REPORT OF PROF. SUNDAY SUNDAY IKIENSIKIMAMA,

THE CHAIR OCCUPANT SHELL-JV ARET ADAM PROFESSORIAL CHAIR IN PETROLEUM ENGINEERING, UNIVERSITY OF PORT HARCOURT, CHOBA, RIVERS STATE, NIGERIA.

ON

THE WORK PLAN AND ACTIVITIES OF THE CHAIR FOR THE YEAR 2022

TO

STAKEHOLDERS OF THE SHELL-JV ARET ADAMS PROFESSORIAL CHAIR IN PETROLEUM ENGINEERING

EXECUTIVE SUMMARY

This report outlines some of the activities that the Shell Aret Adams professorial Chair occupant in petroleum Engineering participated in from September to December 2021and beyond. Other notable things are the list of projects under supervision and students under mentorship at the post graduates and undergraduate levels. The different teaching engagements of the chair is also emphasized as well as webinars and meetings attended within and outside the university of Port Harcourt. Other deliverables such as publications are also part of the report. The report also incorporates various research areas and the projects under them along sides the timelines for the various projects under the different research focus. Also of importance are the activities such as quiz competition, technical paper contest and workshop that will bring together students, lecturers and the academia as well as the stakeholders. These activities will aid in equipping students with knowledge of the Oil and Gas Industry in the area of software application, assist students in their academics and also give visibility to the Chair.

REPORT OUTLINE FOR PROFESSORIAL CHAIR WORKPLAN FOR 2022

LIST OF TABLES AND APPENDICES

1.0 INTRODUCTION

The Chair since its inauguration has been able to run smoothly after the initial hassles. The chair submitted its initial workplan for 2021 last year August 2021.The Chair has contributed to human capacity development and mentorship in the Department of Petroleum and Gas Engineering through energy driven and innovative research in University of Port Harcourt and will continue to do so. The Chair also looks forward to assisting good students and also collaborate with other research on quality research as well as engage in quality research as a way to moving the Chair forward.

2.0. MISSION, VISION AND CORE VALUES

. The chair has its mission, vision and core values.

MISSION: To meet the Research & Development (R & D) needs of the Oil and Gas Industry

VISION: Harnessing Available Human Capital Potentials through Quality Research, Innovation and Collaboration

CORE VALUES: DICT (Pillars for the Vision and Mission)

Diligence, Integrity, Commitment and Teamwork

3.0. RESEARCH FOCUS FOR THE CHAIR

With the Oil and Gas production going offshore, flow assurance issues (hydrates, scales, wax, asphaltenes, corrosion etc.) have become dominant so one of the areas of research focus for the chair will be to handle production and flow assurance issues in oil and gas production and developing database for green inhibitors. Focus will also include big data, artificial intelligence and their application to oil and gas problems, reservoir modelling and simulation studies, gas processing, utilization and monetization, CO_2 sequestration for greener environment for oil and gas production, Petroleum Economics and Risk Management in Petroleum Ventures, Petroleum and Environment as well as Enhanced Oil Recovery (EOR) as well as Pressure, Volume and Temperature (PVT) studies.

4.0. WORK PLAN AND THE ACTIVITIES OF THE CHAIR FOR THE YEAR 2022

The workplan is intended to highlight the Chair's activities for the later part of September 2021 and January – 1st week of March, 2022. The activities the Chair will be engaged in going forward are enumerated below. some of the take-off activities of the Chair are enumerated in the following subsections.

4.1. Running of Flow Assurance Laboratory: The flow Assurance laboratory especially for hydrate studies has been in use both by internal and external students. Table 1 and 2 shows list of students that have used the laboratory and their research topics. At present a locally fabricated flow loop (2016/2017) is being used for gas hydrate studies. This was upgraded to include an industrial cooling unit, a nitrogen gas port for flushing and a visual camera (2019/2020). This still needs upscaling to include more inspection cameras, use of transparent pipes, if possible, full automation for ease of data collection as well as a cumulative gas flow meter to measure volume of gas used up as the experiment proceeds.

Table 1: **Names of External students and Research Topics**

S/No	**Names of Students**	**Title of Research Work/Project**	**School/Faculty/Department**	**Date/Duration of Experiment**
1	Orisamika Benjamin Oluwaseyi Ph. D Student	Performance Evaluation of Selected Bio-chemicals for Gas Hydrate Inhibition	Department of Petroleum Engineering, Faculty of Technology, University of ibadan, Oyo State, Nigeria	12th -27th April 2021 16 days
2	Asikoko Freedom Masters Student	The Use of Cassava Leaf Extract as Gas Hydrate Inhibitor	Department of Petroleum and Gas Engineering Faculty of Engineering, Federal University of Petroleum Resources (FUPRE) Effurun, Delta State, Nigeria	18th-20th October, 2021 3 Days
3	Ndoma-Egba Stanley Masters Student	Laboratory Evaluation of Moringa Oleifera as Natural Gas Hydrate Inhibitor using a Hydrate Flow Loop	Department of Petroleum and Gas Engineering Faculty of Engineering, Federal University of Petroleum Resources (FUPRE) Effurun, Delta State, Nigeria	21st- 23rd October 2021 3 days

Table 2: Names of Internal Students and Research Topics

S/No	**Names of Students**	**Title of Research Work/Project**	**School**	**Date/Duration of Experiment**
1	Odatuwa Toju Masters Student	Experimental Investigation of Local Hydrate Inhibitor	Department of Petroleum and Gas Engineering, Faculty of Engineering, University of Port Harcourt, Rivers State, Nigeria	10th -17th June 2021 7 days
2	Madueke Stanley Masters Student	Enhancing Hydrate Inhibition using Deep Eutectic Solvent and Synergistic Compound	Department of Petroleum and Gas Engineering, Faculty of Engineering, University of Port Harcourt, Rivers State, Nigeria	19th-24th July, 2021 6 Days
3	Isaiah Samuel Masters Students	Effect of Corrosion Inhibitors on Ga Hydrate Formation	Department of Petroleum and Gas Engineering, Faculty of Engineering, University of Port Harcourt, Rivers State, Nigeria	21st-26th June 2021 6 days

4.1.1. Partnership For Skills in Applied Sciences, Engineering and Technology Regional Scholarship and Innovation Fund (PASET-RSIF) Programs Attended

As part of the responsibility of the Chair to the department as stated in the deed which is to assist the Department by promoting and advancing her both in academics, research and development, the Chair also assists the Department to coordinate and manage regional and international student of Petroleum Engineering background sent to us by ICIPE (the regional coordinating unit for PASET) through a Grant Award as African host University (AHU)

4.1.1.1. Webinars/Workshops Attendance

participation in the PASET-RSIF Capacity Building Activities, August 2021- 12th RSIF Student Seminar Series Webinar held on 4th August, 2021.

participation in the PASET-RSIF Capacity Building Activities, August 2021- Guest Webinar held on 25th August, 2021.

participation in the PASET-RSIF Training Workshop: Information Literacy and Reference Management held on Wednesday 18th - Friday 20th August, 2021.

participation in the PASET-RSIF Capacity Building Activities, August 2021- 13th RSIF Student Seminar Series Webinar held on 1st September, 2021.

participation in the PASET-RSIF Capacity Building Activities, September 2021-RSIF International Partner Institution, IPI Presentation for scholars held on 17th September, 2021.

participation in the PASET-RSIF Capacity Building Activities, September 2021-Monitoring and Evaluation Training Workshop for scholars held on 23rd-24th September, 2021.

participation in the PASET-RSIF Capacity Building Activities, September 2021- 16th RSIF Guest Webinar series held on 29th September, 2021.

participation in the PASET-RSIF Capacity Building Activities, October 2021- 14th RSIF Student Seminar Series Webinar held on 6th October, 2021.

participation in the PASET-RSIF Venture Capital Funding Opportunities in Africa held on 3rd November, 2021.

participation in the PASET-RSIF International Partners Institutions (IPIs) and African Host Universities (AHUs) held on Monday 15th November, 2021.

participation in the PASET-RSIF Pre-Conference on Building Capacity for Science, Technology and Innovation (STI) in Africa held on Monday 15th November, 2021.

participation in the PASET-RSIF Pre-Conference, Online held on 16-17th November, 2021.

for participation in the PASET-RSIF Info Webinar-Grant Writing-Erasmus+ 2022 Capacity Building in Higher Education held on the 8th of December, 2021.

participation in the PASET-RSIF Capacity Building Activities, January 2022- 20th RSIF Guest Webinar held on 28th January, 2022.

participation in the PASET-RSIF Capacity Building Activities, February 2022- 18th RSIF Student Seminar Series held on 2nd February, 2022.

4.1.1.2. OTHER PASET-RSIF ACTIVITIES

participation in the PASET-RSIF Cohort IV Students Admission Selection process held on the 15th December, 2021

participation in the PASET-RSIF: IEC Meeting for Cohort 4 application reviews webinar held 25th January, 2022.

4.1.2. Chaired Departmental graduate board for Ph.D. and Master seminars as follows:

- November 2nd 2021, Post graduate students presentation at the department conference room by 10:00am
- December 3rd 2021, Post graduate students proposal presentation at the department conference room by 10:00am
- December 21st 2021, Post graduate students presentation interview at the department conference room by 10:00am

4.1.3. Other Presentations Chaired and Attended

- 27th October 2021: Pre-proposal presentation for Gap analysis/Literature for PASET Ph.D. Scholar-Mr. Itai Matadza
- 3rd November 2021: Pre-proposal presentation for Gap analysis/Literature for PASET Ph.D. Scholar-Mrs. Fawziyah Olarinoye
- 9th November 2021:2nd Pre-proposal presentation for Gap analysis/Literature for PASET Ph.D. Scholar- Mrs. Fawziyah Olarinoye
- 23rd November 2021: 3rd Pre-proposal presentation for Gap analysis/Literature for PASET Ph.D. Scholar- Mrs. Fawziyah Olarinoye
- 26th November 2021 webinar on Energy Generation (Renewable & Non-Renewable Use and Environmental Impact (Carbon Capture research) on how to access funding from Gas Flare Research Funding (GCFR) body with Prof. Chike Oduoza from University of Wolvahursten, UK
- 10th December 2021: Field Development Plan (FDP) seminar for PGD students at Institute of Petroleum Studies (IPS), University of Port Harcourt.
- 12th December 2021: Field Development Plan (FDP) seminar for Masters students at Institute of Petroleum Studies (IPS), University of Port Harcourt.
- 22nd February 2022: Proposal presentations for PASET Ph. D. Scholars Mr. Itai Matadza, Mrs. Fawziyah Olarinoye and Gap Analysis presentation for Mr. Humphrey Harry. Proposal defense for two Masters Students Mr. Otega Solomon Ogenerhwo and Babawale Ojedapo
- 23rd February 2022: Gap Analysis presentation for PASET Ph.D. scholars Mr. Okon Efiong Okon and Mrs. Tosin Samuel-Idara

4.1.4: **Lectures held with Different Sets of Students Within University of Port Harcourt**

- ✓ Lectures with PGD students on Petroleum Economics at Institute of Petroleum Studies (IPS) held on 27th September- 1st October 2021
- ✓ Lectures with Ph.D. students on Risk Analysis at World Bank Africa Centre of Excellence, Centre for Oilfield Chemicals Research (ACE-CEFOR) on 9th December 2021

4.1.5. Examination conducted for Students

- Online external examination for students from University of Mines and Technology, Tarkwa, Ghana on 30th September 2021

4.1.6. **Courses Taught and handled for Undergraduates, Masters and PG Students**

- PNG 302.1 Rock and Fluid Properties
- ENG 402.1 Engineering Economics
- PNG 403.1 Natural Gas Engineering
- GNG 505.1 Petrochemical processes
- PNG 307.2 Fundamentals of Petroleum Engineering
- GES 400.2 Entrepreneurship
- ENG 400.2 Industrial Training II
- PNG 507.2 Petroleum Economics and Property Evaluation
- PNG 508.2 Natural Gas Processing
- PNG 520.2 Final Year Project
- o PNG 802.1 Advanced Natural Gas Engineering
- o PNG 805.1 Advanced Evaluation of Oil and Gas Properties
- o PNG 811.2 Risk Analysis in Petroleum Ventures
- o PNG 812.2 Liquified Natural Gas (LNG) Processing
- o DPE 780.2 Petroleum Economics and Property Evaluation

4.1.7. Meetings Attended Within the University of Port Harcourt

- ➢ Senate Committee on Academic Policies and Programs (SCAPP) Meetings in the University.
  - ✓ November 17th 2021

4.1.8. Conference Attendance

- Attendance of International Association of Research Scholars & Administrators (IARSA)-SPDEG 2021 Conference held on the 10th -11th November 2021 at the Emerald Energy Institute (EEI), University of Port Harcourt.

4.1.9. Mentorship and Supervision of Undergraduate and Post Graduate Students.

As part of supporting the department in the area of human capacity development and mentorship, the Chair took up more mentees and project supervision. Some of these projects and area of research focus and time lines are shown in Tables 3 and 4. List of some postgraduate students working on the various research areas and project titles are shown in Appendix. Students just assigned for supervision can be found in Appendix 2 and 3.

Table 3: Research Focus and on-Going Projects

S/No.	Research Area/Focus	Project Titles
1	Flow Assurance Issues	A Comparative Analysis between Annular Friction Model. Economic Analysis of Artificial Lift System using Gas Lift and Electric Submersible Pump Geo-mechanical Method for Sand Production Management using Kirsh Model in Oil and Gas Well Comparative Analysis of different Artificial Lift Methods using Simply Arithmetic Weighing (SAW) Model Assessment of Gravel Packing Methods used in the Petroleum Industry.
2	Big Data, Artificial Intelligence and its Application to Oil and Gas	Forecasting of Petroleum Production using Data Driven method (Machine Learning) Application of Artificial Intelligence in the Economic Analysis of Petroleum Ventures
3	Reservoir Modelling and Simulation Studies	Application of Geo-mechanical Properties to Reservoir Evaluation Integrated Approach for Source Rocks Characterization of Niger Delta Basin, Nigeria

		Seismic Based Artificial Intelligence and Simulation for improved Reservoir Description in a Niger Delta Field Development of a Fingerprint Model to Classify Niger Delta Reservoirs Using OPEC's Auditing Criteria Permeability Modelling Using Core and Well Log Data in the 'XX Field' of Coastal Swamp Depo-bed in the Niger Delta Basin
4	Gas Processing, Utilization and Monetization	Development of Efficient Infrastructure and Interconnecting Network for Gas Pipelines. Reduction of Transmission and Distribution Losses through Efficient Leak Detection and Monitoring (Case Study: Obite-Bonny Gas Pipeline Network) Evaluation of Development and Economic Options for Stranded Gas Gas Conversion and Utilization Strategies for Economic and Environmental Benefits
5	Petroleum Economics and Risk Ventures	Metaheuristic Intelligent Systems for Ranking International Fiscal Regimes A Stochastic Approach to Cost Estimation and Economic Evaluation of Oil Well in the Niger Delta Techno-Economic Analysis of Floating Gas to Power (FGTP) for Stranded Gas -Offshore Nigeria Economic Impact of Policies and Infrastructures on Gas Utilization Systems in Nigeria. The Economics of Floating Gas to Liquid Technology Economic Analysis of Gas to Power in Nigeria Impact of Transition to renewable energy on Nigeria's Economic Growth

6	Petroleum and Environment	Production of Biofuels from Lignocellulosic Biomass Resources
7	Enhanced Oil Recovery	Evaluation of Surfactant to Improve Sweep Efficiency of an Oilfield in Niger Delta A New Approach of Controlling the Activities of Sulphate - Reducing Bacteria (SRB) in the Reservoir During Water Injection. Applicability of Polymer Flooding for in-situ Development of Nigeria's Heavy Oil Reservoirs Polymer Flooding for Enhanced Oil Recovery

Table 4: Research Projects and Time Lines

S/No.	Project Titles	Time Lines
1	Geo-mechanical Method for Sand Production Management using Kirsh Model in Oil and Gas Well. Comparative Analysis of different Artificial Lift Methods using Simply Arithmetic Weighing (SAW) Model. The Economics of Floating Gas to Liquid Technology. Economic Analysis of Gas to Power in Nigeria Impact of Transition to renewable energy on Nigeria's Economic Growth. Assessment of Gravel Packing Methods used in the Petroleum Industry. Evaluation of Surfactant to Improve Sweep Efficiency of an Oilfield in Niger Delta	3-6 months
2	Forecasting of Petroleum Production using Data Driven method (Machine Learning) Integrated Approach for Source Rocks Characterization of Niger Delta Basin, Nigeria. Techno-Economic Analysis of Floating Gas to Power (FGTP) for Stranded Gas -Offshore Nigeria	8 months

3	Application of Geo-mechanical Properties to Reservoir Evaluation Reduction of Transmission and Distribution Losses through Efficient Leak Detection and Monitoring (Case Study: Obite-Bonny Gas Pipeline Network) Applicability of Polymer Flooding for in-situ Development of Nigeria's Heavy Oil Reservoirs Application of Artificial Intelligence in the Economic Analysis of Petroleum Ventures Gas Conversion and Utilization Strategies for Economic and Environmental Benefits Seismic Based Artificial Intelligence and Simulation for improved Reservoir Description in a Niger Delta Field Economic Impact of Policies and Infrastructures on Gas Utilization Systems in Nigeria. Permeability Modelling Using Core and Well Log Data in the 'XX Field' of Coastal Swamp Depo-bed in the Niger Delta Basin. Metaheuristic Intelligent Systems for Ranking International Fiscal Regimes	1 -1.5years
4	A Stochastic Approach to Cost Estimation and Economic Evaluation of Oil Well in the Niger Delta. Development of a Fingerprint Model to Classify Niger Delta Reservoirs Using OPEC's Auditing Criteria	2 years
5	Production of Biofuels from Lignocellulosic Biomass Resources. Evaluation of Development and Economic Options for Stranded Gas	3 years

4.2. ACTIVITIES OF THE CHAIR IN 2022 AND BEYOND

Going forward the Chair has had approval from the Chairman of Board of Trustees who is also the Vice Chancellor of the university to carry out some activities such as:

1. Workshop on pertinent industry software
2. Students quiz competition
3. Students paper contests.

These programmes have its objectives as

i. Enhance petroleum Engineering education in the University and beyond
ii. Enhance the visibility of the Chair
iii. Assist and encourage students in their academics

Plans are on-going and has been put in place for the take-off of these activities.

4.2.1. Development of database for green hydrate inhibitors

This will be done by carrying out experimental runs on some naturally sourced plant materials around to see their effect on gas hydrate formation. This database will help in model and software development in the area of flow assurance. **Table 5** shows a timeline for some of the activities under this project.

Table 5: Time line for Developing Database for Green Hydrate Inhibitors

S/No.	Activities	Time Frame
1	Local sourcing of raw materials	3 Months
2	Preparation of raw materials	1 Month
3	Experimental runs to ascertain effectiveness of raw materials	2 Months
4	Experimental runs for Comparison with commercial inhibitors	2months
5	Experimental runs for blends of raw materials	2 Months
6	Experimental runs of blends for validation with commercial inhibitors	2 months
7	Cost Benefit Analysis	2 Months
8	Collation of results	1 Month
9	Result Analysis	1.5 Months
10	Report Writing	1.5 Months

4.2.2. Incorporating Holistic Flow Assurance Research (scales, wax, asphaltenes, corrosion, fluid pumpability, components etc.). At present research focus is on gas hydrate as mentioned in section 4.1. The flow assurance lab is being revamped to bring it up to standard. Some equipment needed as a way forward are shown in **Table 6**

Table 6: List of some Equipment Needed for the Flow Assurance Laboratory

S/No.	Flow Assurance Problem	Equipment Required
1	Asphaltenes	• Isothermal depressurization equipment for depressurization experiments • Organic solid filters (OSD) • Reservoir Fluid Particle Analyzer (RFP) • High Pressure Flocculation Trimeter • Asphaltene deposition Inhibitor tester (ADIT) • Solid Deposition Flow Loop (SDL) • Automated Asphaltene Extractor

		• Titration equipment for titration experiments • Particle size distribution and solid onset determination apparatus • Near Infrared Red detection systems for accurate onset determination
2	Waxes or blended water composition	• Cross polar microscopy (CPM) or • Differential Scanning Calorimeter (DSC) for stock tank determination of wax appearance temperature (WAT) and wax dissolution temperature. • Near-Infrared Red (NIR) or PFI equipment for live fluid WAT • High Temperature Gas Chromatography (HTGC) for identification of paraffin distribution in reservoir fluid
3	Hydrates	➢ Hydrates mini flow loops (vertical and inclined) with visual display unit fully automated for ease of data collection to see the effects of elevation on rate of hydrate formation. ➢ Visual synthetic sapphires loops ➢ Rocking Cells ➢ Autoclaves ➢ Hydraeval systems ➢ Fluid Eval for HP-HT Visual studies
4.	Scales	▪ Geochemical software for predicting thermodynamic onset conditions based on water chemistry ▪ Dynamic scale loops ▪ Visual Scale testers
5	Fluid Pumpability	▪ Friction Flow Loop for evaluating Drag Reducing Agents (DRA loop)
6	Components	▪ Flow through SDS Cells ▪ Flow Stand Stirred Pressure Vessel

4.2.3. Revamping the Drilling/Cementing Laboratory: This is very critical as this will help open up and accelerate the research in drilling, drilling fluids and cementing. Some equipment needed for this set up are shown in **Table 7**

Table 7: List of laboratory Equipment for Drilling Fluids/Cementing Laboratory

S/No.	TEST TYPE	EQUIPMENT REQUIRED
1	Fluid /Mud Density	Mud Balance
2	Mud Viscosity	Fann V-G Meter
3	Hydrogen ion Concentration (P^H)	Hydrion P^H Dispenser/ P^H Meter
4	Mud Rheology Test	Variable Speed Rheometer
5	Gel Strength	Rheometer

6	Filtration, all Building and Resistivity	• Low- and high-pressure standard Filter Press • Vernier Caliper • Resistivity Meter
7	Solid/Liquid Content and Emulsion Characteristics	• Sand content set • Fann Emulsion • Electrical stability Tester
8	Differential Sticking Test	Differential sticking tester
9	Reactive solid determination	Methyl Blue
10	EP/Lubricity tests	Lubricity tester
11	Aging Test	Aging/roller oven
12	Calcite build up Test	Calcimeter
13	Drilling Mud preparation	Blenders/Mixers
14	Particle Size Analysis	Wet sieve analysis Kit
CEMENTING TESTS		
1.	Fineness Test	• Sieve or Blaine Air Permeability tester
2	Consistency Test	• Viscat Apparatus
3	Cement Setting Time (Initial and Final)	• Viscat Apparatus
4	Soundness Test	• Chatelier's Apparatus
5	Cement Strength Test/Tensile strength	• Compressive strength Tester • Cement- Mortar Briquette in a tensile testing machine
6	Heat of Hydration	• Calorimeter
7	Cement Weight	• Mud Balance
8	Wettability Test	• Wettability tester
9	Ultrasonic Cement Test	• Ultrasonic cement tester
10	Cement density/weight	• Mud Balance
11	Viscosity	• Rheometer
12	Fluid loss	• Stirring fluid loss tester • Static fluid loss tester

4.2.4. Conference Attendance

There will be a paper presentation at Nigerian Annual International Conference and Exhibition (NAICE) taking place in Lagos, Nigeria from 1st through 3rd August 2022. Other presentations will likely be attended when the abstracts submitted return accepted. This will also be communicated in due course.

4.2.5. Mentorship and supervision of post graduate and undergraduate students: Mentoring and supervision are key part of human capacity development which is very important in baton change for the future of the oil and gas industry. This is a continuous exercise as seen in session 4.1.9 of the report (see **Appendix 1** and **2** also)

4.2.6. Attendance of short courses: There is the need for the Chair to attend short courses especially in line with renewable energy. This will help to reposition the Department (in terms of teaching and curriculum development) for the on-going energy transition. This will also help the Chair give informed suggestions / advice to stake holders whenever the need arises.

4.2.7. Stake Holders Meeting

Meetings will be held with stakeholders to know their research needs and also to make possible suggestions on what would be relevant to donor.

4.2.8. Courses Taught to Undergraduates and Post graduate Students

Teaching of Postgraduate as well as undergraduate students will still continue for the new academic session.

- PNG 302.1: Rock and Fluid Properties
- ENG 402.1: Engineering Economics
- PNG 403.1: Natural Gas Engineering
- GNG 505.1: Petrochemical processes
- PNG 802.1: Advanced Natural Gas Engineering
- PNG 805.1 Advanced Evaluation of Oil and Gas Properties
- PNG 811.2 Risk Analysis in Petroleum Ventures
- PNG 812.2 Liquified Natural Gas (LNG) Processing
- DPE 780.2 Petroleum Economics and Property Evaluation
- PNG 307.2: Fundamentals of Petroleum Engineering
- GES 400.2: Entrepreneurship
- ENG 400.2: Industrial Training II
- PNG 507.2: Natural Gas Processing
- PNG 520.2: Final Year Project

4.3 Key Performance Indicators- KPIs

There are some key activities that has been used to measure the progress or performance of the Chair so far. These are highlighted in the sections following.

4.3.1 Patents

The Chair has a**s** its vision harnessing available human capital potentials through quality research, innovation and collaboration. Some of these quality research has been able to produce innovation which need protections in the name of patents.

4.3.1.1. 1 filed

Flavonoids in Formulation of Gas Hydrate Inhibitors

Virtue Urunwo Wachikwu-Elechi, Sunday Sunday Ikiensikimama, Joseph Atubokiki Ajienka and Onyewuchi Akaranta

4.3.1.2. 3 being compiled

A New Approach of Controlling the Activities of Sulphate-Reducing Bacteria (SRB) in the Reservoir during Water Injection

Otega Solomon Ogherohwo, Sunday Sunday Ikiensikimama. Ohimor, E.O. and Virtue Urunwo Wachikwu-Elechi

Plant Gums in Formulation of Gas Hydrate Inhibitors

Virtue Urunwo Wachikwu-Elechi, Sunday Sunday Ikiensikimama, Joseph Atubokiki Ajienka and Onyewuchi Akaranta

Plant Extracts in Formulation of Gas Hydrate Inhibitors

Virtue Urunwo Wachikwu-Elechi, Sunday Sunday Ikiensikimama, Joseph Atubokiki Ajienka and Onyewuchi Akaranta

4.3.2. Publications

1. Virtue Urunwo Elechi, **Sunday Sunday Ikiensikimama**, Joseph Atubokiki Ajienka, Onyewuchi Akaranta and Okon Efiong Okon **(2021)**. Laboratory Evaluation of Caricaceae Plant as a Locally Sourced Surfactant for Gas Hydrate Inhibition in a Laboratory Mini Flow Loop. Appl Petrochem Res. DOI 10.1007/s13203-021-00275-x
2. Virtue Urunwo Wachikwu-Elechi, **Sunday Sunday Ikiensikimama**, Joseph Atubokiki Ajienka, Onyewuchi Emmanuel Akaranta and Okon Efiong Okon **(2021)**. Suppression Performance Of An Unmodified Bio-Extract For Simulated Offshore Gas Hydrate Mitigation. SPE-206304-MS accepted for presentation at the Annual Technical Conference and Exhibition to be held on 21st -23rd September 2021 in Dubai, UAE.
3. Virtue Urunwo Wachikwu-Elechi, **Sunday Sunday Ikiensikimama**, Joseph Atubokiki Ajienka, Onyewuchi Emmanuel Akaranta and Okon Efiong Okon **(2021**). Zingiberales Extract (ZE): A Locally Sourced Natural Compound as Gas Hydrate Inhibitor. Paper No. SPE-207154-MS presented at Nigerian Annual International Conference and Exhibition held on 2nd-4th August, in Lagos, Nigeria
4. Virtue Urunwo Wachikwu-Elechi, **Sunday Sunday Ikiensikimama,** Joseph Atubokiki Ajienka, Onyewuchi Emmanuel Akaranta and Okon Efiong Okon **(2021).** Eco-Toxicity of 2-Di(methylamino) ethyl methacrylate (2-DMAEM) as a Commercial Kinetic Hydrate Inhibitor (KHI). Paper No. SPE-207156-MS presented at Nigerian Annual International Conference and Exhibition held on 2nd-4th August, in Lagos, Nigeria.
5. Daniel Ocran**, Sunday Sunday Ikiensikimama** and Eric Broni-Bediako **(2021).** Grey Wolf Optimiser as a New Algorithm for Solving Well Placement Optimization Problem. Egyptian Journal of Petroleum, EGYJP-D-21-00158 (Under Review).

6. Kouadio, E. K**.**, Abrakasa, S., Dobo, H. K. B., Oura, E. L. and **Ikiensikimama**, **S. S. (2021).** Visual Kerogene Analysis for Source Rocks Assessment: Case Study of Onshore Niger Delta Basin (Nigeria). Petroleum and Coal Journal, 63(4).
7. Kouadio, E. K**.**, Abrakasa, S., **Ikiensikimama**, **S. S.** Dobo, and Botwe, T. **(2021).** (2021). Rock-Eval Pyrolysis Analysis of Agbada and Akata Shale from Niger Delta Basin, Nigeria. Asian Journal of Geological Research, 4(4), 99-111.
8. Joseph Atubokiki Ajienka, Sunday Sunday Ikiensikimama and Virtue Urunwo Wachikwu-Elechi (2021). An Experimental Investigation of the Order Brassicales Extract (BPE) as Chemical for Gas Hydrate Control. Engineering, ENG-D-21-01518 (Under Review)
9. Ajienka, J. A, **Ikiensikimama, S. S.** and Wachikwu-Elechi, V. U. (2022). Performance Evaluation of the Inhibition Efficiency of Plant Extract (PE) a Local Inhibitor as Gas Hydrate Inhibitor in a Simulated Offshore Environment. Petroleum Science and Technology, LPET-2022-0097 (Under Review).
10. Okon Efiong Okon, Joseph Atubokiki Ajienka, **Sunday Sunday Ikiensikimama**, Onyewuchi Emmanuel Akaranta and Virtue Urunwo Wachikwu-Elechi (2022). Evaluation of Agro-Waste Based Developed Gas Hydrate Inhibitor in the presence of 2-Di(methylamino) ethyl methacrylate and N-Vinyl Caprolactam". Journal of Petroleum Science and Engineering, PETROL 28738 (Under Review)
11. Virtue Urunwo Wachikwu-Elechi, **Sunday Sunday Ikiensikimama**, Joseph Atubokiki Ajienka, Onyewuchi Emmanuel Akaranta and Okon Efiong Okon **(2022**). Suppression Performance Of An Unmodified Bio- Extract For Simulated Offshore Gas Hydrate Mitigation. AbuDhabi International Petroleum Conference and Exhibition.22ADIP-P-34-SPE (Under Review)

4.3.3. Mentorship

In line with some of the aspirations of the Chair, some students have successful completed their studies that is those that have graduated (Table 8), about to graduate (Table 9).

Undergraduate Students (Graduated)

Table 8: List of Some Graduates Mentored and Titles of Supervised Research Projects

S/No	Names/Matric no.	Project Topic	Relevance to Oil and Gas or Significance of the Study	Expected Time Frame to Completion
1	**SULE,** Victor Joshua **U2015/3065029**	A Comparative Analysis between Annular Friction Model	To help identify the best annular friction pressure loss models	Graduated
2	**CHUKWUOGO**, Nkemakonam S. **U2015/3065066**	Polymer Flooding for Enhanced Oil Recovery	To find more effective and economical alternatives to currently used conventional polymers so as to improve sweep efficiency and lead to improved oil recovery.	Graduated

3	**DILINYE**, Chinonso Patrick **U2015/3065037**	Economic Analysis of Artificial Lift System using Gas Lift and Electric Submersible Pump	Selecting the best artificial lift method that would be viable for a well.	Graduated
4	**AGBALA**, Ogheneoke Jenkis **U2015/3065064**	Geo-mechanical Method for Sand Production Management using Kirsh Model in Oil and Gas Well	Predict the critical parameters of sand production and controlling sand production using production data from geo-mechanical method	Graduated
5	**ESOSUAKPO**, Okioghene Mario **U2015/3065053**	Comparative Analysis of different Artificial Lift Methods using Simply Arithmetic Weighing (SAW) Model	Selecting artificial lift system that will optimize productivity in Niger Delta.	Graduated
6	**CHISOM**, Emeto **U2015/3065023**	The Economics of Floating Gas to Liquid Technology	To provides a means of optimizing gas production in Nigeria and reduce flaring activities.	Graduated
7	**IGBOSI**, Tombra Timipre **U2015/3065011**	Economic Analysis of Gas to Power in Nigeria	To determine the optimal gas price to ensure profitability in a gas to power investment.	Graduated
8	**CHARLES-OKHIDE**, Michael Tari **U2015/3065061**	Impact of Transition to renewable energy on Nigeria's Economic Growth	To help identify the relationship between dynamics of the development of the renewable energy industry and production and consumption of fossil fuel	Graduated
9	**MARCUS,** Ruth Leyirah **U2015/3065058**	Assessment of Gravel Packing Methods used in the Petroleum Industry.	To determine the average formation sand size used to find accurate gravel pack size suitable for completion.	Graduated

Table 9: List of Masters and Ph.D. Students about to Graduate (Graduating)

S/No	Name /matric no	Project topic	Relevance to oil and Gas	Expected time Frame to completion

1	Babawale Emmanuel Ojedapo G2018/M.ENG/PNG/FT/042	Forecasting of Petroleum Production using Data Driven method (Machine Learning)	The inability of the current machine learning algorithms to handle seasonal effects associated with oil and gas production data, shift in production regime as well as using oil production and time data, which is not extensive for prediction. This study is an improvement on the existing time series machine learning algorithm by handling the seasonal effects and variety of regimes associated with petroleum production data using multivariate data for time series prediction	Graduating
2.	Noble Ukela Odoi G2018/PHD/ACE-CEFOR/FT/037	Development of Efficient Infrastructure and Interconnecting Network for Gas Pipelines	Evaluating the infrastructural gap in the utilization of natural gas in the gas value chain for the monetization of LPG	Graduating
3.	Ogherohwo Solomom Otega G2017/MENG/PNG/FT/038	A New Approach of Controlling The Activities of Sulphate -Reducing Bacteria (SRB) in the Reservoir During Water Injection.	This research will help in the reduction of cost of pipeline maintenance as a result of microbial induced corrosion (MIC) which is a negative impact of SRB. This approach is more eco-friendly and will therefore	Graduating

			mitigate health risk to personnel caused by hydrogen sulfide (H2S). It is cheaper than other methods of SRB control and will prevent environmental pollution caused by other methods of controlling SRB.	
4.	Koffi Eugene KOUADIO	Integrated Approach for Source Rocks Characterization of Niger Delta Basin, Nigeria	The work will provide a better analytical procedure for the definition and evaluation of source rock characteristics for the Niger Delta formation	Graduating
5.	Eneota, Chidike Paschal G2018/PHD/ACE-CEFOR/FT/038	Gas Conversion and Utilization Strategies for Economic and Environmental Benefits	The project will provide the framework and model for oil and gas including stakeholders that will estimate the gas conversion and utilization in Niger Delta thereby eliminating gas flaring. This will also result in monetization of stranded gas which yields more profit to the oil gas operators and stakeholders.,	Graduating

6.	Vivian Ihejirika G2018/PhD/ACE-CEFOR/FT/058	Economic Impact of Policies and Infrastructures on Gas Utilization Systems in Nigeria.	The study will bring about effective management of gas utilization and also boost gas production to increase revenue accruing to government and stakeholders. It will provide a framework for gas-based industrialization leading to cleaner energy and sustainable power supply.	Graduating

Appendix 1: List of Some Masters and Ph. D Students under Mentorship/Titles of Supervised Research Projects (On-Going)

S/No	Name /matric no	Project topic	Relevance to oil and Gas	Expected time Frame to completion
3	Obashanu Bernard G2018/MENG/PNG/FT/021	Application of Geomechanical Properties to Reservoir Evaluation	Taking into account the dynamic system of the reservoir, as opposed to the conventional static criteria presently used, this study provides the oil and gas with critical insight of geomechanically effects prediction (rate of sand production, well stability, stresses in and around the wellbore as well as avoid NPT which impacts production etc) in the bid to	1 year

			mitigate /eliminate associated cost with their handling	
4	Iriakuma, Erempagamo G2018/PHD/ACE-CEFOR/FT/025	Reduction of Transmission and Distribution Losses through Efficient Leak Detection and Monitoring (Case Study: Obite-Bonny Gas Pipeline Network)		1 year
5	Okon, Christopher Etim G2017/MENG/PNG/FT/004	Evaluation of Surfactant to Improve Sweep Efficiency of an Oilfield in Niger Delta	This work will identify a local surfactant that can be used for chemical enhanced oil recovery	6 months
6.	Usiayo, Afoke Victor APPL/2020PHD/PNG/007	Production of Biofuels from Lignocellulosic Biomass Resources	This project will modify the existing acid pretreatment method by modelling and optimizing the process variables (reactor temperature, acid catalyst concentration and residence) of the feedstock, in order to prevent formation of inhibitors which will result to enhanced yield and quality of biobutanol (bio gasoline) production that can be used directly in a gasoline engine.	3 years
9	Ezeh, Okechukwu Chigozirim G2018/PHD/ACE-CEFOR/FT/020	Applicability of Polymer Flooding for in-situ Development of Nigeria's Heavy Oil Reservoirs	This study will provide guidelines to developing heavy crude oil for in country application. proper screening criteria for heavy crude oil fields that	1 year

			will qualify for polymer flooding.	
10	Joseph Adeoluwa Adetuberu G2018/PhD/ACE-CEFOR/PT/031	Application of Artificial Intelligence in the Economic Analysis of Petroleum Ventures	It will help improve decision making for economic analysis before Field Investment Decision (FID) for both investors and stakeholders with a more realistic forecast based on the actual occurrences over time from other fields within the area. It will help companies understand the major drivers for investment, the strength and direction of the cost variables for field development	1 year
11.	Onu, Chukwuemeka	Evaluation of Development and Economic Options for Stranded Gas	This study will provide economically promising approaches, make clearer the impact of price optimization on a thriving natural gas market and propose a more dynamic fiscal policies for the domestic gas market in Nigeria	3 years
12.	Daniel Ocran PGP-8000082218	Metaheuristic Intelligent Systems for Ranking International Fiscal Regimes	This work will provide an intelligent system for ranking international fiscal regimes using a new well placement optimizer. It will integrate reservoir	1.5 years

			model into economic model for estimating maximum economic returns on investments and quantifying uncertainties and risks.	
13.	Djoi, Nokpo Andre G2020/PHD/ACE-CEFOR/FT/012	A Stochastic Approach to Cost Estimation and Economic Evaluation of Oil Well in the Niger Delta	The work when completed will Facilitate long term and more accurate evaluation of crude oil prices and will give a guide for the drilling team on how to handle events that will lead to NPT (Non-Productive Time).The handling of which will lead to more accurate well/drilling timings and cost estimations	2 years
15	Kamayou Monkam Elise Vianney G2018/PHD/ACE-CEFOR/FT/043	Seismic Based Artificial Intelligence and Simulation for improved Reservoir Description in a Niger Delta Field	This work will help to reduce uncertainty as well as risks in petroleum exploration and production for timely and more accurate reservoir management and decision making.	1 year
16	Obuekwe Chukwukadibia Mogbo G2018/PHD/ACE-CEFOR/PT/004	Techno-Economic Analysis of Floating Gas to Power (FGTP) for Stranded Gas - Offshore Nigeria	This project will identify and rank Nigeria stranded offshore gas fields with respect to floating gas to power projects development. It will also an economic model that will demonstrate the conditions under	8 months

			which FGTP will be economically viable	
17	Anyanwu Chukwuemeka G2019/Ph.D/PNG/009	Development of a Fingerprint Model to Classify Niger Delta Reservoirs Using OPEC's Auditing Criteria	This work will develop model for the proper classification of reservoirs in the Niger Delta, using OPEC criteria as stated in OPEC LXXXIV.286 Resolution. It will also produce source signature for the identification and characterization of reservoirs.	2 years
19	Obiajulu Chukuezugo Ekeh G2019/Ph. D/PNG/PT/002	Permeability Modelling Using Core and Well Log Data in the 'XX Field' of Coastal Swamp Depo-bed in the Niger Delta Basin.	This work will provide a method of deriving rock permeability by correlating multiple well logs with core permeabilities using non-parametric regression in conjunction with multiple variant statistical analysis	1 year

Students just Assigned for Supervision

Appendix 2: List of Some Masters and Ph. D Students under Mentorship/Titles of Supervised Research Projects

S/No	Name /matric no	Project topic	Relevance to oil and Gas	Expected time Frame to completion
1	Chukwu Ikemefuna Ekene G2021/Ph.D/ACE-CEFOR/FT/006			

2	Mutadza Itai G2021/Ph.D/ACE-CEFOR/FT/015	Effect of Reactive Flow in Porous Media for Carbon Capture and Storage in Depleted Reservoirs		
3	Humphrey Harry G2021/Ph.D/ACE-CEFOR/FT/011	Suitability and Applicability of Microwave Spectroscopic Systems in Measurement of Oil Reservoir Rock and Fluid Properties		
4	Fawziyah Olufunke Olarinoye			
5	Okon Efiong Okon			
6	OluwaTosin Adeoti Samuel-Idara			
7	ELOBE-MBAM THEOPHILUS G2019/MENG/PNG/FT/023	Importance of Depositional Environment to History Matching-Niger Delta Case Study		
8	Ogazi Kenechukwu Henry G2019/MEM/ENG/PT/019	The Importance and Applications of Conductor Piling Using Hammers in Nigeria		

9	Chukwudi Onwuaso G2018/MENG/PNG/FT/034			
10	Kenneth Okwor G2018/MENG/PNG/FT/031	Economic Model for Crude Oil Price Dynamic Forecast Using Machine Learning		

Appendix 3: List of Some Under graduate Students under Mentorship/Titles of Supervised Research Projects

S/No	Names/Matric no.	Project Topic	Relevance to Oil and Gas or Significance of the Study	Expected Time Frame to Completion
1	Nwogu Chinwendu Uzoma U2016/3065014			
2	George-Gogo Tari U2016/3065012			
3	Ikeokwu Chinaza Collins U2016/3065005			
4	Ibutonmiema Tamuno Roselin U2016/3065013			
5	Ndidi Precious Onyekachi U2016/3065011			