

BEING THE TEXT OF THE 51ST FOUNDERS' DAY LECTURE OF THE UNIVERSITY OF BENIN TITLED: *GLOBAL ENERGY TRANSITION AND THE IMPERATIVES FOR NIGERIA* DELIVERED BY THE MANAGING DIRECTOR, THE SHELL PETROLEUM DEVELOPMENT COMPANY OF NIGERIA LIMITED AND COUNTRY CHAIR, SHELL COMPANIES IN NIGERIA, OSAGIE OKUNBOR, ON THE 23RD OF NOVEMBER 2021.

Good day, Vice-Chancellor ma, and other academic and non-academic dignitaries present. It is such a delight and an honour to deliver the 51st Founders' Day Lecture of this great university.

As an alumnus of the University of Benin myself, this place holds a lot of nostalgia for me. I remember taking lectures at the social sciences faculty and residing at the halls of residence. That was over three decades ago.

Fast-forward to now, in my capacity as the Country Chairman for all Shell Companies in Nigeria and Managing Director of The Shell Petroleum Development Company of Nigeria Limited (SPDC), I am building new memories of the University of Benin, with the reports I get periodically from the postgraduate Centre of Excellence in Geosciences and Petroleum Engineering, endowed by the SPDC Joint Venture to produce industry-ready graduates. From what I hear, most of these graduates have seamlessly entered various economic sectors of Nigeria and are making impressive impact.

Once again, I thank you for this opportunity to speak on a subject that is so dear to me.

THE GLOBAL ENERGY TRANSITION AND THE IMPERATIVES FOR NIGERIA

The lecture for today is titled **the Global Energy Transition and the imperatives for Nigeria**. Without doubt, the subject of the energy industry transition and the need for urgent action due to the impact of fossil fuels (Coal, Oil & Gas) is one of the most discussed and widely debated topics across the globe.

World leaders just signed a climate pact at the recently concluded United Nations Climate Change Conference, COP26, in Glasgow, United Kingdom, early this month. This underscores how very topical and critical the energy transition is.

This is not unusual, because the impact of Energy is far reaching, affecting every single human being. Energy goes hand in hand with economic activity. It lights, heats and cools our homes and places of work. Energy transports and connects people and goods through

various modes of transportation. It is also used in agriculture and in the manufacture of steel, cement, plastics, medicines etc. I am therefore convinced that the current energy transition drive will be the single largest technological revolution known to mankind.

Before I explain further what this current energy transition is all about, let's be students of history for a while.

1. The Evolution and History of Energy Transitions

1.1. The First Energy Transition: Biomass to Coal

Previous energy shifts have unfolded over mankind's civilisation. According to the World Economic Forum, "a transition is not an abrupt change from one 'reality' to another, but rather a shift that unfolds generationally over considerable time, and one that may lead to greater diversity in the energy marketplace".

More than 400,000 years ago, humanity began using biomass - primarily wood but also crop remnants and animal waste for fuel. Wood was an intuitive fuel; it was readily available, and the use of biomass as a source of energy would eventually retain its dominant role in the energy mix for thousands of years.

The signal that a transition was imminent from biomass began when wood supply became scarce in Europe, the world power at that time, and prices became unbearable coupled with the rising human population.

Coal at that time was plentiful and, in many places across Europe, veins of coal could be seen on the earth's surface. The economics of coal also trumped its nuisance factor, so that despite the pollution it generated it became more and more economical to use coal instead of wood.

In 1709, an ironmaster in Shropshire, England, Abraham Darby, discovered a process to turn coal into coke, which releases coal's sulphur as gas. Over the next 50 years, coke would come to replace charcoal from wood, in iron smelting. Darby's invention marked the beginning of the coal era¹, and the iron industry's adoption of coal in Europe became the first energy transition.

Coal delivered, per kilogram, three times the energy of dry wood and throughout the 19th and 20th centuries it was the predominant energy source used in steam engines that powered the mills and factories of the great industrial revolution, and the power plants that

¹ Energy Transitions: Past and Future (World Economic Forum)

produced electricity. The industrialisation of Europe and the rest of the developed world started on the foundation of coal as an energy source.

We cannot easily forget that Nigeria was also blessed with huge coal deposits. Enugu, in eastern Nigeria became famous for its rich and prolific coal mines and indeed was our major source of energy in Nigeria until the discovery of Oil by Shell at Oloibiri in present day Bayelsa State in 1958.

1.2 The Second Energy Transition: The Demand for Oil and Gas

In the nineteenth century, specifically 1859, oil was found in Pennsylvania, United States and its virtues were immediately clear. Kerosene, an oil distillate, became extremely popular in lighting lamps and providing illumination to many households. In the areas of energy density, adaptability, ease of transport and flexibility, humans were gradually turning to oil instead of coal. Imagine the sheer labour required to shovel coal. All of that was not needed with the advent of oil.

John D. Rockefeller, an American, born in July 1839, founded Standard Oil in 1870 and concentrated his business on oil refining. His wealth, soared as kerosene and gasoline grew in importance, eventually making him the richest man in the world as he controlled some 90% of all oil in the United States at its peak.

The industry that truly thrust oil into dominance over coal was the transport industry, with the manufacture of the modern-day car by Henry Ford in 1908. Car ownership, particularly in the United States became the main driving force behind oil. Along with the rising demand for oil, came increased supply in Russia, Saudi Arabi, Iran and of course Nigeria. Owing to the huge build-up of supply therefore, oil was cheap, and by 1964, oil finally took over coal as the world's number one source of energy.

Interestingly, in this current energy transition, which I will explain shortly, transportation is again being disrupted, with the emergence of electric cars and the meteoric growth of Electric Vehicle Companies like Tesla. There is no denying the superiority of oil as a transportation fuel and I believe that it is this sheer superiority that will make a 100% substitution in this sector, difficult, but not impossible.

1.3 Natural Gas: The Slow but Emerging Fuel

The first shallow natural gas well was drilled in Fredonia, New York in 1821, but it took half a century before natural gas gained a significant foothold in the energy sources mix.²

² Energy Transitions: Past and Future (World Economic Forum)

The properties of natural gas initially made it a difficult fuel choice, even in Nigeria. Costly steel pipelines and trucks were required to transport gas from generation points to utilisation outlets. Without an effective way to reach markets therefore, gas was often wasted: allowed to burn/flare and vent into the atmosphere, especially when discovered alongside oil, which was usually the case then.

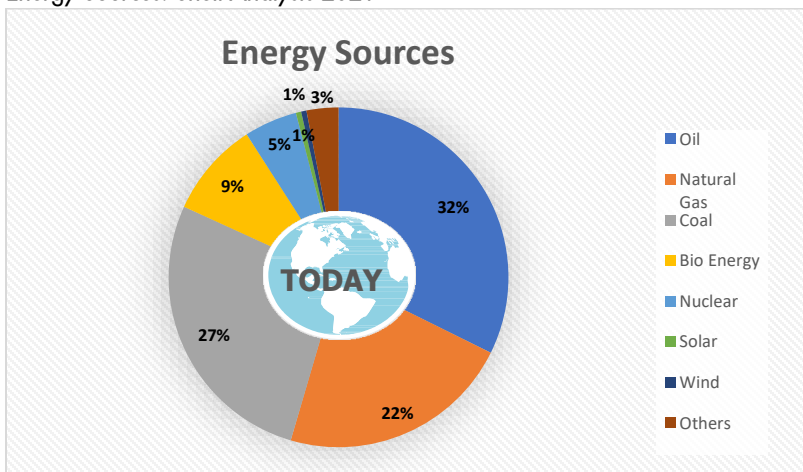
The advent of liquefied natural gas (LNG) however brought gas to the global trade market. LNG allowed gas to be liquefied at extreme pressures and transported across the world in large quantities through specially made vessels. Once the vessel arrives its destination, the liquefied gas is re-gasified and then sent through pipelines to consumers. A truly global LNG market outside of Asia, in my opinion, took off only about two decades ago.

This is the business model of Nigeria LNG, one of Nigeria's crown jewels and owned by the Federal government of Nigeria (49%), Shell Gas B.V (25.6%), TotalEnergies Gas (15%) and Eni International (10.4%).

With the discovery of gas and its many benefits which include: Its cleanness, its environmental friendliness, and its unique properties which make it the optimum fuel for cooking, commercial heating and power generation, gas, is gradually but surely emerging on the global platform as the primary transition fuel, in this current energy transition.

In summary, the evolution of the energy transition up until the 20th century, was driven by the growth and transformation of industries, electrical systems, and transportation methods. The industrial growth and technological advancements the world has seen from the 20th century to date begs the question: why another energy transition?

Energy Sources: Shell Analysis 2021



2. The Current Energy Transition

2.1. The Case for Change

The evolution of the energy industry as I have attempted to summarise in the previous paragraphs had been driven by two primary propelling factors: Industrialisation and Economic advancement. The transition that we are now in, and which has been gradually but rapidly advancing, has at its centre an additional driver which is the Environment.

Emerging scientific research since the start of the 21st century now points out that the cost to our environment, from the current energy sources primarily: Coal, Oil and Gas cannot be ignored.

At the heart of this current energy transition is the drive to reduce carbon dioxide (Co2) emissions, which is the primary source of greenhouse gases emitted through human activities.

The simple definition of a GreenHouse Gas or GHG in short, is, any gas in the atmosphere which absorbs heat and thereby makes the planet warmer than it otherwise would be.³ The warmer the planet, the more vulnerable it is to catastrophic climate conditions, thus making greenhouse gases undesirable.

The main GHGs in the atmosphere are water vapour, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and ozone. Co₂ is however the primary greenhouse gas produced when fossil fuels are burnt.

To tackle climate change and its negative impacts, a global emergency was declared and world leaders at the United Nations Climate Change Conference (COP21) in Paris, reached a breakthrough, called the historic Paris Agreement.

The Agreement sets out long-term goals to guide all nations to:

1. Substantially reduce their global greenhouse gas emissions to limit the global temperature increase in this century to 2 degrees Celsius, while pursuing efforts to limit the increase to even a further 1.5 degrees Celsius.
2. Review their commitments every five years and to:
3. Provide financing to developing countries to mitigate climate change, strengthen resilience and enhance abilities to adapt to climate impacts.

In pursuit of this goal, the agreement calls for a “balance” or what is referred to as “net-zero emissions” where greenhouse gas emissions produced, is the same as greenhouse gases taken out of the atmosphere.

³ Ecometrica: Green House Gases

There have been various commitments by industries and countries in view of the seminal Paris agreement agreed to, by 192 countries in December 2015. The Company I work for, which is Shell, was the first energy company to submit its energy transition strategy to shareholders for an advisory vote.

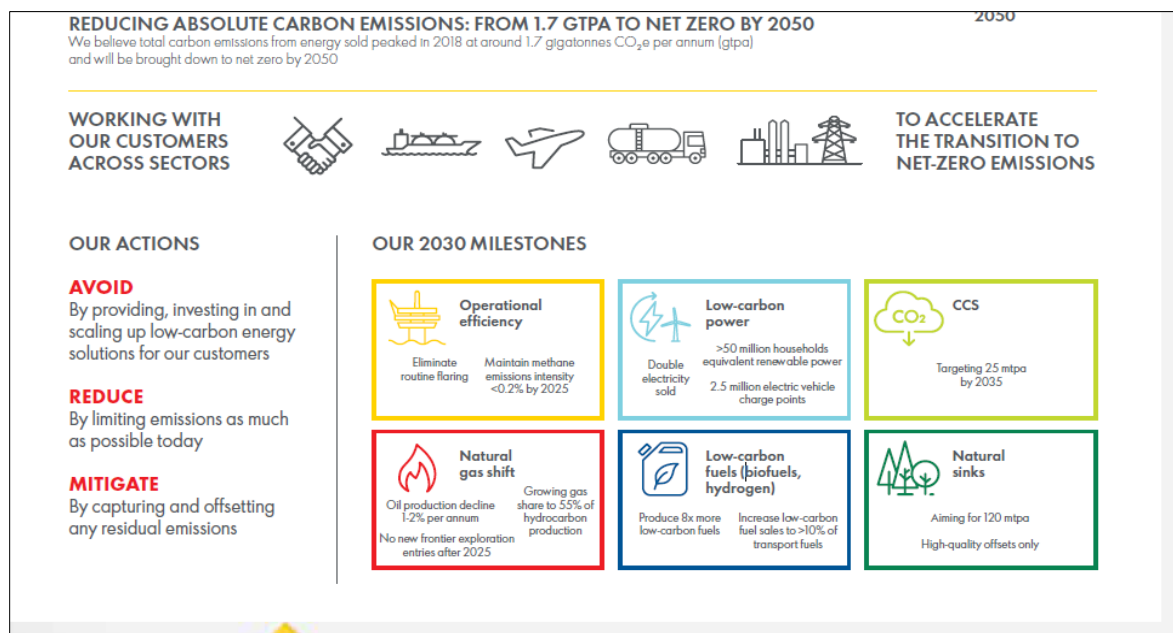
At Shell, we are committed to achieving Net Zero emissions by 2050. This includes all scopes of energy we sell and produce.

As a company, we are clear that while the energy transition brings risks, it also brings commercial opportunities and enables us to build on our positive contributions to society. Our comprehensive energy transition strategy therefore seeks to reduce those risks while enhancing our ability to profitably lead as the world transitions to an energy system that is aligned with the goal of the Paris Agreement.

The diagram you see, describes our short-term energy transition ambitions as a company for this decade.

As a global company, we are approaching GHG emissions reductions from multiple angles:

1. The elimination of routine flaring, which negatively impacts the environment;
2. A shift to natural gas, growing our gas share to 55% of our hydrocarbon production;
3. Low carbon power: Increasing our renewable energy power supply;
4. Production of more low-carbon fuels: e.g. Biofuels and Hydrogen;
5. Targeting the reduction of carbon in the atmosphere through Carbon Capture and Storage (CCS) facilities;
6. Re-forestation and tree planting to take away carbon dioxide from the atmosphere.



2.2. Energy Transition Narrative: *My Views*

In wrapping up this section of my lecture on the current energy transition that is upon us all, I find it necessary share my thoughts as an energy professional on facts that will govern this transition as it most definitely evolves. These thoughts, I must mention, are largely shaped by the broad scenario views of the organisation I work for.

1. Society, as a whole, faces a dual challenge to transition to a low-carbon energy future, which manages the risk of climate change, while also extending the benefits of energy to everyone on the planet. This is a challenge that requires changes in the way energy is produced, used and made accessible to people.
2. The transition is underway, but it will move at different paces and produce different outcomes in different countries depending on local factors. Unexpected events, such as we have seen with the COVID-19 pandemic, may create additional challenges or provide opportunities to accelerate progress.
3. A transformation of the global economy is required, especially in the power sector, transport, buildings, and industry – four main areas where energy is consumed and that produce a significant proportion of energy-related emissions of CO₂.
4. Shifts in the consumption of energy within these areas will determine the long-term energy mix. To tackle climate change, power generation, for example, must evolve to use a combination of more renewable sources of energy, as well as natural gas – the cleanest-burning of the hydrocarbon fuels.
5. When most people think of energy, they think of electricity. In fact, today, electricity is just under 20% of total energy for end use. Increasing use of renewable sources of energy is essential in a transition to a low-carbon future. But they chiefly produce electricity. So, for renewables to have a bigger impact, the use of electricity will need to be extended to a larger range of activities.
6. The move to using electricity generated by low-carbon and renewable sources will be relatively straightforward for some parts of the economy, such as in the manufacture of clothes and food. These require low-temperature processes and mechanical activities, for which electricity is well suited to deliver.
7. Other sectors, such as industries that produce iron, steel, cement, plastic, chemicals and certain types of transport, currently rely on the unique ability of hydrocarbons like oil, natural gas and coal to provide extremely high temperatures, chemical reactions

or dense energy storage. Many of these cannot be electrified at the moment, using current renewable technology, or maybe they can, but at a prohibitively high cost. Bold and ambitious technological advancements and changes will need to happen to advance these sectors in the value chain.

8. To accelerate the change, governments need to introduce long-term policies that reshape main parts of the economy as well as enable the development of lower-carbon and renewable sources of energy, supported by the right technologies. This will help minimise economic and environmental costs to society.
9. Finally, I believe oil and gas will remain in the energy mix for some decades to come. This is partly a consequence of the time needed for renewables to reach the necessary level of materiality. In part, it is also a consequence of the lack of substitution options in some parts of the economy as earlier highlighted. But the world will need to meet its energy needs at the same time as it tackles climate change.

3. Imperatives of the Energy Transition for Nigeria

Nigeria as a developing oil and gas exporting country is clearly at the crossroads with respect to the ongoing transition.

Not only do we require increasing levels of energy due to our population increase, industrialisation and economic goals, we also generate over 90% of our external foreign exchange earnings from the sale of oil and gas resources. The planned, gradual, global transitioning, away from oil and gas is therefore cause for quick strategic thinking and collective action.

At the COP26, our President committed Nigeria to delivering net zero emissions by 2060. This was not without pointing the attention of developed nations to the following cardinal points:

1. Industrialised and advanced economies had access to stable and abundant supply of relatively cheap energy: Coal, Oil and Gas. They are therefore responsible for the current climate crises as underdeveloped countries like Nigeria have contributed very little to historical GHG emissions. As a result, limiting our use of the same energy sources, utilised by these industrialised countries, without viable, inexpensive options, implied a curtailment of our own industrialisation.

2. Monetary commitments pledged to support developing countries in transitioning, based on the Paris Agreement of 2015, were still unfulfilled and needed to be made good.
3. Nigeria, as a country with natural fossil fuel resources, cannot afford for international and multilateral agencies to stop funding the development of fossil fuels, particularly gas projects.

Based on the above, Nigeria's approach to the ongoing energy transition presents opportunities that can be strategically delivered. A simple, in parallel, 2-fold approach should be:

1. To maximise value from existing oil and gas resources whilst paying close attention to the industrial development of our country.
2. Intentional growth of the off-grid power and renewables industry taking advantage of foreign financial support and technology transfer.

Let us look at both approaches in a little more detail.

3.1 Maximising Value From Existing Oil and Gas Resources

On a global basis, natural gas emits around 45% lower greenhouse gas emissions than coal. It is globally agreed that it is a transition fuel in the current energy transition.

Fortunately, Nigeria has gas in abundance. According to latest estimates from the Nigerian National Petroleum Corporation (NNPC), Nigeria has around 202 trillion cubic feet of proven gas reserves and about 600 trillion cubic feet of unproven reserves. Harnessing these vast gas resources and on time too, is key in the next decade of Nigeria's existence.

The Minister of State for Petroleum Resources has declared this decade, a decade of gas for Nigeria, but it needs to go beyond that. We need to, in particular, unlock the gas market across seven thematic areas:

1. Unlocking the domestic gas-to-power value chain.
2. Accelerating infrastructure development plus virtual pipelines.
3. Driving gas-based industrialisation.
4. Deepening domestic liquefied petroleum gas penetration.

5. Building a stable regulatory environment anchored on a willing-buyer-willing-seller pricing regime.
6. Growing the export and regional gas market; and
7. Building local capacity and content for contractors and professionals in the gas sector.

Shell Companies in Nigeria are very clear on the potential that gas holds to accelerate industrial and economic growth in Nigeria and are heavily invested here, across the entire value chain of gas Upstream, Midstream and Downstream.

Let us look at the second pillar:

Intentional Growth of the Off-Grid Power and Renewables Industry

Power and electricity are at the centre of industrialisation of any country and with the current global push for more renewable energy sources plus our unique in-country, access to energy challenges due to inconsistent and unavailable grid power, we need to intentionally ride the wave of global support to grow this budding renewable energy sector.

Shell is making huge strides in Nigeria in this energy space.

Through targeted investments on the platform of Shell's Energy Access team and our fully seeded impact investing company, All On, we aim to catalyse efforts to close Nigeria's energy gap by investing in the renewable energy business, primarily solar.

So far, All On has invested over \$21 mln in 40 off-grid energy companies in Nigeria and has driven over 40,000 solar connections across Nigeria to date.

Imagine the collective impact from concerted policy and financial support in this direction from both the public and private sectors of Nigeria.

CONCLUSION

In conclusion, the ongoing energy transition is here with us. As with other transitions, it is a journey that will involve multiple approaches, collective action and undoubtedly present, new challenges and opportunities.

Nigeria is well positioned to ride the wave of the current energy transition with its abundance of natural fossil fuels and renewable solar energy. We need to move with a greater sense of urgency and a clear sense of direction.

As one of the foremost universities in Nigeria, University of Benin has played significant roles in research, education, and advocacy. You can only deepen this role in this era of

massive investments in low-carbon energy options and the rapid buildout of technologies that have never been deployed in Nigeria.

I look to see the academia and graduates from this university who will build these low carbon technologies and lead Nigeria into the emerging decades where renewable energy takes a more prominent role in the energy mix, thereby creating more economic opportunities for Nigeria and Nigerians.

Thank you.

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