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Decades of Gas: The role of Women Engineers in Achieving a Gas-Powered Economy by 2030 in Nigeria

Adeola A. Adebiyi, Hadiza Ahmed, Yasmin Kaikai, Aisha K. Mustapha, Farida Mustafa, Tosin

Obaparusi, Grace C. Akujobi-Emetuche

Nigerian National Petroleum Company Limited

Abstract

Energy is the heart of the global economy. The nature and mix of energy portfolio as well as energy demand and utilization in a nation's economy are major determinants of its level of economic development. This cannot be done without the Engineers. The number of women in the engineering sector is progressively increasing in Nigeria and the world at Large. Our country has improved greatly because more women are involved in developing the Nation. The Nigerian National Petroleum Company (NNPC) Limited has taken the lead by including more women in top positions. This gives visibility to the opportunities for female engineers, while also ensuring more equitable, inclusive, and representation in executive decisions. The Federal Government aims to transform Nigeria into a gas-powered economy by 2030, and natural gas is a key resource for energy transition. Natural gas can be used in power generation, transportation, air conditioning and domestic purposes. A good energy source should be affordable, easily accessible, and provide energy for the maximum period. It should have a high calorific value, be sustainable, and pollution free. Based on these, gas is the ideal transition fuel.

The need for the active involvement and participation of women engineers in the decade of Gas initiative by the Federal Government cannot be overemphasized. Diversity has advanced beyond a feel-good effort or a government requirement to a form of corporate social responsibility.

Keywords: Gas, energy economy, transition, women.

HUMAN CAPITAL DEVELOPMENT FOR A JUST ENERGY TRANSITION

Habiba Othman, Grace Orji-Ajuka, Amina Mazamaza, Rukaiya Umar, Fatima Zahra'u Ali, Irene

Dadzie, Grace C. Akujobi-Emetuche

Nigerian National Petroleum Company Limited

ABSTRACT

The adoption of energy transition strategies and policies are designed to move the global energy sector away from fossil fuels towards zero-carbon energies. As a result of global warming, there is universal agreement for a need to transition as a way of limiting the effects of CO₂ emissions and hence climate changes. Different parts of the world have been experiencing the very worst of these climate changes, further highlighting the importance of this transition. It is imperative to mention that while developed countries have somewhat reached the goal of energy self-sufficiency, the developing countries such as Nigeria are still working to ensure reliable electricity supplies. Nigeria will experience stunted growth if it strictly follows the standards that have been set out to achieve this energy transition globally and therefore, there is the need for a Just Energy Transition. This Just Transition can be aided by investment in various Human Capital Development strategies. It will create alternatives to people and regions such as Nigeria trapped in fossil fuel dynamics through new economic opportunity, education and skills trainings and adequate social safety systems. These strategies must be carried out by the Government, the Energy Companies as well as all other Energy Stakeholders.

KEYWORDS: Energy, Transition, Capital, Development, Strategies

INSIGHT INTO CARBON CAPTURE AND STORAGE FOR NIGERIA'S ENERGY TRANSITION

Rabi Oziohu Isa - rabionline@futminna.edu.ng

Federal University of Technology, Minna

ABSTRACT

Climate change concerns have triggered campaigns for the reduction of the emission of greenhouse gases especially carbon dioxide into the atmosphere and a just energy transition will require country specific pathways. For a fossil dependent economy like Nigeria, shift towards renewable sources should be considered alongside possible decarbonisation of the environment. This paper tries to introduce stakeholders in the energy transition process to the concept of carbon dioxide capture and storage with

a focus on carbon capture technologies. Several carbon capture technologies were highlighted together with their advantages and disadvantages. Research on carbon capture is being advocated and insight into the material and equipment requirement for such research was given. The concept of transportation, storage and utilization was also introduced. Lack of awareness about carbon capture and storage as well as lack of proper research materials and equipment was pointed out as a major hinderance to breakthrough research in the area of carbon capture. The academia, research institutions, government and other stakeholders in the energy transition chain have important roles to play in this regard.

Keyword: Carbon capture, Materials and Equipment

ELECTRICITY FOR ALL – OFF-GRID POWER GENERATION ALTERNATIVES FOR NIGERIA

Enejoh Agnes Aladi¹, Enenche James Audu².

¹MD/CEO Urbancode Resources Nigeria Ltd, ²Department of Architecture, Ahmadu Bello University Zaria. Nigeria

enejohagnesinfo@gmail.com

ABSTRACT

A sustainable off-grid power generation alternative for Nigeria is the Biomass Power. It is electricity generated from biomass fuels in a modern procedure with minimal environmental damages. Biomass consists of plant materials and animal products. It is fuel derived from residues from food production and processing, trees and grasses grown specifically as energy crops, and biogas produced from solid biomass and wastes. In this paper, the various biomass materials available in the country and the available technologies that are used for converting biomass to electricity are presented. The paper also identified the government policy objectives with regards to the development of renewable energy in general and biomass development in particular. The paper concludes after reviewing some global experiences and best practices, the various options, and their resulting prospects and challenges in

producing electricity from biomass and also their impact on Nigerians and the Nigeria economy. In spite of the fact that the prospects of using biomass for electricity generation is capital intensive, land availability, plant location, scale and choice of technology and distribution of economic benefits are factors that have to be considered in deploying biomass as an off-grid power generation in Nigeria, it is a suitable alternative for sustainable energy transition in Nigeria.

KEYWORDS: Electricity, Off-Grid power, Biomass, Biogas, Sustainability.

SIMULATION DESIGN AND OPTIMUM STRUCTURE PARAMETERS MODEL OF PRESSURIZED H₂O SCRUBBING MECHANISMS OF BIOGAS

¹Unyime Enobong Okure, ²Engr. Nnadikwe Johnson, ³Benedict Okon Edenseteng, ⁴Ibe Raymond
Obinna

Chemical Engineering, ¹Niger Delta University, Wilberforce Island, Bayelsa, Nigeria, ^{2,4}Imo state
Polytechnic, Owerri Nigeria, ³University of Uyo, Akwa Ibom State, Nigeria

okureunyime@gmail.com

ABSTRACT

The design and modelling of a plant-level dynamic control system based on the optimum structure and parameters of the steady state is investigated in this study for the mechanisms of biogas pressurized water scrubbing. A steady state simulation system is built using Aspen Plus to meet the mechanisms requirements of the biogas pressurized water scrubbing pilot-scale facility. To find the best operating parameters, simulation study is carried out under various operating situations. Then, to ensure biogas purification efficiency, plant-level dynamic control schemes and a dynamic simulation system are devised. The system's performance is evaluated by disrupting the biogas inflow flow and the intake flow component. The simulation findings reveal that the system has good dynamic reaction performance, with CO₂ removal rates exceeding 99.8% under various perturbations.

Keywords: Biogas, Removal, Scrubbing, Pressure, Aspen Plus

Sustainable Engineering Education Through Innovation and Industry Based Skills

Development and Practice – EngineeringXpress: The Nigerian Challenges

Uzor Onyia¹, Elizabeth J. Eterigho², Chinenye C. Anyadika³, Joseph O. Odigeru⁴

¹Onyia Construction, ^{2,4}, Federal University of Technology, Minna ³ University of Nigeria,

Abstract

A study to discover and identify industry-relevant skills for safe, innovative and sustainable engineering has been commissioned by the Royal Academy of Engineering and partners. This paper sets to understand and establish the challenges in engineering education in Nigeria. The engineering identity and its influence and challenges were explored through literature review. Questionnaires (1000 copies) were shared randomly amongst the participants of the 30th COREN Engineering Assembly. 638 completed and usable responses were received and analyzed. The study identifies a switch from theoretical to practical-based teaching and learning for outcome-based education with 51% -75% being the most preferred structural change in the curriculum. However, the study cautions that the current laboratories and workshops are not well equipped for entrepreneurship, safety, innovation and industry-relevant skills for sustainable engineering education and practice in Nigeria. It further collaborates the widely accepted views that the review of engineering curriculum should promote entrepreneurship, safety, innovation and industry-relevant skills for sustainable education and practice.

Keywords:

Engineering Education, Engineering Skills, Nigerian Educational Challenges, Outcome Based Education, Sustainable Engineering.

Blue Hydrogen a Catalyst for Sustainable Energy in Nigeria: A Review

Uzoma N. Blessing^{1, a}, and Nmeribe C. Sophia^{2, b}

^{1,2} Association of Professional Women Engineers of Nigeria, Rivers State University Collegiate, Port-Harcourt, Rivers State.

Abstract

The effects of retorting temperature of oil shale on the yield and properties of shale oil produced were studied in a Fluidized Catalytic Bed Reactor. Lokpanta oil shale was retorted at the temperatures of 400, 450, and 500OC. During the retorting process, shale oil samples were collected at different time periods and their various characteristics were analyzed. The yield of shale oil was increased with increasing reaction temperature. In the analysis of shale oil collected at different temperature variations were weighed and characterized after the pyrolysis. The characterization of lokpanta oil shale was performed by thermal and catalytic pyrolysis using a fabricated fluidized catalytic bed pyrolizer. Thermal pyrolysis produced maximum liquid oil (80.8%) with gases (13%) and char (6.2%), while catalytic pyrolysis using synthesized ZSM-5 decreased the liquid oil yield (52%) with an increase in gases (17.7%) and char (30.1%) production. Furthermore, the oil shale sample from Lokpanta was pyrolyzed in a thermogravimetric Analyzer (TGA) to determine the influence of temperature and heating rate on the thermal degradation of the sample.

Keyword: Lokpanta Oil Shale, ZSM-5 and Fluidised Catalytic Bed Reactor (FCBR)

Renewable and Affordable Energy (Biofuels) Production in Small Scale for Sustainable Development, Biomass Wastes as Assets: A review

¹Aremu, M. O., ^{2*}Olowonyo, I. A., ³Akinwumi, O. D. and ⁴Aremu, A. D.

^{1, 2, 3}Department of Chemical Engineering, Ladoke Akintola University, P.M.B. 4000, Ogbomosho.

⁴Department of Chemical Engineering, Obafemi Awolowo University, Ile-Ife.

Email: moaremu@lautech.edu.ng; idayatolowonyo@gmail.com

Abstract

Waste-to-energy is one of the feasible approaches to reduce over-dependence on fossil fuel. The world's increasing population, industrialization and the limited fossil energy resources, which by combustion are damaging the environment, leads to the demand for renewable energy resources. The over-

dependence on fossil fuels as primary energy source has led to myriads of problems such as global climatic change, environmental degradation and numerous human health problems. Also, recent rise in energy prices (natural gas, petrol, diesel, electricity) has called for researches toward other cheap, renewable and sustainable alternative energy sources. Production of biofuels from renewable feedstocks has captured considerable scientific attention since they could be used to supply energy and alternative fuels. Renewable energy provides energy sources that are sustainable and continually replenished by nature (sun, wind, water and plants). Waste biomass, especially from food and agricultural sources is an underestimated but attractive alternative for affordable and sustainable production of biofuels/bioenergy to replace petroleum-based fuels. Hence, biomass wastes conversion present opportunities for addressing global energy crises and efficient waste management problem.

Keywords: Renewable energy, Waste biomass, Biofuels, Bioenergy, Anaerobic fermentation.

AN OPTIMIZED CUSTOMER CHURN PREDICTION ALGORITHM IN TELECOMMUNICATION

Asabe I. Samuel*¹ , Michael David¹ , Bala A. Salihu¹ , Usman A. Usman¹ and Ibrahim M. Abdullahi²

¹Department of Telecommunication Engineering, Federal University of Technology, Minna, Niger State, Nigeria

² Department of Computer Engineering, Federal University of Technology, Minna, Niger State, Nigeria *remmiest@gmail.com

Abstract— To survive in the fierce competition of the telecommunication industry and to retain the existing loyal customers, it has become very important for practitioners and academicians through predictive modeling techniques to predict potential customers who are likely to churn. Likely churners and loyal customers' identification can be done by coming up with efficient predictive models. When a company allocates its dedicated resources to retain these customers, it greatly controls the rate at which dissatisfied customers leave the company. This paper proposes Artificial Neural Network approach for prediction of customers intending to switch over to other operators. This model uses Pastoralist Optimization Algorithm (POA) to enhance the Artificial Neural Network (ANN) by working on multiple attributes from Telecom Company's dataset. In contrast with other prediction techniques, the

results from Pastoralist Optimization Algorithm Artificial Neural Network (POA_ANN) based approach shows that the algorithm can predict the telecom churn with accuracy of 97.0%. Hence necessary steps can be taken by strategic decision makers to eliminate the reasons for churn thereby sustaining profitability.

Keyword— Neural Network; ANN; prediction; churn management, Pastoralist.

Insight into Carbon Capture and Storage for Nigeria's Energy Transition

Rabi Oziohu Isa^{1,a}, and Muibat Diekola Yahya^{2,b,*}

1 Department of Chemical Engineering, Federal University of Technology Minna.

2 Department of Chemical Engineering, Federal University of Technology, Minna

rabionline@futminna.edu.ng^{b,*} muibat.yahya@futminna.edu.ng (rabionline@futminna.edu.ng)

Abstract

Climate change concerns have triggered global campaign for the reduction of the emission of greenhouse gases especially carbon dioxide into the atmosphere. For a fossil dependent economy like Nigeria, a just energy transition should consider possible decarbonisation of the environment alongside shift towards renewable energy sources. This paper introduces stakeholders in the energy transition process to the concept of carbon dioxide capture and storage with a focus on carbon capture technologies. Several carbon capture techniques were discussed together with their advantages and disadvantages. Research on carbon capture is being advocated. The basic material and equipment requirement for such research was listed. The concept of transportation, storage and utilization was introduced. Lack of awareness about carbon capture and storage as well as inadequate research materials and equipment was pointed out as a major hinderance to indigenous research in carbon capture. The academia, research institutions, government and other stakeholders in the energy transition chain have important roles to play.

Keywords: Carbon Capture, Research, Materials and Equipment.

Transformer Oil -Based Biomass - A Panacea for Electric Power Utility Optimization.

¹Unyime Enobong Okure, ²Victoria Enobong Okure, ³Benedict Okon Edenseting, ⁴Uduak Godwin Etokakpan

¹Department Chemical Engineering, Niger Delta University, Wilberforce Island, Bayelsa, ²Department Biochemistry, University of Uyo, Akwa Ibom State, ³ Department of Chemical Engineering, University of Uyo, Akwa Ibom State, ⁴Department of Electrical Electronic, Akwa Ibom State Polytechnic, Ikot Osurua, Akwa Ibom State

ABSTRACT:

Power transformers are the most expensive equipment, frequently posing management challenges for electric power energy suppliers. These transformers frequently develop faults as a result of oil insulation challenges caused by insulation oil, a lack of regular maintenance, pollutants, age and carbonisation among other factors. However, the most cost-effective method of ensuring the reliability of power supply to consumers is to use bio - based insulating oil in power transformers throughout the channels. As a result, this article discusses the process of processing transformer oil from bio - based biomass for use in electric power utility companies. Seed oils were extracted from two selected plants (*Luffa cylindrica* and *Lageneriasinceraria*) and physicochemical analysis was performed on the extracted oils using standard methods to determine their suitability for use as transformer oil. To verify its applicability, electrical parameters must be compared to those of transformer mineral oil (TMO) as well as standard specifications. The oil of *Luffa cylindrica* and *Lageneriasinceraria* was transesterified in the process of producing transformer oil. The dielectric strengths of the oils (35kV for Luffa oil and 29kV for Lageneria oil) were quite close to the ASTM specifications of dielectric strength limits (25-40) kV. The free fatty acid content of the seed oil samples analyzed was within the ASTM range of 0.01 – 0.08 mgKOH/oil. Additionally, other physico-chemical parameters determined reveals that these oils can be used as transformer oils if properly refined.

Keywords: Power Transformer, Insulation, *Luffa Cylindrica*, *Lageneria sinceraria*, dielectric, transesterification

Optimisation of the oil yield from Fluidised Catalytic Cracking of Oil Shale Using

ZSM-5 Catalyst.

B. O. Umeh¹., P.E. Dim² and A. G. Olugbenga³

^{1,2} Department of Chemical Engineering, Federal University of Technology Minna, Niger State, Nigeria

³ Department of Chemical Engineering, University of Abuja, Abuja, Nigeria

Abstract

The effects of retorting temperature of oil shale on the yield and properties of shale oil produced were studied in a Fluidized Catalytic Bed Reactor. Lokpanta oil shale was retorted at the temperatures of 400, 450, and 500°C. During the retorting process, shale oil samples were collected at different time periods and their various characteristics were analyzed. The yield of shale oil was increased with increasing reaction temperature. In the analysis of shale oil collected at different temperature variations were weighed and characterized after the pyrolysis. The characterization of lokpanta oil shale was performed by thermal and catalytic pyrolysis using a fabricated fluidized catalytic bed pyrolizer. Thermal pyrolysis produced maximum liquid oil (80.8%) with gases (13%) and char (6.2%), while catalytic pyrolysis using synthesized ZSM-5 decreased the liquid oil yield (52%) with an increase in gases (17.7%) and char (30.1%) production. Furthermore, the oil shale sample from Lokpanta was pyrolyzed in a thermogravimetric Analyzer (TGA) to determine the influence of temperature and heating rate on the thermal degradation of the sample.

Keyword: Lokpanta Oil Shale, ZSM-5 and Fluidised Catalytic Bed Reactor (FCBR)