NIGERIA ATOMIC ENERGY COMMISSION (NAEC)

THE PRESIDENCY

PROGRESS/ACHIEVEMENTS OF THE NIGERIA ATOMIC ENERGY COMMISSION

2019 ANNUAL REPORT

SUBMITTED BY

THE AG.CHAIRMAN/CEO

TO THE

OFFICE OF
THE SECRETARY TO
THE GOVERNMENT OF THE FEDERATION

THE PRESIDENCY
THREE ARMS ZONE
ABUJA

JANUARY 21, 2020

MDA INFORMATION

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Mission Statement	***To develop a sustainable framework imbued with the fundamental elements of a high safety culture for the peaceful application of nuclear science and technology for the socioeconomic development of Nigeria.***
Agencies/Parastatals under responsibility	**Presidency**

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I THE ORGANIZATIONAL MANDATE

1.1 Background information

The Nigeria Atomic Energy Commission (NAEC), created by Act 46 of 1976 (as amended by Cap N91 LFN, 2004), is the national focal agency charged with the responsibility for the promotion of the development of atomic energy and for all matters relating to the peaceful use of atomic energy. NAEC was, however, activated and became fully operational in July, 2006 under the aegis of the Federal Ministry of Science and Technology, by the appointment of its pioneer Director-General/Chief Executive Officer. In March 2011, Mr. President approved the reconstitution of NAEC, as an independent and self-accounting Commission to operate within the Presidency, by the appointment of the Chairman/Chief Executive Officer and six Members in consonance with Section 4(1) of NAEC's enabling Act. This executive decision by Mr. President was made in order to strategically position the Commission to successfully deliver its core mandate so as to strengthen government's commitment towards achieving short-, medium- and long-term broad-based socio-economic growth in the country as envisioned in the key objectives of the national and regional aspirations such as NEEDS, NEPAD, MDG, SDG, ERGP, amongst others.

1.2 Functions of the Commission

As mandated by its enabling law, NAEC is charged with the principal responsibility of developing the framework and technical pathway to explore, exploit and harness atomic energy for peaceful applications in all its ramifications *for the socio-economic development of Nigeria in conformity with the policies of the Federal Government (FG)*. Particularly, *in furtherance of FG's policy to increase as well as diversify the national electricity generation base beyond the traditional sources of gas, oil and hydro to include nuclear and the renewable sources,* NAEC is vested with the mandate to develop and implement the national nuclear power roadmap for the deployment nuclear power plants (NPPs) so as to realise *base-load and clean electricity* generation in the country for a period of about one hundred (100) years without interruption. Furthermore, the peaceful applications of nuclear technology in agriculture and food sector, medicine and human health, water resources management, industry, and in environmental management, as well as in basic and applied scientific research are within the purview of the Commission's functions.

Specifically, as provided for in the enabling Act, the Commission is mandated to:

i. construct and maintain nuclear installations for the purpose of generating electricity;
ii. produce, use and dispose of atomic energy and carry out research into matters connected with the peaceful uses of atomic energy;
iii. manufacture or otherwise produce, buy or otherwise acquire, treat, store, transport, and dispose of any radioactive substances;
iv. make arrangements with universities and other institutions or persons in Nigeria to conduct research into matters connected with atomic energy or radioactive substances;
v. prospect for and mine radioactive minerals;
vi. educate and train persons in matters connected with atomic energy and radioactive substances;

vii. advise the Federal Government on questions relating to atomic energy.

1.3 Operational Policy Objectives

In order to implement the mandate of the Commission to prosecute a sustainable national nuclear technology programme, a management framework was developed to adequately position it to actualize its core mandate, defined by the operational goal and policy objectives, which are set as follows:

Goal:

The primary goal of the Commission is to serve as the focal point and specialized vehicle of government to develop the ways and technical machinery to effectively explore, exploit and harness atomic energy for peaceful applications for sustainable national development.

Vision:

To lay an enduring foundation for the building of a world-class institution for the development and peaceful deployment of nuclear technology in all its ramifications for national development in conformity with international best practices.

Mission:

To develop a sustainable framework imbued with the fundamental elements of a high safety culture for the peaceful application of nuclear science and technology for the socio-economic development of Nigeria.

Policy Objectives

The policy objectives of the Commission are:

a) To streamline, harmonize, promote and coordinate R&D activities for capacity building and infrastructure development in nuclear technology.

b) To fast-track and catalyze the process of development and deployment of nuclear power plants for electricity generation in Nigeria.

c) To develop a comprehensive manpower programme which includes:

   i. Developing and introducing core training programmes in nuclear science and engineering in institutions of higher learning in Nigeria for the actualization of the critical mass of needed indigenous manpower for the nuclear industry, and,

   ii. Developing, networking and creating opportunities for fellowships and advanced training in nuclear science and technology in international organizations and advanced facilities in other countries.

d) To develop the requisite legal framework for the deployment of nuclear power plants in Nigeria within a strict regulatory regime, and in due compliance with the three cardinal planks of safety, security and safeguards.

e) To liaise with the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency (NEA), the Comprehensive Test Ban Treaty Organization (CTBTO) and other international organizations for the implementation of national programmes.

f) To streamline, harmonize, promote and coordinate the diverse applications of nuclear science and technology in agriculture, water resources management, human health, minerals exploration and manufacturing among others, for the socioeconomic development of Nigeria.

1.4 National Nuclear Energy Programmes

The current overarching objectives of the Federal Government of Nigeria (FGN) include National Security, Job creation, Anti-corruption and Diversification of the Economy; in the light of these, several key developmental activities, initiatives, and projects have been sustained and enhanced within the nuclear sector due to the strong support and reinforcement of government's policy direction.

These activities are encapsulated in four (4) National Nuclear Energy Programmes (NNEP) being implemented/coordinated by NAEC, namely:

(i) Nuclear Power Programme,
(ii) Human Resources and Capacity Development Programme,
(iii) Nuclear Research & Development Programme, and
(iv) Nuclear Technology Applications Programme.

Accordingly, with foremost emphasis on nuclear safety, the development and implementation of the national nuclear energy programmes which involve broad base stakeholder participation for transparency, accountability, enhanced national security, as well as improved performance of relevant sectorial policy in nuclear sphere, would expectedly enhance the overall socio-economic situation of Nigeria in tandem with the current federal government's primary policies on Job Creation/Poverty Alleviation, National Security, Anti-corruption and Diversification of the economy.

II ACTION PLAN

The nuclear energy sector is unique. The successful implementations and completion of these national nuclear programmes are characteristically long-termed (could run up to 100 years) and are usually preceded by a long period of strategic planning in order to ensure safety, transparency and global acceptance. However, the long-term goals of these programmes are achieved through short- and medium-term activities carried out via Federal Government sustained commitment and bilateral and multilateral collaborations.

The Action Plan of NAEC are derived from three (3) main documents, namely:

(i) **The Integrated Workplan (IWP) for Nigeria** reviewed (2018) with the assistance of the International Atomic Energy Agency (IAEA) captures the activities for the actualization of the IAEA Integrated Nuclear Infrastructure Review (INIR) Mission's recommendations for the attainment of Milestone 2 of the IAEA Milestone Approach for nuclear power infrastructure development.

(ii) **The Country Programme Framework (CPF)/Logical Framework Matrix (LFM)-2013/2018 & 2018/2023-** developed with the assistance of the IAEA for identified relevant/beneficial Technical Cooperation projects in the applications of nuclear technology for various sectors of the economy.

(iii) **The Economic Recovery Growth Plan (ERGP) Implementation Plan (2017-2020)** which projects the financial implications of NAEC's activities/programmes/projects for the stipulated period for annual budgetary considerations.

It is noteworthy to emphasize the enhanced progress recorded due to the increase and relatively early budgetary disbursement by the FGN since May 2015.

III. INITIATIVES, ACTIVITIES AND ACHIEVEMENTS (June 2015-Aug, 2019)

(A) NUCLEAR POWER PROGRAMME

In line with the approved Strategic Plan for the Implementation of the National Nuclear Power Programme (2009, revised in 2015 & 2018/2019), the first nuclear power plant is expected to enter into commercial operation and generate 1,200MW of electricity by 2027. Three additional NPPs are expected to increase the generation capacity to 4,800MW by 2037.

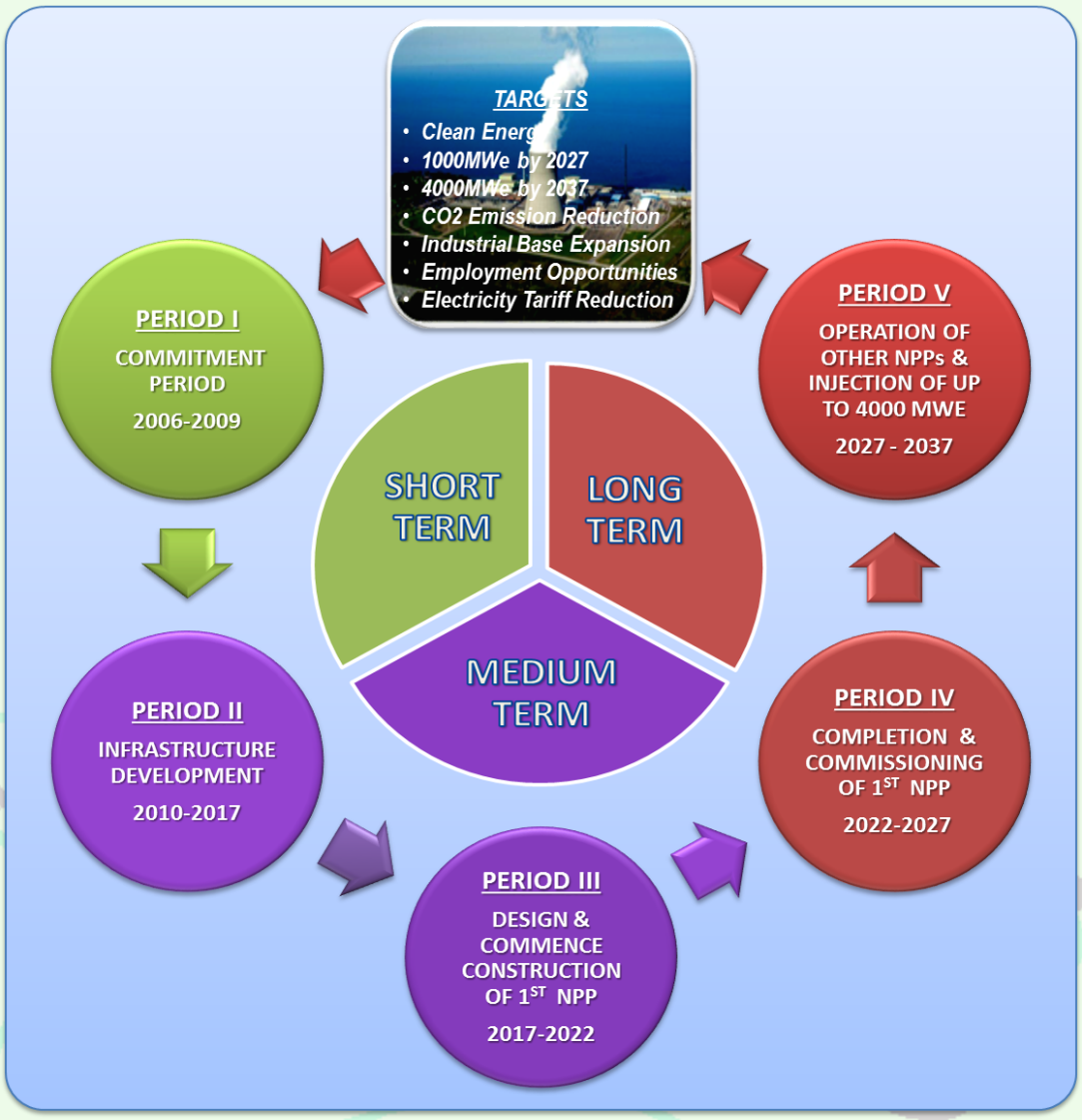

Figure 1: Schematic Representation of Nigeria's Nuclear Power Programme

This would be a guaranteed source of clean (low CO_2 emission) base-load electricity supply (sustained without interruption for a minimum of 80 years) to the industrial sector in Nigeria (and possibly neighboring countries) thus promising enhanced socio-economic development (via industrial base expansion), security (via enhanced employment opportunities), job creation (directly via increased workforce in the plants throughout its lifetime as well as indirectly via industrial expansion in the country) and diversification of the economy (via enhanced investment opportunities).

Some Recent Activities of the Nuclear Power Programme

i IAEA DDG (NE) Visit to the President of the Federal Republic of Nigeria

In recognition of the giant strides accomplished in the implementation of the Nigeria National Nuclear Power Programme, the President of the Federal Republic of Nigeria hosted the DDG(NE) IAEA in November 2015, during which occasion the DDG(NE) IAEA, who represented the DG IAEA, presented the IAEA INIR Mission Report of Nigeria to Mr. President who was represented by the Vice-President. This is a clear demonstration of the government's continuous support and commitment to the nuclear energy programmes.

Figure 2: Vice President of the Federal Republic of Nigeria (centre) playing host to the DDG (NE), IAEA on behalf of the President, Federal Republic of Nigeria, at the presentation of the IAEA INIR Mission Report to Nigeria, 2015.

ii Bilateral Cooperation on Nuclear Energy

Nigeria has an existing Inter-Governmental Agreement (IGA) with the Russian Federation (RF) which has led to the signing of three Cooperation Agreements. NAEC is currently implementing the IGA on the design, construction, operation, commissioning and decommissioning of NPP in Nigeria via the formation of a Joint Coordinating Committee (JCC). The specific technical elements of the IGA on NPP are jointly being addressed through the framework of Joint Working Groups (JWGs). Currently, continuous meetings and discussions are on-going within the framework of the JCC and priority actions, which include project feasibility and financing options amongst other elements, have been agreed upon in the implementation of the national nuclear power programme. As a result, two Project Development Agreements (PDAs) for nuclear power and multi-purpose research reactor has been signed by both countries.

Figure 3a: Signing of the PDAs on nuclear power and multi-purpose research reactor between FGN (represented by Late Professor Simon Pesco Mallam, former Chairman/CEO, Nigeria Atomic Energy Commission (NAEC)) and Russian Federation (represented by Anton Moskin, Vice president for marketing and business development of Rosatom subsidiary Rusatom Overseas) at Abu Dhabi (2018)

Furthermore, the Peoples' Republic of China through China National Nuclear Cooperation(CNNC) has expressed strong interest and willingness to collaborate with Nigeria in various aspects of the Nigerian Nuclear Energy Programmes (NNEPs). Details of this cooperation are still being worked out with the involvement of the FMPW&H. However, an MOU between FGN and The Peoples' Republic of China on cooperation in nuclear energy has been signed in May, 2018.

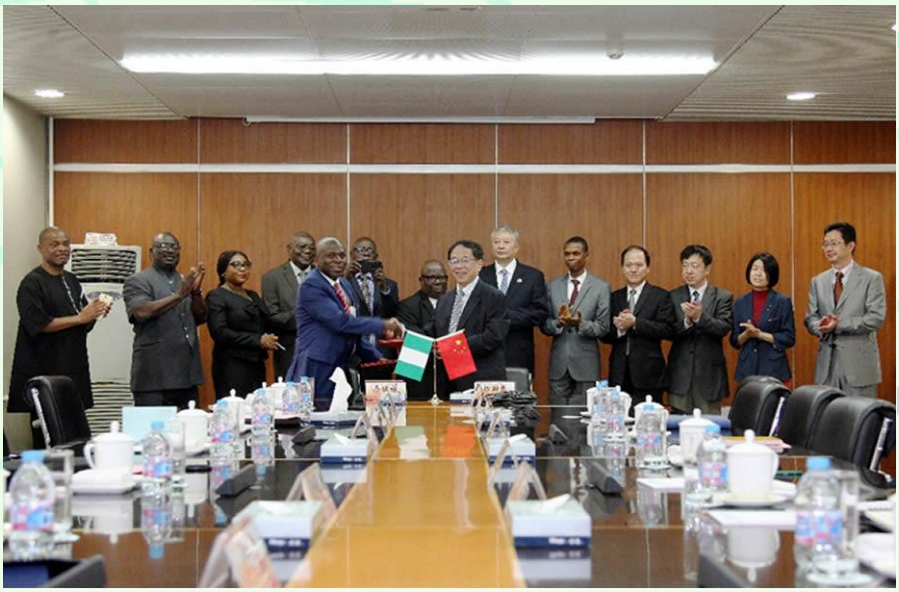

Figure 3b: MOU between FGN (represented by Late Professor S.P. Mallam, former Chairman/CEO, NAEC) and The Peoples' Republic of China (represented by LIN Sen, DG, CNNC International Cooperation Department) on cooperation in nuclear energy has been signed in May, 2018.

iii Progress Achieved in Nuclear Power Infrastructure (NPI) Development

To fast-track the comprehensive nuclear power programmes of Nigeria and to support key government policy objectives, some existing nuclear power infrastructure are being sustained, funded and completed by the Federal Government of Nigeria. Some of the major infrastructure indicating progress achieved between 2015 and 2019 include:

- **Completion of the Multipurpose Research Infrastructure**

Construction work at the Multipurpose Research Infrastructure for Nuclear Instrumentation, Nuclear Safety and Nuclear Security Laboratories and Maintenance Workshops at the NTC, Sheda, FCT, which had been stopped, is now completed (see Figures 4 below).

Figure 4a: The Multipurpose Research Infrastructure for Nuclear Instrumentation, Nuclear Safety and Nuclear Security Laboratories and Maintenance Workshops under construction at the NTC, Sheda, FCT.2015

Figure 4(b) 2018

Figure 4(c) 2018

Figure 4(b) & (c): The Multipurpose Research Infrastructure for Nuclear Instrumentation, Nuclear Safety and Nuclear Security Laboratories and Maintenance Workshops, NTC, Sheda, near completion.2018

Figure 4(d), 2019

Figure 4(e), 2019.

Figure 4(d) & (e): Completion and landscaping of the Multipurpose Research Infrastructure for Nuclear Instrumentation, Nuclear Safety and Nuclear Security Laboratories and Maintenance Workshops, NTC, Sheda, 2019.

- **Progress in the Construction of the Centralized National Facility for Radioactive Waste Management**

In commitment to nuclear and radiological safety, the Commission embarked on the development and construction of a centralized national radioactive waste management facility at NTC, for the management of low and intermediate level radioactive waste from its research centres, hospitals using radioactive sources, orphan sources and other low level radioactive source users. Construction work stopped at this facility which required some architectural modifications to meet with global best practice before 2015.

Figure 5(a): National Low and Intermediate Level Radioactive Waste Management Facility at the NTC, Sheda, FCT (2015)

However, following government recent approval via national budgetary allocations, construction and modification activities resumed in 2018. Figures 5(b) to (e) shows the progress of work on the facility by 2019:

Figure 5(b)

Figure 5(c)

Figures 5(b) & (c): Commencement of construction and modification works at the National Low and Intermediate Level Radioactive Waste Management Facility at the NTC, Sheda, FCT, 2018.

Figure 5(d)

Figure 5(e)

Figures 5(d) & (e): Progress made in the construction and modification of the National Low and Intermediate Level Radioactive Waste Management Facility at the NTC, Sheda, FCT, 2019.

- **Completion of the Researchers' Recreational Facility and Community Centre (RRF&CC) at the Nuclear Technology Centre (NTC), Sheda, FCT**

The Nuclear Technology Centre (NTC), Sheda, is expected to be hosting national/international events which include researches, symposia, workshops, conferences etc as well as nuclear/scientific experts from all over the world. Consequently, a standard Researchers' Recreational Facility & Community Centre as well as a Health Centre and Researchers' Clinic are being constructed at the NTC to meet with global best practice. Figures 6 and 7 below show the work progress from 2015 to 2019:

Figure 6:(a): Researchers' Recreational Facility & Community Centre at the Nuclear Technology Centre (NTC), Sheda FCT (2015).

Figure 6(b)

Figure 6(c)

Figure 6(d)

Figure 6(b),(c) &(d): Researchers' Recreational Facility & Community Centre at the Nuclear Technology Centre (NTC), Sheda, FCT.(2018)

Figure 6(e): Completion and Landscaping of the Researchers' Recreational Facility & Community Centre at the Nuclear Technology Centre (NTC), Sheda, FCT (2019).

- **Health Centre and Researchers Clinic at NTC, Sheda, FCT**

Figure 7: Health Centre and Researchers Clinic at NTC, Sheda, FCT

- **Perimeter Fencing of the Researchers' Hostel and Conference Centre (RHCC) Nuclear Technology Centre (NTC), Sheda, FCT**

Figure 8(a): The Researchers' Hostel and Conference Centre (RHCC), NTC, Sheda, FCT, by 2018

Figure 8(b), 2019.

Figure 8(c), 2019.

Figure 8(b) & (c): Perimeter Fencing of the Researchers' Hostel and Conference Centre (RHCC), Nuclear Technology Centre (NTC), Sheda, FCT.

(B) HUMAN RESOURCES AND CAPACITY DEVELOPMENT (HRCD) PROGRAMME

The successful and sustainable implementation of the national nuclear energy programmes requires a pool of indigenous qualified and highly skilled workforce. This requisite workforce would be needed throughout the life cycle of nuclear facilities i.e from the design, construction, through to the decommissioning stage. In line with the Commission's mandate and policy objectives, the nuclear HRCD programme aim at ensuring the continuous ***availability of adequate pool of trained indigenous professionals*** in the various fields of the nuclear industry. Hence, NAEC in collaboration with National University Commission (NUC) and other stakeholders in the education sector has developed and introduced requisite curricula for nuclear science and nuclear engineering for adoption by institutions of higher learning. Already, a pilot Master's degree programme in Nuclear Science and Nuclear Engineering has been implemented, within a framework of cooperation between NAEC and 4 participating national universities, and with the support of IAEA, which has graduated the pioneer set of 26 students. The 4 partnering universities are Obafemi Awolowo University (OAU),

Ahmadu Bello University (ABU), University of Maiduguri (Unimaid) and University of Port-Harcourt (Uniport).

Furthermore, within the framework of bilateral and multilateral cooperation with the international community, the Commission has continued to implement various programmes for ***education and training of indigenous nuclear professionals*** in other countries such as USA, Italy, Germany, Austria, Russia, China, South Korea, Ghana, Egypt and South Africa.

In addition, NAEC, the national liaison to the IAEA, has facilitated the IAEA assistance for the required human capacity building of many relevant national organizations from various sectors such as Health, Water Resources, Agriculture, Security, Emergency Management and Power, in enhancing their capabilities and functionalities in relation to the national nuclear energy programmes through both onshore and offshore trainings, fellowships, internships, conferences and workshops as well as through the acquisition, utilization and maintenance of requisite nuclear technology equipment and facilities.

In general, the Nuclear HRCD programme is a near and long term catalyst for the attainment of the Federal Government key policy objectives especially in the areas of National Security, Anti-corruption and Diversification of the Economy. Some recent developments include:

(i) Job Creation/Poverty Alleviation

Through government's approval, 56 young indigenous nuclear scientists, engineers, technologists, technicians, accountants, economists and lawyers have been employed (2017) and have undergone an intensive bridging programme to gain nuclear competence at the Researchers' Hostel and Conference Centre, Nuclear Technology Centre (NTC), Sheda, FCT.

Figure 9: Orientation (Nuclearization) programme for new employees of NAEC held at the Researchers' Hostel and Conference Centre, Nuclear Technology Centre, Sheda, FCT (2017).

This is in addition to earlier employed and trained indigenous nuclear personnel in order to meet the requisite critical mass for the construction and operation of nuclear power plants and for other nuclear facilities.

(ii) Staff Career Development of NAEC

In line with the provisions of the Public Service Rules of the Federal Government, NAEC has continued to encourage staff career development across the various professional cadres so as to achieve continuous and sustained improvement in staff productivity. In this regard, the Commission has provided enabling environment for all staff to embark on higher courses of learning relevant to their official assignments in various national and international institutions in line with the Commission's Human Resources Development Plan. Currently, over 50 staff have successfully completed various higher academic and professional programmes.

(iii) Drafting of HRD Plan for Nigeria's Nuclear Energy Programmes

NAEC has concluded the draft of the Human Resources Development Plan for Nigeria's Nuclear Energy Programmes with the use of IAEA Workforce Planning and Human Resource Modelling Software. The document will be sent to the IAEA for their comments in line with international best practices.

(iv.) MoU on HRCD with CZEC, CHINA

Sequel to CNNC-CZEC's expression of strong interest and willingness to collaborate with Nigeria in various aspects of the Nigerian Nuclear Energy Programmes (NNEP), an MoU has been signed on various aspects of nuclear energy and discussions are on-going for cost-free training programmes for indigenous Nigerian nuclear personnel and for local industrial participation in the construction of nuclear facilities.

Figure 10: Technical meeting between Nigeria' delegate led by Late Professor S.P. Mallam, former Chairman/CEO, NAEC, and CNNC China Zhongyuan Engineering Corp.(CZEC) led by Wang Ying, Vice President of CZEC (May 2018)

(iv) Nuclear Education and Training Activities

- **International Cooperation on MSc & PhD programmes**

As aforementioned, the Commission has continued to maintain bilateral and multilateral cooperation with the international community for the education and training of nuclear

professionals in other countries such as USA, Italy, Germany, Austria, Russia, China, South Korea, Ghana, Egypt and South Africa. Some of the statistics include:

About 44 indigenous personnel have graduated with Masters Degrees in Nuclear Science (NS) and Nuclear Engineering (NE), while, there are about 50 others who are currently undergoing graduate programmes (MSc & PhD) outside the country (through AFRA Fellowship, IAEA Fellowship, partnerships with China, South Korea, Japan and the Russian Federation. These will constitute the trainers of future workforce.

- **IAEA Short Training Programmes, Workshops, Conferences, Expert Missions, Technical Meetings, Scientific Visits and Fellowships**

Various national and international training programmes have been conducted in collaboration with the IAEA for staff of NAEC through workshops, conferences, expert missions, technical meetings, scientific visits and fellowships. A typical example related to the Human Resources and Capacity Development, is the "Technical Meeting on Workforce Planning and Human Resources Modelling for Countries with Expanding or New Nuclear Power Programmes".

Furthermore, Staff of NAEC have been trained in the annual IAEA/ICTP Nuclear Energy Leadership Programme and Nuclear Knowledge Management Programme which promise a crop of future capable leaders in the nuclear sector having same focus.

Figure 11: Group Scientific Visit for an International Nuclear Executive Leadership Seminar, Texas, USA, 2019.

- **Post-graduate Diplomas (PGD) in Radiation Protection**

Staff of NAEC with speciality in the field of Radiation Protection attend the School of Nuclear and Allied Sciences, Ghana, for Post-graduate Diploma Programmes in Radiation Protection.

- **NAEC's HRCD Activities as National Liaison to IAEA**

NAEC being the national liaison to the IAEA, has aided many national organizations in various sectors such as Health, Water Resources, Agriculture & Food, Security, National Emergency and the Academia, in enhancing their capabilities in the use of nuclear technology and related state-of-the-art techniques for the accomplishment of their various pertinent applications through IAEA short training programmes, workshops, fellowships as may be contained in their respective Technical Cooperation (TC) framework with the IAEA.

- **Training of National Stakeholders**

All the relevant national stakeholder organizations of NAEC such as the Federal Ministry of Information (FMI), National Emergency Management Agency (NEMA) etc., have desk officers who represent their respective organizations in NAEC activities. Some of these officers have undergone relevant IAEA training programmes which enhance their appreciation and capabilities in their respective roles in the nuclear energy programme.

(C) NUCLEAR RESEARCH AND INFRASTRUCTURE DEVELOPMENT (RID) PROGRAMME

Research, innovation and development programmes are essential elements for the sustainability of the national nuclear energy programmes. ***This is particularly important considering government's plans for technology acquisition and domestication as a means of diversification of the economy***. Seven National Nuclear Institutes (NNIs) are under the supervision of NAEC and serve as the kernel of its manpower development activities spread across six geopolitical zones and the Federal capital. Five of these Centres are university-based while one is an affiliate of a university and the other, a Marine Contamination Coastal Field Monitoring Station.

The centres are:

i. Centre for Energy Research and Development (CERD), OAU, Ile-Ife
ii. Centre for Energy Research and Training (CERT), ABU, Zaria
iii. Nuclear Technology Centre (NTC), Sheda, FCT, affiliated to University of Abuja.
iv. Centre for Nuclear Energy Studies (CNES), UniPort, Port Harcourt.
v. Centre for Nuclear Energy Research and Training (CNERT), UniMaid, Maiduguri
vi. Centre for Nuclear Energy Studies and Training (CNEST), FUT, Owerri.
vii. FGN-IAEA Marine Contamination Coastal Field Monitoring Station (MCCFMS), Koluama II.

The strategic locations of these NNIs would enable them meet their specific mandates in line with the national objectives and enhance the performance of their general functions/provision of services. Their functions are broadly outlined as:

i. Provision of facilities for research, education and training at all levels – undergraduate & graduate in all areas of peaceful, safe and secure uses of nuclear technology;
ii. Development of nuclear instruments, electronics and all associated nuclear devices for peaceful uses;
iii. Provision of routine radiation monitoring services;
iv. Co-operation with relevant stakeholders in R&D; organizing courses, conferences, workshops and seminars; and
v. Linkages with international institutions/agencies like Argonne National Laboratory (ANL), Korean Institute of Nuclear Science (KINS), IAEA, etc.

(I) Intervention in other Sectors of the Economy

The facilities and human capital domiciled in the NERCs are being deployed to harness the opportunities available in the various sectors of the economy which is in line with the government priority policy objectives. The possible services being rendered to the various sectors include:

a) **Academia:**
` Education, Training and Research which enhancing job creation/poverty alleviation

b) **Human Health & Medicine:**
Diagnosis, Therapy, Sterilization and Radioisotope production

c) **Oil & Gas industries:**
Industrial Tracers, Neutron Radiography and Well logging

d) **Mining & Exploration:**
Environmental Tracers, Instruments, Dating and Mineral beneficiation

e) **Food & Agriculture:**
Fertilizers, Increase Genetic Variability, Food Preservation, Pest Control and Food safety which enhances food security

f) **Water Resources:**
Isotope Hydrology

g) **National Security**
Design and construction of IED's detection devices

(II) Progress on the Construction and Completion of Outstanding Physical Infrastructure for HRCD

Funds recently released by FG have enabled the resumption of construction work as well as the completion of various nuclear infrastructures across NAEC Research Centres. These have the impact of enhancing the activities of the Centres in meeting with the priority objectives of government as well as creating employment for Nigerians across the country. Some of the construction advances achieved in the Centres due to government support and leadership guide include:

(a)

(

b)

Figure 12 (a): Nuclear Science and Engineering Laboratory at the Centre for Nuclear Energy Studies and Training (CNEST), Federal University of Technology, Oweri (2015)
(b) Resumption of construction work by 2018.

Centre for Nuclear Energy Studies (CNES)
University of Port Harcourt, Port-Harcourt

Figure 13(a)

Figure 13(b)

Figure 13 (c)

Figure 13 (d)

Figures 13 (a) – (d): Construction completion - Graduate Researchers' Hostel, Centre for Nuclear Energy Studies (CNES), University of Port Harcourt, Port-Harcourt (2018)

Figures 13 (e): Completion of construction, furnishing, landscaping and provision of water reservoir, RHCC, CNES & Construction of road and drainage network, 2019.

Figure 14: Nuclear Thermal Hydraulic Laboratory at the Centre for Nuclear Energy Studies (CNES), UPH, Port-Harcourt.(2015)

Figure 15(a)

15(b)

Figure 15 (c)

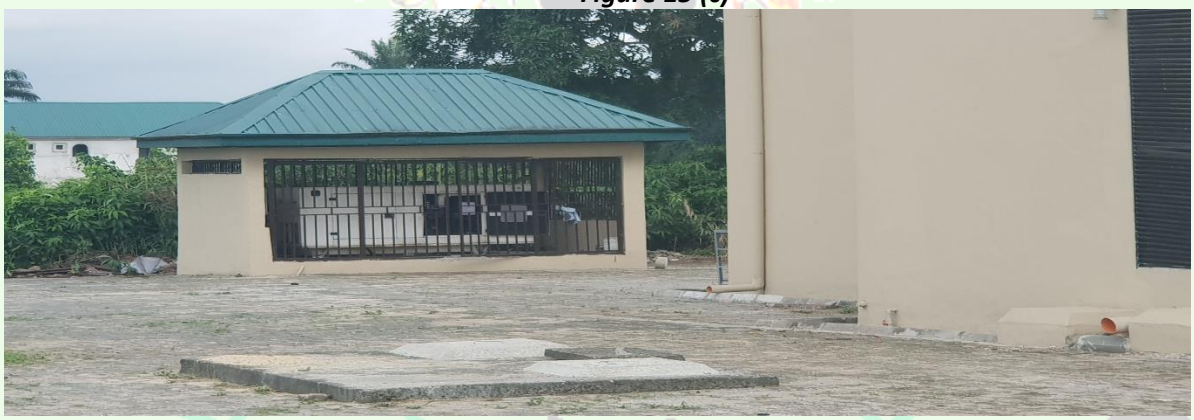

Figure 15 (d)

Figure 15 (a) Nuclear Science and Engineering Laboratory Complex, Centre for Nuclear Energy Studies (CNES), UPH, Port-Harcourt (2015).
Figures 15(b), (c) (d) Laboratory complex completed and furnished (2018)

Centre for Energy Research and Training (CERT)
Ahmadu Bello University, Zaria

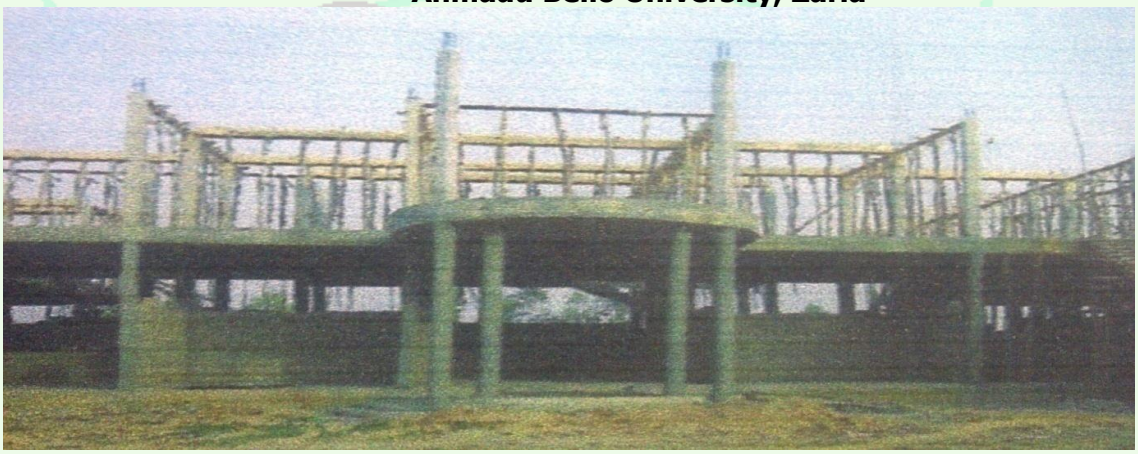

Figure 16 (a)

Figure 16 (b)

Figure 16(c)

Figure 16: (a) Neutronics, Health Physics and Dosimetry Laboratory at the Centre for Energy Research and Training (CERT), Ahmadu Bello University, Zaria (2015).
Figures (b) and (c) Resumption of construction work (2018)

Figure 17 (a)

Figure 17 (b)

Figure 17 :(a) Graduate Researchers Hostel under Construction at the Centre for Energy Research and Training (CERT), Ahmadu Bello University, Zaria (2015).
Figure 17 (b) Resumption of work (2018)

(a)

(b)

Figure 18 (a), (b) Construction of key facilities at CERT, Zaria, 2019.

Centre for Nuclear Energy Research and Training (CNERT)
University of Maiduguri, Maiduguri

(a) ***(b)***

Figure 18(a): Nuclear Science and Engineering Laboratory at the Centre for Nuclear Energy Research and Training (CNERT), University of Maiduguri (2015)

Figure 18: (b) Construction stage at the Graduate Researchers Hostel site, Centre for Nuclear Energy Research and Training (CNERT), University of Maiduguri, Maiduguri (2015)

(a) *(b)*

Figure 19 (a) & (b): Resumption of construction work at the Graduate Researchers Hostel site, Centre for Nuclear Energy Research and Training (CNERT), University of Maiduguri, Maiduguri (2018)

Centre for Energy Research and Development (CERD)
OAU, Ile-Ife,

(a)

(b)

Figures 20(a): Construction of Research & services building, CERD, Ile-Ife (b) Fire fighting vehicle for CERD, 2019.

(D) NUCLEAR TECHNOLOGY APPLICATIONS PROGRAMME

Being a Member State of IAEA, Nigeria has been benefiting from the IAEA Technical Cooperation (TC) Projects. These TC projects which are in general short and medium terms, cover the application of nuclear technology in the various sectors such as Health, Water Resources, Agriculture, Security, Emergency Management and Power. The scope of the TC projects includes training of indigenous personnel and acquisition/utilization of specialized nuclear technology facilities for the benefit of the local community and the nation. The implementation of these TC projects has in various ways aligned with the Federal Government key policy objectives especially in National Security, Anti-corruption and Diversification of the economy by the adoption of 3S (i.e safety, security and safeguards) cultures and operational transparencies in its requirements

Apart from some of the research equipment located at the NNIs other equipment under the framework of the IAEA TC Projects in various government Agencies include:

- Linear Accelerator (LINAC) and CT-SCAN at the University College Hospital (UCH) Ibadan
- Mass Spectrometer utilized by Nigerian Hydrological Services Agency (NIHSA)
- Capacity Building Equipment for IMS/IDC data access, analysis and archiving, utilized by CTBTO, NAEC
- Ebola Diagnostic Tool utilized by Nigerian Centre for Disease Control, Federal Ministry of Health

Currently, over 30 IAEA TC projects which have direct bearing to government priority policy objectives across different sector of the economy such as, human health, food and agriculture, environment management, mineral exploration and exploitation, industry and scientific applications among others, are being coordinated by NAEC.

Construction Resumption/Completion of Some Enabling Physical Infrastructure

(i) The Gamma Irradiation Facility

Figure 20(a): Gamma Irradiation Facility (GIF) Product Warehouse at the Nuclear Technology Centre (NTC), Sheda, FCT

Figure 20(b): Gamma Irradiation Facility (GIF) Product Warehouse at the Nuclear Technology Centre (NTC), Sheda, FCT, 2019.

(ii)Marine Contamination & Coastal Pollution Monitoring

Figure 21: Physical and Research Infrastructure under construction at the FGN-IAEA Marine Contamination Coastal Field Monitoring Station, Koluama (2015)

Figure 22(a)

Figure 22(b)

Figure 22(c)

Figure 22(d)

Figure 22 (a)-(d): Construction completion of the Physical and Research Infrastructure at the FGN-IAEA Marine Contamination Coastal Field Monitoring Station, Koluama (2019)

Cooperation with Private Sector in Nuclear Technology Applications

Figure 23: Meeting of the forme NAEC Chairman/CEO, Late Professor S.P. Mallam with Her Excellency, Dr.(Mrs) Zainab Bagudu, wife of the governor of Kebbi State and Founder Medicaid Cancer Foundation, on cooperation in nuclear medicine (May 2018)

(E) Other Activities in Line with Government's Priority Policy Objectives

Security

NAEC has recorded some successes in the short- & medium-term in contributing to the nation's security and has in its strategic plan, future plans to further enhance the nation's security, these are broadly categorized as follows:

- **Development of Improvised Explosive Devices (IED) detectors:** the Centre for Energy Research and Training (CERT), Zaria, is partnering with the Defence Head Quarters to design and develop IED detectors, this will help in curbing internal insecurity challenges experienced in parts of the country.
- **Member of National Security Committee:** Due to the safety, security and safeguards priority placed in the activities of the nuclear sector, NAEC is a member of the National Security Committee (NSC) under the Office of the National Security Adviser (ONSA). In addition, a Local Security Committee has been constituted in NAEC.
- **Establishment of African Regional Training Centre for Nuclear Security:** Given the imperative of Nuclear Security to nuclear power programme implementation, Nigeria has been given the hosting right by the IAEA for the Regional Nuclear Security School on annual basis.
- **CTBTO:** Also in the area of security, NAEC, is a signatory to the Comprehensive Test Ban Treaty Organization (CTBTO) whose aim is to monitor nuclear or any heavy explosion globally. It therefore serves as an early warning mechanism for Nigeria and neighbouring countries.
- **MoU with Nigerian Armed Forces:** Due to the present security realities in the country, NAEC has agreed to enter into MoUs with the Nigerian Navy and the Military in the usage of some of its nuclear facilities as naval and military bases.

War Against Corruption

- **Compliance with Zero-Based Budget (ZBB) Concept of FGN:** NAEC instituted an in-house special committee to study and implement its annual budgets in compliance with the Zero-Based Budget as directed by the Federal Government of Nigeria. This is in support of the government's policy to check on excesses and corruption.
- **Involvement of External Auditors:** In compliance with the FG's policies, the Commission continuously engages the services of external auditors to audit its accounts/financial dynamics.
- **In-house Staff Training on Safety, Security and Anti-Corruption Practices:** Recently, in-house staff training programmes via workshops, seminars and meetings are being organized so as to engender safety and security culture which are fundamental elements for the sustainability of the nuclear energy programmes and for the promotion of government's policy on National Security and Anti-corruption in Public Service sector. Notable in-house staff training and orientation programmes include: Security Training by DSS on security and physical protection awareness of government's installations and Awareness Seminar on Residential security, Personal Protection and nuclear security culture. Moreover, for effectiveness of the implementation of government's policies, the Commission has established a special committee on

government concept of "Do the Right Thing". Members of this committee have completed a training programme organized by the National Orientation Agency (NOA) and have conducted various workshops/programmes that encourage "Do-It-Right" attitude amongst staff for improved productivity, accountability and transparency in line with government's anti-corruption campaign.

- **Monitoring and Evaluation (M&E) Activities**
  In promotion of government's anti-corruption drive, NAEC has an M&E unit which report directly to the Chairman/CEO. Members of this unit have undergone various workshops organized by the Federal Government of Nigeria via the National Planning Commission (NPC) to ensure their efficiency and effectiveness. In conclusion of their activities, the M&E unit designs the Performance Agreement with respect to specific Key Performance Indicator (KPI) and produces the Performance Reports, Annual Progress Report and the M&E Scorecard.

IV OUTSTANDING ACTIVITIES

The programmes/activities of the nuclear energy sector are generally implemented and sustained over a long period. The nuclear power technology, for example, is sometimes described as a 100-year technology. Since the successful conduct of the IAEA Integrated Nuclear Infrastructure Review (INIR) mission, 2015, Nigeria is currently implementing the Integrated Work Plan (IWP) for nuclear power which was developed with the assistance of the IAEA, in order to realize the recommendations as contained in the INIR Mission report. This would enhance the commencement of the construction phase of Nigeria's nuclear power programme. The implementation of the IWP will cover all the elements of the 19 nuclear infrastructure issues and therefore lead to enhancement of the necessary nuclear infrastructure. Furthermore, it is very important to note that in order to determine the ownership structure and financing model of the nuclear power project, a pre-feasibility and feasibility studies must be carried out by Nigeria. Moreover, the pre-feasibility and feasibility studies are also to be carried out for the multipurpose research reactor project. Other outstanding activities include the payment of counterpart funding & other mandatory contribution to the IAEA (which would enable Nigeria implement her Country Programme Framework via Technical cooperation projects) as well as implementing the ERGP Implementation Plan (2017-2020).

V CHALLENGES OF PECULIAR NATURE

The Federal Government has continued to demonstrate its sustained commitment to the implementation of the national nuclear energy programmes within the operational mandates of the Nigeria Atomic Energy Commission via clear and transparent enhanced support. However, the nuclear energy sector is quite unique requiring long period of systematic broad-based planning for the safe operations of its facilities aligning with global best practices. Hence some of the immediate challenges facing this sector include:

(i) Retention of trained young indigenous professionals;
(ii) Funding of pre-feasibility- and feasibility studies for the nuclear power and multi-purpose research reactor projects;

(iii) Continued payment of counterpart funding of technical projects and national obligations to CTBTO and other international organizations;
(iv) The annual budgetary ceiling is grossly inadequate for meaningful progress in implementation of the national nuclear energy programmes. In general, the funding and financing requirements characteristically very high;
(v) The Build-Own-Operate-Transfer (BOOT) financing model which was approved by the FGN for the nuclear power project is not quite acceptable to all foreign technology collaborators.

VI GOING FORWARD

It is recommended that:

(i) The report of the presidential committee on the "Conditions of Service for the Nuclear Sector" be presented to Mr. President for his consideration and possible approval.
(ii) Funding of pre-feasibility- and feasibility studies for the nuclear power and multi-purpose research reactor projects be done via extra-budgetary allocations.
(iii) There is the need for FGN to revisit the financing options for the nuclear power project so as to have a clear government decision/direction.

VII CONCLUSION

The current overarching objectives of the Federal Government of Nigeria (FGN) are towards National Security, Anti-corruption, Job creation and Diversification of the Economy. In the light of these, several key developmental activities, initiatives, and projects have been established, coordinated and maintained across the nuclear sphere in strong support and reinforcement of government's policy direction. Hence, activities of the various National Nuclear Energy Programmes are being meticulously implemented that would lead to the deployment of nuclear power plants (NPPs) for steady and sustainable base-load electricity generation in the country as well as creating the enabling environment for significant socio-economic growth of the country. Apart from increasing electricity generation base of the country, the positive impact of NPP would also significantly address the current imbalance in the energy mix thereby ensuring energy security as well as diversification of the economy. In addition, activities in nuclear energy R&D and technology applications in medicine, human health, water resources, agriculture and other applied industries are areas which have direct and immediate impact on national economy.

Without gainsaying, the nuclear industry will continue to generate huge employment and investment opportunities for the country which would significantly strengthen the primacy policies of the FGN. Concomitantly, many key priority programmes and projects have been initiated for nuclear infrastructure and human capital development for the nuclear industry.

The preceding sections above contain a concise brief of the activities, initiatives and projects of the Commission in line with the current overarching objectives of the Federal Government of Nigeria (FGN) towards National Security, Anti-corruption and Diversification of the Economy from 2015.