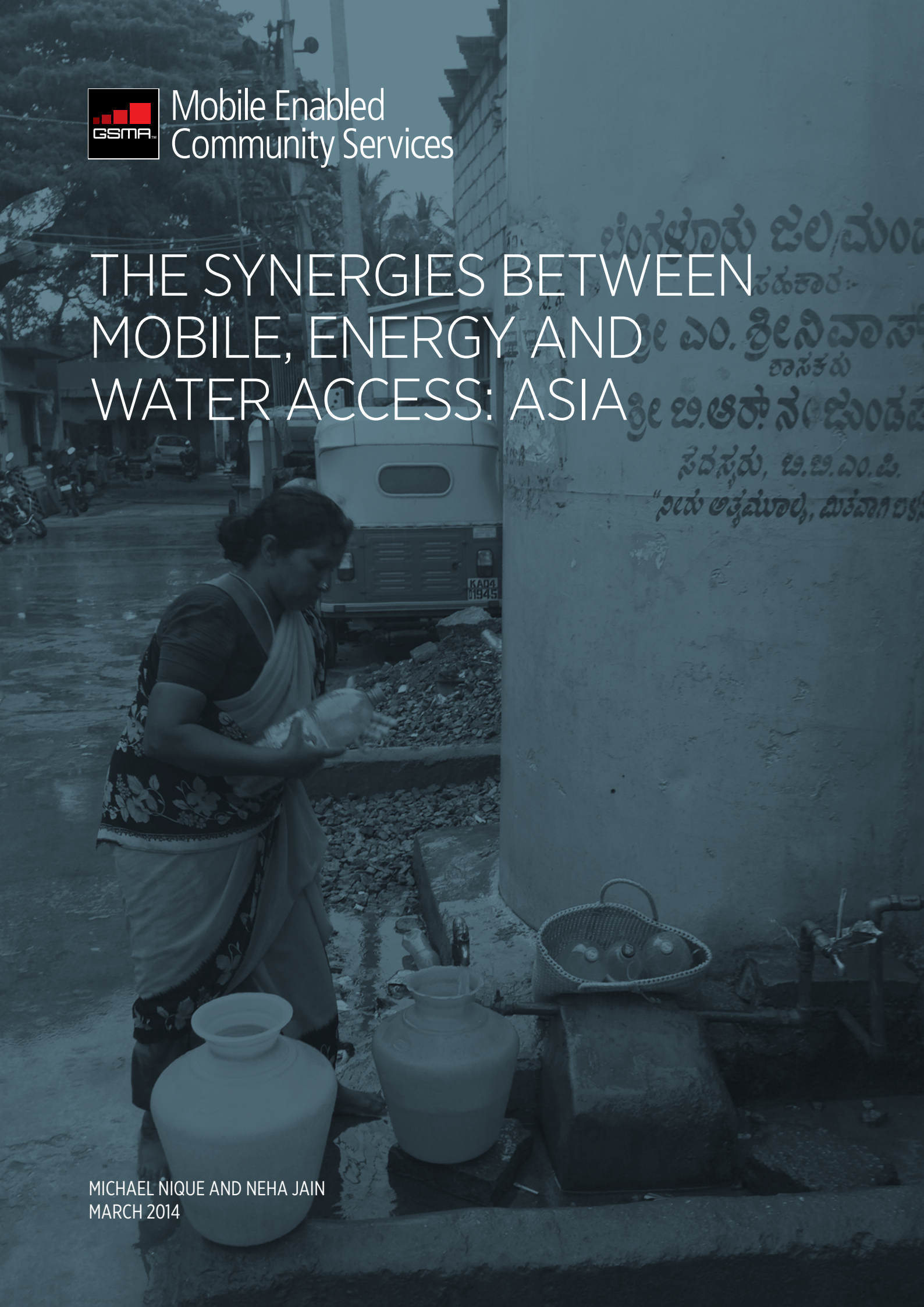


Mobile Enabled Community Services

THE SYNERGIES BETWEEN MOBILE, ENERGY AND WATER ACCESS: ASIA

MICHAEL NIQUE AND NEHA JAIN
MARCH 2014

FRONT COVER: A woman in an underserved neighbourhood in Bangalore collects water for her household. The unreliability of the water networks is a burden for customers as service is intermittent and the hours of service fluctuate greatly. NextDrop, a social enterprise based in Hubli, provides valuable information about water delivery in regions with intermittent supply.

UKaid
from the British people

CONTENTS

Executive Summary

Most of the world's population lives in Asia and current growth trend indicates that the region will include an additional 1 billion people in ten years, mostly in South Asia.[1] As the population growth is outpacing the expansion of the electricity grid and putting more pressure on already-overloaded piped water networks, providing universal access to electricity and clean water to this growing population is one of the biggest challenges of the 21st century.

With mobile networks covering more than four out of five persons in Asia, mobile infrastructure is now reaching places not currently served by the national electricity grid. In South Asia, where 75% of the population has access to electricity[2] and 87% of the population is covered by mobile networks, the gap between access to these two infrastructures has been widening since the early 2000s. The result is that operators have to rely on their own costly power sources (mainly diesel generators) and customers do not have the freedom to charge their phones in their home, but rely instead on third-party charging services. Regarding water access, even though good progress has been made in Asia in the past 20 years – the WHO & UNICEF Joint Monitoring Programme estimates that 85-95% of the Asian population has access to improved water – the reliability and sustainability of these water services are challenged and the quality of the water can be doubtful.

Despite limited access to infrastructure and important poverty levels, Asia holds more than 30% of the world's mobile connections.[3] In terms of unique mobile subscribers, there is still important room for growth as around 42% of the population are unique mobile subscribers.[4] Thanks to the increasing coverage and cheap handset and airtime availability, most of the rural and underserved communities can have access to a mobile handset, either by owning it or sharing it with the rest of the community.[5]

Leveraging the ubiquity of mobile networks and growing mobile ownership among underserved populations, the GSMA's Mobile Enabled Community Services Programme has been increasingly supporting the Asian mobile industry to help solve the challenges of extending and enhancing access to energy and water services. Beyond the language and cultural differences that can be a barrier for foreign entrepreneurs to conduct businesses in Asian countries, increasing opportunities exist for public and private parties to deliver energy or water services to underserved populations, based on five mobile channels: the telecom tower infrastructure, operators' distribution networks, machine-to-machine communication, mobile payments and mobile services (SMS, USSD, Apps). The context appears very different in Asia compared to Africa in terms of how entrepreneurs and public bodies currently leverage these channels. The mobile telecom infrastructure and mobile services have already made in-ways to support and increase utility coverage, whereas distribution channels, mobile financial services and GSM machine-to-machine connectivity are still in very early phases of development.

Following the publication of 'Sizing the Opportunity of Mobile to Support Energy and Water Access',[6] this document presents a more detailed approach to current mobile-enabled energy and water initiatives, business models and opportunities for the mobile sector.

Some of the key trends we identified in this report are as follows:

- From a piloting phase and small scale deployments, the number of mini-grids and/or energy hubs where a telecom tower serves as an anchor customer (Community Power from Mobile Model or CPM) are still in a limited phase of growth, due to the high capital needed to build sites and a long cost recovery. However, thanks to energy service companies' (ESCOs) increasing presence and maturity, the development of smart solutions to increase payment collection and load management for mini-grid operators, and an increasingly-appealing value proposition to outsource energy provision for tower asset owners under mid- to long-term partnerships, more elements become available to support the CPM model growth;

1. UN 2013 – The world population prospect: the 2012 revision.
2. World Bank 2013 – Energy Framework Tracker.
3. GSMA Intelligence 2013 on mobile connections, i.e. number of SIM cards.
4. GSMA Intelligence 2013 on Unique Subscriber penetration.
5. Myanmar is a unique example of poor handset availability and low mobile penetration.
6. http://www.gsma.com/mobilefordevelopment/sizing-the-opportunity-of-mobile-to-support-energy-and-water-access.

- As the population growth puts increasing pressure on urban utilities to deliver efficient and reliable services, mobile channels such as remote monitoring through mobile networks, mobile payments and/or mobile services can play a key role in increasing the flow of information between the service providers and their customers, while improving payment efficiency;
- Mobile-enabled energy Pay-As-You-Go (PAYG) solutions could prove disruptive as a model to acquire clean power systems for low-income populations that are unable to afford such solutions without external financial support. The success of such energy service companies (ESCOs) will be based on accessing working capital to finance these PAYG solutions and creating or partnering with efficient distributors to better reach and serve their customers;
- From digital currencies to mobile money services, the availability of mobile financial services for payments, financing and savings could be critical to unlock further potential of mobile-enabled utility services; while providing new tools to entrepreneurs and NGOs to serve unbanked populations, these services represent an important new revenue stream for mobile operators in highly-competitive environments;
- The development of low-cost smart meter solutions, either for remote water monitoring or smart prepaid meters for mini-grids, may represent one of the cornerstones of future decentralised energy and water services. Mobile can enable the collection of data on a category of the population left unserved from most modern services, while providing flexible tools for this population to afford these services.

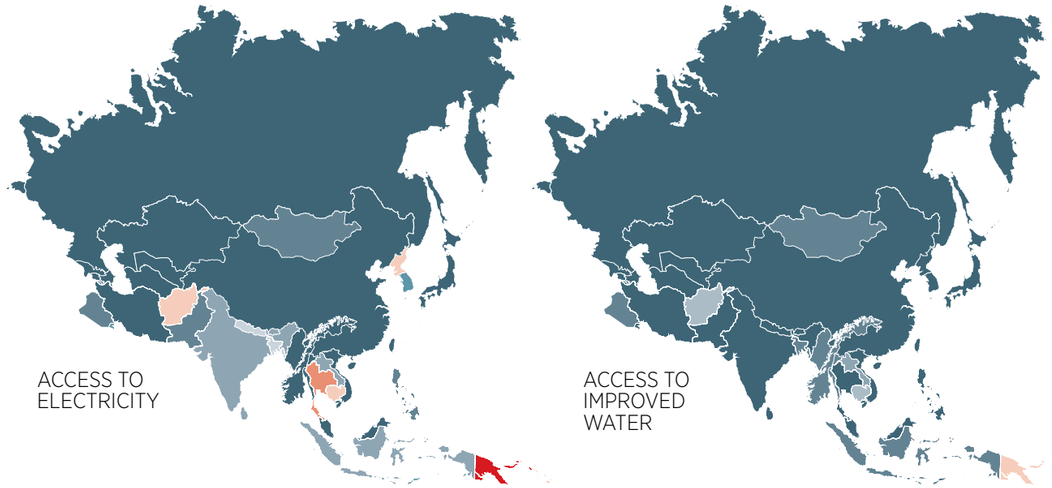
Key mobile-enabled community services trends

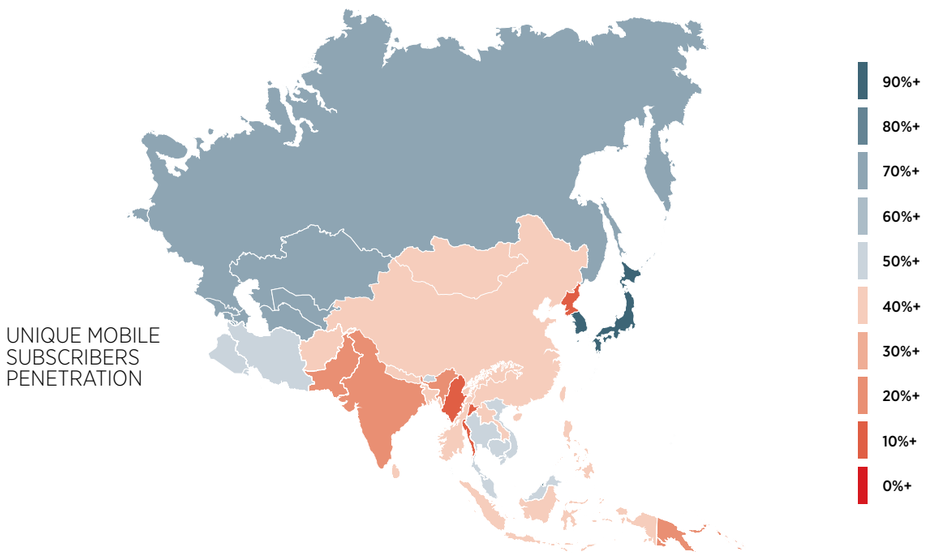
Telecom towers as anchor energy customers – With more than 100,000 off-grid telecom towers operating across Asia, mobile operators and tower companies can represent ideal clients to energy companies willing to build and provide access to electricity to off-grid populations through decentralised systems (mini-grids or energy hubs). The model of the telecom tower as an anchor client is still in an early stage of growth, especially in the South Asian region where population density is high and mini-grids have important potential across this region to connect millions to electricity services. As an example, OMC Power is quickly scaling its sites in India. In the OMC Power model, the power is provided to telecom towers, usually with multiple tenants, (using 10kW or more) and to the community through an energy hub close to the tower location, providing charging services and charged devices. The combination of the prepaid model to provide charged devices and the tower presence has been a factor of success, added to the huge demand by off-grid populations. With 11 sites as at the end of 2013, OMC Power estimates there is a potential to set up 20,000 plants with this model in India.

Unlocking the opportunity of mobile-enabled energy Pay-As-You-Go solutions – While the energy Pay-As-You-Go has started to gain traction in 2013 in East Africa, this model was still in a very nascent phase in the Asian region. Simpa Networks, which provides solar home systems (SHS) under a Solar as a Service model in India, allows its customers to top up for energy using scratch-cards and their mobile phones. At the end of 2013, it was one of very few companies providing such financing solutions with its SHS, leveraging the ubiquitous presence of mobile phones for pre-payments. With increased global awareness of the potential for such solutions and a better availability of mobile money services in many Asian countries, this is an important opportunity for growth of the PAYG model.

Increasing water utility efficiency – The fast-growing urban populations in many Asian cities are putting overwhelming pressure on water utilities. With ageing infrastructure, leakage problems and poor payments collection, the quality of the service of city utilities has decreased considerably and customers often have access to a limited and irregular service, especially for low-income customers. The work that companies such as NextDrop are doing with India's water utilities outlines the significant role that mobile can play in supporting water operations and improving services to customers. By building two-way communications between utilities and city residents through the use of mobile SMS and voice services, more real-time information can be available to the utility on the frequency and duration of services, aiming to provide a more equitable distribution to its customers.

Mobile, energy and water access: key information





KEY DATA ON ASIA (2013):

	ACCESS TO ELECTRICITY (%)	ACCESS TO IMPROVED WATER (%)	GSM POPULATION COVERAGE (%)
SOUTH ASIA	75	90	88
EAST ASIA AND PACIFIC	91	91	89

KEY FACTS ABOUT THE REGION:

255 MORE THAN MILLION
PEOPLE ARE COVERED BY MOBILE NETWORKS BUT ARE WITHOUT ACCESS TO ELECTRICITY IN THEIR HOME

94 MORE THAN MILLION
PEOPLE ARE ALSO COVERED BY MOBILE NETWORKS WITHOUT HAVING ACCESS TO IMPROVED WATER SOURCES

ALTHOUGH STRONG PROGRESS HAS BEEN MADE TO IMPROVE ACCESS TO CLEAN WATER, ONLY

28% AND 30%

OF THE POPULATION LIVING IN SOUTH ASIA AND SOUTH EASTERN ASIA RESPECTIVELY HAS ACCESS TO PIPED WATER NETWORKS

42%
OF THE ASIAN POPULATION ARE UNIQUE MOBILE PHONE SUBSCRIBERS

170 MORE THAN MILLION
OF THESE UNIQUE MOBILE SUBSCRIBERS LIVE OFF-GRID (MORE THAN 100 MILLION IN SOUTH ASIA)

IN SOUTH ASIA AND EAST ASIA AND PACIFIC, THERE WERE RESPECTIVELY

10.5 MORE THAN MILLION
3.3 AND MILLION

ACTIVE MOBILE MONEY ACCOUNTS. THE REGION REPRESENTS MORE THAN 27.6% OF ALL MOBILE MONEY DEPLOYMENTS GLOBALLY

The impact of mobile on utility services access

Mobile coverage in Asia was estimated to cover 88% of the population in 2012.[7] Over the past 10 years, important investments have been made by mobile operators and tower companies to extend coverage across territories; however, around 439 million people remained without mobile coverage in 2013, preventing them from accessing the benefits of mobile services. Overall, there were more than 1.7 billion unique subscribers in Asia[8] in mid-2013, representing 42% of unique mobile subscribers in the region; South Asia had the lowest unique subscriber penetration at 30%.[9] If mobile growth rates in Asia have been slowing down over the past five years, they remain above the global growth rate (>6% of unique subscribers growth per year) and there still is important room for growth providing the extension of mobile coverage to rural areas.

Mobile networks have become the predominant infrastructure in many rural areas, beyond the reach of the national electricity grid (costly to deploy and/or facing natural terrain challenges) and piped water networks (see Figure 1):

- the electrification rate was estimated at 83%[10] of the overall population in 2010, 96% for the urban inhabitants and 74% for the rural dwellers;
- the proportion of the Asian population with access to improved water has increased from 74% to 91% between 1990 and 2010, but high inequalities remain.[11]
- access to sanitation varies according to sub-regions in Asia, but the proportion of the population with access to improved sanitation remains low. If good progress has been made in Eastern Asia, where sanitation coverage increased from 27% in 1990 to 67% in 2011, things remain problematic in South Asia where only 41% of the population has access to sanitation.[12]

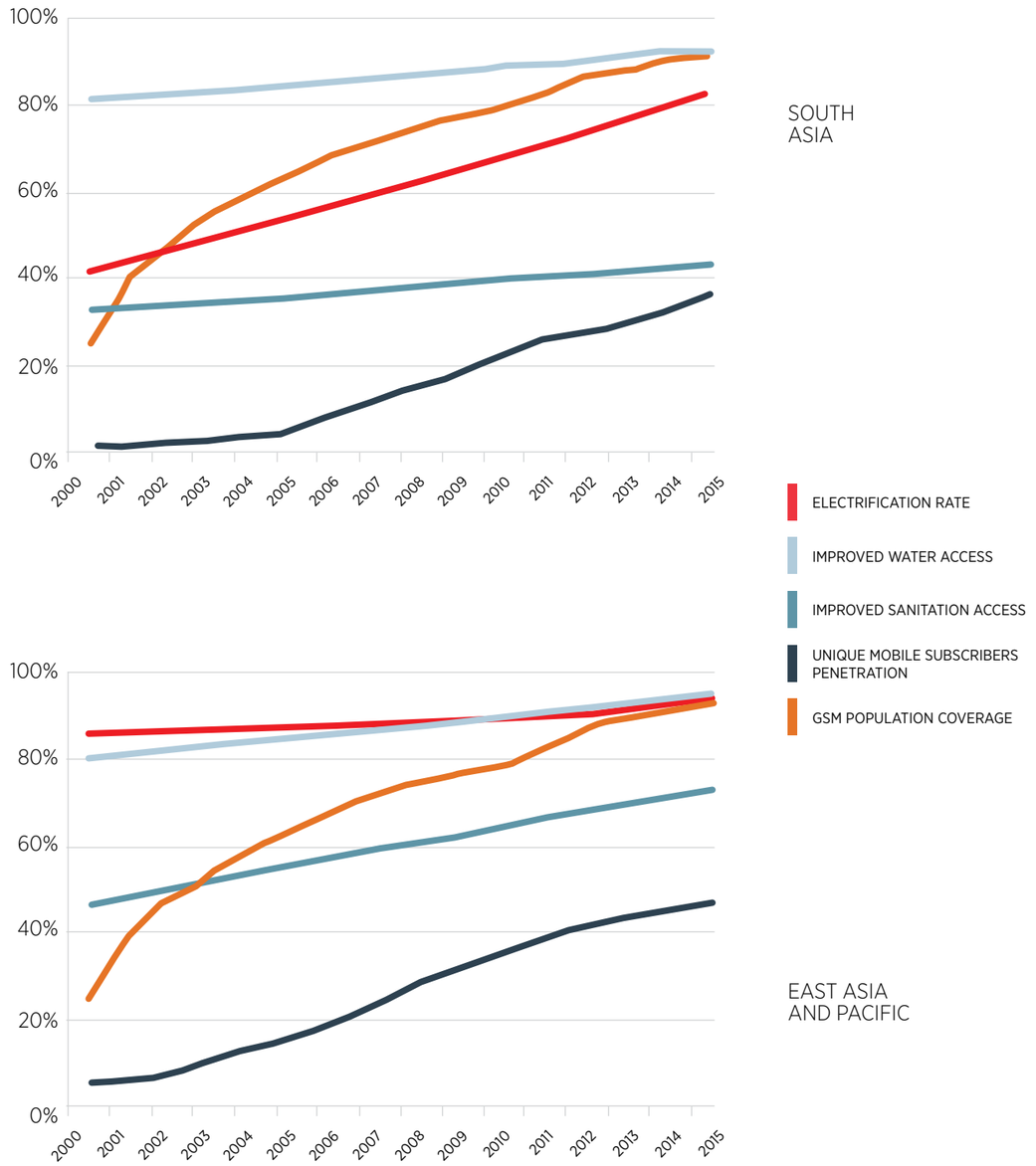
The gap has especially widened between access to mobile and access to electricity as we estimate that more than 255 million people have access to mobile first; the majority of this off-grid population (175 million) lives in South Asia (see Appendix 1 for a map of Asia for energy and water addressable markets). In terms of actual mobile subscribers living off-grid, the GSMA estimates that more than 100 million people are mobile subscribers but do not have access to electricity in their home; this represents 15% of the mobile base in South Asia and 3% in East Asia and Pacific.

From a water access perspective, the strong improvements on clean water coverage are being challenged by the water infrastructure and services offering poor access to clean water especially in underserved areas. In peri-urban and urban neighbourhoods, a water crisis looms triggered by the frequent shortages of piped water services. As mobile networks have become ubiquitous in most Asian cities, mobile has a strong role to play to support current water services which can be plagued by leakages, theft, poor water collection and endemic inefficiencies.

7. GSMA Mobile Enabled Community Services 2013.
8. GSMAi 2013 on Unique Subscriber.
9. Ibid.
10. International Energy Agency 2012
11. WHO & UNICEF Joint Monitoring Programme (JMP)
12. Ibid.

FIGURE 1

MOBILE ACCESS VERSUS ELECTRICITY, WATER AND SANITATION ACCESS IN 2000-2015 **(%, ACTUAL AND FORECASTED)**[13]



13. Source: GSMA

Using mobile channels to support energy and water access

Energy Service Companies (ESCOs) and Water Service Providers (WSPs), operating either as for-profit or non-profit companies, have been trialling mobile technologies as part of their service delivery or product for a few years in several South Asian and East Asian markets (See Appendix 2 for a list of mobile-enabled energy and water services). The impact and footprint of such innovative utility services has for now been limited, due to regulatory barriers, a lack of service provider maturity or a limited access to finance. However, as the potential of mobile becomes clearer to service providers, and as mobile operators begin to partner with such innovative micro-utilities, Asian markets are becoming full of opportunities to pilot new models and launch new commercial services.

Based on the current footprint and maturity of the mobile industry, the GSMA Mobile Enabled Community Services (MECS) Programme envisions this addressable population can benefit from the presence of mobile networks and access to mobile devices, services and technology through five channels:

1. Mobile infrastructure – leveraging the presence of telecom towers in off-grid environments to support rural electrification efforts;
2. Mobile Network Operator (MNO) distribution and mobile money agent networks – leveraging the footprint and brand of mobile operators to reach underserved customers;
3. Machine-to-machine connectivity – enabling the remote monitoring and Pay-As-You-Go capacity of decentralised utility systems;
4. Mobile payments – providing financing and affordable solutions to low income populations;
5. Mobile services (Voice, SMS, USSD, Applications) – leveraging increased mobile phone ownership to collect/disseminate critical information on utility services and/or supply chain management.

The role of mobile for improved energy and water access can be summarised in Table 1.

TABLE 1

IMPACT OF MOBILE CHANNELS TO IMPROVE ACCESS TO ENERGY AND WATER IN ASIA[14]

MOBILE CHANNEL	MATURITY OF CHANNEL IN ASIA	ENERGY	WATER
MOBILE INFRASTRUCTURE	Early Stage - commercial deployments have started in India, with promising results for larger impact.	Increase sustainability of mini-grids and energy hubs by securing stable revenues from mobile operators/tower companies while providing power for consumptive and productive use to the community.	ESCOs could provide additional power to the community for water pumping, water purification or for irrigation purpose.
MNO DISTRIBUTION NETWORK	No partnerships between ESCOs/WSPs and mobile operators have been reported to date.	Improve distribution and availability of off-grid solutions (ex. home solar systems)	Improve distribution and availability of water purification systems and other water-related products.
M2M CONNECTIVITY	Gaining traction – ESCOs operating mini-grids have begun to deploy low-cost meters at the household level using short range wireless technologies; however one of the first trials for GSM-enabled Home Solar System should start in 2014 in Cambodia with Kamworks, thanks to GSMA MECS funding.	Real time monitoring of energy infrastructure/product, better product design through usage monitoring, enable Pay-As-You-Go capacity.	Real time information transfer on hand pump or kiosk operations leading to improved maintenance and knowledge on communities water usage, enabling the Pay-As-You-Go capacity.
MOBILE PAYMENTS	Improving – using mobile for utility payments happen in cities but have been limited for smaller scale projects in rural locations	Provide financing solution and improve affordability of clean energy products by enabling small incremental payments.	Ability to pay for water services by small installments tailored to customers income, improve payment collection, offer innovative financial solutions such as micro-insurance to reduce water insecurity.
MOBILE SERVICES	Improving – services such as SMS, USSD or Apps can be already leveraged to increase information disseminated or collected from mobile phones. Applications of mobile services to increase supply chain management are currently under development but could be widely applicable to most markets.	Entrepreneurs can leverage mobile to optimise supply chain operations and empower local agents.	Enable agents/communities to report for service/infrastructure operations, optimise supply chain operations to timely deliver products such as spare parts.

14. Source: GSMA

Mobile infrastructure

Leveraging telecom towers to extend decentralised energy access

SUMMARY: MOBILE INFRASTRUCTURE CHANNEL

COMMERCIAL ENERGY DEPLOYMENTS USING THE TOWER MODEL ACROSS INDIA AND BEYOND: Kilowatt-scale mini-grids and energy hubs have an important role to play in electrifying Asian rural inhabitants and supporting income-generating activities. Early-phase commercial deployments are already happening in India; these deployments show profitable results, sending a good message to the industry for more partnerships between tower companies/mobile operators and ESCOs to build sustainable decentralised energy systems. With rising diesel costs, the increased maturity of ESCOs and the availability of mobile technologies for better payment collections and load management, there is a greater opportunity for ESCOs to partner with operators; however, in order to unlock this opportunity, operators need to commit to long term partnerships and include the energy agenda at the centre of their rural growth strategy. Pilots in other Asian countries should happen in 2014.

The concept of leveraging the large presence of off-grid telecom towers to support rural electrification efforts is more advanced in Asia than in Africa. The outsourcing of tower infrastructure to third-party companies, such as in India, has served as an enabler for power outsourcing and trust in third-party energy providers. Most of the pilots and early commercial deployments are therefore happening in India today (see Table 2) but new sites should be built in 2014, especially in South Asia.

Leveraging the presence of off-grid telecom towers could lead to a symbiotic relationship between the mobile operator or tower company, the energy service company operating a mini-grid or an energy hub and the community:

- most of the Asian off-grid mobile towers are running on diesel generators (incurring high operating expenses and theft of diesel for operators); the mobile operator or tower company could reduce its operating expenditures in the long term by partnering with an ESCO and act as an anchor load in the mini-grid;
- the ESCO secures a mid- to long-term partnership with an anchor client (e.g. the telecom tower) increasing its financial sustainability;
- the community benefits from mini-grid or energy hub by gaining access to basic and productive energy services for their households, reducing dependence on fossil fuels, obtaining access to power for productive use for local SMEs and providing an opportunity to have better access to clean water.

TABLE 2
PROJECTS LEVERAGING MOBILE TOWERS TO ELECTRIFY RURAL LOCATIONS[15]

PROJECTS	CONCEPT	LOCATION	MODEL	STATUS
ROCKEFELLER SPEED PROJECT	SPEED aims to leverage the power needs of telecom towers in electricity-starved regions as an anchor load to create a cleaner power infrastructure. It has partnered with ESCOs (DESI Power, Gram Power and Applied Solar Technology) to support the implementation of mini-grids.	India	Mini-grid	Early phase of development (2-4 sites built or in development)
OMC POWER	OMC Power builds, operates and owns micropower plants, providing power to telecom towers on a kilowatt-hour-consumed basis and to the local community through a local entrepreneur that rents out lanterns, power boxes, and other power utility products.	India	Energy hub	11 power plants installed in Uttar Pradesh. Planning to have 100 plants built by April 2014
GRAMEENPHONE	At one of its sites in rural Bangladesh, Grameenphone is providing power to the telecom tower and to the local community for lighting, phone charging, and a community center equipped with computers. In 2014, Emergence BioEnergy (EBI), in partnership with Grameenphone and BRAC Dairy, will test EBI's Stirling generator to produce electricity from agricultural waste for telecom towers and surrounding communities, thanks to GSMA MECS funding.	Bangladesh	Mini-grid	CSR initiative – 1 site in operation and new sites in planning

As mentioned in Table 2, two models of energy provision are available to ESCOs partnering with a tower company:

1. Mini-grid model – the ESCO provides power to the telecom tower (the power plant can be adjacent to the site or close) and builds power lines to connect the rest of the community (households and/or businesses). This model required a high population density to minimise distribution network costs and power losses.
2. Energy hub model – the ESCO provides power to the telecom tower (adjacent to site) and to an energy hub located next to the telecom tower; this hub becomes the centre of energy related activities for the community, able to charge devices (e.g. mobile phone, batteries), powering agri-processing systems and health related devices (e.g. vaccine fridge).

The energy hub model implemented by OMC Power at 11 sites has the advantage of limiting capital expenditure by substituting the power lines connecting each household in a mini-grid system with an energy delivery model (or hub model) where the distribution of charged energy devices (lanterns, batteries, etc.) is ensured by local agents.

One of the challenges for mini-grid operators is to provide affordable tariffs to their customers while minimising operational expenditures and optimising cost recovery. Even though tariffs can be equal or lower than what a household and/or business would spend on energy, these decentralised mini-grid tariffs are above their centralised grid counterparts and it is unlikely that grid parity will be reached in the near future. The gap between grid and mini-grid tariffs has, however, consistently decreased over the past years. For example, part of the Rockefeller Foundation SPEED project in India, electricity tariffs to micro enterprises are ranging from INR12-15 (US$0.2-0.25)/kWh while for households tariffs are around INR9 (US$0.15)/kWh. This is still higher than electricity grid prices; in Uttar Pradesh, the tariff for rural customers is close to INR2 (US$0.4)/kWh.[16]

15. Source: GSMA
16. http://www.indianexpress.com/news/up-to-hike-power-tariff-rural-consumers-will-be-worst-hit/1123579/

More than 100,000 off-grid towers in Asia and Pacific

In 2012, the GSMA Green Power for Mobile programme estimated there were more than 100,000 telecom towers operating off-grid in South Asia and East Asia and Pacific, with more than 70,000 off-grid towers in India alone (see Table 3 for more information on tower infrastructure in six Asian countries). Grid unreliability in Asia represents an important challenge for businesses, who needs back-up generators to ensure power is available. Looking for cost optimisation and long-term savings, while reducing their carbon footprint, operators are adopting renewable energy solutions for their off-grid sites. However, these green sites still represent a fraction of the total number of sites (1-2%) and progress remains slow. In Nepal however, more than 12% of mobile operator Ncell's total sites rely on renewable solutions; the mountainous geography of the country makes it extremely difficult to provide fuel supply to off-grid sites, hence justifying the high proportion of green solutions.

TABLE 3
TOWER INFRASTRUCTURE OVERVIEW DATA IN SIX ASIAN COUNTRIES, 2013[17]

COUNTRY	TOTAL NUMBER OF TOWERS	TOWERS WITH UNRELIABLE GRID ACCESS	OFF-GRID TOWERS	GREEN SITES	TOWER COMPANIES' OWNERSHIP
INDIA[18]	440,000	200,000	70,000	Less than 1% of total sites	More than 80% shared towers
BANGLADESH	25,858	3,340	282	Less than 1% of total sites	No established tower company
INDONESIA[19]	90,699	3,834	4,930	~5% of total sites (87% solar)	More than 25,000 towers
AFGHANISTAN[20]	5,292	2,176	1,283	Mostly relies on DG solutions	No tower company
PAKISTAN[21]	33,160	5,636	1,706	Less than 2% of the sites have converted to green sites	No tower company
NEPAL	~2,300 (only Ncell)	Majority of sites		~12% of total (262 solar sites)	No tower company

Power outsourcing models

There are three main energy outsourcing models applicable in the telecom industry:[22]

1. monthly flat fee model;
2. power purchase agreement (PPA) model;
3. energy savings agreement (ESA) model.

17. Source: GSMA Green Power for Mobile
18. http://articles.economictimes.indiatimes.com/2013-09-28/news/42481584_1_telecom-operators-tower-unit-telecom-companies.
19. http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/04/GPM-Market-Analysis-Indonesia_April2013.pdf.
20. http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/11/GPM_Pakistan_Afghanistan_Market-Analysis_Oct-2013.pdf.
21. Ibid.
22. Best Practice Procurement Guide East Africa 2013 – GSMA Green Power for Mobile

The OPEX model enables the operators to reduce energy OPEX and dependence on diesel generators without having to invest the capital for the renewable energy solution. And also, outsourcing power generation will help the MNO/Tower Company eliminate the challenges associated with power management and increase the focus on core activities.

See GSMA Green Power for Mobile **"Best Practice Procurement Guide"**[23] for more information on energy outsourcing models.

CASE STUDY
DESI POWER IN INDIA

DESI Power started building a 50kW mini-grid in Baharbari in the state of Bihar in 2001, based on gasification of rice husk briquettes, as the raw material was abundantly available in neighbouring villages. By 2004, villagers could access electricity in their household for a fixed monthly rental fee. DESI then setup similar gasifier-based power plants with capacity over 60kW in the Araria district in 2008. Thanks to its partnership with the Rockefeller Foundation SPEED Project, DESI Power started piloting telecom towers as anchor tenants at four of its plants in Araria in June 2010. According to early results collected in 2011, this model allowed mobile operators or tower companies to reduce their operational expense and diesel generators (DG) runtimes; in the case of the Bharti Infratel-owned tower in Gaiyari, this saving in the number of DG running hours translated into 1.8 litres for every hour of DG runtime. HTTP://WWW.DESIPOWER.COM/

CASE STUDY
GRAM POWER IN INDIA

Gram Power is building smart mini-grids with 24/7 access in the Indian states of Uttar Pradesh and Rajasthan. After deploying its first system in March 2012, Gram Power had 27 live systems, serving around 7,000 people by August 2013. Each household is equipped with two lights and a prepaid meter which displays the credit remaining on each user's accounts (in rupees) and the number of hours remaining based on household current power consumption. Outdoor lighting is also provided to increase community social activities. In order to pay for energy consumption, a local entrepreneur purchases bulk energy credit from Gram Power and then sells it to local consumers using Gram Power's prepaid energy selling device – it is a small 'wallet' using an optical connection to transfer money wirelessly to the prepaid meters installed in every house. In addition to finding new sites to build its mini-grids in Rajasthan and Uttar Pradesh, Gram is also looking at licensing its smart technology to other ESCOs. HTTP://WWW.GRAMPOWER.COM/

CASE STUDY
GHAM POWER IN NEPAL

In Nepal, power distribution through mini-grids and off-grid solutions are highly practical, since expanding the national grid to remote areas and transporting fossil fuels are prohibitively expensive. With 56% of the population having access to electricity and those connected experiencing regular rolling black-outs, there is a need for alternative solutions. Gham Power builds solar mini-grids (10-20kW) for hospitals, factories and businesses, and its goal is to own the last mile of telecom connectivity, providing power to the telecom tower and the community. Gham Power also targets rural mini-grids, especially for income-generating activities providing services for communication, healthcare, agriculture and mobile banking. As of November 2013, Gham Power had installed several MW of business mini-grids and is developing a smart meter solution that could be coupled to mobile payments. In Nepal, where the influx of remittance from people working abroad is high, this could increase the ability to pay for energy for the local off-grid and low-income populations. HTTP://GHAMPOWER.COM/

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

Mobile distribution networks

Leveraging the footprint of Asian mobile operators to reach rural populations

SUMMARY: MOBILE DISTRIBUTION NETWORKS

INCREASING PARTNERSHIPS BETWEEN MOBILE OPERATORS AND VENDORS – There are currently no active partnerships between mobile operators and energy or water entrepreneurs in Asia. Based on the impact such distribution or marketing partnerships could have to help bridge the last mile distribution gap, and the increase of revenues and customer retention for operators, strong opportunities exist in most Asian countries to provide energy or water solutions via the operators' distribution channel.

Poverty is a persistent and widespread problem in Asia with the bulk of the poor in most countries living in rural areas. In South Asia, the percentage of the poor living in rural areas has been estimated to be 82% in Bangladesh, 78% in India and 73% in Pakistan.[24] The poor conditions of road networks, limited access to electricity and challenging geographies make goods distribution highly challenging. For young energy or water entrepreneurs who are willing to reach underserved communities often living far from urban centres, the lack of knowledge on how to build efficient local distribution networks also makes it difficult to reach economic sustainability. In order to reach scale, partnering with institutions having established their own distribution networks is ideal:

- Fast moving consumer goods – international companies, such as Coca-Cola or Unilever, have developed their own network to quickly move small quantities of their products across nations with difficult road conditions.
- Distribution specialists – in recent years, for-profit and non-profit specialists have emerged to provide life-changing products to people living in poverty and out of the formal and affordable distribution networks. These companies distributing energy and/or water solutions include Dharma Life, Frontier Markets, and Onergy in India, BRAC in Bangladesh, SRE Solutions in Pakistan and Kopernik in Indonesia (and other countries).
- Mobile operators – mobile operators are relying on a formal and informal airtime agents and distribution networks to provide airtime to its customers. These extensive distribution networks can bridge the last-mile divide between cities and rural populations. Even though no formal partnerships have been developed to date, strong opportunities exist to build distribution or marketing relationships between operators and ESCOs or WSPs.

Looking at Africa, several partnerships already exist between ESCOs and mobile operators, where ESCOs can leverage their logistics, warehousing and distribution channels via their dealer network. These distribution partnerships can also include marketing activities, such as product co-branding, and above- and below-the-line marketing.

24. Rural Development and Poverty in South Asia, Syed Naseem – UNESCAP.

Machine-to-machine connectivity

SUMMARY: M2M CONNECTIVITY

PILOT M2M-BASED OFF-GRID SOLUTIONS – the integration of low-cost GSM-enabled meters within households or water systems could be one of the cornerstones to the development of modern mobile enhanced energy and water services in the developing world. Whereas commercial deployments of M2M-connected home solar systems are already underway in Africa, no such systems are currently available across Asia. More pilots should occur in 2014 leading to a better understanding of these types of solutions in Asia, starting with Kamworks in Cambodia which will pilot a financed purchase model using GSM connectivity.

INTEGRATION OF WIRELESS MESH NETWORKS IN MINI-GRIDS – further piloting is needed to better understand the impact and challenges around wireless mesh networks' integration in mini-grid architecture, and how coupling this design to GSM connectivity could create the next generation of smart mini-grids that are able to monitor consumption efficiently, dynamically allocate loads and wirelessly transfer credit to households meter. The standardisation of such smart solutions could better support current and upcoming mini-grids.

THE POTENTIAL OF SMART HAND PUMPS – if smart hand pumps offer great potential for increasing transparency and information on water availability in Asia, there is a need to develop and pilot low cost and easily-repairable smart sensors that could be attached to rural water pumps and transmit information over the GSM networks.

The addition of GSM connectivity to utility systems in urban and rural areas could enhance services and reduce non-technical losses through the ability to remotely monitor unit/network operations and customer consumption or detect impending failure and theft. GSM connectivity also enables the Pay-As-You-Go (PAYG) capacity, as an energy or water system can be monitored over mobile networks and switched on/off remotely according to customer credit. The prepaid PAYG model is especially attractive when servicing underserved customers with low access to capital and financing options and who can't afford to buy modern energy products or pay for the connection to piped water networks.

The role of M2M in cities

An estimated 3.5 billion people now live in cities and this growth is overwhelmingly concentrated in the developing world. Up to 1 billion live in slums, usually with little access to water or sanitation. As it is forecast that the population of cities in developing countries will increase by 3 billion people by 2050, mainly in informal settlements[25], the urban migration trend is already putting increasing pressure on urban utility infrastructures as well as vital services such as transportation, healthcare, education and public safety. A systemic approach is needed to make existing infrastructure more resilient and better able to react by increasing the flow of information that could be channelled city-wide.

25. World Bank 2013 – http://unsdsn.org/files/2013/04/November-2013-Sustainable-Cities-Presentation.pdf

An important proportion of the generated electricity is currently lost through non-technical losses. Smart grids could play an important role to improve reliability, availability and efficiency of current networks. Placing sensors on distribution networks and meters in the power grid would allow irregularities to be traced more efficiently. Remote disconnection on non-payment by consumers and automatic alarms when customers engage in theft will enable utilities to stop pilferage and avoid unsafe situations and accidents. In addition, optimal asset utilisation can be planned with online data of overloading transformers and network, which can help reduce and prevent failures.[26]

CASE STUDY
SMART GRIDS IN INDIA

In India, smart grids can help increase efficiency of power grids. According to the India Central Electricity Authority, total Transmission and Distribution losses during 2010-11 was about 23.9% while aggregate technical and commercial loss was about 16.1%. This includes both theft and technical losses. Further, for every INR1 of power sold, the utilities are able to collect back only INR0.80. The rest is either not collected or is lost due to Aggregate Technical and Commercial Losses. Reducing power theft and increasing usage efficiency via smart meters could also save enough electricity in India to power more than 10 million homes. For example, in Delhi, NDPL, supplying electricity to ~5 million inhabitants, reduced its non-technical losses from 53% to 15% between 2002 and 2009. 90% of these savings were linked to the installation of 30,000 smart meters allowing the supplier to remotely read and monitor the consumption of its largest customers. Part of the Restructured Accelerated Power Development and Reform Programme, India's central government will direct US$10 billion to grid modernisation. India smart-grid roadmap calls for the availability of an indigenous low cost smart meter by 2014.

Water scarcity is also an increasing burden for cities and utilities balancing between improving services, while struggling to reduce non-revenue water (NRW). In India, residents in 22 out of 32 major cities have to deal with daily shortages.[27] The New Delhi Jal Board (DJB) supplies just over 30 million m^3 of water per day, but only 17 million m^3 actually reaches consumers due to infrastructure problems, such as leaking pipes.

Several water utilities have been moving ahead on projects to upgrade their water systems and reduce non-revenue water, through the implementation of advanced meters, mobile collection equipment and software. For example in Delhi, the DJB, is deploying 120,000 advanced meters, 40,000 standard meters, mobile collection equipment and software. Upon completion in March 2014, this project will be India's largest mobile advanced metering system.

Smart mini-grids: remote monitoring to improve operations and maintenance

Mini-grids have an important role to play in Asia to increase rural electrification. Leveraging mobile tools to improve operations and load management, reduce non-technical losses and improve payment collection and affordability to end-users, could support mini-grid development at scale. The smart meters that are beginning to be deployed in developed, and some developing, countries are however not tailored for distributed energy systems; they are expensive (~US$150) and do not offer functionality that serves mini-grid well. Modern prepaid meters already exist;

However these types of prepaid meters still need the intervention of an agent to transfer the credit to the meters, through a mobile wireless wallet, or of the customers who can input a code on a keypad attached to the meter. Such meters are not GSM connected and cannot transfer real-time information about household consumption. One of the barriers to leverage GSM connectivity is related to its cost. Embedding a GSM component in each household meter is proving to be expensive for ESCOs, as prices of GSM modules are in the range of US$8-12; this does not include the extra cost of mobile subscriptions and data communications. If including a GSM module within the mini-grid is still highly relevant for long-haul communication of aggregated data, other shorter-range wireless technologies are available to transfer low quantities of data at the mini-grid level, between households and the central power plant.

26. http://www.pwc.in/en_IN/in/assets/pdfs/publications/2013/m2m-technologies.pdf.
27. Ibid.

For example, Gram Power is installing smart meters in each household connected to its mini-grid – these meters can wirelessly transfer information to a local entrepreneur's mobile wallet such as household consumption and transfer new credit on the meter. As used by entrepreneurs Devergy in Africa and Earthspark in Haiti, the IEEE 802.15.4 (e.g. ZigBee) wireless standard can create wireless mesh networks at the mini-grid level and can be coupled to GSM for long-range communication. Available at a lower cost compared to GSM, technologies such as ZigBee (achieving transmission distance of 10-100m) can be used in mini-grid environments where meters require low data rate exchange, long battery life and secure networking.

CASE STUDY
HUSK POWER SYSTEM IN INDIA

In India, Husk Power System (HPS) installs small scale biomass-based mini-grids (rice husk, mustard stems, corn cobs, etc.) ranging from 25kW to 100kW, wiring villages and hamlets of up to 4,000 people to deliver electricity on a prepaid basis. A typical plant can serve two to four villages within a radius of 1.5 km, depending on their size and population. As of 2013, HPS managed more than 90 plants providing electricity to more than 300,000 people spread across 350 villages. The plant employs local villagers who are trained by HPS to conduct plant operations. HPS plants may provide electricity for up to 14-16 hours each day. To power two lights and a mobile charging station for seven hours, HPS charges an average of US$2-2.50 per household per month on a prepaid basis. According to HPS, this offers consumer savings of at least 30% over competing kerosene and diesel energy sources (annual savings for consumers of up to US$50). HPS connects its plants with a GSM meter, allowing real-time monitoring of power generation and operations. Custom code-based prepaid meters allow the company to ensure that consumers utilise no more than the wattage they have paid for; low-cost transformers ensure consistent voltage flow and theft-free distribution. To replicate and scale-up its business model, HPS has introduced a franchise model whereby it will partner with other local players to roll out its plants.
HTTP://WWW.HUSKPOWERSYSTEMS.COM/

Off-grid solutions: connecting solar systems to collect data on system and customer data

With increased sales of solar lanterns and home solar systems, the addition of a GSM component to the larger systems, which can remain unaffordable to low-income populations, could catalyse sales of off-grid solutions while providing new sustainability models for low-income consumers. Coupling remote monitoring and control to mobile prepayment appears as a disruptive model to overcome the affordability barrier that exists for low-income populations. Without financial external support, only a fraction of the poor population can afford modern home solar systems. GSM-enabled home energy systems have not gained much traction due to limited availability in Asia, however current pilots will help understand the potential of this model in South and East Asia, and could impact soon millions of lives.

Connecting off-grid solutions through GSM is the most seamless solution for PAYG, as remote monitoring and credit updates on the solar system's meter can be done over the air, without an agent or user intervention. Service providers receive real-time information via SMS about the unit operations (power consumption, battery charge/discharge etc.), customers payments (frequency of payments, credit) and any maintenance/theft issues. ESCOs are also building extensive databases on unit operations, which could be then analysed to offer better products and services from a user-centric perspective.

In the general PAYG model, customers usually pay a deposit, a fraction of the unit price (~10%) to get possession of a home solar system. After this initial down payment, customers pay for their energy consumption by small increments daily, weekly or more flexibly according to the model and technology used by the energy service company. The instalments are usually on par or less than what users currently pay for their kerosene expenditure that is used for lighting and phone charging.

Two models are currently used by entrepreneurs operating in Africa providing PAYG schemes:

1. Lease-to-own or financed purchase – the ESCO provides a micro-financed solution to its customers, where users pay for the unit in small installments. Once they repay the full amount, they fully own their device and can use it freely (if the unit is GSM-enabled, the

switch will be permanently unlocked without any agent intervention). Customers have then the choice to continue using this unit or benefit from preferential tariffs to upgrade to a new product with larger capacity and improved efficiency. Products usually come with a warranty of 1-3 years according to contract terms.

2. Perpetual lease or 'energy as a service' – the ESCO provides a service to its customers rather than a product as a stand-alone and the home solar system remains the property of the service provider. ESCO charges an installation fee and customers purchase energy in small increments (the amount purchased varies according to solution size). Energy prices are usually lower than in the lease-to-own model as the solar system or other products provided by the ESCO (more lights, TV, fridge etc.) remains its property. Full maintenance is also ensured under the service agreement with the end-user.

CASE STUDY
KAMWORKS IN CAMBODIA

The off-grid population in Cambodia relies heavily on kerosene for lighting and batteries for household appliances (radios, TVs, etc.). Since 2011, Kamworks has installed 12,000 systems in Cambodia, replacing kerosene usage and empowering rural off grid customers. Part of a new programme called the Cambodian SUN programme, solar home systems are packaged with a microloan to facilitate ownership and increase affordability. For this project, Kamworks collaborated with DuPont, Planet Finance and MFIs like VisionFund, VDA and Maxima. The 100W systems use thin-film technology (this capacity is larger than the average Home Solar System in Africa due to several appliances being owned by Cambodian families; most of them have TVs). The system features four LED lights and a 100Ah battery. Part of its upcoming activities and to complement its work with local MFIs, Kamworks is developing a Pay-As-You-Go version of its home solar systems – their PAYG solution will embed a GSM chipset and will allow customers to pay for energy using their mobile phones. With support from the GSMA MECS Innovation Fund, Kamworks will test rental services for solar home systems in Cambodia, with WING as the mobile money operator partner and the operator CamGSM. This grant will help trial the M2M technology, test the value proposition and study the payment behaviour of Cambodian customers.

HTTP://WWW.KAMWORKS.COM/

Mobile monitoring solutions to improve operations and availability of water services

Large inequalities exist with water access in Asia, as the richest countries and wealthiest citizens are more likely to have better water supplies and governments better prepared for natural disasters. With limited access to piped water to the home, South Asia water coverage remains highly limited (See Figure 2).

Hand pump supply is a major contributor to rural water services and will continue to be so for the foreseeable future. In India, the largest groundwater user in the world, it is estimated that 85% of drinking water is groundwater-dependent.[28] There is, however, a high probability of failures of water systems in rural Asia due to the poor nature of support and maintenance.

As presented below, mobile technologies could be leveraged to improve maintenance and sustainability of operations through the inclusion of smart sensors on a water system.

Smart GSM meters to reduce hand pump failures

Developing low-cost smart meters for hand pump monitoring is one of the key areas of mobile innovation that is being applied to water services. Few solutions are available for now and most of them are currently being tested on the field – more impact data of the use of such technology on improved water access and maintenance should be released in the coming months, from trials in Africa by Portland State University, the Univesity of Oxford and WellDone.

28. World Bank, 2010

The core concept of a smart hand pump is to embed a micro-controller in the handle of the pump or attached to the pump head, with GSM connectivity coupled to a flow meter or an accelerometer which detects handle movements; these different solutions can indicate the amount of water fetched by the community or by individuals and when the pump is activated or needs maintenance. Information is regularly sent via SMS to a central database which builds up a history of community water usage in terms of volume, frequency of use or pump failures.

FIGURE 2
WATER ACCESS OVERVIEW IN ASIA BETWEEN 1990 **AND** 2010[29]

29. Source: JMP 2013

Smart sensors to monitor water kiosk operations

The water kiosk model is more efficient and able to generate profits when located at the heart of a dense community, i.e. peri-urban, urban or rural dense locations. According to Safe Water Network, approaches that rely on capital recovery for water kiosks are generally unrealistic in communities with populations of fewer than 5,000 people, if prices are to remain affordable. In India, many of the slum residents spend several hours a day acquiring water for basic daily needs like drinking, washing and cooking. The cumbersome and time-consuming process often involves waiting in long lines for sporadic trips from government-sponsored water tankers, and long walks with heavy containers to water sources, with people running the risk that these sources may be unclean.

In order to improve operations and optimise services, companies such as Sarvajal and Safe Water Network are implementing water kiosks in India, equipping their kiosks with a series of sensors coupled to a GSM meter that is able to transmit information in real-time about the water filtration unit and the kiosk operations. They have a market-based approach aiming to empower local communities and make these kiosks self-sustainable.

CASE STUDY
SARVAJAL IN INDIA

In India, Sarvajal, a for-profit company backed by the Piramal Foundation, is offering franchise run water filtration and distribution services through cloud connected water ATMs in rural and underserved urban areas. As of 2013, Sarvajal had a customer base of 75,000 people and had installed 35 water ATMs in urban areas in India, planning to launch another 50 in coming months across slum redevelopment communities in Delhi. The ATMs are owned and managed by local franchisee entrepreneurs. Each ATM embeds some 25 sensors and a SIM card, transferring information in real-time in order to monitor water pressure and filtration, and enhance maintenance of these systems. Customers pay for water using prepaid smart cards. Sarvajal is selling a litre of water for as little as INR0.25 (<US$0.01), cheaper than large bottled containers or small water pouches. In India, where water is available but unsafe, such kiosk solutions are critical to increasing clean water access. However the success of such ventures is based on entrepreneur's ability to efficiently run its business, and the population density around the kiosk. HTTP://WWW.SARVAJAL.COM/

At the nexus of energy and water: opportunities to support irrigation in agriculture

Irrigated agriculture has been the backbone of rural development in Asia and about 70% of the world's irrigated area is in Asia. However, in a context where water scarcity is becoming a reality and water risk the highest for the Asian population, there is a need to develop more productive and efficient Irrigation practices in order to preserve water aquifers and optimise food production. Low-cost M2M-enabled water meters can enhance water pump monitoring and contribute to understanding user behaviour. These remote-controlled water pump solutions can be used for automating the process of watering the crops through GSM, ZigBee, Wi-Fi and Bluetooth.

CASE STUDY
VINFINET TECHNOLOGIES IN INDIA

Vinfinet Technologies has developed a device that enables farmers to control irrigation pumps remotely: the device can turn on/off the pump and prevent dry running of the water pump to avoid motor repairs. An Interactive Voice Response System in local languages helps in making selections for switching the motor on or off. Farmers also receive voice alerts for faulty power supply, the motor not starting, a lack of water in the well/bore and attempts to steal the device or motor. As of October 2013, 3,100 units have been sold in Hyderabad and North Karnataka.[30] HTTP://WWW.VINFINET.COM/

30. http://www.dnaindia.com/bangalore/report-a-remote-control-to-end-farmer-woes-in-remote-areas-1908124

Mobile payments
Providing financing solutions and payment flexibility to cash-constrained populations

SUMMARY: MOBILE PAYMENTS

DEVELOP MOBILE PAYMENT FOR ENERGY AND WATER SERVICES – mobile payments for energy and water services remained limited in many Asian countries due to the low availability of mobile money services. With changing regulation, increasing bank partnerships and more willingness from mobile operators to provide such financial services, the opportunity to leverage mobile phones for energy and water pre-payments will improve in 2014. Other mobile payment solutions, such as airtime or SMS payments, also represent opportunities for entrepreneurs to offer more flexible and convenient payment methods to their customers.

PILOTING MICRO-INSURANCE SCHEMES – the potential of micro-insurance schemes could be important for increased water security in rural environments. The number of micro-insurance solutions available in Asia increased significantly in 2014. Mobile-based schemes however represent a fraction of these offers. Some of the mobile-enabled pilots started last year in Africa and Asia will provide realistic results on the efficiency of the mobile channel to offer such financial products to underserved customers, who sometimes have access to mobile first.

Mobile money services for energy and water payments have a high potential in Asia and represent an important tool to financial inclusion. From the *State of the Industry 2013: Mobile Financial Services for the Unbanked*[31], mobile money services steadily grew across the region: there were more than 10.5 million active accounts in South Asia and more than 3.3 million active accounts in East Asia and Pacific. It is however worth mentioning that an important share of these mobile money services, especially in the South Asian region, are available "over the counter" (OTC). In such cases, a mobile money agent performs the transactions on behalf of the customer, who does not need to register to use the mobile money service and does not need a mobile wallet. This is an easier method for unbanked customers to get access to financial services, especially for populations with low literacy levels or who are suspicious of new technology.

For the urban utilities, and smaller ESCOs and WSPs targeting rural operations, there is a real opportunity to leverage mobile payment platforms according to offerings and regulation. Using mobile for billing, payments and financing schemes could improve access to energy and water for millions.

The combination of mobile payments and mobile monitoring can allow:

- increasing affordability – Pay-As-You-Go for energy where customers are using their mobile phone to top up for their energy consumption – mobile payments can be made through mobile money services when available, SMS payments or scratchcards, airtime billing;
- enabling connection finance – if a household is unable to afford a mini-grid connection, mobile payments can be leveraged to allow customers to repay for the connection when they top up for energy;

31. http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2014/02/SOTIR_2013.pdf

- proposing smart tariffs – instead of charging fixed monthly tariffs, customers can be automatically charged based on their energy usage or time of usage (e.g. tariffs will be lower at off peak hours);
- improving payment efficiency – instead of having volunteers or staff collecting payments, these can be processed directly through mobile channels and updated directly on the house meter and online;
- controlling customer consumption – if a mobile-enabled meter is installed in a household, access can be enabled/disabled based on customer credit.

Improving mini-grid payment efficiency

Optimising payment collection is one of the key requirements to sustainability for mini-grid operators. Usually, local agents collect small amounts of money weekly or monthly, which can be a challenging task in places where liquidity is often an issue. As mentioned in the previous section on M2M connectivity, metering each household's consumption ensures customers don't overload the mini-grid and, with prepaid capacity, ensure they only consume what they pay for. Companies such as Husk Power and Gram Power operating in India have each developed custom solutions to allow electricity prepayment through a code-based meter for HPS and a mobile wallet with optical connection for Gram Power, respectively. However from a customer perspective, these are still cash-based transactions and an agent needs to go to each household to collect payments and unlock meters for energy usage. According to local availability, mobile payment solutions, either through mobile money service, Premium SMS, USSD or scratch cards could streamline the payment process. As a digital receipt, customers can also receive an SMS to confirm payment has been received and access to electricity will be granted.

Leveraging mobile payments for off-grid energy access

Thanks to the increasing penetration of mobile money services in many Asian markets, more solutions are available for entrepreneurs to leverage the mobile channel to enable customer payments. However a lot of the current transactions, especially in South Asia, remain Over-The-Counter, needing the presence of an extensive mobile money agent network to perform financial operations.

CASE STUDY

SIMPA NETWORKS IN INDIA

In India, a quality home solar system will retail for US$200-400, including a solar panel, battery, charge controller, three or four lighting points and a phone charger port. Without external financial support, a majority of the population living off-grid can't afford this amount upfront. Simpa Networks is, for now, one of the few companies offering home solar systems under a lease-to-own scheme in Asia, or as Simpa Networks calls it, a 'progressive purchase' model. Under this model, customers can own the solar system usually two or three years after purchase. After making an initial down payment of 10-30%, the system is installed on the customer's premises – Simpa works with its partner Selco India to install the Home Solar System on customer rooftops. Payments can be made through mobile phones to buy energy credit of as little as US$0.88 (or INR50) where codes received by SMS can be input on the keypad on the Simpa box to unlock the system. Simpa Networks also offer its prepaid mobile payment platform to mini-grid operators, where Simpa will collect payments and deducts a service fee before passing balance on to its partners. In 2013, Simpa received a US$2 million equity investment from the Asian Development Bank to expand operations in India will raise capital from other private equity firms in the next three years. HTTP://SIMPANETWORKS.COM/

Mobile payments as an enabler across the water service delivery value chain

Leveraging mobile payments to increase payment efficiency could improve the sustainability and quality of service for many utilities across Asia. Evidence from Africa demonstrated how mobile payments can contribute to more secure and reliable financial flows, though regional uptake suggests caution on simplistic thoughts on scaling-up.[32] The growing availability and penetration of mobile money services offer strong opportunities for service providers to increase their payment efficiency while offering a convenient payment method to their customers. It can also trigger the development of innovative water-financing schemes based on the partnership between utilities, financial institutions and mobile operators.

Mobile money solutions for urban/rural decentralised water services

Sometimes in direct competition with free water resources, rural water services need to be delivered in a cost-effective yet reliable way to its paying low-income customers. Cost recovery is therefore challenging, especially if hand pumps often fail and are not repaired within a few days. Due to their flexible and increasingly ubiquitous nature, mobile payments can be an efficient way for customers to pay their water service providers, on a Pay-As-You-Go basis or time basis (weekly or monthly). Not directly related to mobile, Sarvajal uses RFID cards to allow users to pay and collect their water directly from the 24/7 water ATMs; using mobile phones to pay for such fees could streamline the payment process, minimise extra costs and improve customer relationship management. The opportunity to leverage mobile money payments is however subject to the maturity of mobile money services in the country based on current regulation.

Added to payment opportunities, other innovative financing or savings mechanisms can be potentially developed to increase rural water resilience and security. The maintenance of rural water systems is one of the main challenges to sustainability, as paying for this service or spare parts can be difficult to afford for communities that are often unbanked or now have access to mobile money services. The development of new mobile-based approaches to insure communities against rural hand-pump risk could help design an efficient micro-insurance model for poor customers. According to the 'Landscape of Microinsurance in Asia and Oceania', around 173 million people are covered by micro-insurance schemes. Countries in the region attained a substantial growth of up to 30% between 2010 and 2012, such as Bangladesh, China, India, Thailand and the Philippines. If mobile is playing a small role as a distribution channel for micro-insurance products, it could play an important role in the water sector and innovations are happening (e.g. mobile micro-insurance in Papua New Guinea).[33]

32. http://www.globalwaterforum.org/wp-content/uploads/2012/04/Prospects-for-achieving-and-maintaining-universal-drinking-water-services-in-South-Asia-and-sub-Saharan-Africa-GWF-1340.pdf.
33. http://www.munichre-foundation.org/dms/MRS/Documents/Microinsurance/2013MILandscape/2013_AsiaOceaniaLandscape_BriefingNote_E_Web.pdf.

Mobile services (SMS, USSD & Apps)

Leveraging increased mobile ownership to collect and disseminate information on utility services and supply chain management

SUMMARY: MOBILE SERVICES

INCREASED OPEN DATA TO SUPPORT UTILITIES OPERATIONS AND CUSTOMER SERVICE – The data collected through remote monitoring and/or crowd-sourced methods (through simple phones) could serve to build important history on energy and water usage for individual customers and communities. Better real-time information can be channelled to end-users via SMS, voice services or apps to improve service and product usage.

SUPPLY CHAIN MANAGEMENT PLATFORM – as of 2013, there has been an increasing trend for distributors to develop mobile tools that will help them manage their supply chain and improve customer relationship management. The solutions which are currently emerging allow agents to leverage feature phones to order supplies in real-time and could be critical to better address the last-mile distribution challenge in rural environments.

There were more than 1.8 billion unique subscribers in Asia at the end of 2013.[34] The GSMA estimates that more than 170 million of these subscribers are living off grid, about 1 in 10. The increasing presence of mobile phones in underserved off-grid communities makes it an attractive proposition to strengthen rural electricity and water access based on:

- mobile phones owned by the communities and/or agents working for a service provider can be leveraged to increase the dissemination/collection of critical information on community well-being and utility systems operations;
- players in the distribution value chain of energy or water products could also use mobile platforms to better manage sales stocks and operations while improving customer relationship management.

Improving utility operations through mobile services

Mobile devices have become ubiquitous across Asia and can be even found in places where there is no mobile coverage. From cities to villages, collecting and disseminating information via customer handsets can support operations by creating a two-way communication platform where timely information can be channelled to customers. For example, NextDrop in India is working with utilities and underserved customers to increase awareness of water availability. In Afghanistan, USAID, in partnership with Arc Finance, developed a water well monitoring tool, the Watertracker, to improve the sustainability of water points after construction (an estimated 30% to 50% of water points were not functional after 2 years).[35]

34. GSMAi on Unique Subscribers, representing the total unique users who have subscribed to mobile services (excluding M2M)
35. http://www.usaid.gov/global-waters/june-2012/starts-with-sustainability

CASE STUDY
NEXTDROP IN INDIA

Water services can be highly unreliable in Indian cities, with households receiving water for only 3-4 hours a day. Hours of service can also be unpredictable. NextDrop, working with the local government water providers in Hubli and Bangalore, has developed a platform allowing customers to be informed 30-60 minutes before water is released in their area. The service is based on a monthly subscription ranging from US$0.16-0.40 and works by connecting the ground-level utility staff, namely the valvemen who manually open and close water supply valves, with an Interactive Voice Response (IVR) line. Through this line the valvemen report when the valve will be opened, and Next Drop in turn sends this information to its customers via SMS or voice calls. Since its origin, the system has morphed into an information portal for the Bangalore Water Board. As of the end of 2013, NextDrop had 35,000 households with estimated 5x beneficiaries in Hubli and had recently expanded to Bangalore. HTTP://NEXTDROP.ORG/

Using mobile devices to raise awareness and educate communities

Mobile devices can also be used to train and educate agents and communities. With tablets becoming more affordable, thanks to economies of scale and the development of low-cost models targeting the developing world, there is an increasing opportunity for entrepreneurs to leverage such tools. For example, production of the Aakash 4 tablets was set to start in January 2014[36], manufactured by Indian players and with expected retail prices of INR2,500-1,500[37] (US$40-25). These 7-inch tablets will have a 4GB local storage capacity and support cellular connectivity (2G, 3G, 4G). The use of these tablets as part of a behavioural change programme could further improve the awareness of communities of the benefits of clean water and sanitation services on their health and well-being.

CASE STUDY
SAFE WATER NETWORK IN INDIA

Safe Water Network faced a challenge in generating enough revenue from water sales to cover the costs of operating a safe water plant in rural India. Although the district was bearing the effects of high levels of fluoride in the ground water (which causes fluorosis), a minority related it to the water they drank. A field survey in the Warangal district of Andhra Pradesh collected evidence that people believed the water looked clean and that people had been surviving on this water for generations. Dialogue Factory and IMRB, in collaboration with Safe Water Network, built a behaviour change programme, using a tablet as a tool for a water and health education campaign in order to build awareness and demand for safe water in rural communities. The campaign used multiple regional dialects and culturally-specific marketing content to educate community members on the benefits of safe water. As the tablet symbolises technology and progress, it creates a connection with their urban counterparts. HTTP://WWW.SAFEWATERNETWORK.ORG/

36. http://www.zdnet.com/in/aakash-4-tablet-production-to-start-in-january-7000024503/.
37. http://timesofindia.indiatimes.com/tech/tech-news/hardware/Aakash-4-production-to-start-in-January-Sibal/articleshow/27656515.cms.

Improving rural distribution supply chain management

While basic fast moving consumer goods (FMCG) are usually available in rural markets, new products such as clean energy systems have yet to benefit from efficient distribution networks. A key barrier to improving supply chain efficiency is the lack of available and accessible data. Consumer and location data enabled by the internet and mobile phones can optimize distribution services, through smarter itineraries for product delivery and the aggregation of demand and direct connection between supplier and customers.

CASE STUDY

DHARMA LIFE IN INDIA

Dharma Life operating in India has created a rural distribution network relying on village level entrepreneurs. This model enables the creation of income generation opportunities for rural inhabitants while providing customised solutions according to the community needs. Dharma Life has trained and supported more than 2,000 village-level entrepreneurs (VLEs) within rural India. This VLE network has grown at 190% year-on-year. Each VLE serves its own village, which typically includes a minimum of 500 households. The VLEs are provided with a sample product and a catalogue, which is used to generate demand. Products distributed include solar lighting, clean cookstoves, water purifiers etc. The VLEs are visited weekly by a district-level sales manager to conduct trainings, mentoring, marketing activities and order-taking. HTTP://WWW.DHARMALIFE.IN/

Conclusion

The Asian continent, with large disparities in terms of access to infrastructure and capital, holds one-third of all mobile subscribers across the world. With mobile penetration growing, increased availability of mobile money services and extensive mobile coverage, mobile could play an important role in modernising and improving access to basic life services for a segment of the population which has so far been underserved. Growing signs of the synergetic relationship existing between mobile, energy and water can be seen in many countries, at a pilot or commercial stage, already improving the lives of millions.

Each of the five mobile channels outlined in this report – mobile infrastructure, mobile operators' distribution channels, machine-to-machine connectivity, mobile payments and mobile services - plays a different role and has a different impact on supporting utilities and entrepreneurs willing to improve their services or launch new business models. Whereas in Africa, leveraging mobile operators' distribution networks, mobile payments or machine-to-machine connectivity are making strong progress (related to serving the underserved with modern energy and water solutions), in Asia such channels are being used in only a limited way. The mobile telecom infrastructure, through the large presence of off-grid telecom towers, is however key to the development of decentralised energy models such as with OMC Power in India, to deploy solar power plants serving the tower and the community. Providing mobile and energy services to communities goes hand in hand with the modernisation of underserved locations.

While the mobile-enabled Pay-As-You-Go model for home solar systems has already gained traction in East Africa, based on partnerships with mobile operators and a more mature mobile money ecosystem, this model is still nascent in Asia. Despite a strong model, solid technology and partnerships, Simpa Networks, providing home solar systems under a progressive purchase agreement model in India, has for now had a limited impact. As access to capital plays a crucial role for such asset financing companies, 2014 should be the year of growth for this company: the Asian Development Bank provided a US$2 million investment to scale the solution to 60,000 households. The PAYG model will also be tested by Kamworks in Cambodia. Thanks to GSMA with the support of the UK Government, the company will pilot rental services in partnership with mobile money provider WING and mobile operator CamGSM.

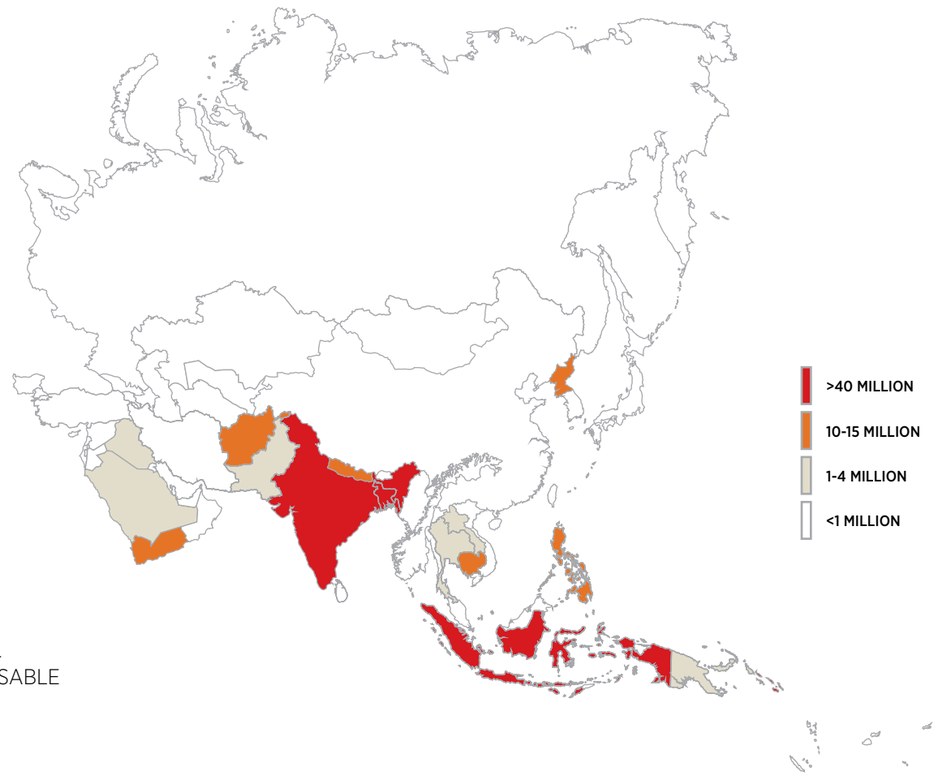
As mobile also enters the water sector and is being increasingly used by water providers, utilities, NGOs and entrepreneurs, it proposes new tools to solve some of the challenges currently being faced by these organisations: lack of accountability, ageing infrastructure leading to water leakages, theft and poor payment collection. In India, the work that companies are doing, such as Sarvajal developing access to clean water through M2M-connected water kiosks, or NextDrop working in partnership with the water utility in Bangalore to improve communication with its customers, shows promising perspectives for future utility services. If these initiatives are still at an early stage of development, the building blocks to a successful path are appearing: customer trust in the service, strong partnerships, smart usage of the mobile channels integrated in the company business model, and better availability of mobile money services.

As competition intensifies in many Asian markets and average revenue per user falls, mobile operators can find new revenues, strengthen their mobile money service, increase their customer retention and improve their branding by partnering with these energy and water innovators. For energy, the outcome is clear: mobile operators and tower companies can reduce their operating expenditure while minimising their carbon footprint when partnering with an ESCO providing power to their tower under a long-term agreement; providing better and cheaper power to their off-grid customers (currently relying on expensive third-party phone charging services) increases their average revenue per user (15% is the norm). For water, the impact for operators is less clear but the potential is important. Hundreds of millions of people across Asia benefit from poor water services; integrating mobile technology in different layers or at different stages of the water service delivery, through water systems connectivity, payments or customer messaging, is an opportunity not to be missed for the mobile value chain stakeholders. By the end of 2014, the results from the GSMA Mobile Enabled Community Services' water grantees in Africa and Asia will provide insightful information on the potential and impact of mobile for water.

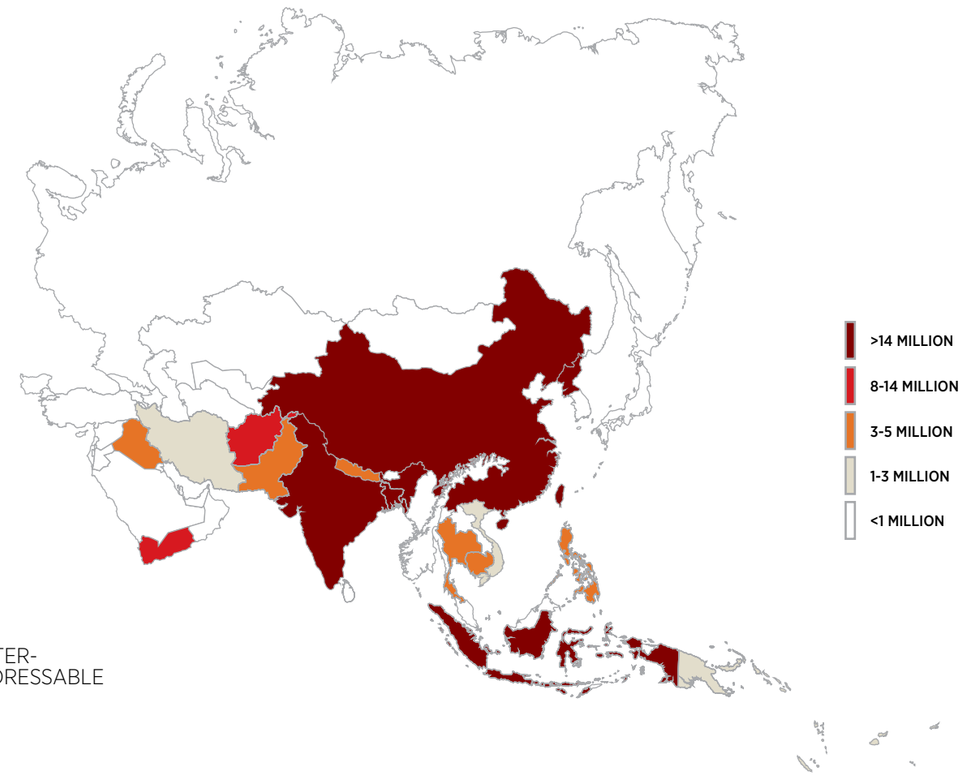
Appendix 1 – Addressable energy and water markets in Asia

We estimated in our previous report, **'Sizing the Opportunity of Mobile for Energy and Water Access'**, the size of the addressable energy and water markets, which is the total population covered by GSM networks without access to electricity and/or improved water.[38] The following map serves as a visual representation of current potential market sizes across the Asian continent.

FIGURE 3
OVERVIEW OF THE MARKETS IN ASIA BY POPULATION (2013)[39]



ENERGY-
ADDRESSABLE



WATER-
ADDRESSABLE

The countries in red and dark red on both diagrams are the ones with the highest potential for mobile enhanced solutions – they indicate a low access to the electricity grid and or lower access to improved water in the region versus a more predominant presence of mobile networks. These are India, Bangladesh and Indonesia. Populations living in Myanmar and Papua New Guinea have a limited access to electricity services; however the current GSM population coverage (respectively 11% and 33% of the population) is limiting the impact mobile infrastructure and services could have to support energy and water services.

38. For more information http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/12/Sizing-the-Opportunity-of-Mobile_Nov-2013.pdf?utm_campaign=M4D_News_03DEC13_MECS%20Report&utm_medium=email&utm_source=Eloqua
39. Source: GSMA

Appendix 2 - Mobile-enabled energy and water services in Asia (as of 2013)

CAMBODIA

Kamworks*

1001 Fontaines*

BANGLADESH

Grameenphone
Emergence BioEnergy*

NEPAL

Gham Power

Akvo Flow

INDIA

OMC Power
Rockefeller SPEED project
DESI Power
Gram Power
Husk Power Systems
Simpa Networks
Dharma Life

Safe Water Network
Sarvajal
NextDrop*
WaterAid
Akvo Flow
Vinfinet

PAKISTAN

Easypaisa*
EcoEnergyFinance*

AFGHANISTAN

USAID Watertracker with Arc Finance

• In planning phase

Appendix 3 - Key Asia metrics

The following table presents key metrics in the mobile, energy and water sectors, in order to compare countries attractiveness to deploy mobile-enabled energy and water services.

TABLE 4
ASIA METRICS FOR MOBILE-ENABLED COMMUNITY SERVICES (2013)[39]

COUNTRY	IFC EASE OF DOING BUSINESS INDEX	GSM POPULATION COVERAGE	MOBILE CONNECTION PENETRATION (4Q2012)	POPULATION WITHOUT ACCESS TO ELECTRICITY	OFF-GRID MOBILE SUBSCRIBERS	ENERGY-ADDRESSABLE MARKET	POPULATION WITHOUT ACCESS TO IMPROVED WATER	WATER-ADDRESSABLE MARKET	POPULATION BELOW THE POVERTY LINE (%)
INDIA	134	87%	68%	309,171,683	45,344,704	84,941,124	93,675,040	15,661,401	42%
BANGLADESH	130	99%	70%	69,612,916	18,355,487	60,815,444	28,251,505	19,252,338	43%
INDONESIA	120	95%	114%	66,653,332	12,632,093	41,371,277	43,176,769	18,669,636	21%
PAKISTAN	110	85%	68%	19,707,612	2,310,739	1,309,632	13,887,471	2,619,263	21%
MYANMAR	182	11%	5%	37,486,096	2,295,721	0	8,153,712	0	32%
AFGHANISTAN	164	77%	61%	17,596,476	4,062,990	14,127,711	17,192,534	8,392,774	36%
DPR KOREA	-	85%	7%	18,016,209	-	14,174,647	486,925	149,753	-
NEPAL	105	90%	55%	12,088,726	2,788,869	11,757,030	3,295,530	2,870,206	25%
CAMBODIA	137	99%	140%	10,256,606	3,679,078	9,311,679	5,089,772	4,059,012	23%
PHILIPPINES	108	99%	107%	16,440,150	4,214,604	11,756,106	7,460,864	3,325,382	18%
CHINA	96	90%	82%	13,506,950	3,179,542	0	120,446,956	13,986,609	16%
PAPUA NEW GUINEA	113	33%	28%	6,091,959	1,227,172	1,221,313	4,114,960	0	36%
SRI LANKA	85	95%	105%	3,049,200	1,152,091	2,527,560	1,877,395	883,575	7%
PDR LAOS	159	70%	86%	2,259,581	616,957	110,101	2,046,295	46,951	34%
VIETNAM	99	99%	143%	3,551,020	1,289,160	605,476	4,346,823	1,212,006	17%
MONGOLIA	76	88%	90%	391,508	72,987	0	496,080	70,439	30%
EAST TIMOR	172	18%	53%	750,344	156,940	0	348,550	0	37%
THAILAND	18	97%	118%	667,850	386,763	1,312,510	2,764,889	2,878,556	0.4%
FIJI	62	52%	107%	384,886	190,755	55,242	17,212	0	6%
MALAYSIA	6	95%	135%	292,399	31,639	0	-	0	4%
VANUATU	74	70%	63%	182,135	-	108,845	23,965	0	-
MALDIVES	-	80%	172%	3,159	-	0	6,318	5,865	1%
SAMOA	61	86%	117%	1,831	-	15,169	7,323	4,150	-
BHUTAN	141	12%	74%	207,710	44,090	0	29,038	0	10%
TONGA	57	96%	88%	8,325	-	10,997	-	247	-
SEYCHELLES	-	-	104%	61,433	-	-	-	-	0%
MICRONESIA	156	-	75%	48,868	-	-	-	-	31%
BRUNEI	59	90%	156%	0	-	-	-	3,146	-

40. Source GSMA Mobile Enabled Community Services, GSMAi, World Bank, JMP (WHO/UNICEF)

About the GSMA

The GSMA represents the interests of mobile operators worldwide. Spanning more than 220 countries, the GSMA unites nearly 800 of the world's mobile operators with more than 230 companies in the broader mobile ecosystem, including handset makers, software companies, equipment providers and Internet companies, as well as organisations in industry sectors such as financial services, healthcare, media, transport and utilities. The GSMA also produces industry-leading events such as the Mobile World Congress and Mobile Asia Expo.

About Mobile for Development

Serving the underserved through mobile

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

For more information on the GSMA's Mobile Enabled Community Services programme please contact mecs@gsma.com