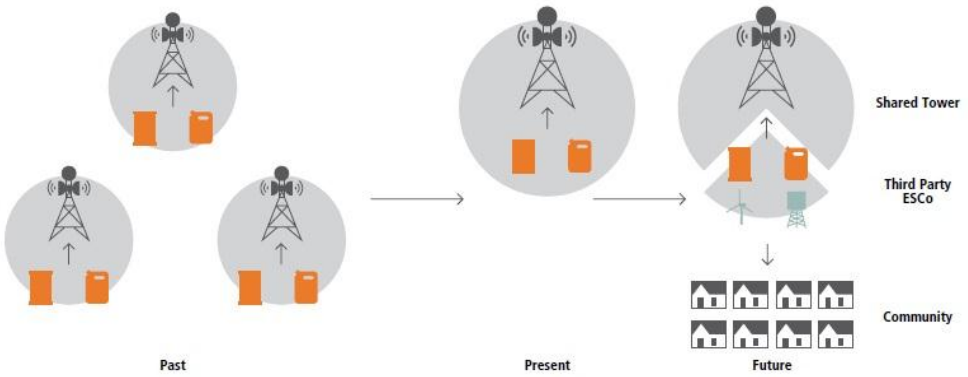
4.4 Future Business Model

In the future, the one to one site sharing business model is expected to grow in Pakistan and Afghanistan to help MNOs expand their network and coverage. MNOs will bring their own power systems on the shared site premises. This one to one site sharing has a disadvantage as MNO needs to match the number of shared sites with the other MNO.

In some parts of the world, we already see the trend shifting in terms of the business model and infrastructure ownership. Tower companies will provide passive infrastructure for MNOs removing the need for MNOs to spend their time and capital on providing power systems to the sites and they can therefore focus on their core business to maintain their market share and customer satisfaction.

[29] GPM Analysis and Research

Figure 19 Business Model Trend



The transformation from site sharing to energy outsourcing has only just started. Energy Service Companies (ESCOs) are yet to fully emerge in the region, in order to provide reliable power outsourcing options to MNOs or tower companies.

The ESCO can act as an energy provider to both tower companies and MNOs and not take responsibility for financing the equipment, nor the full provision of power to the tower. The ESCO business model that is being developed and tested in the market place includes:

- Power Purchase Agreement (PPA), the ESCO installs the renewable energy power system and sells power to the MNOs at an agreed per kWh rate.
- Energy Saving Agreement (ESA), the ESCO installs the renewable energy power system on existing sites and the MNOs' fee is based on the portion of verified energy cost 'savings'.
- Fixed Fee Operating Lease, the ESCO installs the renewable energy power system and sells monthly power to the MNO at a fixed cost. The main benefit from this scheme is that MNOs will not have any variable budget on their expenditure.

The ESCO model will allow MNOs to make some savings without or with a minimal CAPEX commitment. The savings for MNOs of 10,801 potential outsourced sites is of USD 41.6 million in 2013 and will reach USD 104.3 million by 2016, without investing any CAPEX. The potential market sizing for ESCO is about USD 141.9 million with an estimated revenue of up to USD 23.6 million in 2013.The market will reach up to USD 320.5 million with an estimated revenue of about USD 53.4 million for 24,397 sites by 2016[30].

[30] GPM Analysis and Research

5. Conclusion

In Pakistan and Afghanistan, the telecom sector's green deployments are still at an early stage, with less than 2% of their sites converted to green. MNOs will green their network as the next step after DG-battery solution, as it allows for OPEX savings by optimizing battery life cycles in the sites.

The government is promoting the adoption of renewable energy resources in Pakistan to attract the investor and industrial community with financial and fiscal incentives. On the other hand, the government of Afghanistan has no specific incentives to push the market to be greener.

To adopt green power and to reduce emissions the telecom industry needs to work hand in hand with the industry stakeholders and the government. The government, as a regulator, needs to play an important role to support green deployments in the telecom industry.

About the GSM 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 more than 230 companies in the broader mobile ecosystem, including handset 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 the Mobile World Congress and Mobile Asia Expo.

About Mobile for Development: Serving the underserved through mobile

GSMA 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, economic impact and stimulate the development of scalable, life-enhancing mobile services.

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

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