

In partnership with the Netherlands

Bi-annual Report January 2013



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Welcome Note

Our seventh Bi-annual Report – and what a year 2012 has been for us. At the time of writing this report, the team were working hard to close off what has been a fantastic year for the industry, before taking a well-deserved break over the holidays. So what have we achieved since our last report?

Our partner, the International Finance Corporation, awarded us with another grant earlier in the year to continue our programme. Whilst we continue to serve mobile network operators globally, the IFC placed key importance on a number of target markets in West Africa, East Africa and Asia including Indonesia, Bangladesh, Pakistan, Nigeria, Kenya and Tanzania. With Project Managers based in each of these regions, we are now in process of building our industry engagements and addressing the requirements of these markets. We have already published market sizing reports for each of the markets which are available on the resources page on our website.

We also saw our project in India come to a close having received 18 months of dedication from our India Project Manager. Green Power for Mobile in India reached a phenomenal scale and the interest was apparent from the attendance, knowledge and contribution to our India Specific Working Groups. For more details on the outcomes of this project please read more.

We continue to host regional focused Working Groups and have also introduced one day country specific Working Groups. Since our last Bi-annual Report, we have hosted our Asia Working Group in Cambodia and Africa Working Group in Accra as well as India, Bangladesh and Indonesia Country Working Groups. Detailed summaries of these can be found in our Programme Overview, and summaries from Nigeria and Indonesia will be available on our website at the end of the month. The continued growth of these Working Groups is not only a testament to the hard work and commitment of the industry, but also a strong indication of the interest we are building. We are continuously working to make sure that the content of the Working Groups is fresh and exciting to attendees and are ensuring that the knowledge is shared in more efficient and effective ways.

As we wrap up the writing of this Bi-annual Report we also come to the end of the International Year of Sustainability for All, introduced by the UN Secretary General Ban Ki-Moon. The GSMA's Mobile for Development is a firm believer that the mobile industry is uniquely positioned to leverage itself to drive this opportunity forward, and where possible we showed our support to these initiatives through the Green Power for Mobile and Community Power from Mobile (CPM) programmes. The final section of this report summarises CPM's key activities and is a small insight into what you can inspect from their White Paper due to be published in February 2013.

The team looks forward to continued collaboration with our Working Group members and the industry in general to ensure that our work is relevant to our stakeholders, actionable and aids in advancing this emerging sector within the telecommunications industry. I trust you will find this edition of the Bi-annual Report educational and informative. We look forward to working with you on the issues raised in this report and establishing a work plan for the programme's next phase.



Areef Kassam
GSMA Programme Director – Green Power for Mobile

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Meet the Team

Who's who in GPM and CPM



Areef Kassam
Programme Director

Areef is the Green Power for Mobile Programme Director. In this role he is responsible for Managing the development and delivery the programme products and services that are tailored to support operators in the decision-making process around deploying renewable energy for base station power.



Michael Nique
Strategy Analyst

Michael Nique joined the GSMA as a Strategy Analyst for the Green Power for Mobile programme. In this role, he is monitoring key innovations in renewable energy applied to the mobile industry and services to the end users. Michael also provide insights on data analysis for the mobile and development markets.



Abirami Birrell
Projects Manager

Abi Birrell is the Projects Manager for the Green Power for Mobile Programme. In this role, she organises key GPM events and supports the team more broadly with planning and research. Abi also leads the management of the Green Deployment Tracker. Abi joined the GSMA in 2009 after completing a Masters in International Business and Global Management, where her thesis explored consumer behaviours which made mobile money products successful in emerging markets. Prior to turning her interest towards technology and development, Abi had a strong bond with bacteria and their DNA whilst pursuing a degree in Human Genetics.



Ferdous Mottakin
Programme Manager

Ferdous is the Green Power for Mobile Programme Manager. Within GSMA Mobile for Development, he is responsible for leading and managing the programme globally. Additionally, his role involves creating industry collaborations and enhancing mobile for development outreach. Prior to his role as Programme Manager, Ferdous successful completed the India-specific GPM project for 18 months. Before joining the GSMA, Ferdous spent much of his career working across the globe in different areas of the telecom industry. Ferdous holds a Bachelor degree of Electrical Engineering from Simon Fraser University of British Columbia.

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Satish Kumar
Africa Project Manager

As the Africa Project Manager, Satish leads the focus and activities of the Green Power for Mobile (GPM) programme for the African region and is responsible for the overall programme focus and deliverables for Africa. Within GPM, he has previously conducted several Green Power Feasibility studies across countries in Africa and Asia, and contributed to the knowledge base through case studies and publications. Prior to GSMA, Satish has worked in various roles engaging with government bodies and organizations across telecoms, renewable energies and rural enterprises. He holds a Bachelor’s degree in Electrical Engineering from IIT Kanpur and an MBA from IIM Bangalore.



Mary Roach
Community Power from Mobile Business Development Manager

Mary Roach joined the GSMA in 2011 as an advisor for the Community Power from Mobile Programme. Prior to joining the GSMA she spent two years working on rural energy solutions in sub-Saharan Africa and five years working with GE Power Generation as a project and operations manager. She holds a MBA from Oxford University and a Bachelors in Chemical Engineering from McGill University.



Charlotte Ward
Community Power from Mobile Programme Manager

Charlotte brings over 12 years of experience in investment banking, carbon finance, renewable energy and telecom to her role in the GSMA Development Fund, managing the Community Power from Mobile programme from Nairobi. Prior to joining the GSMA in 2011, Charlotte consulted government and corporates on carbon and energy projects in East Africa, following 8 years with Deutsche Bank in global capital markets within business development, sales and trading. Charlotte has a Master’s Degree in Applied Environmental Science from Sydney University and a Bachelor’s Degree in Geography from Bristol University.



Ali Imron
Asia Project Manager.

In his role, he is responsible for conduction Green Power market analysis, feasibility studies and vendor landscaping deliverable in Asia Region. Ali has varied experience working with operator on O&M field and vendor as well. Ali holds degree from STT Telkom Bandung.

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Chapter 1

Review of Core Activities from the Green Power for Mobile Team

By Abirami Birrell, GSMA



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Deployment Tracker

The Green Power for Mobile Programme was launched in 2008 to promote the use of renewable energy sources by the telecoms industry. Four years later, we are now six months into Phase 2 of the programme, and are running as strong as ever. The Green Deployment Tracker is now hosting almost 30,000 live sites, close to 11,000 diesel battery hybrid sites and a further 6,500+ sites that are planned in developing countries alone.

Recently, the Green Deployment Tracker moved from Wireless Intelligence to Mobile and Development Intelligence, an online publically accessible data-driven portal for our member operators and wider vendor community. This portal covers six sectors including green networks, mobile money and mobile health. The green networks section includes profiles of organisations, their green products or initiatives, data analytics and metrics, as well as our deployment tracker. A new section, Energy Access, is associated with our Community Power from Mobile Programme and will be accessible on Mobile and Development Intelligence this month.

Recent updates to the tracker include a major operator reaching the transformation stage (10,000+ sites), 39 operators achieving scaled demonstration and many more piloting renewable energy base station sites. We continue to call for more information to update our tracker to ensure that it showcase the industry accurately.

Feasibility Studies

The GPM team continues to work closely with operators to assess the feasibility of their networks for energy efficiency and the ability to power their base stations with renewable energy. To date, GPM has successfully completed feasibility studies in 26 countries and most recently studies were performed for Ucell in Uzbekistan and Geocell in Georgia. Ucell and Geocell are part of TeliaSonera, a multi-country operator group with operations across Europe and Asia. The complete network of base stations was analysed and evaluated for green power feasibility.

Ucell, with its network spanning across 13 regions in Uzbekistan, has been facing acute challenges in powering the network and has experienced severe network downtime, thus affecting its revenue potential. Using the GPM Feasibility Study Methodology, recommendations were made to overcome the challenges of energy provision to the network, thereby improving the network uptime to 99.98% from the current 80%. Our recommendations demonstrated a savings of ~7.8 million litres of diesel consumption per year for the entire network of close to 2,400 base station sites.

The study for Geocell's network demonstrated a savings of ~8,600 litres of diesel per site per year by implementing our green power recommendations for 41 off-grid sites. The potential for connecting off-grid sites to the grid was also assessed and it was suggested that 53 sites out of 114 sites are suitable for grid extension; more so than converting existing sites to run on renewable energy.

Case studies for most GPM feasibility studies are available online. For further information on engaging with Green Power for Mobile for feasibility studies, please get in touch at greenpower@gsm.org.

Working Groups

Since the last issue of the Bi-annual Report in July 2012, GPM has hosted four Working Groups – two for the global GPM programme, and a further two for our country-specific projects: one for India and one for Bangladesh. Highlights from these Working Groups are summarised below.

Highlights from Cambodia

On the 24th and 25th of July 2012, Hello (Axiata Group) co-hosted the South East Asia Regional Working Group in Phnom Penh, Cambodia. Over 30 delegates from mobile operators, vendors, energy service companies and other industry experts attended the event. After opening remarks from Areef Kassam, GPM Programme Director, a number of presentations spurred discussions around the current opportunities and challenges the mobile industry faces:

- Zaki Sharizan from Hello, talked about Hello's energy efficiency initiative and gave an overview of Cambodia's telecom industry and power infrastructure. Hello is committed to being more energy efficient and plan to contribute more to green initiatives.
- Umar Sharif of CamGSM then showcased a case study of their 1500 deployed solar sites (66% of their total network); their target is to reach 80%. As a part of a network modernisation project, 53% of their sites have been upgraded to newer more energy efficient technologies.
- Nicolas Pocard, Sales director for Ballard, in the APAC region spoke in detail about the current development of fuel cell technologies. He also gave a comparative analysis among different fuel cell technologies and the financial viability of using fuel cells.

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■ Dr. Karl Kolmsee, the Managing Director of Smart Hydro Power talked about their recently developed pico-hydro solution and how it can be used in the telecom industry as an alternative power source provided a moderate wave velocity is available at a water source.

■ Beeline’s Eric Castaneda, presented a case study from Cambodia. Increasing fuel cost, low ARPU, un-reliable or no-grid, site access constraints and market competition are some of the key driving forces for them to consider green power alternatives. 61% of Beeline’s network is off-grid and to date, 71 renewable energy sites have been deployed - 2% of its network.

■ Chay Lo, the Co-founder of 1001 Fontaines, shared their initiatives on clean water supply across Cambodia and how this initiative saved the lives of thousands.

■ TK Shih, the CTO of Alta Energy shared their experience on the ease of deploying outdoor sites (off-grid or grid deficit sites) and their strategy for looking primarily at new outdoor sites utilising green power.

■ Deepak Pandey shared an insightful case study of the transition of Ncell, Nepal, over the last few years and their reasons for considering renewable solution as a key component for all their future deployments. To date only 5% of Ncell sites are green powered, and have the ambition to increase this to 12.3% by 2013.

Additional presentations were given by the IFC and GSMA on fuel cells and Mobile and Development Intelligence.

Highlights from India

After 3 successful events, on the 11th of September, GSMA and IFC co-hosted the 4th Green Power for Mobile India Regional Working Group in New Delhi, India, with the Tower and Infrastructure Providers Association (TAIPA). 59 delegates from 35 different organisations attended the Working Group.

■ Firas Ahmad of Emergence Bioenergy brought the new concept of utilising biogas for telecom tower using the OPEX model – a first for the telecoms industry. The solution is highly efficient and environmentally friendly.

■ Umang Das, the Director General of TAIPA, spoke about various reasons for why green power promotion is a priority on their agenda. He also described TAIPA’s recent initiative - the industry-wide RESCO model RFP for 100,000 sites.

■ Rajan Mathews, the Director General of COAI, discussed how Indian mobile operators are contributing to the national economy and what key measures are being put in place to go green.

■ From government & regulatory stakeholders, J. K. Roy, Member of the Department of Telecom, P. K. Panigrahi, Senior DDG of Department of Telecom and K. K. Minocha, DDG of USOF, Department of Telecom also addressed the different government initiatives to promote telecom services for rural communities.

■ Bharat Agrawal of Bloomberg New Energy Finance (BNEF) showed the attendees how the solar market price is changing. He provided some competitive price information for both large power production and distributed power production.

■ Alok Goel of Ballard Power Systems presented the current market trend of fuel cells in telecom and made suggestions for how it is the ideal solution for the Indian market, given that the supply chain is not challenging for the scale they require.

■ Manoj Kumar Singh of TAIPA presented their in-house developed business model for promoting RESCO into telecom power generation and management business. He described, Community inclusion can enhance the possibility of such model.

Highlights from Bangladesh

For the first time, the GPM team held a Bangladesh specific Working Group in Dhaka on the 16th of October, co-hosted by Grameenphone. Over 50 delegates from 29 organisations attended the event. The day-long event was divided into 5 sessions:

- The GSMA and IFC opened the session with the overall target to promote green power, with Bangladesh being a targeted country.
- Grameenphone and Robi Axiata both shared their experience as operators in the second session, talking about several of their green and energy efficiency initiatives.
- The third session was used to introduce new green technologies; Ballard, the world’s leading fuel cell provider, and Emergence Bioenergy spoke of their solutions.
- Energy outsourcing is a core interest for the telecom industry in Bangladesh. To address this, Applied Solar Technologies and KMRI were invited to present their energy outsourcing models.

Finally, a break-out session was conducted to discuss two topics:

1. The challenges of going green
2. The CAPEX vs. OPEX model

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Highlights from Ghana

For the first time since the launch of the programme, the GPM team went to West Africa to co-host an African Working Group in Ghana on the 6th and 7th of November along with Millicom. 40 delegates attended over the two days and engaged in discussions throughout. Following an opening presentation from Areef Kassam, Programme Director, Arata Onoguchi from the IFC, and Garry Bridgewater, Integrity Manager, for Millicom:

- Patrick Ayivor of Airtel Ghana presented a case study on their solar deployment experiences. He demonstrated how their approach has enabled them to realise an energy OPEX saving of about 74% by replacing diesel power with solar.
- Sam Basson from Eaton Towers presented a case study on their Ugandan operations which allowed them savings of close to 30% in costs as a result of their OPEX and energy efficiency initiatives.
- General Electric's Obinna Onuchuckwu shared their experience in deploying DG-battery hybrid solutions in Africa highlighting that people, process and products are key elements that make hybrid a success or a failure.
- Laurentius Human of Inala Technologies, highlighted that the "one size fits all" approach will not work across the globe and replicating a successful business model in one continent, does not guarantee its success elsewhere.
- Helios Towers Africa briefed the group on their operations and gave an insight into what it's like to do business in Africa.
- HIP Consult's Judah Levine took a strategic view at green energy and energy efficiency in the telecoms industry and stressed an integrated approach for formulating energy related strategies and programmes. Judah's session looked at various frameworks to analyse and comprehend the multi-dimensional aspects of energy and strategies to adopt in order to develop and execute successful energy programmes.
- ATC's (American Tower) Darren Crosse presented their progress since the Cape Town Working Group in November 2011. Through their energy efficiency and optimisation initiatives, ATC saves on average 500,000 litres of diesel each year and reduce CO2 emissions by 1,340 tonnes, which is equivalent to 45 acres of forest.

- Simon Beard of Altobridge followed with their experience in extending coverage to remote rural areas through their standalone solar powered Lite-Site solution. This solution is suitable for isolated areas including unreliable and off-grid locations with as few as 1,200 subscribers.
- PowerOasis, through their successful deployments, highlighted the need for a structured approach through planning, implementation and future proofing of deployed systems. John O'Donohue demonstrated that scaled deployments would result in business returns and stressed that standard configurations and clustering of sites is key to enable scaled deployment of green power and other energy saving solutions.

It is clear that the telecoms industry has the green agenda at the forefront of their minds with innovative solutions and business models evolving all the time. We will continue to bring together key stakeholders to convene and share their knowledge of the topic.

Future Working Group Dates:

Nigeria: 29-30th January 2013

Barcelona: Mobile World Congress Seminar "Energy+Mobile for Development", 25th February 2012

India: April 2013 TBC

Africa: April 2013 TBC

Please contact us as greenpower@gsma.com if you would like:

- Further information about our Working Groups or as an Operator, would like to attend
- If you are able to contribute to the Green Deployment Tracker now with live or planned sites

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Chapter 2

Powering Telecoms in East Africa: Green Power for Mobile Market Analysis

By Satish Kumar, GSMA



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3 The Green Power for Mobile (GPM) programme has looked at
4 three key markets in East Africa, namely Kenya, Tanzania and Uganda, in
5 order to assess the potential use of green power solutions for addressing
6 the many challenges faced by mobile network operators and tower
7 companies in the region. GPM has looked at the overall market status
8 at present including the size of the network, approach to powering
9 the network and the current regulatory environment in the three focus
10 countries. The analysis has broadly looked into the below and facilitated
11 understanding of the overall market and the potential for OPEX savings
12 going forward.

The article provides a summary of the East Africa Marketing Sizing Report published by GPM. The full report is available online.

Overview and the Network Size

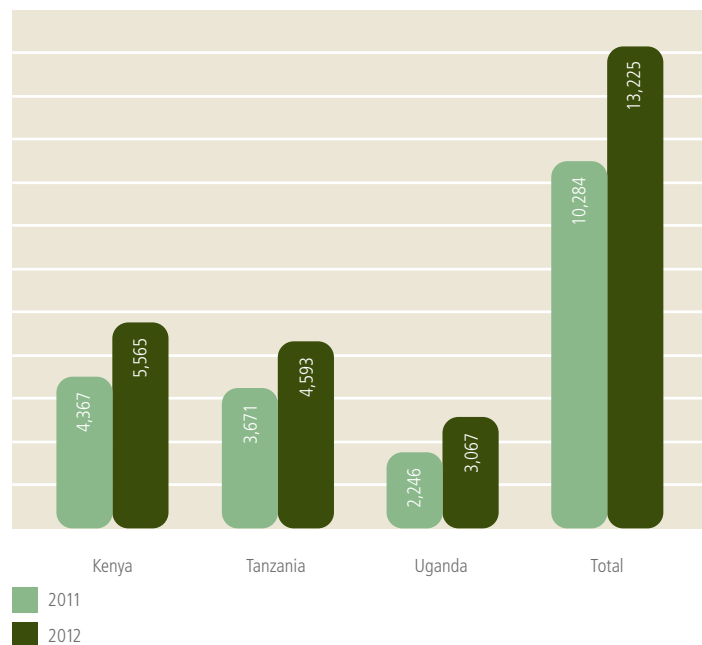


Figure 1: Number of Base Stations & Annual Growth

The growth of mobile telecommunications in Kenya, Tanzania and Uganda has resulted in reaching an overall subscriber base of 70.98 million which accounts for about 58% of the population of the three countries. The number of subscribers in Kenya, Tanzania and Uganda are 29.2 million, 26.8 million and 15 million respectively¹. Kenya records the highest penetration levels of mobile services at 74% of the population, followed by Tanzania at 62% and Uganda at 42.4%. Mobile network coverage across the region stands at an overall 80% of the population and close to 50% of land area. Nearly 96% of the uncovered population is rural and poses geographic and economic challenges to bring them into areas with mobile network coverage to enable access to mobile telecom services.

The three countries combined have a total network of 13,225 base station sites as of Q3 2012. Kenya has the highest number of base station with

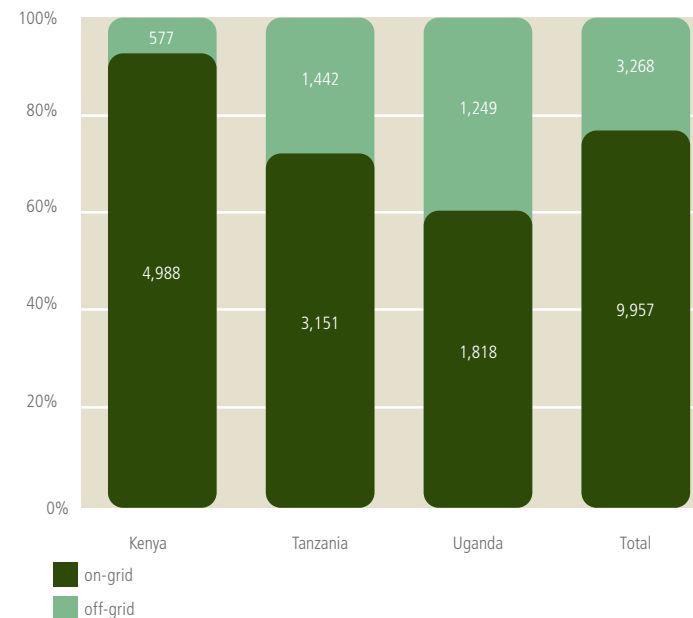


Figure 2: On-grid and off-grid Sites (Numbers)

¹ GSMA GPM Research and Analysis (source: published reports from Communications Commission of Kenya (CCK) – www.cck.go.ke, Tanzania Communications Regulatory Authority (TCRA) – www.tcra.go.tz, Uganda Communications Commission (UCC) – www.ucc.co.ug)

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5,565 sites followed by Tanzania with 4,593 sites and Uganda with 3,067 sites. Of the total 13,225 base station sites, 9,957 are connected to the commercial grid power supply and the remaining 3,268 base station sites are off-grid and are located in areas without access to the grid.

The Current Powering Scenario

The majority of on-grid sites are deployed with grid-DG-battery hybrid

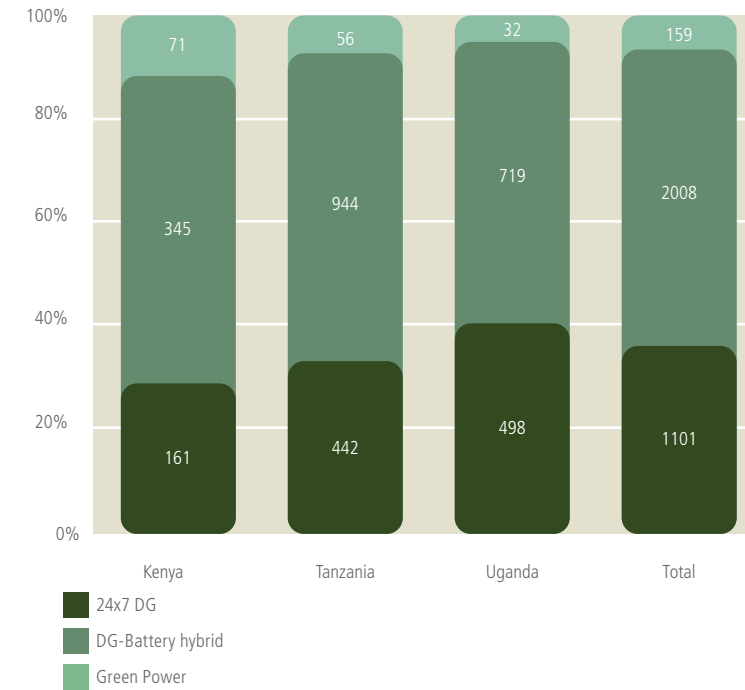


Figure 3: Sites by Power Solution Deployed (Off-grid)

power systems which reduces the number of hours of DG runtime. Of the total 9,957 on-grid sites, 6,849 (~69%) sites have diesel generators deployed as the backup power source. On average, an on-grid site currently consumes ~400 litres of diesel every month. An off-grid site consumes 1080 litres of diesel every month based on current power solutions deployed at these sites, as indicated below.

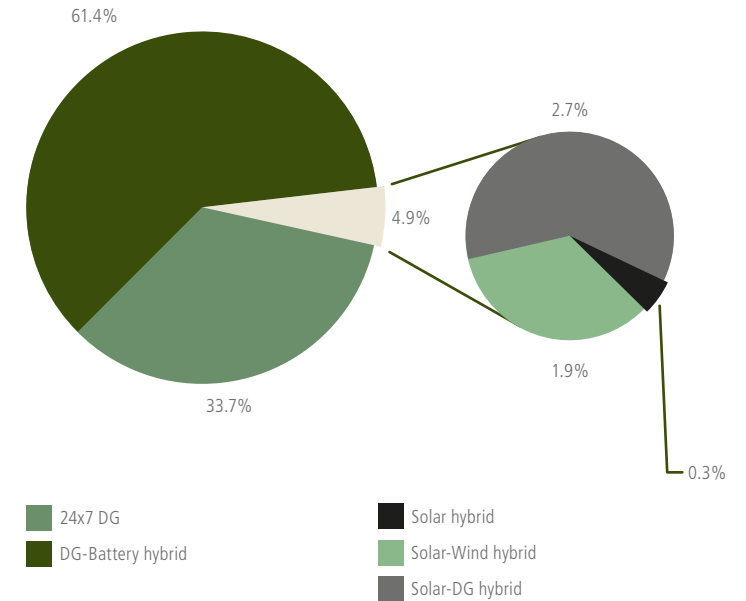


Figure 4: Deployed Power Solutions Breakdown (Off-grid)

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3 Currently 5% of total off-grid sites are deployed with green power (mostly solar hybrids) while 61% are deployed with DG-battery hybrid power systems; the remaining 34% of sites run on diesel generators 24 hours a day.

6 Green Choices: Potential and Adoption

10 The evaluation of the various green choices against traditional choices in terms of the OPEX savings potential for off-grid telecom sites are presented below, along with their availability and ease of adoption. The colour of the bubble indicates how green the solution is.

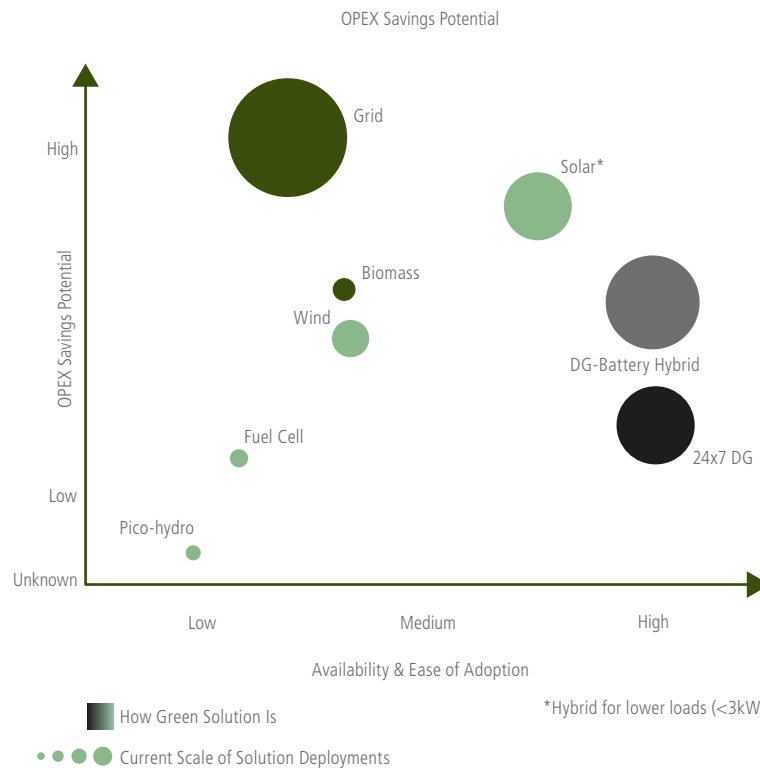


Figure 5: OPEX Savings Potential vs. Availability & Ease of Adoption

Table 1: Green Fit Potential vs. Adoption for East Africa

Green Choice	Stage of Adoption	Resource Potential	Barriers to Adoption	Risks of Adoption
Solar	Commercial	High	<ul style="list-style-type: none"> High initial CAPEX Space requirements Scarcity of external funding 	<ul style="list-style-type: none"> Operational risk in terms of local challenges in theft and breaking of solar panels Reliability issues due to variation in weather
Wind	Pilot	Low (Except Coastal region)	<ul style="list-style-type: none"> Reliability of power generation Low scalability High investment 	<ul style="list-style-type: none"> Operational risk in terms of variability in wind speeds and unreliable power generation characteristics
Biomass	Pre-Pilot	Medium	<ul style="list-style-type: none"> Operational complexity Supply challenges Pre-pilot stage and unproven operational feasibility 	<ul style="list-style-type: none"> Biomass supply and sustainability Reliability issues due to breakage in supply links
Fuel Cell	Pre-Pilot	Medium	<ul style="list-style-type: none"> High initial CAPEX Hydrogen fuel supply OPEX Savings not yet established 	<ul style="list-style-type: none"> High replacement cost of fuel cells Reliability of fuel supply
Pico-hydro	Pre-Pilot	Unknown	<ul style="list-style-type: none"> Low market awareness Availability of water body close to tower locations Cost of technology Regulatory clearance 	<ul style="list-style-type: none"> Operational risks associated with limited knowledge and readiness

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3 **The Green Power Market Size and OPEX Saving Potential**
4 Based on the current power supply scenario, a total of 4,019 sites (30% of the total telecom sites) are estimated to have potential for green power alternatives. Of these potential sites, 23% are unreliable grid sites with power outages of more than 12 hours a day. The remaining 77% of sites are completely off-grid and are powered by diesel generators and battery hybrid power systems.

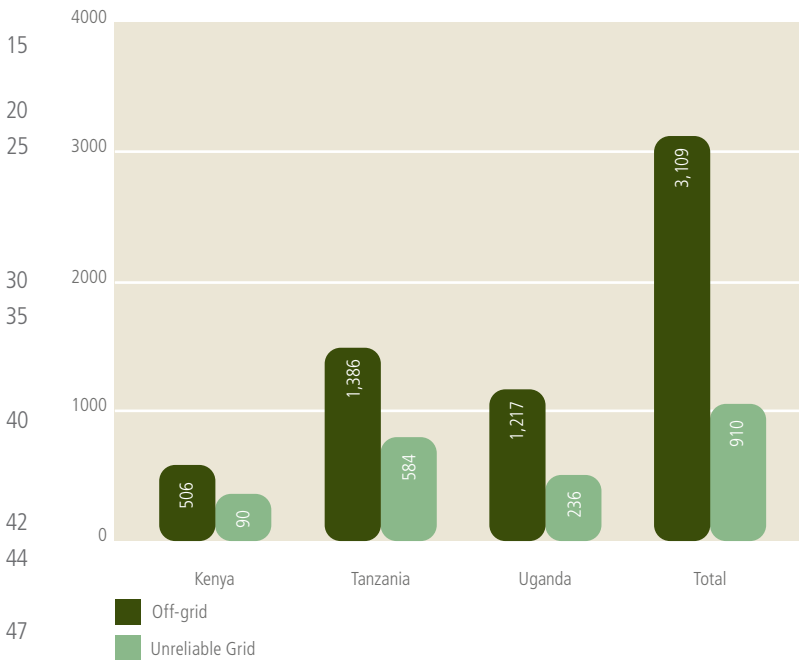


Figure 6: Green Power Potential (Number of Sites)

Based on current diesel consumption levels for on-grid and off-grid sites, the GSMA estimates that for the 4,019 potential sites, savings of US\$59 million in energy OPEX and around 36 million litres of diesel can be made each year. This presents a saving of around 73% in diesel consumption from current levels if green solutions are implemented.

Long Term Growth Outlook

In the long run, GSMA estimates that the overall number of base station sites across the 3 countries will reach 22,317 by 2015 at a CAGR (Cumulative Annual Growth Rate) of 19.1%. The estimate is based on various parameters including current penetration levels, coverage, network capacity and other demographic characteristics.

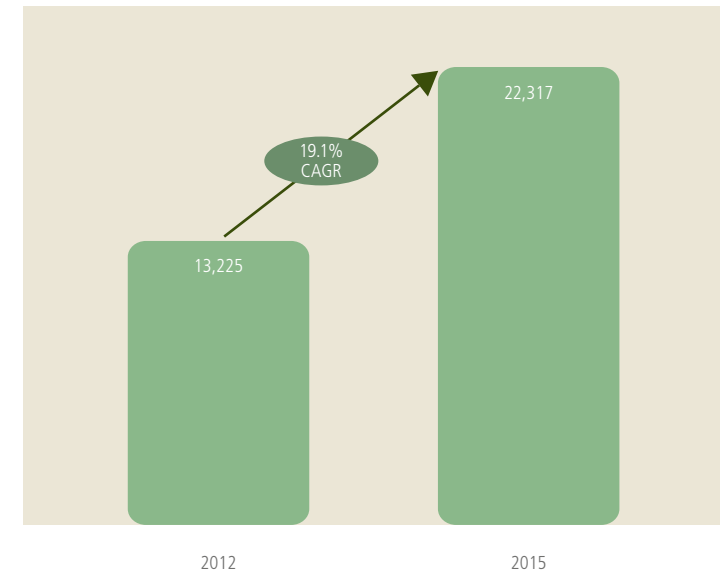


Figure 7: Network Growth Estimate 2012 to 2015 (Number of Sites)

Conclusion

The MNOs and Tower Companies in Kenya, Tanzania and Uganda are presented with various challenges in terms of powering the network. They have taken various measures to reduce the energy OPEX including the use of battery hybrids and green power solutions. However, the adoption of green power for telecoms infrastructure is in its early stage and requires regulatory support as well as business model innovations to accelerate investments and promote a more sustainable approach for reducing the energy OPEX.

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Chapter 3

Site Security and Access Control: An Integrated Approach for Managing Telecom Tower Assets

By Daandré Jansen van Vuuren, Risk & Safety Advisor,
Eaton Towers Uganda



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3 Introduction

Eaton Towers is an independent London-based infrastructure-sharing company owning and managing towers across Africa. African mobile network operators are facing increased demand for telecom services driven by price competition and have tightened focus on reducing operational costs of running the network. Tower sharing is now becoming an essential strategy for African mobile operators with a need to reduce operating costs, reduce CAPEX and offer focus on their core business of providing service for their customers.

Eaton Towers Uganda Ltd commenced with operations in January 2012 and own more than 800 towers with national coverage, following the acquisition of the Orange and Warid Towers in Uganda. Eaton Towers provides governance for the security function as part of the integrated framework that includes health and safety, environment, HIV / AIDS and quality. Our broad security approach focuses on:

- Security risk management processes and analysis
- Strong proactive control measures
- Effective standards, policies, and procedures to manage the implementation
- Investigations & information gathering and analysis
- Voluntary principles on security and human rights
- Critical incident management & appropriate response to incidents
- Security management and quality

Eaton contracted security expertise with global exposure to develop and train a professional and competent local security and investigative team. As a team, our mandate is to identify security risks and ensure that effective controls are in place to protect people, product, assets, and company reputation.

Security at telecom sites has become an integral part of managing telecom infrastructure in order to protect the assets and control breach/theft of equipment and consumables. The operators and tower companies have confronted with the security challenge especially in protecting the

critical passive power equipment and consumables in the form of diesel fuel which are critical to achieve service reliability and network uptime. Despite the potential for savings in energy OPEX, site security challenges have long been hindering the telecom operators and tower companies from investing in new technologies including green power to address the energy OPEX at many sites running on diesel generators.

Site security and access challenges

The management and protection of communications infrastructure in African countries such as Uganda is possibly one of the most precarious challenges a company will face in a globally networked world. Technologies on passive infrastructure and consumables at towers sites raise complexity, causing interoperability issues and risking availability and security.

Most of the tower sites are located in rural locations making it a challenging task as these sites are not permanently staffed and are remote; all these increase the level of vulnerability and risks. Eaton Towers Uganda commenced with an extensive processes of due diligence, vulnerability and security risk assessments at the tower sites. The information collected revealed that sites are exposed to a variety of direct and indirect threats. Poor access control, the magnitude of different locks and unaccounted number of legal and duplicated keys confirmed a high likelihood for unauthorised site access, theft of fuel, batteries and other commodities such as starter motors, copper and smaller assets at tower sites.

A comprehensive risk mitigation plan and strategy was developed to mitigate the threats and to manage security risks to controllable levels through a site hardening process. Eaton Towers has undertaken strategic initiatives to control site access and improve security of telecom and passive power infrastructure in order to reduce operational costs and service reliability. The initiatives detailed below explain the systems and processes to achieve the broad objectives of site security and access control improving the overall operational control over the telecom infrastructure.

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Security Risk assessments and threat analysis revealed that sites are exposed to a variety of direct and indirect threats.

Direct threats

- Crime syndicates operating in region
- Theft of batteries; fuel
- Vandalism/ removal of SIM cards in alarm monitoring systems
- Vandalism/ removal security illumination on site
- Loss; mismanagement of keys
- Vandalism/ removal locks
- Major power outages
- Armed attacks on security guards on site
- Collaboration with security guards

Indirect Threats

- Terrorism
- Natural disasters, rain etc.
- Man-made disasters
- HAZMAT pollution by way of spillage, disposal of replaced parts.
- Lightning damage

Other

- Overdue maintenance, neglect

Site hardening

The main objective of site hardening is to develop and implement different levels of protection for perimeter, facility, DG and external fuel storage, security staff safety, outdoor/indoor shelters and battery cabinets. The aim during the development stage was to keep the site hardening roll out as modest as possible yet effective enough to ensure full control over the site security, access and privileges. The site hardening process include the refurbishment and installation of a good BTS asset management system to enhance improved service availability and significantly reduced operating costs through decreased energy consumption.

Integrated mobile site asset management and hybrid energy control

Risk mitigation strategies and plans may differ significantly from one region or country to another. A comprehensive country threat analysis and security risk assessment should place a company on the best direction possible. Layers of protection will ensure that failure of one element in the system will not create a critical vulnerability in the whole system. A good layer system will delay infiltration in event of security violations and other breaches. The ability to have real-time control and to immediately have credible information to attend to events on towers sites is a “must have” within the telecoms industry. After evaluations and various product reviews, Eaton Towers Uganda engaged into a partnership with Inala Technologies. Inala provide Eaton with a cost-effective site management system for our tower sites that will maximise revenue from our network assets. The ability to record real-time alarm events help Eaton to rectify malfunctions before they become service affecting and alarm status reporting allows them to respond to emergencies as they occur.

The Inala system achieves OPEX savings by automatically taking control of generator and commercial utility grid supply in order to reduce fuel usage and power costs. This is done by using the backup batteries until a point where their threshold limits are reached, then switching back to a power supply source. This is known as effective power conservation control or hybrid energy control complex BTS. Inala enable Eaton to establish a suitable working environment, meaning a secure, temperature-controlled location with an uninterrupted supply of clean power. The systems job is to help ensure that this is a reality rather than a specification.

The Inala system supports our layer protection approach and enhances our ability to:

- Deter, detect and delay, all mechanical and other infrastructure functionality;
- Integrate systems on the tower site
- Provide layers of protection on equipment
- Security measures
- Physical barriers
- Lighting
- Intrusion detection
- Video surveillance
- Physical entry and access control,
- Fuel, battery protection and detection

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Site sharing

Increasing competition, along with investments in ever-changing technology, has been pushing telecom operators towards new ways of maintaining margins. Considering that building and operating infrastructure is a significant cost for operators, it is the ideal way to find quick wins. The estimated CAPEX savings resulting from tower sharing in the Middle East and Africa region amount to US\$ 8 billion.

Telecoms infrastructure for operators primarily consists of:

- Active infrastructure (such as spectrum, switches, antennae)
- Passive infrastructure (such as towers, BTS shelters, power)
- Backhaul

Eaton Towers provide site sharing to ensure growth in the business to a number of operators. This means a greater demand for access to the BTS locations by a number of contractors, tenants and other interested parties. More visitors to our sites demand for a highly effective access control system to protect all infrastructures on the location inclusive to control access privileges to both passive and active infrastructure.

Lock change out to regain site access control

Access control and a good perimeter fence form the first line of defence to protect tower infrastructure. Since Eaton took over Orange in July 2012, the theft of batteries in just six weeks reached around \$60,000. Investigations by Eaton security staff revealed that access to the tower sites has been compromised, as there were a number of keys in circulation that were officially issued, stolen or duplicated allowing uncontrolled access to the sites by criminal elements. Eaton's intervention resulted in the police arrested members of a crime syndicate found in possession of keys that can open any tower site in Uganda, and batteries owned by Eaton Uganda. The removal of the keys from the crime syndicate enabled a decrease in battery theft at Eaton to be reduced significantly by approximately 80%.

Eaton Towers Uganda accepted the Acsys Code Generated System Key at our sites in Uganda. The Acsys CGS key system is a customised solution, which was deployed for other Acsys customers. Acsys agreed with Eaton Towers to avail a customised version for Eaton.

The outcome of all the discussions lead to a customised system developed by Acsys to control not only access to our sites, but also to be in a position to immediately restrict access to any of our sites to any key holder at any time due to the time frame that will be allocated. The Acsys CGS key system allows Eaton to implement best practices and security

towards Eaton remote assets with the ability to enforce effective access control and key management on a real time basis remotely. The Acsys system has the same features as other suppliers however, the Acsys key system is on top as their keys are fully encrypted (others aren't), has a much simpler software (ideal for large scale deployments), has a much larger amount of software options than any of its competitors and is able to offer multi-regional management and features that none of the other suppliers have. The lock change out and the relocation of the guards run parallel with each other. The lock change out is the primary risk mitigation strategy as Eaton will regain control over access to the tower locations and manage access privileges. The locks will be all compatible with a CGS Key system, with shackle and key retaining ability.

The CGS key enables Eaton to assign access privileges to specified areas on the towers site. This means that the refuelling team will be able to open the locks at the main entrance gate and generator only, as the key will be programmed to access those locks only.

Battery Box Protection Unit (BBPU)

Batteries are sought after commodities and will be targeted along with other assets. Current battery cabinets/shelters indicate vulnerability and Eaton decided to strengthen them to secure assets.

Target areas to change and currently in process:

- Mark all Eaton batteries and record details
- Strengthen current battery housings (externally), replace locks
- Replace locks on shelters
- Issue CGS keys to restrict unauthorised access,
- Reactive measures on possible loss/theft to ensure asset recovery and perpetrator accountability

Generator belt

Fuel as batteries are a sought after commodity and will be targeted along with other assets. The generators utilised in the past have weak locking systems, which increase their vulnerability to theft of fuel and starter batteries, etc. Current generator canopy/covers indicate vulnerability and it was decided to strengthen the canopy by introducing a well-secured metal bar around the DG.

Welcome Note	3	Target Areas to change and currently in process:
Meet the Team	4	<ul style="list-style-type: none"> ■ Strengthen current generators utilising deterrence such as the “generator belt” ■ Replace locks and review additional measures to enclose external tanks ■ Activate alarm and commission ■ Monitor probes and commission for SOC observation ■ Introduce re-active measures to further investigate losses and warrant perpetrator accountability
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9. One Mobile Tower and One Lantern at a Time	42	<ul style="list-style-type: none"> ■ Change security guards from inner perimeter and recover all keys in possession on lock change out ■ Enhance commination with guards – shared group line with SOC ■ Issue SOP for access control both sites with guards and sites without guards ■ SOP for Security Operations Centre escalation of security violations and incidents from sites increased observation by Security
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Resources	51	Future site security developments
Associate Members	54	The management of a good security function is imperative to ensure success and therefore need professional and competent leadership and staff to accomplish the reduction of OPEX and successful intervention to protect both Eaton Tower’s staff and assets. Eaton Uganda will continue to develop and implement a security risk management strategy and plans to incorporate both pro- and reactive measures in the business operation areas with the aim to increase security at the sites, and reduce the current and perceived losses significantly. Additional site hardening measures

will run concurrent with the lock change out process up to the 3rd quarter 2013. These activities will include, but not limited to, the key areas below.

Surveillance cameras on pre-identified sites

High tech surveillance cameras aim to replace security guards and enable Eaton to manage and monitor remote sites from the security operations centre.

Motion detection onsite

High tech motion detectors aim to replace security guards and enable Eaton to manage and monitor remote sites from the security operations centre. Motion detectors to be rotated according to risk assessments and priority, and security violations to be immediately reported to country police units for sting operations and quick response.

Additional deterrents such as pepper spray

Site hardening will increase security; however some sites may require increased methods to secure assets. This may be to ongoing criminal activities or the importance of the site. These locations may require that Eaton consider installing pepper spray in the shelters or containers that contain critical assets.

Media liaison, communications strategy & awareness

Community involvement and community-based policing (CPF) may add value to the protection of Eaton assets at the tower locations. CPFs can form a platform to create awareness to arrange in conjunction with the police to inform the community on the prevention of assets, create awareness to report suspects and suspected stolen property. Awareness should include target areas where stolen assets are sold, so that the public may inform police on stolen assets. Eaton Towers will incorporate these activities with the Eaton Towers Community Involvement strategy.

Review, assess and corrective action

Audits, reviews, assessments and corrective action form part of quality assurance. The security department monitors security violations and intervenes with reactive measures. They will also inspect systems for compatibility and performance. The security department will conduct ongoing risk mitigation strategies through security risk assessments and revision of threat levels.

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Chapter 4

The Tower Business Model: An Observation in Indonesia

By Ali Imron, GSMA



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Objective

The objective of this report is to increase understanding about the tower sharing business model in Indonesia, the power management relationship between the tower company and Mobile Network Operator (MNO), as well as the supporting actions from the government on infrastructure sharing regulation. This article presents common practice of tower companies in Indonesia and describes ownership of each infrastructure elements. This report introduces energy outsourcing, which can be beneficial for the tower company and MNO, as well as the barriers for ESCOs by implementing the energy outsourcing concept.

Indonesia at Glance

The population in Indonesia is around 240 million people with a GDP per capita of US\$3,495 in 2011¹. As a developing country in the ASEAN region, 35.5% of the population of Indonesia is still without access to electricity² with the majority living outside the islands of Java and Bali. In contrast, the telecommunications sector has been mushrooming for the last two decades, with the total number of connections at more than 268 million. ARPU is approximately US\$3.66³ and more than 98% of connections are prepaid.

Regulation in Site Sharing

A telecom tower is one of the key elements of an MNO's infrastructure. The growth of subscribers encourages MNOs to build more towers, extending their coverage and upgrading the capacity to fulfil consumer demand. Due to the compounding problems of growing number of towers required and the issues of space availability, community encroachment, security and neighbourhood aesthetic, the ICT Ministry has released Act No. 02/PER/M.KOMINFO/03/2008 to promote site sharing implementation and deployments⁴. With site sharing and tower leasing regulations, the Government hopes to make site deployments and network coverage expansion faster for MNOs, so that they can concentrate their efforts towards network quality improvement as they save from CAPEX on infrastructure.

Current Business Model

Baring in mind the above, tower companies have been in existence long before any site sharing regulations were in place. A leading pioneer was Indonesia Tower (SKP) who has now merged with the Tower Bersama Group (TBG). Business boomed in 2008 after the new act on telecommunication infrastructure regulations was introduced. However, a paradigm shift of tower company activities did not take place and to this day, the industry is still very much focused on renting space rather than acting as a total infrastructure provider; including energy provision for their tenants.

In deploying new sites, tower companies will try a Build-to-Suit scheme for any new location to attract an anchor tenant and to guarantee their revenue. On the investment side, the cost to construct a complete site with normal grid connection may be dependent on location and tower height. In general, tower companies need to invest between US\$ 84,000 – 115,000 to do a single site hunting, tower erection and infrastructure construction, with an estimation on Return of Investment (ROI) of 3 – 4 years. Currently, more than 25,000 towers are owned and operated by tower companies with a tenancy ratio of 1.5 – 1.6 (i.e. more than 40,000 BTS have been installed in each site).

The scope of work for tower companies is generally as shown below on the Build-to-Suit model:



Figure 8: Built-to-Suit Model

- *Site Hunting/Selection* and acquisition is key to a site leasing business. In site hunting, tower companies will try to get exact coordinates to match customer requirements. Inside this activity, tower companies will include terrain information, commercial power availability and tower recommendations.
- *Site Construction*, once permits and acquisitions are done, the project phase will move to RFC (Ready for Construction) where the labour commences. It usually takes 1.5 – 3 months to construct the infrastructure.
- *Ready for Installation* (RFI), operators usually lead this activity and instruct their vendors to install their BTS/ microwave. This activity takes 2 – 4 weeks.
- *Ready for Service* (RFS) will be declared after all equipment has been commissioned and tested to provide the services to the end user. At the same time, site acceptance will be conducted between all parties to ensure the completeness of each task. Then the operator will declare the site is officially *On-Air*.

Tower companies need two to four months to complete the process for delivering their site to an MNO. With the current situation in Indonesia where each MNO is keen to expand their network and to increase their market share, sometimes construction activities can occur in parallel with telecom equipment installation so that the entire process is completed in less time.

1 World Bank – www.worldbank.org
2 World Bank – www.worldbank.org
3 Wireless Intelligence
4 ICT Ministry – www.kominfo.go.id

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3 **Power Management in Tower Companies**

4 Nowadays, MNOs are rapidly extending their network coverage outside the islands of Java and Bali and at the same time increasing their capacity in high density traffic areas. Power availability is one of critical consideration for an MNO when constructing a new site, especially for sites outside Java and Bali. Grid connection is the favoured option for power connectivity. Tower companies as infrastructure providers have pressure for getting of this preferable connection by MNOs before the site selection is finalised. In many cases, MNOs need to upgrade the transformer or extend the grid poles to get 6 to 12 hours of commercial power connection with a price point of around US\$0.09/kWh⁵. In several cases, the cost of upgrading and extending the grid has been attributed to the tower company. The detail interaction in picking up power system solution is shown in the figure below.

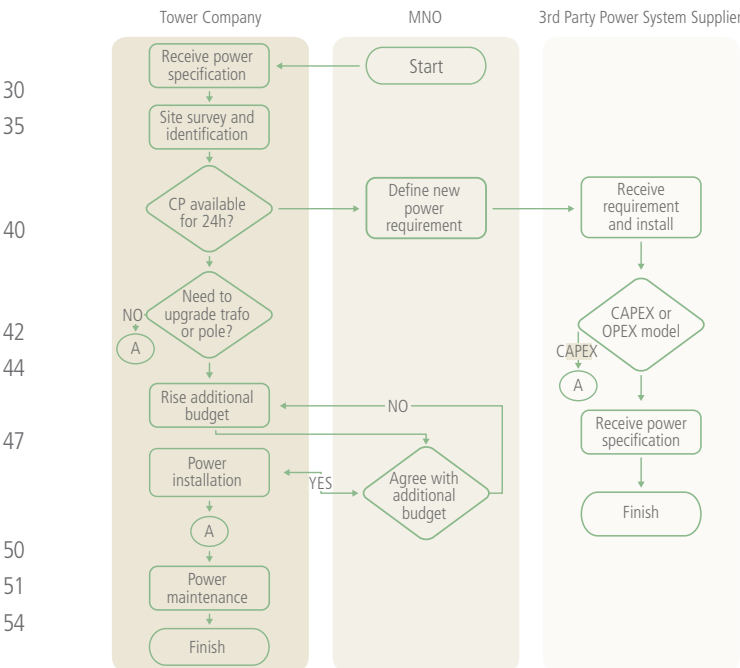


Figure 9: Interaction between Tower Company, MNO and 3rd Party Power System Supplier

We can see from the flow chart above, the operator is the one that makes the decisions about changing power connection specifications and vendor selections. Below is a table that depicts the power ownership structure between a tower company and operator in the instance that one location is occupied by multiple tenants:

Table 2: Power Ownership Structure between Tower Company and MNOs

	Tower Company	MNO 1	MNO 2	MNO 3
Tower	Owned			
Shelter	Owned			
Power Source		Owned	Owned	Owned
Rectifier		Owned	Owned	Owned
Battery		Owned	Owned	Owned
DG		Owned	Owned	Owned
Power Controller		Owned	Owned	Owned
Power NMS		N/A	N/A	N/A
Telco Equipment		Owned	Owned	Owned
Telco NMS		Owned	Owned	Owned

Based on the table above, the deployment is not the most efficient with each tenant needs to bring their own power system, back-up system and their own Network Monitoring System (NMS). But in current practice, power NMS is rarely installed and managed by an operator.

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It will be more wise or more efficiency if the structure of power ownership as the table below:

	Tower Company	ESCO	MNO 1	MNO 2	MNO 3
Tower	Owned				
Shelter	Owned				
Power Source		Owned			
Rectifier		Owned			
Battery		Owned			
DG		Owned			
Power Controller		Owned			
Power NMS		Owned			
Telco Equipment			Owned	Owned	Owned
Telco NMS			Owned	Owned	Owned

Table 3: Power Ownership Structure between Tower Company, ESCO and MNOs

Energy Service Companies (ESCOs) are specialised in power maintenance and management so that tower companies do not have to. The use of an ESCO streamlines the procurement process and guarantees the power availability for the tenant based on an agreed upon SLA.

Move to Power Outsourcing

In the past, tower companies and MNOs have been sceptical of both being able to reliably run a site from renewable energy and of the potential savings that could be achieved. Through the data from numerous trials, pilot sites and case studies that have been released from across the industry, a level of confidence has been built in the technology and financial benefits from Indonesian operators. Continued price reductions and technological improvements have set the stage for a market poised for expansion. Recently with competition and tariff wars in the market, MNOs have concentrated on attracting new subscribers. The options to raise the capital for renewable energy rollouts have been limited to internal financing or equity financing. More recently, MNOs have approached vendors to share the burden of capital costs. This is now going a step further with MNOs working with vendors to completely outsource power provision.

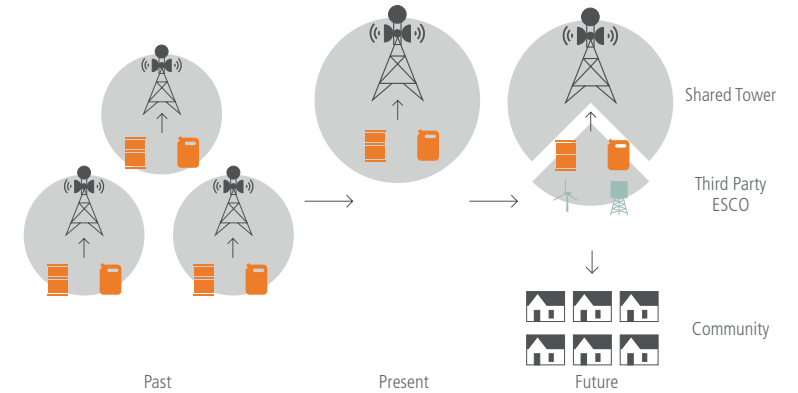


Figure 10: The Evolution of the Outsourcing Model

ESCO models that are being considered, developed and tested in the market include:

- **Power Purchase Agreement (PPA)**, the ESCO will install the renewable energy power system and sells power to the MNOs at an agreed per kWh rate.
- **Energy Saving Agreement (ESA)**, the ESCO will install the renewable energy power system on existing site and MNOs pay based on portion of verified energy cost 'saving'.
- **Fixed Fee Operating Lease**, the ESCO will install the renewable energy power system and sell it at the fix cost to MNOs. The main benefit from this scheme is MNOs will not have any variable budget on their expenditure.

Welcome Note	3	Benefit for the MNO and Tower Company
Meet the Team	4	These are the advantages of a 3rd party ESCO solution for an MNO or tower company:
Green Power for Mobile		<ul style="list-style-type: none"> ■ Budget saving: MNO and tower companies will have the potential for OPEX savings by using renewable energy without any CAPEX. ■ Simple procurement: MNO and tower companies will have simpler procurement process in purchasing power solutions to make their rollouts faster. ■ Headcount: reducing required human resources on maintaining power system on the network. ■ Service level: ESCO will guarantee an SLA for each site, so that an MNO and tower company can focus their core business.
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		To guarantee all these benefits, MNOs and tower companies need to have sufficient confidence in the ESCO to entrust them with BTS power systems, which requires the ESCO to have a proven track record in renewable energy system, site operation and maintenance.
Green Power for Mobile: India		Barriers to Outsourcing
6. The Progress of Green Telecoms in India	30	Shifting the responsibilities to an ESCO will bring new challenges and issues to the industry. MNOs require ESCOs to have significant prior experience and a proven track record in renewable energy power systems. This creates financing and marketing barriers for ESCOs to enter the market and often makes it challenging for small, less experienced ESCOs to compete. At the same time, human resources will have different issues regarding power maintenance and renewable systems. Training is required to ensure maintenance staff will follow technical specification, as most of the off-grid sites are located in remote areas.
7. Green Technology in the Telecoms Sector	35	Tower business models are different in different countries. Based on local market competency and requirements, the local tower industry in Indonesia customised its business model. However, unless the model allows maximisation of resource sharing, the tower business model may not become sustainable.
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Chapter 5

Globe Goes Green in its Network Transformation Programme

By Ronaldo David, Globe Telecom Inc., Philippines



Welcome Note	3	As Globe Telecom embarks on its network transformation programme
Meet the Team	4	deploying technologically-advanced solutions, it is also taking on the challenge of an ecologically-responsible organisation by transforming its facilities into “green” infrastructures all over the country.
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1. Review of Core Activities from the Green Power for Mobile Team	6	Under its site transformation track, Globe is now building more “eco-friendly” BTS sites.
2. Powering Telecoms in East Africa: Green Power for Mobile Market Analysis	10	Apart from concerns on capacity, Globe’s existing equipment poses a challenge in terms of cost efficiencies, as it requires cooling equipment such as air conditioners to enable efficient functioning, thereby creating large power footprints. Likewise, the current site configuration features a traditional setup which use diesel fuel and lead acid batteries which can be detrimental to the environment; the actual expenditures for these items are also increasing higher year-on-year.
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4. Tower Business Model: An Observation in Indonesia	20	
5. <i>Globe Goes Green in its Network Transformation Programme</i>	25	
Green Power for Mobile: India		
6. The Progress of Green Telecoms in India	30	Globe Chief Technical Advisor Robert Tan says, “That will undergo a radical change soon through our site transformation strategy. We envision the facility layer of the Globe network to consume less power and fuel by introducing cost-effective, environment-friendly solutions which leverage on the operational benefits of new technologies.” He added that the application of cost-saving technologies will have to be carefully selected based on a site’s geographical and operational features.
7. Green Technology in the Telecoms Sector	35	
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8. Going Beyond the Grid: Seeing Opportunities to Improve Community Energy and Water Access plus Rural Mobile Commerce	40	Metropolitan areas or commercial business districts will achieve power protection through agreements with building owners, allowing Globe to connect into the building’s emergency power systems. This type of arrangement saves huge capital expenditures in constructing generator set (genset) facilities.
9. One Mobile Tower and One Lantern at a Time	42	
10. Solar Power has a Place in Mozambique: From the Central and Southern Provinces	44	
11. Sustainable Energy & Water Through M2M Connectivity	47	Those located in areas where commercial power is unreliable will be provided with deep-cycle batteries coupled with efficient gensets to provide rapid battery charging rates and address regular commercial power outages.
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Additional Notes:
 1. Globe’s total no. of wireless sites is 6,200++
 2. Part of our plan also include
 a. BTS change out and provision of high efficiency power systems for 1,400 sites that are already outdoor
 b. Some 2,000++ indoor sites are in close proximity to salt water will remain as indoor
 c. The rest of Globe’s indoor sites houses critical nodes that will remain indoor too but resilient and redundant in power and facility design

As such, Globe Telecom critical sites, such as core, transmission and base station controllers (BSC) or radio network controller (RNC) sites, will need to be designed with high operational availability featuring redundant power systems and engineered to be resilient to withstand core node failure in the event of a natural calamity. For example, it is introducing a pooling concept with geographical diversity for its mobile switches and media gateways, such that should there be a failure in any mobile soft switch (MSS) or media gateway (MGW) nodes in the pool, the others will seamlessly take over.

In addition, with regards to carbon footprint reduction, Globe is deploying solar power solutions for off-grid sites where commercial supply is not available. With solar and genset hybrid solutions, the runtime of generators is dramatically reduced by 80%, translating to about 70% in savings.

Deep cycle battery for poor grid sites will also drive down fuel consumption by 50% and maintenance costs by 40%. Cooling boxes for batteries are being deployed to cut back on air conditioning usage by 70%. Free cooling solutions such as fan ventilators are being deployed as new generation equipment and can operate in higher ambient temperatures inside the shelter.

Last-mile sites will also be situated outdoors where feasible, thus eliminating use of air conditioners and providing up to 35% savings in power. Rectifier systems will have efficiencies at 96% with at least eight-hour battery back-up time.

With the deployment of a Facilities Management System (FMS), each regional operations centre will have real-time monitoring of the energy consumption and environmental conditions to get into a proactive mode. The FMS will also be able to, among others things, enable remote switch-over to gensets during commercial power outages, provide real-time battery conditioning and perform remote charging and discharging of batteries to prolong its useful life. Rectifier loading can also be seen in the FMS that will help to ensure utilisation does not breach capacity. Real-time monitoring of fuel usage will also be achieved to discourage acts of pilferage. More importantly, the FMS being integrated into the company’s Network Operations Center will aid its personnel from improving its mean time to response or MTTR to recorded network alarms at pre-identified sites before actual outages transpire. This will aid revenue protection through site availability.

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This 'green' initiative has so far been implemented in 434 sites out of a total of 6,000+ sites, with the programme gathering momentum for full completion in 2013. Tan clarified that "in the midst of the company's aggressive radio access network (RAN) and core roll-out, we acknowledge the urgent need to address commercial power reliability in certain areas. Hence, a parallel track in deploying and replacing ageing gensets, batteries and even rectifiers are being pursued. This is to ensure that the operational benefits of a transformed network can be realised much earlier."

Already for some of the core network buildings, Globe is reaping the benefits from the actual operations of the variable refrigerant volume or VRV-type air conditioning units as they are efficient, reliable and energy-saving with minimum installation time and disruption to operations. Reduction in electricity consumption registered up to 20% compared to using the traditional cooling set-up.

According to Tan, the plan is to roll out the following:

- Solar-based solutions at 68 sites with no commercial power or those that are purely dependent on fuel
- Deep cycle battery solution for 44 sites with frequent power outages and with high fuel consumption
- Conversion of at least 1,200 indoor sites to outdoor models to eliminate air conditioning
- Use of intelligent gensets for at least 16 sites identified as "most expensive to operate" in the entire network and of free-cooling solutions with battery coolers at sites which require shelters (approximately about 700 sites).

Tan says that, "When our site transformation programme is complete, we expect to save in excess of 30% in operating costs. Already, we are reaping 15% savings on partially-transformed sites."

Globe President and CEO Ernest Cu remarked that, "By embarking on our own 'green' initiative, we are doing our share in preserving the environment while delivering on our commitment to provide superior customer experience as we build a future-proof brand new network."

New Technology Adoption

When asked to outline what would make their organisations accelerate the adoption of new, advanced battery technology, most participants pointed to the need for greater education on how the technology would work in real-life applications. This could be achieved through:

- Road shows featuring engineering teams and other product experts to increase understanding of the new technology
- Extended on-site pilots to demonstrate the system's performance in the field
- Clearer performance data, particularly in comparison to tried-and-tested lead-acid batteries

The discussion also circled back to the issue of sheer costs. MNOs felt they would be more apt to adopt new battery technologies if they came with a clear performance guaranty and a reasonable CAPEX. New technology companies that can offer an alternative business model based on the OPEX savings or the performance of their solution would be more likely to successfully mitigate the risks associated with their product's high CAPEX.

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3 Some examples:
4 Outdoor to Outdoor transformation

Before Transformation

Legacy BTS equipment and rectifier system

End of Useful Life Genset, Change-over Switch and Fuel Tank with no remote monitoring capability

Indoor to Outdoor transformation:

Before Transformation

Equipment Cabin using 2 x 2.5Hp Aircon

Site located beyond 3KM from shoreline. No corrosion issue due to air salinity. Can be converted to outdoor setup being "a last mile site"

End of Useful Life Genset, Change Over Switch and fuel tank with no remote monitoring capability

Indoor to Outdoor transformation:

Before Transformation

Equipment Cabin using 2 x 2.5Hp Aircon

Site located beyond 3KM from shoreline. No corrosion issue due to air salinity. Can be converted to outdoor setup being "a last mile site"

End of Useful Life Genset, Change Over Switch and fuel tank with no remote monitoring capability

After Transformation

From legacy outdoor BTS equipment and rectifier system to new outdoor set-up using IP 55 cabinets, high efficiency rectifier system with 5 hour battery back up time

New Genset, Change-over Switch and Fuel Tank with intelligent remote monitoring system

After Transformation

Using existing shelter, new high efficiency rectifiers with 8 hour battery back up time. Aircon run time to be reduced by using free cooling low wattage fans and battery coolers to support battery

New Genset, Change-over Switch and Fuel Tank with intelligent remote monitoring system

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3 Site transformation using solar hybrid:

 <p>From Using 2 units Genset running alternately 24/7. Solar power system is provided as the main power source of the site with Genset being used as back-up power source.</p>	   <p>New Genset, Change-over Switch and Fuel Tank with intelligent remote monitoring system</p>
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Site transformation using deep cycle batteries:

 <p>1 - Deep Cycle Battery 2 - Hi Efficiency Rectifier 3 - BTS Equipment</p> <p>Sites with space restriction and power requirement more than 2.5kw, deep cycle battery system is provided as the main power source of the site with Genset being used as back up power source.</p>	   <p>New Genset, Change-over Switch and Fuel Tank with intelligent remote monitoring system</p>
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Chapter 6

The Progress of Green Telecoms in India

By Ferdous Mottakin, GSMA



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With the second largest mobile phone market, India has the largest number of off-grid and poor-grid sites in the world. Due to grid unavailability and unreliability, mobile operators and tower companies in India are forced to use diesel-based power generators. However, due to growing concerns over greenhouse gas emissions and ever increasing diesel prices, the industry is now strongly advocating and rapidly promoting renewable and green power deployments. Additionally, the Government's 'Green Telecom Directive' has set a milestone for the Indian mobile industry to achieve a stiff target. The overall engagement among all the different stakeholders has remarkably progressed over the last few quarters. As a direct outcome, a significant number of energy efficient and/or green deployments are underway.

During 2011-2012, the Green Power for Mobile (GPM) programme undertook an 18 month project in India to stimulate market momentum in enhancing the growth of green deployments. GPM, being a market facilitator, produced a number of knowledge based reports on India over the period. Examples of these included a Best Practise Procurement Guide, CAPEX vs. OPEX Model Analysis, Vendor Landscaping, Renewable Energy Market Sizing and others. This is in addition to the three Working Group meetings targeted purely for Indian stakeholders. As a part of our technical assistance, we also engaged with a number of major industry stakeholders to share knowledge with their staff. Overall, GPM played a vital role in bringing the current green telecom phenomena to India. Having said this, there is still a lot more to be done in order to successfully reach transformational scale.

Snapshot of Current Development

In the last Bi-annual Report, an article on 'The Current Market Status in India' shows the ongoing and planned initiatives for green telecom. In the last 6 months, almost all the major telecom players in India have had some level of progress. Some highlights include:

- Through an RFP process, TAIPA (Tower and Infrastructure Providers Association) of India has selected a service provider to deploy 500 green pilot sites for its member tower companies. The sites will be deployed using Bio-CNG (compressed natural gas). After completion of implementing the first 500 sites, TAIPA will go for large scale deployment of green power.
- Bharti Infratel is deploying approximately 250 sites using biomass gasification. An RFP for deploying 3,000 solar sites is also in progress.
- Indus' energy efficiency project is underway to reduce the dependency on DGs and air conditioners.

Additionally:

- Idea Cellular has a separate initiative for green energy. The target is to deploy a total of 1,000 sites by the end of 2012.
- Vodafone is deploying 150 hybrid solar sites; this is on top of the 390 sites they are currently deploying.

Shortcomings Still Exist

Despite the heavy engagement among all stakeholders, the number of successful green telecom projects in India is very limited. However, a significant number of interested service providers/system integrators are keen to work in this market. The Government's intervention by introducing the 'Green Telecom Directive' is yet to play any significant role in increasing the growth.

There are 5 major reasons for why growth has been stagnant:

1. The expectation of price per kW
2. Lack of clarity of the government's directive
3. Lack of low cost investment in the green power industry for telecoms
4. Lack of risk sharing elements in the energy outsourcing model
5. Lack of interest from large energy organisations to enter the sector

Being a price sensitive market, it is essential that a green power business model is not only environmentally friendly but is also self-sustaining. In most instances, green power, OPEX saving & business sustainability do not go hand in hand. A technology-agnostic approach should be used at every site to identify the best suitable solution.

As we mentioned in our last Bi-annual Report, the government's directive on green telecom has many unclear areas. Mobile network operators and tower companies are conservative when exploring initiatives for going green, due to the lack of clarity of the definitions within the directive. The Government should bring these to the table and formally clarify anything that is unclear.

It is estimated that the Indian telecom industry will require an additional US\$6 billion- US\$10 billion commitment to convert all its sites that have potential to go green. Unless the industry can bring in the investment required, it is inevitable that the expectation of large scale green deployment in the telecom may never happen. With India's double digit interest rate, it may not be easy for the industry to achieve a sustainable

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3. Site Security and Access Control: An Integrated Approach for Managing Telecom Tower Assets	15	■ Partial investment into the venture
4. Tower Business Model: An Observation in Indonesia	20	■ Guaranteed energy usage (specific lower cap)
5. Globe Goes Green in its Network Transformation Programme	25	■ Guaranteed duration of contract
		■ Constructing site fence to increase site security (wherever necessary)
Green Power for Mobile: India		
6. The Progress of Green Telecoms in India	30	We are yet to see any large companies enter the market, but when such companies do, the business model will possibly take an entirely different shape. Since utility companies may have a mandate to electrify communities, growth centres and other businesses, they may be encouraged to consider telecom towers as their anchor client.
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3 Technology & Business Innovation

4 Recently, a number of technology and business innovations have been introduced to the industry some of which have a lot of potential. This has opened up the opportunity to increase the pace of green power deployments for the telecoms industry.

6 **OMC Power:** OMC's Micro-Power plant model for telecoms and the local community is very innovative. The pilot sites successfully demonstrated the capability of the model. They now plan to deploy 350 power plants by 2013. OMC is offering monthly fixed fees for energy or a fixed rate for kWh power.

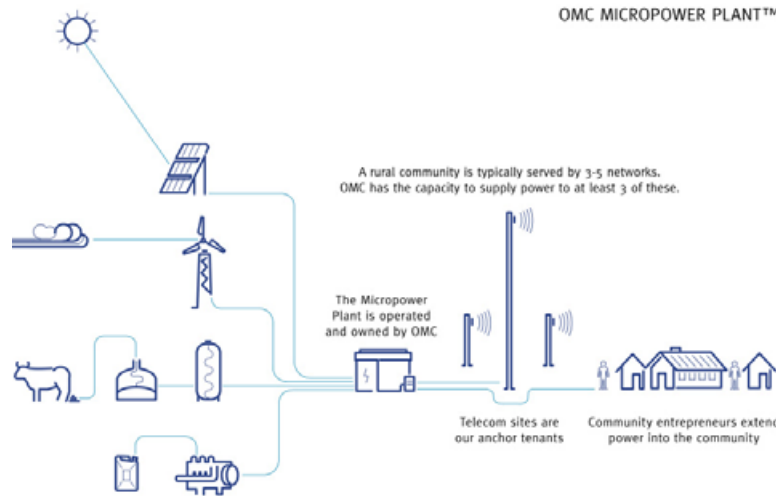


Figure 11: OMC's Business Model

50 **KMRI:** KMRI introduced a distributed on-site power generation model using bio-mass. They have customised the solution based on the practical requirement and constraints of telecom towers. The solution also has a community power component which can be scaled up quickly. KMRI is offering a monthly fixed fee or kWh rate for energy. They also provide an end-to-end service at a tower location which makes the energy management business also site management.

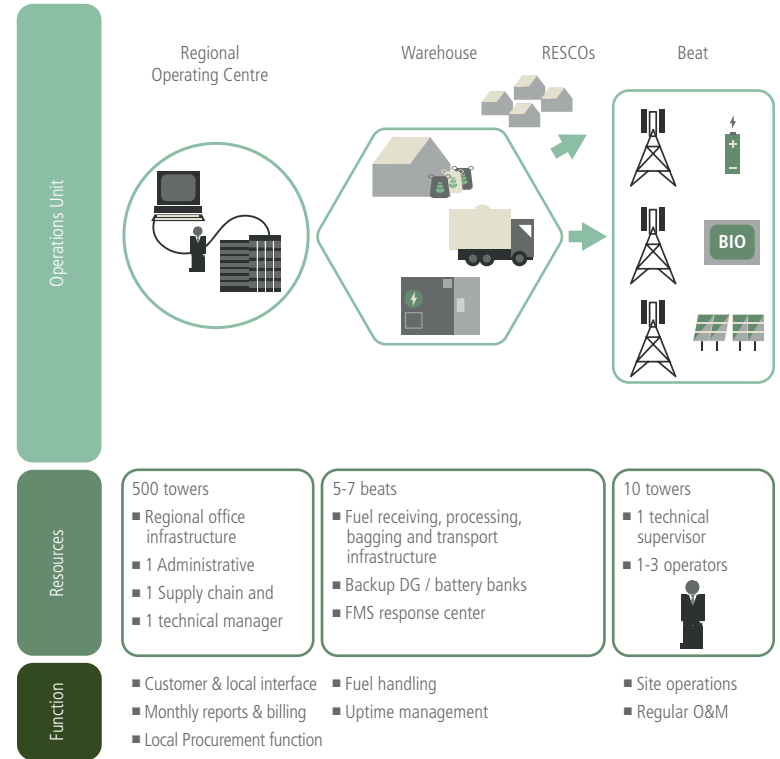


Figure 12: KMRI's Business Model

NextGen PMS: has developed a very innovative bio-CNG distributed power generation model whereby an in-house biogas digester has been developed for organic waste to be converted to useful energy applications without compromising the reliability, hygiene and aesthetic value. It takes a variety of inputs from food to human waste and the gas produced can be used as a substitute for LPG or used to generate electricity through a compressed natural gas (CNG) based generator.

Welcome Note	3	What Needs to be Done?
Meet the Team	4	The Indian market is clearly heading toward the largest green telecom deployment in the world. However, for this to occur, some specific areas need to be addressed with care:
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1. Review of Core Activities from the Green Power for Mobile Team	6	■ A thorough energy audit and benchmarking should be done to come up with site standard energy management processes/ dimensions. This can be for existing or future sites.
2. Powering Telecoms in East Africa: Green Power for Mobile Market Analysis	10	■ Energy and telecoms are two different segments. The energy requirement for telecom should be treated as energy access for essential services (telecom). The Government needs to be made aware of this this in order to provide fiscal support.
3. Site Security and Access Control: An Integrated Approach for Managing Telecom Tower Assets	15	■ The 'Levelised Cost of Energy (LCE)' should be introduced to forecast the future energy OPEX of the telecom site and make it predictable.
4. Tower Business Model: An Observation in Indonesia	20	■ Stakeholders should realise that the green power source with 99.99% uptime may not be cheaper. If a RESCO/ESCO makes their business sustainable, they can offer a range of sustainable models.
5. Globe Goes Green in its Network Transformation Programme	25	■ The local financial institutions should bring adequate low-cost financing
		■ Large power producers and utility companies have a place in this market. They should be generating and distributing power locally. A distributed power model can help the country to achieve a higher electrification rate quickly.
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The Green Power for Mobile programme will continue to work closely with Indian stakeholders in order to ensure that critical issues are addressed. India is in a unique position to become a leader in the green telecom industry; the GSMA would be delighted to assist in reaching the next level.

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Chapter 7

Green Technology in the Telecoms Sector

By Nafis Ehtisham, Grameenphone



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3 **Power Situation and Bangladesh**

4 Energy is a nationwide crisis for Bangladesh. Around 90 out of 160 million people in Bangladesh do not have access to electricity. A large portion of these people live in remote rural regions that are unlikely to get connected to the regular grid. This severely limits socio-economic development and has direct consequences at the individual level when it comes in terms of communication, health and education. There is a huge gap between the demand and supply of the electricity generation and it doesn't seem like this gap is going to close in the near future. In 2010-2011, the demand forecast was 6765 mW where demand served was 4890 mW. The total gap was 1875 mW. Bangladesh currently has the lowest per capita electricity generation of 252 kWh p.a., which means millions of people are living in the rural off-grid areas. Even for Grameenphone to provide communication services to these off-grid remote areas is a huge challenge. The base stations sites in these areas are required to be running on diesel generators which are very OPEX intensive. Operating costs are high due to high spending on diesel which also adversely affects the environment by emitting CO₂.

Grameenphone Ltd and Climate Project

Grameenphone's endeavor to become a green company with the "Building a Greener Network" initiative which was initiated back in 2007 by the Bangladesh telecom market. The aim of the initiative was to transform Grameenphone's network and offices to be environmentally friendly and to reduce carbon emissions by saving energy and fuel consumptions. For this reason, Grameenphone launched the Climate Change Programme back in 2008 to gain sustainability as well as to help the community and its people. Grameenphone has taken lots of green initiatives to reduce its carbon footprint both individually and collectively.

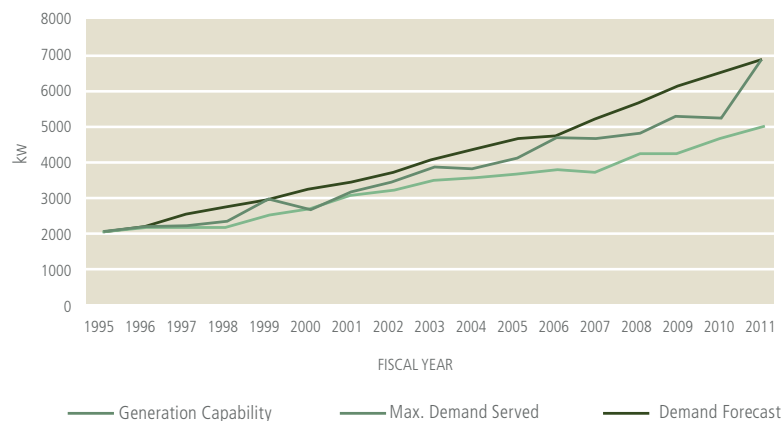


Figure 13: Installed Capacity Demand Served and Demand Forecast

Source: www.berc.org.bd – Annual Report 2010 -2011

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3 Industry Overview (Grameenphone):

Table 4: Grameenphone Industry Overview

Total Sites of Grameenphone	Sites Run by Utility Providers		Sites Running by Alternative Power Systems	
8042	Dhaka Electric Supply Company (DESCO)	384	Regular Solar Sites (PPA & Purchase)	130
	Dhaka Power Distribution Company (DPDC)	656	Humming Bird Solar Sites	1
	House Owner	481	Low Cost Coverage Solution Solar Sites (LCCS)	2
	Rural Electrification Board (REB)	4392	Wind Turbine Sites	1
	Power Development Board (PDB)	1392	Only Gen Sites/NCP	155
	West Zone Power Distribution Company Limited (WZPDCL)	448		
		7753		289

Green Initiatives:

Initiatives undertaken for reduction of power consumption from network:

From An Equipment Perspective:

1) Network Modernisation and Obsolete Node Power Down Project:

The telecom network is responsible for 90% of Grameenphone’s overall energy consumption. Grameenphone took on a network modernisation project to reduce its network energy consumption by 50%. By swapping high power consuming legacy base stations to low power consuming base stations, it not only saved cost but also reduced huge electricity/fuel consumptions and significant amount of CO2 emissions. This equipment is simplified, modern and innovative (ready for 3G and broadband) and also supports the infrastructure sharing and wholesale business sector. Grameenphone has also completed on obsolete equipments power

shutdown programme after the swap which also saves a significant amount of energy and reduces CO2 emissions.

2) Core Site Consolidation and Optimisation Project:

Due to the reduced equipment footprint, Grameenphone initiated the “NANO Project” to consolidate and optimise core locations throughout the country with an aim to reduce energy consumption and increase work efficiency. As a result, significant amount of OPEX has been reduced and also carbon emissions have decreased. When this project kicked off, Grameenphone had a total of 40 core sites in 22 different locations and the major objective was to reduce this to 20 core sites at 9 locations by 2014.

From BTS Site Perspective:

1) Deployment of DC Ventilation:

Grameenphone’s vision for Going Green and to be energy efficient has given rise to another concept; dismantling existing air conditioner systems to reduce energy costs and to install DC ventilation systems (DVS) instead to regulate the room temperature. This is also known as a free cooling system. It’s a very low power device which runs with DC power. It can ensure the optimum use of air conditioner and hence reduce electricity cost as well as CO2 emissions. In all of Grameenphone’s existing sites there is an air conditioner for cooling. Running air conditioners requires 40-50% of the site’s total energy requirement. DVS works with a controller circuit and two fans, one is for inlet & the other for outlet. The entire system is made dust free using dust free filters. This unique system reduces the operating hours of air conditioner usage and electricity costs. Even if the air conditioner is removed, it can maintain certain levels of temperature at the BTS. DVS proves extremely viable with the prospects of saving 40%-50% of the sites total energy and reduces CO2 emissions.

2) Reduction of number of generators and generator run hours:

By increasing battery backup and by doing extensive discharge combined with network modernisation, Grameenphone has reduced generator run time by a significant amount. Grameenphone has also off-loaded many generators from its existing network as a part of Going Green.

3) Deployment of renewable energy sources such as solar and wind turbines:

There are a number of base station sites in remote off-grid areas which are entirely dependent on diesel generators. In December 2007, Grameenphone deployed its first two solar sites in Ajmiriganj, Sylhet on an pilot basis.

Welcome Note	3	This resulted an immense success as the generator run time in the two off-grid sites decreased to 2 hours compared to a daily generator run time of 9 hours in other off-grid. Convinced by its success, Grameenphone further deployed 12 solar sites in 2009. Currently Grameenphone has 133 solar sites including 1 Humming Bird solar site, 2 LCCS Solar Sites (Low Cost Coverage Solution), and 1 wind turbine running site. Grameenphone's target is to deploy a further 40 solar sites by 2012.
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Initiatives Undertaken Based at Grameenphone's Head Office:

1) Grameenphone House – A Green Workplace

Grameenphone's new head office has a gas-based CoGen system. The heat generated from the exhaust is being used to run the chillers which is cutting the cooling energy requirement by half. Double layered glass has been used as walls to optimise daylight usage and also to reduce the solar heat gain. Significant amounts of energy is saved from the CoGen system as well as there being a reduction in CO2. The building is saving approximately 60% in energy compared to the previous building. The waste water treatment plant also saves up to 31% of the former water consumption.

2) Implementation of Environmental Management System (EMS)

As per ISO 14001:2004, Grameenphone established the EMS where proper disposal guidelines are being imposed, resources are being trained and certified, used batteries are being refurbished and recycled, an e-waste management system is being engaged, and regular audits are being carried out to ensure energy conservation.

3) Other initiatives at Grameenphone's Head Office include transport initiatives and a Recycle, Reuse, Reduce and Dispose of Project.

4) Other initiatives at Grameenphone's Head Office include transport initiatives and a Recycle, Reuse, Reduce and Dispose of Project.

Initiatives Undertaken for Underprivileged Segment:

1) Community Power Project:

Grameenphone partnered up with the University of Oslo to develop an advanced Community Power Project. Grameenphone piloted this project in a remote village called Paharpur, located in the northeast of Bangladesh. A mini-grid has been developed and around 136 households are connected to this grid; getting power from 5pm to midnight. Through this project, Grameenphone for the first time also rolled out a community information centre in this off-grid region where computers, printer and scanners run on solar power during the day and enabling internet services to users.

Initiatives Undertaken as for Awareness/Consciousness Purpose:

1) Awareness Programs:

We believe to be successful, our employees and suppliers need to understand and believe in our green endeavour. Employee awareness and engagement has been encouraged over the past few years in order to make this change. A few of these initiatives include: a quarterly environmental bonus, a desktop campaign, promoting renewable energy amongst others. Grameenphone has also co-hosted Green Power for Mobile Working Group which aims to promote Renewable Energy in Bangladesh. We believe that the palette to paint the environment green actually lies in our hands. With this belief, we also launched a web portal and put out an external environmental campaign "Stay Green, Stay Close" which highlights out success stories.

2) Click Green – A Photography Competition:

Grameenphone is successfully carrying out its photography competition for the third year in a row and continues to be launched on the 5th June, World Environment Day. The aim was to engage employees, Grameenphone Facebook fans & journalists to act and reflect on what climate change means to them.

Benefits in Terms of Energy Savings, Reducing CO2 Emission & OPEX Savings

The success of the "Building a Greener Network" initiative ensures significant energy saving across Grameenphone's operation. Grameenphone has an environmental roadmap which aims to promote a low-carbon society, and our first priority is to take responsibility for the excess CO2 emissions generated by our operations. Grameenphone has set a target of reducing its carbon emission by 40% by 2015 from the business as usual situation; 2008 is the baseline. The amount of emissions saved from this initiative has contributed to achieving the yearly emissions target. The measurable KPI for this programme is the amount of energy saved in terms of electricity and fuel.

By becoming energy efficient, it has helped Grameenphone to achieve business benefit with long term sustainability. Specifically, up to 2012 these initiatives have enabled total savings of around US\$ 20 million from energy and fuel expense.

Network modernisation initiatives have drastically reduced the OPEX and have significantly enhanced the business benefit in terms of cost, operational efficiency and environmental friendliness. To build a low carbon sustainable modern network, swapping of 7272 BTS and targeting the reduction core nodes from 40 to 20, as well as to reduce

Welcome Note	3	locations from 22 to 9 with energy efficient modern equipments, saved approximately 53 gW-Hr of electricity and 400,000 litres of fuel - over 30,000 tonnes of CO2 reduction.
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1. Review of Core Activities from the Green Power for Mobile Team	6	The deployment of 133 Solar BTS from 2007 to 2012 saved approximately 1,594,000 litres of fuel which is over 4,200 tonnes of CO2 reduction. Solar deployments were targeted to operate networks by using less energy, gaining efficiency and profitability as well as saving OPEX.
2. Powering Telecoms in East Africa: Green Power for Mobile Market Analysis	10	
3. Site Security and Access Control: An Integrated Approach for Managing Telecom Tower Assets	15	Dismantling 7150 AC and installing 7230 DC ventilation systems has saved approximately 77 gW-Hr of electricity which is equivalent to over 43,000 tonnes of CO2 reduction.
4. Tower Business Model: An Observation in Indonesia	20	
5. Globe Goes Green in its Network Transformation Programme	25	Grameenphone House ensures continuous and smooth business operations by reducing carbon emission and saving huge OPEX for fulfilling environmental sustainability. Water savings have now reached 12 million litres/yr and the energy savings is approximately 11 gW-hr/yr - over 6,100 tonnes of CO2 reduction.
Green Power for Mobile: India		
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Overall Impact

Overall, Grameenphone's initiative saves 150 GWhr of electricity usage which contributes to improve national grid availability for the off-grid community and to enhance life standard. Its green initiatives also created employment opportunities and developed local entrepreneurs which have led to developing local economies. Additionally, Grameenphone has saved US\$20 million from this initiative which helped the organisation stay competitive in a low ARPU environment.

Future Strategy and Ultimate Target:

A large core network consolidation and optimisation project is underway and will continue until 2014, which aims to save 7gWhr of electricity usage with over 280k litres of diesel fuel being saved. Rolling out solar solutions for both poor and off-grid sites are prioritised along with making diesel generators obsolete. The overall initiatives are taken as a part of Grameenphone's corporate commitment of 'Building a Greener Network'.

Saving energy consumption by reducing electricity and fuel usage eventually reduces carbon footprint, lowers greenhouse gas emissions, prevents climate change and contributes toward a healthier environment. Grameenphone's ultimate target is to establish a sustainable mobile network with higher efficiency and profitability.

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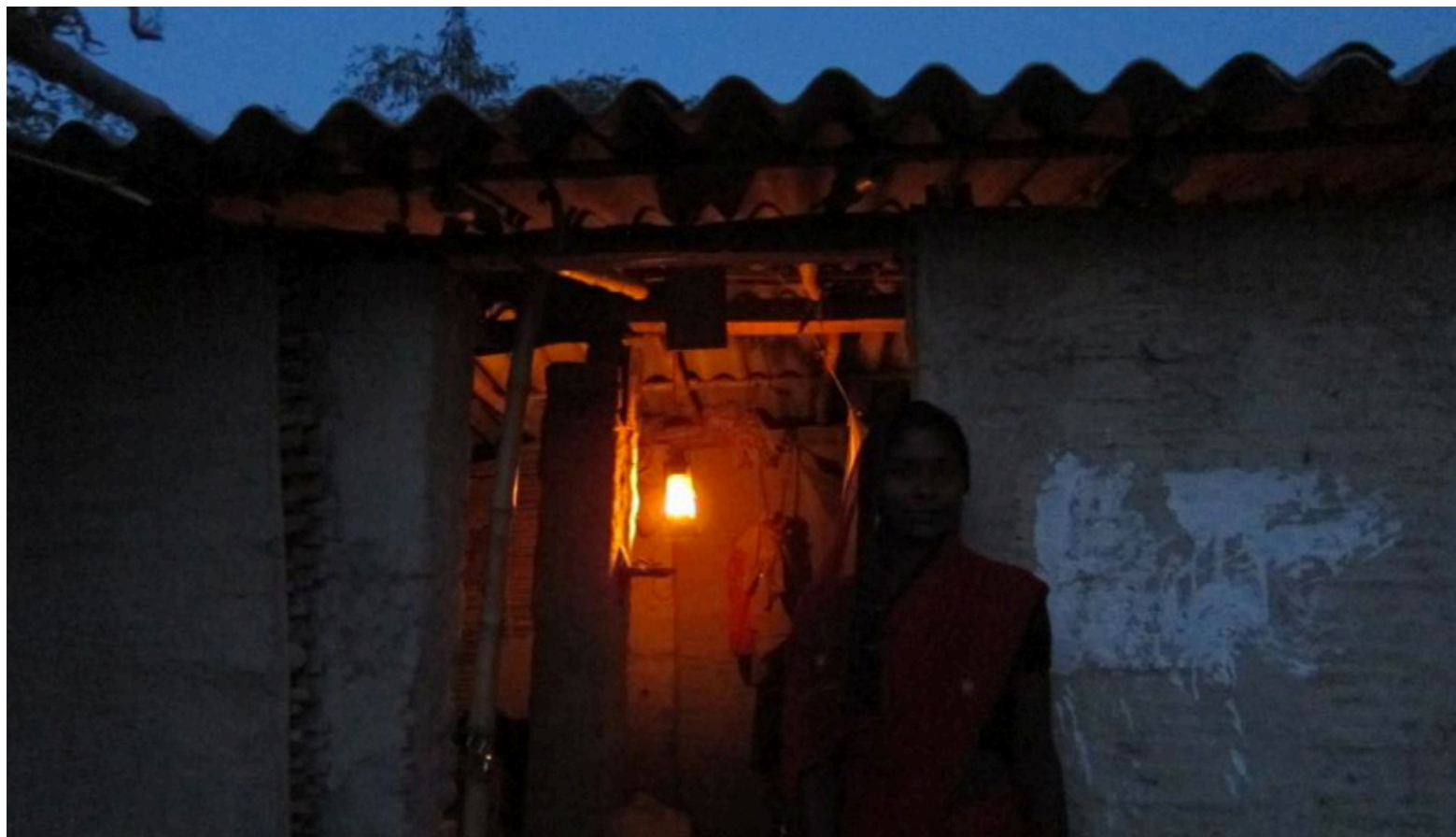
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Chapter 8

Going Beyond the Grid: Opportunities to Improve Community Energy and Water Access, Plus Rural Mobile Commerce

By Charlotte Ward, GSMA



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The Community Power from Mobile team has had the privilege and pleasure of visiting many emerging markets during the last eight months. It has progressed our understanding of the opportunities for delivering better energy and water services in partnership with the mobile industry.

The map shows the countries visited and what follows are some highlights from Mozambique and India and information about our feasibility studies.

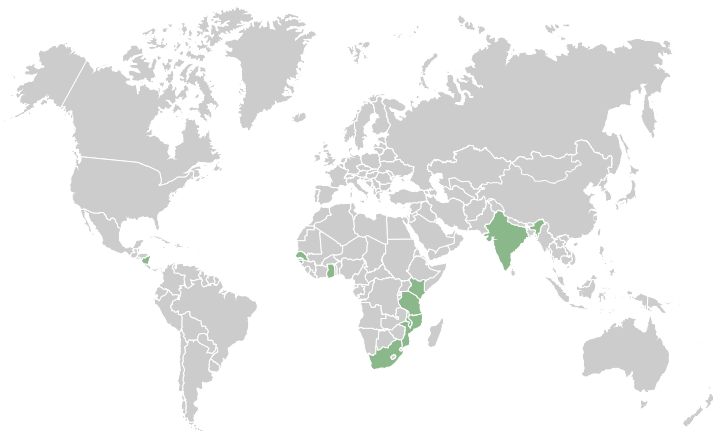


Figure 14: Destinations of the CPM team in 2012: India, Kenya, Malawi, Tanzania, South Africa, Mozambique, Senegal, Ghana, and Nicaragua.

Evaluating the Opportunity through Engaging with Operators in Feasibility Studies

Between April and October 2012, the GSMA, with the support of the International Finance Corporation and the Inter-American Development Bank, worked with Safaricom, Movistar Nicaragua and Telekom Networks Malawi (TNM) to evaluate the opportunities to improve access to energy services for their customers, while improving the business case to serve off-grid areas. The GSMA will be publishing more on the individual outcomes of these feasibility studies in 2013.

As part of the goals of the Community Power from Mobile programme to identify the opportunity for the mobile industry to provide modern energy services to off-grid communities, and stimulate activity with scalable and commercial solutions, feasibility studies with mobile operators provide in-depth analysis relevant to their network and services.

What was found in these countries, and is the case in many other emerging markets, is the large gap between the small number who have formal access to electricity and the total off-grid mobile connections. Ultimately many mobile subscribers in emerging markets have a phone before they have a place to charge it. This presents a potential means to expand energy services at an unprecedented scale through partnership with the mobile industry.

In many markets mobile connections are also expected to keep rising with mobile service available in further reaches and covering greater proportions of the population. The large majority of populations of countries we visited live in rural areas (such as approximately 75% in Malawi and Kenya) where grid power distribution and reliability remains poor. Even where accessibility is an option, affordability for (formal) grid connectivity is an obstacle. The number of mobile subscribers living without easily accessible electricity is set to increase unless off-grid energy services improve dramatically.

At the same time, energy is the backbone of the mobile industry. Mobile operators' expenditure on energy is increasing due to rising diesel costs impacting the operating cost per kWh, plus increasing off-grid diesel theft and the site security required in these sites and in remote locations.

The wide adoption of mobile services by underserved populations provides an opportunity to develop energy solutions at a scale never before seen, leveraging human and physical infrastructure and innovative payment technologies, whilst delivering cost savings to the network and revenue uplift.

The rural energy and water access sectors are nascent and expanding, with several innovative companies forming commercial partnerships with mobile network operators in 2012. We hope to see this number grow in 2013.

Coming soon in February 2013 from GSMA are the Community Services from Mobile White Paper and our Deployment Tracker on Mobile and Development Intelligence

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One Mobile Tower and One Lantern at a Time

By Mary Roach, GSMA



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On our travels and from the numerous people we speak to each day we collect a wealth of interesting information which we document on our blog. We would like to use this platform to build a community for regular discussion so please go to our blog for regular updates. Here is one of our favourites from the year.

“The happiness on his face was the same as I had on the day that my father bought me the first television. This was in 1972. Seeing the boy and his reaction, I felt both happy and sad. Happy because you see that you’re contributing to bringing smiles to the boy and his family. Sad because in 2012, people have to be happy to get a lantern in this country.”
Rohit Chandra, COO of OMC Power

Over the past few months, our newsfeed has been abuzz with the changes impacting our mobile industry partners in India. From July’s historic blackout which left 620 million people without power but with mobile coverage, to TAIPA’s plans to outsource green power to 100,000 towers, these events reflect the scale of the energy challenges India faces and the void the mobile industry is trying to fill.

In the midst of all of this, as correctly noted by Justin Guay of the Sierra Club in the Huffington Post, a landmark 10-year deal was signed between Bharti Infratel and OMC Power to build and operate micropower plants that are capable of delivering power to mobile towers and the community. To further illustrate the importance of this event, this is the first deal of its size where both telecom AND community energy requirements are part of the business plan from Day 1.

Since then, OMC Power has been featured on both the BBC and most recently on Forbes. As noted in the Forbes article community uptake has surpassed OMC’s expectation reaching 30% penetration within 45 days. Thus you can imagine our delight when we had the opportunity to spend the day with the team at OMC Power at their site in Uttar Pradesh to see what everyone was talking about. While it is too soon to call their model a runaway success, there are several things we observed about OMC Power which is setting them on the right path.

Getting the basics right

OMC Power realises that what makes their model bankable—what makes their business model a credible investment decision—is to ensure that they deliver on their core business promise: providing steady power supply to their mobile industry customers. Before venturing out to serve communities, the company stabilised its services to the mobile tower.

Delivering high-quality services to the community

With over 200 million people, Uttar Pradesh is India’s most populous state. While reported electrification rates in the state are 88.3%, it is important to note that for a region to be deemed electrified it does not mean that all households have to be connected, or that power actually needs to run through the lines. Many of the villages we visited served by OMC Power have been waiting for close to 10 years to see electricity run through their grid. OMC focusses on delivering high-quality 24/7 services to their rural customers commensurate with their income levels. Smartly dressed OMC staff deliver and pick-up the customers’ energy products to their doorsteps, and sleek nameplates affixed to homes identify OMC customers in the community helping neighbours recognise the most progressive of households. OMC Power has also put special emphasis on delivering “luxury” services providing a fan as part of the OMC PowerBox (or BijiliBox as it known locally in Hindi).

Innovate and Evaluate

By making community power central to OMC Power’s strategy, they have made understanding the wants and needs of rural customers an essential component of their business strategy. In the few months since launching field operations, they have focussed on a process of continual innovation and evaluation: listening to customer feedback, testing new products and working with suppliers to adapt products to suit customer needs.

The company understands the need to develop a series of products that supports their customers’ transition up the energy ladder; starting with lighting and phone charging. Over the next few months, we expect OMC to continue to push the innovation envelope, trialling new concepts and getting more granular on customer segmentation.

We look forward to following the progress of OMC Power over the next few months. We believe their entry into the markets paves the way for other energy service companies serving the mobile industry to pilot Community Power.

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Chapter 10

Solar Power Has a Place in Mozambique: From the Central and Southern Provinces

By Charlotte Ward, GSMA



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Islands of Connectivity

From Muxuenge in the province of Sofala, the sandy road west heads 80 km to the town of Chitobe, soon leaving behind a power line and any evidence of easily accessible water supplies. It is a dedicated task to receive an SMS on your mobile phone along a route with unreliable mobile coverage and no electricity!

Arriving just before dusk in Chitobe, there is hope that the isolated diesel-powered mini-grid will light the streets, but without funding for fuel we instead see a few indoor lights and the occasional noise of a TV or radio and proof of the free enterprise required to attain and provide services using solar power and car batteries. During the day the market streets, alleys and roofs are scattered with solar panels brought in from Harare and Johannesburg, vastly overpaid for by earnest shopkeepers and bar owners.



Sticks used to help get better mobile connectivity in underserved Sofala

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3 “Bem Vindo a Carga de Telefones”: Welcome to Charge Phones

4 All three mobile service operators have towers in in the town, but while there is no grid-power (like 97% of other rural households in Mozambique), kiosks and barbers make good business at about US\$0.30 per phone charge. This was the same price as one large torch battery and one large candle on sale. Some businesses provided a large variety of phone model charging plugs, as well as universal battery chargers (preferred by customers so they can keep the handset to avoid theft) and if they had more sockets and power, they would charge more phones.

20 Under the Grid but un-Powered

25 There was clear evidence of an unmet demand for electricity services in communities living across areas without power grid distribution, and this was the case even for those living directly under power lines (and fibre lines) because households cannot always afford connection and service without prepaid facilities.

35 With Power Comes Water

40 Medical centres were in places provided with solar-powered water pumps with the ability for storage, but not always offered as a community-wide service. This did provide opportunity for a keen enterprise to earn a living from a diesel-powered water pump where free hand-pumped taps are on the other end of the village.

47 From our travels and from the numerous organisations we speak to each day we collect a wealth of interesting information which we share on our blog. This platform allows us to provide more regular information and we hope to use it increasingly to support discussion. The following two articles are some of our favourites from the year.



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Chapter 11

Sustainable Energy & Water Through M2M Connectivity

By Michael Nique, GSMA



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Beyond voice and SMS, the decrease in maturity and cost of Machine to Machine (M2M) solutions coupled with the development of mobile micropayments pave the way for innovative thinking whereby connectivity provided by cellular networks can be leveraged, to enhance affordable energy and improved water access. After preliminary research earlier in 2012, the GSMA Community Power from Mobile team has increasingly been following this topic and is publishing a white paper in December 2012 outlining challenges and opportunities of M2M-based solutions for enhanced utility access in emerging markets.

Mobile as the Predominant Infrastructure

From urban to rural areas, mobile networks have become the predominant infrastructure in emerging markets and more people are now covered by mobile networks than have access to energy and water (see Figure 15). The population without access to energy and/or water but with GSM network coverage could be impacted by the implementation of M2M-based solutions that would support remote monitoring and maintenance of decentralised utility systems. The remote monitoring element is especially critical in the rural water sector where one in three hand pumps do not function at any given time in Africa⁶ due to deficiencies in community pump management.

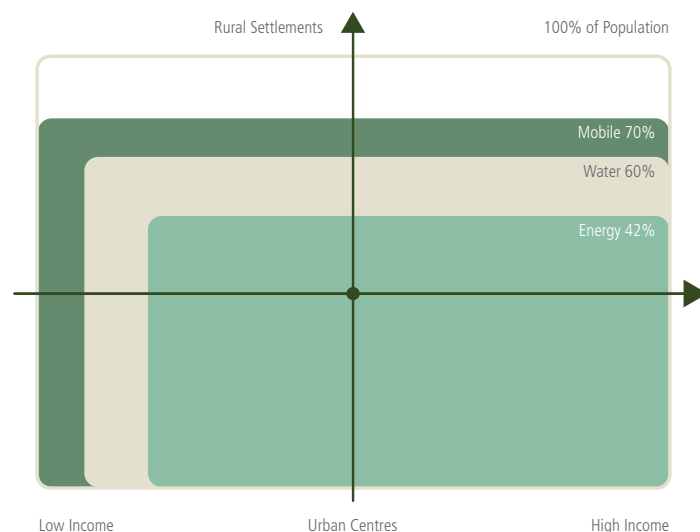


Figure 15: Mobile Coverage, Grid Access and Improved Water Access in Sub-Saharan Africa

Source: GSMA, IEA, UNICEF

The Pay As You Go Model

With more than 2.5 billion adults around the world lacking access to a formal bank account, GSM modules embedded in Solar Home Systems can extend consumer financing, reaching low income populations that can't afford the upfront capital costs of purchasing solar products. This population often has to choose less efficient, more costly and hazardous alternatives (e.g. paraffin lamps as opposed to solar lanterns)⁷. The "Pay As You Go" model, where users get prepaid credit for energy and water purchases, allows for more flexibility in payment terms from a user perspective and more control by the micro-utility as they are able to monitor a user's usage remotely.

Increased Traction of M2M Connected Solutions

The emergence of new ventures and business models using GSM connectivity is already enabling tens of thousands of people to have more affordable and sustainable access to basic life services (See Figure 15). At the recent IFC Lighting Africa conference held in November 2012 in Dakar, most of the solar lantern providers were looking to integrate connectivity to their solutions, either through GSM or RFID technology; to add Pay As You Go solutions to their portfolio.

Mobile Operators are also beginning to show an increased interest in this domain:

- Distribution partnerships – a recent deal between Safaricom and M-Kopa in Kenya⁸ to use the operator's extensive distribution network to reach remote customers
- Use of mobile money channels – M-Kopa, Mobisol and Grundfos Lifelink leverage the M-PESA mobile money service for user payments

There are important opportunities for mobile operators to partner with innovative companies using M2M for enhanced energy and water access. These include:

- To create new revenue streams,
- Reduce customer churn in an increasingly competitive market and
- Also to build data intelligence on consumer behaviours.

6 Source: RWSN 2010 Myths of the Rural Water Supply Sector
7 Source: M-Kopa
8 <http://www.safaricom.co.ke/about-us/media-centre/press-releases?layout=edit&id=429>

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Table 5: List of Energy/Water providers leveraging M2M technology

	Location	Model	Payment
M-KOPA	Kenya	Provides solar home systems from D-Light Design to rural Kenyans on a pay-as-you-go basis. M-KOPA solar is currently available in 75 shops in Eldoret and Kitale with plans underway to scale nationwide through Safaricom's distribution network.	An initial deposit of KES2,500 applies, then customer pays daily instalments of KES40 via M-PESA for a period of one year
Mobisol	Tanzania, Kenya	Distributes 4 types of solar home systems integrated with a pay-as-you-go system utilising SMS, GPRS and a mobile app which connects via 2G or 3G.	Users pay a deposit (depending on the solar home system model) and then pay monthly instalments, from KES1,100-4,400 through M-PESA
Shared Solar	Mali, Uganda	Deploys micro-grids connecting up to 20 families. The core technology is smart metering, enabling real time consumption monitoring and prepaid use. The gateway is capable of communicating via SMS as well as 2G and can also be tied-in with 3rd party mobile banking services.	Payments are made through scratch-cards at the moment (and looking to integrate M-PESA). Customers can buy a scratch-card from a local vendor for as low as US\$0.50.
Grundfos Lifelink	Kenya, Uganda	Provides renewable powered water systems to low income markets, combining existing water service technologies, embedded GPRS solution and mobile banking for payment. Grundfos Lifelink has deployed close to 40 sites to date.	Users have to pay 250 KES for a RFID key fob that can be recharged using M-PESA. Users swipe the card against the water unit and pay as low as KES3 (~0.02USD) per 20 litres of water.
Sarvajal	India	Builds water systems and recruits local entrepreneurs to sell water to their communities using a combination of embedded solutions and mobile payments. Sarvajal has 153 franchisees to date.	Users are paying 30 Paise (~0.003USD) per litre and use an RFID card at the "water ATM" to get purified water

Source: GSMA, based on industry feedback

New Design with Lighter Functionality Would Reduce Cost of GSM Modules & Unlock High Volume Growth

The Pay As You Go & remote monitoring solutions targeting low income population have to remain low cost to be affordable and adding a GSM module can be a hurdle to achieve scale. In 2012, the cost of a GSM module was in the range of US\$13-17 per unit based on current production volumes⁹. For entrepreneurs developing solutions requiring low data bandwidth and no voice usage, current solutions, even low cost, may not be best tailored. There is then a legitimate request to the main M2M module providers¹⁰ today on the development of simpler designs, with lighter functionality that will be able to achieve lower costs per module. Beyond energy and water services, there could also be a high demand for solutions in the sanitation, irrigation and agricultural sectors.

Although there is a greater focus on developed markets at the moment, alternative wireless wide area network solutions provided by companies such as Neul¹¹ and SigFox¹² could emerge to offer lower cost M2M modules. In terms of Total Cost of Ownership, such solutions would require higher costs of operation and maintenance (and the need to deploy new infrastructure), but the advent of lower cost chipsets is appealing to a large community of entrepreneurs willing to leverage WAN technology to increase the resilience of decentralized systems. In the case of Neul, their current work through the Weightless Standard¹³ is set to define a common set of specifications without royalties, which it claims will support the key requirements for M2M communications, including a chipset cost of under US\$2, a range of up to 10 kilometres and a battery life of 10 years.

More information on this topic is available in our white paper and we will continue to update our blog with our developments.

⁹ Source: GSMA, 2012

¹⁰ There has been an important consolidation in the cellular M2M module market over the past years. Sierra Wireless, Telit Wireless and Cinterion are the main providers. Other suppliers include Huawei, Novatel Wireless, Quectel, Sagemcom, u-blox, and ZTE.

¹¹ Neul <http://www.neul.com/> is based in Cambridge and uses license free TV white space spectrum to create Wireless Wide Area Network.

¹² Sigfox <http://www.sigfox.com/en/> is based in Paris and has developed a UNB wireless communication technology for cellular data transfer network optimised for low bandwidth M2M/ Internet of Things applications

¹³ The Weightless Standard recently gained more traction with the creation of a Special Interest Group gathering Neul, ARM, CSR and Cable & Wireless, in order to define royalty free specifications <http://www.weightless.org/news/pr/release/3/en>

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Glossary

2G/3G – Second-generation and third-generation mobile telephone technology	
AC/Alternating Current – An electrical current or voltage with a changeable direction (polarity) with respect to a fixed reference	
Ah/Ampere-hour – Unit of electric charge, the electric charge transferred by a steady current of one ampere for one hour	
ARPU – Average Revenue per User	
BoP – Base of Pyramid	
BTS/Base Transceiver Station – The name for the antenna and radio equipment necessary to provide mobile service in an area	
CAPEX – Capital Expenditure	
CO₂e/Carbon dioxide equivalency – A quantity that describes, for a given mixture and amount of greenhouse gas, the amount of CO ₂ that would have the same global warming potential when measured over a specified timescale.	
COAI – Cellular Operators Association of India	
CPM – Community Power from Mobile, GPM project	
DC/Direct Current – An electrical current or voltage with a constant direction (polarity) with respect to a fixed reference	
GHG – Green House Gases	
IFC – International Finance Corporation – a member of the World Bank Group	
IRR – Internal Rate of Return	
kg/kilogram – A kilogram is a unit of mass	
km/kilometre – A kilometre is a measure of distance	
KPI – Key Performance Indicator	

kVA/Kilovolt-Ampere – The unit of apparent power. KVA is used for measuring the power consumption of non-resistive equipments such as generators	
kW/kilowatt – A kilowatt is a unit of power (see watt)	
GDP – Gross Domestic Product	
GPM – Green Power for Mobile Programme	
GPRS – General Packet Radio Service	
GSM – Global System for Mobile communications	
GSMA – GSM Association	
M2M – Machine to Machine	
MEE – Mobile Energy Efficiency, GSMA Initiative	
MHz/megahertz – The hertz is a unit of frequency. It is defined as the number of complete cycles per second.	
MSC/Mobile Switching Centre – Interface between the base station system, ie the BTS and the switching subsystem of the mobile phone network	
Operator – Mobile Network Operator	
NGO – Non Governmental Organisation	
NPV – Net Present Value	
OPEX – Operating Expenditure	
PV/Photovoltaic – In this instance refers to PV cells which convert visible light into direct current	
ROI – Return on Investment	
V/volt – The value of the voltage equal to one ampere at one watt of power	
W/watt – A unit of electrical power equal to one ampere under a pressure of one volt	

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HOMER Software – Training Guide for Renewable Energy Base Station Design

<http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/06/HOMER-Software-Training-Guide-June-2011.pdf>



Green Power for Mobile Vendor Directory

<http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/04/vendorpdfupdateinteractive110112.pdf>



Community Power from Mobile White Paper (December 2011)

<http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/04/cpwhitepaper161211interactive2.pdf>



Green Power for India Interactive Replication Guide

http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/06/Indian_ReplicationGuide_300512_Final.pdf



Green Power Vendor Landscape in India

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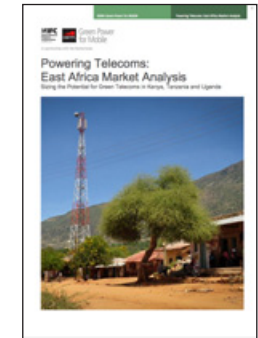
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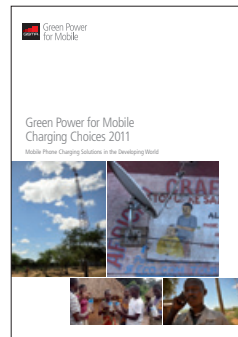
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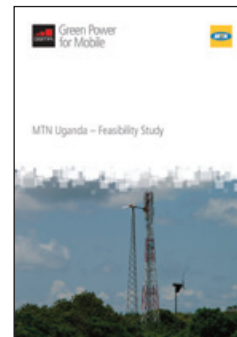
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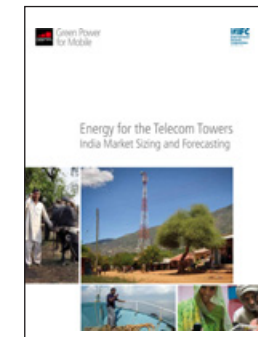
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Green Power for Mobile: Top Ten Findings

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Community Power – Using Mobile to Extend the Grid

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GE Energy Storage

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