



KUMASI TECHNICAL UNIVERSITY



GREEN CAMPUS PROPOSAL

Executive Summary

Table of Contents

Executive Summary	1
1. Introduction	3
1.1 Background	3
1.2 Problem Definition	4
1.3 Project Objectives	4
2. Conceptual Framework.....	6
3. Expected Outcomes and Outputs.....	7
3.1 Outcomes.....	7
3.2 Output.....	7
4. Description of Activities (Logical Framework)	8
5. Budget.....	12
Bibliography	13

1. Introduction

1.1 Background

Kumasi Technical University of Ghana (KsTU) was recently converted from a Polytechnic with the aim of providing higher education through teaching and research. It hopes to take advantage of this conversion to be known for the development of renewable energy and sustainable engineering in Ghana. This goal must align with the University's day to day activities which require redefining its work-place environmental culture and developing new paradigms by creating sustainable systems on campus.

Even as it carries out its mandate as an institution of higher learning, KsTU must demonstrate to the public, staff, and students that it is responsible and willing to take the lead in creating a more sustainable tomorrow by testing systems and technologies, and to advance innovative solutions to national and global challenges. The university can manifest sustainability in two ways that should be complementary – curriculum and operations. In other words, we have the ability to manifest sustainability, not only in theory, but in practice in everyday operations on our campus.

Consequently, KsTU has recently established a Centre for applied research, technology development and training in Renewable Energy and Energy Efficiency through a grant won under Skills Development Fund (SDF). The Centre (known as CREK) undertakes applied research in areas of RE & EE and offers tailor-made vocational and technical training programmes to diverse groups of people including local artisans, as well as students and graduates from Technical and Vocational Education and Training (TVET) institutions. The mandate of the Centre is to provide long-term support to local (and Regional) businesses that deliver products and services related to renewable energy (RE) and energy efficiency (EE).

Also, the University is seeking to develop a niche in renewable energy and sustainable environmental engineering. The curricula of these two programmes are under development. A green campus will therefore be a practical demonstration of what the University will be teaching in theory.

Campus greening is a concept which stands for the efforts to establish environmentally sustainable practises in educational institutions the world over. Its goal is to diminish the impact of ecological footprints by implementing the principles of sustainability at every level of institutional functioning. Greening the campus includes doing away with wasteful inefficiencies and using conventional sources of energies for its daily power needs, correct disposal and handling of waste, purchase of environment friendly supplies, and effective recycling program.

1.2 Problem Definition

The University is confronted with unique challenges as the campus has grown considerably over the past several years, growing from just 4,000 students, to over 10,000 students in recent times. The population is expected to increase further with the conversion from polytechnic to technical university. This growth has necessitated the expansion of the campus facilities and the construction of new buildings thereby increasing the energy demand and waste generation on campus.

The university presently consumes about 10 GWh of electricity annually. Paying of electricity bill has always been a major problem, inability to pay, sometimes results in the university being disconnected by the power company. Besides, the university also experiences frequent power outages due to unreliable supply from the national grid.

There is no data on the volume of waste generated on KsTU campus presently, however the indiscriminate disposal of waste around the campus and in lecture halls, hip of solid waste left unattended to for several days, inadequate, and inappropriate waste collection bin, are evident of waste management challenges on campus.

1.3 Project Objectives

The main objective of this project is to establish a green campus concept at Kumasi Technical University. This is expected to reduce waste generation, enhance waste management, and reduce energy consumption and dependency on national grid.

The specific objectives are to:

1. Generate 20 % of university's energy demand using solar
2. Install smart energy systems for efficient control and use of energy
3. Conduct energy audit for KsTU to identify lost and cost centres

4. Establish an energy management/audit team
5. Improve waste disposal, collection and management among students and staff of the university through the provision of waste bins, education, waste sorting, and waste reduction
6. Establish an environmental management system
7. Design and install rain harvesting systems for KsTU
8. Design and develop appropriate waste recycling systems

2. Conceptual Framework

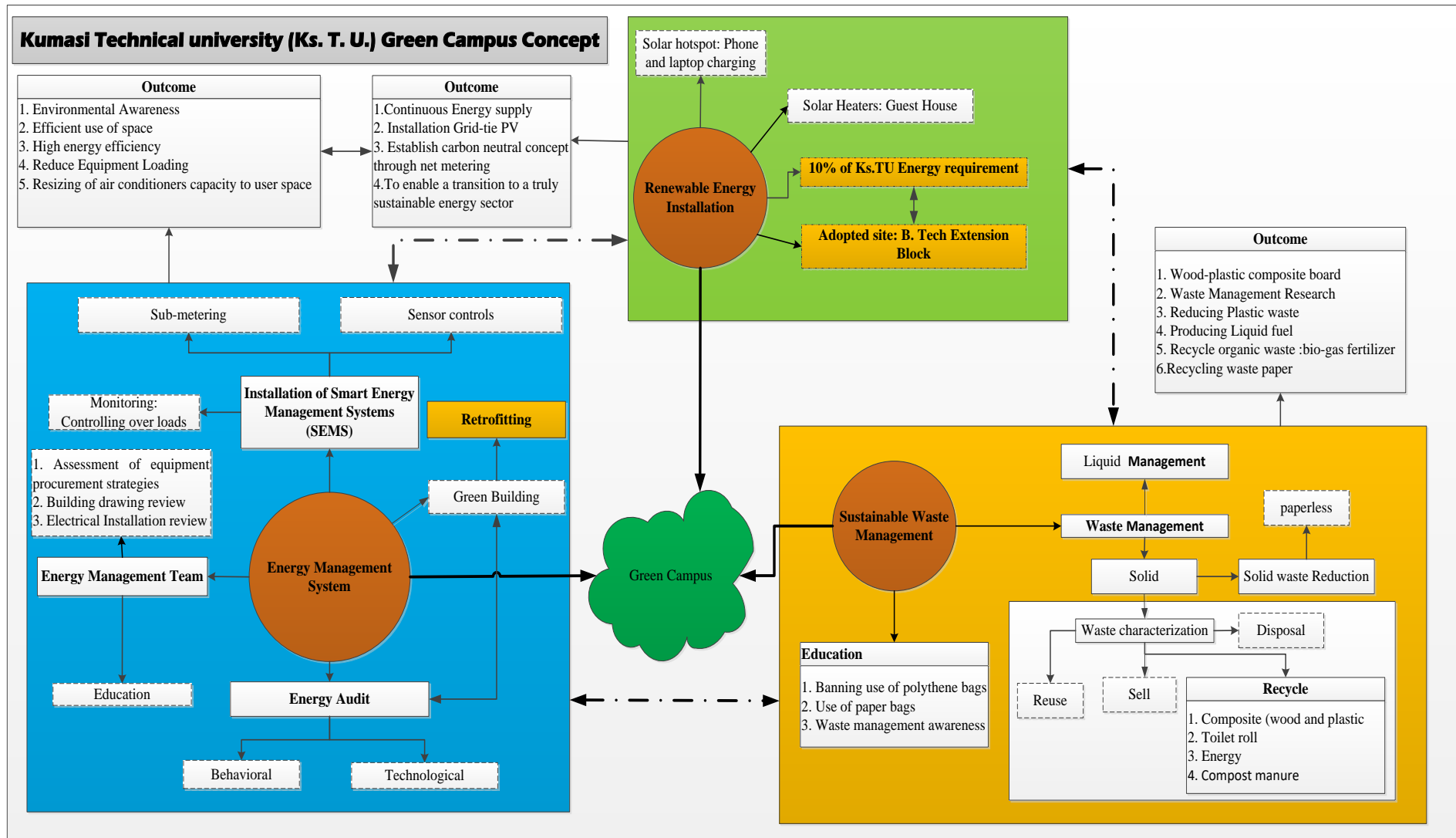


Figure 1: Conceptualize Frame work of KsTU Green Campus

3. Expected Outcomes and Outputs

3.1 Outcomes

The project is expected to have four tangible outcomes as follows

1. Energy consumption from national grid reduced by 10 % by 2021
2. Renewable energy systems installed to replace 20 % of conventional energy supply by 2021
3. Waste management systems implemented to reduce waste generation and enhance waste collection and reuse by 2021
4. Waste recycling systems designed and developed by 2021

3.2 Output

The project is expected to have the following outputs after implementation:

Renewable Energy System

1. Smart energy management systems installed
2. Energy management/audit team/task force formed
3. Compact Fluorescent Lamps (CFLs) retrofitted with Light Emitting Diodes (LEDs)
4. Two solar hot spots installed with capacity of 5 kWp each
5. 250 kWp solar PV system installed for KsTU
6. Solar water heaters installed for school cafeteria and guest house

Sustainable Waste Management Systems

7. Waste generation reduced
8. Standard waste collection equipment procured. This includes paddle waste bins, skips, waste trucks, and wheel barrows.
9. Solid waste sorted and characterized
10. Waste recycled into other useful products such as composite materials, paper, manure, etc.

4. Description of Activities (Logical Framework)

This section outlines the specific activities needed to be carried out to achieve each expected project outcome.

Outcome 1: Energy consumption from national grid reduced by 10 % by 2021			
Output	Description of output	Activities	Indicator
1. Smart energy management systems installed	This entails setting up of systems that are intelligent enough to control and monitor the consumption of energy by existing equipment in various offices at the university thereby improving energy efficiently.	1.1 conduct energy audit of facilities on campus 1.2 Procure smart energy systems 1.3 Install sub metering and monitoring systems 1.4 Installation of motion sensors for lighting and air conditioning control	Energy audit conducted with report submitted. Smart energy systems procured and installed.
2. Compact Fluorescent Lamps (CFLs) retrofitted with Light Emitting Diodes (LEDs)	This involves changing existing lighting systems to LEDs.	2.1 Procure LEDs 2.2 Install LEDs 2.3 Remove and discard old bulbs	LEDs procured and installed
3. Energy management/audit team/task force formed	Energy management team is being proposed to develop strategies for continual and efficient use of the university's energy. The team will be responsible for educating the	3.1 Identification, selection and screening of members 3.2 Establish an energy management office/desk 3.3 Train members on modern	Energy management team formed. Energy management office established. Energy management team trained.

	university community on energy conservation methods.	energy conservation techniques	
Outcome 2: Renewable energy systems installed to replace 10 % of conventional energy supply by 2021			
Output	Description of output	Activities	Indicator
4. Two hybrid solar PV hot spots installed with capacity of 5 kWp each	It is proposed that two student's waiting areas are equipped with solar charging units for mobile phones and laptops. This will address the challenge of students using classrooms as mobile phone charging point.	4.1 Perform site assessment and selection 4.2 Produce architectural and wiring design 4.3 Procure and install systems	A total of 10 kWp system installed at students waiting areas.
5. 250 kWp solar PV system installed for KsTU	Solar PV systems will be installed on roof tops of various building on campus with a total capacity of about 250 kWp to meet the 10 % RE target for the institution.	5.1 Perform site survey and assessment 5.2 Conduct load assessment for selected buildings/facilities ¹ 5.3 Size and specify system requirement 5.4 Procure and install the system	250 kWp solar PV system installed in phase.
6. Solar water heaters installed for school cafeteria and Cd	To further reduce energy use by KsTU, we hope to install solar	6.1 Collect hot water usage data from kitchen and guest house	Solar water heater installed for kitchen and guesthouse.

¹ A preliminary load assessment has been done for one of the engineering buildings. Details are given in the appendix of this proposal.

guest house	water heaters for the school restaurant and guesthouse.	6.2 Size and specify solar heating system 6.3 Procure and install system	
Outcome 3: Waste management systems implemented to reduce waste generation and enhance waste collection and reuse by 2021			
Output	Description of output	Activities	Indicator
7. Waste generation reduced	A sure way to reduce our ecological footprint and ensure eco-friendly environment is to reduce waste generation at KsTU. This can be achieved through several means including reducing paper usage by using emails and social media to send memos,	7.1 Collect baseline data on the quantity of waste generated 7.2 Introduce paperless procedures and systems on campus 7.3 Ban the use of polyethylene for packaging food on campus 7.4 Introduce biodegradable food pack	Waste generation on campus quantified
8. Standard waste collection equipment procured. This includes color coded paddle waste bins, skips, waste trucks, and wheel barrows.	Efficient collection and disposal of waste generated is important in keeping the campus clean and green.	8.1 Specify and procure the items needed	Waste collection and disposal equipments provided
9. Solid waste separated and characterized	This involves source separation, sorting and characterization of the	9.1 Provide colour coded bins on campus	Coded bins provided. Communication messages

	<p>various solid waste generated.</p> <p>This is needed to determine the appropriate technologies required for recycling.</p>	<p>9.2 Develop communication messages and materials for proper waste disposal</p> <p>9.3 Educate University community to separate waste into appropriate bins</p> <p>9.4 Determine the composition of waste generated on campus</p>	<p>developed.</p> <p>Members of the University educated on proper disposal of solid waste.</p> <p>Solid waste characterised.</p>
Outcome 4: Waste recycling systems designed and developed by 2021			
Output	Description of output	Activities	Indicator
10. Waste recycled into other useful products such as composite materials, paper, manure, etc.	As part of our green campus initiative, KsTU aims at being able to recycle some of its waste into other products. If proper waste sorting is achieved, then we could produce biogas from digestable organic waste and also recycle waste paper.	<p>10.1 Convert wood and plastic waste to composite material for the furniture department</p> <p>10.2 Convert digestable organic waste to biogas</p> <p>10.3 Convert lignocellulosic waste to bio-oil</p> <p>10.4 Convert plastic waste to fuel</p> <p>10.5 Recycle waste paper to tissue paper for use by students and staff</p>	<p>Composite materials produced from waste</p> <p>Biogas plant designed and constructed</p> <p>Pyrolysis plant designed and constructed</p>

5. Budget

Item	Estimated cost, USD
Proposal Development	20,000
Smart energy management systems	90,000
Compact Fluorescent Lamps (CFLs) retrofitted with Light Emitting Diodes (LEDs)	20,000
Energy management/audit team/task force formed	30,000
Two hybrid solar PV hot spots installed with capacity of 5 kWp each	100,000
250 kWp solar PV system installed for KsTU	1,400,000
Solar water heaters installed for school cafeteria and guest house	20,000
Waste generation reduced	10,000
Standard waste collection equipment procured. This includes color coded paddle waste bins, skips, waste trucks, and wheel barrows.	350,000
Solid waste separated and characterized	15,000
Waste recycled into other useful products such as composite materials, paper, manure, etc.	220,000
TOTAL	2,275,000

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