

SUSTAINABLE DEVELOPMENT: 2015 CLIMATE CHANGE AGREEMENT AND NIGERIA'S COMMITMENT TO ITS NATIONALLY DETERMINED CONTRIBUTIONS

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ABSTRACT: Nigeria's per capital emission figures and aggregated greenhouse gases concentration are projected to grow exponentially under the normal economic growth scenario. Climate system interference and declining productive arable land questions the capability of existing natural resource stock to support a projected population in excess of 300 million by 2050. Stabilizing greenhouse gases emission and preserving the ecosystem sustainability requires confronting every scale of environmental degradation through robust and resilient green-growth strategies. Formulating adaptation and mitigations strategies for deploying innovative low carbon policies, yet institutional framework with legislative backing and non-governmental actors are germane in mobilising wholesale solutions to overcome bottlenecks affecting immediate and long-term transition to low-carbon climate change resilient society. With the desirability of attaining its voluntary NDC, the feasibility of navigating pathways centred on the political thrust, inclusive diplomacy and proven policies to address developmental challenges, submission/attainments can be skewed to interpretations linked to partisan manifestos if independent third-party assessments are lacking. Synthesizing this paper will reveal Nigeria performance through a broad systematic data evaluation to accentuate contextual interpretations, national milestones, gaps and how impacts are localized on the subnational structures.

KEY WORDS: Climate Change, Sustainability, Agriculture, Carbon Emissions, Renewable Energy, Population

1. INTRODUCTION

Climate change has exhibited variations in weather patterns manifesting in growing incidence of increased temperature, drought, rising ocean levels, flash floods and other ecosystem distortions dangerous to the natural ecology. Frequencies of atmospheric greenhouse gases emissions, or oceans and land vegetation absorption, are growing following uncontrolled burning of carbon rich fossil fuels. The United Nations (UNFCCC) data reported that total CO₂ emissions decreased about 2% between 2015 and 2016, driven entirely by lower land-use emissions. World Bank reports that 350 million tons of carbon dioxide is flared annually, whilst fossil fuels and industrial production accounts for 89% of emissions. The challenge is to limit warming to "well below 2C", as per the Paris Agreement pathway of staying well below 2C even though the analysis of different sectorial contributions show that the gulf between the NDCs and the 2C or 1.5C trajectories is still wide. This suggest that the existing NDC commitments to the Paris agreement still fall short of the prerequisite targeted emission level unless ambitious actions assess and monitors the post 2015 Paris Climate Agreement. The Carbon Brief (2016 illustration) graph in figure 1 below, CO₂ emissions will continually increase from 1980 reflected in the black curve and NDC pledges under the Paris Agreement in the dashed curve in contrast with the high emissions scenario in the orange curve juxtaposed with the limiting global warming to 2C above pre-industrial levels scenario in the blue curve. Whilst the prevailing climate-change effects is dilapidating, the effects of humanity's indifference to the growing level of carbon emission escalate global temperature by as much as 3.20 to 5.40C. Therefore, attaining the goal of limiting rising temperature "well below" 2C

above pre-industrial levels, global emissions reductions will need to be compelling, deliberate and collaborative, otherwise the planetary system will continue on the high emission trail dangerous for human survival. Already, the United Nations Environmental Program (UNEP) Inquiry reported that 6.5 million premature deaths from air pollution linked to the energy system; natural disaster displaces an average of 26.4 million people annually since 2008 and one third of global arable land jeopardized by land degradation. However, fulfilling commitments to the 2015 Paris Agreement present comforting projections for carbon emissions control and climate change mitigation.

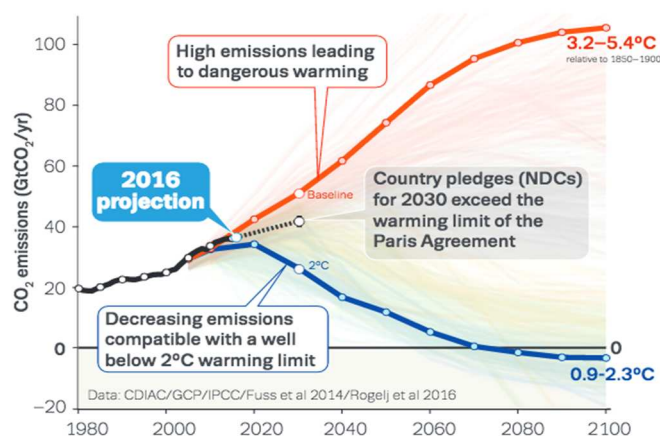


Figure 1. CO₂ Emission Projections, NDCs and Relative Scenarios Source: Le Quéré, C. et al. (2016) Global Carbon Project

The Paris Agreement anchored on the Sustainable Development Goals (SDG) on Climate Action, Affordable and Clean Energy, Sustainable Cities and Communities and Responsible Consumption and Production as the initial climate agreement contributions to adaptation and mitigation action to the 2030 Agenda. Global greenhouse gas emissions continued increase, and the underlying implications reflects a planet off its emission transition plan for sustainability. Staying well below 2 and 1.5°C necessitate stringent adherence to emission reductions programme, with subsequent decreasing emissions levels till 2030. Science is indisputably convinced of atmospheric Green House Gases (GHGs) increase, particularly Carbon Dioxide CO₂, Methane (CH₄) and Nitrate Oxide (N₂O) as common activator of global warming effects. Uncontrolled and wasteful consumption of natural resources, reckless and large-scale fossil fuel consumption, loss of forest formation, rapid urbanization, environmental degradation etc., are precipitously driving the growing rate of carbon emissions. Stern Review (2006) surmised three key policy elements for effective global climate change response. The first is pricing carbon through taxes, trading or regulation. The second is enactment of policies that supports innovations for mass-producing and deploying low-carbon technologies. And the third is actioned programmes that eliminate impediments to extensive energy efficiency utilization as well as awareness creation through information, education and persuading institutional stakeholders, individuals and societies on carbon footprint management. Hence, it is clear that the objective of carbon neutrality and eliminating atmospheric GHGs concentration requires designing carbon capture, utilisation and storage technologies. This is in addition to transiting from unrestrained fossil fuel consumption to renewable energy sources; and an articulated resource efficiency paradigm that measures individual and multi-stakeholders' footprint. This requires the steadfastness of locking down further increase of global average temperature to well below 2°C above pre-industrial levels, and to limit the temperature increase to 1.5°C above pre-industrial levels. Properly enforced, it can translate to stronger mitigation action plans from previous emission assessment. Hence, accessing the preparedness of Nigeria and other stakeholders to their NDC has become very imperative.

Nigeria as a country characterized with huge production and consumption of fossil fuel commits to stabilize greenhouse gas emissions at a level that will reduce its emissions contributions to the planetary system as stated in Table 2. Plagued with desert encroachment in the North, deforestation and flooding in communities along the river basin in the middle-belt and Niger Delta coastline, and hydrocarbon pollution in the crude oil rich Niger Delta, the country vulnerability is intensified by its weak programmes to combat the effects of climate change. Its low adaptive capacity, low economic growth rate and unstable level of infrastructural development exposes it to rising temperatures, flash floods, and unpredictable weather pattern with the attendant impacts on agricultural value chain on which more than 70 percent of its labour force depends. With high poverty ratio, growing populations (Table 1) and natural resource dependent economy, extreme climatic conditions poses disturbing concern for food security, resource conflicts and security threats. A further breakdown of climate change risks ranges from effects on water, food, health, land, and environment that will culminate to more developmental stressed society of low crop yield, hunger, loss of essential species, increased incidence of flooding, climate induced outbreaks of pests, diseases, low GDP etc. A 2015 climate vulnerability index placed Nigeria amongst extreme vulnerable country, alongside

six other countries in Africa. Despite the escape from extremely vulnerable list, it remains highly sensitive to climate volatility with implications on key economic drivers and natural assets. This will be obvious on infrastructures deficit, adverse effect on the environment and ultimately threatening other economic sectors. According the United National Environmental Programme (UNEP), the shrinking Lake Chad from 25000 square kilometres in the 1963 to less than 2500 square kilometre miles has undoubtedly resulted to livelihood losses for about 50 million inhabitants. Migration, farmers/herdsmen clashes, low food production and rise in security in the North-East Region presently characterized the local communities has displaced about 2.8 million people, whilst and another 9.2 million people requires humanitarian support. The floods that occurred in 30 States in 2012, killed 363 people and displaced over 2.1 million people, estimating damages and losses to US\$635(Impact Forecasting).

Table 1. Comparative Socio-Economic Multi-Indicator Analysis

S/N	Description	Data
1	Population (2018 Estimate) (Million)	198
2	Population Without Electricity (Million) (2015)	95.5
3	GDP (Billion US\$) (2016)	405.1
4	GDP Per Capital (US\$ 2016)	2,177.99
5	Gini Coefficient (2016)	0.49
6	Life Expectancy (2018)	53.9
7	Human Development Index (HDI) 2018	0.523
7	CO ₂ Emission (MT Per Capital) (2016)	0.546

Source, Author's Compilation from NPC, World Bank, NBS, CIA data

1.1. Significance of Study

Technology-based, open and transparent progress tracking and reporting systems for Nationally Determined Commitments (NDC) should be the prerequisite for a robust implementation, whilst decoupling associated bureaucracies through adaptive mechanisms that troubleshoot public policies deviancies. Findings from this study and other specialised global developmental can serve as an independent and objective reference that benchmarks assessed high carbon emission performance of public institutions and private corporations which can be used to validate data national attainments. Without voluntary assessment like this, weak outcomes from self-assessment could remain unreported or be expressed diplomatically in policy documents. Also, institutions and resource governance gaps or peculiar corruption occurrences could be allowed to linger with no proper accountability.

1.2. National Climate Change Plan

Nigeria became a party to the UN Framework Convention on Climate Change (UNFCCC) in Kyoto in 1994, ratified the Protocol in 2004 and has since been actively engaged in international climate policy negotiations as well as other Clean Development Mechanism (CDM) projects. In September 2012, the comprehensive climate change policy response strategy was adopted to foster economically efficient response for low carbon economic growth development that pledges to improve individual wellbeing, social inclusion, alleviate poverty and also

provide healthy environment. It signed the Paris Agreement in September 2016. Its Nationally Determined Contributions (NDC) submission was ambitious, yet attainable through coherent resource efficient policies that will deliver deeper carbon emission reductions. As a sovereignty, it can muster both political will and pragmatic strategies anchored on robust legislations and governance structures to strengthen institutional capabilities for mitigation and adaptation goals. Choosing to be complacent as a nation that presently accommodate the largest populations of 198 million in Africa (based National Population Commission, NPC 2017 estimate), coupled with the responsibilities of managing the continent's largest economy of US\$406 billion (World Bank 2016), is grave for its growth and developmental agenda. Especially, an economy currently on recession, with development constrains ranging from insecurity, inefficient energy mix, severe poverty, ethnicity, and other economic complications. In its NDC submission, it proposed, "economic and social development, to grow its economy 5 percent per year, improve living standards and electricity access for all." It also set an unconditional target of 20 percent and a conditional mitigation of 40 percent, with key measures of ending gas flaring by 2030; accelerate off-grid solar PV of 13GW (13,000MW) at 2 percent per year energy efficiency (30 percent by 2030); improvement in electricity grid and development of climate smart agriculture and reforestation programme and the emission per US\$ (real) of 2015 GDP 0.873kg CO₂e target to 0.491kg CO₂e in 2030. This however, presently contrast post Paris Agreement Sustainability metrics as compiled in Table 2. The cost of delaying its contributions will worsen GHGs concentration with other attendant socio-environmental implications that might worsen its vulnerability to climate change impacts. Integrating adaptation and mitigation strategies in development policies through measures that forestall reactive climate actions is not indispensable. Even though the NDC targets provides the baseline information on inventories of greenhouse gases emissions, mitigations, vulnerabilities and adaptation, awareness and proposed projects for further monitoring and mitigating climate change, the enactment of the National Climate Change bill that legitimises institutional structures for a comprehensive response plan is still pending at the national legislature.

Table 2. Key Post Paris Agreement Sustainability Metrics

Year	Aspect	Details
2016	T CO ₂ /kUSD/yr	0.082
2016	GDP (Current US\$ billions)	404.65
2016	GDP Growth rate (annual %)	-1.6
	CO ₂ emission (metric tons per capital)	0.55
	Forest Area (sq. km) (thousand)	11.8
	Gas Flared (MSCF)	2015 - 341,372,264, (11.65%) 2016 - 312,448 053, (11.25%)

Source: Author Compilation

1.3. Milestone of National Climate Change Plan

In a mitigation plan that provides a cross-cutting framework for low carbon, high growth, sustainable path for national development, the country proposed a 45 percent reduction of Green-House Gas (GHG) emissions intensity of GDP by the year 2030 in contrast to the base period records of between 2010

and 2014. Focusing on key economic sectors (petroleum resources, transportation, energy and power generation and agriculture), it pledged to eliminate gas flaring, transform the transport sector by replacing cars with buses; institute climate smart agriculture; deploy off-grid solar, attain energy efficiency and engender massive reforestation across the regions. The Ministry of Environment reported the conceptualization of a National Climate Change Strategy and Action Plan (2018-2022) that outlines a roadmap for implementing its blueprint; awareness creation and rapid capacity development of multi-sectorial stakeholders to bridge knowledge gaps. It initiated global climate finance by developing a National Readiness Plan for assessing the Green Climate Fund (GCF), a pipeline of low-carbon infrastructural projects submitted to the Green Climate Fund for financing; the Sovereign Green Bonds mechanism raised capital and promoted investment for mitigation and adaptation green projects linked to the NDC. It provided a platform to redirect resources efficiently with dual impact of attaining development targets in power generation and agriculture as well as strategic solutions to control GHGs emission. The recently launched programmes to increase access to financing, including the Commercial Agricultural Credit Scheme (CACS), the Anchor Borrowers Programme and the Nigeria Incentive-based Risk-sharing System for Agricultural Lending (NIRSAL) and grants to rural farmers have improved land cultivation and food sufficiency across the country. In addition, the Petroleum Resources Ministry recently enforce stiffer penalty on gas flaring and accelerated investment on large-scale natural gas distribution networks as a first-line solution to curb the easy gas flaring option. Capacity building projects, advocacy, tree planting and renewable energy/energy efficiency initiatives were other programmes that have been deployed.

2. KEY ECONOMIC SECTORS DRIVING CARBON EMISSIONS REVIEW

The NDC is laudable in theory but the practicalities of midwifing the national preparedness and attainment is more complex than the existing programmes initiated by the government as a national actor. The ability to fully attain the commitments lies beyond different tiers of government to the very large informal sector not adequately captured in national planning, which is a reflection of the huge inequality gap and the Human Development Index (HDI) of 0.532 that ranked among countries with the low HDI group. Combating the menace of climate change is a collective and inclusive large-scale efforts that galvanizes stakeholders' submission as implementers of efficiently designed programmes that trickles down to the grassroots. Therefore, this paper though cannot exhaustively capture the entire national scorecard, rather it is an independent but scholarly assessment of national benchmarks vis-à-vis the gaps and compliance in key economic sectors associated with high carbon footprint. Data for this review were sourced from reports and research findings from both statutory regulatory agencies, local research institutions and multilateral developmental agencies.

2.1. PETROLEUM RESOURCES

2.1.1. Natural Gas Flaring

Energy efficiency that reduces energy consumption and related GHG emissions has become a prime consideration for new power generation development projects. Under the Clean Power Plan (EIA 2015) transition to renewables, the 2040 projection for the contribution of wind (14 percent) and solar (6 percent) to

total electricity output is significant. But clean and renewable energy sources is presently constrained by technical and cost efficiency, thereby portending adverse effects on growth potentials for full penetration. The country's 192tcf of gas endowment positions its reserve as the 9th largest gas nation and the seventh-largest gas flaring globally. Hydrocarbon exploration and production processes flare significant amount of associated gas as by-product daily, a potent source of Green House Gas emissions. Gas flaring is prevalent in several local oil fields due to governance, technical and economic lapses. Around Port Harcourt metropolis, partially processed hydrocarbons from illegal crude oil refineries and the poorly organised operations of local enforcement agencies, in retrieving and evacuating stolen crude oil releases black carbon soot into the atmosphere. The national oil company (NNPC) statistical bulletin showed that about 313 Billion Standard Cubic Feet (BSCF) of gas was flared in 2016, a significant improvement from the 341BSCF flared in 2015 from about 140 flare sites across the country; in line with the national climate change plan. The latest gas flaring report published by a new media TVC show that 216.5 billion was flared between January and September 2018. A more audacious commitment to atmospheric GHGs concentration through elimination of routine flaring by 2030, the Nigeria Gas Flare Commercialization Programme (NGFCP), is pursuing a 2020 target date. This is attainable through strategically developing innovative approaches deliberately aimed at ending gas flare by improving energy efficient installations and harnessing gas from major flare sites, for viable utilization in power generation and other gas related projects.

As a country rich in natural gas rich, yet electricity challenged, with less than 5000 Mega Watts (MW) peak generation, an intervening strategy for balancing the energy mix in the short term, is to invest heavily on flexible power grid that carefully harness natural gas in the immediate absence of commercial wind and solar power plants. As the pursuit for cleaner and renewable energy sources persist, natural gas is predictable, flexible and attractive fuel for currently underperforming grid reliability in the interim as backup source for the fast-growing penetration of wind and solar generation. More so, gas plants as complements to renewable, can quickly ramp up electricity generation when the wind and/or solar energy sources faces challenges. The achievement will deeply support the national policy to curb the ecological, social and economic impact of gas flaring especially in the predominantly agrarian host communities as well as provide electricity for about 75 million Nigerians (World Bank 2016) without access to electricity supply. Efficient resource consumption through a robust gas sector development for electric power generation remains key to cascading the gas flare-out benefits for its growing local demand for socio-economic development. By absorbing applicable social, economic and environmental guidelines, development practitioners should cognise frameworks that continually addresses root causes, but are conscientious of ecological resources as carbon sinks and reservoirs for greenhouse gases (Oka 2017). This is pending a clear roadmap for efficient and effective energy transition to forestall abrupt changes in fuel mix that can further distort the economic development plan, ripple societal resilience and affect other global sustainable development indicators.

2.2. ENERGY AND POWER GENERATION

2.2.1. *Power Generation and Transmission Losses*

Grappling with protracted energy generation crisis, Nigeria has an installed capacity of 12,522MW (Mega Watts), broken into 1,930MW from Hydro and Gas 10,592MW plants, with a current generation capacity of about 3,879MW and a transmission capacity of 5,300MW for a 2017 estimated population of about 198 million. Out of the 3,879MW generated, 85 percent is fuelled by natural gas and estimated 46 percent of energy generated is lost due through technical, commercial and collection issues (Nigeria Power Baseline Report 2018). The International Energy Agency (IEA) reports that Nigeria produces 254.3 Mtoe (Million Tonne of Oil Equivalent), consumes 26.2 TWh (Tera Watts Hour), imports 139.4 Mtoe and total primary energy supply (TPES) of 139.4 Mtoe. According the Nigerian Electric Regulatory Commission (NERC), the current national transmission wheeling capacity is 5,300MW with an average operational generation capacity of 3,879MW which is below the total installed generation capacity of 12,522MW. Capacity utilisation (currently at 31 percent), transmission and distribution losses are put at 19 percent. Experts proffers that injecting energy leakages back into the national grid, will reduce CO₂ emissions of 64.4MT (IEA 2015). More significantly, the daily combustion of millions of litres of fossil fuels by domestic and industrial consumers from unregulated self-help power generation appliances to augment electricity supply deficit, is a huge source of CO₂ emissions that have resulted in series of household fatalities reported to have inhaled toxic fumes in many homes across the country. The challenge that must be confronted immediately, is conceptualising a business and technical framework for efficient low carbon environmentally and cost energy generation solutions that accelerate policy enablers' ability to provide immediate affordable and efficient energy consumption options to vast majority of Nigerians.

2.2.2. *Renewable Energy Diffusion*

The existing major renewable energy source is hydro-power and biomass, whilst wind is still evolving in the northern part of the country. Solar energy is gradually gaining traction mostly amongst urban centres domestic cluster, public infrastructural deployment for street lighting, small irrigation project and water pumping for agrarian communities. Aiming to utilize the country's vast and largely untapped potential for renewable power energy, the federal authorities proposed that 2,000 MW of its energy needs to be generated using renewable sources by 2020. The new regulation mandates electricity distribution companies (DISCOs) to source a 50% minimum electricity procurement requirements from renewables. Electricity procurement from small renewable energy power plants ranging from 1 MW to 30 MW is therefore expected to be integrated into the grid, whilst a new feed-in tariff policy for larger renewable energy projects has been developed. However, with the population size outside the electricity grid, renewable energy power source provides a faster, cheaper and sustainable alternative. Renewable off-grid solutions can serve households in remote locations, with economically inefficient energy consumption for grid connection and buffer for unstable on-grid power supply consumers. This however require a robust logistics plan that ease affordability, supply to rural settlements, by creating an extensive distributors' network that will foster cross-country deployment. Reports from pre-existing energy efficiency improvement schemes have proven that affordability,

willingness to pay and effective payment mechanism make technology attractive to customers in off-grid communities.

2.2.3. *Weak Power Generation Structure and Air Pollution*

Energy poverty leaves about 55 percent (about 95 million) Nigerians lacking electricity access, and those connected are compelled to endure epileptic supply and interruptions. With a per capita power consumption of 151 kWh in a net energy availability of 3.1 GW, this value chain bottlenecks mean that households, businesses and public institutions must explore alternatives source of bridging the supply gap through self-help. World Bank estimated that 41 percent of local businesses generate their own power supply to bridge the national grid supply. Estimates suggest that between 8 and 14 GW of decentralised diesel generator capacity is currently installed in the country. About 86 percent of the companies' own or share a generator and about 48 percent of their total electricity demand is covered by these private generators (GIZ; Mar 2015). The rural and urban poor without access to electricity resort to traditional biomass as energy source. Systemic efficiency will boost sufficiency across the energy value chain and accelerate other development indices with attendant impact on economic efficiency. Yet air pollution is one of the greatest environmental risk that cause over 3 million annual premature deaths globally (WHO). It reports that declining urban air quality contributes to high risk of stroke, heart disease, lung cancer, and other chronic respiratory diseases. Additionally, WHO data (2016) rated some Nigeria cities amongst the list of top twenty most polluted globally. This reality is attributable to the high reliance on high-carbon fuels for domestic cooking, arbitrary burning of waste, traffic pollution from most poorly maintained obsolete vehicles and hazardous emissions from the earlier highlighted self-help power generating dependency. This uncontrolled emission of greenhouse gases exposes the entire ecosystem, especially human populations to health hazards and the challenges of greenhouse gases concentration.

2.3. TRANSPORTATION

2.3.1. *Automotive Pollutants*

Relevant Ministries Departments and Agencies (MDAs) spearheaded by the Standard Organization of Nigeria (SON) collaboratively reviewed the sulphur content specification for its petroleum products. The maximum sulphur levels were established at 50 parts per million (ppm) for diesel (AGO-Automotive Gas Oil) from the previous 3,000 ppm on diesel, 150 ppm for petrol from the previous 1000ppm and 150 ppm for Household Kerosene (HHK). This is anticipated to reduce toxic emission from automotive engines fuel combustion across its transportation spectrum. In concentrated foreign imported used car market of 11.5 million vehicles (NBS 2017) plying the local road network, of which 53.8 percent are commercially deployed, whilst 44.5 are privately owned. Emissions from large scale used vehicle imported into the country annually contribute to atmospheric pollution. Also with the effective enforcement of existing local transportation and motor vehicle inspections laws, pollution control from poorly maintained vehicle and high mileage engines can worsen atmospheric air quality in most congested urban centres like Lagos, Kano and Port Harcourt. Efforts by relevant authorities to re-emphasis strict adherence to existing standards amongst local lubricant blending plants, imported lubes and fuel quality can control the combustion efficiency of internal combustion engines.

2.4. AGRICULTURE DEVELOPMENT

2.4.1. *Forest Resource Management*

Forestry is vital in carbon sequestration for carbon emission control and regulating local air quality. Reducing the severity of arbitrary tree felling, desertification and reversing land degradation is germane for ecological conservation and overall national development plan. Between 1990 and 2015, the country lost about 35 percent of its remaining forest resources and over 50 percent of other wooded land (FAO 2015), ranking it among the countries with the highest rate of deforestation. Its forests have been dwindling at an annual rate of 3.5 percent per annum over the last three decades largely due to pressures from the agriculture, industrial production, human settlement and infrastructure development sectors. Also, extraction of forest products, illegal logging, demand for firewood and charcoal, and grazing of livestock have also contributed to the degradation of forests. IEA reports show that around 85 percent of locally consumed energy, 99.3 Mtoe annually comes from biofuels and waste. From the total biomass consumption, 58.4 million is from firewood according to the Energy Commission of Nigeria (ECN). Almost 90 percent of that energy is for residential consumption. This means that biofuels and waste covers about 98 percent of the energy demand in the residential sector. This is against the backdrop of Stern Review (2006) that highlighted that depletion of natural forests contributes more to global emissions than the transport sector. Therefore, curbing deforestation is an a cost-effective approach for emissions control. Additionally, harvesting trees as domestic cooking fuels depletes soil nutrients and cover, a practice that is harmful to overall health of the forest. Likewise, oil spills from damage underground pipelines and storage tanks are regular occurrences that renders vast expanse of forest formations and water bodies unproductive in fossil fuel extraction region of the country.

2.4.2. *Land Degradation*

Soil erosion, poor domestic and industrial waste management, oil spillage etc., all are having heavy toll on natural vegetation in the country. The national environment ministry disclosed that the south-eastern region is currently experiencing destructive gully erosions. An estimated 3,000 erosion sites, spanning 10 km long with multiple fingers spreads through the rural or urban landscape. Gullies and areas exposed to erosion have tripled from about 1.33 percent (1,021 km) in 1976 to about 3.7 percent (2,820 km) in 2006 and a recent estimate indicate that about 90 percent of the total land area of the country is under some form of soil erosion, to an extent that about 6,000 km (about 6 percent of Nigeria's land mass) is severely degraded. In spite of the heavy toll of oil spill from ruptured pipelines along the pipeline network and local Niger Delta communities' saboteurs, the activities of the joint military taskforce, inaugurated to curb crude oil theft and pipeline vandalism have worsened an already threatening situation. Official statistics of land degradation especially from Niger Delta may be underestimated, arising from the destruction of recovered crude oil and partially processed products from makeshift illegal refineries around the Niger Delta creeks with no known systematic destruction procedure. Oil spillage arising from equipment failures, pipeline sabotage and unconventional processing illegal refineries, coupled with the unplanned destruction of recovered fossil fuel products are other sources of grave concern. The Hydrocarbon Pollution Restoration Project (HYPREP), a special purpose vehicle for the clean-up of the devastating pollution of environment around Ogoni was legalized in 2014. However, the proposed clean up exercise to restore the ecological resources in

affected communities to its pristine state is presently wrapped in government bureaucracy and local politics. Likewise, the ecosystem of the north is plagued with severe drought and desertification. This obvious desertification from persistent drought and climate volatility is gradually translating local vegetation of grasses and occasional trees to expansive desert-like areas. It is estimated that the country is currently losing 351,000 hectares of its landmass to desert-like conditions annually that is currently advancing southwards randomly at the annual rate of about 600metres. Lastly, improper waste disposal and collection has resulted to blockage of drainage networks, choking natural vegetation and water bodies, whereas efficient waste management will result in the abatement or total elimination of pollution.

2.4.3. *Agricultural Cultivation*

Food production is becoming a fundamental factor militating against sustainable development goals, and exerting exponential pressure on the natural resource stock. FAO (2015) statistics estimate that 40 percent of land area is deployed to different forms of cultivation, making it the largest transformer of land of all kinds, including 80 percent of global deforestation. Also, its reports that agriculture is a leading cause of land transformation and greenhouse gas emissions - the single largest source of greenhouse gases roughly 30 percent and 17 percent from agricultural production, and another 15 percent from deforestation. This is in addition to being the single largest cause behind loss of biodiversity, and the prime cause behind overloading of nutrients in water bodies. In Nigeria, agriculture provides a strong base of livelihood for a large segment of the population. Despite agriculture being the largest economic sector that employs two-thirds of the labour force (NBS 2014), cultivation bottlenecks have significantly stifled the growth performance of the sector. Total agricultural land is estimated at almost 71 million hectares, which is 77 percent of the total area of the country. In 2013, the cultivated area was 40.5 million hectares, of which arable land covered 34.0 million hectares and permanent crops 6.5 million hectares (FAO 2016).

Planned developments that will require use water from the shallow groundwater aquifer will divert more freshwater from the wetlands for irrigation in upland areas, affecting both the ecology and the irrigated agricultural production in the

floodplain. Current food availability is not commensurate with investments in agricultural production and population growth rate, resulting in declining level self-sufficiency, majorly due to reliance on rain-fed agriculture, poor planting material and weak agricultural extension. The country is annually losing a sizeable portion of its land mass to advancing desert encroachment which is threatening forest formation in far and central northern Nigeria. Urban encroachment, concentration of intensive agriculture around urban centres, salinization from inappropriate agro-chemicals use have exacerbated soil degradation and water resources. Human consumption of water for crop production and the nutritional needs of the growing global population has been ascending. Agriculture appropriates 85% of global surface and groundwater from the water bodies (Shiklomanov 2000). A sizeable portion of the wetlands is continually being depleted due to drought and upstream dams. Sample of the impact of food cultivation is explicit from the Mekonnen et al (2011) illustration in figure 2 below that captures majority of the food crops cultivated across the country and depicts the overall impact of food production on the general water bodies. In predominantly large agrarian economy driven by subsistent agriculture, coupled with existing government policy pushing for large-scale agriculture, water usage for food cultivation is expected to be very high - a threat to sustainable development. In global hunger index, Grebmer et al (2017) reported data that showed Nigeria had worsened from 15.00 in 25.50 in 2015 and remained unchanged in 2017 ranking it as 91 out of 104 countries. It declined from 33.7 in 2008 to 25.7 in 2017 to be categorized as serious in the Index. This is despite the 21 million metric tonnes food production increase between 2011 and 2014 that resulted to a drop in food import. With 4.5 million people in northeast at risk of famine from insecurity, the proportion of the undernourished increased from 6.1 percent in 2009 to 7.9 percent in 2016. Conflict and climate change stagnating agricultural productivity as well as population upsurge, policy distortions and poor infrastructure (amidst poor economic indices as in Table 1), are hitting the poorest people hardest, deepening hunger crisis and increasing inequality. The insufficiency of natural ecosystem to support the sustenance need of the population will eventually result to undernourishment and possibly deteriorate to famine and social conflicts.

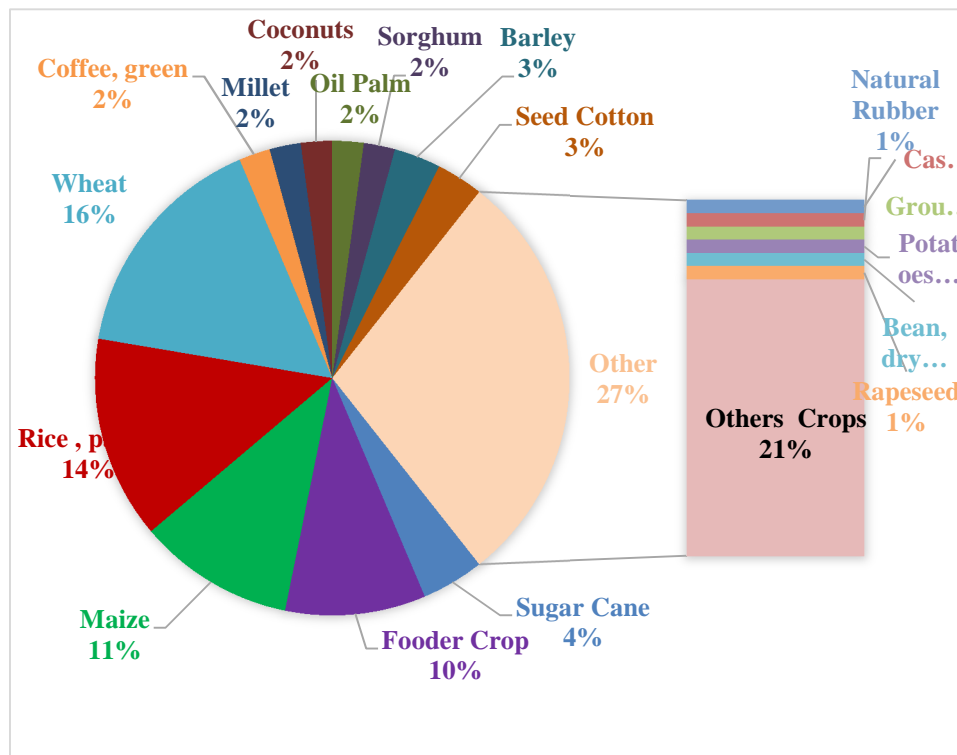


Figure 2. Contribution of different crops to the total global water footprint of crop production – 1996 – 2005. Source: Mekonnen M. M. and Hoekstra A. Y. (2011)

2.5. ECONOMICS PLANNING AND SOCIAL DEVELOPMENT

2.5.1. Economic Recovery and Growth Plan

The Economic Recovery and Growth Plan (ERGP), a medium-term plan for 2017 – 2020, was articulated for the purpose of restoring economic growth, with the understanding of eliminating bottlenecks that impede innovation and market-based solutions through a knowledge-based economy. The ERGP is also consistent with the aspirations of the Sustainable Development Goals (SDGs) given that the initiatives address its three dimensions of economic, social and environmental sustainability issues. Some of the policy objectives include promoting sustainable management of natural resources, addressing severe land degradation & desertification through Great Green Wall initiative and support communities adapting to climate change (e.g., plant trees); implement environmental initiatives in the Niger Delta region like the continued Ogoni land clean-up and reduce gas flaring; attract financing using a Green Bond for environmental projects; establish one forest plantation in each state; rehabilitate all forest reserves and national parks to enhance eco-tourism; encourage and promote the development of green growth initiatives; reducing gas flaring by 2 percent points a year, eliminating gas flaring in 2020 and adding 10 Giga Watts renewable energy mix to local power supply. However, efforts to achieve the NDCs are conflicting with latest economic recovery and growth plans expected to infuse crucial stimulus. The recovery and growth plan that outlines urgent projection of crude oil production increase to as much as 2.2 million barrels per day (MBPD) in the short-term and 2.5 MBPD by 2020 as a strategy to boost foreign exchange; the presidential initiative on fertilizer seek to scale crop production by subsidizing sales price and plan to facilitate coal production for firing power plants, are all in contrast to its Nationally Determined Commitment targets. An NDCs targets that seek elimination of gas flaring by 2030 cannot attain its milestone if post 2015 climate change agreement ERGP plan is anchored on rapid development of hydrocarbon resources.

2.5.2. Population Control

Economic development consume energy, and other natural resources that exerts pressure on the ecological resources, therefore knowledge, through intensive awareness creation, is central to the sustainable development goals. Volatile population growth, global warming, disease epidemics, water scarcity and the declining natural resources stock, threaten the planet's biodiversity balance. With a population of 198 million, with an annual growth rate of 6.5 percent, the country is currently Africa's largest and 7th largest in the world (UN 2018 estimate). Coupled with a relatively high fertility growth rate, the United Nations projects it to surpass the United States of America's population before 2050 to ascend the country with the largest population on the planet. As a natural resource dependent economy, uncontrolled population effects on current per capita levels, agricultural production, industrial and other economic output, and provision of health and other social services should stir certain level sustainability apprehension. This level of population growth can exacerbate the NDC to the global climate change from growing human activities induced build-up greenhouse gases. For a sustainable future, human activities must be designed to consume renewable resources below the natural ability of replenishment, consume non-renewable resources at reduced rapidity otherwise source substitutes with low greenhouse effects. Murtaugh and Schlax (2009) warned that focus should however shift from population growth to environmental impacts of individual reproductive choices that contribute to population upsurge and global resource consumption. The additional challenge of the offspring reproduction decision can ripple additional impacts from potential future generations. Yet emphasis on carbon footprint assessment and monitoring that adopts more resource efficient individuals' lifestyles is crucial as a mitigating strategy.

With the lingering complexities of generating accurate demographic and the policy alignment of population size to resources allocation, spiralling population will create disproportionate physical and social imbalance. Weak policy

therefore poses sustainability bottlenecks for the NDC attainment. Hence, given the impracticalities of previous census exercise, adopting a national population estimate of 198 million and the existing fertility rate, can amplify the consequence of socioeconomic and environmental impacts. Presently, a larger population segment falls within the productive age cluster of 15 – 65 years, reversing immediate climate change impacts amidst volatile, multicultural, fossil fuel dependent economy can foster transformation and resource re-distribution that immediately lower per-capita greenhouse gas emissions.

2.5.3. Rapid Urbanisation

At a present population size of 198 million and density of 217 per square meter, there are cases of rapid urban encroachment from escalating population rate and weak economic opportunities predominantly in rural agrarian areas. As a developing urbanized country, the urbanization growth rate of the maintained environmental standards is creating social dysfunction in most cities, with attendant effects on quality of life and macro-economic potentials. At rural population estimated as 60 percent of the entire population, the 1999 urbanization rate of 35.3 percent, rose to 49.4 percent in 2010 and now 49.4 percent in 2018, with a projected growth rate of 56.8 percent and 63.6 percent in 2020 and 2030 respectively (NBS 2014). Residents in predominantly urban suburbs of Lagos, Kano, Benin City, Onitsha and Port Harcourt etc., where urban centres have extended to rural farmlands, live in poverty and over-crowded settlements characterized by dilapidated buildings, poor sanitary conditions and inadequate social amenities. Such living conditions, can compels households to increase carbon footprint through fossil fuels burning and improper waste disposal that inevitably exacerbates communal fragility. Also, rapidly encroaching urban areas to rural land aggravates urban centres' functionality with exposure to industrial wastes and automobile gaseous air quality pollution prevalent in many cities in developing countries.

2.6. ENVIRONMENTAL DEVELOPMENT

2.6.1. Climate Change Bill – Socio-Economic Impact

Climate change impacts every scale of human development, natural resource governance and global planetary wellbeing. A legislative actionable plan is required to implement the 2015 Climate Change agreements and other related consented conventions or treaties. For developmental transformation, it should encapsulate comprehensive analysis of economic impacts and other related effects on the national and sub-national economic structures. This include distortion of local energy mix, impact on agriculture, labour force, and cost of consumer goods or any other combined implications that might directly impact social wellbeing. The climate change bill currently before the national legislative body seeks to establish a commission focusing on operational areas such as climate change mitigation, vulnerability impacts, adaptation, research and partnerships. The agency that will be responsible for planning and coordinating national policies, climate change and energy, initiating technological use research, acquisition, and deployment for low carbon growth, is anticipated to establish programmes for restoration of local environment through Green House Gases (GHGs) elimination. Additionally, the agency will promote research, survey concerning causes and effects that will help prevent and eliminate hazardous pollutants in compliance with UNFCCC, Kyoto Protocol and related climate change framework. Since the bill has passed a second reading, and at the committee review stage, cautious acceleration of the bill could be a booster to reinforce the country's NDC.

2.6.2. Environmental Performance and Preparedness Index

The Environmental Performance Index (EPI) assess 180 countries globally on 24 performance indicators across a number of vital metrics covering environmental health and ecosystem vitality for policy insights and tracking sustainability trends and attainment. The metrics provide a scaling benchmark for global environmental policy goals. Latest advances in environmental science with specific datasets that identifies problems, track trends, highlight effective policies, identify best practices, and optimize environmental management investment gains compute sustainability levels for each country. According to the index, Nigeria with a population of about 186 million (2016 estimate) on a land area of 910,770 square meter scored 54.75 out of an aggregate of 100, to rank 100 amongst the 180 countries. It ranked 159 in environmental health, 152 in air quality, 168 in water and sanitation, 60 in heavy metals, 23 in ecosystem vitality, 102 in biodiversity and habitat, 21 in fisheries, 10 in climate and energy, 15 in air pollution, 134 in water resources and 72 in agriculture and its SDG index of 48.6. Similarly, a Global Adaptation Index (ND-GAIN 2015) that measures overall country's exposure, sensitivity and capacity to adapt to the negative effects of climate change, evaluated Nigeria vulnerability using six life-supporting sectors food, water, health, ecosystem service, human habitat, and infrastructure scored 0.48 ranking 124 out of 181 countries. Overall, using economic governance and social components, it scored 0.24 ranking 170 out of 191 for readiness in leveraging investments converted to adaptation actions. Lastly, German Watch (2015) assessment of exposure and vulnerability to intermittent and harsh climatic risk preparedness using weather-related loss impacts of fatalities and economic losses analysis, Nigeria scored 111.83 ranking 122 of 182 countries.

3. METHODOLOGY

This study uses comparative analysis using statistical data to assess the country's preparedness and how its prioritise programme design, evaluations, validations and reporting of its objective. It deployed an integrated evaluation using indicators from key multilateral agencies to connect cross-cutting relationships with actual performance. For transparency and objectivity, this paper strengthens its validity by presenting concepts and dataset from statutory public institutions reports, publications and communiques retrieved and compared with Nigeria's NDC submission. Also, qualitative independent reviews using several variables' statistics from scientific papers, reports, books and conference communiques including Nigeria's Ministries, Departments and Agencies (MDAs), multilateral agencies and other neutral research organisations. The logical consistency of this exercise is provisionally supported by applying independent data from climate change research bodies, in anticipation of revealing relationships amongst reviewed some key economic sectors. Despite the strains of sourcing data from several public institutions which made it challenging to exhaustively articulate the scholarly task, sourcing of data from MDAs multilateral partners was supplementary to reinforce possible data gaps.

4. DISCUSSION

Infrastructural gaps coupled with the negative impacts of climate change, desertification, natural disasters and low utilization of mechanized farming hinders service provision and livelihoods opportunities. This currently reflect the existing economic and humanitarian crisis in the North-East region. The sectoral review

shows that fossil fuel extraction is associated with some of the most socio-political and economic complications in the country's developmental projections. However, the country currently experiencing unique growth-related challenge, must audaciously and systematically confront its over-reliance on fossil fuel, dwindling agricultural productivity as well as low value addition in the agricultural value chain. Therefore, with a working commitment to its NDC but lacking cross-cutting strategies for low carbon growth regime amidst other complex social, environment and economic challenges, the country is far from accomplishing its NDC targets. From forestry, to rapid urbanization, oil pollution, population upsurge, electricity transmission losses, land degradation, ambient air pollution and wholesale deployment of fossil fuel powered electricity generating machines; signifies the urgency to deeply rethink its framework with resolute political will. An extensive appraisal of institutional architecture that infuses data analytics for assessing baseline, establishing benchmarks and providing independent monitoring remains significant in implementing climate change policies. This is certainly obvious in its EPI index that shows a lot more is still required to achieve its 2015 Paris Agreement targets.

5. CONCLUSION - SDG IMPLEMENTATION MILESTONE

Certainly, strategy perfection is not immediately expected in measuring, verification, analysis and reporting of data because, ongoing institutional learning and periodic review are required to accelerate milestones. Additionally, every marginal effort at legitimizing institutional policies and procedures can engender coordinated technical monitoring system to the universal emissions-reduction goal. Nigeria must concretize its political commitment by galvanizing its key Ministries and Departments and Agencies (MDAs) responsible for a sizeable portion of its emissions controls through a purposive aggregation of GHG emissions reduction that equalizes the efforts of the state and non-state actors, whilst cognizing an in-depth social resilience factors in implementing a long-term climate change action-plans. Stakeholders must align with policy decisions that galvanise economic structures to attain zero carbon emissions for a healthy ecosystem. With the highlighted data in Table 1, especially with the rate of per capital income (which is lower now compared to 2016 data), Gini Coefficient and the population of citizens with access to on-grid electricity, switching from fossil fuel powered plants might be systematically infeasible but in the existing scenario of unreliable and epileptic power supply for a country that requires the slightest stimuli to bridge the poverty threshold of about 85 million people to the minimum practicable, the existing huge investment natural gas can immediately deployed to jumpstart the economy for the much needed growth impulse. Natural gas is definitely not a clean fuel when compared to renewable energy and poses pollution threats to the planetary systems, but cleaner than coal and other fossil fuels. The imperative short-term need to eradicate gas flaring can alternatively reinject natural gas for green energy generation, pending the conceptualisation of a long-term plan that will involve wholesale transition to renewable energy source. More so, for a country with the largest global poor population and a fragile resource dependent economy to discard its multi billion dollars sunk cost on natural gas infrastructural developments without deriving commensurate return of investments, will be adjudged as reckless and ethically fallacious that can railroad an already challenged economy to desperation with broader implications. Meaningful sustainability pragmatic solutions build socio-

environmental resilience and ignites optimism in the peoples' consciousness. Otherwise the new level of devastation and misery will worsen the initial conceptual objectives that does not concurrently consider the dimensions of ecology and culture as inseparable entities in developmental practice. This means that sustained scaling of renewable energy grid investments which is presently locally less competitive at a pace that far exceed funding in natural gas as a trade-off strategy to bring clean energy power to the people.

From the foregoing, Nigeria should be tele-guided to religiously follow its voluntary NDC pathways in deepening sustainability for its people and shared humanity. This is achievable through adequate regulatory structure that promotes short and long term renewable energy investments plans, innovative financing, technical support development assistance, domestic resource mobilization in alignment with global, national and sub-national partnerships. Reinforcing its commitments, government can mainstream NDC into national policy frameworks through action plans that integrates global benchmarks, using data mapping to address evaluations and an extensive development via institutional capacities strengthening. These can be consolidated into the post Paris Agreement NDC peer-group collaboration network that connect members with tailored solutions for prioritising adaptation actions, low carbon development and sustainable development goals at different levels. Natural resources can trigger new waves of prosperity for existing and future generation through resource-efficient stewardship and governance architecture. Poorly managed, economics instability, social conflict and lasting ecological destruction will reactivate a new virtuous cycle; which can be diffused through inclusive and participatory driven public policies that promote sustainable lifestyles for its over 60 million high carbon footprint middle class.

6. ABBREVIATIONS

AGO – Automotive Gas Oil
 BSCF – Billion Standard Cubic Feet
 CDM – Clean Development Mechanism
 CH4 – Methane
 DISCO – Electricity Distribution Companies
 ECN – Energy Commission of Nigeria
 EIA – United States Energy Information Administration
 ERGP – Economic Recovery and Growth Plan
 EPI – Environmental Performance Index
 FAO – Food Agriculture Organisation
 FMARD – Federal Ministry of Agriculture and Rural Development
 GCF – Green Climate Fund
 GDP – Gross Domestic Product
 GHGs – Green House Gases
 GIZ – German Development Agency
 GW – Giga Watts
 HDI – Human Development Index
 HHK – Household Kerosene
 HYPREP – Hydrocarbon Pollution Remediation Project
 IEA – International Energy Agency
 KG – Kilogram
 KM – Kilometre
 KWh – Kilowatt Hour
 KM2 – Square Kilometre
 MBPD – Million Barrels Per Day
 MDAs – Ministries, Department and Agencies
 MTOE – Million Tonne of Oil Equivalent
 MW – Mega Watts
 NDC – Nationally Determined Contribution

NEMA – National Emergency Management Agency
 NERC – National Electric Regulatory Commission
 N2O – Nitrate Oxide
 NIRSAL – Nigeria Incentive-based Risk sharing System for Agricultural Lending
 NGFCP – Nigeria Gas Flaring Commercialisation Programme
 NNPC – Nigeria National Petroleum Corporation
 PPM – Part Per Million
 SDG – Sustainable Development Goals
 SON – Standard Organisation of Nigeria
 TCF – Trillion Cubic Feet
 TPES – Total Power Energy Supply
 TWh – Tera Watts Hour
 UN – United Nations
 UNEP – United Nations Environment Programme
 UNFCCC – United Nations Framework Convention on Climate Change
 WHO – World Health Organisation

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