Community Power from Mobile

IFC International Finance Corporation World Bank Group

Service over Technology: Defining the Role for Mobile in Energy Access

January 2013

Contents

Foreword

by Richenda Van Leeuwen, Executive Director for Energy Access, United Nations Foundation

Sustainable energy service provision in developing countries both benefits and can benefit from an increasing tie-in with mobile communications. Its role as a critical enabler for development in areas from improved health to increased income and gender equity is now well recognized globally. A broad global coalition of public and private sector stakeholders has been established to work in this sector towards achieving universal energy access, improving global energy efficiency and promoting the utilization of renewable energy solutions, through the UN Secretary-General's Sustainable Energy for All Initiative.

As the GSMA have shown in their reports, mobile penetration and the services it enables such as the use of mobile money, support of "mobile health" applications as well as access to new markets are of significant benefit to communities in developing countries. Furthermore, the ability to charge mobile phones as well as have access to improved lighting is highly sought after by customers, constrained predominantly by the ability to pay up front capital costs for the solution set, and the availability of dependable solutions in the local market.

At the UN Foundation we host an almost 1,000 member strong Energy Access Practitioner Network – a diverse network of energy services companies bringing off-grid solutions to developing country customers and communities in support of the Sustainable Energy for All's focus on achieving universal energy access by 2030. Among our membership, we are seeing the emergence of new business models drawing on the many synergies between the energy and telecommunications sectors, particularly focusing on the service aspects of delivery to non-traditional customers.

One area where there is increasingly strong interest among both practitioners and investors is in the use of "micro-grids" as one in an array of configurations at the community level for providing electricity on a sustained basis. This is being tested through the utilization of mobile phone base stations as "anchor tenants" in micro-utility applications, at the same time extending energy services to nearby communities. Equally, a number of energy companies are drawing on the strong capacity of mobile money solutions to enable "pay as you go" micro-transactions for the rental or purchase of small solar lighting and charging solutions in their homes and communities, rather than having to incur the cost and inconvenience of sending the phone for charging to a nearby town with power from the grid or a car battery. The utilization of SMS enabled service requests as a mechanism to improving service for customers should also be encouraged as a means to provide better after sales service, which remains a weak point in many parts of the sector.

The application of renewable energy services for communities is not inherently new. Well established companies like SELCO-India and Grameen Shakti have led the way on off-grid solar PV home system and small scale solar thermal applications, and micro-hydro project finance is generally well understood. But the increasing application of renewable energy solutions, in particular the decrease in cost of solar PV modules over the last several years, the increasing availability of small scale charging and lighting solutions, and the increasing ability to support hybrid applications has created a resurgence of interest in micro-grids. This can be with a view to eventual grid connectivity, or operating on a standalone basis serving small industrial and community purposes, with emphasis on the ability to back out the use of diesel as solar PV moves towards grid parity in a number of markets. Maintenance still remains a challenge and the rigor for energy companies in contracting with base station operators should help to ensure that communities can also benefit from improved service over time.

The GSMA in this report has captured some key emerging lessons that will prove valuable as the energy access sector seeks to scale further in the coming few years towards reaching the 2030 universal access goal.

Richenda Van Leeuwen is the Executive Director for Energy Access at the United Nations Foundation. She has more than 20 years of experience in energy access, sustainable development, micro and SME operations, as well as venture capital renewable energy investment experience in developing countries.

The GSMA Community Power from Mobile Team

Areef Kassam
Programme Director

Charlotte Ward
Programme Manager

Mary Roach
Business Development Manager

Michaël Nique
Strategy Analyst

Abirami Birrell
Projects Manager

Our Green Power for Mobile Colleagues

Ferdous Mottakin
Programme Manager

Satish Kumar
Africa Project Manager

Ali Imron
Asia Project Manager

Acknowledgements

As part of our commitment to support the development of a thriving ecosystem, our annual report includes contributions from sector experts working across energy access, energy investment, the mobile industry, start-up communities and academia. Recognition and thanks are owed to the following guest writers for providing their key insights and expertise: Richenda Van Leeuwen (UN Foundation, Executive Director of Energy Access), Sairam Prasad (CTO at Bharti Infratel), Mike Lin (CEO at Fenix International), Robert Hope (Senior Research Fellow and Course Director at Oxford University), Pepukaye Bardouille (Global Energy Advisor at the IFC) and Jigar Shah (CEO of Jigar Shah Consulting and an investor into KMR Infrastructure). In addition we are grateful for the input from our colleagues at Invested Development, the African Enterprise Challenge Fund, Acumen Fund and Monitor.

Thanks is also offered to the Community Power interns – Lavan Thasarathakumar, Firas Arab and Caitlin Egan – who provided invaluable contributions during 2012 whilst the team was spread out across the globe.

Welcome Note

2012 has been marked by growth, major milestones and the emergence of strong champions. The UN International Year of Sustainable Energy for All in 2012 brought with it an increased focus and better understanding of the role that energy plays in the development agenda of every country. The question was often posed: **How can energy access leapfrog the same way the mobile industry did a decade ago?** Our point of view is that the answer is in the question: energy access can leverage the strength of the mobile industry. The presence of mobile services in off-grid areas provides an opportunity to develop solutions by addressing common failure modes of decentralised systems[1].

In October 2012, the GSMA published a ground breaking piece of research which for the first time attempted to identify not only the number of global GSM connections, but the actual number of subscribers. In doing so, the research showed that in many emerging countries access to mobile phone services still remains a challenge, and highlighted the difficulties for mobile operators across these countries to develop bankable business models in areas of low Average Revenue Per User (ARPU). With over 500 million off-grid connections (one in ten within emerging markets) and the lengths off-grid mobile subscribers go to in keeping their mobile phone charged, delivering access to basic energy services should be a core business activity.

The lessons and recommendations we made last year are still relevant, but with an additional year of experience we are able to provide further nuance. In each of the three CPM channels identified in the 2011 White Paper, we have proof of a commercial trial with a mobile industry player.

The theme for this year's report is **Service over Technology**. While technology underpins the business models of Community Power from Mobile, ultimately the quality of the service to the customer is what creates success from the business model. This holds true whether an energy service company is a third party energy provider delivering to the mobile industry or a product provider selling solar home systems to rural dwellers: good technology is not enough. While the mobile channel can provide a path to scale, improve sustainability and affordability, ultimately it is a tool which needs to be used properly and effectively to deliver real results.

Last year we expressed that the opportunity for the mobile industry extended beyond excess power from mobile towers; in 2012 this has proven to be true. Our thinking has also evolved on the role that mobile technology, including payments, but increasingly voice, SMS and machine-to-machine technology can play in supporting the sustainability of off-grid systems. What was a mere mention of an opportunity in our 2011 paper has its own section in this annual report, with two further comprehensive reports on "enhanced utilities" published in early 2013[2,3].

The lessons and recommendations from 2011 expressed in "Harnessing the Full Potential of Mobile for Off-grid Energy" have led to the development of new conclusions. Additional lessons we discuss and consider in this report include; Different business models make sense in different markets; Working with the mobile industry can be challenging; Financing still remains an issue, not only at the seed stage but also when graduating businesses across different financing blends and risk profiles; Enhanced utilities are playing a more significant role in supporting the sustainability of not only the energy sector but water access as well.

We welcome the support of the UK Government for the launch of the Mobile Enabled Community Services (MECS) programme. Drawing on the strong foundations of Community Power from Mobile, MECS helps to improve access to both energy and water services leveraging mobile infrastructure and technology. The programme includes over £2 million in grants to fund research and innovation, to help reduce one of the major roadblocks we have observed in the sector and deliver tangible trials from which the industry can build from.

We look forward to the year ahead - to working with new and established partners, to learning from the innovators, to assisting the mobile industry identify opportunities and to better understanding the challenges of delivering sustainable community services.

Regards,
Charlotte Ward

1 See Table 1 in the Appendix section of this report for the Impacts of the mobile industry on failure modes of current decentralised energy and water projects

2 www.gsma.com/mobilefordevelopment/new-gsma-report-on-sustainable-access-to-energy-water-through-m2m-connectivity

3 www.gsma.com/mobilefordevelopment/a-look-at-m-kopa-an-interview-with-nick-hughes

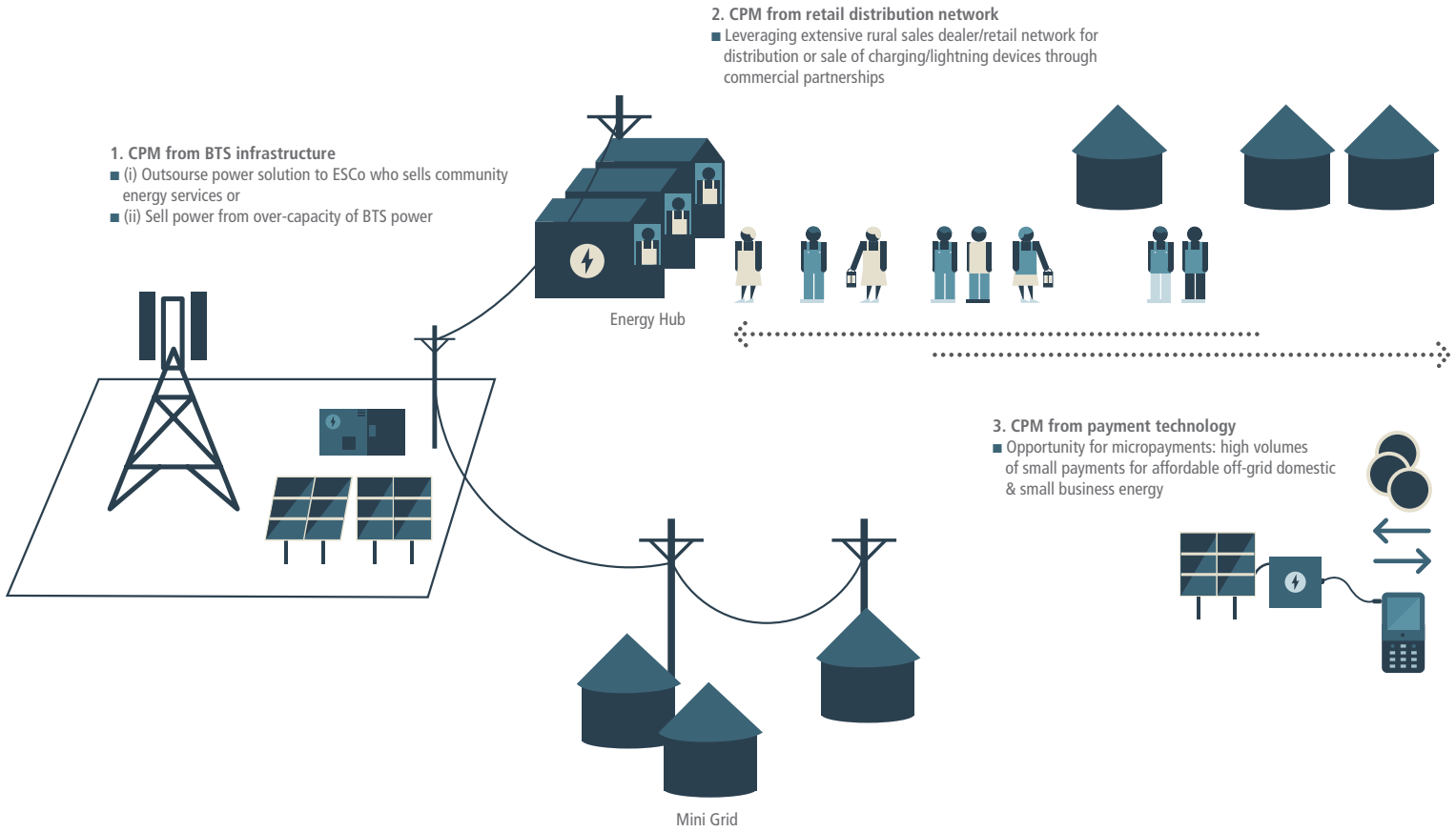
Introduction

Defining Community Power from Mobile

Over 1.3 billion people lack access to electricity. In many emerging markets mobile network operators have become adept at generating their own off-grid power as mobile penetration has outpaced the growth of the electricity grid. Community Power from Mobile (CPM) works to leverage the scale of mobile technology and infrastructure to improve the case for off-grid telecoms and provide millions of underserved people access to vital energy services.

Since the launch of the programme in November 2010 the evolution of the original concept – that excess power from mobile towers is used to provide energy services to surrounding communities – has given way to the definition of three channels for the delivery of services that leverage strengths of the mobile operator. These three channels are depicted in the Figure 1 below:

Figure 1: Mobile can provide energy access through three channels



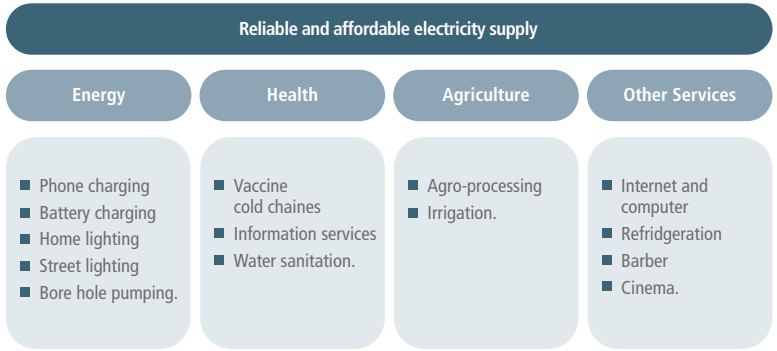
The wide adoption of mobile services by underserved populations provides an opportunity to develop energy solutions at a large scale, leveraging human and physical infrastructure and innovative payment technologies.

What do CPM trial and commercial deployments look like?

Trials and commercial deployments engage mobile operators in a variety of ways:

- Using their network of airtime vendors and partners to supply energy solutions to their customers
- Committing to be a stable 'anchor' client to a third party energy service company powering both the base station and community
- Providing excess power from their towers to the community for small needs like charging up mobile handsets, large household batteries and rechargeable lanterns

The potential for rural service delivery has much greater magnitude with dedicated and affordable power supply:



How does GSMA work to help grow the CPM sector?

The team aims to help the development of Community Power from Mobile initiatives worldwide with an understanding of their geographic context. We seek to:

1. Raise awareness through knowledge sharing and convening, publication of case studies and business case development
2. Partner with mobile network operators and tower companies to conduct feasibility studies and establish trials
3. Develop relationships with private investors and provide technical assistance for due diligence in to the rural ESCO sector by interested investors with the aim to support longer term rural ESCO success.

Launching Mobile Enabled Community Services

Innovations in applying mobile technology in models for access to services are not only supporting access to basic phone charging and lighting services, but also irrigation, water point monitoring and access to water. Future potential includes support for improved levels of sanitation.

The Maintenance Challenge of Decentralised Water Infrastructure

The Post-Construction phase of water services represents one of the biggest challenges as communities don't have the tools or training to ensure proper maintenance and the remoteness of sites impacts on efficient and fast repairs. With the continued expansion of mobile network coverage in emerging markets and the innovation in technology, occurring in the domain of existing water meters and within mobile applications, there is the potential to address several challenges hindering the "water for all" concept.[4]

The new Mobile Enabled Community Services programme will focus on market facilitation to deliver the evidence, champions and trails required to drive solutions to the next phase of maturity. It will also provide challenge/seed funding, run on competitive terms, to support innovation in mobile technology and business models that leverage mobile infrastructure for community services. The grants from the fund seek to address the following questions:

- What types of mobile technologies can support community services?
- For a solution to be adopted at scale what building blocks would be needed?
- What is the social and commercial impact of delivering community services to rural mobile subscribers?

The lessons from these grants will be captured and shared with the wider industry via the production of publications and events.

4 UNICEF data shows 40-80% of African hand pump installations not functioning due to maintenance challenges
5 World Bank 2012
6 World Bank 2012

Mobile Enabled Community Services

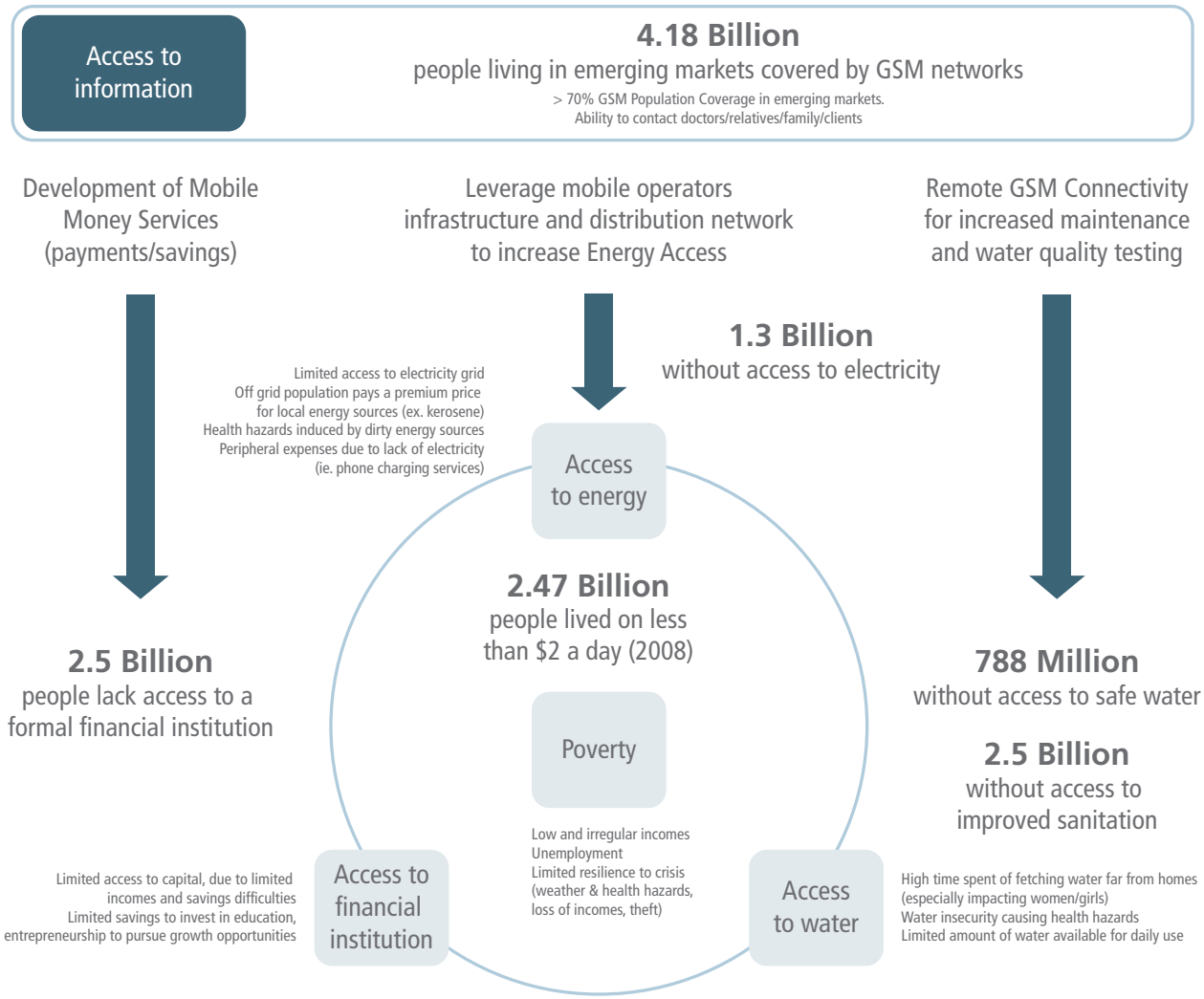
Defining the Addressable Market: the size of the opportunity

Delivering basic utility services to the 1.3 Billion people without access to energy and the 783 Million without access to an improved water source is made more challenging by their poverty levels and access to other services:

- In 2008, 43% of the population in developing countries was living on less than US$2 per day). In sub-Saharan Africa, this proportion reached 47%.[5]
- In 2010, only 23% of adults living in the developing world living on less than US$2/day reported having an account at a formal financial institution[6].
- The situation for communities living in rural areas is made worse as these markets are very poorly served, dominated by the informal economy and, as such, relatively inefficient and uncompetitive.
- The poor of under-served markets often pay a "poverty penalty" spending more than wealthier communities for the same product or service.

With more than 70% of the population of emerging markets having access to a GSM Network the mobile industry can play a significant role in accelerating deployment of basic services. By leveraging the access to information through GSM networks, there is a possibility to improve access to energy, water and financial institutions for millions or billions of people (See Figure 2 overleaf).

Figure 2: How the access to mobile networks could impact energy, water and financial access and sanitation



Source GSMA, UN, World Bank

Based on the population coverage of GSM networks in emerging markets, the GSMA estimates that the total number of people who could benefit from the potential of mobile technologies and infrastructure for better access to energy and water to be 411 million people for energy and 164 million for water.

Figure 3: Addressable Energy Market: 411 million people worldwide

Source: GSMA

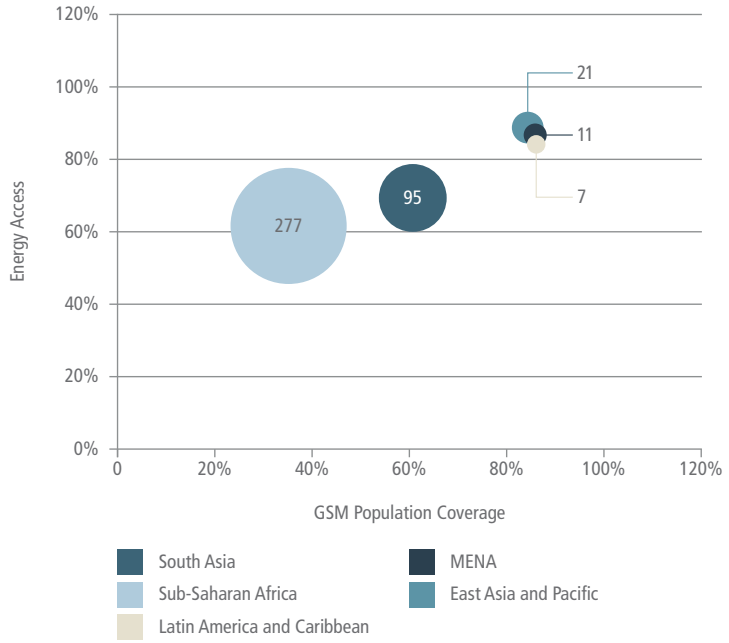
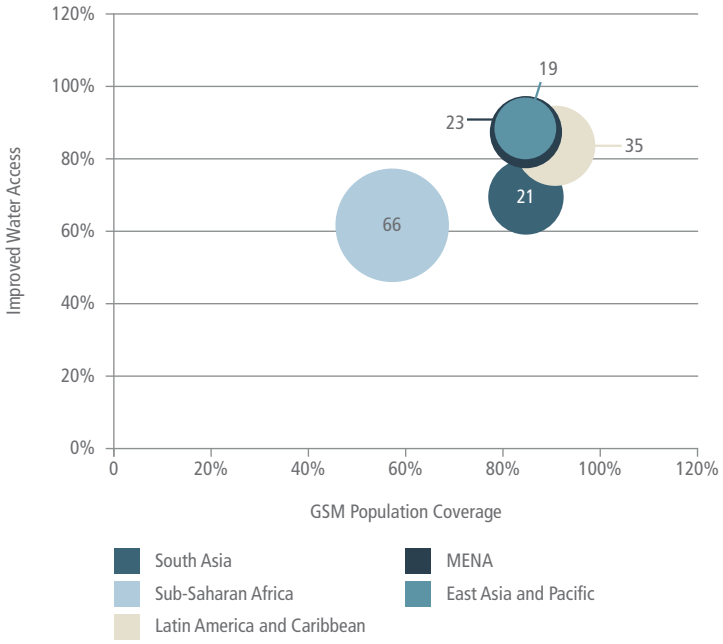


Figure 4: Addressable Water Market: 164 million people worldwide

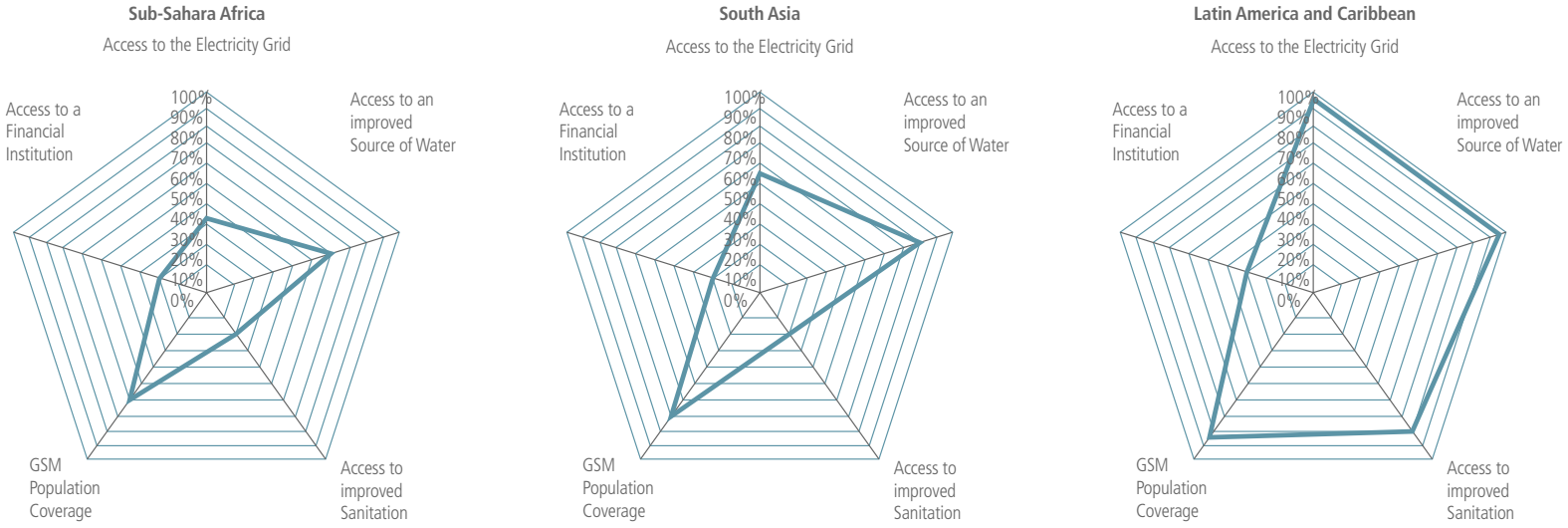
Source: GSMA



Considering the expected rise in both mobile coverage and population with mobile connectivity, the opportunity and addressable population are expected to grow, unless rates of household electrification and clean water access increase dramatically by policy-driven measures and other innovative technologies. As can be seen the size of the opportunity for mobile enabled community service delivery is not the same across varying geographies, depending on the current access to infrastructure per region.

Figure 5 helps to illustrate the size of the MECS opportunity for its 3 most prominent regions, taking into consideration the different drivers that contribute to sustainable livelihoods (also included in Appendix Regional Profiles).

Figure 5: Access to Infrastructure in Sub-Sahara Africa, South Asia and Latin America

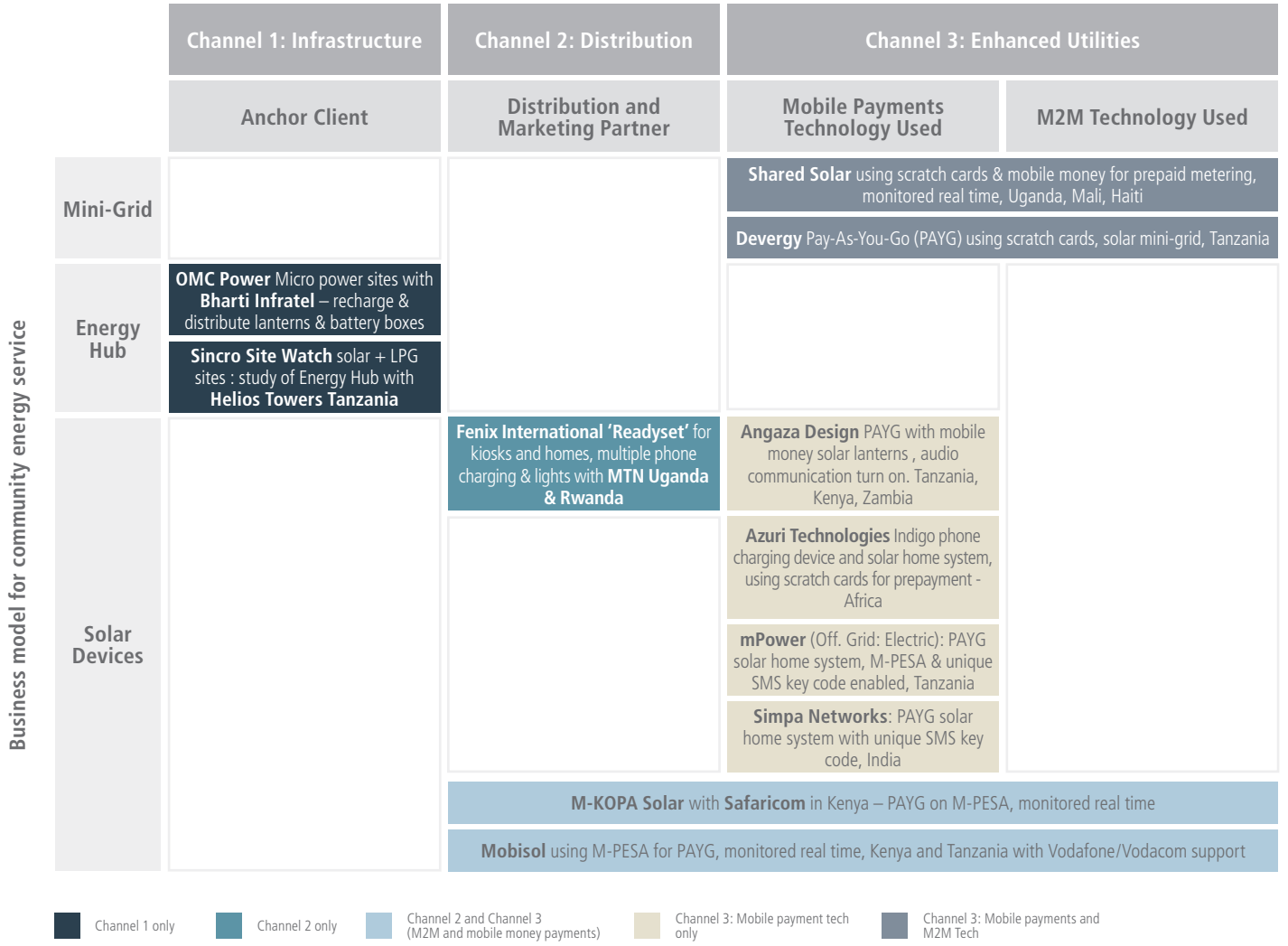


2012: Marking a Year of Growth, Milestones and Trail-blazers

	HOW THE GSMA HAS PARTICIPATED			WHAT THE INDUSTRY IS DOING		
JAN				Secretary General Ban Ki-Moon launches International Year of Sustainability for All	December 2011: Vodacom Site Launch in Emfihlweni, South Africa	
FEB		Mobile World Congress Seminar attended by 150 and 4 round table sessions	Vendor Catalogue Published – included 24 vendors	Telecom Regulatory Authority of India Green Regulation announced	World Bank Energy Day – Electricity and Telecom Services: Realising Synergies	
MAR						
APR	CPM contributes to the mWomen blog after an insightful field trip to India	Hosted a half day CPM Specific India Working Group – 15 participants	Qatar Working Group, CPM Advisory Panel – 8 participants			
MAY	TNM Malawi Feasibility Study commenced	Feasibility Study with Telefonica SA and Movistar Nicaragua commenced	Rockefeller Foundation & AREA Conference – Rural Electrification with Minigrid Solutions Panel	Twenty world leading off-grid clean energy entrepreneurs send letter to World Bank President asking for support		
JUN			CPM contributes to the GPM Biannual report	Rio+20 – 1 Billion Reasons to Deliver clean Energy Access to the Poor	Barefoot Power wins an International Ashden Award	
JUL			Safaricom Kenya Feasibility Study commenced			
AUG				OMC Power and Bharti Infratel Partnership announced	Launch of Azuri Technologies	
SEP		World Energy Forum - Joined the Energy Access Advisory Board	Participated at GPM India Working Group – 20 CPM specific participants	Simpa Networks and Angaza Design are winners of Tech Awards	African Enterprise Challenge Fund Winners: Off-grid: Electric, Azuri Technologies and Fenix International	World Bank funds Sincronicity's Feasibility Study in Tanzania
OCT		Started engagement with Vodacom	Participated at SOCAP12 – Bringing affordable energy to the village through technology	Fenix International and MTN Rwanda commercial partnership announced	M-KOPA and Safaricom commercial partnership announced	Article in Forbes: Clean start up finds poor villagers more profitable than mobile telecoms
NOV	Participated at the International Off-grid Renewable Energy Conference	Hosted the first CPM Working Group in Ghana – 45 participants	Participated at the Lighting Africa Conference in Senegal	OMC Power and Azuri Technologies shortlisted for Ashden Awards		
DEC				Article in Forbes: How to Light Africa within a decade	Five reasons why the off-grid solar revolution will be driven by cell phones	Devergy releases a documentary on their first pilot site in Tanzania

Organisations that Leverage Mobile Technology and Infrastructure to Deliver Improved Energy Services

Figure 6. Role of Mobile technology and infrastructure in live trials and partnerships



Lesson 1

Challenges working with Mobile Operators

Author: Mary Roach, Business Development Manager

In 2012, almost 3 years since the first Community Power from Mobile Paper, the opportunity the mobile industry presents to support energy access is increasingly recognised.

"The opportunities for off-grid solar are just kicking off, and there will continue to be synergies between the proliferation of cell phones and the mobile, decentralized type of clean power that off-grid solar provides."

– Ryan Levison, Sun Funder, 5 reasons why the off grid solar revolution will be driven by cell phones, **GigaOM**

Yet while the opportunity is well recognised, partnerships between mobile industry players and ESCOs to deliver energy access remain few and far between. The mobile industry is less informed and sceptical of working in an industry that they do not understand and where the predominant view remains that energy access (even phone charging) is not core to their operations. Furthermore, many of the ESCOs are start-ups themselves and leveraging mobile to deliver energy access is still a nascent and innovative approach.

Three major challenges have been identified to improving the speed of adoption of the MECS business models across emerging markets:

- The time required to build relationships with the mobile industry
- The need to have tried and tested business models
- Proving the ability to scale from Day 1

Time required for building relationships:

The amount of time required to build commercial relationships with mobile industry players was highlighted by all ESCOs we spoke to as one of the barriers to the scaling of solutions whether they are selling a phone charging solution or providing energy services to a mobile operators' towers.

Third party ESCOs can more easily identify the department and stakeholders to engage with than ESCO product companies, who when introducing a new concept to an operator must first identify the key decision maker. The product or service may be of interest to several people sitting across different departments but the ESCO needs to navigate the organisational maze to determine which departments' strategy is best served by their offering.

On average, organisations we spoke with said it could take between 18 and 24 months to go from initial discussion with a mobile operator to a first commercial contract and the process often involves a lengthy pilot phase. As a result, ESCOs who seek to work the mobile industry need to balance the opportunity to scale with the need to adopt longer term horizons when considering business development.

Tried and Tested business models:

Very few mobile operators or tower companies would view energy delivery as a core competence, although it is a pre-requisite for many to operate in areas of poor or no grid-availability. While operators are interested in energy solutions that support their off-grid customers' access to phone charging and the provision of energy services to their towers, they are hesitant to trial new concepts.

This is especially true of 3rd party ESCOs since problems with network power and therefore uptime have an immediate impact on ARPU, particularly in markets where customers own more than one SIM and can switch instantaneously to a rival network provider. While the strength of mobile operator's off-grid presence and brand can be a great tool to support energy access, they are highly guarded and protected by the operator.

In summary, **mobile industry players are seeking partners with tried and tested business models or at least organisations that can take on the risk.**

The definition of a viable business model depends significantly on which of the three channels are used.

- For service delivery from mobile infrastructure, the operator must first be open to considering energy outsourcing by a third party or the deployment of additional human and capital resources if the mobile tower company or operator decides to deliver the service themselves. From the ESCO's perspective business models need to ensure 24/7 power delivery to their anchor customers (mobile industry) and need to protect themselves from the strict Service Level Agreement penalties that come with these contracts

For partnerships between energy product providers using distribution channels, mobile operators need to understand the challenges that a lack of adequately charged phones and lights pose to their business. Across our field visits in East and Southern Africa, India and Latin America, phone charging costs range from US$0.10 to US$0.40 per phone charge and on average an off-grid subscriber spends ~50% of national level ARPU on phone charging. While more research is underway to better understand the actual proportion of spend by off-grid subscribers on phone charging vs. airtime, the 50% statistic needs to be widely understood by the mobile industry. Access to energy has also shown to help increase opening hours of airtime and mobile money agents which in turn increases their volume of transactions.

- Business models using mobile money platforms to support progressive payment for energy can help to drive transaction volumes for mobile operators from poorer and less strategic customer segments. In increasingly competitive markets, where the only untapped growth opportunity remains the rural unconnected, brand extension and growing the number of mobile enabled services can reduce customer churn and increase utilisation of the mobile operator's services.

Proving the ability to Scale from Day 1

For the most part, Mobile Operators want to work with organisations that can scale quickly. This means that even before they enter into discussion with ESCOs, they want to be assured that the ESCO has the management capacity and access to the capital required to deliver the solution at a national level. As was discussed in last year's White Paper, ESCOs are essentially stuck in the middle of operators and funders:

- Potential investors require the signed commitment of mobile network operators before they consider investment

- Potential MNO partners require proof of concept before they are willing to consider partnering with ESCOs.

"This leads to a lose-lose-lose scenario with passionate ESCOs without funding or pilot sites, MNOs frustrated by socially leaning enterprises and investors, and social investors without deal flow." (reference GSMA)

Q&A with Sairam Prasad, CTO of Bharti Infratel

What is Bharti Infratel's motivation to outsource energy?

We operate our network in some of the toughest terrains in the country where telecom penetration has far exceeded electrification reach, specifically in remote rural areas. In the absence of reliable grid power , the Tower Infrastructure sector continues to depend on diesel generators and battery back-up to provide 24X7 Network Uptime and uninterrupted Passive Telecom Network Infrastructure to Mobile Operators. To that extent, power generation and distribution is not our core competency. However, as an industry leader, Bharti Infratel has always led landmark initiatives, which have been instrumental in setting benchmarks for the industry. With the ever-growing demand requirement of power supply, and the need to reduce Green House Gas (GHG) emissions, there was a strong need to adopt clean technologies in power generation. Keeping both of these objectives in mind, we started encouraging renewable energy service companies who would offer energy services in distributed generation models using renewable sources of energy.

When did Bharti Infratel start investigating the opportunity to outsource power generation to 3rd party producers and how has your strategy evolved over time?

We started engaging with RESCOS in 2009 as part of our strategy to reduce our carbon foot print and improve our energy security & sustainability. In the initial phase, we tried and tested various renewable energy technologies like Solar, Fuel Cells and Wind Energy to develop technically feasible and economically viable models. After successful technology trials, we adopted solar power in a big way using energy service vendors and an OPEX model over the last 3 years. Further exploration in this area has also shown that the use of Biomass which can not only power our tower sites but can provide power to nearby communities. We have developed a workable model along with our partners and done trials in our sites in 2012 using biomass and solar with a RESCO model.

Can you describe the steps involved in selecting a new ESCO? And how long the overall process takes?

When we first started there was no ready-made vendor ecosystem and we had to identify, engage in design and development of these models with interested partners. The end-to-end process including model design, development, trials and testing would take around a year. But once trials are successful, we can scale faster. Now that we have done trials, the partner ecosystem is developing well and hopefully we can do faster deployments with vendors who already have prior experience and business knowledge.

What are the major challenges in selecting ESCOs? What criteria do you use?

Some ESCO's have good technology solutions but lack an economically viable preposition. However, we require partners who have both and are willing to put their energy and focus into this game. This requires the highest levels of on-the-ground execution excellence to provide reliable 24X7 power supply to make it a win-win situation for both.

Can you briefly describe the type of contractual relationships that you use with your 3rd party energy providers?

There are basically two models

1 OPEX model: An OPEX fee is paid every month for providing end-to-end energy services at tower sites

2 RESCO model: An Energy Meter is installed at the tower sites and payment is based on units consumed and unit rate agreed

Sairam Prasad is the Chief Technical Officer & Head of O&M at Bharti Infratel. As part of his role, Mr. Prasad is also responsible for the execution of Bharti Infratel's Green Energy and Energy Management activities. Bharti Infratel Limited is amongst India's leading telecom tower infrastructure service providers. The company has over 34,000 towers, of which nearly 9000 are in off-grid / poor grid locations, across 18 states of India. Bharti Infratel also holds a 42 per cent stake in Indus Towers Limited - a Joint Venture between Bharti Infratel, Vodafone & Idea Cellular.

Q&A with Mike Lin, CEO of FENIX International

Fenix International is a Silicon Valley renewable energy company. First incorporated in 2009, Fenix designs and manufactures new power generation and energy storage solutions for off-grid mobile subscribers. The Fenix ReadySet is designed to empower rural entrepreneurs in emerging markets to become micro-utility providers and deliver sustainable energy to their communities by powering mobile phones and rechargeable lanterns and torches. To date, Fenix has sold nearly 3,000 ReadySets and estimates ReadySet entrepreneurs are powering over 5 million phones each year, earning more than a $1M in income for their micro-utility businesses.

When did you decide that the telecom industry could be a good distribution partner?

Mobile Network Operators (MNOs) were our main target distribution partner from the company's founding. I had worked on power systems for the One Laptop Per Child project for two years and realized that models of give-aways and free handouts would not be the answer to sustainable or scalable distribution. Rather, we drew inspiration from the mobile phone industry, a rather incredible example of a for-profit, scalable and positively disruptive model

The GSMA paper "Charging Choices", first published in 2009, helped solidify the opportunity to partner with Mobile Operators. The need and opportunity were clear.

Can you tell us about your current partnerships with operators and what each party provides?

We first launched the ReadySet with MTN in Uganda and then recently expanded into Rwanda with MTN as well

Fenix provides the ReadySet hardware as well as sales, marketing and aftersales training and support.

MTN provides logistics, warehousing and their distribution channel via their Retail Dealer network and Service Centres. MTN also co-brands the ReadySet with their logo and brand color as well as joint marketing such as above-the-line radio, tv and print as well as below-the-line road shows, market activations and collateral.

How long does it generally take from the time you start a conversation with an operator to the time you have a signed contract for a commercial roll-out? What steps are generally involved?

In the 2 OpCo contracts we have signed with MTN, it has taken Fenix 12-24 months from first contact to deal signing, and then an additional 6-12 months for commercial roll-out, but this is accelerating. Energy is a new field for the MNOs and as a result, the process often requires extensive lab testing, multiple rounds of piloting, the ROI needs to be examined and a business case needs to be made before operator executive management gives the green light for commercialisation. The mobile operators have a lot of moving parts, which is definitely part of the challenge, but also largely part of the success of our model's scalability.

What are some of the strengths of partnerships with operators? What are some of the challenges?

Strengths

- The mobile operators understand their customers, know how to market and distribute products, and provide after-sales service better than any other company in most countries we work in. By plugging the ReadySet into the operator's retail network, we can reach national scale in a matter of a few months, rather than years or decades like traditional energy distribution models.

Challenges

- Many executives understand the idea that phone charging is a problem for their off-grid customers. However, some departments and individuals within the mobile operators still consider ARPU increases from energy to be too soft. As we roll out commercially, we are continuing to make the case for measuring revenue data, to increase sample size and make the business case to telecoms.

Mike Lin is the founder and CEO of Fenix International. He lectured environmental engineering and design at Stanford as well as social entrepreneurship at Yale. Mike has served on the board of advisors to several eco-startups, consulted for Apple on climate change and environmental toxins and worked on the "Inconvenient Truth" presentation as part of The Climate Project.

Lesson 2

Emergence of Enhanced Utility Access

Author: Michaël Nique, Senior Strategy Analyst

The term enhanced utility access refers to the use of mobile technologies, either through Machine to Machine (M2M) usage and/or mobile services. These are SMS/USSD and mobile payments, to enhance the access to energy and water for the population who lacks access to a formal utility connection.

Dr. Robert Hope, Oxford University: The potential of mobile technology and services for rural water service delivery

Living in rural Africa is often synonymous with being poor and water insecure. Around 200 million rural Africans depend on groundwater for their health and livelihoods. Handpumps are the most common technology to pump groundwater though one in three is generally broken. If a handpump breaks people often have no alternative but to collect water from more distant and dirty water sources. This results in high but avoidable health, time and economic costs for women and girls who are responsible for water collection. Researchers at Oxford University have designed, tested and are now deploying the world's first 'smart handpumps' which are being used in Kenya to improve water security. Inspired by mobile phones, the handle of a smart handpump has a small and low-cost transmitter securely inserted which automatically texts (SMS) information on how many times the handpump is pumped every hour of every day. Managers can immediately see when and where handpumps fail and get them fixed in days rather than weeks or months. This opens up new business opportunities to improve institutional performance to deliver reliable water services to rural areas where over 80% of people without improved water services live globally.

Oxford University's mobile water for development *(www.oxwater.co.uk)* research group explicitly links science, policy and enterprise. Global partnerships with UNICEF working across 193 countries provide a platform to scale the model based on on-going trials in Kenya. Working with mobile network operators opportunities to use mobile money platforms to promote financial security are being tested. This provides a unique and exciting prospect for a global coalition of the mobile industry to work with leading scientists specialising in the economics, institutions and engineering of rural development to deliver reliable water services to everyone. The moral imperative is matched by the business opportunity. The current handpump maintenance market is estimated at around US$300-450 Million per year with projections to US$1 billion based on population growth. Major donors required to achieve a 'sustainability clause' on public investments understand that improving accountability can generate value for money whilst guaranteeing water services to the poor.

Dr. Rob Hope is a Senior Research Fellow and Course Director of the MSc in Water Science, Policy and Management at Oxford University. His research focuses on water and human development in relation to policy, design, performance and impacts of ecosystem services initiatives and the sustainability of improved water supply services in developing countries. Rob is currently leading an interdisciplinary, cross-departmental research cluster that sets out to design, build and evaluate mobile technology innovations for water security called mobile/water for development. The cluster has recently completed a cross-country analysis of mobile water payment innovations in urban Africa and have started the first global studies that are testing 'smart handpumps' in rural Kenya and Zambia.

Today, 3 of every 4 new connections are occurring in the developing world.[7] This means 5.12 Billion mobile connections were coming from the developing world at the end of 2012,[8] compared to 1.36 Billion connections in developed markets. As mobile networks have become increasingly ubiquitous in emerging markets, more people are now covered by mobile networks than they have access to energy, water or sanitation. The GSMA estimates that, in 2012, more than 500 Million connections were off-grid. This means one in every ten mobile connections in the developing world is made off grid.

Beyond voice telephony connecting millions of users in the developing world, machine-to-machine (M2M) connectivity enhances utility solutions by increasing sustainability and resilience of decentralised utility services. Solutions are being increasingly researched and used by entrepreneurs, charities and academic researchers, and have emerged as a potential disruption in the energy and water sectors.

As stated by Dr Robert Hope, mobile technology and services also "open up new business opportunities to improve institutional performance". Mobile can be applied to enhance service delivery of the micro-utilities working in underserved and rural regions, where mobile networks are the only infrastructure in place.

If service delivery remains critical to the success of decentralised utility systems, technology can surely strengthen the current business models.

Enhanced Energy Services

Maintenance of remote systems and affordability of products and services have been amongst the main challenges faced by current Energy Service Companies (ESCOs). The addition of M2M connectivity, for remote monitoring of systems and operations, and the use of mobile payments, either through mobile money services or scratch cards (similar to airtime top-ups), can empower both entrepreneurs providing the energy service and the consumers of this service. Most of the enhanced energy solutions are for now being deployed in East Africa. Despite having the lowest mobile penetration rate in Africa (~44% compared to 69% in average for Africa), East African countries have low levels of energy access, but high levels of GSM population coverage and the highest penetration of mobile money services in the world making this region ideal to develop mobile enhanced energy services.

As of 2012, the GSMA estimates that enhanced utility solutions could further help up to 411 Million people living in emerging markets have access to clean energy solutions (see Figure 3). The addressable market is the highest in sub-Saharan Africa and South Asia, due to the combination of low energy access, rising GSM population coverage and high poverty levels. These two regions represented 90% of the total addressable market in 2012.

How Mobile Payments Can Lower the Affordability Barrier The "Poverty Penalty"

In 2008, 25% of the population in developing countries was living in extreme poverty (on less than US$1.25 per day). In sub-Saharan Africa, this proportion reached 47%.[9] The situation for communities living in rural areas is made worse as these markets are very poorly served, dominated by the informal economy and, as such, relatively inefficient and uncompetitive. This phenomenon of "poverty penalty" often applies to low income population and refers to the fact that people in these underserved markets have to spend more than wealthier ones for the same product or service. As poor households spend increasingly greater shares of their income on energy, they reach a point where they begin to cut back on their energy use to minimum levels and are being deprived of other basic goods and services needed to sustain life[10]. They are however increasingly connected to GSM networks and own a phone (or at least a SIM card, synonym of a unique phone number).

7 Wireless Intelligence 2012
8 Based on Wireless Intelligence surveys and estimates, the number of unique subscribers is around 2.33 Billion as prepaid mobile users are more likely to have several sim cards.
9 World Bank 2012
10 World Bank 2010 - Energy Poverty in Rural and Urban India: Are the Energy Poor Also Income Poor?

Impact of Mobile Money

Joint research undertaken by McKinsey, CGAP and GSMA, also showed that, in 2010, about 1 Billion people in emerging markets had a mobile phone but no access to banking services.[11] In Kenya, over the past five years, M-PESA has allowed people living without access to formal banking services and/or a permanent address to use a virtual mobile wallet to make payments, transfer funds and build up savings[12] through their mobile phone subscription. The number of M-PESA users has risen to more 15 Million to date[13] in Kenya and over 50% of the adult population now use the system.

Pre-Paid Services

Similarly to what happened in the mobile industry with the introduction of prepaid airtime, the use of prepaid energy solutions, leveraging mobile money solutions, can further unlock access to sustainable energy in the developing world. This pre-paid model is enabled by the introduction of a GSM modem in the solar unit, making it possible to lock the system remotely in case the payment has not been fulfilled. This financial monitoring component is key to increasing customer payment efficiencies.

The prepaid or Pay As You Go solutions developed by ESCOs for off-grid and often the unbanked population are helping low income customers with financing challenges by providing them with micro-loans. In the case of a home solar system, this business model means eliminating the prohibitively high upfront costs needed to acquire a solar panel, while enabling the customer to pay for the product as they use it. As revenue collection is a major challenge for off-grid project sustainability, the integration of mobile money with the energy service represents a clear disruption in the way low income people have access to affordable energy. The use of money services also allows users to send remittances to the account of their off-grid relatives helping them to pay the needed instalments of such Pay As You Go solutions.

Table 1: Pay As You Go Methods

Solution Type	Component	Method	Challenges
Real Time Solution	GSM Module	In M2M enabled units, systems are remotely monitored over the GSM networks and can be unlocked based on user's account credit. Payments seamlessly unlock the micro-utility unit over the air.	Reliable GSM coverage Cost of GSM module Mobile Money Penetration
Near Real Time Solution	Handset & SMS	Users buy scratch cards and send a code to a central server. An SMS code is sent back to the user who types the code on the keypad attached to the energy equipment (i.e. prepaid meter).	Distribution & Stock Management of Scratch cards
	Audio Channel	Open audio channel can communicate the customer's payment to their product, using specific frequency modulation. By using audio communication to leverage the customer's existing phone hardware, additional price can be minimized – to date, Angaza Design is the only company leveraging this technology for Pay As You Go solar	Quality of Audio/technology reliability
	RFID Key/Card	Used by companies such as Grundfos Lifelink for water access – credit is transferred by an agent to a RFID keyfob which can be swiped against a water dispenser to get access to 20 L of water per user	Extra Cost for RFID key/Card and reader

Source GSMA based on Industry Feedbacks

11 By 2012 this population would reach 1.7 billion – McKinsey, CGAP & GSMA 2010
12 Safaricom launched the savings service M-Shwari open to M-PESA subscriber http://www.safaricom.co.ke/personal/m-pesa/m-shwari
13 Safaricom Sustainability Report 2012

Remote Monitoring

The active technical monitoring of Solar Home Systems installed on household rooftop or larger solar arrays for micro-grid projects, allows ESCOs to have real time information about their on-going operations. At regular intervals (hourly or more frequently), an embedded microcontroller sends information to a central server about user's consumption, photovoltaic energy production, battery voltage. By allowing these systems to send operational data, it diagnoses all sorts of possible system failures before they actually occur. This data is stored in a central database and can be retrieved later.[14] The central server can communicate with customer cell phones and the local meters using Hypertext Transfer Protocol (HTTP) and SMS messaging over the GSM network. Users can then be automatically notified by text messages about financial or technical issues, or pieces of advice on their energy consumption.

Enhanced Water Services

Millions of women and children spend several hours a day collecting water from distant sources of varying quality. In addition, dysfunctional water supply systems have led to a huge loss of investment (US$1.2 billion for Africa[15]), caused by poor maintenance, limited financing and an overall failure to address sustainability challenges in the field.[16] Enhanced water solutions are still at an early stage of development at the beginning of 2013, and less mature than enhanced energy solutions. However the opportunity and impact of enhanced water solutions could be important. The GSMA estimates that out the total population without access to an improved source of water, enhanced water solutions could target 164 Million people in emerging markets covered by GSM mobile networks (see Figure 2).

Smart water pumps

A key area of development in the water sector is on the low cost water smart units that would connect hand-pumps to a centralized system, monitoring operations and the quality of the water fetched by the local population in each district of a city, a region and a country. As it is estimated that 30% to 40% of rural water schemes in Africa are non-functional,[17] upgrading of tens of thousands of water pumps will help identify dysfunctional wells and provide information to local utilities. Several organisations, such as the Welldone Organization, the Sweetlab (Sustainable Water, Energy and Environmental Technologies Laboratory at Portland State University) and Oxford University Mobile water for development Research Group, are today working towards the development of such a system. The recent US$ 5 Million grant received by Charity Water from Google to create and install sensors on 4,000 wells across Africa by 2015, is a sign that philanthropists are also willing to support technology enhanced projects having a social impact.

Added to this emerging work on smart hand-pumps, other pioneers exist in the water space:

- Grundfos Lifelink in Kenya and Sarvajal in India have built their business models for purified water delivery around the integration of M2M connectivity in their water dispenser units, allowing for remote monitoring and pay as you go payments.
- Manobi based in West Africa has developed a feature phone application used to monitor operations of rural water sites
- mWater has developed low-cost water test kits to check the quality of water sources. They have also developed mobile phone and web applications to make it easy to share this data online.

14 A Prepaid Architecture for Solar Electricity Delivery in Rural Areas, D. Soto, M. Basinger, S. Rodriguez-Sanchez, E. Adkins, R. Menon, N. Owzarek, I. Willig, V. Modi, Earth Institute at Columbia University, Advancing Energy, ICTD ACM 2012

15 Evan Thomas, Zdenek Zumr, Christina Barstow, Karl Linden, "Proving Sustainability: The International Development Monitoring Initative," ghtc, pp.164-170, 2011 IEEE Global Humanitarian Technology Conference, 2011

16 http://www.sweetlab.org/wp-content/uploads/2011/05/SWEETSenseOverview_IEEE_GHTC_8.31.11.pdf

17 World Water Development Report – UN 2009

Mobile + Water Access – Grundfos Lifelink in Kenya

As of 2012, Grundfos LIFELINK installed close to 40 purified water dispensers powered by solar energy in Kenya. The company uses a variation on M-PESA's bill-paying function, in combination with a water key card and Grundfos dispenser, to allow rural communities to access safe water from an automated water system. Water consumption and information about each installation could be viewed online. According to Grundfos, the Total Life Cycle (TLC) cost could be as low as US$ 1/cubic meter, with service up to 10-15 years.

Mobile Operator's Role

There is an increasing opportunity for mobile operators to play an important role partnering with entrepreneurs providing enhanced utility services, either through revenue sharing, distribution or marketing. Beyond the service delivery itself, partnerships allow to build deeper relationships with end-users who have been left out of the access to modern services and products.

The presence of mobile networks in rural areas, the operator's extensive distribution networks reaching remote populations and the "trust effect" induced by mobile operators brand are clear enablers to the success of enhanced utility solutions. In the case of M2M enabled solutions, more than pure data delivery, the value is shifting to building data intelligence on customer usage and payment frequency. Getting information on an unbanked customer's payment frequency could be used to provide an objective credit rating to financial institutions for loan allocation.
At this early stage of maturity, added to the marketing and distribution partnerships, the GSMA believes the following actions initiated by mobile operators would support the growth of enhanced utility solutions:

Data and Mobile Money Channels – Inexpensive data rates and access to mobile money networks would help mitigate costs and are important enablers to the scalability of nascent business using M2M.

Influence on M2M TCO – Design and provisioning, including approvals and certification processes, represent an important part of the Total Cost of Ownership (TCO) for low-traffic M2M devices.[18]

Fostering Innovation in Emerging Markets – Given their influence in the developing world, mobile operators could play an important role fostering innovation at the service level and support the development of compelling business models.

18 The total cost of ownership for embedded mobile devices – Analysis Mason & GSMA 2010

GSMA's Role in the Enhanced Utility Sector

2013 will be a test year for mobile enhanced utility solutions following the increasing hype surrounding these new solutions. In the energy space, larger scale deployments will be announced, new partnerships will be created and more ESCOs applying M2M connectivity will emerge. In the water space, more commercial models leveraging mobile technology will be tested and the development of low cost smart hand pump equipment will mark an important milestone for the rural water sector.

As part of our newest programme, **Mobile Enabled Community Services** (MECS), supported by the UK Government, the GSMA will continue to investigate the potential of enhanced utility solutions for socio-economic empowerment, in order to:

- Catalyse the development of partnerships between key players: entrepreneurs, technology suppliers & mobile operators
- Outline opportunities and addressable markets in the developing world for M2M based solutions for energy access, water access and beyond
- Support Entrepreneurship through market intelligence and innovation funding

Low end M2M Design for Emerging Market Applications

The cost of an M2M GSM module is in the range of US$13 to US$17 per unit based on current production volumes, while a 3G module costs between US$35 and US$47. For entrepreneurs developing solutions requiring energy efficient, low data bandwidth and no voice usage, a simpler design, hence having the potential to achieve a lower cost per unit, could extend the reach and affordability of enhanced utility solutions.

In 2013, the GSMA will engage with the Chipset Provider community to stimulate the issuance of new guidelines for a low end M2M GSM module. Solution providers, such as M-KOPA, are eager to work with M2M module providers to develop use cases and requirements for module specifications (See GSMA report "Sustainable Access to Energy and Water through M2M connectivity").

Lesson 3

Different Business Models Exist in Different Settings

Author: Charlotte Ward, Programme Manager

Introduction written by Pepukaye Bardouille, Global Energy Specialist, International Finance Corporation

"Energy access" is a nascent but rapidly-developing industry; the number of companies around the world formally selling modern energy services at the lower end of the economic pyramid has multiplied in the past decade. This has largely been driven by recognition that, despite their income levels, the poor are energy consumers and, thus, constitute a market; declining input and manufacturing costs; and business model innovation. Of the various energy services, lighting appears to be commanding the most attention. Device companies are offering a broad range of products, from US$3-5 hand-held dry cell battery lamps, to US$10-20 solar PV LED task lanterns, to U$75-150 solar kits that allow small devices such as mobile phones to be charged, to much larger, multiple-use rooftop/solar home systems costing anywhere from US$300-1,000. While it is hard to generalize, most of these companies focus on a few parts of the value chain, either design and manufacturing or distribution and retail, leveraging a variety of partners in areas from end-user financing to social marketing to establish a desirable offering, get products to end-users and grow their consumer base.

For devices, different business models work in different markets but, as with most products, a common thread to date has been a strong distribution network and, in some areas, good brand recognition. In certain newer technology categories, such as PV lanterns, product quality and consumer awareness of their benefits over traditional energy options, such as kerosene lanterns or candles, has been instrumental for growth in sales and, thus, overall market penetration. For larger systems, key to success in most cases where tens of thousands of poor customers are being served is some degree of subsidy, an affordable way of spreading remaining capital costs in small payment instalments, and the cost-effective management of on-going equipment maintenance. For both devices and home systems, technology particularly on the payment side, is rapidly evolving and it is too early to say whether there will be a winning model. Still in relative infancy are mini-grid businesses that provide electricity for a few hours a day to around the clock to households and small businesses; while entrepreneurs selling power at the community level using small diesel generators, micro-hydro plants and other energy sources are wide-spread, there are barely a handful of examples of this being done at scale, largely because the capital costs are high and operating requirements complex. The legal and regulatory environment required for mini-grids to work successfully are generally of significant importance, as is the existence of a minimum demand or base load, ability of companies to manage plants and collect payment, and availability of financing to cover equipment costs. While several promising approaches to decentralized power generation can be founds globally, collectively these factors appear to be slowing down market development and, if not addressed, will continue to hamper the take-off of the sub-sector.

Amongst others, the mobile sector offers potential synergies with electrification in remote areas. Indeed, in some instances, it is helping to overcome some of the aforementioned challenges to the establishment of community-level mini-grids. For example, we are seeing models emerge where base stations serve as anchor clients providing the requisite power demand to make a mini-grid viable; supplying electricity to households and small businesses in surrounding areas helps to ensure the secure operation of towers; and mobile phone credit is used as (pre-)payment for electricity units. It will be interesting to see how well these two industries fit together at the long-term and are replicable across geographies or market types.

A Global Energy Specialist with the International Finance Corporation (IFC), Pepukaye Bardouille leads activities on energy access, focusing on innovative, commercially-viable models to extend electricity and clean fuels to base of the pyramid markets, and providing global support to the Africa Clean Energy Advisory portfolio, which also includes grid-connected renewables.

The role of the mobile telecommunications industry in business models for off-grid energy access is being defined by innovative technology and service companies that are seeking and securing partnerships with the mobile industry. It is difficult to write about what works, where and why as it is too soon to make that judgement in a market that is still so young. However, it is important to explain why there can be no "winning" business model for mobile enabled community power services. This should help activate broad investment and support across the sector.

To illustrate why different mobile-enabled business models need to exist in different setting, two key questions need attention:

- Why do different energy service models work in different settings?
- Why do different mobile-enabled energy service models work in different settings?

Why do different energy service models work in different settings?

"Low return rates, political setting of tariffs and a weak customer base in rural areas makes RE [Renewable Energy] unattractive… Among local barriers, most stakeholders mention poverty and low population density – the latter having huge impact on both distribution and transmission costs. Despite low tariffs (that are financially unviable), rural customers find it difficult to afford connection and subsidies are often used to overcome this barrier. To find a level appropriate both for satisfying consumers and encouraging private sector incentives in the energy sector is difficult."

Quote refers to Tanzania: "Drivers and barriers to rural electrification in Tanzania and Mozambique – grid extension, off-grid and renewable energy sources".[19]

The geographical and political context in which an energy services company operates will impact the success and failure of multiple aspects of its business model. It will go a long way to determining how the energy service is delivered, to what extent consumer financing could secure more customers and which technologies are most appropriate in that market.

Size and location of consumer demand (layout of the community)

A high density of many households and/ or businesses with a reliable and continual demand for electricity may be best served via a mini-grid. A low density or smaller settlement may be best served via an energy hub or household solar systems, due to the higher capital and maintenance costs of a mini-grid.

Figure 7: Portrayal of a clustered community development

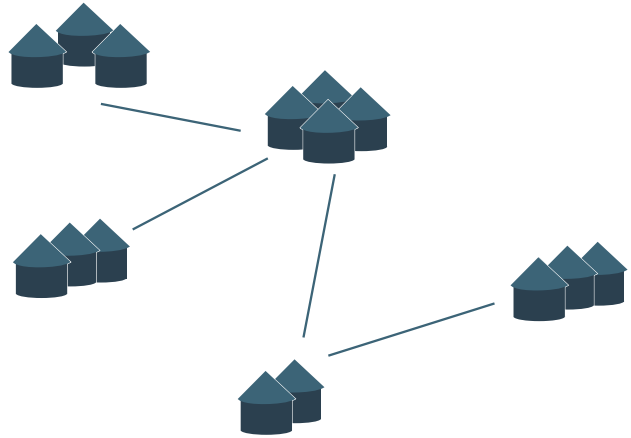
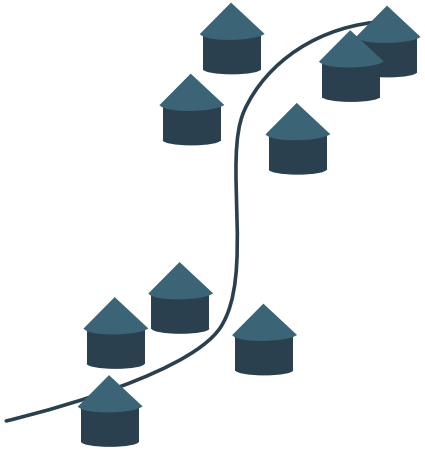


Figure 8: Portrayal of a ribbon community development



19 World Renewalbe Energy Conference 2011, Sweden (Helene Ahlborg, Linus Hammar) http://www.ep.liu.se/ecp/057/vol10/028/ecp57vol10_028.pdf

Power in to the home is a sought-after service and with sufficient customers the capital costs of the infrastructure will be returned in an attractive timeframe for investors. Scaling up a business model to capture operating and cost efficiencies may be best achieved with multiple clients or one large anchor client serviced by a single mini-utility company. The relative location and proximity of a community of households, small businesses and any larger industrial customers (such as a factory, plantation, hotel or mobile phone tower) will determine the feasibility of servicing all from one central infrastructure. The size and stability of base load demand will also determine the feedstock supply required and may impact the need for fuel diversity (such as biomass with solar power and battery as a secondary source where electricity required continuously).

Traditional/ incumbent options for energy and awareness of alternatives

Distribution and sales of energy services requires an understanding of an average customer's daily life and why they choose their current fuel (like kerosene) today. What may actually make them choose a different option tomorrow? Factors include upfront and on-going costs, the social aspects of collecting or using traditional fuels and the impacts on health? Getting a new customer requires an understanding of how to best get their attention and with an understanding of their decision-making process developing that to taking action. Their level of awareness of technologies (like solar panels, solar lanterns and key pads) will dramatically affect the sales process and the speed of new sales.

Incentives from government

Subsidies or non-discriminatory tax concessions that don't distort the market may help facilitate the growth of new technologies and community energy services. For example, grants for electrifying off-grid households in Tanzania may improve the economics of supplying the service so long as it's maintained, and tax incentives for solar panels will incentivise the proliferation of the technology.

The ability for customers to pay

> *"More than four-fifths of the world's poor live in rural areas and depend on agriculture for livelihoods. Because of seasonal income shocks, the poor who are generally poor are likely to be even poorer during a particular agricultural season, while those who are not poor year-round may also be so during that season."*
>
> Quote taken from the Abstract to Seasonal Hunger and Public Policies[20] 2012, Khandker, Shahidur R.; Mahmud, Wahiduddin)

The daily income of a household and its seasonal variability will determine the pricing of the energy service, the need for consumer financing to make upfront costs affordable and provide for flexibility in the payment patterns.

20 http://elibrary.worldbank.org/content/book/9780821395530

Why do different mobile-enabled (CPM) energy service models work in different settings?

The market landscape and maturity of mobile operators and tower companies will impact the success of business models leveraging mobile infrastructure and technology. These include the extent of rural off-grid penetration of mobile services and the maturity of the tower outsourcing model, the 3rd party ESCO model and mobile money services.

Where mobile services are poorly servicing rural and off-grid areas, improving energy access options for both the towers and the communities may also be a key driver to penetration. The opportunities are specific for every market: mobile service penetration is variable and can be higher or lower levels than market electrification rates.

Table 2: Penetration of mobile services (connections and subscribers) and electrification rates from sampled emerging markets

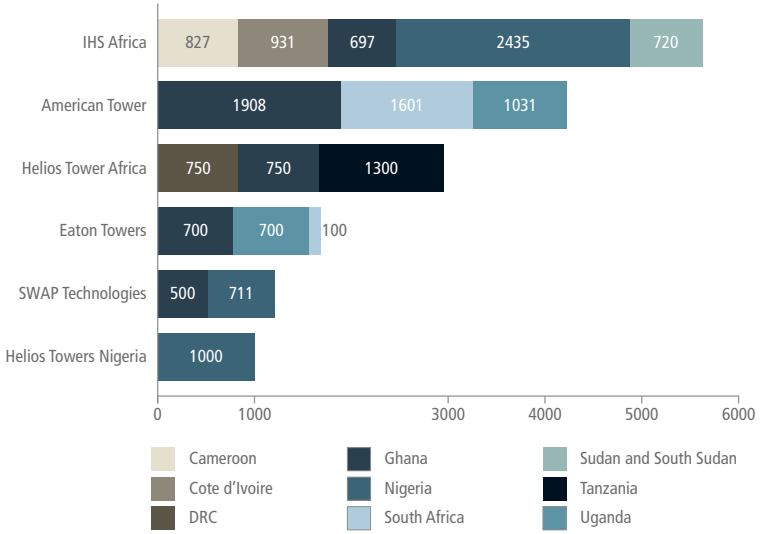
Country	Electrification Rate (%) [1]	Penetration of Connections (%) [2]	% Penetration of Subscribers (Market) [2]
India	75.0%	74%	25%
Tanzania	13.9%	52%	29%
Kenya	16.1%	69%	30%
Mozambique	11.7%	34%	**19%**
Ghana	60.5%	90%	**45%**
Bangladesh	41%	67%	**38%**
Haiti	38.5%	58%	**39%**
Cambodia	24%	129%	**50%**

Sources: 1 IEA: World Energy Outlook 2011 Energy; 2 Wireless Intelligence 2012

Maturity of the Tower Company Market

In markets where tower ownership has moved away from mobile network operators and the model for tower companies managing energy provision to the BTS is relatively mature (such as India), the benefits and motivations of mobile network operators are somewhat detached from the conversation. The expansion of tower ownership or management by tower companies in Africa is increasing, led by West Africa.

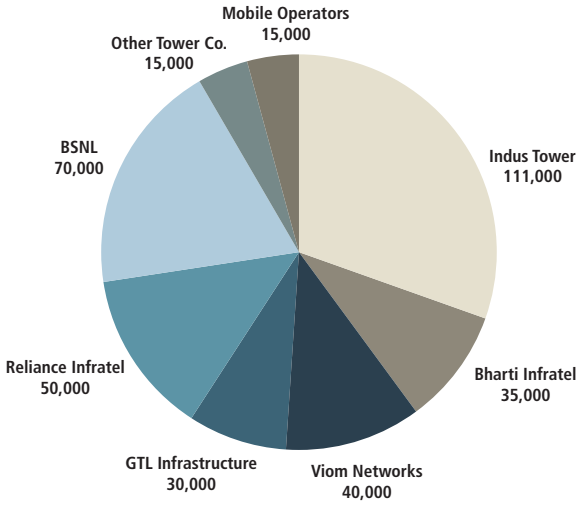
Figure 9: Estimated number of towers owned or managed by Tower Company in Africa



Source www.towerxchange.com TowerXchange Issue 1, December 2012

Towerco	Est # of towers	Acquisitions from	Countries active
IHS Africa	5610	MTN	Nigeria, Cotd'Ivoire , Cameroon, Ghana, Sudan, South Sudan
American	4540	Cell C, MTN	Ghana, South Africa, Uganda
Helios TA	2800+	Millicom	Ghana, DRC, Tanzania
Eaton	1500+	Vodafone, Orange, Warid	Ghana, South Africa, Uganda
SWAP	1211	Starcomms	Nigeria, Ghana
Helios TN	1000+	N/A	Nigeria

Figure 10: India Tower Company Landscape



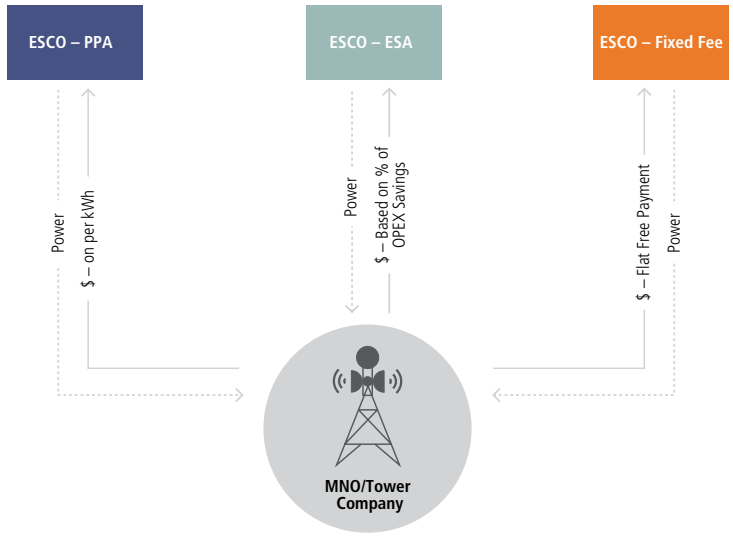
Source GSMA

The Indian tower company landscape of approximately 366,000 towers is dominated by Indus Towers holding approximately 30% of the market in terms of number of towers, followed by BSNL (19%) and Reliance Infratel (approximately 13%).

Maturity of ESCO Model and Operators

New models of energy supply to telecom base station sites are gaining attention with the entry of a third party energy service company (ESCO) to the eco-system In the ESCO models, the energy service company completely owns on-site power generation and supply of power to the base station sites, thus reducing the burden of deploying and managing the power plant from the mobile network operator or tower company. The energy demands of the mobile industry in off-grid locations present an excellent opportunity for an ESCO to service a BTS site acting as an anchor load. The demand for off-grid energy by nearby households and small businesses, especially using cleaner fuels, can be serviced by an ESCO through energy hubs or mini-grids that share the same power plant as the BTS site.

Figure 11: 3rd Party ESCO Business Model



PPA – Power Purchase Agreement
ESA – Energy Savings Agreement
Fixed Fee – Monthly Fixed payment

Source GSMA 2012

Where the 3rd party ESCO model is immature, which is still the case in Africa, the challenges of servicing a tower and a community are greater since the model will be less proven and the ESCO less established. A challenge to the ESCO is in integrating the power demands of the telecom client and that of the community without impacting service levels, and delivering services at a price affordable to each party. As expressed in Chapter 1, ESCO's need to ensure 24/7 power delivery to their anchor customers (mobile industry) and they need to protect themselves from the strict Service Level Agreement penalties that come with these contracts. The technical challenges can perhaps be overcome more easily than the operational challenges of integrating a telecom client and a community energy service in to a scalable business model.

Proliferation of Mobile Money Services

The penetration of mobile money services will determine the extent to which Pay As You Go models using mobile "wallets" will be successful, driven by the volume of immediate users and customers that are familiar with the technology of mobile money. There could be an alternative business case that energy access models using mobile money platforms may help to increase mobile money customers where electrification is extremely poor and amongst an un-banked population that is yet to be reached by a mobile money service.

What is clear is that Mobile Money is continuing to expand around the world. Currently there are a recorded 150 deployments of mobile money services across 73 countries, 40 of which were launched in 2012. Services are available in 34 of 47 sub-Saharan countries. Telecoms is driving the mobile money revolution with 72% of deployments operationally run by a mobile operator and competition is increasing, proven by 40 markets that have at least two mobile money services.[21]

Figure 12: Countries where Mobile Money Deployments are available at the end of 2012

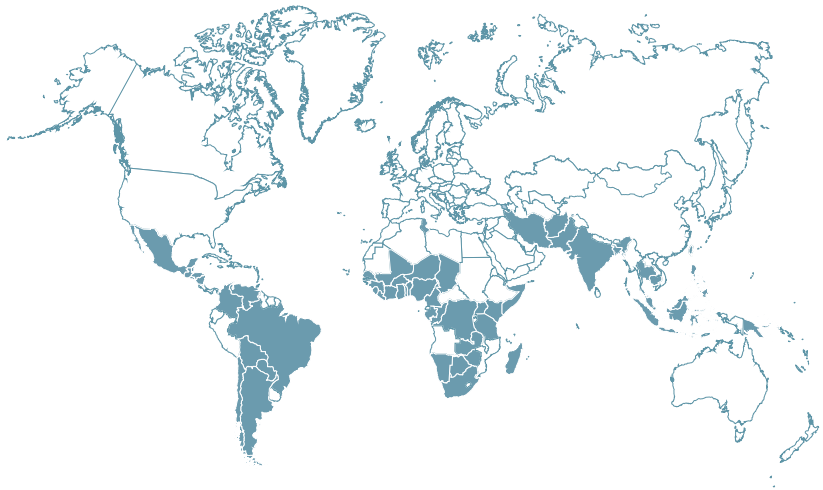
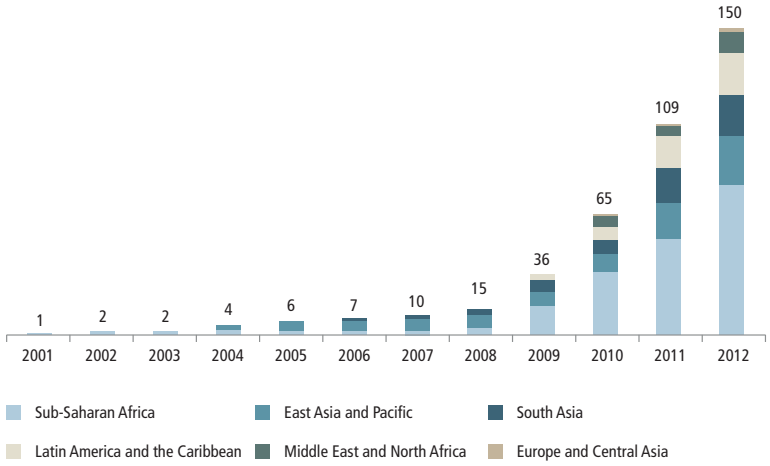


Figure 13: Number of Live Mobile Money Services for the unbanked by region at year end for the period 2001-2012



The involvement of the mobile industry cannot overcome all challenges or support all critical success factors for business models, such as financing for R&D to design and manufacture cheaper technology or supply chain financing (except where the partnership is to purchase products wholesale). Energy service providers who are full-service integrators and play across the value chain require a strong operating presence on the ground above and beyond others who are product manufacturers or distributors seeking partnership channels. This the mobile industry cannot provide alone. The mobile infrastructure and technology can go a long way to supporting innovative business models capable of scaling-up. The market is still very young with most commercial operations and partnerships less than 2 years old, so we will continue to watch and see which models work well and where, and try and distinguish why. In the meantime, as expressed in other chapters of this report, the playing field could be levelled further by regulators and policy makers, a broader market support provided and financing could be made available from start-up to scaled commercial roll-out.

21 MMU Deployment Tracker http://www.gsma.com/mobilefordevelopment/programmes/mobile-money-for-the-unbanked/tracker

Lesson 4

Financing is still a struggle

Author: Mary Roach, Business Development Manager

Introduction by Jigar Shah, CEO of Jigar Shah Consulting

With nearly US$200B in financing annually, the renewable electricity business has arrived for grid-connected applications. Technological improvements and increasing diesel fuel prices create more attractive economics for off-grid and energy access. Increasingly, for governments looking at grid expansion, the cost of decentralised energy solutions are less than capital costs of stringing power lines and building distribution grids.

There's good news. In 2011, Indian Telcos inked contracts with 20-plus companies accounting for 15,000 telecom towers. With 200,000-plus towers globally running eight or more hours per daily on diesel fuel, the market will require at least US$2B of capital. Applied Solar Technologies and OMC Power have raised venture dollars – with an implied interest rate of 40 percent. To reach full potential, lower cost capital is needed, but with conditions. Bringing renewable energy into these projects and receiving lower cost capital requires the following:

Trusted technology: Today, solar power is fairly trusted. However, off-grid projects using batteries generally have turned out to be more expensive than anticipated. This is especially true when factored in are expected emerging market interest rates at 18%. High upfront project costs pose a financial burden in meeting equity investor requirements for renewable energy projects. Biomass, a good choice as well, has just started being proven for small projects. So, trust by the financial community is not on par with solar PV. Mobile phone payment integration, village power meters, and other technologies are progressing, but few are mainstream-capital tested. However, with on-going quality tests, mainstream investor data thresholds should soon be met. To attract mainstream investors at the billion-dollar scale generally requires about 100,000 hours (12 years) of testing.

Solid contracts: Contracts in the energy access space today are often weak. From village power contracts to telecom contracts, few are financeable. Contracts do not include basic required investor protections. These protections include the following: timely resolution of common reasons for non-payment (performance); inability to cancel a contract on a whim; protection from high inflation; and refusal to sell units for less than fair market value at contract end.

Good credit counterparties: Credit counterparty risk matters to investors. In the telecom space, large mobile operators and telecom tower owners can be acceptable to large investors. But, village power and other bottom of the pyramid business strategies are often problematic. While funding is critical to test the business models, at some point credit counterparty risk will stop many solutions from scaling. In the past, this was bridged by using expensive money like microfinance. Or in the 20th century, central governments guaranteed bonds – as is documented by rural electrification in the USA.

Trust: The promoters have to be trusted by customers and investors to deliver technology, contracts, and most importantly execution. It is execution over time that leads to large-scale financing. So, new promoters without history slowly earn trust through demonstrated hardship. Many jump ship. But, those that persevere are rewarded. While aid money is a key to the momentum, we must find balance. Aid money should be used to cover upfront business development costs. But, companies should be required to attract commercial finance to scale.

Traditionally, finance came from the private sector. But, today with crowd funding and impact investing, there are more options. Still certain actions to de-risk investments are critical. For example, even after aforementioned tests are met, mainstream investors demand returns that significantly exceed inflation. With inflation in India at about 7%, for scale, we need the 18% equity returns expected in emerging markets. . Last, scale in this industry means thousands of local entrepreneurs with hundreds of companies. Over time, consolidation may create large regional or even global players, but unlikely. Local and increased competition means a healthier industry and we need the right structure of investments to ignite growth.

Jigar Shah is currently the CEO of Jigar Shah Consulting and an investor into KMR Infrastructure.,. A renowned visionary committed to renewable energy, Mr. Shah is the founder and former CEO of Sun Edison. Mr. Shah sits on the boards of the Prometheus Institute, Greenpeace USA and the Carbon War Room (where he served as President from 2009-March 2012).

"Innovation across multiple dimensions in order to pioneer new business models serving the BoP is especially risky. In the emerging field of inclusive business, there are still many more unproven models than there are proven ones, so the vast majority of investment opportunities are at the early stage"[22]

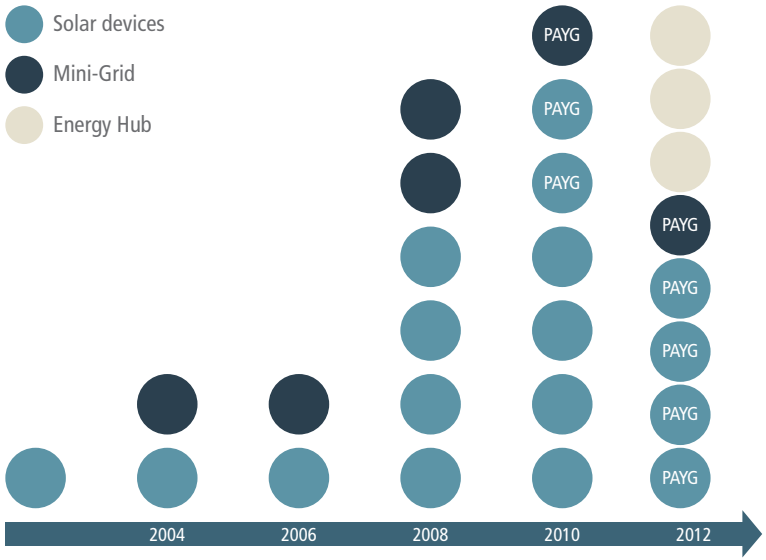
The two years GSMA has spent focussed on pushing a new model for energy access has taught us quite a bit about the funding needs of organisations working in decentralised energy access, and the funds available to them as well as the funders who are willing to interact in the sector. While conservative estimates suggest that US $48Billion per year[23] is required to support universal access to electricity by 2030, key questions still remain unanswered on how to support the hundreds of organisations trying to serve the 1.3B people without access to electricity.

- **What** kind of funding is required by organisations focussed on delivering commercially viable energy access programmes?
- **Who** will be able to step in and serve each of the tranches of financing required?
- **When** will this funding be required and when will it become available?

State of the market:

Most decentralised energy access organisations can be characterised as small, less than 10 years old, and with relatively low capitalisation.

Figure 14: Growth in Enterprises That Provide Energy Services to Off-grid Communities in India/Africa



Examples of the more mature organisations in this sector include d.Light Design who has just passed the 2 million mark in sales of their solar lanterns after 5 years in operation[24] and Husk Power Systems who operate nearly 100 decentralised bio-gasification mini-grids. While these are great pioneering organisations it is fair to say that they alone cannot solve the energy divide. The challenge is how to fund hundreds of d.Lights and Husk Power Systems?

22 Source: from BLUEPRINT TO SCALE; http://www.mim.monitor.com/blueprinttoscale.html

23 www.worldenergyoutlook.org/media/weowebsite/energydevelopment/weo2011_energy_for_all.pdf

24 www.dlightdesign.com/wp-content/uploads/2012/09/Press-Release-Ten-Million-Empowered-November-14-2012.pdf

What funding when?

Companies require different types of funding at different stages of growth. This is also true for organisations focussed on energy access and further complicated by the long valley of death faced by energy organisations discussed in our last white paper. Personal investments, grants, angel and friends-family-fool funding can support the development of proof of concept. Equity-like funding can support the CAPEX investment to further grow, and debt is required to support working capital along the entire value chain.

"The "valley of death" is often known as the gap in financing that startups face somewhere between grant funding and commercialisation. Two studies conducted last year[25] suggested that the valley of death was particularly precarious for energy companies since:

- They maintain high variable costs even after proof of concept either in the form of building products (i.e. carrying inventory) or developing physical plants
- They take a long time to scale: in comparison to the IT companies, development of clean tech product and installations takes much longer
- Energy development must navigate a series of political, financial and
- Regulatory issues specific to the geography they wish to operate in."[26]

The role of Grants and Venture Philanthropy

While many investors get prickly at the "G" word, it is clear that grants are still required to support the proof of concept of business models and support innovation. To date, we have found a very limited number of donors or investors capable of delivering the capital required to support wide scale trials and innovations. The African Enterprise Challenge Funds and USAID's innovation grants are exceptions but even they have limitations. Tying funding to pre-determined windows limits the number of applicants and their ability to apply for funding when it makes the most sense to them. Additionally the due diligence costs remain high and the total number of grants remains low. Granting mechanisms are often further encumbered by detailed definition of what is in and what is out of scope. The industry's growing love affair for commercially viable business models often means we continue to invest more in organisations that are already doing well rather than newcomers to the field. But what is the answer?

Debt

Fund raising at any stage is time consuming and securing debt investment seems to be the one of the largest challenges most organisations face. The challenge with the working capital requirements and credit requirements of energy access organisations is that they can be paid back over a long period of time and spread out across multiple players. Manufacturers need working capital to make product. Energy access organisations need funding to buy product, support inventory and in many cases extend further credit to their customer (either further distributors or directly to customers in the case of pay-as-you-go). To be able to scale, energy access organisations will need to access large amounts of debt to support their growth.

Mobile operators and other industries are increasingly moving towards leaner "zero inventory" models. While this may not affect software providers or "App" startups, energy solutions require physical hardware to supply the essential electricity needed to power those Apps. This presents a real challenge for smaller, agile energy innovation startups

25 http://thebreakthrough.org/blog/Valleys_of_Death.pdf
26 Harnessing the Full Potential of Mobile for Off-grid Energy (GSMA, 2011) http://www.gsma.com/mobilefordevelopment/harnessing-the-full-potential-of-mobile-for-off-grid-energy

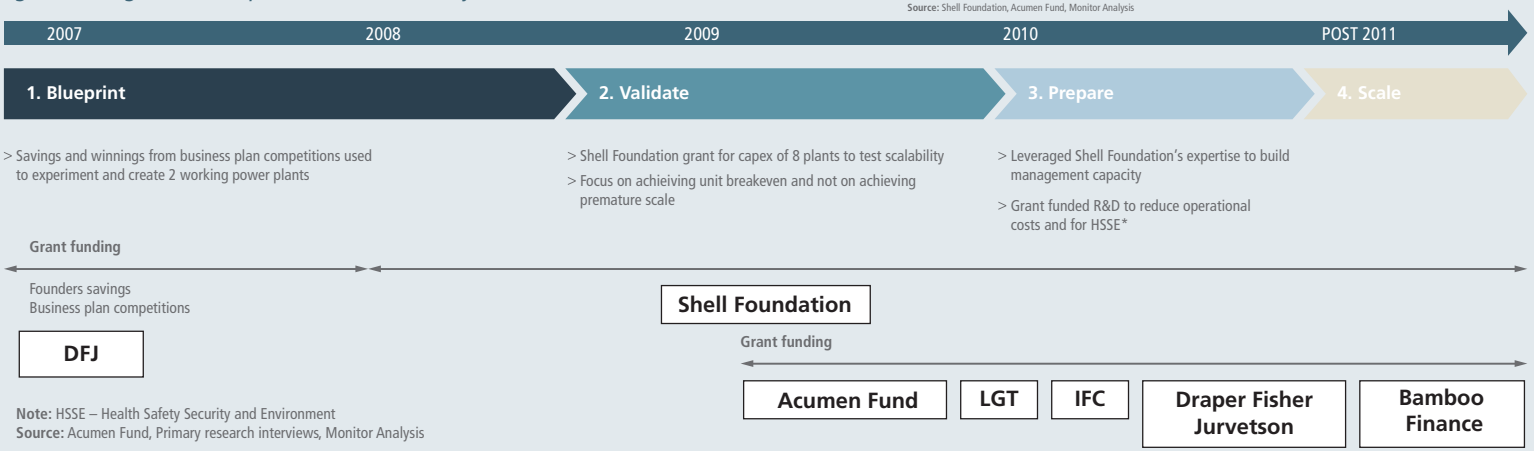
CASE STUDY: Shell Foundation and Husk Power Systems[27]

The Monitor Group and Acumen report From Blueprint to Scale highlighted the need to provide a blend of commercial and first-loss investment along the lifetime of an investment.

The report defines the stages of a business as Blueprint, Validate, Prepare, and Scale. To illustrate the role that "venture philanthropy" plays in supporting the development of commercially viable social enterprises the report draws on the experience of Acumen with Husk Power Systems (one of their early energy investments). The report highlights the role that grants from Shell Foundation provided in helping Husk Power Systems graduate to increasingly more commercial funding.

The Shell Foundation has been a key supporter of venture philanthropy in the energy sector. Established by the Shell Group in 2000 the Shell Foundation's mission is to develop, scale-up and promote enterprise-based solutions to the challenges arising from the impact of energy and globalisation on poverty and the environment.[28] Their Excelerate programme helps bring energy to the poor by investing grant capital in small business that provide modern energy services to low-income communities.

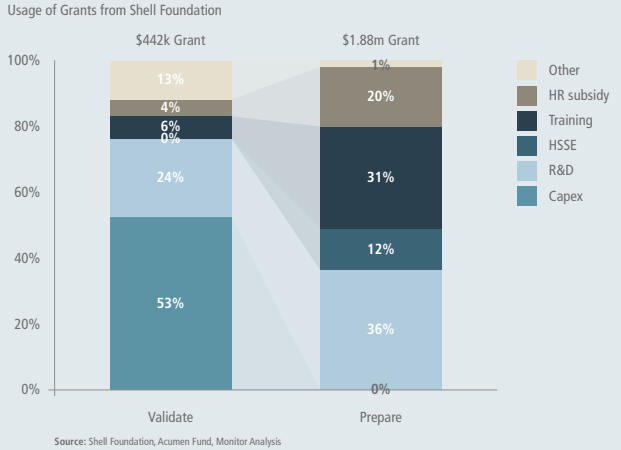
Figure 15: Stages of Development of Husk Power Systems.



Note: HSSE – Health Safety Security and Environment
Source: Acumen Fund, Primary research interviews, Monitor Analysis

Figure 15 chronicles the stages of development of HPS from Blueprint to Scale and the different grant and commercial funding the organisation received since its inception. Figure 16 illustrates how the grants were used over time. As is illustrated, the first Shell Foundation grants were used to help build the proof of concept with the majority of the funding going towards the CAPEX requirements of setting up the decentralised biogas systems. In the 'prepare' stage, none of Shell's grant is going to support the CAPEX requirement and the majority of the grant is going to support R&D, training and an HR subsidy for its management staff.

Figure 16: Usage of Grants from Shell Foundation



Source: Shell Foundation, Acumen Fund, Monitor Analysis

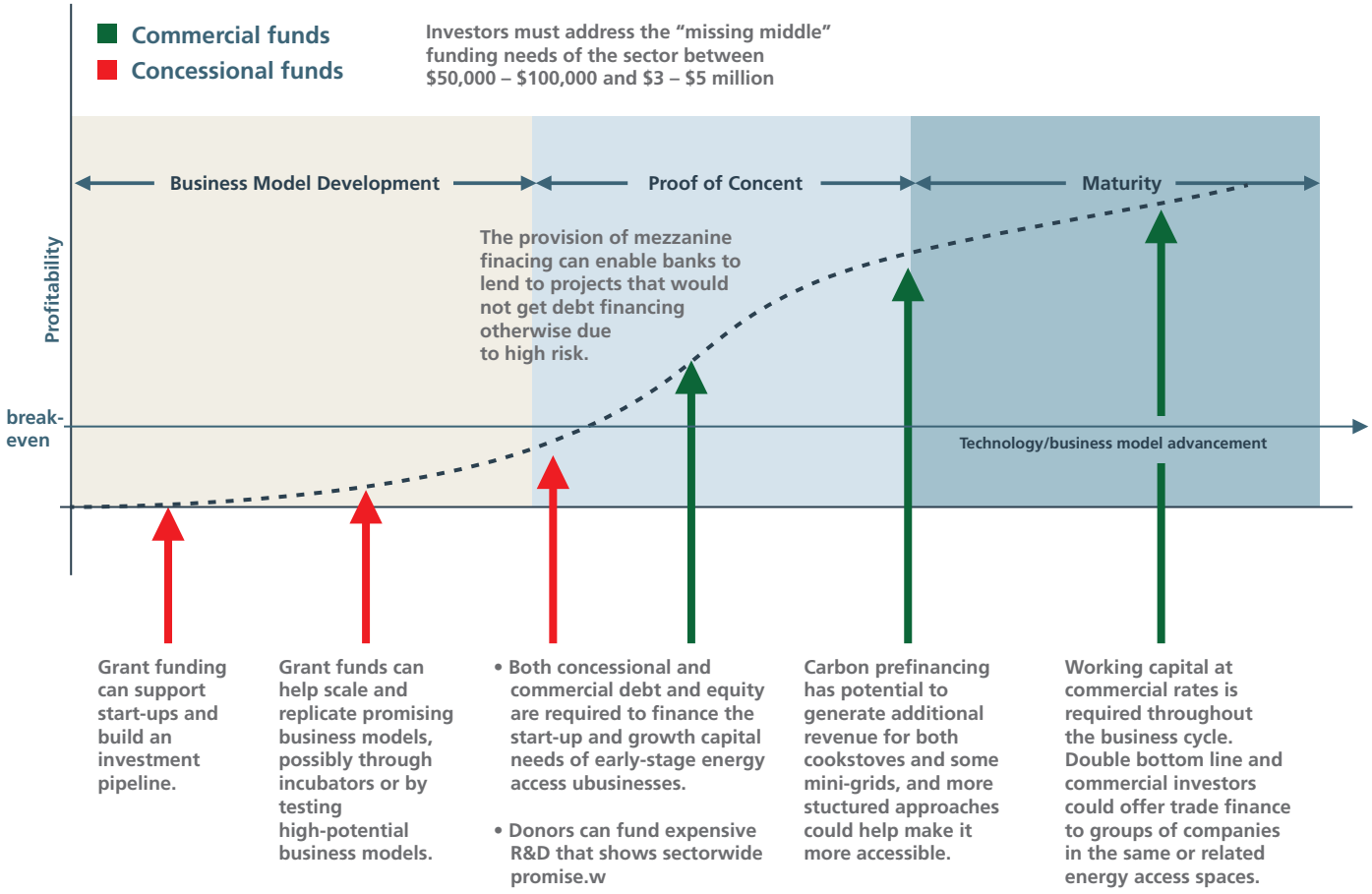
27 Source: from BLUEPRINT TO SCALE; http://www.mim.monitor.com/blueprinttoscale.html

28 http://www.shellfoundation.org/pages/core_lines.php?p=our_approach_content&page=ourmission

Who will deliver the funding required for ESCOs to grow?

The large need for investment in the energy access sector provides room for several investors from multilaterals to purely commercial investors to co-exist and collaborate (see figure 17).

Figure 17: Financing needs and obstacles early in the company life cycle



Source: From Gap to Opportunity: Business Models for Scaling Up Energy Access, IFC 2012

Co-investment: reducing the pool of investors?

Reviewing the list of investors of many of the leading ESCOs we know of and work with, we have noticed a pattern of co-investment by several impact investors to the same company. The merits of co-investing are clear: risks are shared across investors and opportunities exist to leverage the strengths of the individual investors. One question that is less clear to us is: how do investors view their role in helping to develop the hundreds of energy access organisations required to reduce the energy gap? We have heard from ESCOs that some investors believe that there are conflicts of interest if they invest in the same type of company (i.e. product companies or service companies). As a result, what happens is that "darlings" are formed in the impact investing circle that find it easier to raise capital while other are left struggling to raise funds.

Can we crowd-source our way out of this dilemma?

The rapid growth of crowdsourcing platforms has provided a new avenue for energy access organisations to raise money for innovation. Organisations such as Fenix,[29] EarthSpark,[30] and Angaza Design[31] have been featured on traditional crowd-funding platforms. There is now an energy specific platform called SunFunder which was started by Ryan Levinson, a former investor at Wells Fargo.

As energy, development and technology enthusiasts we think crowd-funding is a great platform to raise awareness about issues and new innovations and to attract new investors. But can we really raise the billions required via crowd-funding? How do we ensure that the "right" projects get featured on these platforms, and that these projects have impact?

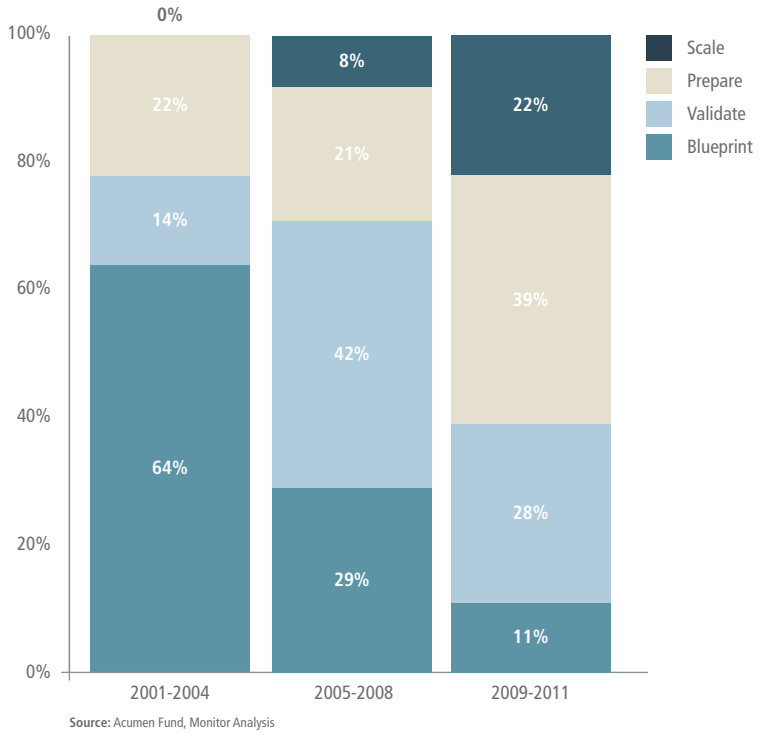
Other options for delivering funding

With the clear lack of bankable business models it is questionable whether or not we need to bring in more investors, each with their own overhead costs and due diligence processes, or whether it makes sense to support the development of organisations who invest in several similar companies. This could produce the groundswell that is required to drive innovation, foster competition and eventually lead to consolidation.

When will these funds be required and when will it become available?

At this moment organisations spend considerable amounts of time competing for the little funds that are available with the risk profile they seek. Over time Acumen, a leader in the impact investment sector has changed its risk profile to invest in more mature and less risky ventures, helping to fill a funding gap for the more promising ventures and in the process creating a gap for early pioneers (see figure 18): "In the first three years of its life, Acumen Fund made 78 percent of its capital and funding deployment in the blueprint and validate stages, compared with 39 percent in the last three years".[32]

Figure 18: Acumen Fund's deal profile evolution



Source: Acumen Fund, Monitor Analysis

29 http://www.kickstarter.com/projects/mikelin/readyset-solar-kit-for-ipad-iphone-android-and-mor
30 http://www.globalgiving.org/donate/13118/earthspark-international/reports/
31 http://www.sunfunder.com/projects/view/31
32 Source: from BLUEPRINT TO SCALE; http://www.mim.monitor.com/blueprinttoscale.html

In a recent article in Forbes, serial entrepreneur Xavier Helgeson, CEO of Off.Grid:Electric and founder of Better World Books, suggested that Results Based Financing could be used to drive the growth of the sector, and create a perfect role for multilateral banks and donors to support the private sector without distorting the market.

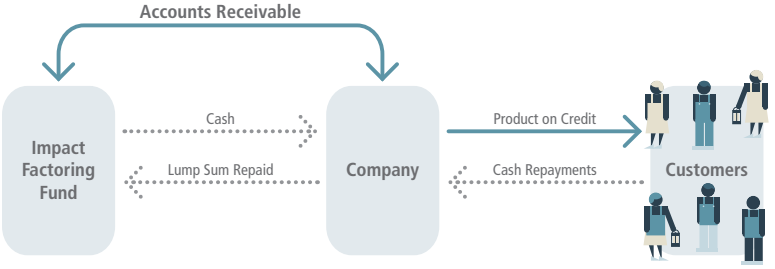
How might a well-designed results-based finance program for lighting Africa look? It ought to have five main principles[33]:

- Fund Services, Not Watts – Efficiency is the name of the game when you are off the grid. An inefficient 50 watt system and an efficient 15 watt system can deliver exactly the same service level. Fund outcomes that can be objectively measured: lumens of light, hours of radio, number of phones charged, etc.
- Fund Durability – It is easy to deliver a high level of service the first time a cheap or poorly designed solar system is used. It is much harder and more expensive to provide a system that delivers at a high level for years, with service included. A strong technical analysis can identify high quality systems and reward the investment in quality. Some funding should be reserved and only dispersed after systems are demonstrated to be functioning highly after 1-3 years.
- Only Fund on Audit-able Data – Any organization seeking funding should provide exact data, in spreadsheet format, including GPS coordinates of customers and detailed system specifications, so that a random audit can be conducted.
- Release Funding Quickly and Transparently – A well-designed program cannot subject entrepreneurs to a yearlong opaque process and grueling reporting requirements. It must have a transparent funding protocol with rapid turnaround and personalized service.
- Build a broad market – No more than 20% of the fund should go to a single company, country or organization, and funds should be distributed pro rata if there is more interest than funds available. This prevents one large & well-funded company from swooping in and claiming a lion's share. Special effort should be made to fund local small solar dealers as well as ambitious high-growth startups.

Forward thinking impact investors like Invested Development are looking into alternative financial mechanisms to support the working capital requirements of energy access companies.[34] They are in the process of raising funds for the Impact Factoring Fund (IFF) to "provide short term liquidity and working capital to early stage, high-growth companies in emerging markets".

"Factoring is a financial transaction where accounts receivable (the value of payments owed to the company) are purchased at a discount in exchange for the future stream of payments (the aggregated customer payments). In other words, the IFF buys a start-up's accounts receivable to inject working capital while the customer pays back their credit at their own pace. The start-up then pays the fund (IFF) back after it has received full payments from the customer. Most valuably, this provides the start-up with the ability to scale; it is no longer waiting for cash during long payback periods and more customers can afford and benefit from the start-up's products."

Figure 19: Invested Developments Impact Factoring Fund

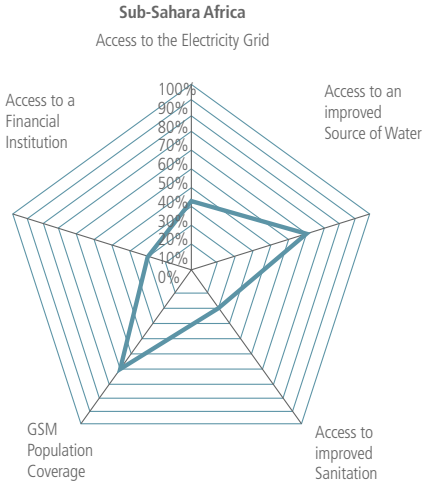


Source: Invested Development 2012

Ultimately, the immediate need for funding must be addressed to deliver the large numbers of bankable business models the world requires to deliver universal energy access. Larger pools of seed funding should be made available to organisations that excel at finding and supporting early stage enterprises developing the pipeline for next stage investors. Large and easy to access commitments to Results Based Financing mechanisms or working capital pools will allow existing organisations to focus more time building their businesses, and less time courting the small pool of impact investors. Ending the energy divide is possible, but it will require the collective agreement of large bilateral and multilateral organisations to take more risk, and support the foundation of existing organisations to draw in more private and commercial funding.

33 www.forbes.com/sites/xavierhelgesen/2012/12/12/how-to-light-africa-within-a-decade
34 http://investeddevelopment.com/iff/

Appendices



Addressable Market
277M
People without access to energy but covered by GSM network

Addressable Market
66M
People without access to an improved water source but covered by GSM network

Appendix 1 – Regional Profile of sub-Saharan Africa

Total Addressable Market in sub-Saharan Africa includes up to:

- **93 Million people for energy access in West Africa**
- **30 Million people for water in West Africa**
- **106 Million people for energy access in East Africa**
- **29 Million people for water in East Africa**
- **78 Million people for energy access in the rest of Africa**
- **7 Million people for water in the rest of Africa**

West Africa

Infrastructure

Orange in Niger

- Karazomé village Community Power Project, Maradi region of Niger. In the pilot, a dispensary 100 meters from an Oryx solar powered base station site is taking excess energy from the telecom site to power several lights, a fan and with an additional rooftop solar panel supplied by Orange, power is supplied to a vaccine refrigerator.
- Orange has partnered with Altobridge[35] to deploy solar powered radio base stations, providing mobile connectivity to 50 off-grid village communities, covering an average of 1,200 people in each location.

Orange in Senegal, Mali and Niger

- Orange Community Phone Services (Djamaa in Senegal, Karkara in Niger) are based on a SIM card combined with solar charging, allowing off network communities to have access to phone services.

Shared Solar in Mali

- Shared Solar has installed micro-grids in rural Mali providing power to approximately 170 households. The concept is to provide PAYG micro-grid services, connecting up to 20 families per project. Core technology is a smart meter that enables real time consumption monitoring and prepaid use with mobile phone payments. Their gateway is capable of communicating via SMS as well as 2G and can also be tied to 3rd party mobile banking services.

Tigo/Altobridge in Ghana

- Tigo has partnered with Altobridge to deploy solar powered radio base stations in rural Ghana, providing phone charging services at most of its off grid sites. 10 towers have been built to date, based on a partnership between K-net, iDirect satellite communications equipment, Altobridge 2G and 3G Base Station Subsystems and Ameresco solar power technology. K-net plans to expand to 300 additional sites with private sector funding[36].

Mobile Payments

Shared Solar in Mali

- Shared Solar uses mobile payments for their Pay As You Go micro grid solution. Payments are made through scratch-cards for now (and looking to integrate with a mobile money service). Customers buy a scratch-card from a local vendor for as low as US$ 0.50.

Water Access

Manobi in Senegal, Mali, Benin, Niger

- The mWater service uses mobile telephones to support billing services, record keeping and equipment operation, to improve the management of rural and small town water systems. In Mali, a total of 55 small water providers, with access to 556,000 consumers across rural Mali, have signed up to an initiative in which mobile phones are used to improve their operational efficiencies.

Akvo FLOW in Liberia

- In 2011, the Liberian government, assisted by the World Bank, used Akvo FLOW to map 10,000 water points in Liberia. Akvo FLOW is a software tool that collects, manages, analyses and displays geographically referenced monitoring and evaluation data using mobile phones.

35 www.altobridge.com/2012/11/13/orange-and-altobridge-bring-first-time-mobile-connectivity-to-remote-communities-in-niger/
36 www.telecompaper.com/news/k-net-altobridge-to-expand-rural-backhaul-in-ghana--907594

East and South Africa

Infrastructure

Vodacom Community Power Site in South Africa

- Vodacom deployed its first Community Power site in December 2011 at Emfilhweni, a rural area in Kwazulu-Natal province. The Solar plant built by Vodacom is powering the BTS, a local school equipped with computers donated by Vodacom & a water pump. A small solar panel and a phone charging equipment was donated to the local shop, so users can charge their mobile phone for free. Vodacom is currently looking for more sites in South Africa and its other operating companies in Africa where community power sites can be established.

Shared Solar in Uganda

- Shared Solar has installed solar powered micro-grids in eight different points in Ruhiira Millennium village in Uganda. SharedSolar households now spend on average 12,000 UGX (approx. 5 US$) on their energy needs per month[37]. Four schools have also been connected to the solar scheme. SharedSolar was looking to install systems in an additional 40 households and businesses in Ruhiira in 2012.

Energize the Chain in Zimbabwe[38]

- Energize the Chain seeks to improve the efficiency of vaccine storage and delivery systems in Zimbabwe by supplying energy efficient vaccine-storage refrigerators to rural clinics with limited access to reliable power supply, and leveraging electricity generated at telecom towers to power vaccine-storage refrigerators. In June 2011, Energize the Chain partnered with Econet Wireless in Zimbabwe and has deployed refrigeration units at 10 BTS sites in 2012. An additional 100 sites are in different stages of progress, with 100 more budgeted for the next financial year.

Distribution Channels

MTN Uganda & Rwanda and Fenix International

- Fenix International partnered with MTN Uganda in 2011 and MTN in Rwanda in 2012 to sell their ReadySet renewable energy systems in MTN shops. Fenix products are focused on creating micro-utility business opportunities, allowing entrepreneurs to charge local mobile phones. MTN has co-branded the ReadySet with their logo, and is leveraging their sales, marketing, distribution and after-sales service network to extend the reach of Fenix with the goal of powering over 1M subscribers by 2014. MTN Group has sold over 2,000 ReadySet energy systems across East Africa to date.

Safaricom and M-KOPA in Kenya

- M-KOPA partnered with Safaricom in 2012 to sell their GSM enabled pay-as-you-go solar solutions through Safaricom's network. The M-KOPA units embed Safaricom enabled sim cards and users pay for energy access by daily instalments of Kshs.40 via M-PESA for a period of one year. As of October 2012, M-KOPA had 1,000 customers in Kenya. M-KOPA is currently available at more than 100 Safaricom's shops across Kenya.

Econet Solar in Burundi, Lesotho and Zimbabwe

- In September 2012, Econet Wireless Zimbabwe launched their Green Kiosk initiative, selling Econet mobile phone accessories, airtime, EcoCash mobile money services and allowing Econet customers to charge their mobile phones for free using solar energy. The Green Kiosks are operated by independent individuals. Econet was planning to roll out a minimum of 5,000 units countrywide by end of February 2013[39].

Mobile Payments

Shared Solar in Uganda

- Shared Solar uses mobile payments for their Pay As You Go micro grid solution in Ruhira Uganda. Payments are made through scratch-cards for now (and looking to integrate with a mobile money service).

M-KOPA in Kenya

- M-KOPA users are paying for energy, by daily instalments, using the M-PESA platform.

Mobisol in Tanzania

- Users pay for their electricity using the Vodacom M-PESA platform.

Devergy in Tanzania

- Devergy is building small micro-grids in rural Tanzania, providing solar power to households and businesses. Each household connected to the micro-grid are equipped with an energy meter allowing a pay-per-use approach: each user tops up his credit by buying a scratch-off card and sending an SMS obtaining a credit code to the Devergy payment system.

Off Grid Electrics in Tanzania

- Off grid Electrics provides Pay As You Go solar home systems in rural Tanzania. Customers sign up for the service through the agents' smartphone application. Credit is purchased through M-PESA or other mobile money accounts. Unlock codes are sent via SMS to unlock power system for specified time.

Grundfos Lifelink in Kenya

- Grundfos Lifelink users are able to pay for their daily water using the M-PESA platform. They can transfer money from their M-PESA directly to their personal RFID key fob, which will be swiped against Grundfos Lifelink units to deliver 20L of water per user

Azuri Technologies in South Sudan, Kenya, Uganda, Rwanda, Tanzania

- Azuri Technologies provide small Solar Home Systems under a Pay as You Go model in several African countries. Users are able to buy prepaid electricity, using their mobile phone and buying weekly scratch cards for 1USD. The Indigo scratch card is validated using SMS from a mobile phone and the resulting one-off passcode entered into the Indigo unit which causes it to operate for a period of time (typically a week).

Water Access

Grundfos Lifelink in Kenya

- Grundfos Lifelink provides clean water service in rural Kenya, based on the combination of a solar powered submersible water pump and embedded mobile connectivity in the pump, allowing for remote monitoring and mobile payments.

Oxford University Water Project in Kenya and Zambia

- Researchers from Oxford University[40] have started piloting projects in drought prone areas in Kenya and in Zambia, where they installed low-cost data transmitters on hand pumps. These smart hand pumps automatically send SMS messages to the district and national water managers. The data sent by SMS also provide water output estimates that show fluctuations in daily to seasonal demand levels.

Welldone Organization Project in Kenya

- The WellDone[41] organization will soon start piloting their prototype of GSM enabled remote monitoring units for water pumps in the first quarter of 2013. Their goal is to help local utilities operate their water network based on increased data availability and water projects accountability.

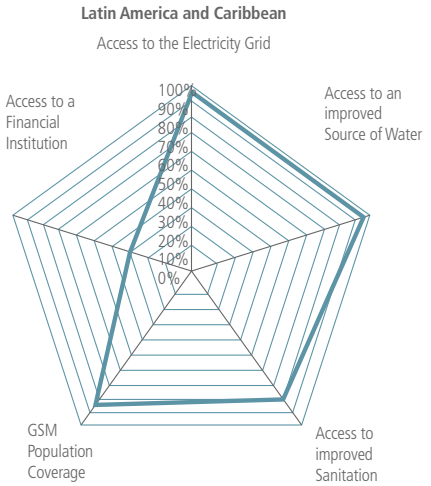
37 http://www.millenniumvillages.org/field-notes/solar-power-lights-up-new-business-in-uganda-village

38 http://energizethechain.org/content/econet-wireless-zimbabwe-%E2%80%93-energize-chain-program-zimbabwe

39 http://www.techzim.co.zw/2012/09/econet-solar-green-kiosks-the-launch/

40 Oxwater Project - http://oxwater.co.uk/

41 Welldone Organization - http://www.welldone.org/about-us/



Addressable Market

7M

People without access to energy but covered by GSM network

Addressable Market

35M

People without access to an improved water source but covered by GSM network

Appendix 2 – Regional Profile of Latin American Mobile Enabled Community Services

Infrastructure

Digicel and Earthspark in Haiti

- Digicel Haiti partnered with Earthspark International to develop a mini-gird for the community of Les Anglais. Using excess power from an off-grid Digicel tower site Earthspark is providing electricity access to 14 households[42]. As a 2nd phase of development, Earthspark hopes to integrate a 150kW of solar and battery story to serve 400 households using a smart meter designed for the BOP market[43].

Distribution Channels

Digicel & Solengy in Haiti

- Digicel Haiti has partnered with Solengy to install over 400 solar powered street lamps and phone charging stations across Haiti. Each station is operated by an airtime vendor who sets up shop below the street light and manages the phone charging service.

Mobile Payments

Quetsol in Guatemala

- Quetsol is a Guatemala based PV Installation Company dedicated to delivering energy solutions to off-grid communities. Quetsol was expected to launch a pilot of a pay-as-you-go solution in the last quarter of 2012 for a roll-out in Q1 2013[44].

Water Access

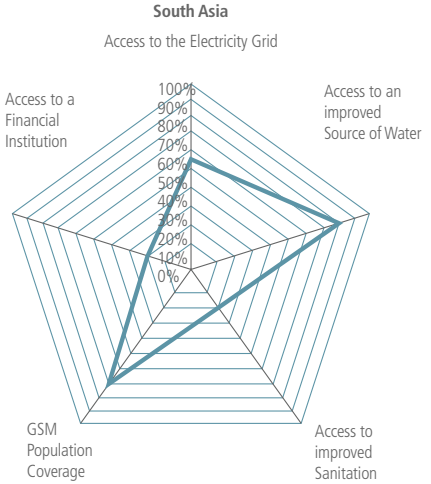
Water.org in Haiti

- Water.org partnered in 2012 with Digicel on a pilot program that will offer Port-au-Prince residents information on clean water sources nearby through their mobile phones.

42 http://haitirewired.wired.com/profiles/blogs/earthspark-uses-micro-grid-pre-pay-electricity-to-power-homes-in

43 http://earthsparkinternational.org/blog/

44 http://unreasonableinstitute.org/wp-content/uploads/2010/12/Quetsol-Guatemala-UI-2-Pager1.pdf



Addressable Market
95M
People without access to energy but covered by GSM network

Addressable Market
21M
People without access to an improved water source but covered by GSM network

Appendix 3 – Regional Profile of South Asian Mobile Enabled Community Services

Infrastructure

Bharti Infratel – OMC Power in India

- Tower company Bharti Infratel has entered into a 10-year partnership with OMC Power for powering its off-grid and poor grid telecom tower sites in rural areas. OMC Power builds Micropower Plants with renewable energy sources providing power to mobile towers and a home delivery service of changed lanterns and battery boxes to the surrounding rural communities. As of the end of 2012, OMC Power has 10 Micropower Plants in operations in Uttar Pradesh.

Vodafone Essar in India

- At each of the 93 USO Fund's sites managed by Vodafone in the Vidarbha region of Maharashtra, there is a single socket power point that can be used for phone charging.

Applied Solar Technologies in India

- AST is a 3rd party energy service company providing hybrid energy as a service for Bharti Infratel, Indus Tower and Idea Telecom at over 2000 site locations. AST has recently launched a community power pilot providing a dedicated power source to a water service provider and to charged battery and lantern services in one of their communities.

Smart Power for Environmentally-sound Economic Development (SPEED) Rockefeller Foundation in India

- The Rockefeller Foundation has made a three year commitment to demonstrate the potential for significantly expanding decentralized renewable energy provision in rural India, by leveraging the rapidly expanding cellular telephone tower network as an anchor customer. Partner organisations include: DESI Power, Confederation of Indian Industry - Green Business Center, Johns Hopkins University, Prayas, Sambodhi Research and Communication, Technology and Action for Rural Advancement. The programme is currently working in 10 district clusters across Uttar Pradesh, Bihar, Jharkhand, Chhattisgard and Madhya Pradesh.

Grameenphone in Bangladesh

- Grameenphone partnered with the University of Oslo to build a solar powered mini-grid to provide power to the village of Paharpur, a remote community in the Sylhet region of north eastern Bangladesh where 20,000 people live without power. The pilot project provides 136 households with electricity from 5.pm. to 12.a.m. daily[45].

Mobile Payments

Simpa Networks in India

- Simpa sells home solar systems using a progressive purchase model. Customers make a small initial down payment and then pre-pay for the energy service, topping up their systems in small user-defined increments using a mobile phone. Each payment for energy also adds towards the final purchase price.

Water Access

Sarvajal in India

- Sarvajal builds water systems in India and recruits local entrepreneurs to sell water to their communities using a combination of embedded solutions and mobile payments. Their solar powered Water ATM allow customer to pre-pay for purified water. The ATMS are remotely monitored using embedded solutions and the mobile network to ensure high quality water purification and service. Sarvajal has over 193 franchisees providing purified water to 90,000 people.

Ossian Agro Automation in India

- In 2008, the Ossian Agro Automation Group, launched Nano Ganesh, a mobile-enabled remote control device for water pumps. The Nano Ganesh allows for remote monitoring and control of the water pump allowing rural farmers in India to turn on and off their water pumps, check the power supply and be alerted in case of tampering. Ossian Agro Automation has sold over 10,000 units.

WaterAid in India

- Water Aid has been using mobile-enhanced maintenance in India, resulting in over 70% of hand pumps being repaired in 24 hours. They are currently seeking more information on the potential of mobile tools for their projects.

Grameenphone and HYSAWA in Bangladesh

- HYSAWA, an international NGO has installed approximately 30,000 tube wells to ensure safe water supply for approximately 10 million rural inhabitants. To support the initiative Grameenphone has introduced an SMS-based service that enables the wells caretakers to send a text message when a tube well is not working directly to the HYSAWA head office.

45 www.millenniumvillages.org/field-notes/solar-power-lights-up-new-business-in-uganda-village

Appendix 4: Failure Modes

Failure Mode	Solution
Resilience of Decentralised Systems	Mobile industry provides 24/7 capability • Mobile operators through their subcontractors have become adept at delivering highly reliable power to off-grid base stations • Mobile towers are often the best piece of serviced infrastructure in off-grid areas with the help of highly skilled technical staff • Mobile operators are incentivised to establish good-will with off-grid communities to reduce diesel theft and site vandalism. Up to 20% of total diesel consumed by the telecom industry is pilfered.
Scale of Solutions	The mobile industry is unique in the number and geographic reach of its distribution channels and vendor penetration, that can scale-up responsively to the needs of the community
Payments	Scratch-card and mobile money products can be used to deliver consumer financing and pay-as-you go solutions for the flexible purchase of basic utilities
Reporting & Maintenance	The presence of the mobile network reduces the challenges of rural service delivery • Voice and text messages can be used by community members to support on-going operation & maintenance of decentralised solutions • Embedded mobile solutions can support remote real time monitoring and the development of pay-as-you go solutions

Appendix 5: Report Card

Recommendations in 2012	Actions	2012 Experience
Develop rigorous models for CPM from infrastructure	Collect and disseminate business models Adapt models with changing tower infrastructure ownership	Completed 4 feasibility studies Visited 16 energy access organisations to document their business models
Assist mobile operators in developing CPM strategies	Identify ways to leverage telecom supply chains and human infrastructure Map deployment opportunities Correlate accessible and affordable energy access with phone usage	Completed 4 feasibility studies Held 2 half day and full day CPM specific days with mobile industry players bringing together over 100 people
Conduct research to inform innovative service providers	Understand the demand for priority energy services and their impact on MNOs Identify potential obstacles and opportunities posed by rural energy and communication policies	More information has been collected in this area. Staff have spent over 120 days in rural areas, visiting communities during the day and night to fully appreciate their energy need More work is required and we are actively looking to leverage the experience of other organisations.
Partner with the investor base to drive capital into the sector	Engage, inform and learn from investors Nurture a pipeline of opportunities	Built our network of investors interested in the sector, worked across investors. Provided pipeline introductions to 4 investors

Appendix 6: Lessons Learned

Lessons from 2011	Drivers	Bottom Line	2012 Experience
Excess Power is less of a reality	Understand site load requirements Reducing dependency on diesel	Energy service business models need to be developed that provide mutual benefits to the mobile network operator and the community and provide for the long term maintenance of its services	OMC Power is the first to do this 2012 Feasibility studies with operators prove the opportunity for CPM across markets in Africa R&D capital is still required
Off-grid market is complex and immature	Challenges in last mile delivery Rural energy market remains immature Lack of capital for the sector	Companies delivering energy products and services to off-grid customers still remain few and far between. Bigger players are defined by their ability to draw investments through their path to scale. In a market of this size there are still no clear winners and more importantly there is plenty of room for competition Organisations improving energy access face significant challenges in raising the funds for both proof of concept and growth.	We have seen the growth of both product and services companies serving off-grid communities. Proof points are beginning to emerge and mobile plays an active role: Operational efficiencies and benefits of anchor tenants Mobile payments to support consumer financing Phone charging is a key selling feature of home solar products (See Figure 11) R&D capital is required to spur innovation and to road-test business models
CPM: More than infrastructure	Towers+ Last Mile delivery supply chains Mobile Payments and Scratchcards	In the push to increase market share and mobile penetration, mobile operators are unintentionally helping to lower the barrier to off-grid energy electrification. At the heart of this opportunity is the realisation that a mobile customer is also an energy customer and without affordable energy, cannot participate in the mobile economy	Proof points have emerged in using supply chains, mobile money and mobile infrastructure. The mobile channel is increasingly being used for remote monitoring and operation of systems. Payment technology is being trialled for other energy services (water access and irrigation) but it is still early days. A Lot of opportunity for innovation exists in this sector
More than Pilots are required for large scale adoption	CPM delivers social value Tie pilots to strategy of telecom player 3rd party financing is required	To move CPM from one-off CSR activity to a viable opportunity to engage external organisations requires deeper interactions with telecom players To become a reality, a risk ready environment needs to be created where good enterprises are mentored, nurtured and monitored, have access to the patient capital and test sites they require to gain proof of concept.	In 2012, 4 feasibility studies were completed, (summarise our program) The UK Government funding under the MECS programme provides some of the R&D funding required The structure allows for the programme to be replicated across markets with other funders.