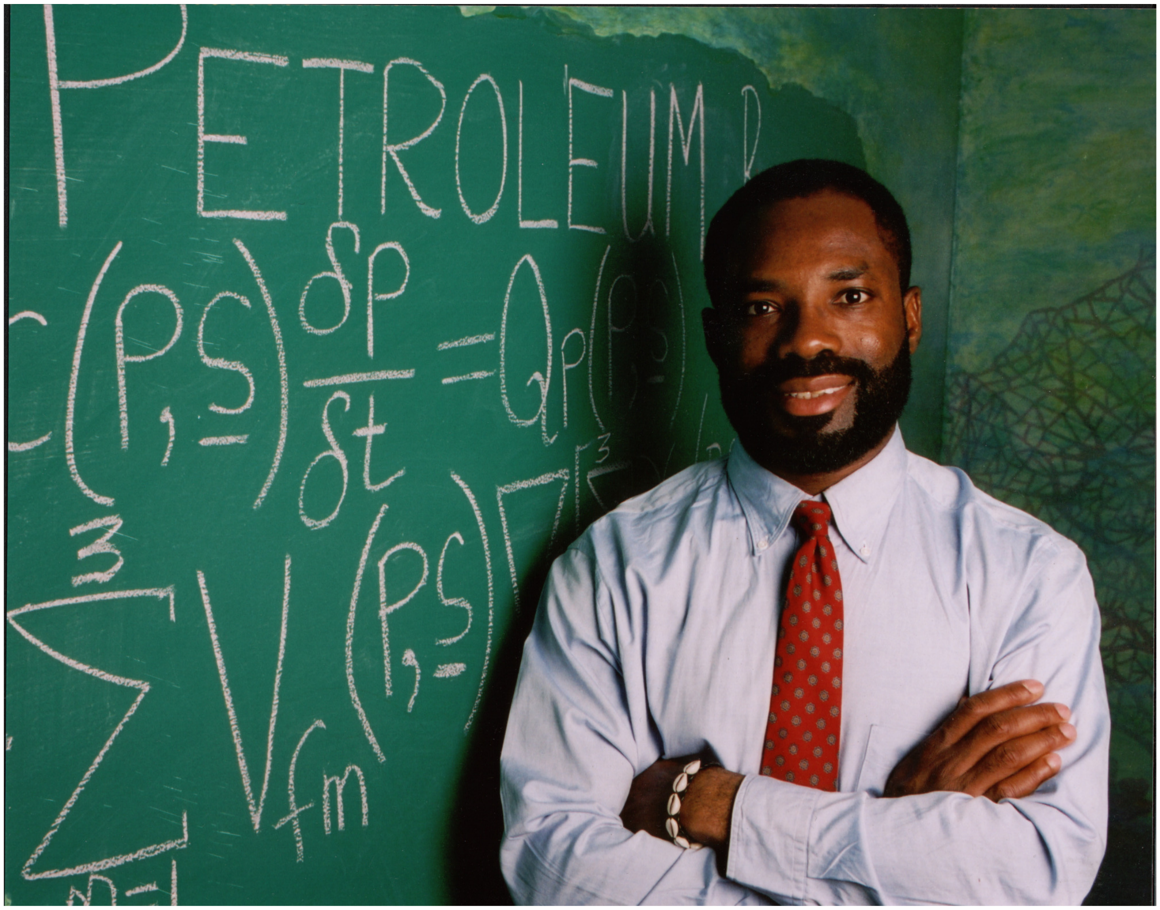
NEW TECHNOLOGIES
FOR AN
EMERGING ECONOMY



REMARKS BY

UCHE OKPALA

DURING THE INAUGURAL CONFERENCE OF

EMEAGWALI CENTRE

FOR RESEARCH, RENEWABLE ENERGY AND MATERIAL SCIENCE (ERREMS)

Uche Okpala, Coordinator of Emeagwali Center

CHAPTER ONE.

1.0. INTRODUCTION.

I am to do my final Ph.D practical research work in India because of lack of facilities in Nigeria. I don't like this idea because I have not the wings to fly to India due to the harshness of the Economy. This has challenged and inspired me to sort for the assistance of the state Government and the university in instituting such research center with laboratories in Anambra, Nigeria. Also, sequel to the Government's effort and commitment towards building a better Anambra state. I Okpala Uchechukwu V. of the department of Industrial Physics, have designed and written a proposal on a centre named after an illustrious son of Anambra State as "Emeagwali Centre for Research, Renewable Energy and Material Science. (ERREMS). It is a centre covering all the research areas in Sciences, Medical and Engineering. Emeagwali is chosen to bring at home and imortalise, the name of a man, an Anambranian who is the father of science in the recent times. This man wrote one of the fastest programmes in the world. One could not differentiate between Emeagwali and the internet. He has celebrated the name of Anambra and Nigeria at large. He won a noble prize of excellence. I therefore, pray all well meaning Anambranian home and abroad to come together and contribute to this epoch making event. It is capital intensive and by this needs a committed effort from the Government and the university. By so doing, people from and across the Niger would come in Anambra state to research. I pray the honourable vice chancellor to use his good offices to see to the success of this novel idea and allow it happen in his reign.

This project is of three types in one and could be done in two phases.

1.1.Objectives of the Centre

Emeagwali Centre for Research, Renewable Energy and Material Science (ERREMS) was designed to help bring the good news at home. It is a Centre designed to help researchers, Academics(ians), Scholars, Institutes and firms, exchange ideas and work together towards capacity building and human development in the areas of science and Technology. The centre would specialize in Research and development through conferences, training of personnel/man power development, researching for National and international bodies, firms, Governments and Individuals.

Above all, the centre in conjunction with a solar Energy manufacturing company in China would be producing and making available solar energy appliances/consumeables to Anambranians and beyond to help tackle the problem of ‘power holdings’

1.2.Personnel

The centre would have 5 laboratory technologists, three for the material Science lab. and 2 others for the Solar Energy lab. 2 lab attendants, 2 computer operators, 1 cleaner, 1 driver and a receptionist.

CHAPTER TWO.

Under the sun the worldwide energy crisis has deepened and conventional energy sources are becoming limited, unreliable and contributes to environment pollution, more and more countries are searching for alternative sources of energy. The alternative sources of energy is found in renewable energy technologies, particularly for remote and rural areas. China, India, Greece, Israel and Jordan have developed their renewable energy technologies. Here in Nigeria, with her fast growing population the country is almost 100% dependent on conventional sources of energy and the citizenry, particularly those residing in the rural areas are paying heavily for it. By virtue of this, the critical indices for material welfare are not available. Many Nigerian homes, presently experience poor living standards, ignorance, disease, low productivity and illiteracy. These are of adverse effect to the growth of the economy of the nation. Solar energy has been the source of survival under the sun and there is need to harness it in other to improve the living standard of the people. Presently, the country has only two viable government funded renewable energy centers located at Usman Dan Fodio University Sokoto and the other at the university of Nigeria Nsukka. University of Bauchi is fast development its own Energy center which is lonely funded by the university. The mandate of the Federal Government funded centre, is to carry out researches, development and dissemination of information in solar energy and other alternative technologies. The centers are charged with the training of personnel (Engineers, Scientists, technicians, Craftsmen, e.t.c.) in a wide range of technology options.

There is therefore the urgent need to diversify and create more Renewable Energy Centres. Anambra State as the light of the Nation needs one. This is the reason why this inspired ideal should not be allowed to die.

2.0. ACTIVITIES WITHIN THE IMAGINED CENTRE.

The activities include:

1. PHOTOVOLTAIC TECHNOLOGY.

We know that the sun's energy can be converted into electricity using devices called solar cells. These cells when interconnected form modules which can be used as single units or integrated to form photovoltaic arrays capable of generating electricity for a wide range of applications which include.

i. Lighting (in our homes, office, streets, security)
ii. Solar water pumping which includes, surface water bore hole
iii. Educational (power or computers and laptops)
iv. Communications(GSM.,etc.)
v. Refrigeration (vaccines, Food, Drinks etc.)
vi. Recreational

The proposed centre is expected to have expertise in the design, installation and monitoring of system for the above applications, the centre when established should be able to carry out feasibility studies on how to integrate photovoltaic system into the energy mix of anambra States.

2. SOLAR CHICKEN BROODERS.

Solar brooding technology is aimed at raising healthier poultry through the utilization of solar energy. We are aware that farmers often loose a sizeable proportion of their day old chicks during the brooding period as a result of inadequate power supplies. This research is on the socio- economic impact of using soar energy in poultry brooding technology in rural and even some urban centres in Anambra State. The special features of the innovative poultry brooding technology are that it harness solar energy as heat source and use locally available materials. Development of this new technology at the propose centre will lead to

- A pollution free environment for poultry brooding
- Checks of improved feed conversion ratios and lower mortality rates.
- Systems that are free from hazards and allow higher profit margins than convention brooders.
- Development of small, medium and large scale poultry brooding system

3. BIOMASS/BIOGAS TECHNOLOGY

The centre will embark on the design and fabrication of family and commercial size biodigesters. My conversation with the present director of U.N.N. Energy Centre made me to know that various capacities of Biodigster that use animal dungs, farm waste and brewery effluent have been installed and proved to be very efficient in the generation of cooking gas. Biogas slurry, a product of the biogas generation process has been used as fertilizer for growing crops.

4. COAL BRIQUETTING TECHNOLOGY

Anambra state is a densely populated region. With this large population, there has been increasing demand for energy, particularly energy for cooking. The massive use of fuel wood, popularly known as fire wood, for domestic energy requirement is known to be major cause of desertification particularly in the North and soil erosion in the South of Nigeria. There is therefore the urgent need to provide alternatives to those who use wood for cooking. The answer is that fuel wood can be effectively replaced by smokeless coal briquettes which could be readily provided through the processing of the nations abundant coal resource.

5. DOMESTIC COOK STOVES

Domestic cook stoves are devices designed to harness thermal energy released from combustible materials for a given task. The earliest cook stove known to man is the tripod stove, which has continued to adorn various kitchens in the state although it has an efficiency of less than 10%. The Energy centre at Nsukka has developed for adaptation and commercialization of various modules of domestic cook stove designed to use fuel such as coal briquettes or coal-char, charcoal, sawdust and even shaped fire wood. Efficiencies of the stoves are in the range of between 25-35%. Anambra State proposed centre would produce stove with efficiencies in the range of 80-85%.

6. SOLAR ENERGY DRYERS

The enormous amount of post harvest agro wastes underscores the need for drying of agricultural produce not only as a means of preservation but to improve handling, storage and utilization.

7. SOLAR WATER HEATER

Hot water utilization in homes, hospitals, institutions and hotels is well known and therefore cannot be over emphasized. The new centre if empowered can develop prototypes solar water heaters ranging from 50 litres to over 500 litres.

2.1.SITE SELECTION

A site with a building containing 2 laboratories 12 x 12 capacity one for Renewable energy lab and the order for material Science, 1 library hall 12 x 12, one 12 x 12 hall for cyber café one 16 x 16 hall seminar/conference, 2 offices: one master and the other ordinary of 10 x 8 capacities. Two separate toilets.

BUDGET PROPOSAL

I crave the indulgence of the university to give a maximum support to this project in connection with the State Government and the sponsor. It is pertinent to mention that the international centre for theoretical physics Trieste, Italy is interested in this project with a view to making it an affiliate.

(**1) PHOTOVOLTAIC ACTIVITIES**

Proposal for 1kw solar power source

S/N	**DESCRIPTION**	**UNIT COST (N)**	**QTY**	**AMOUNT (N)**
1	Photovoltaic module 55 watts each	51, 000. 00	20	1,020,000.00
3	1 kw linear charger	50, 000.00	1	50,000
4	1.5 kw inverter	61, 000.00	4	244,000
5	Sub- Total	.-	-	1,314,000
	Contingency	-	-	50,000
	Total			**1, 364,000**

(2) **RAISING HEALTHIER POULTRY- SOLAR ENERGY BROODING SYSTEM:** small scale, medium scale and large(Trombe wall).

S/No	**Capacity (No of day old chicks)**	**UNIT COST (~~N~~)**	**AMOUNT (N)**
1	50	26,000.00	26,000
2	100	51,000.00	51,000
3	200	81, 000.00	81,000
4	2000 (POULTRY HOUSE)	950,000	950,000
	Total		**1,108,000**

(3) FAMILY AND COMMERCIAL SIZE BIODIGESTER.

S/N	**CAPACITY**	**UNIT COST(~~N~~)**	**AMOUNT(~~N~~)**
1	Family size	46,000.00	46,000.00
2	10m^3 (fixed dome biogas digester)	950, 000. 00	950,000.00
3	20m^3 (fixed dome biogas digester)	910,695.00	910,695.00

4	Contingency	110,000.00	110,000.00
	Total		**2,016,695.00**

4 Coal Briquetting
5. Domestic Cook Stoves
6. Solar Energy Dryers

180,000.00

PROPOSAL FOR A CYBER CAFÉ

S/N	DESCRIPTION	QTY	UNIT COST (N)	AMOUNT (N)
1	Computer	12	80,000.00	960,000.00
2	Photocopier	2	155,000.00	310,000.00
3	Internet service Provider (ISP)			18,000.00
4	Contingency			100,000.00
	Total			**1,388,000.00**

PROPOSAL FOR A LIBRARY FURNISHING

S/N	DESCRIPTION	QTY	UNIT COST (N)	AMOUNT (N)
1	Shelves &chairs			1,200,000.00

2.	Books			1,000,000.00
3.	Contingency			200,000.00
	Total			**2,400,000.00**

CHAPTER THREE.

PHASE II

3.0.MATERIAL SCIENCE DIVISION

The quest for nano-technology has overtaken micro-technology. One-dimensional nanostructures have attracted increasing interest in recent years in terms of fundamental physics as well as device applications. These materials have stimulated much attention due to their promising potential in extensive applications. The dependence of electrical transport, optical and mechanical properties on size and dimensionality which are veritable assets in electronic and solid state industries can be investigated in this Centre.

In recent years there has also been a growing interest in semiconductor materials that exhibit ferromagnetism above room temperature (4-6). These materials are key ingredients for the development of spintonic devices such as non-volatile memories; spin valve transistors and ultra-fast optical switches. The optoelectronic properties of nanomaterial thin films are strongly dependent on their size, due to quantum confinement effects. In semiconductors, quantum confinement modulates the band structure of nanomaterials and increases the band gap. Therefore, the optoelectronic properties of nanomaterials can be tuned by changing the nanomaterial size. The control of nanomaterial size and shape remain a challenge in nanotechnology and a large body of research is devoted to this subject. For example, nanowires and nanodots based on II-VI compounds are suitable candidates for applications in nano optics and nanosensoring (7,8). Due to their wide band gap, some of the II-III compounds have been extensively studied as materials for lasers and light-emitting diodes in the blue-green region of the visible spectrum (9-10). However, the controlled synthesis of such compound nanomaterial is still in their infancy (11,13). Nanomaterial can be synthesized in the gas phase, liquid phase, solid phase or inside the pores of a porous material.

Molecular beam epitaxy has been widely used to deposit II-V and II-VI material devices and is well known to be an effective method to grow heterostructures with very sharp interfaces (9,10). Moreover, single electron transistors and resonant tunneling devices have been demonstrated with MBE-grown II-V semiconductor nanomaterials (14). Other approaches for the growth of nanomaterials, include vapour phase growth (11), metal organic chemical vapour deposition (MOCVD) (12,13) and chemical bath deposition technique (16,17). The Sol-gel deposition technique would also be studied in this lab. For the existence of ferromagnetic semiconductors at room temperature, there have been several experimental works reporting the appearance of ferromagnetism above 300k (18,25). Using capping agents and surfactants (26-27), formation of the particles in the nanometer pores of a porous material (28,29) and formation of the particles in the small micelles (30,31) are reported.

Post-synthesis chemical treatment of nanocrystals is an important process that can involve such procedures as narrowing the size distribution through controlled precipitation (32-33), removing unwanted reaction byproduct (32), changing the solvent host (34-35), changing the surface morphology (36) and even incorporating the nanocrystals into a polymer matrix (37). The ability to perform a vast array of post-synthesis treatment opens many new possibilities for the potential applications of a particular nanocrystal ranging from photovoltaics (38) and quantum computation (39) to Bio-photonic (40). Narrowing the size distribution results in a narrowing of the optical spectroscopic features and this is ideal for most applications of nanocrystals in solar energy conversion system, gas sensors, opto-electronic devices, multi-reflection coatings, solid state industries, among others. The areas to research in are

i. Depositing nanomaterial binary and ternary thin films using low cost techniques
ii. Studying the compositional properties of the films deposited using X-ray photoelectron (XPS) and energy dispersive X-ray fluorescence (EDXRF)
iii. Evaluating the crystallographic and structural properties of the films using optical microscopy, X-ray diffraction (XRD),

scanning electron microscopy (SEM) and Transmission electron microscopy (TEM).

iv. Studying the optical, electrical and magnetic properties using available equipment such as spectrometer, KEITHLEY 690 MULTMETER, and EPR-variable temperature electron paramagnetic resonance photoluminescence (PL). Photoluminescence excitation (PLE) spectroscopy will be conducted using a fluorimeter (Spex Fluoromax3)

v. The in-situ monitoring of the deposition of nanomaterials will be considered and post deposition treatment of the materials be carried out.

vi. The nanomaterials synthesized using the chemical bath deposition technique will have their properties compared with that deposited using other techniques. Analyzing, interpreting, comparing and correlating the various characteristics of the films with results obtained from other deposition techniques.

3.2. CONSUMABLES

Item	Use	Oty. required	Unit Prize	Cost Estimates NGN (N)
Chemicals				1,500,000.00
Laboratory breakable equipments	Measuring and weighing of chemicals			100,000.00
X-ray diffractometer	Film packing orientation of film component		22,500.00	22,500.00
Scanning Electron Microscope (SEM)	Surface topography, Element mapping		2,500,000.00	2,500,000.00
Transmission Electron Microscope (TEM)	Interior and electronic structure, composition		2,500,000.00	2,500,000.00
Ellipsometer	Film thickness		1,000,000.00	1,000,000.00
High Resolution Transmission Electron	Determination of crystal size and its		3,000,000.00	3,000,000.00

Microscope (HERTEM)	distribution			
Atomic Force Microscope (AFM	Study the surface morphology and surface roughness of the film, surface force		2,000,000.00	2,000,000.00
x-ray Photoelectron Spectroscopy (XPS)	Chemical states of surface atom		5,500,000.00	5,500,000.00
Energy Dispersive Spectrometer (EDS)	Chemical composition and Element mapping		12,500,000.00	12,500,000.00
Keithley Electrometer/Multmeter	Resitivity measurement		1,000,000.00	1,000,000.00
Fluorimeter (Spex Fluoromax3)	Photoluminescence excitation (PLE) spectroscop		900,000.00	900,000.00

	y			
Rutherford Backscattering Spectrometer (RBS)	Elemental composition and stiochiometry of the films, film thickness		7,500,000.00	7,500,000.00
Electron Paramagnetic Resonance	Variable temperature electronic		1,500,000.00	1,500,000.00
Infrared spectrometer (FTIR)	Identify surface functional group, order and tilt of film		1,500,000.00	1,500,000.00
UV-VIS-IR spectrophotometer	Absorbance, transmittance, reflectance		1,500,000.00	1,500,000.00
		Total cost		**69,000,000.00**

3.3. Information unit, this would require the installation of computers and internet services.

Finally, a car for the centre.

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