Talking Points & Contemporary Issues for CEOs WEC (African Indaba) Informal Presentation

For: Wednesday, 19th Feb 2014
Starting @ 9:00am
Ending @: 12:00
Location: Level 2, Boardroom 1/2/3 Sandton Convention Centre

Overview of WEC

- The African energy Indaba is the African nucleus of WEC
- The Global Electricity Initiative (GEI) was launched in 2011 at the COP-17 (Cottee of Parties to the UN Frame work Convention on Climate Change (17 indicate the series of meeting) summit in Durban, South Africa. The initiative was well received and it was agreed to scale up the initiative and cover a larger group of electricity utilities around the world. The new phase was announced in 2012 at COP-18 in Doha, Qatar.
- The initiative is driven by three of the largest industry-based and sustainability networks in the world: World Energy Council (WEC), World Business Council for Sustainable Development (WBCSD) and Global Sustainable Electricity Partnership (GSEP).
- GEI is chaired by Philippe Joubert (Frenchman).
- The objective of GEI is to identify, record and showcase voluntary action that utilities are undertaking to mitigate and adapt to climate change, increase energy access and reduce their global environmental footprint.
- Dr. Amadi is the only West African Regulator on the Indaba, & one of two Africans in WEC GEI

Specific issues laid out for Chairman to tackle

- Chairman should note that the discuss here takes a continental/ global perspective.
- You may then use your Nigerian/NERC experience to buttress or emphasize or exemplify a point.
- **Chairman is to provide perspectives on:**

• Can today's markets structure and existing technologies deliver tomorrows energy for the developing world? Or do we need a new business model?

• What environmental risks may expose tomorrow's energy infrastructure to the greatest vulnerabilities?

Time allowance: 10:50- 11:20

Chairman's total talk time:- 30mins

Matters arising

- 70% of GHGs (green house Gas) come from electricity generation, from industry, buildings and transport.
- If we continue as we are today, economic and population growth will imply tripling of emissions.
- But climate is changing anyway and we have to take measures to adapt to it.
- The energy sector is very vulnerable to this change.
- Most global discuss on solutions to Climate Change focus on mitigation
- Tip: Chair, always remember to approach issues from universal, then Continental & final Country perspective.

CC impacts on the Nigerian Energy Sector

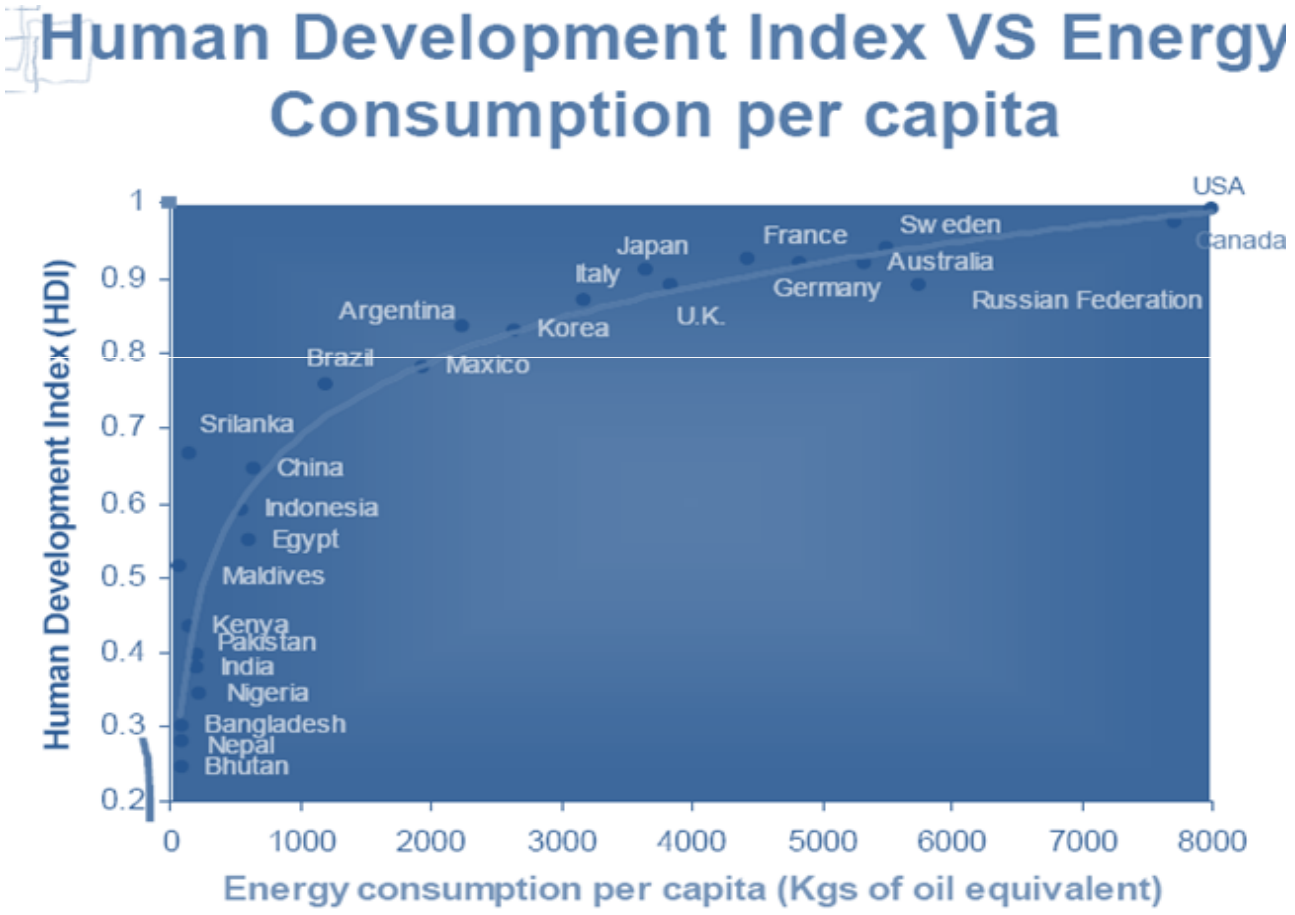
Impacts on energy	Temperature increase	Other CC variables
Gas powered	impact on supply as feedstock is definite & exhaustible.	An ever potent source of ozone depleting green house gas emissions
Hydro power	Increased evaporation reduces generating capacity	Reductions in generating capacity via floods (more storage), droughts (less turbine runoff)
biomass	Technology at very rudimental stages in Nigeria	
wind	Output decreased due to decrease in air density	Most impacts would reduce generating capacity
solar	Efficiency decreases	Reductions in system reliability
Transmission/ distribution	Changes in capacity utilization	Reductions in system reliability

Problem exposition

- Energy in the Future – Petroleum
- At current levels of consumption, the world's oil reserves are expected to last about 40 years.
- There may be some oil that is currently undetected, but it cannot be economically extracted with current technology
- **Energy in the Future – Natural Gas**
- Known gas reserves are expected to last about 60 years at current consumption levels with current technology

The Nigerian Perspective

The conundrum: human development is tied to Energy:- the higher the consumption, the better the development



Dilemmatic Challenges in Nigeria

Poor electrification status

- At a population of 170m, & estimate less than 50% on-grid, over 90m Nigerians without access to electricity
- Many villages yet to be electrified, & thus in serious energy & economic poverty
- Electricity supply situation is still poor even in electrified places
- Over 80% of rural Nigeria dependent on traditionally dirty & unsustainable fuels for cooking
- At present national generation peak of 4500mws & evacuation capacity of less than 5000mws, fierce growth is needed.

The dilemma: since human development is tied to national energy security, what do we do

Urban and peri-urban scenario in Nigeria:

- Rapid pace of urbanization
- Use of commercial energy increasing rapidly in residential and commercial sectors
- Electricity supply plagued with black-outs and brown-outs.

- **Energy security**
  - At the national level
- Energy security is not only about the risks of fuel supply disruption
- Energy security also pertains to fuel price volatility
  - The real risk of volatile energy prices - unpredictable & cause economic activity to decline.

Energy security

- Nigeria is endowed with good renewable energy resources like solar, wind, and biomass
- Especially at rural levels, use of locally available resources will be preferable than using fuels transported from the far-flung areas.
- Renewable energy is more appropriate as the resources are diffused and decentralized.

Part of Nigeria energy strategy is renewable

- Inability of the conventional systems to meet growing energy demands in an equitable and sustainable manner.
- Need to efficiently and economically meet the energy needs of all the citizens, particularly the rural poor.
- But RE don't come cheap & lifespan of most technology is short lived
- To this effect, NERC has designed a generous REFIT to incentivize RE uptake

Smart Grid - Future

- Smart Grid technology changes the way we manage and distribute energy by making our current power grid more intelligent.
- A Smart grid delivers electricity from distributors to consumers using digital technology to save energy, reduce cost and increase reliability.

Embedded/Distributed generation to the rescue

- Captive power generation
  - In my reckoning, may be currently higher than average grid generation
  - Industries will be encouraged to look at renewables for captive power generation, e.g:
- Thermal energy
  - Hot air for drying
    - fish, farm produce, etc.
  - Hot water
    - Leather, dairies, textile, and chemicals, etc.
- Co-generation
  - huge MW potential
    - Sugar, breweries, fertilizer, Textiles, auto, cement, rice mills etc.
    - Our incentivizing EG & BP Regulations are designed to help

Summing up on Nigeria country Review..

- Nigeria has abundant renewable energy resources, which can contribute towards reduction in dependency on fossil fuels.
  - Renewables assume special significance in Nigeria, considering its geographic diversity and size, not to mention the size of its rural economy.
- Nigeria has to chart out a course of action that meets its growing energy needs in a sustainable and environmentally benign fashion.
- NERC under my stewardship is systematically building the new NESI with a clear understanding of the need to mitigate the CC menace, rather than contribute to an already bad situation.
- But we need real time technological assistance, from our western better off counterparts

Part 2

- Tomorrows energy infrastructures & vulnerabilities
- A global perspective

Vulnerability of energy infrastructure to environmental risk

Hurricane Sandy generated an estimated loss of $5 billion for business interruption (Kinetic Analysis Corp). Significant damage to business was due to lack of power, especially for small business (CNN Money, 30/10/2012).

- As a consequence of Fukushima accident Japan faces a severe electricity shortfall. (National Geographic Daily news, 8/3/2012). "The cost to purchase an additional 20 million tons of LNG due to make up for the loss of the nuclear power plant outages will be $44 billion (3.4 trillion yen)".
- *If these damages where unpreventable in developed economies, the African scenario is best imagined.*

Vulnerability of energy infrastructure to environmental risk

Hydropower: Resource Endowment .

- Reduced production impacts already being observed in some regions (Andes cordillera, Zambezi Basin, Rio Lempa basin and the Simú-Caribbean basin of Central America)
- Stability of stream flows is predicted to be impacted. Studies for some rivers in South America confirm this but actual effects are very basin specific.
- An important factor is the competing demand for water especially agriculture, which will alter availability for hydropower.

Vulnerability of energy infrastructure to environmental risk

Hydropower: Energy Supply.

- Climate change adds a significant amount of uncertainty to the already uncertain design and operation of hydropower systems.

- Modeling by the Norwegian University of Science and Technology examined climate impacts on river flows and hydropower generation to 2050. Systems at highest risk had both a high dependence on hydropower generation for electricity and a declining trend in runoff.
- South Africa is quoted as one example with a potential reduction of 70 gWh per year in generation by 2050. Afghanistan, Tajikistan, Venezuela, and parts of Brazil face similar challenges.
- Variations in runoff can be accommodated through increased storage capacity but obviously at an increased cost
- Research by Honodudu University in Norway has found that countries that rely on hydro for over 50% of its energy are vulnerable to environmental risks

infrastructure to environmental risk

Wind: Resource Endowment

- Expected higher temperatures and low humidity in southeastern Europe are expected to be accompanied by shifts in the northern extent of wind fields in the Mediterranean that affect the endowment of wind energy
- Soil instability in permafrost areas affected by warming may compromise construction of wind farms that involve installation of large towers subjected to forces from the rotating turbine.
- Climate variables can also affect vertical wind speed profile; such effects are very site specific.

Vulnerability of energy infrastructure to environmental risk

Wind:Energy Supply

- The energy contained in wind is proportional to the cube of the wind speed, which means that alterations in the latter can have significant impacts on the former.
- Hence any analysis of climate impacts on wind energy supplies should include the frequency distribution of wind speeds as well as the average value.
- Although wind power production is likely to be potentially more vulnerable to the negative impacts of climate change than hydropower generation, wind power systems have smaller life spans, making them more adaptable in the longer term.
- In this context, climate impact studies on wind power systems should focus on the total exploitable wind resource, indicating the future availability of power generation and identifying/prioritizing areas for site-specific viability assessments

Vulnerability of energy infrastructure to environmental risk

Solar Power: Resource Endowment

- Climate change can affect the solar energy resource by changing atmospheric water vapor content, cloudiness, and even cloud characteristics that affect atmospheric transmissivity.
- Solar Power: Energy Supply
- A reduction in solar radiation reduces efficiency. For example, a 2% decrease in global solar radiation will decrease solar cell output by 6%.
- Efficiency would be reduced by higher mean temperatures and could also be impacted by available water

Vulnerability of energy infrastructure to environmental risk (oil & Gas)

- **Resource endowment:**
- Climate change may force the shutting down of oil- and gas-producing areas (for example, those lying on melting permafrost in Alaska).
- But it could also increase the feasibility of exploration in areas of the Arctic through the reduction in ice cover.
- In Siberia, for instance, the actual exploration challenge is the time required to access, delineate, produce, and deliver oil under extreme environmental conditions, where temperatures in January range from –20°C to –35°C. Warming may ease extreme environmental conditions, expanding the production frontier.

Vulnerability of energy infrastructure to environmental risk (oil & Gas)

- **Energy Supply:**

- Oil and gas production from offshore facilities, as well those in low-lying coastal areas, are disrupted by extreme events, such as hurricanes, that can lead to shutdowns.
- Hurricanes in the Gulf of Mexico in 2004 and 2005 resulted in a large number of destroyed and damaged offshore oil and gas structures: more than 124 platforms were destroyed and over 660 structures were extensively damaged.
- Production is also affected by structural damages caused by other extreme events, such as flooding due to sea level rise and storm surges that may cause erosion and other damage.

Vulnerability of energy infrastructure to environmental risk (oil & Gas)

Oil & Gas Resources: Energy Supply

- At high latitudes (for example, near the Arctic), rising temperatures and permafrost melt can compromise the structural integrity of the energy transfer and production infrastructure built upon it.
- Oil refining is a large water consumer and is thus affected by lower water availability. Total water consumption in an average U.S. refinery is estimated at 65 to 90 gallons of water per barrel of crude oil. Some refineries already face water resource competition issues without considering climate change (for example, REPLAN, the largest refinery in Brazil). Water demand in oil refineries can also rise as a result of higher temperatures and its use in cooling units (around 50%).

Environmental vulnerability of Transmission & Distribution

- Extreme winds and ice loads, combined wind-on-ice loads, lightning strikes, conductor vibrations, and avalanches, landslides, and flooding, can cause power transmission and distribution lines to fail.
- Oil and gas pipelines can be impacted by a range of weather and climate factors. Climate change increases the probability, recurrence, and distribution of natural disasters (heavy precipitation, high temperatures, strong winds, and floods).
- For example, two colder-than-normal winters in Russia in 2005–2006 and 2009–2010 led to severe disruptions in natural gas supply to Europe. Electric power transformers failed in the 2006 summer heat wave, impacting several areas of the United States
- On the other hand transport by sea faces some opportunities. E.g. as Arctic sea ice melts at unprecedented rates, new shipping routes will open up.

Summary of impact of environment change on energy

- Households use about 1/3rd of all end use energy and demand is increasing fast (19% between 1990 and 2005).
- In temperate countries about ½ is for heating but cooling demand is growing there as well as in emerging economies in non-temperate zones.
- Various empirical studies have found that total energy demand depends on outdoor temperature in a U-shaped fashion: low temperatures correspond to relatively high energy demand (higher energy demand for heating), intermediate temperatures correspond to lower energy demand, and high temperatures correspond to higher energy demand again (higher energy demand for cooling). This implies CC may have ambiguous effects, depending on region and season. Some studies do however predict increased overall demand. (7-10% in S. Europe by 2050)

Summary of impact of environment change on energy

- Increase in uncertainty about availability of energy from most sources.
- Decrease in generating capacity for many hydropower plants but some possible increases as well.
- Potential decrease in generating capacity for wind and solar (but high uncertainty)
- Complex impacts on liquid biofuels, (possible increases)
- Potential increase in endowment of oil and gas but major increases in risk of disruption to supply
- Increased risk of disruption to transmission and distribution of electricity, oil and gas.
- Changes in pattern of demand with possible overall increases.
- Increase in water demand for energy

Way forward

- Improving knowledge
- Provide higher-resolution models for local and small-regional impact evaluation where most energy facility decisions operate.
- Research the technologies and practices to save cooling energy and reduce electrical peak load demand.
- Space cooling efficiency potential
- Role of regional interconnections to improve resilience of supply systems
- Research how the changing regional patterns of energy use impact regional energy supply, institutions, and consumers.

Mitigating actions

- Actions can be categorized as technological, behavioural and structural.
- Technological actions include:
- Physical protection such as targeted retrofitting of existing infrastructure to address increased in exposure
- Better design of assets in planning stage through improved design standards (e.g. structural footings for new pipeline systems in areas where permafrost can no longer be considered permanent).
- Increased efficiency in use of water. E.g. Amoco reduced its freshwater consumption by 14% and effluent flow by 24% by optimizing techniques.
- New technologies (e.g. Smart grids to accommodate renewable sources with intermittent generation into existing grids).

Mitigating vulnerabilities of energy infrastructures

Behavioural actions include:

- Reconsider location and design of investments. Substantial investments in new infrastructure are likely to take place in next decades as a result of scheduled decommissioning, new development, etc. These should take account of CC impacts, based on improved forecasting tools with positive impacts.
- E.g. Quebec hydropower undertook extensive assessment of likely changes and found that output could fall by 14% with no action, but could increase by 15% with appropriate adaptation actions.
- These measures require climate risks to be mainstreamed into decision-making processes
- *Diversifying energy systems. The level of diversification can have a profound influence*

Adaptation adaptation…

- Win-Win Options - some examples:
- In Malta a smart grid is being implemented that governs both water and electricity. The grid quickly pinpoints theft, leakage and defective meters thus promoting efficient use of energy.
- In Tanzania, hydropower provides 80% of electricity but Central Tanzania faces falls in reserve margins to zero under a high climate change scenario. This could cause a 1.7% decrease in GDP. But current reserve margins could be restored with simple low cost energy efficiency measures currently being pursued

Adaptations…

- Other structural actions include:
- *Decentralizing energy systems, based on locally available renewable sources at secure locations. This would reduce the probability of large scale outages.*
- *Urban design and land use planning. Through building design, codes and standards and changes in consumption patterns.*
- *Integrated Planning. This includes planning for energy sector with others such as water. An example of its application is for Brazil's power system, which evaluated the least cost options power expansion under climate scenarios. It concluded that increased capacity needed by 2035 to compensate or lack of hydro reliability was made up of gas, higher efficiency sugarcane-bagasse, wind and nuclear or coal.*

Adaptations…

- Increasing resilience is key to adaptation in all sectors but specially in the energy sector.
- Main actions that increase resilience are:
- Source diversification
- Measures that postpone high cost energy investments where knowledge on impacts is poor. (e.g. Non-regret options of early warning systems, energy efficiency, demand side management)
- Use of fiscal instruments, which can be changed at low cost as new knowledge becomes available.

Summing up

- The energy sector faces major impacts from climate change; indeed we are already seeing evidence of these.
- There are strong reasons to believe that we face greater variability in parameters that determine energy supply from different sources.
- This means it is critical that we increase diversification.
- We also need to increase our knowledge base on impacts and responses of supply and demand to different measures

Summing up…

- We need to take measures that are technological, behavioural and structural.
- But within these there is a strong preference for those that involve behavioural changes based on fiscal and other instruments. These allow for a flexible response and one that can be modified as more information becomes available.
- At the same time there are opportunities as well as challenges. Let us not forget the former!

Implementation challenges and constraints

- Policy and programme implementation gap is widening and crippling the achievement of desired sustainable development objectives
- Inadequate institutional, human and/or financial resources capacities continue
- High level of financial, technical and technological investments required for the establishment, operation and maintenance infrastructure for transport, energy, mining, waste and chemicals management
- Inadequate incentives to promote pubic-private partnerships that could contribute to overcome the financing constraints.
- Compartmentalized approaches still prevail in the implementation global and regional initiatives notably the various chemicals-related agreements and other (UN-Multi-lateral Environmental Agreements) MEAs. These approaches result in poor coordination, duplication and strain on the limited resources.
- Low research, monitoring and information dissemination capacity

Lessons learned and the way forward

- Generating political will and commitment which is essential in ensuring effective implementation of the strategies
- Effective resources mobilization from both domestic and ODA sources - sustained resources provision
- Enhance access to niche markets - Africa has a distinct potential and opportunity in RE solutions, but lack requisite tech
- Adopting and up scaling integrated initiatives and approaches
- Strengthening the information base
- Cooperation in development and transfer of technology particularly energy efficient technologies
- Linking and coordinating global, regional and subregional initiatives with national development processes