Green Power for Mobile

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hello

Hello – Cambodia – Feasibility Study

Cambodia, with an area of 69,898 square miles, is bordered by Thailand, Laos and Vietnam and has a coastline on the Gulf of Thailand. Apart from the Cardamom Mountains in the south-west and uplands in the north-east, the country is predominantly flat. The scarp slope of the Dangrek Mountains marks much of the northern border with Thailand. In the centre of the country is the largest lake in South East Asia, the Tonle Sap.

Background

The capital, Phnom Penh, is located at the confluence of the Mekong, Tonle Sap and Bassac rivers. Beyond the river valleys the land is frequently infertile because rainfall is scant and there is little irrigation.

Most Cambodians live in rural areas, cultivating rice as their staple crop. *Dry season* runs from November to April on the back of the north-eastern monsoon. November to January are cooler months, while February to April are hot and dusty. November is the coolest month while April is the hottest. *Wet season* runs from May to October courtesy of the south western monsoon. Wet season brings 75% of Cambodia's annual rainfall and July to September are the wettest months.[1]

A pioneer in Cambodia's telecommunications industry, Hello began its services with analogue mobile technology in the early 90s. The company began providing services on the GSM 900/1800 frequency bands under a 35-year cellular concession in 1996 and over the next few years has grown organically to expand its network coverage and market share. In March 2010, the company changed its name to Hello Axiata Company Limited (HACL).

Hello is committed to bringing the latest technologies and solutions to every corner of the kingdom, delivering enhanced communications that will improve the quality of life of every

[1] www.fco.gov.uk

Cambodian. With excellent network quality, Hello has strong presence in key provinces through its network of HelloPoint branch offices and a comprehensive range of voice and data services.[2]

Power Infrastructure in Cambodia

Cambodia's national electricity company, Electricité du Cambodge (EDC), undersupplies and struggles to keep up with an ever-increasing demand for electricity. In order to 'top up' supplies, Cambodia imports electricity from Thailand and Vietnam. Even so, only 20% of the population has access to mains electricity. In remote rural areas, people make do with diesel generators, car batteries, kerosene lamps and candles. Cambodia has no national grid; provincial towns and cities have their own power generation plants and distribution networks with little interconnection. The power plants are small and are mainly fuelled by imported diesel - prices reflect this.

The average price of electricity in Cambodia is approximately US$0.16 per kilowatt/hour and can be as high as US$0.90 per kilowatt/hour in remote rural areas. Electricity prices in Cambodia are the highest in the Asian region.[3]

Challenges of Hello's Network

It is a challenge for operators to keep the energy related OPEX in line while keeping the countrywide operation running smoothly. Around 18% of Hello's base stations are off-grid. The daily running cost for these DGs on average is US$1,113 which creates pressure on Hello's bottom line. Additionally, many sites have very difficult access, especially during the rainy season when many sites are virtually inaccessible for weeks at a time.

Network Summary of Hello

Total Base Stations	622
Off-grid Base Stations	92
On-grid Base Stations	530
Daily OPEX to Run DG	US$1,113
Daily CO2 Emission	100 Tonnes

Source: Hello

Power consumption for air-conditioners is another key challenge for Hello. Air conditioners for indoor BTS sites consume large amounts of power and make the use of alternative energy sources very difficult and expensive.

Challenges of Feasibility Study

GSMA's Green Power for Mobile (GPM) programme worked with Hello to analyse the entire Hello network - consisting of 622 base stations - to identify specific solutions for energy cost savings. There were several challenges in doing this analysis:

- Although many sites are currently 'off-grid', the commercial power supply is expanding into the rural areas, so the cost and likely timeframe of commercial power had to be considered for each site.
- The accessibility of each site was considered when prioritizing the list of suitable sites.
- Demonstrating a financial benefit for replacing diesel generators with an alternative power supply. This was a difficulty because Hello already runs an efficient system of small generators and uses deep cycle batteries to drastically reduce the number of hours the generators need to run per day.

[2] www.hello.com.kh
[3] www.investincambodia.com

Approach of Feasibility Study

Analysing Data

Data analysis is the most important part for a Feasibility Study. Following the supply of very detailed network information from Hello, it became clear that only the 'off-grid' sites would provide a viable model to use 'green power'. Therefore the 92 'off-grid' sites were analysed in detail. While analysing the data, GSMA considered all details which could possibly help dimension the right solution for the network operator.

Design Models

Green power design models were created based on the data analysis. After analysing Hello's network data, GPM found 92 sites have potential for green power implementations. 15 design models were created to cover all 92 sites. These designs were based on Solar and Solar-DG hybrid solutions. All the design models were carefully prepared to get the best possible technical and financial output.

Business Cases for Design Models

GPM created business cases for each design model considering a 20 year business plan. The business cases were prepared based on actual market data and rates and provided a full overview of the CAPEX, OPEX and investment metrics, such as NPV and ROI.

Site Selection for Priority Group

GPM identified site priorities based on technical, financial and environmental indicators. These site priorities were essential for Hello to make a more efficient investment plan. Out of the potential 92 sites, 11 were identified as being the highest priority based on access issues and the probability of availability of commercial power. The 'months to EDC' column indicates the amount of time before commercial power may become available.

Priority Site List

Site Name	Total Site Load (W)	Solar Config (KW)	Battery (Ahr)	Solar Capex ($)	Design	Months to EDC	Distance from Road
Site 1	556	4.26	1500	36,786	2	30 to 35	300 metres from nation road 48 to KKG
Site 2	556	4.26	1500	36,786	2	30 to 35	Close road to KKG
Site 3	570	4.48	1500	37,040	3	30 to 35	25km from main road
Site 4	556	4.03	1500	35,140	1	10 to 15	24km from nation road
Site 5	556	4.03	1500	35,140	1	50 to 60	On island
Site 6	644	4.70	1500	37,990	4	40 to 45	8km from main road
Site 7	644	4.90	1500	39,636	5	40 to 45	15km from main road
Site 8	556	4.03	1500	35,140	1	30 to 35	25km from main road
Site 9	556	4.03	1500	35,140	1	25 to 30	10km from main road
Site 10	556	4.03	1500	35,140	1	35 to 40	9km from main road
Site 11	556	4.03	1500	35,140	1	35 to 40	8km from main road

Renewable Energy Results and Recommendations

Site Designs

15 design models were created for off-grid sites using a pure solar and battery solution. Each of the designs was carefully created to maximise the utilisation of the energy generated.

Design	Total Site Load (W)	Solar (KW)	Battery (Ahr)	Solar Capex ($)	Number of Potential Sites
1	556	4.03	1500	36,836	11
2	556	4.26	1500	37,786	6
3	556	4.48	1500	38,736	4
4	556	4.70	1500	39,686	3
5	644	4.90	1500	40,636	1
6	687	5.15	1500	41,586	1
7	699	5.38	1500	42,536	1
8	791	5.38	2000	46,136	13
9	791	5.82	2000	48,036	10
10	791	6.05	2000	48,986	8
11	911	6.27	2000	49,936	15
12	862	6.50	2000	50,886	9
13	911	6.70	2000	51,836	1
14	862	6.80	2000	52,786	1
15	972	6.94	2500	56,386	4

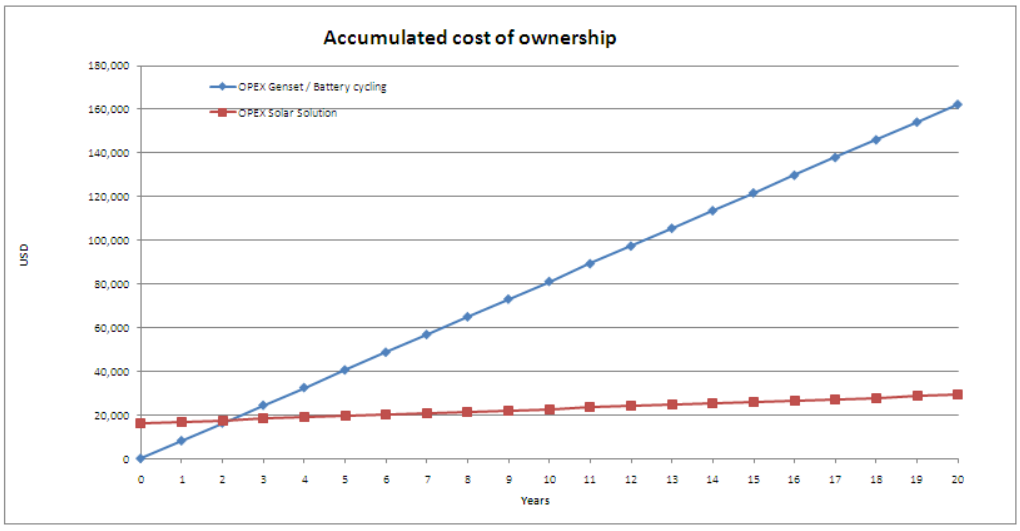
Business Case and Financial Analysis for Priority

GPM created an analysis table for each priority group based on the business case of each design model. This detailed analysis brought an easy understanding for the network operator to identify the credibility of their investment. The analysis consisted of solution details, performance indicators of solution, financial indicators and environmental indicators. The 15 solar models provided payback of between 5 and 9 years depending on site load. This was determined to be generally too long, so hybrid solutions were considered. The hybrid solution utilised solar energy with the generator providing 'backup' power when required. The payback for these designs varied from 2.18 to 4 diesel years.

Hybrid Designs for Priority Sites

Site Code	Total Site Load (W)	Solar Config (KW)	Battery (Ahr)	Hybrid Capex ($)	Solar ROI (Years)	NPV ($)
PKS	570	3.14	800	16,300	2.18	32,552
CHAM	556	3.14	800	16,300	2.18	33,000
KRUS	644	3.81	800	19,150	2.56	34,000
PORG	556	3.14	800	16,300	2.18	33,000
PSLT	556	3.14	800	16,300	2.18	33,000
DRPN	644	3.81	800	19,150	3.08	33,000
RSSK	556	3.14	800	16,300	2.84	33,000
KKTH	791	4.70	800	22,950	3.06	33,000
DNG	791	4.50	800	22,000	3.34	33,000
TPRO	911	5.82	800	27,700	4.00	33,000
BPRL	862	5.60	800	26,750	3.67	33,000
Total Spend				219,200		

Example of Cost Comparison Over 20 Years



Energy Efficiency Recommendations

For overall energy optimisation, GPM came-up with a list of recommendations which could help Hello reduce their energy requirement at every site. These included:

- Not using AC Aircons for off-grid sites
- Using Free Cooling Units (FCU)/DC Aircon for Shelter/BTS-room environment control
- Not using ONLY Aircon for on-grid sites. Use FCU + Aircon if there is a low power outage tendency
- For high power outage on-grid site, use only FCU for Shelter/BTS-room environment control
- Not to keep anything other than telecom equipment in BTS-room
- Purchase outdoor BTS for upcoming deployment
- Use battery coolers for all both on-grid and off-grid sites. It will increase battery life by 50%.
- Use VDT/intelligent controllers to manage battery and DG operation.
- Use energy saving light for all GF/GFRT sites

Summary Results for full Feasibility Study

After the 8 week Green Power for Mobile Feasibility Study, GPM concluded that:

Green power solutions should be implemented at	362 off-grid sites
Green power solutions should not be implemented at	468 off-grid sites
Deep battery cycling at should be implemented	On-grid Sites having more than 6 hrs power outage tendency
A list of generic recommendations those can save up to 40% of energy OPEX.	

GSMA also provided the operator with financial figures for entire green power rollout for priority sites:

Total CAPEX requirement for Priority Sites Green Solution implementation	US$219,200
Current total energy OPEX for off-grid sites	US$89,298/ Yr
Total energy OPEX for off-grid sites after implementing Green Solution	US$7,107/ Yr
Total energy OPEX can be saved at off-grid sites by implementing Green Solution	US$82,191/ Yr
Average Payback period	2.84 yrs
Payback period less than 4 yrs	11 sites
Average NPV	US$33,050
Carbon Emissions Savings	119 Tonnes/ yr

About the GSM Association

The GSMA represents the interests of mobile operators worldwide. Spanning 220 countries, the GSMA unites nearly 800 of the world's mobile operators, as well as more than 200 companies in the broader mobile ecosystem, including handset makers, software companies, equipment providers, Internet companies, and media and entertainment organisations. The GSMA also produces industry-leading events such as the Mobile World Congress and Mobile Asia Congress.

About the Development Fund Serving the underserved through mobile

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

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

GSMA Development Fund