The World Bank

AFRICA CENTRE OF EXCELLENCE FOR SUSTAINABLE POWER AND ENERGY DEVELOPMENT
UNIVERSITY OF NIGERIA, NSUKKA
OFFICE DIRECTOR

: (+234) 8028433576

Ref: UNN/ACE-SPED/001

Date: 25TH APRIL, 2022

Engr. Prof. V.S.Aigbodion
Industrials Liaison Officer
ACE-SPED

Dear Engr. Prof. Aigbodion

Chairmanship of Innovation-Oriented Cooperation of Research Infrastructures and Collaboration with a Private Sector through Advisory Services.

On behalf of the Board of ACE-SPED, I appoint you the Chairman of the **Innovation-Oriented Cooperation of Research Infrastructures and Collaboration with A Private Sector through Advisory Services**

The appointment is with immediate effect.

Other members of your Committee are:

Engr. Prof. Cosmas Anyanwu
Engr. Dr. P. U. Akpan
Engr. Dr. Mkpamdi.Eke
Engr. Dr. P.o.Offor
Engr. Dr. Onyekwere Ojike

It is hoped that you and your Committee will be willing and able to serve the Centre diligently in this capacity.

Terms of Reference

1. Draft specimen memorandum of understanding for collaborations with external Institutions and agencies.
2. Seek out and identify potential facility users
3. Pursue the collaborations with industries.

Engr. Prof. Emenike Ejiogu

Centre Leader
ACESPED), University of Nigeria Nsukka

AFRICA CENTRE OF EXCELLENCE FOR SUSTAINABLE POWER AND ENERGY DEVELOPMENT
UNIVERSITY OF NIGERIA
MINUTES OF THE INNOVATION-ORIENTED COOPERATION OF RESEARCH INFRASTRUCTURES AND COLLABORATION WITH A PRIVATE SECTOR THROUGH ADVISORY SERVICES HELD ON 15th May, 2022

ICRICPDS/2022/05/01. ATTENDANCE

1. Prof Victor Aigbodion — Chairman
2. Engr. Prof. Cosmas Anyanwu — Member
3. Engr. Dr. P. U. Akpan — Member
4. Engr. Dr. Mkpamdi.Eke — Member
5. Engr. Dr. P.O.Offor — Member
6. Engr. Dr. Onyekwere Ojike — Secretary

* Absent with permission.

ICRICPDS /2022/05/02 OPENING PRAYER

The meeting commenced at about 9.30am with an opening prayer said by Dr. P.O. Offor. The Chairman, in his opening remarks, welcomed members to the first meeting; he informed members that this was the inaugural meeting of the Committee. He congratulated the members for their nomination to serve in their various capacities as members of the **Innovation-Oriented Cooperation of Research Infrastructures and Collaboration with a Private Sector through Advisory Services**. He also urged members to remember that their appointment to the **Innovation-Oriented Cooperation of Research Infrastructures and Collaboration with a Private Sector through Advisory Services** is a call to divine service and to follow the Committee's terms of reference.

ICRICPDS /2021/3/03 Reading and Adoption of the Agenda

The agenda for the meeting was read and Engr. Dr. Onyekwere Ojike moved for the adoption, while Engr. Dr. Mkpamdi.Eke seconded the motion.

ICRICPDS /2022/3/04 Reading Terms of Reference

The Chairman read the terms of reference to the Committee members as directed by the Director/Centre Leader. He further explained that the terms of reference form the basis for the **Innovation-Oriented Cooperation of Research Infrastructures and Collaboration with a Private Sector through Advisory Services** duties, rules, and regulations.

ICRICPDS /2022/3/05 DELIBERATION ON THE TERMS OF REFERENCE

After deliberation on the terms of reference, the following was agreed upon:

1. The meeting should be held every quarterly.
2. The meeting should be hybrid
3. Members were given tasks to complete as well as relevant sources cutting-edge material

ICRICPDS /2022/3/06 AOB

There was no any other business for discussion

ICRICPDS /2022//3/07 ADJOURNMENT/CLOSING

Adjournment for the meeting was moved by Dr. P.O.Offor, Engr. Dr. Onyekwere Ojike seconded the motion and also closed the meeting with a word of prayer.

Engr. Prof Victor Aigbodion
(Chairman)

Engr. Dr. Onyekwere Ojike
(Secretary)

AFRICA CENTRE OF EXCELLENCE FOR SUSTAINABLE POWER AND ENERGY DEVELOPMENT
UNIVERSITY OF NIGERIA
MINUTES OF THE INNOVATION-ORIENTED COOPERATION OF RESEARCH INFRASTRUCTURES AND COLLABORATION WITH A PRIVATE SECTOR THROUGH ADVISORY SERVICES HELD ON 10th NOV, 2022

ICRICPDS /2022/11/01. ATTENDANCE

1.	Prof Victor Aigbodion	Chairman
2.	Engr. Prof. Cosmas Anyanwu	Member
3.	Engr. Dr. P. U. Akpan	Member
4.	*Engr. Dr. Mkpamdi.Eke	Member
5.	Engr. Dr. P.O.Offor	Member
6.	Engr. Dr. Onyekwere Ojike	Secretary

* Absent with permission.

ICRICPDS /2022/11/02 OPENING PRAYER

The meeting started by 11:35am with an opening prayer led by Engr. Dr. Onyekwere Ojike . The Chairman thanked the members for their steadfastness in the work.

SEM/2021/3/03 Reading and Adoption of the Agenda

The agenda for the meeting was read and Dr. P.O. Offor moved for the adoption, while Engr. Dr. P. U. Akpan seconded the motion.

ICRICPDS /2022/11/04 Reading and Adoption of the Minute

The minutes of the last meeting held on May 15th, 2022, were read by the Secretary. The motion for adoption was moved by Engr. Prof. Cosmas Anyanwu and seconded by Dr. P.O. Offor.

ICRICPDS /2022/11/05 ARISING MATTERS

A list of possible **private sector** with detailed were shared among the members.

ICRICPDS /2022/11/06 AOB

A member noted that there is a need to contact with the private sector for collaboration and after deliberation it was accepted that the secretary should write the private sector.

ICRICPDS /2022/11/07 ADJOURNMENT/CLOSURE

Adjournment for the meeting was moved by Dr. P.O. Offor. Engr. Prof. Cosmas Anyanwu seconded the motion and also closed the meeting with a word of prayer.

Engr. Prof Victor Aigbodion
(Chairman)

Engr. Dr. Onyekwere Ojike
(Secretary)

AFRICA CENTRE OF EXCELLENCE FOR SUSTAINABLE POWER AND ENERGY DEVELOPMENT
UNIVERSITY OF NIGERIA
MINUTES OF THE INNOVATION-ORIENTED COOPERATION OF RESEARCH INFRASTRUCTURES AND COLLABORATION WITH A PRIVATE SECTOR THROUGH ADVISORY SERVICES HELD ON 5th FEB, 2023

ICRICPDS /2023/02/01. ATTENDANCE

1. Prof Victor Aigbodion — Chairman
2. Engr. Prof. Cosmas Anyanwu — Member
3. Engr. Dr. P. U. Akpan — Member
4. Engr. Dr. Mkpamdi.Eke — Member
5. Engr. Dr. P.O.Offor — Member
6. Engr. Dr. Onyekwere Ojike — Secretary

* Absent with permission.

ICRICPDS /2023/02/02 OPENING PRAYER

The meeting started by 11:35am with an opening prayer led by Engr. Dr. Mkpamdi.Eke, the Chairman, who welcomed members to the meeting.

ICRICPDS /2023/02/03 Reading and Adoption of the Agenda

The agenda for the meeting was read and Dr. P.O. Offor moved for the adoption, while Engr. Dr. Onyekwere Ojike seconded the motion.

ICRICPDS /2023/02/04 Reading and Adoption of the Minute

The minutes of the last meeting held on NOV 10th, 2022, were read by the Secretary. The motion for adoption was moved by Dr. P.O. Offor and seconded by Engr. Prof. Cosmas Anyanwu

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ICRICPDS /2023/02/05 ARISING MATTERS

The chairman advised the members to prioritize the purchase of modern equipment to supplement the existing laboratory equipment. The chairman agreed to discuss the purchase of SEM/EDS, FTIR, and XRF for the centre with the centre director, following a member's suggestion.

ICRICPDS /2023/02/06 AOB

No AOB

ICRICPDS /2023/02/07 ADJOURNMENT/CLOSURE

Adjournment for the meeting was moved by Engr. Dr. P. U. Akpan. Engr. Dr. Onyekwere Ojike seconded the motion and also closed the meeting with a word of prayer.

Engr. Prof Victor Aigbodion
(Chairman)

Engr. Dr. Onyekwere Ojike
(Secretary)

AFRICA CENTRE OF EXCELLENCE FOR SUSTAINABLE POWER AND ENERGY DEVELOPMENT
UNIVERSITY OF NIGERIA
MINUTES OF THE INNOVATION-ORIENTED COOPERATION OF RESEARCH INFRASTRUCTURES AND COLLABORATION WITH A PRIVATE SECTOR THROUGH ADVISORY SERVICES HELD ON 15th JUNE, 2023

ICRICPDS /2023/05/01. ATTENDANCE

1. Prof Victor Aigbodion — Chairman
2. Engr. Prof. Cosmas Anyanwu — Member
3. Engr. Dr. P. U. Akpan — Member
4. Engr. Dr. Mkpamdi.Eke — Member
5. Engr. Dr. P.O.Offor — Member
6. Engr. Dr. Onyekwere Ojike — Secretary

* Absent with permission.

ICRICPDS /2023/05/02 OPENING PRAYER

The meeting started by 10:35am with an opening prayer led by Engr. Dr. P. U. Akpan. The Chairman welcomed members to the meeting.

ICRICPDS /2023/05/03 Reading and Adoption of the Agenda

The agenda for the meeting was read and Engr. Dr. P.O.Offor moved for the adoption while Engr. Dr. Onyekwere Ojike seconded the motion.

ICRICPDS /2023/05/04 Reading and Adoption of the Minute

The minutes of the last meeting held on 5th Feb, 2023 were read by the Secretary. The motion for adoption was moved by Engr. Prof. Cosmas Anyanwu and seconded by Dr. P.O. Offor.

ICRICPDS /2023/05/05 ARISING MATTERS

After a discussion, the chairman informed the members that the director had approved the purchase of the SEM, XRF, and FTIR machines. **The next meeting will discuss the quotations from three vendors.**

ICRICPDS /2023/05/06 AOB

The Chairman agreed to discuss with the Centre leader the need to purchase resource materials for the lab.

ICRICPDS /2023/05/07 ADJOURNMENT/CLOSURE

Adjournment of the meeting was moved by Dr. P.O. Offor. Engr. Prof. Cosmas Anyanwu seconded the motion and also closed the meeting with a word of prayer.

Engr. Prof Victor Aigbodion
(Chairman)

Engr. Dr. Onyekwere Ojike
(Secretary)

AFRICA CENTRE OF EXCELLENCE FOR SUSTAINABLE POWER AND ENERGY DEVELOPMENT
UNIVERSITY OF NIGERIA
MINUTES OF THE INNOVATION-ORIENTED COOPERATION OF RESEARCH INFRASTRUCTURES AND COLLABORATION WITH A PRIVATE SECTOR THROUGH ADVISORY SERVICES HELD ON 10th October, 2023

ICRICPDS /2023/10/01. ATTENDANCE

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1. Prof Victor Aigbodion — Chairman
2. Engr. Prof. Cosmas Anyanwu — Member
3. Engr. Dr. P. U. Akpan — Member
4. Engr. Dr. Mkpamdi.Eke — Member
5. Engr. Dr. P.O.Offor — Member
6. Engr. Dr. Onyekwere Ojike — Secretary

* Absent with permission

ICRICPDS /2023/10/02 OPENING PRAYER

The meeting started by 10:35am with an opening prayer led by Engr. Prof. Cosmas Anyanwu

. The Chairman welcomed members to the meeting.

ICRICPDS /2023/10/03 Reading and Adoption of the Agenda

The agenda for the meeting was read and Engr. Dr. P.O.Offor moved for the adoption, while Engr. Dr. Mkpamdi.Eke seconded the motion.

ICRICPDS /2023/10/04 Reading and Adoption of the Minute

The minutes of the last meeting held on 15th June, 2023 were read by the Secretary. The motion for adoption was moved by Dr. Mkpamdi Eke and seconded by Dr. P.O. Offor.

ICRICPDS /2023/10/05 ARISING MATTERS

We deliberated and reached a consensus on the subsequent matters: We awarded the contract to Katchey Company Limited Lagos to supply the equipment in three months.

ICRICPDS /2023/10/06 AOB

Members, thank the centre for the refreshment.

ICRICPDS /2023/10/07 ADJOURNMENT/CLOSURE

Adjournment for the meeting was moved by Dr. Mkpamdi.Eke. Dr. P.O. Offor seconded the motion and also closed the meeting with a word of prayer.

Engr. Prof Victor Aigbodion
(Chairman)

Engr. Dr. Onyekwere Ojike
(Secretary)

AFRICA CENTRE OF EXCELLENCE FOR SUSTAINABLE POWER AND ENERGY DEVELOPMENT
UNIVERSITY OF NIGERIA
MINUTES OF THE INNOVATION-ORIENTED COOPERATION OF RESEARCH INFRASTRUCTURES AND COLLABORATION WITH A PRIVATE SECTOR THROUGH ADVISORY SERVICES HELD ON 10th Jan, 2024

ICRICPDS /2024/01/01. ATTENDANCE

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1. Prof Victor Aigbodion — Chairman
2. Engr. Prof. Cosmas Anyanwu — Member
3. Engr. Dr. P. U. Akpan — Member
4. Engr. Dr. Mkpamdi.Eke — Member
5. Engr. Dr. P.O.Offor — Member
6. Engr. Dr. Onyekwere Ojike — Secretary

* Absent with permission.

ICRICPDS /2024/01/02 OPENING PRAYER

The meeting started by 10:35am with an opening prayer led by Engr. Dr. Mkpamdi.Eke. The Chairman welcomed members to the meeting.

ICRICPDS /2024/01/04 Reading and Adoption of the Agenda

The agenda for the meeting was read and Engr. Dr. P.O.Offor moved for the adoption while Engr. Dr. P. U. Akpan seconded the motion.

ICRICPDS /2024/01/05 Reading and Adoption of the Minute

The minutes of the last meeting held on Oct 10th, 2023 were read by the Secretary. The motion for adoption was moved by Engr. Dr. Mkpamdi Eke and seconded by Dr. P.O. Offor.

ICRICPDS /2024/01/06 ARISING MATTERS

We deliberated and reached a consensus on the subsequent matters: We intend to refurbish our laboratory equipment while waiting for Katchey Company Limited Lagos to supply .

ICRICPDS /2024/01/07 AOB

No AOB

ICRICPDS /2024/01/07 ADJOURNMENT/CLOSURE

Adjournment for the meeting was moved by Engr. Dr. Mkpamdi.Eke and seconded by Dr. P.O. Offor seconded the motion and also closed the meeting with a word of prayer.

Engr. Prof Victor Aigbodion
(Chairman)

Engr. Dr. Onyekwere Ojike
(Secretary)

AFRICA CENTRE OF EXCELLENCE FOR SUSTAINABLE POWER AND ENERGY DEVELOPMENT
UNIVERSITY OF NIGERIA
MINUTES OF THE INNOVATION-ORIENTED COOPERATION OF RESEARCH INFRASTRUCTURES AND COLLABORATION WITH A PRIVATE SECTOR THROUGH ADVISORY SERVICES HELD ON 15th May, 2024

ICRICPDS /2024/05/01. ATTENDANCE

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1. Prof Victor Aigbodion — Chairman
2. Engr. Prof. Cosmas Anyanwu — Member
3. Engr. Dr. P. U. Akpan — Member
4. Engr. Dr. Mkpamdi.Eke — Member
5. Engr. Dr. P.O.Offor — Member
6. Engr. Dr. Onyekwere Ojike — Secretary

* Absent with permission.

ICRICPDS /2024/05/02 OPENING PRAYER

The meeting started by 10:35am with an opening prayer led by Engr. Prof. Cosmas Anyanwu . The Chairman welcomed members to the meeting.

ICRICPDS /2024/05/03 Reading and Adoption of the Agenda

The agenda for the meeting was read and Engr. Dr. P.O.Offor moved for the adoption while Engr. Dr. Onyekwere Ojike seconded the motion.

ICRICPDS /2024/05/04 Reading and Adoption of the Minute

The minutes of the last meeting held on the 10th of Jan 2024 were read by the Secretary. The motion for adoption was moved by Engr. Dr. P. U. Akpan and seconded by Dr. P.O. Offor.

ICRICPDS /2024/05/05 ARISING MATTERS

We deliberated and reached a consensus on the subsequent matters: the Chairman informed members that Katchey Company Limited Lagos will supply the equipment in the month of June 2024

ICRICPDS /2024/05/06 AOB

The Chairman informed members that the development of manual for the new equipment will commence next meeting.

ICRICPDS /2024/05/07 ADJOURNMENT/CLOSURE

Adjournment for the meeting was moved by Engr. Dr. P. U. Akpan, Dr. P.O. Offor seconded the motion and also closed the meeting with a word of prayer.

Engr. Prof Victor Aigbodion
(Chairman)

Engr. Dr. Onyekwere Ojike
(Secretary)

MODULE 3. INNOVATION-ORIENTED COOPERATION OF RESEARCH INFRASTRUCTURES AND COLLABORATION WITH A PRIVATE SECTOR THROUGH ADVISORY SERVICES

Verification criteria (provide evidence for each)

i. Developed documents for expanding of testing facility

The University of Nigeria, Nsukka, being a foremost centre of excellence in teaching and research within the region, is at the forefront of fostering regional and international integration through teaching and research. The ACE-SPED expansion of the testing facilities is to further strengthen the regional impact of the university through impactful testing and cutting-edge research in the area of sustainable power and energy development. This document established ACE-SPED as a laboratory hub for sub-regional testing facilities.

ii) University of Nigeria, Nsukka have standard Nano-laboratory, NLNG advanced materials characterization laboratory, high voltage laboratory, energy research centre, equipment research and maintenance centre, centre of entrepreneurship and development and innovation science park. These laboratory and centre are equipped with modern testing equipment such as solar and PV analyzer, high voltage materials, battery, electrochemical,

iii.) The following testing facilities are proposed to enhance the testing needs of the region:

A. Control and Instrumentation Equipment

CE110 Servo Trainer	A compact self-contained bench mounting d.c. servo apparatus designed to allow students at all academic levels to investigate basic and advanced principles of control. In particular the CE110 deals with control issues relating to position and speed control in servo systems
Microgrid	The microgrid combines the outputs of Wind Turbine emulator, PV Emulator and Fuel Cell at a common DC link via different DC-DC converters which is further connected to a three-legged programmable inverter to deliver the combined power to an Actual Grid. Microgrid system enables user to do research in the field of Microgrid management, load side management, priority allocation to renewable sources etc.
Solar PV Grid Tied Training System	Enables user to study wiring and interconnections of different components involved in the system to develop basic understanding of working and operation of a Grid connected system
5kW Wind Emulator	Wind turbine emulator mimics the behaviour of wind turbine for hardware level simulations. This system has a DC motor coupled with the Induction generator/Permanent Magnet Synchronous Generator, speed of which is controlled as per the speed reference calculated by solving the mathematical model of wind turbine. An induction generator is coupled to the DC motor and bidirectional inverter is connected to the terminals of the generator.
B. Advanced Materials Characterization	
AA6000 mini Desktop Scanning Electron Microscope	Scanning electron microscope (SEM) is one of the most widely used instrumental methods for the examination and analysis of micro- and nanoparticle imaging characterization of solid objects. One of the reasons that SEM is preferred for particle size analysis is due to its resolution of 10 nm, that is, 100 Å.
7600 FTIR spectrometer	It is a valuable tool for various analytical applications in fields such as chemistry, medicine, food and beverage, wine industry, material , energy, and power, engineering and quality process control and for examining the functional group
STA 449 F5 Jupiter® Simultaneous Thermal Analyzer (TG-DSC/DTA Apparatus)	The Nano DSC and the Multi-Cell DSC represent ultrasensitive differential scanning calorimeters with unmatched flexibility for characterizing molecular structure and stability. The Nano DSC, with fixed-in-place cells, is specifically designed to analyze in-solution samples. The Multi-Cell DSC offers three removable cells and one reference cell for maximum sample flexibility.
c. RENEWABLE AND NEW ENERGY SYSTEMS	

Elemental Analyser with complete accessories Brand/Model: Perkin Elmer CHNS(O) Specification: Perkin Elmer 2400 Series II	The 2400 Series II offers multiple analysis modes and fast analysis times. Modes Time (Minutes) CHN 6 CHNS 8 Oxygen 4 Productivity and precision are your partners with the 2400 Series II. User-selected calibration procedures of single-standard calibration (multiple linear regression) offer the user increased precision throughout the broad analysis range of the 2400 Series II. Uses: For determination of elemental composition of Organic Liquids
Oxygen Bomb Calorimeter Brand/model: CAL3K-F CALORIMETER WITH MANUAL OXYGENCAL3K-AP Specification: 3K-F - CAL3K-F BOMB CALORIMETER SYSTEM.	**Uses:** For determination of Heating value of fuels. The CAL3K-A Oxygen Bomb Calorimeter System can be used with most applications including such as Coal Analysis, Fuel Analysis, Alternative Energy, Waste Analysis, Animal Feed Research, University Research, Food/Nutrition Analysis, Explosives Analysis, Coal Analysis, Oil Analysis, and other traditional and non-traditional applications.

ii. Approved management policy document

The ACE-SPED testing laboratory is owned by the Africa Centre of Excellence for Sustainable Power and Energy Development (ACE-SPED), University of Nigeria, Nsukka. The Centre Leader of ACE-SPED is Chairman of the Management Team, while the rest of the ACE-SPED Management Team assumes their respective roles on the board. The daily operation of the centre was overseen by a technical coordinator, while resource persons for specific assignments were drawn from a resource pool from relevant units of the university.

The ACE-SPED management laboratory policy is in line with the principles and set goals of the ACE-SPED in order to meet the requirements of the Laboratory Quality Management System in conformance with ISO 15189.

i) Objective of ACE-SPED management laboratory policy

- Ensure that the information generated by the laboratory is correct.
- Quality management is not restricted to the development and retention of quality control charts but rather includes all aspects of laboratory activities that affect the results produced, from the choices of methods to the monitoring of instruments to the education of personnel to the handling of specimens to the reporting of results.
- The true purpose of quality management activities is to determine how correct or incorrect the results emanating from the laboratory are and to allow those managing the laboratory to determine whether or not the lab is fulfilling its function satisfactorily.
- External services and supplies refer to reagents, consumables, equipment, and services sourced from outside.
- The management policy ensures that potential users know and understand the scope of the laboratory's activities. It is also its responsibility to understand the needs of the users and make additional services available.
- Good laboratory practice warrants customer interactions. In such interactions, there is tremendous scope for improvement. Additionally, feedback is suggested as a powerful tool for improvement.

- Management review is a valuable component of quality management systems in accordance with ISO 15189.

- **Meeting customer requirements as per ISO-accredited standard**
- **Compliance with national and international standards.**
- **Prompt delivery of test reports.**
- **Provision of a safe and conductive work environment.**
- **Safety of laboratory personnel.**

- **Ensuring that all personnel concerned with the testing activity within the laboratory are familiar with the documentation and implement the policies and procedures in their work.**
- **Compliance with ISO/IEC 17025:2017 requirements and continual improvement in the effectiveness of the management system.**
- Consult with clients regarding test results and findings in a professional manner, and ensure each issue is resolved promptly and documented appropriately.

iii. Centre Consulting Business Development Office established

ACE-SPED Business Development Consult Ltd, abbreviated as ACE-SPEDBDC has been established, is the business consulting unit of the Africa Centre of Excellence for Sustainable Power and Energy Development (ACE-SPED), University of Nigeria, Nsukka. ACE-SPEDBDC and provide provides consulting services to a wide range of businesses including startup businesses. The services include business consultations, business plans, lender meeting consultations, financial analysis, and marketing consultations tailored to meet the needs of clients. The unit will be registered with the Cooperate Affairs Commission, Nigeria as a limited liability company.

SERVICES

The services offered by ACE-SPEDBDC includes but not limited to:

i. Business Plans

ii. Financial Analysis & Projections
iii. Marketing Strategies
iv. Operations Plan
v. Business Policies & Procedures Implementation

MANAGEMENT TEAM

ACE-SPEDBDC is owned by the Africa Centre of Excellence for Sustainable Power and Energy Development (ACE-SPED), University of Nigeria, Nsukka. The Centre Leader of ACE-SPED is Chairman of the Management Team while the rest of the ACE-SPED Management Team assume their respective roles in the board. The daily operation of the Centre overseen by a Business Coordinator while resource persons for specific assignments and drawn from a resource pool from relevant units of the university.

ACE-SPEDBDC partners with the following units in the University of Nigeria for human resources sharing:

i. The university of Nigeria, Consultancy Services Ltd
ii. Centre for Entrepreneurship and Development Research (CEDR)
iii. Center for Technical Vocational Education Training and Research (CETVETER)
iv. Faculty of Business Administration
v. Faculty of Engineering
vi. Faculty of Environmental Sciences
vii. Faculty of Vocational and Technical Education
viii. Department of Economics
ix. Intellectual Properties and Technology Transfer Office (IPTTO)

i. Develop management policy for the Labs
ii.

v. Develop modules for training Laboratory personnel

i) Background

In order to meet the objective of the innovation-oriented cooperation of research infrastructures with the private sector through advisory services, the ACE-SPED ensure training and re-

training of the personnel, giving them great proficiency. Information on internal rules and procedures to be followed for consumer product testing, staff training, report writing, safety, research, reviewing data from private laboratories, and other laboratory operations is provided.

ii) Objective

In addition to formulas and other technical material, laboratory manuals provide common laboratory practices, modern methods, and safety precautions.

1. **Trained** laboratory personnel must understand how laboratory facilities operate. Given the chance, they should provide input to the laboratory designers to ensure that the facilities meet the needs of the laboratory's functions.
2. **Laboratory** personnel must understand the capabilities and limitations of the ventilation systems, environmental controls, laboratory chemical hoods, and other exhaust devices associated with such equipment and how to use them properly.
3. **To** ensure safety and efficiency, the experimental work should be viewed in the context of the entire laboratory and its facilities.

iii) The training manual is divided into two categories:

A) the general Laboratory guide and B) the specific manual for the equipment

A) the general Laboratory guide

i) Safety Training

The ACE-SPED laboratory policy believes that human error and poor procedure can affect the best safeguards to protect the laboratory worker. Thus, a safety-conscious staff as well as a

student body well-versed in the recognition and control of laboratory hazards is key to the prevention of laboratory-acquired incidents and accidents. For this reason, ACE-SPED ensure continuous in-service training in safety measures, which is essential. An effective safety programme begins with the laboratory managers, who should ensure that safe laboratory practices and procedures are integrated into the basic training of employees and students at all levels.

- **Training in Instructional Laboratories**

Laboratory safety training in instructional laboratories provided by the ACE-SPED course instructor or safety officer, lab instructors should have documented training in advance. ACE-SPED ensure the training includes a discussion of the risks associated with the substances used and procedures to be performed, proper techniques for handling and disposing of hazardous substances, safety precautions to be used to prevent exposure or release into the environment, and emergency and spill procedures.

The ACE-SPED Safety Officer is available to assist course instructors in developing this training and provide additional laboratory safety training in instructional courses upon request.

The manual assist in strict cooperation with the University Laboratory Safety Committee in developing and circulating training aids and documentation, staff and student training include information on safe methods for highly hazardous procedures that are commonly encountered by all laboratory personnel and that involve:

1. Inhalation risks (*i.e*. aerosol production) when using loops, streaking agar plates pipetting, making smears, opening cultures, taking blood/serum samples, centrifuging, etc.
2. Ingestion risks when handling specimens, smears and cultures
3. Risks of per-coetaneous exposures when using syringes and needles
4. Bites and scratches when handling animals
5. Handling of blood and other potentially hazardous pathological materials
6. Decontamination and disposal of infectious material.

- **Information and training manual provided the following:**
    i. The location and availability of the written Laboratory Safety Manual
    ii. The health hazards, signs, and symptoms associated with exposure(s) and infection(s) with the biohazard us agent(s) used in the work area
    iii. The measures employees can take to protect themselves from these hazards include specific procedures the university or department has implemented, such as appropriate work practices, emergency procedures, and personal protective equipment.
    iv. The location and availability of reference material on the hazards, safe handling, storage, and disposal of biohazardous agents

A. Laboratory instrumentation

The use of instruments in a laboratory is for observation, measurement, or control. It entails using or working with equipment, particularly using one or more while doing laboratory procedures. The creation or use of measuring instruments for observation, monitoring, or control

is referred to as instrumentation. A group of test equipment is referred to as laboratory instrumentation. A set of these tools might be used to automate testing procedures. The design, manufacture, and supply of instruments for measurement, control, etc.; the condition of having such instruments all at once or being controlled by them

Laboratory Instrument

Any device, tool, or utensil used in a laboratory is referred to as a laboratory instrument. A tool that measures a physical property, such as flow, concentration, temperature, level, distance, angle, or pressure, is known as an instrument. Instruments may range in complexity from multi-variable process analyzers to simple direct-reading hand-held thermometers. A medical instrument is a tool used to identify and treat illnesses. A tool or device used for a certain task; particularly, a tool or piece of equipment designed to do meticulous and precise work. a tool for measuring anything.

Laboratory equipment

The measuring instruments used in a scientific laboratory are often electronic in design. The many instruments and tools that scientists use when working in a laboratory are referred to as laboratory equipment. Typically, laboratory equipment is used to conduct an experiment, take measurements, and collect data. A scientific instrument is often a larger or more advanced piece of equipment. More and more, open hardware ideas are being used in the design and sharing of scientific instruments and lab equipment. In addition to specialised tools like operant

conditioning chambers, spectrophotometers, and calorimeters, the traditional equipment comprises instruments like Bunsen burners, microscopes, and spectrophotometers.

Laboratory techniques

Laboratory techniques are the procedures used in both pure and applied sciences to conduct experiments, all of which adhere to the scientific method. Some of these procedures call for the use of sophisticated laboratory apparatus, such as electrical devices and laboratory glassware, while other procedures call for specialized or expensive supplies.

Laboratory apparatus

A collection of instruments, tools, or a machine used in a laboratory is known as a laboratory apparatus. The equipment used in laboratories, whether it be a single instrument, a whole set, or both, is used to undertake projects and experiments. the most typical tools and equipment required for hands-on activity in laboratories. The sort of laboratory you are in and the experiment you will do will determine what equipment you need.

Laboratory tool

Any physical object that may be utilised in a laboratory as long as it is not consumed while being used is considered a laboratory tool. Different names for tools used in certain areas or occupations include "instrument," "utensil," "implement," "machine," "device," and "apparatus." Equipment" is the collection of tools required to do a task. Technology is the understanding of creating, getting, and employing tools.

B. **Calibration of Equipment**

The ACE-SPED laboratory policy believes that human error and poor procedure can affect the best results from the testing laboratory. As a result, the ACE-SPED laboratory policy makes training on the calibration of equipment necessary.

What is calibration of an instrument?

Calibration is the act of determining whether or not a piece of measuring equipment is performing safely and effectively by comparing it to an established standard in order to test or restore its accuracy. After calibration is complete, the equipment's values at each point of reference are calibrated, and the standard calibration equipment must match the results or fall within the tolerance/accuracy range permitted before the equipment may be certified as safe.

However, if there is a deviation, the instrumentation engineer makes the necessary adjustments, corrections, resets, or repairs to the equipment to return it to the anticipated or usual standard. Instrument calibration basically makes sure that businesses (food processing, environmental, oil and gas, etc.) are able to stop incorrect readings in their operations, making sure that the instruments continue to match their makers' requirements and designated purpose.

What makes calibration necessary?

As a result of the aforementioned explanation, we now know the importance of trustworthy calibration services for quality. In light of this, we thought it would be excellent to provide some justifications for why calibration is crucial to the calibre of your output. A new instrument has to be calibrated to make sure it is operating correctly and in accordance with the appropriate standard. When the instrument has been subjected to unfavourable circumstances, turbulent

processes, etc., calibration is necessary. Additionally, when an instrument has been fixed or altered, calibration is necessary.

How are measurements Done

It is essential to remember that each kind of equipment has a unique calibration procedure and approach when thinking about how calibration is done. However, there are certain essential fundamental procedures that must be considered before calibration may begin. Here are the actions to take:

- Decide what kind of instrument you are calibrating, such as if it measures temperature or pressure.
- Select a calibration tool that can accurately assess the calibration range of the target device.
- Organise the calibration environment.
- Make sure the calibrator is correctly attached to each instrument you are calibrating. This will assist in avoiding errors in your readings and save you from making incorrect observations.
- You now carry out the calibration. However, it is suggested that you calibrate your device two or three times. This process of "iteration" is carried out to guarantee the accuracy of your results. Even if you always obtain the desired outcome the first time, always do this.
- Make a note of your readings and see if any variances exist. If there are, make sure it falls within the equipment's allowable deviation. That device did not pass the calibration if the variation was outside of its allowed range. Recommendations may be made in light of the findings.

List of calibration equipment

Here’s a list of some of the calibration instruments that are popularly used:

- Dead weight tester
- Loop calibrator
- Comparison pump
- Multimeter
- Temperature bath
- Test flange
- Test bench

What equipment has to be calibrated

Every measuring device eventually has to have its calibration checked. Scales, speedometers, thermometers, flow metres, temperature probes, and other devices need to be calibrated. The reality is that practically every instrument will eventually start to lose accuracy as a result of difficult working circumstances, exposure to severe environments, mechanical shocks, etc. Additionally, as it is usual for instruments to depart from pre-set parameters, such deviations must be fixed beforehand to avoid having an impact on the final product's quality.

How often an instrument should be calibrated

- The frequency of instrument calibration is yet another inquiry we often get. And although a straightforward response would be wonderful, the reality is that it's not so straightforward since it mostly relies on use.
- A shorter interval between calibrations, such as monthly, quarterly, or semi-annually, can provide you better results if your business makes essential measurements.

- Annual calibration will be your best choice if your firm performs both crucial and less essential measurements.
- Regardless of the procedure and environmental factors, it is a legal necessity that all process equipment be calibrated yearly or twice a year.

What role does ACE-SPED team play in calibration?

It is impossible to overstate how crucial instrument calibration is. Any business that employs instruments and equipment must always do this essential maintenance task. **ACE-SPED Engineer**s has a team of qualified staff on hand to address the calibration requirements of the testing laboratory.

iv. Certification documents from relevant agencies

In order to maintain standards, the ACE-SPED has initiated certification with some international and national agencies. Some of our testing equipment is currently undergoing evaluation for certification, while our National Stove Eligibility Laboratory (NSEL) has been certified by the Standards Organisation of Nigeria (SON) and others by the National Equipment Maintenance under the University of Nigeria, Nsukka.

v. Documents on equipment usage

Some of our existing Laboratory/Workshops are

listed below:

1. Materials Characterization – NEW NLNG laboratory
2. Foundry shop- Metallurgical and Materials Engineering/Mechanical Engineering
3. Metallographic – Metallurgical and Materials Engineering/Mechanical Engineering
4. Mechanical Testing- Metallurgical and Materials Engineering/Mechanical Engineering
5. Mechatronics Laboratory- Mechanical Engineering
6. Corrosion Laboratory - Metallurgical and Materials Engineering
7. Strength of Materials Laboratory – Civil Engineering
8. Electrical Engineering Laboratory
9. Electronic Engineering Laboratory
10. Central Laboratory

Some list of our equipment usage and their pictures

S/N	Name of Equipment	Picture of the Equipment	Location of Equipment
1	Universal Testing Machine		NLNG Lab

2	Inverted Metallurgical Microscope		NLNG Lab
3	Drying Oven		NLNG Lab
4	Creep Testing Machine (Low temp)		NLNG Lab

5	Electrochemical Analyzer		NLNG Lab
6	Weighing balance		NLNG Lab
7	Weighing balance		NLNG Lab

8	Water bath		NLNG Lab
9	Plasma cutter and welding machine		NLNG Lab
10	Heat treatment furnace		Foundry lab

11	Heat treatment furnace		Foundry lab
12	Rotary furnace		Foundry lab

13	Welding machine		Foundry lab
14	Charcoal fired furnace		Foundry lab

15	Gas fired furnace		Foundry lab
16	Crucible Furnace		Foundry lab

17	Ball milling machine		Foundry lab
18	Rockwell hardness testing machine		Materials Science Lab
19	Polishing machine		Materials Science Lab

20	Polishing machine		Materials Science Lab
21	Polishing machine		Materials Science Lab
22	Polishing machine		Materials Science Lab

23	Mounting press		Materials Science Lab
24	Impact testing machine		Materials Science Lab

25	Optical Emission Spectrometer		

NATIONAL STOVE ELIGIBILITY LABORATORY

The National Stove Eligibility Laboratory (NSEL) National Centre for Energy Research and Development, University of Nigeria, Nsukka was founded in 2015 with grant funding from United Nations Foundation. The laboratory is affiliated with Standards Organisation of Nigeria (SON) and specializes in testing and certification of biomass cookstoves.

The equipment in the testing facility includes (i) the Laboratory Emissions Measuring System (LEMS), which is a computer-based system for carrying out Water Boiling Test. It is equipped with sensors for Carbon Monoxide, Carbon dioxide, and Particulate Matter; (ii) Testing Hood; (iii) High Precision Analytical Balance, (iv) Thermocouples and thermocouple read-out meters.

Laboratory Emissions Measuring System

vi. Web link to documents

https://www.unn.edu.ng/central-science-research-laboratory-conference-new-generation-technologies-for-sustainable-development/

https://nanotechunn.com/

vi. Appointment letters and minutes of meeting

The appointment letters and minutes of meetings of the various committees under the Innovation-Oriented Cooperation of Research Infrastructures and Collaboration with the Private Sector through Advisory Services have been attached

viii. List of potential facility users and record of their engagement

The laboratories in the ACE-SPED have made a great impact in the sub-region as a result of sample testing for partners and institutions in the region. The following is a list of our potential users as of 2022.

- Scientific Equipment Development Institute (SEDI) Enugu
- **Standards organization of Nigeria(SON)**
- Project Development Institute (PRODA) Enugu
- Enugu Electricity Distribution Company (EEDC)
- UNESCO International Centre for Biotechnology
- National Power Training Institute of Nigeria (NAPTIN)
- National Centre for Equipment Maintenance and Development(NCEMD), University of Nigeria, Nsukka
- Jibs Engineering Ltd Trans Amadi Port Harcourt Rivers State

- GREENAGE TECHNOLOGIES,10, ENUGU ONISHA EXPRESS WAY TRANSEKULU ENUGU STATE, NIGERIA
- A1 Tronix R&D Electrical and Electronics Engineering, Igbo-Etche, Port Harcourt, Rivers State
- CLEANERGY NIG LTD ASABA, DELTA STATEEngr. John Bipialaka,
- Poda Green Consult. 27b OlumorotiJaiyesimi Street, Gbagada Phase 2, Lagos.
- Foundation for Innovative Electronics and New Energy Systems (FIENES) Suite Abuja, Nigeria
- EL-FAD Concept, D 248, Ikota Shopping Complex, VGC, LekkiAjah Express way, Lagos.
- VACC LIMITED, 9, MacGregor Road, Ikoyi, Lagos.
- Edugen Technologies Nigeria Limited, Mekason Plaza Odenigbo Road Nsukka
- IGUWORLD SOLAR, Abuja;
- Green and and Smart Technologies Ltd. Maitama, Abuja.
- CYMAS TECHNOLOGY LIMITED, 44 Eket-Oron Road, Eket, AKWA IBOM State
- Decrown West Africa Company Limited. No. 44 Lord Lugard Street, Asokoro, Abuja – FCT
- FONGU Electrical Installation | Bamenda
- Vynet Invent Network Solutions Festac Town, Lagos State.
- Oracle Business Limited (Plastic Industry), Makurdi, Benue State.
- CF OLYC NIG LTD Enugu
- J&G Engineering, Lekki, Lagos.
- Edo State Mining and Investment Company (ESMIC), Benin City
- Engineering Company Limited, 36, Orominike Lane
- Gezeora Commercial Enterprise. Worgu road, off east west road Adjacent Wazobia radio office Complex, GRA Phase V Ozuoba.
- Liberia Electricity Corporation (LEC) Waterside, Monrovia Liberia.
- Transmission company of Nigeria (TCN), Apo transmission substation Abuja.
- BEDC Electricity Plc Agbarho Service Unit (92 Ughelli Patani Road By Orido Junction, Agbarho Ughelli North Lga Delta State),
- Regional Centre for Training and Development Office Address: 1st Floor Goldcrest Plaza, by Mega Chicken Restaurant, Ikota First Gate Bus Stop
- Universities in the Sub-regions