

Innovative Approaches for Climate Change Mitigation in Transport Institutions in Nigeria

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Abstract

Accelerating the national and international innovative approaches for climate change mitigation is one of the key drivers for the achieving the objectives especially in developing countries like Nigeria where the policy implementation is becoming very difficult. Transport agencies reducing their greenhouse gas emissions are not in their self-interest because the domestic costs outweigh the domestic benefits according to their tradition. Several inter-governmental agencies are now incorporating innovative climate change mitigation such as managing transportation demand as much as possible by reducing the need to travel. This paper aims to review these programs with paired goals of assessing their success in promoting these innovation, and identifying newly formed innovation Instruments. The paper concludes that all programs reviewed have promoted the innovative approaches for climate change mitigation in transport agencies despite with incomplete implementation of these policies. The research has recommended that the international practices for innovative climate change mitigation approaches should be adopted in Nigeria in order to reduce incidents cause by climate change. Similarly, in future programs, part of the funding of the transport agencies should be dedicated to programs, doing research for new innovative approaches for climate change mitigation in transport agencies and development as well.

Key words: Climate change, innovation, transport, mitigation.

Introduction

Transport infrastructure is one of the pillars of economic development of society and at the same time the largest contributor to greenhouse gases (GHG) emission that largely driven by the road and air transport. Global transport-related GHG emissions are expected to double by 2050 (Organisation for Economic Cooperation and Development, 2012). Transportation is significant to any nation economy, its quality of life and at the same time responsible for the greenhouse gases (GHG) emissions that are warming our planet. Scientists warn that global emissions caused by human activities must be adjusted in order to prevent its consequences within a timeframe of a decade or we face the consequences especially in developing countries where the large majority of the population of the world lives and where the susceptibility to climate change impacts is extreme. The International Panel on Climate Change (IPCC) defines adaptation as the “adjustment in natural or human systems to a new or changing environment”. Whereas the International Panel on Climate Change (IPCC) defines mitigation as: “An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases.” In 2007, scientists from the International Panel on Climate Change predicted that the warming of oceans and melting glaciers or ice can create the rise of sea level up to 5 meters by the year 2100. Transportation activities are responsible for up to 23% of world energy-related greenhouse gas (GHG) emissions. Besides this, the transport sector is the second largest and second fastest growing source of global GHG emissions (Renukappa, 2013). Global transport-related greenhouse gas emissions (GHG) are expected to double by 2050 if no new innovations and policies have been put in place (Organisation for

Economic Cooperation and Development, 2012). Evidence from scientists has confirmed and claims that climate change presents serious global risks for various sectors of endeavor such as water resources, food security, biodiversity, human settlement, health, living conditions, and international peace and security. Therefore, climate change demands a serious global attention and coordinated response on multiple levels (Renukappa, 2013).

The Paris Climate Conference held in December 2015, countries of more than 160 submitted their Intended Nationally Determined Contributions (INDCs) as their plan to decrease greenhouse gas (GHG) emissions and increase resilience. 140 countries INDCs identify transport as an important source of GHG emissions and an area where action is needed. 23 countries INDCs identify their target on transport GHG emission decline and 105 nation states INDCs define their mitigation actions (Löhr, Perera, Hill, Bongardt and Eichhorst, 2017)

There are different innovations used in reducing the greenhouse gas emission in transportation by various countries in the world. The transportation sector is really a major GHG emission contributor that has a lot of discussion but how to decarbonise the sector are still not defined (Löhr, Perera, Hill, Bongardt and Eichhorst, 2017). The United States of America prospect to cut its GHG emissions from the transportation sector in cost-effective and more efficient up to 65 percent below 2010 levels by 2050 is through the improvement of vehicle efficiency, shifting to less carbon intensive fuels, travel behavior change, and operating as well (Greene, Baker Jr, Steven and Plotkin, 2011). Climate models suggest that Africa's climate will generally become more variable, with high levels of uncertainty regarding climate projections in the

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Africa Sahel zone. Temperatures in West Africa, and particularly the Sahel, have increased more sharply than the global trend (Federal Ministry of Environment, 2010).

For Nigeria, a recent study by Department for Food and International Development (DFID) (2009) predicts a possible sea level rise from 1990 levels to 0.3 m by 2020 and 1m by 2050, and rise in temperature of up to 3.2°C by 2050 under a high climate change scenario. This is based on IPCC climate change assumptions, latest research findings and results of a consultation exercise in Nigeria. The low estimate predictions are for sea level rise of 0.1 m and 0.2 m by 2020 and 2050 respectively, and a temperature increase of 0.4 to 1°C over the same time periods (Federal Ministry of Environment, 2010).

This paper has focused on the innovation used in Nigeria for mitigation of climate change causes by transport, their impact to climate change mitigation and the need to adopt new climate change mitigation practicing internationally in order to achieve our goals at national and international level. In Nigeria, The Federal Government's economic growth plan of Nigeria as of Vision 20:2020, Economic Transformation Blueprint (2009), has identifies the climate change as a threat to sustainable growth in the next decade. The federal government of Nigeria recognized climate change as a critical challenge to the world and, in Nigeria, as a potential driver of "damaging and irrecoverable effects on infrastructure, food production and water supplies, in addition to precipitating natural resource conflicts." This recognition is an important first step towards a climate change adaptation strategy and action plan in transformation Agenda 2011 – 2015. The agenda adapts the full priority policies and programs to suite into projects, purposely to ensure continuity,

consistency and commitment of national development determinations. It identified 1613 projects across from 20 Ministries; however, the policy and implementation framework did not adequately address issues of climate change. In order to reveal the increasing importance of climate change issues in Nigeria, the Federal Executive Council in 2012 adopted the Climate Change Policy Response and Strategy. To ensure an effective national response to the significant and multi-faceted impacts of climate change, Nigeria has accepted a broad plan, as well as a number of specific policies such as low carbon to obtain certain objectives. The Nigeria objective is to contribute by taking action to adapt climate change in reducing its impact intensity, increasing the resilience, sustainable wellbeing of all Nigerians, minimizing risks by adaptive capacity improvement, leveraging new opportunities, and facilitating collaboration inside Nigeria and global community as well (Pew Research Center spring, 2015)

Literature

Climate change is among of the greatest challenges that our planet is facing in the future. Transportation is a major contributor to greenhouse gas (GHG) emissions that result to global warming. About one-third of the province's total GHG emissions in Ontario are coming from the transport activities and more than 80% originating from road-based transportation. Combating climate change impact will require less carbon- rigorous forms from transportation and initiate strategies that will reduce the need to travel (Ministry of Transportation Ontario's, 2009). Transportation is essential to nation development, which provides access to goods and services, social and economic benefits but if not properly managed, it lead to the extent of severe environmental, social and economic damage. UNDESA has conducted

a researched which predicted that the world population will reach 9 billion by 2075 and most people will live in cities by 2025. So far this is already the case in industrialized nations; with rapid changes in developing countries that will need assistance to shift toward more sustainable development direction. Health concerns and down fall of living conditions caused by traffic congestion and pollution has become necessary to invite for more efficient, economical, socially acceptable and environmentally viable transport structures and defining limits to fossil fuel resource use for climate change (Commission on Sustainable Development 9 and 18, 2000 and 2010)

Innovation and technology will be an essential in provide responses to climate change, energy security and economic growth. The solutions are achievable, affordable and realistic but will require full determination work and international cooperation to be successfully implemented. To achieve this, we must have a double foresight immediately to apply the available decision in order to minimize this global emission by the year 2020 and spend in the technologies of the future in order to build the capacity to make long-term cuts decision. Copenhagen is the moment for the world to signal this commitment and clearly signpost the path to a sustainable future (The Climate Group, 2009).

In the context of the work of the Commission on Sustainable Development, the transport theme was included in Agenda 21 and the Johannesburg Plan of Implementation as a result of the World Summit in Rio de Janeiro in 1992 and since then part of intergovernmental discussions, among others highlighted in climate smart department (CSD 9) in the year 2000 and (CSD18) in 2010. Transport will also be part of the negotiations at the CSD in 19 May 2011 and an important theme in the United Nation Climate Smart Department

(UNCSO) in 2012. In order to keep the global temperature increase below 2 degrees Celsius, as recommended in the Copenhagen Accord, industrialized countries will need to reduce emissions up to 25-40% below 1990 levels by 2020. With regards to developing nations, they would need to reduce GHG emissions of 15-30% below Business as Usual (BAU) by 2020. For the transport sector alone this would turn to 0.6-1.3 GtCO₂-eq/yr reduction by 2020. This will require determined and coordinated action on the side of developing countries with combines domestic action and internationally support actions through: (a) traditional development, including the multilateral development banks (MDBs), (b) special climate funds like Global Environmental Facility (GEF) and Clean Technology Fund (CTF), as well as (c) dedicated climate mechanisms in the form of Clean Development Mechanism (CDM) and Nationally Appropriate Mitigation Actions (NAMAs) (Commission on Sustainable Development 9 and 18, 2000 and 2010).

Emission from air transportation is expected to increase with income growth in developing countries and an emission from shipping is expected to grow by 150-250% compared to emission levels in 2007. According to the International Energy Agency, transport accounts for 13% of all global GHG emissions and 23% of global carbon dioxide emissions. Transport energy consumption increased by 37% between 1990 and 2005 while carbon dioxide emissions from transport anticipated increasing by 57% between 2005 and 2030. Road transport alone accounted 89% of energy use attributed to transport in 2005, and grew by 41% between 1990 and 2005, compared to 13% growth in emissions related with non-road modes of transport. Almost 60% of total global road transport emissions originate from North America and Western Europe. China ranks third

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in transport related energy consumption and emissions behind the USA and Europe, and tripled its consumption of transport related energy between 1990 and 2005 (United Nations Environment Programme, Green Economic Review, 2011)

The Kyoto Protocol (KP) is a treaty between industrialised and non-industrialised nations that was discussed in Kyoto, December 1997 in Japan under the United Nations Framework Convention on Climate Change (UNFCCC). The treaty was then opened for signing in 1998, closed in 1999, and became active later in February 2005. Under this treaty, industrialised countries are required to reduce their greenhouse gas emissions by 5.2% compared to 1990 levels of emissions but the agreement has not been endorsed by the USA and a few other leading industrialised nations. Nevertheless, the targets for the European Union are set at 8%, the US 7%, Japan 6% and Russia 0%, while increases of 8% has been permitted for Australia and 10% for Iceland. The introduction of the carbon economy has profound implications for competitiveness of cities. The direct implications are that cleaner production. The post-Kyoto discourse on climate change and the need to reduce GHG emissions has taken many twists and turns. At first, the science behind climate change projections was subject to serious inspection by governments which were unwilling to contemplate the large changes that would be required to offset the progression of global climate change effects. The recent United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen in 2009 failed to ensure that a legally binding deal was signed. Prior to Copenhagen 2009, the Bali Climate Convention in 2007 agreed that negotiations would occur on two tracks with working groups dealing with long-term cooperative action (LCA) and the Kyoto Protocol

(United Nations Environment Programme, Green Economic Review, 2011)

The LCA working group was concerned with negotiations on long-term reduction targets for developed countries and on the role and potential of developing countries to engage in mitigation and adaption activities through technology transfer and support from developed countries. The KP working group was concerned with deeper emission cut targets for developed countries, potential amendments to KP, and the role of Clean Development Mechanisms (CDM), land use change, forestry etc. in reducing emissions. Both LCA and KP negotiations should have been concluded by the end of Copenhagen 2009. Perhaps the most significant development at Copenhagen was that the accord recognizes – for the first time – the need to restrict global warming below 2 degrees Celsius. Yet no binding agreement was obtained, and while a 25-40% reduction in GHGs is required of rich countries according to the IPCC. World Resource Institute study indicates that commitments by rich countries range between 13-19% (United Nations Environment Programme, Green Economic Review, 2011)

Paris Climate Conference held in December 2015, countries of more than 160 submitted their Intended Nationally Determined Contributions (INDCs) as their plan to decrease greenhouse gas (GHG) emissions and increase resilience. 140 countries INDCs identify transport as an important source of GHG emissions and area where action is needed. 23 countries INDCs identify their target on transport GHG emission decline and 105 nation states INDCs define their mitigation actions. A high level analysis of the NDC documents carried out by GIZ showed that transport has been recognized as one sector of key relevance for climate change. Due to the imperfect level of information provided in the

official NDC documents, more analysis at the country level is needed to be able to assess the role of transport in the INDC development and implementation process. To gain such insight for the transport sector in rapidly-motorising countries, seven case studies were carried out in the following countries namely: Bangladesh, Colombia, Georgia, Kenya, Nigeria, Peru and Vietnam. Data for the analysis was gathered through literature investigation and stakeholder interviews and complemented by experiences from GIZ's and Ricardo's day-to-day work in countries. Some of the lessons learnt from these countries are (Löhr, Perera, Hill, Bongardt and Eichhorst 2017):

- Lack of transport data limits the sectorial ambition.
- Not in cooperating key transport actors is essential for ambitious sector targets.
- NDC should be more closely associated with transport sector strategies.
- Transport authorities need more climate change expertise.

There are different innovations used in reducing the greenhouse gas emission in transportation by various countries in the world. Transportation sector is really a major GHG emission contributor that has a lot of discussion but how to decarbonise the sector are still not defined (Löhr, Perera, Hill, Bongardt and Eichhorst, 2017).

The scientific evidence is clear that human activity is causing the global climate to change and this activities will still persist that will cause more extreme changes. The need to begin reducing emissions of CO₂ and other GHGs from all human activities sources in transportation sector is supported by many independent scientific sources. The 2010 America's Climate Choices report by the U.S. National Academy of Sciences (NAS, 2010) makes it clear that the earth's climate is changing and majority of these

changes are due to human activity. The NAS concludes that climate change is occurring, caused largely by human activities which causes threat generally to human and natural systems" (NAS, 2010). A report by the U.S. Environmental Protection Agency (EPA) in 2010 identified a number of climate change indicators already evident today. For example, sea surface temperatures have been warming in the last three decades than any other time since large-scale measurement began in the late 1800s, and Arctic sea ice in 2009 was 24 percent below the 1979 to 2000 historical average. In the United States, seven of the top 10 warmest years on record for the lower 48 states have occurred since 1990 (EPA, 2010e). To mitigate future climate impacts, curbing GHG emissions from all sectors including the transportation sector must begin now (Greene, et.al, 2011).

Transportation will have to severely reduce its GHG emissions by 2050 to mitigate the effects of climate change. The three scenarios how different combinations of policies, technologies and behavior could reduce transportation's CO₂ emissions by anywhere from 15 to 65 percent below 2010 levels by 2050. However, at present, it is not possible to conclude with confidence precisely how great a reduction in transportation sector could happen by 2050 (Greene, et.al, 2011).

Reducing GHG emissions from all sectors must begin now in order to minimize climate impacts. While the role of GHGs in changing global climate is well established, there are disagreements about what might constitute unacceptable damage and a range of projected temperature changes and resulting impacts. Many governments in developed countries have called for GHG emissions to be cut by up to 80 percent by 2050 in order to stabilize atmospheric concentrations of GHG. Transportation accounts

about fifth of global GHG emissions, reducing emissions from this sector must be a key part of a global strategy to combat climate change (Greene, et.al, 2011).

Vehicle ownership in Nigeria is currently low by international standards, standing at approximately 29 cars per 1,000 people as of 2010. However, ambition for car ownership is high due to the status of increasing income levels expected to bring Nigeria into line with other countries based on expected per capita income levels. The combined impact of population growth and growing car ownership is expected to increase the private car fleet in Nigeria from 4.65 million to over 20 million over the forecast period. However, growth in public transport and commercial vehicle numbers and activity is expected to be even more pronounced. Passengers traveling by public transport are typically served by para-transit, minibuses etc. These vehicles are usually privately owned and operated to serve the interests of the owner/operator, with intense competition among drivers. GHG emissions are forecast to increase significantly in Nigeria over the forecast period, driven by increasing population, economic activity, and wealth, reaching over 187 Mt by 2035. So far, Nigeria has no stated CO₂ emissions standards for cars. The current average emissions level across the Nigerian private car fleet is estimated to be 214g CO₂/km. This is clearly far behind the standards being adopted in Europe. To put this into context, by 2035, emissions levels in Nigeria are likely far to exceed the level currently generated by the road transport sector across Sub-Saharan Africa as a whole (133 Mt in 2008) (Federal Government Gazette, 2011). In order to reflect the increasing importance of climate change issues in Nigeria, the Federal Executive Council adopted in 2012 the Nigeria Climate Change Policy Response and Strategy. To ensure an effective national response to the significant

and multi-faceted impacts of climate change, Nigeria has adopted a comprehensive strategy, as well as a number of specific policies. The strategic goal of the Nigeria Climate Change Policy Response and Strategy is to foster low-carbon, high growth economic development and build a climate resilient society through the attainment of the following objectives (Federal Government Gazette, 2011):

- ✓ Implement mitigation measures that will promote low carbon as well as sustainable and high economic growth;
- ✓ Enhance national capacity to adapt to climate change;
- ✓ Raise climate change related science, technology and to a new level that will enable the country to better participate in international scientific and technological cooperation on climate change;
- ✓ Significantly increase public awareness and involve private sector participation in addressing the challenges of climate change;
- ✓ Strengthen national institutions and mechanisms (policy, legislative and economic) to establish a suitable and functional framework for climate change governance.

The country Nigeria is considerably impacted by climate change. The north of the country, for example, is highly vulnerable to drought. A recent Bench Research Center global attitudes survey found that 65% of Nigerians are very concerned about the threat climate change poses, ahead of global economic instability (48%). HE President Buhari has stated in his inaugural speech that Nigeria is committed to tackling climate change. Nigeria's intended nationally determined contribution (INDC) demonstrates its determination to contribute to the success of the

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Paris climate summit in December 2015 and to grow its economy sustainably while reducing carbon pollution. The INDC promotes sustainable development and delivering on government priorities. The policies and measures included in the Nigeria INDC will deliver immediate development benefits and do not compromise sustainable growth, on the contrary. Ambitious mitigation action is economically efficient and socially desirable for Nigeria, even when leaving aside its climate benefits. The policies and measures alleviate poverty, increase social welfare and inclusion, as well as improving individual well-being, which includes a healthy environment. Furthermore, by not undertaking these measures, Nigeria would incur significant adaptation costs from intensified climate change. Nigeria has been actively engaged in international climate policy negotiations since it became a Party to the UN Framework Convention on Climate Change (FCCC) in 1994 ratifying its Kyoto Protocol in 2004. Nigeria submitted its First National Communication (FNC) in 2003 and a Second National Communication in February 2014. Nigeria is host to a number of Clean Development Mechanism projects, as well as projects financed by the Adaptation Fund. In September 2012, the Federal Executive Council approved the Nigeria Climate Change Policy Response and Strategy. HE, President Muhammadu Buhari, The President of the Federal Republic of Nigeria on 26 November 2015, approved the Nigeria INDC (Pew Research Center spring, 2015)

Nigeria institutional framework

Nigeria has created a Special Climate Change Unit (SCCU) within the Federal Ministry of Environment with the Secretariat in Abuja, Nigeria. The Unit is created to implement the Convention and the protocol activities. The SCC Unit also has responsibility of coordinating the

activities of the Inter-ministerial Committee on Climate Change with representation from various; Finance, Agriculture, water Resources, Energy Commission, Nigeria National Petroleum Corporation (NNPC), Foreign Affairs, Nigerian Meteorological Agency (NIMET), industry, NGOs (Nigerian Environmental Study/Action Team), and Academic (Centre for Climate Change and Fresh Water Resources, Federal University of Technology Minna; Centre for Energy , Research and Development, Obafemi Awolowo University Ile-Ife; and Abubakar Tafawa Balewa University, Bauchi. There is also a Presidential Implementation Committee on the Clean Development Mechanism (CDM) in the Presidency. With regards to improving the national capacity to create observational climate data and climate monitoring systems, government upgraded the Department of Meteorology in the Ministry of Civil Aviation to a full-fledged Nigerian Meteorological Agency (NIMET) in 2003, which now has a Climate Research Unit for data generation and climatic information dissemination (Federal Ministry of Environment, 2010)

With regards to the political system of the Nigeria, the Senate has a standing committee on ecology (Senate Committee on Ecology) while the National House of Assembly has a standing Committee on Climate Change. Members of these Committees have facilitated the passing of a Climate Change Commission (CCC) Bill in both the House and Senate level. However, there is still no timeframe as to the time the CCC will take off. In addition to the Committees, there is a National Council on the Environment, made up of representatives of governments at the Federal and State levels. The Council meets at irregular intervals to discuss the state of the environment in Nigeria (Federal Ministry of Environment, 2010)

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Climate Change Adaptation in Nigeria

The summary of impacts above shows Nigeria to be highly vulnerable to climate change. The 2014 World Climate Change Vulnerability Index, published by the global risk analytics company Verisk Maplecroft, classifies Nigeria as one of the ten most vulnerable countries in the world. A recent government study determined vulnerability across Nigeria's geographical regions, focusing on the three principal determinants of vulnerability: adaptive capacity, sensitivity and exposure. The relative vulnerability of the six geopolitical zones of Nigeria is shown below. There is a general south-north divide. The three northern zones show higher vulnerability than those in the south. This reflects the higher rainfall and socio-economic development of the south. The south-south shows highest relative variability among the three southern zones, reflecting the challenges of coastal flooding and erosion, as well as the impact of petroleum exploration and exploitation in that part of the country. The southwest is least vulnerable, the northeast, on the other hand, is most vulnerable. Understanding these spatial vulnerabilities is crucial to shaping climate-resilient development in Nigeria. Euro II standards (FGG 2011) were adopted at the end of 2011 for all new and imported vehicles. The import of two-stroke motorcycles was banned although import of large numbers of these high-polluting three-wheelers prior to the ban means that they are wide-spread in many parts of the country. The existing vehicle fleet is made up of aging, high-polluting vehicles, majority imported from western countries only when they approach the end of their economic life. Cars up to 8 years old can be imported, trucks younger than 15 years can be imported and buses less than 10 years old as well (Pew Research Center spring, 2015)

Business as Usual Emissions Projections in Nigeria

Nigeria's economy and population are both growing rapidly, and the population is attaining a higher standard of living. This growth will have a strong impact on future emissions. Following careful review of the re-based GDP data for 2010-2014 and official population projections the "business-as-usual scenario" was developed as part of the preparation of this INDC. This scenario assumes an economic growth at 5%, population growing at about 2.5% per year, all Nigerians to have access to electricity (both on-grid and off-grid) and demand is met, industry triples its size by 2030. Under this scenario, emissions are projected to grow 114% by 2030 to around 900 million tons around 3.4 tons for every Nigerian. Under a high growth scenario, with economic growth at 7%, this rises to over one billion tons (Pew Research Center spring, 2015)

Mitigation Potential Assessment of GHE Emission in Nigeria

The mitigation assessment in Nigeria could be difficult at the moment because the Nigeria is at the phase1 of the INDC. The mitigation actions, which could be undertaken, were assessed in a bottom up manner, building on expert assessments of both the challenges facing individual sectors, as well as a review of policies and measures already in place. The measures included in Nigeria's INDC are expected to deliver significant development benefits. The mitigation actions that bring the largest development benefit are reducing air pollution, indoors and outdoors, with enormous immediate health and social benefits. Secondly, innovation in "clean" technologies brings resource efficiency and produces more knowledge and jobs than those in "dirty" technologies. Thirdly, fiscal reform is proving an efficient mitigation action. This releases significant resources in the

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budget that can fund investments in efficient infrastructure and other fiscal policies, thus creating jobs and fuelling growth. Beyond mitigation actions that could be quantified, several qualitative policies and measures have been identified (Pew Research Center spring, 2015).

Unconditional Contribution of GHE Mitigation in Nigeria

In the event an ambitious, comprehensive legally binding global agreement is reached at Paris convention on climate change, Nigeria will make an unconditional contribution of 20 per cent below BAU that is consistent with the current development trends and government policy priorities. The policies and measures that will deliver these savings are cost-effective, even at the current high interest rate, which constrains investment. They include improving energy

efficiency by 20 percent, 13 GW of renewable electricity provided to rural communities currently off-grid, and ending gas broadening (Pew Research Center spring, 2015)

Conditional Contribution of G Mitigation in Nigeria on International Support

Nigeria can make a significant additional contribution with international support, in the form of finance and investment, technology and capacity building. The combined policies and measures described below can deliver in a cost-effective manner direct development benefits to the country and reduce emissions 45 per cent below BAU. The key measures are an increased level of energy efficiency and a significant reduction in the use of generators, while providing access to energy for all Nigerians (Pew Research Center spring, 2015).

Aspect	Detail
Type of objective	Reduction from Business as Usual (BAU)
Target year	2030
Implementation Period	2015-2030
Base data period	2010-2014
Summary of objective	Economic and social development: grow economy 5% per year, improve standard of living, electricity access for all
Unconditional and conditional mitigation objectives	20% unconditional, 45% conditional
Key measures	<ul style="list-style-type: none"> • Work towards ending gas flaring by 2030 • Work towards Off-grid solar PV of 13GW (13,000MW) • Efficient gas generators • 2% per year energy efficiency (30% by 2030) • Transport shift car to bus • Improve electricity grid • Climate smart agriculture and reforestation
Trajectory [update figure once agreed]	
Emissions per US\$ (real) GDP	0.873 kg CO ₂ e (2015) [0.491 kg CO ₂ e (2030)]
GDP per capita (US\$)	2,950 (2014) 3,964 (2030: real 2015 US\$)

Source: Nigeria's INDC

Short-Term GHE Emission Mitigation in Nigeria

Introduced regulation related to engine technology, prohibiting the import of two-stroke motorcycles and adopting Euro 2 standards as a minimum for all vehicles imported or sold from the end of 2011 (FGG 2011) although import of large numbers of these high-polluting three-wheelers prior to the ban means that they are wide-spread in many parts of the country. The existing vehicle fleet is made up of aging, high-

polluting vehicles, majority imported from western countries only when they approach the end of their economic life. Cars up to 8 years old can be imported, trucks younger than 15 years can also be imported and buses less than 10 years old as well (Pew Research Center spring, 2015).

Long-Term GHE Emission Mitigation in Nigeria (Pew Research Center spring, 2015):

- Modal shift from air to high speed rail
- Moving freight to rail

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- Upgrading roads
- Urban transit
- Toll roads/ road pricing
- Increasing use of Compressed Natural Gas (CNG)
- Reform petrol/ diesel subsidies

International Policy and Implementation on GHE Emission Mitigation on Transport

Business Planning

Any organization that carries a business activities, operation or services must have principles and certain characteristics peculiar to it. Applying the principle of GHG emission mitigation as business priorities, funding requirements and performance measures will ensure that the desirable results and outcomes of the program will be achieved efficiently and cost effectively. Similarly, the implementation stages should go along with evaluation, reporting as feedback for the purpose of correcting any mistake in the policy or during the implementation periods (Ministry of Transportation Ontario's, 2009).

Standard and Practices

Standardization in any aspect is very important especially in transportation system. Incorporating standard in designing, construction, operation and maintenance will seriously help in economy, social and environmentally. Pavement design standard make road construction more sustainable by maximizing the lifespan of the pavement reduces noise, use of raw material, reuse and recycle. These practices will assist in use less energy and less GHG emission (Ministry of Transportation Ontario's, 2009).

Environmental Impact Assessment

Transportation infrastructure is one of the major contributors to climate change and therefore need environmental assessment in carrying any project. Transportation impacts are well-understood and some can be predicted based on experience. Therefore, it will be steward to study any project that will be undertaken to pass all necessary consideration that may affect the environment and offer a proper recommendation (Ministry of Transportation Ontario's, 2009).

Stakeholder/Shareholder

Appropriate communication and involvement of Stakeholders' will add considerable value to the program. The earlier they are involved, the better the result, involving the stakeholders are a powerful mover for change, while ignoring them can lead to failure. Their involvement should include (British Standard Guideline, 2010):

- (a) Focus groups;
- (b) facilitated workshops;
- (c) Early prototyping;
- (d) Simulations.

Employee Education and Awareness:

Employees are important tools that any organization use to initiate, implement any new programs. Therefore, it will be necessary to educate them the basic aspect of the GHG emission mitigation in a formal and informal approach. This can be obtained through (Ministry of Transportation Ontario's, 2009):

- Developing workshop
- Lunch and learn
- Ride-sharing
- Provision of shuttle services

Employee Recognition

Recognizing staff to incorporate sustainable business practices will help drastically in full awareness of the subject matter. There is need for celebrating any achievement or initiative contributes by any staff because this will encourage them to continue to find means to integrate GHG emission mitigation into their activities (Ministry of Transportation Ontario's, 2009).

Legislation and Regulation:

Legislation and regulation is one of the parameters the planners used in trying to stabilize the transportation system. For instant, mandating the use of speed limiters in determining speed, prohibition of old age vehicles will all help in reduces GHG emissions, road safety and fuel economy (Ministry of Transportation Ontario's, 2009).

Infrastructure:

The choices we plan in building infrastructure, how and where to build and how long to stay in operation has an impact to our GHG emission. Expansion of road to reduce congestion, protecting natural and agricultural land and asses the environmental impact before and after the project completion is vital (Ministry of Transportation Ontario's, 2009).

Public Education:

GHG emission issues are all about changing of people behavior in respect to their daily activities for better living. There is need people to be educated on what are expected to change their behavior. Medium that is used to achieve this are (Ministry of Transportation Ontario's, 2009):

- ❖ Incorporating GHG emission in beginners' drivers education curriculum,

- ❖ Preparing and distributing books to schools,
- ❖ Educating people impact on climate change,
- ❖ Educating people on sustainable mode, available mode, travelling information as well as the implication of each,
- ❖ Organizing conferences for all sort of organization.

Benefits of GHE Emission Mitigation on Transportation (Raji, (2017) :

- Shifting to green transportation would help clear the atmosphere of toxic gases since these modes of transportation have few to zero emissions.
- Saves you money by embracing green transportation modes like bicycles, multiple occupant cars, electric motorcycles, ride sharing etc. This will save you a lot from costs related to buying fossils fuels at the filling station.
- Manufacturing and distribution of green vehicles will go along with improving existing transport systems. This will lead to creation of more jobs in the transport sector, hence, minimizing social-economic disparities and building up a sustainable economy.
- Minimize over-reliance on fossil fuels, which drain an economy.
- Improved health by producing green vehicles that are not harmful to human health, so embracing green transportation will only improve a country's health status.
- Reducing the cost of travel due to traffic congestion.

Challenges of GHE Emission Mitigation on Transportation

Increase in Population

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UNDESA has undertaken that the world population will reach 9 billion by the year 2075 and by 2025 most people will live in cities. This situation has already manifested itself in industrial countries and many developing countries are rapidly changing. Improper management of such increase in the population will lead to air pollution, shortage of transport infrastructure, deterioration of water quality and so forth (Ministry of Transportation Ontario's, 2009).

Congestion

A reliable transportation network is essential giving access to goods and services to people. Transportation system is the most vital components of business logistic cost in economic activities. One third to two third of the expenses of enterprises logistic cost is spending on transport (Jeon, 2005). The biggest influence of population in transportation system is traffic congestion. Congestion cost losses in business to significant figure of money from £7b to £20b on different estimate. Therefore relieving congestion is good to economic, social and environmentally (Joseph, 2000).

Creating Green Economy/Reaching Zero Waste

Transportation network is one of the key drivers in any society, hence we do not have chosen between environmental protection and a sound economy. New opportunities can occur from protecting the natural environment and reduces our GHG emission (Ministry of Transportation Ontario's, 2009).

Methodology

The researcher has used secondary data to carry out this piece of research. Some of the reasons that lead to secondary data and not primary

source, there is not much literature on the context of GHG emission even at the federal government of Nigeria level talk less on private sector in the country. Therefore, the researcher has used Intended Nationally Determined Contributions (INDCs) documents submitted by Federal Republic of Nigeria, International Panel on Climate Change (IPCC), UN Framework Convention on Climate Change (FCCC) in 1994 ratifying its Kyoto Protocol in 2004, U.S. National Academy of Sciences and other few journals on GHG emission mitigation in Nigeria. Nigeria is one of the African countries that are located in West Africa which is the most populated country in the entire Africa, with about 155 million people in 2011, about one-sixth of the entire continent. The country is predicting to be among strongest 20 economic countries in the world and therefore call for GHG emission mitigation is equally important before the scenario of negative impact on climate change become out of control.

Results and Discussion

Transportation system is one of the organs of any developed or developing nation which cannot do without it. The functionality of any sector in the world will never be operated efficiently without good existence of transport. Movement of goods, services and companies rely on transportation activities to make their function are all part of transport family. Therefore, human being cannot adopt full live without transportation system and at the time transportation system is one of the major contributor of greenhouse gas emission that create a lot of negative impact in our planet. From what is happening today and base on experience, live is not complete without transportation system. Since we cannot escape from this sector, there is need to improve how transportation system carry out their day to day activities including other companies that rely

their function on transport to reduces this greenhouse gas emission to our planet. There are a lot practices adopted in the world with the intention of mitigation the greenhouse gas emission in transportation activities to our planet such as improvement of technology, human behavior, changing of fuel technology among other.

Nigeria has been actively engaged in international climate policy negotiations since it became a Party to the UN Framework Convention on Climate Change (FCCC) in 1994 ratifying its Kyoto Protocol in 2004. Nigeria submitted its First National Communication (FNC) in 2003 and a Second National Communication in February 2014. Nigeria is host to a number of Clean Development Mechanism projects, as well as projects financed by the Adaptation Fund. In September 2012, the Federal Executive Council approved the Nigeria Climate Change Policy Response and Strategy. Recently, His Excellency, President Muhammadu Buhari, The President of the Federal Republic of Nigeria on 26 November 2015, approved the Nigeria INDC. According to the World Climate Change Vulnerability Index, published by the global risk analytics company Verisk Maplecroft in 2014, Nigeria has been classified as one of the ten most vulnerable countries in the world. Secondly, Nigeria's economy and population are both growing rapidly, and the population is attaining a higher standard of living. This growth will have a strong impact on future emissions.

A recent government study determined vulnerability across Nigeria's geographical regions, focusing on the three principal determinants of vulnerability. The relative vulnerability of the six geopolitical zones of Nigeria shows that the three northern zones illustrate higher vulnerability than those in the south. This reflects the higher rainfall and socio-

economic development of the south. The south-south shows highest relative variability among the three southern zones, reflecting the challenges of coastal flooding and erosion, as well as the impact of petroleum exploration and exploitation in that part of the country. The southwest is least vulnerable, the northeast, on the other hand, is most vulnerable. Understanding these spatial vulnerabilities is crucial to shaping climate-resilient development in Nigeria. Therefore, Nigerian has understood and experienced the negative impact of GHG emission to our planet. The submission of Intended Nationally Determined Contributions (INDCs) by the Nigeria government is a positive movement in supporting the international community in trying to reduce or mitigates greenhouse gas emission to our planet. So far Nigeria is at the phase 1 of the INDC submitted documents that is not more preparation and planning of the implementation stage. Nevertheless, Nigeria government were able to introduced regulation as start and short term GHG emission mitigation related to engine technology, prohibiting the import of two-stroke motorcycles and adopting Euro 2 standards as a minimum for all vehicles imported or sold from the end of 2011 (FGG 2011) although import of large numbers of these high-polluting three-wheelers prior to the ban means that they are wide- spread in many parts of the country. The existing vehicle fleet is made up of aging, high-polluting vehicles, majority imported from western countries only when they approach the end of their economic life. Cars up to 8 years old can be imported, trucks younger than 15 years can also be imported and buses less than 10 years old as well. The assessment of mitigation measures start by Nigeria government is too early mention due to the lack of comprehensive data and measuring mechanism on GHG emission in the country. Therefore, the researcher looks as progress to Nigeria government and Nigerian

citizens as well in term of GHG emission mitigation or control.

Conclusion

Greenhouse gas emission has become a global issue which requires much attention and cooperation among the developed or industrialised nations and developing countries as well in order to reduce its impact on our planet. Nigeria has been actively engaged in international climate policy negotiations since it became a Party to the UN Framework Convention on Climate Change (FCCC) in 1994 ratifying its Kyoto Protocol in 2004. Recently, His Excellency, President Muhammadu Buhari, The President of the Federal Republic of Nigeria on 26 November 2015, approved the Nigeria INDC documents submitted in the Paris climate summit in December 2015 as a support and participation on the international effort in trying to mitigate the negative impact on GHG emission as a result of the human activities and in particular on transport sector as a major contributor. This paper has found that the initiative of the Federal Republic of Nigeria on GHG emission mitigation on transportation sector can bring some changes as per as the phase 1 of the INDC documents is concern. It is too early and difficult to obtain reason data collected on GHG emission on transport that can be access on the implementation of the INDC official documents submitted by the Federal Republic of Nigeria.

Secondly, almost all the parameters used in determining the level or intensity of GHG emission by country or sectors are being aided and access by the international mechanism. Thirdly, there are still shortages of skills personals or experts on transportation sector in Nigeria that can give correct figures on the intensity or amount of GHG emission mitigation achieve based on the INDC documents submitted by Federal Republic of Nigeria. Lastly but not the

least, according to the World Climate Change Vulnerability Index, published by the global risk analytics company Verisk Maplecroft in 2014 which Nigeria is involved, most of transport agencies staff are not involved in this GHG emission mitigation business. Nevertheless, Nigeria will achieve its goal on states, regions; national and international standards as far as these phases of INDC official documents submitted by Nigeria government in the Paris climate summit in December 2015 will be fully adopted and implemented.

Recommendation

According to the literature review on climate change mitigation in Nigeria and the researcher view, the following points must be adopted with respect to climate change mitigation in Nigeria to achieve the objectives:

- Nigeria government cannot fully implement the climate change mitigation as require by industrialised nations without the international funding aid.
- There is need for Nigeria government to provide its GHG emission level by the cars.
- There is need for the Nigeria government to provide the measuring mechanism that will provide precise data on the GHG emission emitted by transport.
- In cooperating key transport actors is essential for achieving the goals in transport sector.
- Special budget should be arrange for climate change mitigation in Nigeria
- Private sector participation and investment into climate change opportunities.
- Climate change mitigation is not an issue of single handle responsibility but need the involvement of 36 states and 774

local government areas in the country for the achievement of the goals.

- Transport authorities must be involves in GHG emission policies and planning for the success of the programmes.
- Nigeria need more transport expert on climate change mitigation for precise and available data.
- There is need for Nigeria government to adopt the international climate change mitigation practices around the world.

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