Green Power for Mobile

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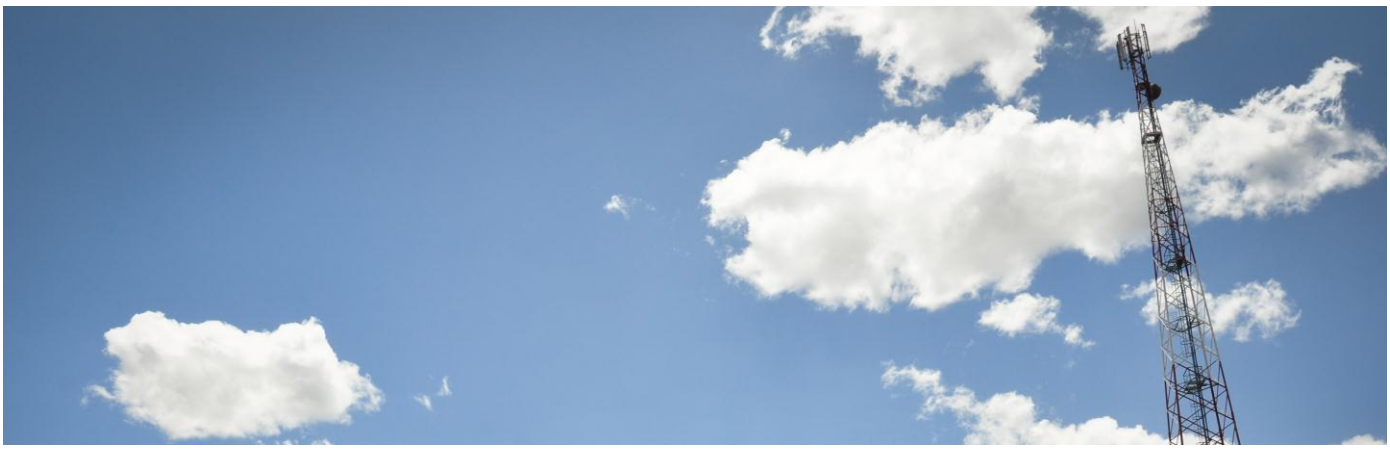

Telecel – Zimbabwe – Feasibility Study

Zimbabwe is twice the size of the United Kingdom. The country is completely land-locked, occupying the high plateau between the Zambezi River to the north and the Limpopo to the south, with a mountainous region in the east. Zambia, Mozambique, South Africa and Botswana border Zimbabwe (clockwise from the north).

Background

Electricity is severely restricted and there are frequent water shortages. Official unemployment is over 90%. Life expectancy – at 37 for men and 34 for women - is the lowest in the world. HIV/AIDS kills an average of 50 people a day. Agriculture is the most important sector of the economy, but has been severely disrupted by land resettlement.[1]

Power infrastructure in Zimbabwe:

Zimbabwe Electricity Supply Authority (ZESA) has the sole responsibility for power generation and distribution. The search for national energy self-sufficiency in the early 1980s led to an emphasis on coal and other thermoelectric projects (78 percent of supply) and the hydroelectric power from the Kariba dam (22 percent). Although the second stage of the Hwange thermal power station, commissioned in 1987, raised the total capacity to 2,071 megawatts (mw), supply has failed to keep up with demand, leading to imports from Mozambique and South Africa.

All oil and gas is imported. A pipeline from Port Beira in Mozambique to Mutare which was built before the 1965 declaration of independence did not become operational until 1982, and was extended to Harare only in 1993. Ethanol, produced since 1980 from sugarcane, is blended with gasoline for domestic sale.[2]

Although the power distribution covers most areas within the country, the reliability of

[1] www.fco.gov.uk
[2] www.nationsencyclopedia.com

supply is inconsistent, and getting power to remote stations can be expensive.

Challenges of Telecel Zimbabwe network

Telecel Zimbabwe has a small network consisting of only 290 BTS sites covering the most inhabited areas, and the roads that transverse the country. Zimbabwe has a good commercial power network, although daily outages are common place. Most sites are relatively close to a commercial power connection, at a relatively low cost. Where commercial power is present, the only viable business cases for the implementation of a 'Green Power' Solution are for the low power sites.

Several sites were identified by the Telecel team, as being very expensive to connect commercial power; these sites provided a good opportunity to produce a financial viable business case for the introduction of renewable power. Designs and business cases were produced for all these sites.

Challenges of Feasibility Study

Zimbabwe has an extensive commercial power network, and therefore all of the BTS sites are connected to the commercial power network, or are waiting for commercial power connection. The financial business cases for renewable solutions do not provide a competitive result if compared to commercial power, especially if the commercial power has already been connected. The GSMA study concentrated on the more new remote sites, where the cost of commercial power can be very high. The BTS sites are also relatively high power consumption, due to the equipment chosen, and the need for the provision of 3G at all sites.

GSMA also suggested the replacement of diesel generators with deep cycle batteries, where the commercial power is unreliable.

Approach of Feasibility Study

Analysing data:

Data analysing is the most important part for a green power feasibility study. GSMA analysed the entire Telecel Zimbabwe network. The main focus for the study was the planned sites with a large capital expense for the connection to the commercial power network, thus allowing a good financial business case for the implementation of a solar solution. A wind power solution was not found to be suitable due to the lack of sustained wind, in this land locked country.

Design Models:

Green power design models are created based on the data analysis. Due to the general availability of the commercial power network it was not financially viable to provide a green solution. However HOMER models were created for the sites which were found to have a high cost for power connection. Five sites have been initially identified as having high power connection cost, with others to follow as the network expands. All sites are similar design, and therefore have the same power consumption at about 1900W. 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.

Renewable Energy Results and Recommendations

Five 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 equipments, a specific load requirement was calculated and solution was recommended based on the precise load calculation.

Business Case and Financial Analysis

GSMA created an analysis table for each site based on prepared business case of each design model. As Telecel Zimbabwe was suggested to invest based on GSMA recommendations, 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 the five Solar sites are given below:

Table 1: Solar Solution Financial Analysis

	Commercial Power Cost ($)	PV (KW)	Battery (Ahr)	Autonomy (Hrs)	Excess Elec (%)
Driefontein	70,000	11.5	4000	71	12.7
Matangeni	20,000	11.5	4000	71	12.7
Ngundu	60,000	11.5	4000	71	10
Chadomunhu	40,000	12	4000	71	11
Rutenga	30,000	12	4000	71	12

	Commercial Power Cost ($)	HOMER ($)	Additional Cost ($)	Total Cost ($)	Payback (Yrs)	NPV
Driefontein	70,000	61,100	40,000	101,100	1.6	$20,162
Matangeni	20,000	61,100	40,000	101,100	6.4	-$22,338
Ngundu	60,000	61,100	40,000	101,100	2.6	$11,829
Chadomunhu	40,000	62,400	41,000	103,400	4.7	-$6,918

From the financial results, it is shown, that commercial power connection costs above 60K provide a good return on investment, having a payback of less than three years.

	Overall Financial analysis for the Five New Sites				
	CAPEX (US $)	OPEX Saving/yr (US $)	Payback Period (yr)	NPV (US $)	CO2 Emission reduction (Tonne/Yr)
Total	511,000	53,200	4.2	-12,517	230
Average	102,200	10,640		-2,503	46

Telecel should look at replacing diesel generators at most sites with commercial power, with a bank of deep cycle batteries. This would reduce carbon emissions, and protect the operator from increased fuel prices and fuel theft in the coming years.

Replacing the generators with batteries would reduce the overall OPEX per site by $50k over 10 Years. Therefore over the whole network this could save in excess of $14 Million in OPEX over 10 years, and negate the effect of any diesel price rise. The CAPEX cost to replace all Generators with Batteries would be approx. $4 Million. But a phased approach would be recommended.

This would save approx. 850,000 Litres of fuel per year, and reduce Carbon Emissions by 2244 Tonnes / year.

Deep Cycle Battery Summary:

	Overall Financial analysis for converting existing sites to Deep Cycle Batteries				
	CAPEX (US $)	OPEX Saving/yr (US $)	Payback Period (yr)	NPV (US $)	CO2 Emission reduction (Tonne/Yr)
Total	3.7 Million	1.45 Million	2.6	5,335	2244

Energy Efficiency Recommendation

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

Many of which Telecel have already started to implement, with their replacement of indoor sites, with outdoor.

- 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

Summary Results for Full Feasibility Study

Telecel Zimbabwe has expressed a great deal of enthusiasm to start a roll out for energy saving initiatives, including outdoor BTS, and battery cycling. They are also keen to trial the totally solar powered sites.

After a four week green power feasibility study, including training, GSMA concluded with the following findings.

Suggesting green power solution implementation at	5 off grid / high cost Sites
Not suggesting green power solution implementation for Off grid Sites at	0 off grid sites
Deep battery cycling at	Currently being implemented at all sites throughout the network. Saving up to 60% of Diesel consumption.
A list of generic recommendations can save up to 40% of energy OPEX.	

For the initial implementation of the 5 solar sites, the following figures have been calculated

Total CAPEX requirement for Green solution implementation	$511,000
Current projected total energy OPEX for the five sites	$62,000/ yr
Total energy OPEX for Off grid sites after implementing Green solution	$8800/ yr
Total energy OPEX can be saved at off grid sites by implementing Green Solution	$53,200/ yr
Payback period less than 5 yrs	3 sites
Diesel Savings	14,600 L/ yr
Carbon Emissions Savings	38.5 Tonnes / yr

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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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