



# Mobile for Development Utilities

Assessing the opportunity to improve energy access:  
Ncell in Nepal

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# Executive Summary

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Mobile connectivity has extended beyond the reach of electricity grids around the world. The mobile industry is unique in terms of the size and reach of its power infrastructure, penetration rates and brand power, which gives it the opportunity to impact lives on an unprecedented scale. GSMA's Mobile for Development Utilities programme seeks to identify these opportunities in the energy, water and sanitation sectors, and to stimulate them with scalable, commercial solutions.

Nepal suffers from an energy crisis. According to the 2011 Nepal Census,<sup>1</sup> nearly a third of the country's 5.4 million households were not connected to the electricity grid. For households and telecom towers connected to the grid, rolling blackouts are common.<sup>2</sup> Despite the energy challenge, 90% of Nepal's population is covered by mobile networks,<sup>3</sup> which have created over 24 million connections.<sup>4</sup> The total addressable market for energy, defined as the population with mobile coverage but without access to the electricity grid, is 3.7 million people.<sup>5</sup>

This Feasibility Study explores the potential for Ncell, the largest Mobile Network Operator (MNO) in Nepal, to expand access to energy in the country. Two business models were evaluated:

- **Community Power from Mobile (CPM), also known as Anchor Business Community (ABC)** – Can Ncell leverage its existing mobile tower infrastructure or widen its footprint to provide superior energy access to communities in the vicinity of its towers?
- **Pay-As-You-Go (PAYG)** – Is there a market for Pay-As-You-Go (PAYG) solar home systems in Nepal? Can Ncell leverage its assets to participate in this market?

Based on extensive desk research and field visits, Mobile for Development Utilities has concluded there is potential for Ncell to increase network uptime, reduce the costs of powering its existing network, and reach populations not currently served by energy or mobile. Specifically, partnering with energy service companies (ESCOs) to outsource its energy supply could improve the efficiency of its operations. At the same time, an anchor load like a telecom tower could make it more financially viable for ESCO's energy business to serve the surrounding community. However, the ESCO market in Nepal is nascent and it would be necessary to pilot CPM deployments before embarking any large-scale rollouts.

In addition to leveraging infrastructure for CPM, operators and practitioners are also leveraging mobile to bridge the energy access gap. One of the most popular business models is PAYG energy, particularly through the financed purchase of solar home systems (SHS). Opportunities for Ncell to participate directly in the financed purchase of SHS are currently limited because there are no large vendors in Nepal to act as reliable partners. However, the situation could change almost instantly if the subsidy policy changed to encourage financed purchase. Then, a vendor could immediately leverage Ncell's extensive distribution network and mobile money service (if Ncell deploys one in the future) to reach customers and collect payments.

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1. 2011 Nepal Census: [http://unstats.un.org/unsd/demographic/sources/census/2010\\_phc/Nepal/Nepal-Census-2011-Vol1.pdf](http://unstats.un.org/unsd/demographic/sources/census/2010_phc/Nepal/Nepal-Census-2011-Vol1.pdf)

2. Ncell power consumption data for mobile towers.

3. GSMA estimate, 2014.

4. Q3 2014 data from GSMA Intelligence.

5. Mobile for Development Utilities research based on population covered by mobile networks and access to grid electricity as per World Bank and IEA statistics for 2012.

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## Recommendations

Mobile for Development Utilities has made the following recommendations to Ncell:

1. **Trial CPM deployments at existing off-grid sites in partnership with ESCOs.** Several of Ncell's 156 off-grid sites would be suitable as anchor loads for CPM deployments, especially in the districts of Panchthar, Baitadi and Salyan. However, the grid is advancing around some of these sites, so it is important to gather additional ground-level data to identify areas where grid access is not imminent.
2. **Extend the mobile network in underserved areas in partnership with ESCOs.** In areas where pockets of the population lack both energy access and mobile coverage—primarily the Hill and Mountain regions—work with ESCOs to explore whether it is feasible to provide energy and extend mobile networks. For ESCOs, the business case is improved with a telecom tower as anchor load. For Ncell, outsourcing energy supply to a reliable partner improves operational efficiency and saves costs.
3. **Closely track developments in the Alternative Energy Promotion Centre's (AEP) subsidy policy.** The AEP is expected to revise its subsidy policy later this year. If the policy shifts towards providing access to financing in the solar supply chain, it could accelerate the adoption of PAYG solar home systems. PAYG solar products are helping to create close, commercially viable partnerships between MNOs and SHS vendors, especially in East Africa. PAYG trials are already being planned in Nepal. Ncell should participate in these early trials by offering connectivity at favourable rates and then building relationships with promising partners.

# 1. How mobile can facilitate access to energy

90% of Nepal's population has mobile coverage, but over 30% cannot connect to the electricity grid. Where grid access is available, long hours of blackouts are common, especially in the winter months.

## 1.1. Mobile and energy

According to GSMA estimates, 90% of Nepal's population is covered by mobile networks.<sup>6</sup> GSMA estimates the size of the addressable energy market, defined as the population with mobile coverage but no access to the electricity grid, to be 3.7 million people.<sup>7</sup> As of Q3 2014, there were over 24 million mobile connections in the country, but only about 11 million, or 39%, of these were unique subscribers. Mobile penetration is expected to grow as networks continue to expand in uncovered areas and to improve coverage in areas already covered.

One of the main challenges to expanding coverage is unreliable access to energy. Covering the last remaining pockets of the population often means running very remote sites on diesel. Recently, however, MNOs have begun to rely on solar energy to power these remote sites. In Nepal, towers are owned and managed by MNOs, which means the responsibility for accessing or generating energy falls to the MNO rather than external tower companies or ESCOs. Energy logistics can therefore be a major operational drag on an MNO and detract from its core functions.

For consumers, lack of access to energy limits their cell phone use and leads to slow adoption of life-enhancing but power-hungry smartphones. As of Q3 2014, smartphones in Nepal accounted for just under 15% of total connections. Greater adoption of smartphones would also spur customers to sign up for VAS and data services.

## 1.2. Mobile channels for energy access

Mobile can help to improve access to basic utility services across the developing world. Innovative mobile applications, not just for energy but for water and sanitation as well, are bringing critical services to underserved populations through the following five channels:

- **Mobile infrastructure** – Leveraging the presence of telecom towers in off-grid environments to support rural electrification efforts
- **Mobile operator's distribution and mobile money agent networks** – Leveraging the distribution reach and brand of mobile operators to reach underserved customers

6. GSMA Intelligence, 2015

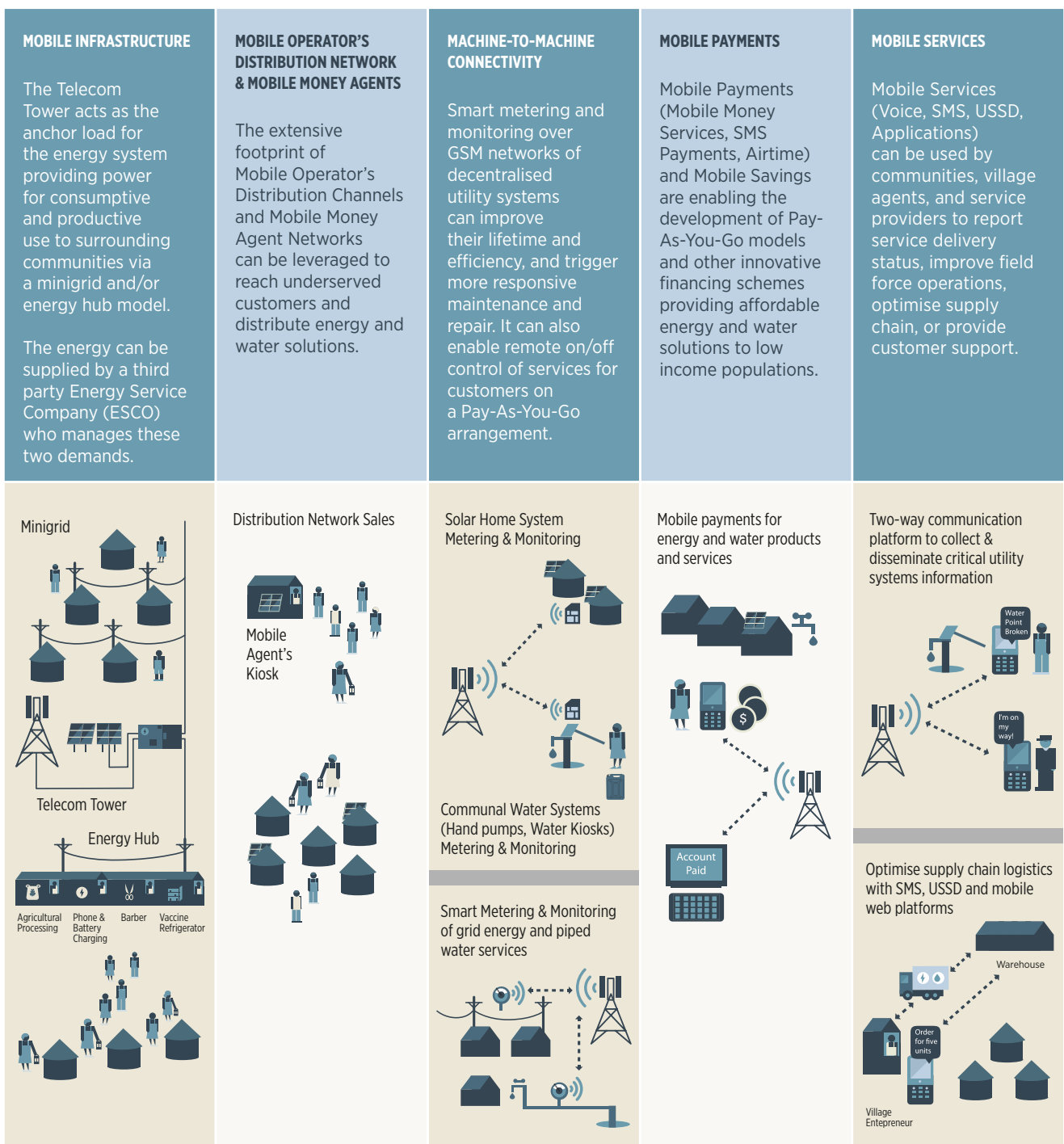
7. Mobile for Development Utilities research based on GSMA Intelligence, World Bank and IEA statistics for 2012

- **Machine-to-machine connectivity** – Enabling the remote monitoring and PAYG capacities of decentralised utility systems
- **Mobile payments** – Providing flexible, convenient and secure mobile-enabled payment solutions to low-income populations
- **Mobile services (voice, SMS, USSD, applications)** – Leveraging increased mobile phone ownership to collect/disseminate critical information on utility services and/or supply chain management.

FIGURE 1

## THE FIVE MOBILE CHANNELS

SOURCE: GSMA



The five mobile channels illustrated above can be combined in various ways to create an offering. A more detailed description can be found in the Mobile for Development Utilities publication, [Sizing the Opportunity of Mobile to Support Energy and Water Access](#).

**Two popular business models—CPM and PAYG—are best suited to the current market situation in Nepal.**

### 1.2.1. COMMUNITY POWER FROM MOBILE (CPM)

As MNOs seek to expand their networks beyond the limits of the electricity grid, they need to find ways to provide power to their towers, either by working with the local utility to extend the grid or by providing decentralised energy solutions to each tower and Base Transceiver Station (BTS). In both cases, a mobile network can help to deliver energy services to communities without electricity.

Mobile towers can act as an anchor customer for a third-party energy service company operating a decentralised power system. Mobile towers improve the commercial viability of a decentralised system because of the reliable demand and revenues they generate, and can help to deliver other community services as well.

Mobile towers can serve as a central point from which other services can be delivered:

- If the grid were extended to the tower, an electrical connection could be established to a concentrated hub of buildings adjacent to the tower, which could then deliver services.
- If the tower has its own autonomous power system, excess power from the system could be used to provide basic services (such as phone charging services) to surrounding communities.

In Haiti, the mobile operator Digicel installed phone charging boxes at their towers, providing employment to a local operator and reducing the risk of vandalism to their towers.



PHONE CHARGING OFFERED OUTSIDE DIGICEL HAITI'S MOBILE TOWERS (SOURCE: DIGICEL HAITI)

In India, where there are over 230,000 off-grid and bad grid towers<sup>8</sup> and 400 million people without access to electricity, mobile operators are actively working to outsource their energy needs. OMC Power, a third-party energy service company, is the first business of its kind delivering 24/7 power to mobile towers while also providing charged lanterns and battery boxes to the surrounding community on a subscription basis.



AN AERIAL SNAPSHOT OF A SOLAR POWER PLANT WITH VARIOUS LOADS (SOURCE: OMC POWER)



OMC POWER'S BATTERY BOX AND APPLIANCES (SOURCE: GSMA)

8. GSMA Green Power for Mobile, December 2014, "The Global Telecom Tower ESCO Market: Overview of the Global Market for Energy to Telecom Towers in Off-Grid and Bad-Grid Areas," <http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2015/01/140617-GSMA-report-draft-vF-KR-v7.pdf>



### 1.2.2. PAY-AS-YOU-GO (PAYG)

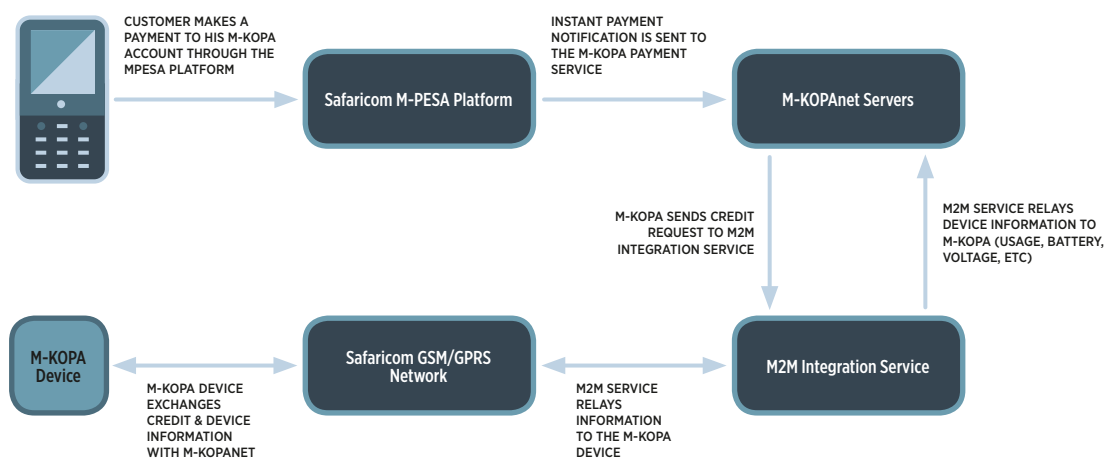
For off-grid households wanting to buy a solar home system (SHS), one of the biggest challenges is the upfront cost. Unable to afford economies of scale and living day to day, those off the grid must often pay a premium for energy products and services, such as one day's worth of kerosene, one battery, or a single phone charge.

Although energy accounts for a relatively large share of their total budget, the rural poor find it difficult to access the financing required to purchase assets such as an SHS. However, the prevalence of scratch cards and the growth of mobile wallets can be leveraged to deliver PAYG solutions for energy access by providing financing for unbanked customers to purchase products. Since 2011, there has been a significant rise in the number of enterprises using PAYG solutions for energy.

M-KOPA provides micro-financed energy products in Kenya, Uganda and recently started operations in Tanzania. As of September 2014, M-KOPA provides an 8W solar system including two lights, phone charger, portable lamp and radio. The company has sold more than 200,000 units, with recent sales trend of 2,500 units per week. Each M-KOPA unit embeds a GSM module enabling the real time monitoring and connection/disconnection of the unit according to customer credit. M-KOPA has partnered with M2M specialist Eseye to manage the M2M communication system. Figure 2 below illustrates the use of mobile by M-KOPA to collect payments.

FIGURE 2

### USING MOBILE MONEY AND M2M COMMUNICATIONS FOR PAYG



SOURCE M-KOPA

# 2. Country overview

Nepal is a landlocked country bordered by India in the east, south and west, and by China in the north. It is home to the Himalayas and Mount Everest.

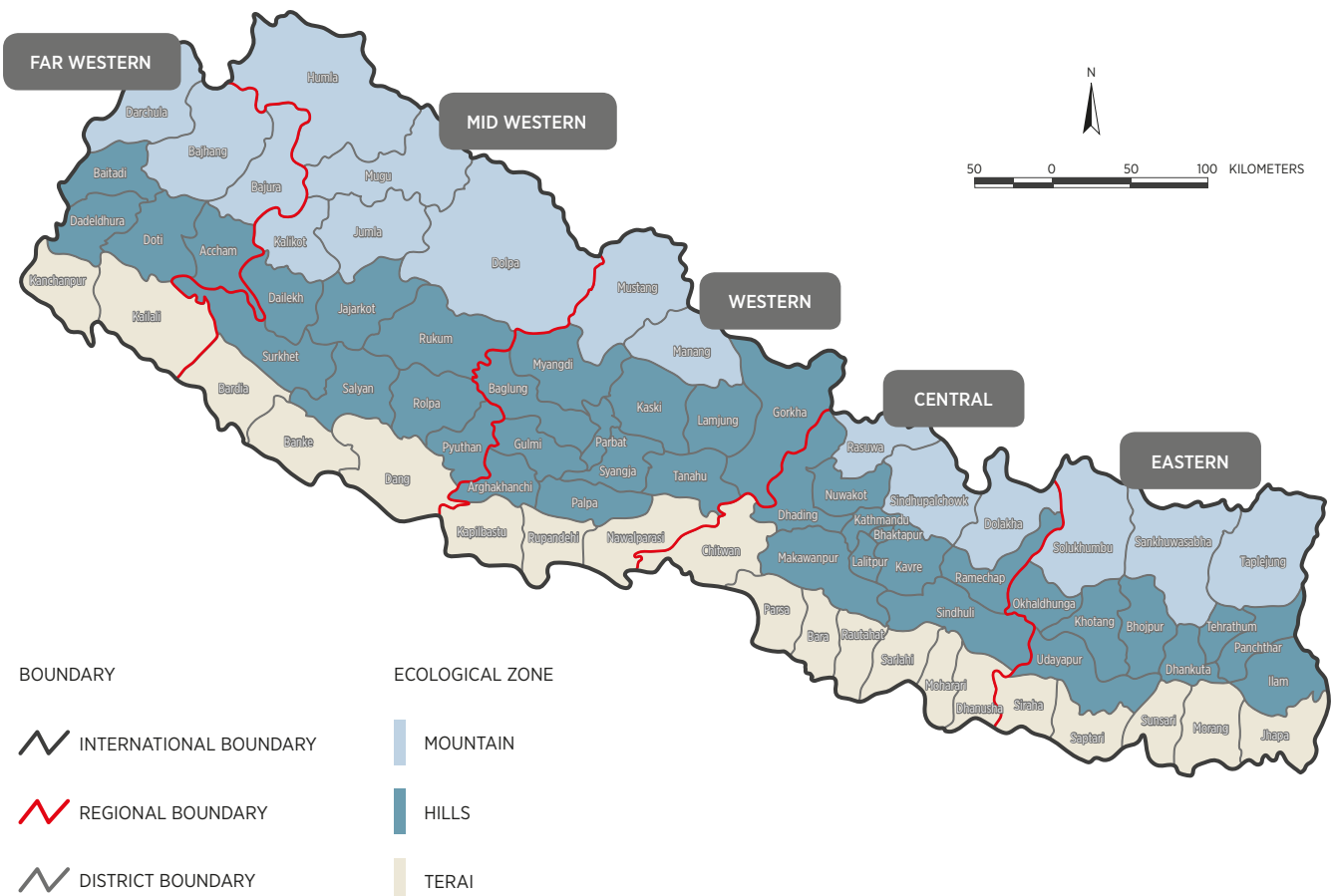
Nepal's 5.4 million households are home to over 28 million people.<sup>9</sup> Nepal spans 147,181 square kilometres and has a population density of about 180 people per square kilometre.

## 2.1. Geography

Nepal is divided into three ecological zones by terrain: Mountain, Hill and Terai (plains). Administratively, Nepal is divided into five development regions: Eastern, Central, Western, Mid-Western and Far-Western. It is further sub-divided into 14 administrative zones, 75 districts and 3974 Village Development Councils (VDCs). The map of Nepal below shows these ecological zones, development regions and districts.

FIGURE 3

### ECOLOGICAL AND ADMINISTRATIVE MAP OF NEPAL<sup>10</sup>



9. 2011 Nepal Census: [http://unstats.un.org/unsd/demographic/sources/census/2010\\_phc/Nepal/Nepal-Census-2011-Vol1.pdf](http://unstats.un.org/unsd/demographic/sources/census/2010_phc/Nepal/Nepal-Census-2011-Vol1.pdf)  
 10. Nepal: Ecological Zone Map (as of 2000), <http://reliefweb.int/map/nepal/nepal-ecological-zone-map-2000>

## 2.2. Economic background

Nepal is one of the world's 'least developed countries' as defined by the World Bank, with a Human Development Index (HDI) of 0.54,<sup>11</sup> putting it on par with Bangladesh and Pakistan. However, as Table 1 shows, Nepal's gross national income (GNI) per capita is significantly lower. Over 80% of Nepal's people live in rural areas, putting tremendous pressure on the country's electricity distribution systems as they struggle to reach far-flung populations, especially in the Hill and Mountain zones.

TABLE 1

### KEY INDICATORS: NEPAL AND OTHER SOUTH ASIAN COUNTRIES<sup>12</sup>

	NEPAL	BANGLADESH	INDIA	PAKISTAN
Population	28.12 million	156.6 million	1252.1 million	182.1 million
GDP (current USD)	19.3 billion	150.0 billion	1877.0 billion	232.3 billion
GNI per capita (current USD)	730	1,010	1,570	1,360
HDI ranking (of 187)	145	142	135	146
Urban/Rural %	18.3% / 81.7%	29.7%/70.3%	32.5%/67.5%	37.6%/62.4%
% living in poverty (<USD 1.25 PPP/day)	23.7% (2010)	43.3% (2010)	23.7% (2012)	12.7% (2011)

The five districts with the lowest per capita income are Kalikot, Baitadi, Achham, Bajura and Bajhang, which are all in the Far-Western or Mid-Western Development Regions.

## 2.3. Telecom networks in Nepal

Table 2 shows Nepal's mobile telephony market is dominated by two MNOs—Ncell and Nepal Telecom—which have a combined market share of over 90% (as of Q3 2014). The remaining 10% is divided between three small MNOs. The Chaudhary Group (CG), the largest business group in Nepal, owns a mobile license but has not launched its service yet. When it does, market dynamics will change significantly.

TABLE 2

### MNO MARKET SHARE IN NEPAL<sup>13</sup>

OPERATOR	MARKET SHARE
Hello Nepal (Nepal Satellite Telecom)	0.6%
Ncell (TeliaSonera)	49.3%
Nepal Telecom	43.4%
Smart Cell (Smart Telecom)	4.8%
United Telecom	1.9%

11. The UNDP Human Development Index (HDI) ranks a country's performance in three areas: health, education, and standard of living. In 2013, Norway was ranked first, with an HDI of 0.944. At the other end of the spectrum, Niger was last (187th) with an HDI of 0.337. HDI is based on gross national income (GNI) in purchasing power parity (PPP), rather than GNI in current USD. This is why the HDI for the countries in Table 1 is comparable despite the difference in GNI in current USD.

12. World Bank data for 2013, except where specified. HDI data from UNDP for 2013.

13. Q3 2014 data from GSMA Intelligence.

Table 3 shows the mobile statistics for Nepal and proximal countries. Nepal's connection statistics compare favourably, with unique subscribers accounting for nearly 40% of the total population. However, each unique subscriber has approximately two SIMs, which means millions in Nepal do not have individual access to the mobile network. Although 90% of Nepal's population is covered by GSM networks, only about 40%<sup>14</sup> of its area is covered. The remaining uncovered pockets of the population are therefore sparsely distributed. Nearly 15% of all connections are made with a smartphone, which tends to generate higher average revenue per user (ARPU) for mobile operators. However, as mentioned earlier, smartphones are typically power-hungry devices and inadequate access to energy can result in both low usage and low ARPUs. Like other countries in the region, Nepal's connections are overwhelmingly prepaid, as subscribers around the country have become used to paying for a service in advance.

TABLE 3

### MOBILE STATISTICS FOR NEPAL AND OTHER SOUTH ASIAN COUNTRIES<sup>15</sup>

	NEPAL	BANGLADESH	INDIA	PAKISTAN
Population	28,200,712	158,987,240	1,271,148,963	185,885,705
Connections (total)	24,430,577	119,426,187	949,081,259	140,507,896
Unique subscribers	10,997,365	64,789,993	440,667,655	58,301,372
Penetration, unique subscribers	39.00%	41.99%	34.67%	31.36%
Smartphone adoption	14.92%	14.93%	14.31%	14.5%
Number of operators	5	8	12	9

## 2.4. Access to energy in Nepal

Access to the electricity grid in Nepal is between 67.3% (according to the 2011 Nepal Census) and 76.3% (according to World Bank data for 2011). The census data is much more granular and is used for most of the analysis in this report. The World Bank data is used for comparative purposes, as well as for estimates of the addressable market.

Although 67.3% of households get electricity from the grid, access is not consistent, especially in winter months when snow-fed rivers supplying hydropower power plants dry up. November to March are considered dry

TABLE 4

### ELECTRICITY INDICATORS<sup>16</sup>

	NEPAL	BANGLADESH	INDIA	PAKISTAN
Annual per capita electricity consumption (kWh)	106	259	684	449
Electrification %	76.3%	59.6%	75.3%	68.6%
Rural Electrification %	72.1%	47.5%	66.9%	57.4%

14. Conversation with Ncell personnel

15. Q3 2014 data from GSMA Intelligence. Population statistics differ from those in Table 1 as they are estimates for 2014.

16. World Bank Data for 2011 (annual per capita electricity consumption) and 2012. The electrification rate for Nepal is higher by World Bank estimates than in Nepal's census.

months. As Table 4 indicates, Nepal's per capita consumption of electricity is by far the lowest among this group of South Asian countries.

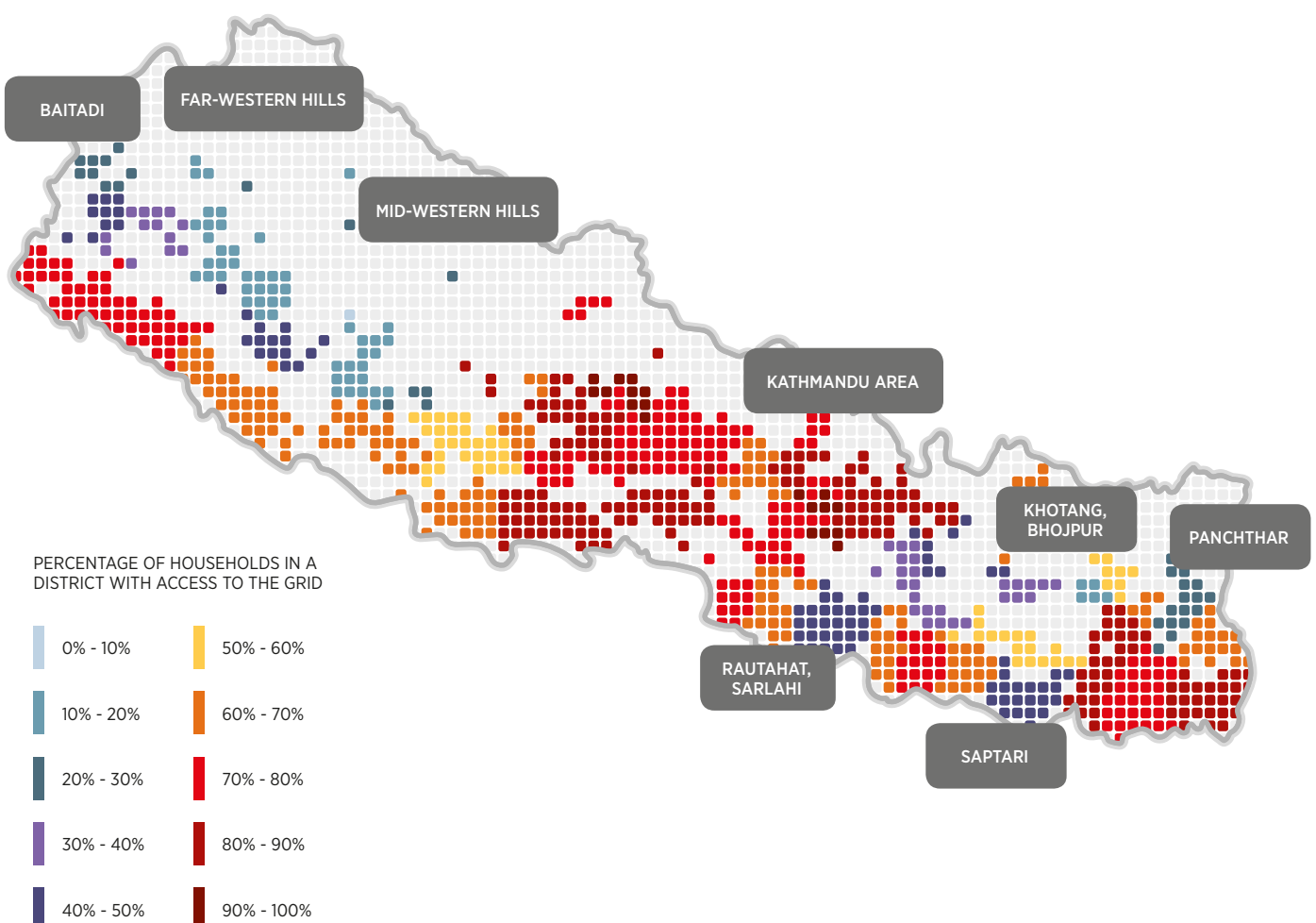
To visualise access to the electricity grid around Ncell sites, data on district grid access from the 2011 Nepal Census was overlaid on Ncell tower locations. Figure 4 below is a digitized map of Ncell tower locations where the colour represents the percentage of households in that district with access to the electricity grid.

As Figure 4 illustrates, access to the grid is best in the Terai zone (southern belt) and urban areas, such as the Kathmandu Valley. However, there are districts even in the Terai, such as Saptari, Rautahat and Sarlahi, where fewer than half of households have access to the grid. The Hill zone is most deprived, especially in the eastern and western parts of the country. The grid reaches less than 30% of households in Panchthar and Baitadi districts, and less than 20% households in many Mid-Western and Far-Western Hill districts. There is very sparse coverage in the Mountain zone (northern belt) where populations are dispersed.

Nepal is rapidly constructing new large hydropower plants to address its generation shortfall. Nepal and India have also begun to trade power, opening up a new source of electricity for both countries.

FIGURE 4

### NCELL COVERAGE OVERLAID WITH PERCENTAGE OF HOUSEHOLDS IN DISTRICT WITH ACCESS TO ELECTRICITY GRID<sup>17</sup>



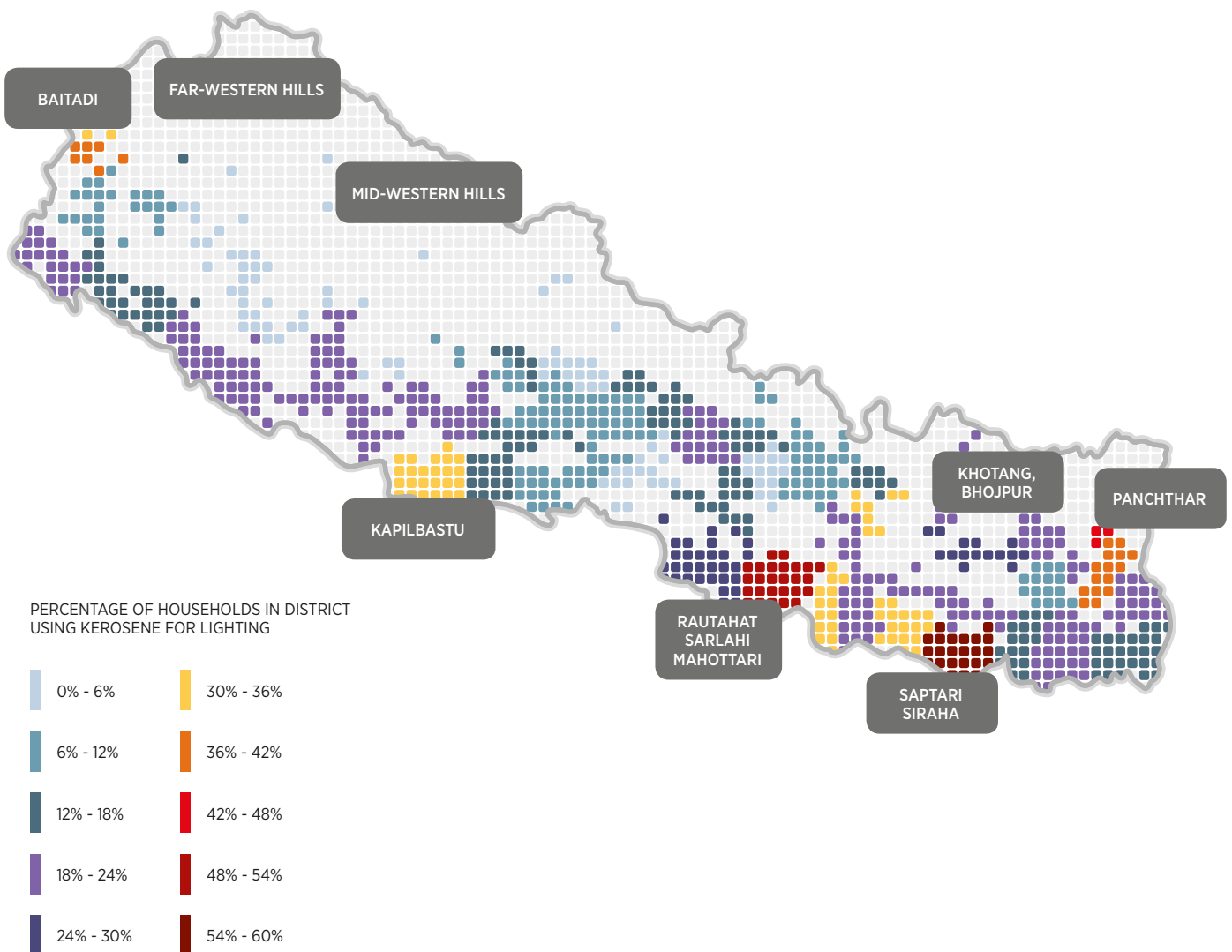
17. 2011 Nepal Census data overlaid on Ncell tower locations

However, increasing supply will address only part of the problem, as Nepal faces significant distribution challenges as well. Large swaths of its territory are hilly or mountainous, and extending the grid over this difficult terrain is extremely expensive. Recently, Nepal received aid from the Government of Norway (USD 55 million) and concessional financing from the Asian Development Bank (USD 180 million) to improve and extend its grid infrastructure.<sup>18</sup> The Nepal Electricity Authority (NEA) has sole distribution rights for grid electricity, but local mini-grids can operate independently of the NEA.

Nearly a million households in Nepal use kerosene as their primary source of light.<sup>19</sup> Figure 5 below is a digitized map of Ncell tower locations where the colour represents the percentage of households in that district using kerosene for lighting. Kerosene usage is highest in some parts of the Terai (southern belt) and in the easternmost and westernmost parts of the Hill zone. More than half of households in Saptari and Rautahat and nearly 40% of households in Panchthar and Baitadi use kerosene for lighting.

FIGURE 5

**NCELL COVERAGE OVERLAID WITH PERCENTAGE OF HOUSEHOLDS IN DISTRICT USING KEROSENE FOR LIGHTING<sup>20</sup>**



18. Royal Norwegian Embassy in Kathmandu, "Increasing energy capacity and network," 14 November 2014, [http://www.norway.org.np/Norway\\_and\\_Nepal/News\\_and\\_events/Increasing-energy-capacity-and-network/#.VMXPyyAvxq](http://www.norway.org.np/Norway_and_Nepal/News_and_events/Increasing-energy-capacity-and-network/#.VMXPyyAvxq)

19. 2011 Nepal Census: [http://unstats.un.org/unsd/demographic/sources/census/2010\\_phc/Nepal/Nepal-Census-2011-Vol1.pdf](http://unstats.un.org/unsd/demographic/sources/census/2010_phc/Nepal/Nepal-Census-2011-Vol1.pdf)

20. 2011 Nepal Census data overlaid on Ncell tower locations

About 400,000 households in Nepal use solar for lighting. According to AEPC's 2013 Subsidy Policy, solar photovoltaic (PV) systems of 10W are eligible for a subsidy of up to NPR 5,000 (USD 51.37).<sup>21</sup> Table 5 shows the entire subsidy scheme for solar photovoltaic systems. This subsidy is provided directly to the vendor so the consumer pays only about NPR 2,500 (USD 25.69) for small systems with two lights and a mobile charger.<sup>22</sup> However, the subsidy scheme can provide a perverse incentive to vendors to supply low-quality systems because the amount of the subsidy is linked to installed capacity, not actual generation. The AEPC is expected to revise the subsidy policy in 2015, and if the new policy improves access to capital to the solar products supply chain, it would create a large PAYG market.

TABLE 5

### SUBSIDIES FOR SHS AS PER 2013 AEPC POLICY<sup>23</sup>

SOLAR PHOTOVOLTAIC (PV) SYSTEMS	SUBSIDY IN NPR (USD)		
	CATEGORY "A" VDCs	CATEGORY "B" VDCs	CATEGORY "C" VDCs
Small SHS (10Wp) <sup>24</sup>	5,000 (51)	4,800 (49)	4,500 (46)
20Wp–50Wp SHS	7,000 (72)	6,200 (64)	6,000 (62)
> 50Wp SHS	10,000 (103)	9,000 (92)	8,000 (82)

Table 6 shows how much each income quintile of the population spends on energy. The quintile with the lowest income spends over a fifth of its income on energy. As expected, the expenditure on energy as a fraction of income drops as income rises.

TABLE 6

### HOUSEHOLD ENERGY EXPENDITURE PER INCOME QUINTILE<sup>25</sup>

INCOME/ENERGY VARIABLES	FIRST QUINTILE	SECOND QUINTILE	THIRD QUINTILE	FOURTH QUINTILE	FIFTH QUINTILE	ALL HOUSEHOLDS
Income (NPR/month)	3,352.9	5,590.9	6,922.8	9,294.5	16,387.9	7,679.3
Income (USD/month)	34.45	57.45	71.13	95.50	168.38	78.90
Energy expenditure as % of income	22.0%	14.8%	12.4%	10.5%	6.4%	11.4%

Where there is no access to the grid, phone charging can cost NPR 10–20<sup>26</sup> or USD 0.1–0.2 per charge plus any associated travel and time costs. MNOs lose revenue when people in energy-constrained areas use their phones sparingly.

#### 2.4.1. ENERGY SERVICE COMPANIES (ESCOs)

In markets with country-wide energy access, the term 'energy service company' (ESCO) is often reserved for companies that design, install and operate power generation and energy supply, delivering energy to their customers in the form of kWh. But in emerging markets where there is not 100% electricity coverage, the term

21. Exchange rate: USD 1 = NPR 97.3261, retrieved from [www.oanda.com](http://www.oanda.com) on 22 January 2015. Figure in USD is rounded to the nearest dollar.

22. Data from field trip to Panchthar district.

23. AEPC Subsidy Policy for Renewable Energy 2069 BS: [http://www.aepc.gov.np/docs/resource/rescenter/20130818060043\\_RE%20Subsidy%20Policy%202013%20-%20English.pdf](http://www.aepc.gov.np/docs/resource/rescenter/20130818060043_RE%20Subsidy%20Policy%202013%20-%20English.pdf)

24. Wp denotes the peak capacity of a solar panel in watts.

25. Reproduced from "Power and People: The benefits of renewable energy in Nepal", 2011, <http://documents.worldbank.org/curated/en/2011/01/14776571/power-people-benefits-renewable-energy-nepal>

26. Conversations with people in the communities visited.

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ESCO is also used to describe organisations, both for profit and not-for-profit, that work on improving energy access. These organisations often operate as traditional ESCOs, but also support the distribution of portable energy products.

Despite low access to the electricity grid, Nepal has a nascent ecosystem of ESCOs supporting renewable energy deployments with broad distribution networks. Community-run micro-hydro plants are an important alternate source of energy, and local and imported solar lanterns and solar home systems of variable quality are widely available. These markets for alternative solutions are still largely unorganised, however.

The situation is beginning to change. Gham Power, with support from the Asian Development Bank (ADB) and DOEN Foundation, is in the process of setting up three solar mini-grids in Khotang district.<sup>27</sup> Lotus Energy is also setting up a solar mini-grid in Tanahu district. All these mini-grids will power productive and consumptive loads. Empower Generation, which has already distributed over 35,000 solar lanterns through its network of women entrepreneurs, is planning to introduce financed purchase of solar home systems.

## 2.5. Mobile and energy: The opportunity

At the time of this study, about a third of Nepal's population did not have access to electricity and 10% did not have mobile coverage. As Ncell seeks to grow its customer base and increase coverage in remote areas, there is both an opportunity and a need to consider how mobile towers will be powered and how customers will keep their phones charged. The 2.8 million people currently without access to both electricity and mobile networks represent a significant market opportunity for Ncell, which will have to find new and creative ways to serve them.

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27. New Ventures, "DOEN Foundation supports Gham Power; a New Ventures facilitated deal", [http://www.nvindia.biz/mailer/NVI-DOEN-GHAM\\_2014\\_1016\\_web.html](http://www.nvindia.biz/mailer/NVI-DOEN-GHAM_2014_1016_web.html)



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# 3. The opportunity in Nepal by business model

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The primary objective of this Feasibility Study was to assess Ncell's tower network and evaluate the opportunity to offer community energy services through the Community Power from Mobile (CPM) model. The secondary objective was to assess other market opportunities in the energy sector that would be profitable for Ncell to participate in.

## 3.1. CPM model

Ncell's network of 2,348 towers is concentrated in the Terai zone, with lower numbers in the Hill and Mountain zones. Of these sites, 156 (6.6%) are off-grid while virtually all sites suffer from brownouts, sometimes for over 20 hours per day during the dry months. Many off-grid sites are powered at least in part by solar energy. Although Ncell is continuously expanding its network to cover remote regions, the operational burden and cost of powering its sites is becoming prohibitive. Subscribers in remote regions typically have limited access to energy, which restricts both mobile phone use and ARPU for Ncell. The CPM model, with energy supplied by an ESCO, can help increase revenue while lowering operating costs.

### 3.1.1. PRIORITY DISTRICTS FOR CPM

The viability of the CPM model depends on at least the following factors:

- No competition from the grid
- High use of carbon-based fuels that can be easily displaced by the new service
- An anchor load with stable demand
- High population density to reduce the cost of distribution.

The following data was used to identify districts where customer demand is highest:

- Households without grid access (% of households in a district)
- Household kerosene usage (% of households in a district)
- Highest number of off-grid sites
- Number of rooftops within 2 km of off-grid sites

Based on this data, three priority districts for CPM were identified: Panchthar, Baitadi and Salyan (see Table 7). Nearly 43,000 households in these districts use kerosene for lighting and only about 6,000 households are within a 2 km radius of the 28 off-grid sites in these districts.

TABLE 7

### PRIORITY DISTRICTS FOR CPM<sup>28</sup>

DISTRICT	HOUSEHOLDS	OFF-GRID SITES	RATIO: OFF-GRID/TOTAL SITES	KEROSENE USAGE (% OF HOUSEHOLDS)	GRID ACCESS (% OF HOUSEHOLDS)	SOLAR USAGE (% OF HOUSEHOLDS)	HOUSEHOLDS/SQ KM	AVERAGE ROOFTOPS WITHIN 2KM OF OFF-GRID SITES
Panchthar	41,176	15	65%	39.5%	27.9%	26.8%	33.2	275
Baitadi	45,167	6	55%	39.8%	24.9%	17.9%	29.7	119
Salyan	46,524	7	44%	18.7%	14.5%	34.6%	31.8	198
Average across all 75 districts	72,311	2.1	6.6%	18.3%	67.3%	7.4%	36.8	311

## 3.2. Pay-As-You-Go (PAYG) systems

PAYG systems offer buyers financial flexibility. Financiers can offer full flexibility to allow buyers can pay in variable instalments that match their uneven cash flow or mandate periodic payments as for a traditional loan.

Collecting these payments can be a monumental task for financiers, especially when the payment period is flexible. Mobile payments are ideally suited to collect such variable payments as well as periodic payments from remote buyers. Moreover, establishing distribution channels to sell PAYG systems in remote communities is prohibitive for solar system vendors. Leveraging an existing, extensive distribution network makes the sale of PAYG systems feasible. Finally, some PAYG systems require a mobile network so they can be remotely monitored and controlled, which would allow an MNO to participate in the sale and operation of PAYG systems in multiple ways: through mobile money (if available), airtime (if permitted by regulation), distribution channels and connectivity.

### 3.2.1. MOBILE MONEY

Mobile money in Nepal is required to be tied to a bank account. There are numerous commercial banks in Nepal, but no dominant players. According to a 2010 paper on the market structure of the banking industry,<sup>29</sup> market share is divided between 25 banks, indicating a fragmented and competitive industry.

Given that it would not be viable for each bank with a fraction of an already small market to design and implement its own mobile money software, two competing platforms have emerged:<sup>30</sup> Fonepay by eSewa and Hello Paisa by FinAccess. Fonepay was launched in 2009 and Hello Paisa in 2012. More than 30 banks use Fonepay, which has access to over 3,000 agents, while Hello Paisa is the platform for six banks with just under 1,000 agents. Despite impressive growth, both platforms still have a long way to go before their agent networks are able to reach large segments of the underserved population.

28. Ncell data and 2011 Nepal Census Data.

29. Dinesh Prasad Gajurel, 2010, "Market Structure of Nepalese Banking Industry", [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1657903](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1657903)

30. Gunnar Camner, 25 November 2013, "Banks in Nepal are building interoperable mobile money offerings," <http://www.gsma.com/mobilefordevelopment/banks-in-nepal-are-building-interoperable-mobile-money-offerings>

In contrast to the banking industry, Nepal's mobile industry is highly concentrated, with two large MNOs serving over 90% of subscribers. If Ncell were to launch a competing mobile money platform, it would have the immediate advantage of being a ubiquitous, attractive brand with a large customer base and the ability to bundle, the capacity to invest, and the power to bargain and enforce contracts with banks, all of which start-ups lack. If the subsidy policy changes to encourage financing rather than a direct subsidy, there would be a significant opportunity for Ncell to benefit from solar vendors using its platform for payment collection.

### 3.2.2. DISTRIBUTION NETWORKS AND CONNECTIVITY

Ncell's omnipresence gives it the opportunity to participate in sales of PAYG solar home systems through its agent network. Ncell agents in central community markets could stock a demo system, do a sales pitch and accept orders. Delivery and installation, if necessary, would be conducted by the system vendor. The partnership could extend to co-branding with Ncell once systems and vendors have proven to be reliable.

Machine-to-machine (M2M) communication-enabled solar systems require GSM connectivity to upload performance data and enable remote control and upgrades. Currently there are only 20,000<sup>31</sup> M2M connections in Nepal. M2M-enabled solar systems could kick-start the adoption of M2M and open up a revenue stream for Ncell.

### 3.2.3. PRIORITY DISTRICTS FOR PAYG

Some of the success factors for PAYG are:

- Access to finance across the entire supply chain as well as the buyer
- Low competition from the grid
- High usage of carbon-based fuels that can be easily displaced by the new service
- Medium population density with availability of product and service at market hubs
- Easy access to payment points.

Based on an assessment of these factors, three priority districts for mobile-enabled PAYG were identified: Rautahat, Saptari and Sarlahi (see Table 8). Over 186,000 households in these districts use kerosene to light their home. Solar has not yet penetrated these markets so they are ripe for trials of affordable access to clean energy.

TABLE 8

### PRIORITY DISTRICTS FOR PAYG<sup>32</sup>

DISTRICT	HOUSEHOLDS	KEROSENE USAGE (% OF HOUSEHOLDS)	GRID ACCESS (% OF HOUSEHOLDS)	SOLAR USAGE (% OF HOUSEHOLDS)	HOUSEHOLDS/SQ KM
Saptari	121,064	55.3%	41.9%	1.0%	88.8
Rautahat	106,652	50.5%	46.6%	0.9%	94.7
Sarlahi	132,803	49.4%	46.6%	2.3%	53.3
Average across all 75 districts	72,311	18.3%	67.3%	7.4%	36.8

31. Q3 2014 data from GSMA Intelligence

32. 2011 Nepal Census: [http://unstats.un.org/unsd/demographic/sources/census/2010\\_phc/Nepal/Nepal-Census-2011-Vol1.pdf](http://unstats.un.org/unsd/demographic/sources/census/2010_phc/Nepal/Nepal-Census-2011-Vol1.pdf)

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# 4. Conclusions

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The Community Power from Mobile model will require experienced ESCO partners to be successful in Nepal. However, the industry is still nascent. Although several institutional systems have been implemented (for example, powering a hospital), solar mini-grids have not. With support from the AEPC, a few pilot systems are in the advanced planning stage. Gham Power is close to implementing mini-grids to power three rural communities with support from the ADB and the DOEN Foundation. Ncell will have to nurture and evaluate such ESCO partners through pilot deployments before launching any large-scale rollouts.

PAYG solar home system distribution is just beginning in Nepal, but a favourable change in the subsidy policy could unlock this market. Initially, PAYG systems will be distributed through Village Level Entrepreneurs (VLEs) and other NGO networks, but these channels are limited in reach and extremely fragmented. Leveraging Ncell's extensive distribution network and a future mobile money deployment presents a significant market opportunity for Ncell.

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# Appendix

## List of abbreviations and acronyms

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- [AEPC](#): Alternative Energy Promotion Centre
- ARPU: Average revenue per user
- CPM: Community Power from Mobile
- ESCO: Energy service company
- kWh: Kilowatt hour
- M2M: Machine-to-machine
- MNO: Mobile network operator NEA: Nepal Energy Authority
- [NEA](#): Nepal Energy Authority
- NPR: Nepalese Rupee
- PAYG: Pay-As-You-Go
- PV: Photovoltaic
- SHS: Solar home system
- VDC: Village Development Council
- VLE: Village level entrepreneur
- Wp: Watt peak



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The GSMA represents the interests of mobile operators worldwide. Spanning more than 220 countries, the GSMA unites nearly 800 of the world's mobile operators with 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in industry sectors such as financial services, healthcare, media, transport and utilities. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai and the Mobile 360 Series conferences.

For more information, please visit the GSMA corporate website at [www.gsma.com](http://www.gsma.com). Follow the GSMA on Twitter: @GSMA.



## Mobile for Development

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



## Mobile for Development Utilities

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The Mobile for Development Utilities Programme improves access to basic energy, water and sanitation services in underserved communities using mobile technology and infrastructure.

Our work encompasses any energy, water and sanitation service provided to a community which includes a mobile component, whether it is voice, SMS, USSD, Machine2Machine, NFC, a mobile operator's agent network or tower infrastructure.

We aim to seize the opportunity, leveraging mobile technology and infrastructure to enhance access to affordable and reliable energy, clean and safe water and sanitation services in underserved communities.

The GSMA Mobile for Development Utilities Programme receives support from the UK Government.



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Present across all the 75 districts of Nepal, Ncell is the leading GSM operator in the country, with over 11 million mobile subscriptions (Q2/2015) and y2014 sales of over USD 500 million (NPR 51.234 billion). Ncell is Nepal's biggest tax payer and has over 500 employees.

Since October 2008, Ncell has been part of TeliaSonera, a leading European telecommunication company present in 17 markets, including the Nordic and Baltic countries, the emerging markets of Eurasia, and Spain.



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