PROJECT PROPOSAL

A Solar Powered Electricity Backup System for Fantsuam Foundation's Community Wireless Network

Fantsuam Foundation
Kafanchan, Nigeria

v1.0
21 November 2006

Executive Summary

Fantsuam Foundation is currently undertaking the first phase of the implementation of a community wireless network that will provide Intranet and Internet services to 13 partners in Kafanchan (Nigeria). One of the goals of the community wireless project is to increase the availability of Internet services to the community and optimize the use of the existing VSAT satellite connection (for more information about the existing wireless community project see: executive summary in Appendix A).

Although Fantsuam Foundation is connected to the power grid, power surges and outages are frequent in the region. Power voltage instability is common and during the raining season, it is common to have no electricity supply up to three days at a time. Currently, a diesel generator is used as an alternative source of energy. Unfortunately, operating a Wireless Internet Provider relaying on diesel generation is inviable. Electricity costs are already 500 USD/month where 80% are related to the diesel generator that is frequently operating.

Electricity stability has been identified as one of the risks for the success of the wireless community project. A electricity backup system will not only ensure stable Internet services but also improve the general productivity of Fantsuam Foundation activities.

This project proposal seeks funding for **the establishment of an alternative electricity backup system for Fantsuam Foundation's Offices and its Network Operation Center**. The electricity backup system will address the following energy needs:

- Offices: cybercafe, cashier, administration, two computer rooms and a repair room
- Street: independent Street Lighting Poles
- Tower: solar-powered “signal light” for the wireless communication tower
- Network Operation Center: high availability backup system for the Network Operation Center
- Wireless Backbone: Solar-Powered Radio Repeaters to extend the wireless network backbone

The initial design is based on the use of deep cycle batteries connected to the grid by means of voltage stabilizers and intelligent chargers. In case of power outage, energy from the batteries is supplied by a group of inverters. This system is complemented with a photovolatic subsystem that acts as a second source of energy. The photovoltaic subsystem has been dimensioned to ensure the high availability of the Network Operation Center.[1]

The project is divided in four phases: 1) pre-study, 2) basic training and collection of data, 3) evaluation of bids and 4) supervision of implementation and advanced training.

Apart from the implementation of the electricity backup system and two dedicated trainings, the project will deliver a a set of training materials addressing dimensioning and maintenance of *batteries connected to grid* and *solar systems.*

The materials will pay special attention to solar energy dimensioning and wireless communications. Dissemination of the implementation results including all training materials will fall under the *Creative Commons Non-Commercial Share-Alike* license.

This proposal requests 90 KUSD.

[1] A set of simulations have been conducted using the data available from the International Institute for Tropical Agriculture, IITA. Solar raditional series from Port Harcourt (04°51 N, 07° 01E, altitude 17.6 m) has been used.

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1. Project partners and stakeholders

1.1 Proposing Institution

Fantsuam Foundation, a non-profit organization founded in 1996 (Jos, Nigeria) with focus on micro finance and ICT services and development in rural communities of Nigeria.

Registered with the Kaduna State Government, Nigeria (Reg. #KDS/YC/99/2897), the Nigerian Corporate Affairs Commission (#495066) and the Charities Commission of England and Wales (UK Charity Reg. # 1078142).

1.2 Partners Institutions

IT +46

IT +46 is a Swedish consultancy company funded in 2004 with main focus on ICT in developing regions. Its areas of expertise includes IT wire and wireless infrastructure, VoIP, localization of FOSS and computer and network security.

IT+46 is providing training and technical supervision to two Community Wireless Projects in Uganda (with Makerere University) and Nigeria (with Fantsuam Foundation). The wireless community projects were initiated after a set of trainings in wireless community networks conducted in Africa during 2005-06.

Alberto Escudero-Pascual (PhD), co-founder of IT+46, has a Master of Science in renewable energies. His master thesis addressed both the energy needs of a rural self-sufficient farm and the design of a hybrid (solar-wind) renewable energy system.

2. Time Frame

The project duration is 12 months starting from 1 February 2007.

3. Background

Fantsuam Foundation is a non-for-profit organization based in Kafanchan (Nigeria) with focus on ICT's for development in rural areas.

Kafanchan is a poorly connected district in terms of Internet connectivity, POTS (plain old telephone system) and mobile telephony. Fantsuam Foundation has currently the only Internet connection in Kafanchan and POTS is not available in the area. GSM coverage did just arrive to this area.

Fantsuam Foundation is currently undertaking the first phase of the implementation of a community wireless network that will provide Intranet and Internet services to 13 partners in Kafanchan. By doing so, Fantsuam Foundation will become a wireless ISP and deliver both data and voice services over the wireless network.

One of the goals of the community wireless project is to increase the availability of Internet services to the community and optimize the use of the existing VSAT satellite connection.

Although Fantsuam Foundation is connected to the power grid, power surges and outages are frequent in the region. Power voltage instability is common and during the raining season, it is common to have no electricity supply up to three days at a time. Currently, a diesel generator is used as an alternative source of energy. Unfortunately, operating a Wireless Internet Provider relaying on diesel generation is inviable. Electricity costs are already 500 USD/month where 80% are related to the diesel generator that is frequently operating.

Electricity stability has been identified as one of the risks for the success of the wireless community project. For that reason, this proposal has been put together in order to ensure stable Internet services in the wireless network. Also, the power backup system will improve the general productivity of Fantsuam Foundation activities which includes a wide range of ICT trainings and other ICT related activities.

4. Objectives and Actions

This project contains six objectives. Each and one of them are described below together with the methodology that will be used in order to fulfill the objectives.

1. **Increment the number of working hours of the ICT Infrastructure**
   - Implement an electricity backup system based on *deep cycle batteries connected to grid*. The backup system includes six subsystems in Fantsuam Foundation compound: cybercafe, cashier, administration, 2 computer rooms and a repair room

2. **Improve the physical security** in the premises
   - Implement six independent street lighting poles
   - Include a solar-powered "signal light" in the wireless communication tower

3. **Improve the availability of Intranet and Internet core services** to Fantsuam and identified partners within the community.
   - Implement a electricity backup system based on *deep cycle batteries connected to grid* in the Network Operation Center (NOC)
   - Implement a solar panel subsystem to extend the autonomy of the NOC.

4. **Expand the network** by means of establishing two solar-powered repeaters
   - Establish *two solar-power repeaters* that will enable the expansion of the backhaul network to include another 5 partners and increase the service area of the community network.

5. **Improve the availability of the wireless backbone network**
   - Implement a electricity backup system based on *deep cycle batteries connected to grid and solar panels* in the wireless backbone nodes that act as repeaters

6. **Build capacity** within Fantsuam Foundation in designing, implementing and maintaining electricity backup systems with solar panels and deep cycle batteries
   - Conduct basic general training in renewable energies
   - Conduct advanced training in the dimensioning and simulation of solar-powered autonomous and backup systems
   - Develop manuals and training material
   - Deploy a set of backhaul *communication links* and clients installations using electricity backup systems jointly with Fantsuam Foundation staff .

5. Methodology

The project is divided in four phases: the first phase is an initial technical assessment that started with elaboration of this proposal (November-February 2007). The second phase is a basic training to Fantsuam Foundation in renewable energies and the collection of data and suppliers for the preparation of a tender document (Visit 1 of the external consultant, February 2007). The third phase is the evaluation of the bids (April-June 2007) and the supervision of the installation (Visit 2 of the external consultant, June 2007). Finally the fourth phase is an advance training in the maintenance of the backup system and the integration of wireless-solar repeaters as part of the wireless infrastructure (December 2007).

Taking advantage of the visit to Kafanchan of the two external consultants (IT+46) to the wireless project (February 2007), a technical requirements for a future tender document will be drafted. The tender document will consider the energy demands and potential energy savings in Fantsuam Foundation and the results of a field study that will include the components and prices available in the local market. This first visit will also include a first training in renewable energies and the different components of an energy backup system. The training will help Fanstuam to negotiate better bids including the quality of the components and installation.

It is expected to have a tender document ready for early April 2007 and and open bid period of the following 6 weeks. A visit of the external consultant to specifically supervise the installation is scheduled for June 2007. During the period July-November 2007, the system will be in an evaluation phase, gathering data and identifying operational problems. This testing period will be used to outline and prepare the content of a second and advanced training in the maintenance, simulation and troubleshooting of solar-grid connected systems. In December 2007, also this time taking advantage of the second visit of the external consultants for the community wireless project, a second training will take place and a set of solar-wireless routers will be installed.

6. Project Benefits

This proposal supports all the outcomes of the initial wireless community network proposal but with special emphasis in "availability" and "optimization" of the existing services.

6.1 Availability of Local Services

Thanks to the availability of stable energy supply we will be able to:

- More effectively use the wireless distribution network to support community-based applications
- More effectively use the satellite connection to retrieve and upload content to the network outside of office hours. (e.g. implementation of a local mail server)
- Offer uninterrupted local voice services over the wireless network (VoIP) to any connected node

6.2 Training Curriculum

- Support Fantsuam's ICT curriculum online content delivery and exchange of information and data within the WLAN and also across the Internet
- The energy backup subsystem and the training materials developed with the project will complement Fantsuam Academy training curricula
- Create an online information space detailing how the Fantsuam Foundation energy backup system was envisioned, designed, and maintained. This will complement the local training initiatives to be undertaken, and serve as a reference for other community networks

6.3 Local Skills

- After acquiring proper training in (1) maintenance and servicing the energy backup subsystems and (2) implementation of solar-powered repeaters, the expansion of the network as more partners come on board can be done more cost-effectively by the Fantsuam staff.

7. Indicators and Outcomes

Our expectation is that the project will result in the following outcomes:

1. A electricity backup system that is locally maintained and able to support ICT related activities and services

Indicator: Increase of the uptime of the Internet and Intranet's services. Number of institutional and individual clients capable of connecting to the new wireless network without disruption.

2. Increase productivity during hours without sunlight in Fantsuam Central Offices

Indicator: Reduction of number of hours of power outage in the premises. Reduction of liters of diesel used in the generator and monthly costs for electricity.

3. A safer working environment for Fantsuam staff and surrounding community

Indicator: Number of lighting hours in the streets surrounding Fantsuam Foundation premises and a signal light installed in the 45m central communication tower. Increase of community activities during dark hours.

4. Staff and volunteers of Fantsuam Foundation will gain the capacity to design, install and maintain electricity backup systems (solar and grid connected) throughout the region.

Indicator: Number of staff and volunteers trained in designing, installing and maintaining of electricity backup systems

5. The Fantsuam team will develop a training curriculum in Solar Energy Back-up for the Fantsuam Academy

Indicator: Training materials and curriculum in Solar Energy Back-up developed

6. Staff and volunteers of Fantsuam Foundation will be able to deliver training in electricity backup systems (solar and grid connected) throughout the region.

Indicator: Number of courses delivered and people trained

8. Present Situation (Pre-study)

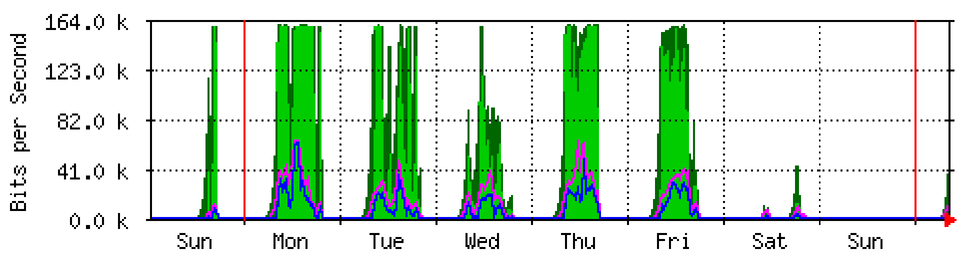
8.1 Internet Connectivity

In November 2003, a VSAT was installed in the premises of Fantsuam Foundation, and for the first time, Kafanchan was connected to the Internet. Ever since then, Fantsuam has been the only supplier of Internet connectivity in Kafanchan. In order to leverage the connectivity, Fantsuam runs a small Internet Café, a Cisco Academy and other ICT training courses in their compound.

The project of expanding the Fantsuam network by means of wireless technology has been initiated in June 2006. In October 2006 a 45m central tower that will serve as a wireless hub for 13 partners was established.

Access to stable electricity has been identified as one of the bottlenecks in the strategy of increasing and optimizing the current usage of the Internet. By being able to operate the Internet connection out of office hours and reduce the consumption of diesel we expect to be able to optimize the existing satellite connection.

The graphs obtained from the router shows that the Internet connection is used mainly during office hours from Monday to Friday. No traffic in the link is present during the weekends. However, the satellite Internet subscription is not limited to the amount of hours that the connection is used.



8.2 Telephony

Kafanchan is very poorly connected area in terms of telephony. Still in 2006, there are no traditional land based telephone lines and there is no plan to fix the long broken equipment that connects it to the telephone grid. Two GSM operators are present in Kafanchan MTN and V Mobile.

As a part of the wireless community project we aim to establish a local VoIP operator. The VoIP operator will allow the establishment of local phone calls using the wireless backbone. Also, the possibility of bridging the VoIP network to the GSM network will be explored.

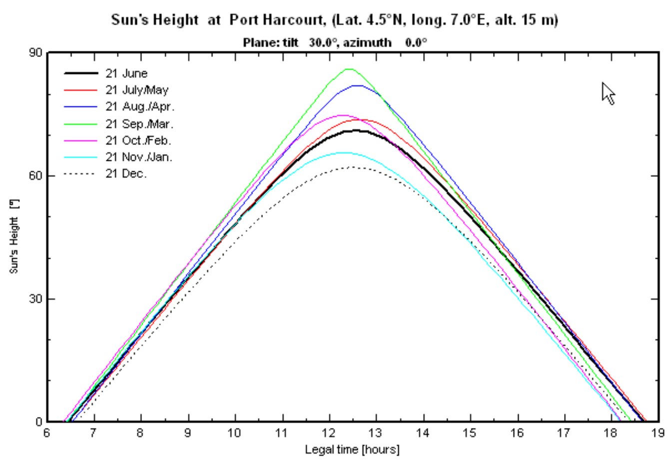
As the VoIP infrastructure uses the wireless backbone, reliable electricity supply is a necessary condition for telephony services.

8.3 Weather

The Abuja region experiences two weather seasons: the rainy season, which typically runs from April to October, and the dry season, extending from October to April. Temperatures through the year range from 20 degrees Celsius to just over 40 degrees Celsius.

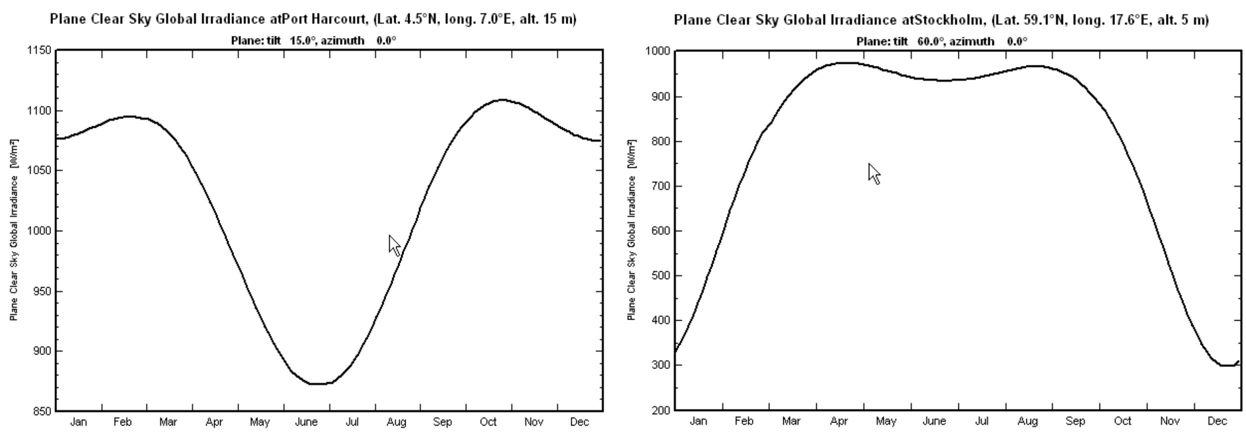
The heavy rainfall comes in June-September, which can complicate outdoor installation works specially the installation of the solar panels. Lightening happens mainly during the first few weeks of the rainy season in April and the last few weeks of October.

Due to the latitude of Kafanchan (Equator), the extraterrestrial solar energy suffers small fluctuations during the year. The number of the hours of day light remain almost constant throughout the year. However, the solar radiation patterns (terrestrial) are heavily influenced by the rains. According to statistical data the months with the least amount of sun light are July and August which are in the middle of the heavy rainfall period.



Picture 1: Changes of Sun's Height at Port Harcourt

A comparison of instantaneous values of solar radiation at Port Harcourt (Nigeria) and Stockholm (Sweden) shows the small fluctuations of the global irradiance in Nigeria. Hence, solar panels installed in Nigeria will not require a seasonal change of inclination.



Picture 2: Global Irradiance comparition (Nigeria vs Sweden)

8.4 Solar Radiation

The yearly average of solar radiation in Nigeria is estimated to 4.1 Kwh/m^2.day. Solar systems with a constant energy demand should be optimized during the rainy season (summer period). Results of the simulations show that a system optimized for July-September in Nigeria will require an inclination of the panels of 0 degrees. As panels needs to be protected from dust, a minimum angle of 15 degrees is recommended. This change of inclination will force the panel to be in a suboptimal position. An increase of 10% of the energy is possible in the rainy period at the price of higher maintenance. For all the simulations a reference value for the worse month of the year is 3.2 Kwh/m^2.day assuming a 15 degrees inclination[2].

Month Kwh/m^2.day	***Incl. 0°***	***15 °***	***20°***
January	4.2	4.5	4.6
February	4.3	4.5	4.5
March	4.5	4.5	4.4
April	4.5	4.3	4.1

[2] On the other hand, if a pump systems needs to be deployed, the system should be optimized for the dry season. That would imply a maximum value of 4.7 Kwh/m^2.day during December with an inclination of 20 degrees.

Month Kwh/m².day	***Incl. 0°***	***15 °***	***20°***
May	4.4	4.0	3.8
June	3.9	3.5	3.3
July	3.5	3.2	3.0
August	3.5	3.3	3.1
September	3.9	3.8	3.7
October	3.9	4.0	4.0
November	4.0	4.3	4.3
December	4.2	4.6	4.7
Average	4.1	4.0	4.0

Table 1: Solar Radiation Data for different inclinations (Port Hartcourt).

Average temperature in Abuja, 12 years statistics

Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
°F	82	85	86	84	80	79	77	77	77	79	80	80
°C	23	28	29	30	29	27	26	25	25	25	26	27

Average precipitation in Abuja, 12 years statistics

Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
cm	0.3	0.5	1.3	6.1	13.7	17.5	20.6	21.8	23.9	9.9	0.3	–
inch	0.1	0.2	0.5	2.4	5.4	6.9	8.1	8.6	9.4	3.9	0.1	–

Table 2: Temperature and Average Precipitation

8.5 Grid Power

Nigerian Electric Power Authority (NEPA) is responsible for electricity generation and distribution in Nigeria. Unfortunately, demand for electricity is far greater then what the Nigerian power grid can effectively generate and deliver. This makes the grid power system very unreliable and blackouts and brownouts occur frequently. The situation is slowly getting better, but will not be stable enough to directly plug electronic equipment into grid powered outlets for some time forward.

The issue of ensuring a reliable and stable source of power at Fantsuam Foundation has long been a problem. Fantsuam do have a backup generator at their premises that has power to run the whole compound in case of a power outage. Due to the high operating cost (20 USD/hour), the generator is only used if a training session is running at Fantsuam Foundation during a power cut. In general, power can not be ensured at Fantsuam during office hours today.

8.6 Backup System Alternatives: Grid-Batteries or Solar-Grid-Batteries

There is two technical alternatives for providing an electrical backup system for Fantsuam Foundation. The first alternative is a **Grid-Batteries System** that do not to use any solar components at all. All the energy for the backup system will be extracted from the grid and stored in batteries. When energy is needed an inverter will extract energy from the batteries. This is a traditional set up for environments were electricity from the grid is not available for a few hours (maximum 18 hours). Unfortunately, electricity from the grid in Kafanchan can be unavailable for as much as 4 days in a row during the rainy period.

The second alternative is to complement the Grid-Batteries Backup System with another source of energy. The proposed solution is a **Solar-Grid-Batteries System** that includes a set of photovoltaic (PV) panels that will extend the autonomy of the overall system and will ensure the a Network Operation Center working 24/7. If the conditions from the grid improves, the solar panels will be reallocated to other parts of the wireless network.

Two suppliers of solar and renewable energy equipment have been identified in the region (*Solar and Renewable Energy System* and *NCL*). The majority of the equipment (solar panels, deep cycle batteries, inverters and stabilizers-regulators) is locally available in Nigeria from Jos and Kaduna.

Although local suppliers are available, a survey needs to be conducted during the first phase of the project to identify the best options for the system components: stabilizers, inverters, regulators/charge controllers, deep cycle batteries and PV lighting poles.

8.7 Worst Month - Results of Simulation Data

The following table summarizes the information used to estimate the worst time of the year. The second and third column are the estimated solar radiation with an inclination of 0° and 15° degrees. The fourth column is an estimation of the days of autonomy expected from the system. The days of autonomy is the result of the maximum number of days of electricity grid outage during the period. The last column is the distribution of rain in % in respect to the maximum value. Although September is the month with most heavy rains, July has the minimum value of solar radiation available. Our worse month for a constant energy demand is July. During this month the power outage can last as much as 3 days.

Month	***0°*** ***Kwh/m²(day)***	***15 °*** ***Kwh/m²(day)***	***Autonomy Days*** ***(Required)***	***Rain*** ***%Total***
January	4.2	4.5	1	1
February	4.3	4.5	1	2
March	4.5	4.5	1	5
April	4.5	4.3	2	26
May	4.4	4.0	3	57
June	3.9	3.5	3	73
July	**3.5**	**3.2**	**3**	**86**
August	3.5	3.3	3	91
September	3.9	3.8	3	100
October	3.9	4.0	2	41
November	4.0	4.3	1	1
December	4.2	4.6	1	1
Average	**4.1**	**4.0**	**4.0**	**-**

8.8 Energy Demand and Dimensioning

The next table summaries the estimated energy demand for the different subsystems.

The first six subsystems (cyber cafe, cashier, administration, two computer rooms and repair room) are dimensioned for a total energy consumption of 77 Kwh/day. An autonomy of 1.5 days and a value of 80% battery discharge has been used for the calculations. Values for two types of batteries have been considered (Bat1: 200 Ah) and (Bat2: 500 Ah).

The second group of calculations corresponds to the energy demand of the server room and the network operation center. The simulation considers 4 days of extra autonomy for the for the NOC. A PV solar system with a nominal power of 1.7 KWp has been included to provide a daily energy of 3.8 Kwh.

Syst		PC	Laptop	Printer	Router	Lights					Bat1 (Ah)		Bat2 (Ah)	#
	Power (W)	150	30	100	360	30					200		500	
	Autonomy (days)										1.5		1.5	
	% Discharge										0.8		0.8	
		Units	Units	Units	Units	Units	W/day	time	Wh/day	Amp (12V)	Units	#	Units	#
1	Cyber Cafe	6				3	990	8	7920	660	6.19	6	2.48	3
2	Cashier	2	3			2	450	8	3600	300	2.81	3	1.13	1
3	Administration	1	1	1		3	370	8	2960	247	2.31	3	0.93	1
4	Computer Room 1	15				4	2370	8	18960	1580	14.81	15	5.93	6
5	Computer Room 2	15			5	4	4170	8	33360	2780	26.06	26	10.43	10
6	Repair Room	8			4	3	2730	4	10920	910	8.53	8	3.41	3
TOTAL									**77720**		60.72	61	24.29	24

							Load	24h	Wh/day	Amp(12V)	4 days		4 days	
7	NOC – Wireless						175	24	**4200**	350	8.73	9	3.49	4
TOTAL									**81920**	6826.67		**70**		**28**

	NOC – Wireless	P (W)	I (A)	Voltage	Batteries	Panels	Kwh
8	PV Solar	55Wp	3.5A	24V	**10**	**32**	3.8

The result of the calculations summarizes as follows: 80 200Ah batteries (or 28 batteries of 500 Ah) and 32 panels of 55 Wp for PV solar subsystem.

A detailed study which models the specifications of the available equipment in Nigeria is planned as a part of the project.

9. Implementation Plan

9.1 Activity Plan

The project activities have been divided into four main components. Each component contains a set of activities that relates to each other. Activities that jointly lead to a deliverable have been clustered.

The abbreviations described below indicate the different activity leaders.

FF= Fantsuam Foundation

EC= External Consultant

The work packages are:

WP A: Initial Technical Requirements

WP B: Basic Training, Measurements and Simulations

WP C: Procurement, Implementation and Supervision of installation of the Energy Backup Subsystems

WP D: Advanced Training and Wireless Repeaters Implementation

WP A: Initial Technical Requirements

A	***Deliverable***	***Activity***	***Resp.***
A1	Technical Requirements for grid connected backup subsystem	1. Technical Requirements for Tender Document (cybercafe, 2 computer rooms, administration,	EC
		2. Negotiation, Procurement and Supervision	FF
A2	Technical Requirements for solar-panel backup subsystem	3. Technical Requirements for Tender (server room, NOC)	EC
		4. Negotiation, Procurement and Supervision	FF

A	*Deliverable*	*Activity*	*Resp.*
A3	Technical Requirement for solar wireless repeaters	5. Technical Requirement (backbone network and extension with solar-powered wireless repeaters)	EC
		6. Negotiation, Procurement and Supervision	FF
A4	Technical Requirement for light signal and street lights	7. Technical Requirements for Tender Document	EC
		8. Negotiation, Procurement and Supervision	FF

WP B: Basic Training, Measurements, Simulations

	Deliverable	*Activity*	*Resp.*
B1	Basic Theoretical Training in renewable energies	9. Training Material “Introduction to Renewable Energies”	EC
		10. Print Training Material	FF
		11. Conduct Training (Nigeria)	EC
B2	Study of existing suppliers in the local market	12. Visit to suppliers and local installations (Nigeria)	EC/FF
		13. Identify local products and guarantees	EC
B3	Energy Consumption and Savings	14. Study consumption patters	EC
		15. Energy saving measures and strategy	EC
B4	Implementation Plan and Final Tender Document	16. Implementation Plan and Tender Document based on A1-4 and B2-3 17. Review of bids	EC/FF

WP C. Implementation of Energy Backup Subsystems

	Deliverable	***Activity***	***Resp.***
C1	Signal Light and Street Lights	18. Supervision of the implementation of signal light and street lights	FF
C2	Fantsuam Offices backup subsystem	19. Supervision of the installation of deep cycle batteries, inverters, DC disconnect and power regulator	FF
C3	NOC and Server Room Solar Subsystem	20. Supervision of the installation of deep cycle batteries, inverters, DC disconnect and power regulator	FF
		21. Supervision of the installation of solar panels and charge controllers	
C4	Solar-powered wireless repeaters	22. Configuration of solar-powered wireless repeaters	EC
		23. Installation of solar-powered wireless repeaters	

WP D: Advanced Training

	Deliverable	***Activity***	***Resp.***
D1	Advanced Theoretical Training	24. Training Material “Simulation Tools”	EC
		25. Training Material “Maintenance of equipment”	EC
		26. Conduct Training	EC
D2	Evaluation and Project Report	27. Evaluation and Final Project Report	FF

10. Training and Dissemination

Theoretical and practical training will be conducted by the external consultant and target the technical staff at Fantsuam Foundation. The training will be given at two different points in time, in February 2007 and December 2007.

10.1 Energy Dimensioning and Design Training

The first training period will target renewable energies *in general* and cover:

- Rural Communities and Solar Energy
- Electricity Alternatives
- Introduction PV/Solar Energy. Equipment and Sizing
- Introduction to wind or eolic systems
- Basic applications of renewable energies
- General concepts. Methodology and design

The second training period will cover:

- Simulation tools. PVSYST
- Energy savings
- Maintenance of solar PV systems
- Introduction to solar-powered wireless repeaters
- Deep cycle batteries, regulators, stabilizers and inverters
- Security Measures
- Economical Studies. Sustainability.

The training curricula for this period can be modified accordingly to the need of the technical staff at Fantsuam Foundation at that point in time.

Each of the training periods will last approx. 3 days.

10.2 Training Materials

Engineering Without Borders (EWB), a federation of Non-Governmental Organizations (NGOs) funded in 1990 has published a 100 pages manual in solar photovoltaic energy in developing regions. The manual is originally written in Spanish. EWB has granted the translation and update of sections of the manual under a Creative Commons license.

Other manuals in renewable energies will be included as part of the curriculum development. It is expected that by the date of the implementation of the project two unpublished handbooks (ITU and UNEP) will complement the available literature in the field.

10.3 Dissemination

A strategy for the dissemination of the training materials and outcomes of the project will be planned during the first visit of the external consultant to Kafanchan.

For the materials, it is expected that a similar strategy as the one followed for the community wireless materials will be adopted. The materials of the wireless community networks are publicly available in three repositories: IT+46, MMTK itrainonline and the Wilac portal in the LAC region.

The target of the training materials will be technical personnel responsible for the procurement and maintenance of energy backup systems.

All training materials and the results of the implementation will fall under the *Creative Commons Non-Commercial Share-Alike* license.

10.4 Time plan

The time planning is based on the following requirements:

- The first site visit (V1) by the EC will take place in February 2007 (basic training and data gathering)
- The second site visit (V2) by the EC will take place in June 2007 (supervision of implementation phase)
- The third site visit (V3) by the EC will take place in Dec 2007 (advanced training and wireless repeaters)

Travel costs for V1 and V3 are covered by the community wireless project.

Comp.	Deliverable	#	Activity	Resp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
A1	Technical Requirements for grid connected backup subsystem	1	Technical Requirements for six subsystems.	EC														
		2	Negotiation, Procurement and Supervision	FF														
A2	Technical Requirements for solar-panel backup subsystem	3	Technical Requirements for NOC and server room	EC														
		4	Negotiation, Procurement and Supervision	FF														
A3	Technical Requirement for solar wireless repeaters	5	Technical Requirement backbone and wireless repeaters	EC														
		6	Negotiation, Procurement and Supervision	FF														
A4	Technical Requirement for light signal and street lights	7	Technical Requirements for Tender Document	EC														
		8	Negotiation, Procurement and Supervision	FF														
B1	Basic Theoretical Training in renewable energies	9	Training Material “Introduction to Renewable Energies”	EC														
		10	Print Training Material	FF														
		11	Conduct Training (Nigeria)	EC		V1												
B2	Study of existing suppliers in the local market	12	Visit to suppliers and local installations (Nigeria)	EC/FF														
		13	Identify local products and guarantees	EC														
B3	Energy Consumption and Savings	14	Study consumption patters	EC														
		15	Energy saving measures and strategy	EC														
B4	Implementation Plan and Final Tender Document	16	Implementation Plan and Tender Document based on A1-4 and B2-3	EC/FF														
		17	Review of bids	EC/FF														
C1	Signal Light and Street Lights	18	Implementation of signal light and street lights	FF														
C2	Fantsuam Offices backup subsystem	19	Installation of deep cycle batteries, inverters, dc disconnect and power regulator	FF						V2								
C3	NOC and Server Room Solar Subsystem	20	Installation of deep cycle batteries, inverters, dc disconnect and power regulator	FF/EC														
		21	Installation of solar panels and charge controllers	FF/EC														
C4	Solar-powered wireless repeaters	22	Configuration of solar-powered wireless repeaters	EC														
		23	Installation of solar-powered wireless repeaters													V3		
D1	Advanced Theoretical Training	24	Training Material “Simulation Tools”	EC														
		25	Training Material “Maintenance of equipment”	EC														
		26	Conduct Training	EC														
D2	Evaluation and Project Report	27	Final Report	EC														

11. Project Organization

Project leader: John Dada, Programs Director at Fantsuam Foundation
Responsibility: Project management

John Dada has worked as Research Fellow with Ahmadu Bello University, Nigeria and the University of Leeds, UK. He is a trained nurse, holds an MPH degree from the University of Leeds and is a member of the African Stakeholders Network - United Nations ICT Task Force, African Research for Information Society Emergence, the Open Knowledge Network, the International Burden of Disease Network, IBDN and was the chair of the African Technical Advisory Committee, ATAC, to the UNECA (2002 – 2004). John Dada is currently a member of the membership committee of the Global Knowledge Partnership (GKP) and a Council member of the Association for Progressive Communication.

Project Administrator: Comfort Kazanka, Fantsuam Foundation
Responsibility: Local procurement

Mrs. Kazanka Comfort is the General Secretary of Fantsuam Foundation. She holds a first degree from Ahmadu Bello University, Zaria, Nigeria (1987). She has a Diploma in Social Studies from the University of Birmingham, UK, and attended the 37th International Dialogue of the Grameen Trust in 2000 in Bangladesh. She has also completed her Law degree with the University of Jos, Nigeria (2001). She was awarded the first Hafkin Africa Prize for her outstanding and creative use of Information and Communication Technologies for women in rural communities in 2001. She is a member of the AAW (APC Africa Women) and has concluded an internship with WomensNet in Johannesburg.

Technical Staff : Ochuko Onoberhie, Fantsuam Foundation
Responsibility: Coordination of local training and contact with local suppliers

External consultant: IT +46
Responsibility: Capacity building within Fantsuam Foundation (on-site) theoretical and practical training, technical specifications for tender documents, supervision of installation
Workload: Approx. 37 working days including 10 days on site in Nigeria.

11. Project Budget

	Quantity	UNIT (USD)	TOTAL
GRID STABILIZER			
Stabilizer 5000 Watts – Digital	1	1725	1725
Stabilizer 3000 Watts – Digital	4	125	500
Grounding System	1	150	150
Lightning arrestor AC	11	100	1100
Electric panel Boards	7	50	350
SOLAR SUBSYSTEM			
solar panels (55Wp)	32	350	11200
charge controllers (30A)	6	250	1500
support structure	8	125	1000
LIGHTS (LIGHT POLES AND SIGNAL LIGHT)			
Supply and installation of street lighting poles	6	775	4650
Signal Light	1	800	800
DEEP CYCLE BATTERIES AND INVERTERS			
Inverter charger 10000 Watts/48V Modified Sine wave	3	2500	7500
Inverter charger 2400 Watts/24V Modified Sine wave	4	1250	5000
DC Disconnect 500 amps	4	1150	4600
Battery Deep cycle (Sealed) – 200 Ah	80	360	28800
Battery Stand	13	100	1300
Battery fuses 110 amp / DC	5	100	500
Battery fuses 200 amp / DC	6	150	900
EXTRAS			
Distribution box	7	75	525
Dividing box	80	10	800
Cables and accessories	9	100	900
Clips – Trunking	9	25	225
INSTALLATION COSTS			
Transport, Installation, and Overheads	1	3000	3000
			0
SOLAR POWERED WIRELESS REPEATERS			0
Inveneo	2	1700	3400
TOTAL			80425
Fantsuam Overhead (12%)	1	9651	90076

12. Appendix A

Executive Summary: Fantsuam Foundation Wireless Community Project

Kafanchan, located 100 km Northeast of Abuja, is a poorly connected area in terms of fix telephony and Internet connectivity. Today, no fix telephony is available and GSM just arrived in 2005. Fantsuam Foundation is the only Internet Service Provider.

The main objective of this project is to improve access to communications in Kafanchan by implementing a community wireless network. The network will provide Intranet and Internet access to a set of identified local partners. The community network will mainly be formed by community-based organizations such as educational institutions, faith-based institutions and health services.
The objective will be achieved by capacity building within Fantsuam Foundation in designing, implementing and maintaining community wireless networks. Theoretical and practical training will be conducted by an external consultant on site in Kafanchan. After the training phase and the joint deployment of a set of wireless outdoors links; Fantsuam staff will alone undertake the implementation of the remaining links of the network by replicating the process learnt during the training.
As a part of the project, Fantsuam Foundation will work on developing a sustainable social and cost-effective business model for the wireless network. The model will not be based on simply re-selling the bandwidth provided by satellite communication but on the creation of revenue-bringing activities. For example, such add-on services could include local mail accounts, web space with content management systems and the implementation of a low cost voice service in the local network (VoIP).

In order to prepare for a future expansion of this project, four viability studies will be carried out to address the following topics: (1) Establishment of a solar power system to run the backbone infrastructure (2) Deployment of two sun-powered repeaters for the future expansion of the core network (3) Upgrading of the VSAT connection (4) Socio-economical impact of the wireless network and its services on the local community.

In terms of wireless infrastructure, this initial proposal budgets the implementation of a central tower at Fantsuam Foundation premises and the deployment of a wide wireless outdoor network (NET13) consisting of 11 backhaul links connecting 13 partners.

The project will be lead by Fantsuam Foundation. Four technical staff from Fantsuam Foundation will undertake appropriate training and later lead the implementation of the network.

The project requests 63 KUSD that briefly can be summarized as: *Human Resources and Training* (26 KUSD), and *Hardware and Transport* (37 KUSD).