



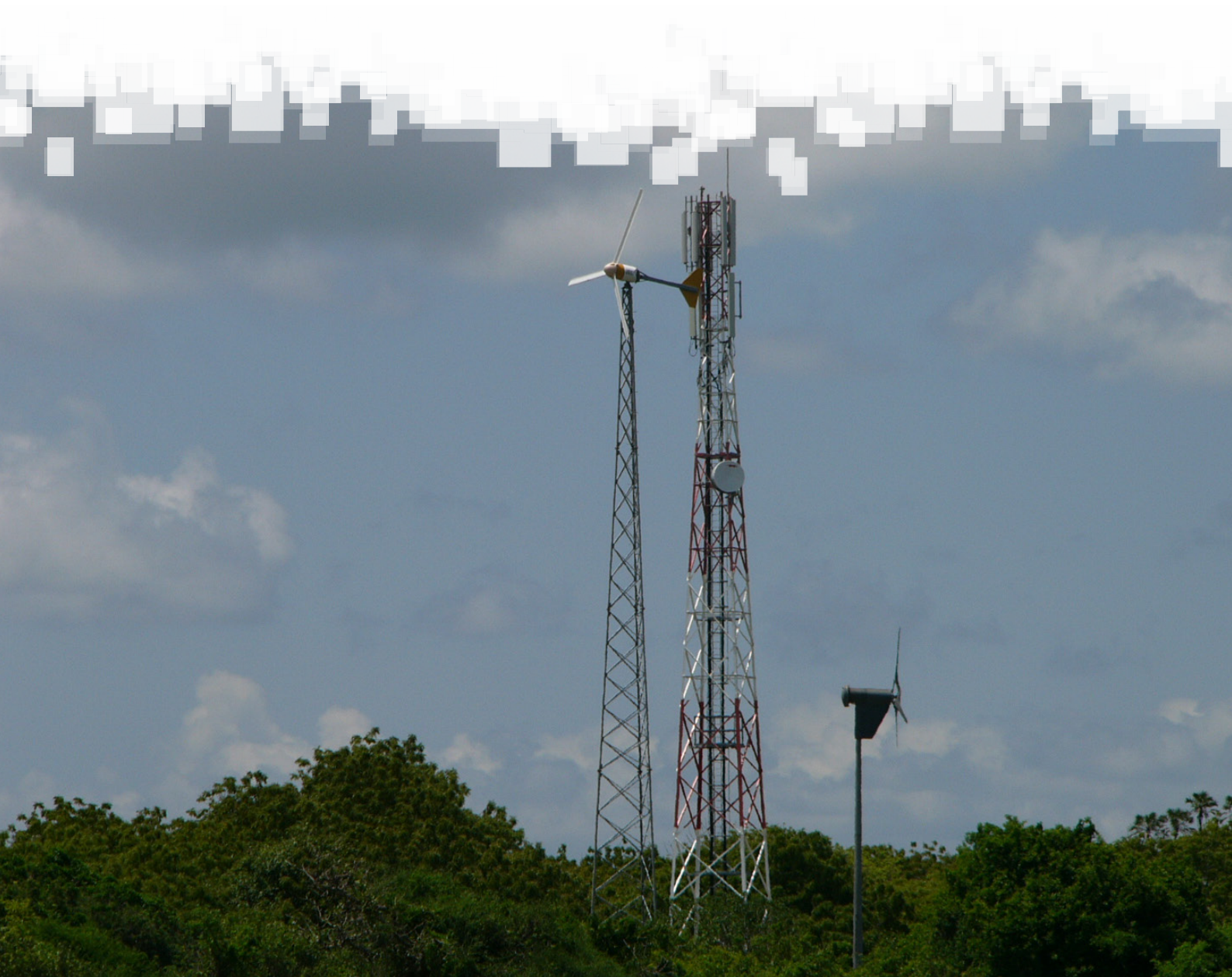
Green Power for Mobile



Supported by



Econet Wireless Burundi – Feasibility Study





This document has been written to provide information to mobile operators who are considering or planning to deploy 'green' renewable power resources for base station and transmission sites. It details the experiences gained during the GSMA Feasibility Study conducted for Econet Wireless Burundi.

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Executive Summary

The GSMA Development Fund was commissioned by Econet Wireless Burundi during March to May 2010 to complete a Green Power for Mobile Feasibility Study to analyse the operator's network and propose a plan for a green power network. The study analysed the operator's entire existing and immediate upcoming network and ranked the most suitable green sites according to specific criteria defined in the GSMA Green Power for Mobile (GPM) methodology. Field visits to several sites were conducted and site dimensioning proposals were drafted for all target sites.

The main findings of the study which analysed 117 sites are as follows:

- The implementation of green power solutions in off-grid and excessive power outage on-grid base station and transmission sites represented a technically feasible and financially attractive solution for Econet Wireless Burundi compared to current power provision systems in the majority of the sites that were studied
- Energy analysis should be undertaken at network planning and vendor selection stage. At existing sites there is often not enough space for installing the ideal photovoltaic system whereas the telecom equipment power consumption is very high in almost every case
- Low power and diesel generator only sites show the best financial indicators. At these sites, generators are often oversized and run 24 hours a day. The usage of a green power solution would allow a significant decrease in generator run-time and operating expense (OPEX). On-grid sites with excessive power outage can also be considered the same
- Mobile operators venturing into green power solutions for their networks must be supported by experienced resources those are specialised in the specific application of green power and telecoms. The GSMA offers technical assistance services through its 'Green Power for Mobile' programme to provide operators with the skills and understanding to implement green power solutions. See 'GSMA Technical Assistance for Operators' for more information
- Implementing all the proposed solutions would have a total capital expense (CAPEX) value of US\$8.7 million, which would create a yearly saving of \$US2.9million in OPEX and approximately 3000 tonnes of CO₂ emissions.

Objective

Implementation of renewable energy systems to off-grid sites were complete during the GSMA Development Fund's previous green power trials in Namibia, India, Vanuatu and Sri Lanka, which have proved the effectiveness and financial viability of green power solutions. As a result the GSMA has developed a vendor neutral advisory service that is available to member operators through a 10 to 12 week feasibility study.

The main objectives of the feasibility study was to demonstrate the GPM methodology for green power solutions, to provide Econet Wireless Burundi with a high level analysis of their network from an energy perspective, to produce a ranking of priority target sites and to complete site dimensioning proposals for target sites.



Background

Burundi is a small landlocked hilly country with considerable altitude variation from 772m to 2670m in East Africa. It has a population of over 9.5 million¹, most of which live in rural areas. The climate in Burundi is equatorial and there are two rainy seasons from February-June and from September-December; the rest of the year is dry. Despite the rainy seasons, sun radiation levels are satisfactory for green applications throughout the year, but average wind-speed is less than 4m/s which is typically not suitable for wind turbines.

Econet Wireless Burundi is part of the Econet Wireless Group and currently its market penetration rate in Burundi is 0.96%². The operator launched its services on March-2009 and currently has more than eighty thousand subscribers. Econet Wireless Burundi is providing GSM coverage and currently expanding its network more than 32% of their BTS and transmission sites are not connected to the electrical grid and are powered solely by diesel generators.



¹ CIA World fact book (<https://www.cia.gov/library/publications/the-world-factbook/geos/by.html>)

² Data from Econet Burundi

Power Infrastructure in Burundi

Burundi is a small country with no natural gas or oil resources. Civil war and political instability for decades made this country one of the poorest nations in Africa. Gross Domestic Product (GDP) growth was 3.2%² in 2009. The lack of energy sources put Burundi under extreme pressure when it comes to producing electricity. Currently Burundi provides only 92million kWh of power³ on-grid which only covers approximately 15% of the total land area. Even in areas where grid connectivity is available, power outages are common and range from 6-16 hours per day due to the limited production. This lack of power infrastructure and production has prevented the mobile operators in Burundi from rolling out telecoms infrastructure aggressively due to the increased operating expense which has drastically impacted the market penetration and availability of telecoms service. The regulatory authority in Burundi has put pressure on network operators to expand network coverage to more rural and remote areas as a part of their license obligations.



³ CIA World fact book-Indexmundi (http://www.in dexmundi.com/burundi/electricity_production.html)

Feasibility Study

The Feasibility Study conducted at Econet Wireless Burundi was based on the GSMA GPM methodology which has been developed based on the experience of previous GPM trials in combination with consultation with mobile operators and renewable energy experts.

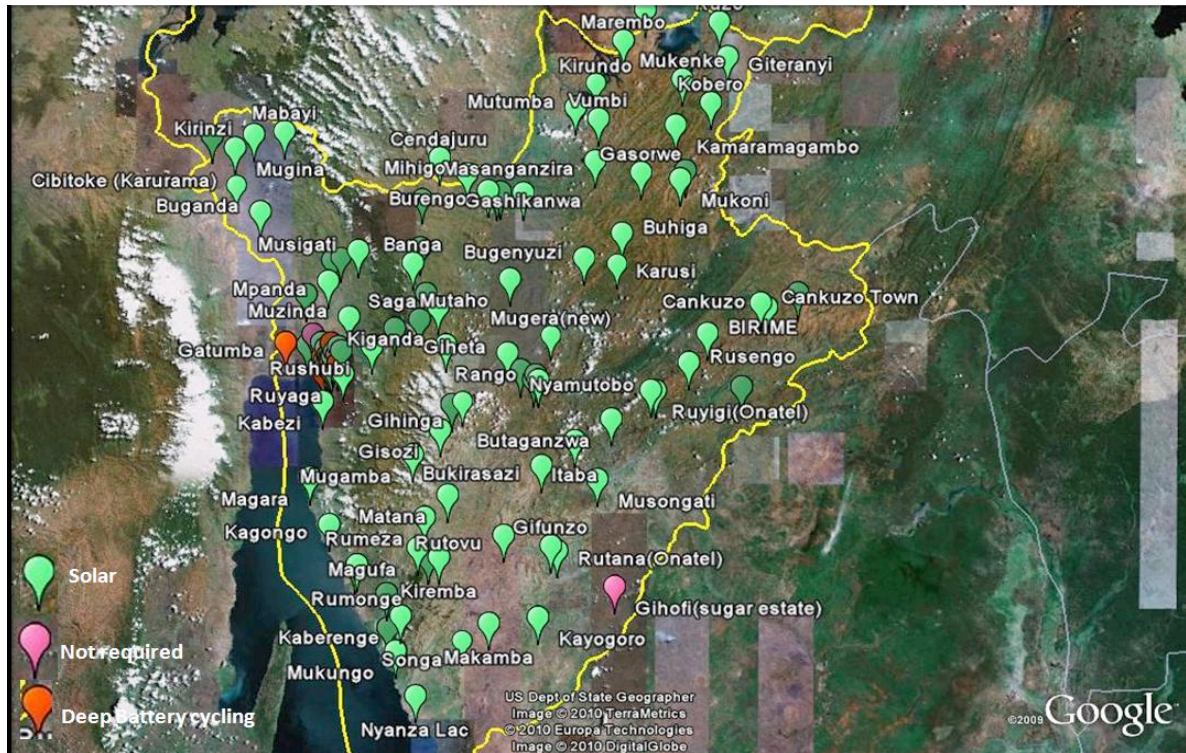
There were three phases of rollout for Econet Wireless Burundi. Each phase has on-grid and off-grid sites with both indoor and outdoor base-stations. The study focused primarily on off-grid sites but close attention was also given to on-grid sites as there are substantial power-outages at each on-grid site.

After assessing the entire network and analysing the sites in terms of site configuration, equipment and power requirements, eight sets of priorities were defined that will help the operator plan investments. The selected sites were grouped into 11 specific design models based on the site characteristics and power consumption.

Site visits were conducted for existing sites – this was key in understanding site specific characteristics including availability of space for green power equipment, terrain obstacles, micro-climate etc. These characteristics are all key pieces of information that need to be considered when prioritising sites.

For each of the targeted sites, accurate financial and renewable energy forecasts were completed using the HOMER (NREL-The National Renewable Energy Laboratory) software to dimension the renewable energy equipment.

Figure 1 - Map of Base Stations Analyzed in Feasibility Study with Recommended Solution



Results and Recommendations

Key Performance Indicators

Financial indicators, renewable energy indicators and environmental indicators were calculated and presented to Econet Wireless Burundi with a set of recommendations:

Financial Feasibility Indicators

Return of Investment (ROI) was established as a key performance indicator for assessing the financial viability of the proposed renewable energy solution. This parameter together with other financial indicators such as Net Present Value (NPV), Capital Expenditure (CAPEX) and Internal Rate of Return (IRR) were also calculated based on vendor specific quotations received. It was identified that if green power solutions would be implemented on the analysed sites, a total of US\$2.72M per year in OPEX could be saved.

Renewable Energy Indicators

Data collected from weather databases showed that for selected locations wind would not be a reliable source of power for the sites. However solar power proved to be an acceptable solution, especially when combined with deep cycle batteries and the existing diesel generator (as a backup power source). Some of the essential indicators in the design decision making process included the power contribution of the renewable energy component compared to the overall system requirements and the autonomy of the system.

Environmental Indicator

CO₂ emissions due to diesel generators can be reduced drastically by implementing renewable energy solutions. The amount of CO₂ emission reduction is also a key factor for selecting appropriate green solution. An estimated 3000 tonnes of CO₂ emission can be saved by implementing green solutions for the suggested sites.

Figure 2 - Example of Key Financial and Technical Indicators

Priority	Energy Contribution	Average Autonomy (hr)	Number of Sites	Total CAPEX (US\$)	Total Yearly OPEX (US\$)	OPEX Saving/yr (US\$)	Payback period (yr)	ROI	NPV (US\$)	IRR	CO ₂ Emission Reduction (tonnes)
1	PV 93% : DG 7%	53.2	4	456,096	3,852	160,588	2.84	35%	305,936	34%	186.7
2	PV 93% : DG 7%	57	27	2,054,292	173,830	793,580	2.61	39%	1,721,789	38%	102.6
3	PV 100% : DG 0%	89.6	12	694,560	212,416	212,416	3.27	30%	324,028	30%	189.2
4	PV 100% : DG 0%	162	5	412,260	173,659	173,659	2.19	62%	401,281	56%	203
5	PV 93% : DG 7%	53.2	7	684,144	240,882	240,882	2.84	35%	458,904	34%	280
6	PV 92% : DG 8%	50.5	3	342,072	115,392	115,392	2.96	34%	208,869	32%	139
7	PV 100% : DG 0%	78.7	29	2,192,808	553,566	558,566	3.96	25%	531,650	25%	571.6
8	PV 100% : DG 0%	80.6	25	1,865,560	475,420	475,420	3.92	25%	472,104	25%	492.75

Key Renewable Energy Recommendations

- 76 sites were recommended to use only Solar Panel as a source of green power.
- 25 sites were recommended to use Solar + DG.
- Suggested to reduce CO₂ Emission by minimizing the usage of diesel generator.
- Wind turbine was not recommended for any site as average wind speed for Burundi is below good workable range.

Key Energy Efficiency Recommendations

GSMA listed and made key recommendations to Econet Wireless Burundi to reduce power consumption and provided ways to optimise power consumption such as:

- Replace all existing air-conditioner to DC air-conditioner for phase-1 sites.
- Switch off all unused transceivers (TRX)
Use outdoor BTS for upcoming sites.

GSMA Technical Assistance for Mobile Operators

The GSMA has identified a need for mobile operators to have access to vendor neutral, non-biased technical assistance services. Through its GPM programme, the GSMA has established a service to address this need.

Green Power for Mobile

In September 2008, the GSMA Development Fund launched its Green Power for Mobile programme (GPM) to ‘extend mobile beyond the grid’ with two primary objectives:

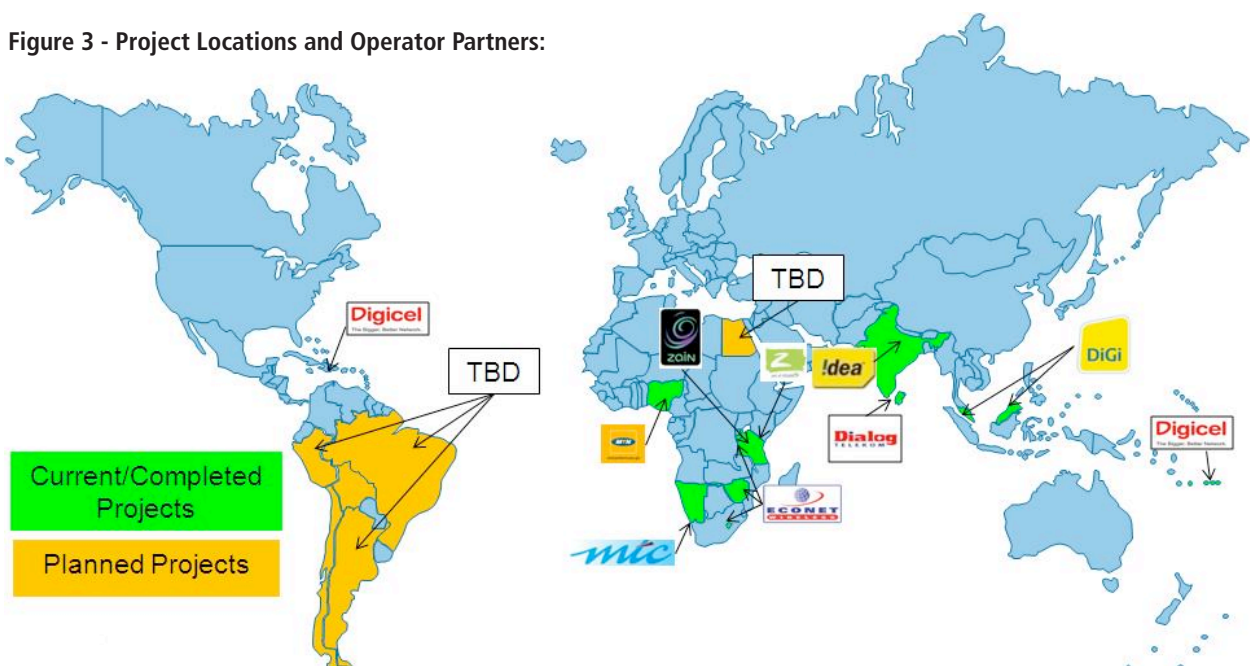
1. To systematically reduce diesel consumption by mobile operators through the promotion of renewable energy technologies and energy efficient base stations
2. To remove the barriers to handset charging in off-grid regions

The GPM programme aims to advance the use of renewable energy sources by the mobile industry to power 118,000 new and existing off-grid base stations in developing countries by 2012. Achieving this target will save up to 2.5 billion liters of diesel consumption and cut annual carbon emissions by up to 6.8 million tons.

The programme has partnered with the International Finance Corporation (IFC). The IFC are providing both financial support for the programme’s activities and seeking to assist operators with financing for green base station rollouts.

Green Power for Mobile is now offering a Feasibility Study service for operators. This service analyses an operator’s entire country network of base stations, identifies those that are most suitable for green power solutions, dimensions the equipment required and forecasts CAPEX and ROI. Our primary goal is to maximise the Return on Investment for operators and to provide training on the Green Power for Mobile Methodology. The service also assists operators with RFP design and interpretation of responses from vendors specific to the use of alternative energy.

Figure 3 - Project Locations and Operator Partners:



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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T +44 (0) 20 7356 0600
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June 2010