Green Power for Mobile

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Mobinil - Egypt – Feasibility Study

Egypt lies in the north-eastern corner of Africa, a major crossroads between Europe, the Middle East, Africa and west and south Asia, with an area of 386,000 square miles (four times the size of the UK). It is bordered by Libya to the west, Sudan to the south, the Occupied Palestinian Territories, Israel and Jordan to the north-east. Its north coast is on the Mediterranean Sea, while the Red Sea bounds the eastern coast. The Suez Canal links the Red Sea to the Mediterranean - a linkage vital to both Egypt and the world. Less than 4% of the country is cultivated and inhabited, mainly in the Nile Delta and along the banks of the Nile.

Background

The Nile runs for over 1,000 miles within Egypt, from Wadi Halfa in the south to the Mediterranean in the north. It divides the country into four broad regions; the Western Desert, which occupies almost two-thirds of the total area, the Eastern Desert, the Sinai Peninsula, and the Nile Valley and Delta, which is the most densely populated region of the country. Egypt is dependent on the Nile for nearly all its water needs. The vast majority of the remaining land is made up of sparsely inhabited, arid desert.

Egypt is hot and dry in the summer, mild in the winter with rainfall increasing nearer the coastlines. Temperatures increase southwards, and on average, these vary between 22-37 degrees Celsius in the summer and 9-19 degrees Celsius in the winter.[1]

[1] www.fco.gov.uk

Power Infrastructure in Egypt:

Electrical power is supplied to Egyptians by the state-owned Egyptian Electricity Authority (EEA), which has the capacity to produce 15,000 megawatts of power, 80 percent of which are from natural gas. Plans are underway to expand power production by an additional 1,950 megawatts by 2002. Power consumption has been growing at the rate of 5.6 percent year, and EEA plans to invest some US$4.5 billion in the coming years to boost the country's power generation capacity. [2]

Generally the power supply is good in Egypt, especially in high population areas. However many of the telecom sites are in remote areas covering transport links, where commercial power is not available, and these sites are currently powered by diesel generators.

[2] www.nationsencyclopedia.com

Challenges of Mobinil Egypt Network

Mobinil has a large network consisting of nearly 5000 sites covering the most inhabited areas, and the roads that transverse the country. Egypt has a good commercial power supply in most inhabited areas, but many of the Mobinil sites are in remote areas covering the large road network, and these sites have no access to commercial power. The high summer temperatures can be a challenge for providing economic cooling solutions. All off grid sites are powered 100% by diesel generators, and the operator is concerned with the likely large increase to the current subsidized diesel price in the country.

Network Summary

Total Base stations	**4910**
Off grid Base stations	150
On grid Base stations	4760
Daily OPEX to run DG	$6,500
Daily CO_2 Emission	8846 Tonnes

Source: Mobinil

Challenges of Feasibility Study

GSMA had to analyse the entire network which consists of 4910 base stations. Egypt is a geographically large country, with varying meteorological conditions. The current Diesel fuel price is heavily subsidised by the government. The current price of $.29 / L, is very low compared with other countries, and makes any renewable energy solution difficult to promote. However it is thought that the diesel price will increase markedly in the coming years, so that was built into the business cases. However the increase is only a projected increase, based on previous years, and could indeed be far higher in actual terms.

Approach of Feasibility Study

Analysing Data:

Data analysis is the most important part for a green power feasibility study. GSMA analysed year-wise network data for Mobinil that consisted of 4910 sites. While analysing the data, GSMA considered every detail which possibly could help dimension the right solution for the network operator. Solar solutions are suitable throughout the country, but a Wind solution was deemed to be suitable in certain areas close to the Red Sea.

Design Models:

Green power design models are created based on the data analysis. After analysing Mobinil network data, GSMA found 150 off grid sites, 98 of these sites were deemed most suitable for green power implementation. Five Homer Solar design models were created to cover all 98 sites. A separate list was developed for possible wind sites, which involved a site visit to ascertain suitability. Eighteen sites were found to have the potential for a wind solution. For the higher power sites a Solar / Generator Hybrid design was produced, this was deemed suitable for the remaining off grid sites. All design models were carefully prepared to get the best possible technical and financial output.

Business Cases for Design Models:

GSMA created business cases for each design models considering 10 year business plan. The business cases were prepared based on actual market data and rates. Each of the business case provided a full idea of CAPEX, OPEX, Cash Flow and all relevant financial terms.

Priority Group:

GSMA identified site priorities based on technical, financial and environmental indicators. Priority groups were set based on site importance, site load, CAPEX, ROI and OPEX saving of individual sites. Site priorities were essentially important for Mobinil to make their investment plan more efficient. After preparing technical solution and business cases for all 98 most suitable sites the GSMA analysed and came-up with 3 priority groups. Investment plan and analysis of financial indicators were also done for all 3 priorities. Setting Site priority enabled operator to make their investment plan more flexible and accurate.

	Priority 1 (500W)	Priority 2 (600W + 700W)	Priority 3 (800W + 900W)
Number of sites	13	51	34

Renewable Energy Results and Recommendations

5 Homer Solar design models were created for off-grid sites. Each of the design is created carefully to maximize the best utilization of generated energy. While dimensioning the equipment, a specific load requirement was calculated and solution was recommended based on the precise load calculation. Solar-hybrid solutions were proposed for higher power sites (above 900W) as the complete Solar solution did not provide a Financially viable solution above that power level. Separate models were produced to show the viability of wind power at certain sites.

Business Case and Financial Analysis for Priority

GSMA created an analysis table for each priority group based on prepared business case of each design model. As Mobinil was suggested to invest based on GSMA recommended Priority, the detailed analysis brought an easy understanding for the network operator to identify the credibility of their investment. The analysis consisted of solution details, performance indicator of solution, financial indicator and Environmental indicators. An analysis table for Priority 1 Solar sites is given below:

Priority 1 Financial Analysis

	Overall Financial analysis for Priority-1 rollout (500W)					
	CAPEX (US $)	OPEX Saving/yr (US $)	Payback Period (yr)	ROI	NPV (US $)	CO2 Emission reduction (Tonne/Yr)
Total	740,883	204,007	1.73	58%	361,270	767
Average	56,991	15,692			27,790	59

Priority Results Summary Table

Similar to above, a detail analysis is prepared for each priority group. To emphasize on investment part, a separate financial details was created to have specific focus. It's noticeable that mobile operators mainly considers CAPEX and OPEX saving part within the financial analysis, therefore this was addressed with proper attention. A summary table of financial results for all priority groups is as follow:

Priority Sites Summary Table

Total Site Power	CAPEX	10 Yr Payback (Yrs)	20 Yr Payback (Yrs)	10 Yr NPV	20 Yr NPV	Operating Cost Savings (10Yr)	Operating Cost Savings (20Yr)	Potential Number Of Sites	Total CAPEX Required	Total Cost Savings (10Yr)	Total Cost Savings (20Yr)
500W	$56,991	1.73	0.75	$27,790	$59,922	$156,929	$841,570	13	$740,883	$2,040,077	$10,940,410
600W	$74,089	2.67	1.14	$12,585	$45,674	$137,502	$824,472	4	$296,356	$550,008	$3,297,888
700W	$78,976	2.93	1.26	$8,325	$41,602	$132,465	$819,856	47	$3,711,872	$6,225,855	$38,533,232
800W	$92,501	3.72	1.63	-$4,290	$25,411	$115,449	$770,529	15	$1,387,515	$1,731,735	$11,557,935
900W	$98,232	4.04	1.76	-$9,265	$20,434	$109,481	$766,389	19	$1,866,408	$2,080,139	$14,561,391
							Total	98	$8,003,034	$12,627,814	$78,890,856

Potential Carbon Savings - For the 98 Sites converted to Solar Power. This would save 2,189,214 Litres of Diesel per year. This equates to a saving of 5757 Tonnes of Carbon per year

Wind Solution

A total of eighteen sites were surveyed along the Red Sea coast and were deemed suitable for Wind Power. The wind is consistent throughout the year, and wind studies have already been carried out in the area, there is also several commercial wind farms in the area, which indicates the potential for wind power.

Wind Solution Financial Analysis

	Overall Financial analysis for Wind Solution rollout (18 Sites)					
	CAPEX (US $)	OPEX Saving/yr (US $)	Payback Period (yr)	ROI	NPV (US $)	CO2 Emission reduction (Tonne/Yr)
Total	1,332,000	331,200	2.71	37%	211,896	1061
Average	74,000	18,400			11,772	59

Hybrid Solution

The remaining higher power (>900W) off grid sites are best suited to the Hybrid solutions, an example is shown below. There are more than fifty sites, which currently fit this criteria.

Hybrid Solution Financial Analysis

	Overall Financial analysis for Hybrid Solution					
	CAPEX (US $)	OPEX Saving/yr (US $)	Payback Period (yr)	ROI	NPV (US $)	CO2 Emission reduction (Tonne/Yr)
Site 1200W	69,000	19,040	3.2	31%	3,717	56

Energy Efficiency Recommendations

For an overall energy optimization, GSMA came-up with a list of generic recommendations which could help Mobinil reducing their energy requirement at every site. Such as:

- Not to use any Aircon for off-grid sites
- Use **FCU/DC Aircon** for Shelter/BTS-room environment control.
- No to use ONLY Aircon for on-grid sites. Use **FCU + Aircon** if 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 cooler** for all both on gird and off grid sites. It will increase battery life by 50%.
- Use **VDT/intelligent controller** to manage battery and DG operation.
- Use energy saving light for all GF/GFRT sites

There is a number of off-grid sites which were not been recommended for green solution due to the site characteristics and poor business case. GSMA came up some specific recommendations for those sites which can help reducing Mobinil energy OPEX on those particular sites. Such as:

- Dismantle all existing Aircon and use FCU instead
- Use battery cooler
- Turn off unused/less used TRX
- Use energy savings light

Summary Results for Full Feasibility Study

Mobinil have expressed a great deal of enthusiasm to start a roll out for solar sites, starting with the higher priority sites. After an 8 weeks green power feasibility study, GSMA concluded with the following findings.

Suggesting green power solution implementation at	150 off grid Sites
Not suggesting green power solution implementation at	4760 off grid sites
Deep battery cycling at	Any on grid sites those are having more than 6hrs power outage tendency
A list of generic recommendations those can save up to 40% of energy OPEX.	

For the initial implementation of the 98 solar sites, the following figures have been calculated

Total CAPEX requirement for Green solution implementation	$8 million
Current total energy OPEX for off grid sites	$1.9 million/yr
Total energy OPEX for Off grid sites after implementing Green solution	$127,000/yr
Total energy OPEX can be saved at off grid sites by implementing Green Solution	$1.77 million/yr
Payback period less than 4 yrs	98 sites
Diesel Savings	2.19 million Litre
Carbon Emission Savings	5757 Tonnes

GSMA Green Power for Mobile Programme

Promoting Green Power to Extend Mobile beyond the Grid

An estimated 1.6 billion people live without electricity. An additional 1 billion people live in areas with unreliable access to power. In order to expand into areas without regular electricity, mobile networks have primarily used diesel generators for power. However, as diesel prices rise and mobile network infrastructure is built in increasingly inaccessible regions, mobile operators need a viable alternative to diesel, such as solar and wind power. Recent technological improvements and cost reductions in green power solutions have made this alternative more commercially attractive. Coupled with the environmental benefits of reduced diesel use and subsequent emissions, green power solutions provide a promising opportunity for operators.

The GSMA Green Power for Mobile programme has set the goal of helping the mobile industry use renewable energy sources, such as solar, wind, or sustainable biofuels, to power 118,000 new and existing off-grid base stations in developing countries by 2012. Achieving that target would save up to 2.5 billion litres of diesel per annum and cut annual carbon emissions by up to 6.8 million tonnes.

The Green Power for Networks work stream within the Green Power for Mobile programme focuses on aiding the mobile industry to deploy solar, wind, or sustainable biofuels technologies to new and existing off-grid base stations in developing countries. The Green Power for Networks work stream supports the mobile industry in this initiative by providing:
- Network Feasibility Studies: Complete network assessments on technical and financial viability of renewable energy for BTS sites.

Aiding network operators to deploy renewable energy, GPM will be promoting the expansion of mobile networks into regions currently lacking coverage (to bring coverage to the unconnected) and the systematic reduction of reliance on diesel consumption by operators.

Project Locations and Operator Partners:

Community Power:

Community Power aims to utilize the excess power created by base stations, by distributing it into the local community. At a minimum, operators can provide excess power to the community for small needs such as charging up mobile handsets, large household batteries and rechargeable lanterns. At a maximum, the consistent power requirement of a mobile base station provides a stable demand for a bigger investment by a third party company in a village energy system, powering the base station as well as local homes and businesses. This is currently being investigated by the GPM team in India and East Africa with the hope of extending further into the developing world upon success.

GSMA Contacts

If operators are interested in finding out more about this service or the GPM programme please enquire at the contact information given below:

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http://www.gsma.com/Green-Power-for-Mobile/

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