

## Maximum energy, minimum emissions strategy

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### Abstract:

Carbon dioxide (CO<sub>2</sub>) emission or the greenhouse gas (GHG) emitted into the atmosphere over several decades, has adversely impacted the environment with the consequences of global warming (GW) from the eventual climate change on earth. GW manifested from consumption of fossil fuels (coals, crude oil and natural gas) to generate energy for daily economic and commercial activities. To mitigate the devastating impact of GW, the United Nations (UN) initiated climate action policies that apply innovative measures to minimize and reduce carbon emissions. Nations are engaged in annual multilateral conventions, for a net-zero future against imminent catastrophe. The policy objective is, to preserve the planet earth for man's future/sustainable existence. The GW mitigation and adaptation measures are enforced partly through implementing global energy solutions management (GESM), applied on energy-mix menu, for optimal energy utilization, energy security and affordability. This paper highlights the critical roles in energy transition and security, involving continual utilization of fossil fuels to produce cleaner energy as well as renewable energy.

**Keywords:** Innovative measures; CNG; maximum energy-minimum emissions; energy-mix menu; energy security

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### 1. Introduction

The energy security project in a world that is ever growing and increasing in human population presently put at eight billion; demands a consistent research approach on energy sourcing, availability, and prospects of the new discoveries in terms of dependability, affordability and sustainability. The study is conducted along the global energy-value chain for energy-solutions management on energy-mix menu/portfolio. The degree of energy quality will impact each product in the energy-mix menu has on the environment, coupled with its climate compliance effect on adaptation plan, is relatively comparable in proportion to each source contributions. The optimal solution in managing the energy-mix menu (considering each product's affordability) therefore, is chosen from among the complementing aggregate composition on the available energy-mix menu, with a scientific mindset that always complies with the climate change action plan. On the existing carbon emission rules and regulations of the United Nations, it is hoped that a globally sustainable energy security roadmap into the future is maintained. Such move is exhaustively discussed, deliberated upon and optimally considered, implemented and taken note of. An absolute comparison amongst the other components in the energy mix portfolio is conducted through the global energy solutions management. Such shall be periodically observed from time to time.

From creation to man's existence on the planet earth; energy production and consumption is vital to life, and both are inseparable. This is based on the fact that life cannot function nor be maintained without continuous supply of energy, with recognition that energy consumption and life maintenance are compatible. Energy therefore, is synonymous to life, as its functions complement life because, "energy is the ability to do work". In exploring

efficient use of traditional energy, the paper is submitted as a policy highlight on developing low-carbon and green energy strategic programs with roadmaps for future energy supplies with cleaner energy, which may not necessarily be derived from renewable sources alone. This mixed of energy sources is done through partnering arrangements that provide vital and critical information, with manufacturers of high-efficiency clean energy equipment, and the providers of environmental technology, with progressive efforts made for efficient clean energy growth. Success is severally expected to be achieved through a continuous talent hunt in pilot projects designed to counter energy poverty challenges at any given point. Its further development lies in the engagement of youth entrepreneurship within the global economy, through research efforts for innovative discoveries in chemical sciences, to actualize the desired energy commercialization (commercialized CNG).

Energy security would be assured, if the proposed concept of maximum energy, minimum emissions strategy is applied in the economies that are rich in hydrocarbon deposits (oil and gas producing nations). The UN policy on carbon reduction (decarbonization) targets net-zero emissions (carbon neutrality) with support from the proposed strategy being applied for the production of alternative cleaner energy (CNG) sourced from fossil fuels. This goal is achievable in addition (York and Bell, 2019) to renewable energy sources for the energy-mix portfolio, done through energy transition process.

## **2. Energy Security and Energy Transition**

The meaningful policies for GW mitigation target to reduce carbon emissions generated from the usage of fossil fuels, for global energy production and consumption. The regulatory policies therefore, are put in place to check and mitigate excesses of GW, and control or adapt to the environmental impact of climate change on earth. Hence, the growing trend in the development of newer sources of renewable energies production and the promotion for green energy usage. This basically has critical rooting to GW mitigation and adaptation action plan of the UN's net zero climate target (IEA, 2021). All things as stated, work simultaneously towards a seamless sustainable global energy consumption and conservation of the planet earth; while the global population keeps rising. The increase in population no doubt, progressively mounts pressure by the day over a period, on the energy demand and consumption. Invariably at all times, this mounting energy demand pressure poses future challenge for "energy security". With continuous planning to avert energy poverty, positive results are achieved through constant addition of newer sources of energy production. From the argument made by the authors of *Energy Research & Social Science* that: "Evidence from contemporary trends in energy production likewise suggest that as renewable energy sources compose a larger share of overall energy production, they are not replacing fossil fuels but are rather expanding the overall amount of energy that is produced" (York and Bell, 2019). This position made by the authors as stated, could be more accurately placed as energy additions rather than energy transitions. The reason is that the mounting pressure on energy demand as a result of the global rising population pushes for imminent energy poverty and energy crisis at the same time. This therefore, demands for urgent and innovative means and ways of developing more sources of low carbon energy, in addition to the transition plan for renewable energies for sustainable energy supplies. In effect, this reason strongly supports the global energy solutions management on energy-mix module that favorably backs the postulation of the proposed "maximum energy, minimum emissions" strategy (Dahan, 2022). This suggestion is currently being pursued in Abu Dhabi National Oil Co (ADNOC), as presented Dr. Sultan Ahmed Al Jaber at the 38th edition of the Abu Dhabi International Petroleum Exhibition Conference (ADIPEC). He pointed out the huge and unimaginable colossal losses they would have incurred if fossil fuels or hydrocarbon business is completely stopped. He further remarked by considering the shock the industry recently experienced as a "minor tremor" if hydrocarbon investment is zeroed out completely due to natural decline (Dahan, 2022).

Sultan Al Jaber's superior argument that, what the world needs is "maximum energy, minimum emissions", is an innovative move on the net zero carbon emissions concept to sustain energy availability, without further heating up the planet (Cavcic, 2022). This strategy is one of the opportunities the world needs to focus more on for a sustainable global energy security value-chain (as a preferred energy-mix concept), than the challenges and contemporary GW issues. This maximum energy, minimum emissions strategic concept for energy security therefore, calls for more research inputs from chemical sciences on innovative discoveries for commercialization.

### 3. Energy-Mix Menu

Interestingly for this study, looking at two chemical compounds, carbon dioxide (CO<sub>2</sub>) and Methane (CH<sub>4</sub>). Both gases may be conveniently classified into inorganic and organic compounds, respectively. They are among the greenhouse gases (GHGs) that accumulate in the atmosphere. GHGs form the heat-reflective layer, insulation that warm the earth enough by keeping it at a liveable temperature that supports life from freezing at places like the arctic regions. The process is through a phenomenon called “greenhouse effect” (Reichle, 2019). This process however, involves trapping long-wavelengths infrared energy (“heat”; ranging from 2,000-15,000 nanometers) from the earth and thereafter re-radiates it to space, while some of it back downwards (York and Bell, 2019). Its excess storage that have accumulated over the period, resulting from energy consumptions, sourced from fossil fuels for commercial purposes and activities during the industrial era, heat up the planet significantly. The same process applies to CH<sub>4</sub>, a powerful GHG, emitted into the air, which similarly escapes from oil wells during extraction and production of Crude oil. CH<sub>4</sub> is more potent than CO<sub>2</sub> by 80 times over a 20-year period; and has accounted for about 30% of GW since pre-industrial era with even faster spread from when its records started to be kept in the 1980s (Balzani, 2019). It not only contributes to GW directly but, also indirectly by primarily releasing CO<sub>2</sub> and water vapor (H<sub>2</sub>O vapor) into the space through oxidation reaction, among other pathways as shown in this balanced chemical equation:  $2O_2 + CH_4 = 2H_2O + CO_2$ .

From the global market outlooks, to formulate the right energy solutions that will ensure a sustainable global energy security to curb incidences of global energy crisis, it is further suggested that the world needs all the energy solutions it can get from all sources, for a global energy-mix portfolio. The balanced energy-mix portfolio includes oil, gas, wind, solar, nuclear energy and hydrogen electrolyzer. These, plus the clean energies yet to be discovered, when commercialized and deployed at the same time, would reduce carbon emissions to address climate challenge (Smil, 2016).

In Al Jaber’s remark that “energy security” is the foundation of all progress, the statement directly points to the fact that the three strategic pillars of economic, social and climate progress focus on sustainable energy sufficiency that maintains uninterrupted human activities on a daily basis. Energy progress aspires to further expand by 30% before 2050; with the imminent rise in the global population that is already predicted at 9.7 billion by then. This further buttresses the fact that “energy business should be everybody’s top priority” because, there is really no gainsaying the fact that currently, its global landscape is going through “a perfect storm” (Dahan, 2022). However, the hope rising relies on the fact that energy technology infrastructure is going to be one of the greatest enablers in the oil & gas industry. The energy-mix portfolio management therefore, shall in the future be optimizing the most feasible options in terms of affordability, availability, and above all, be sustainably and significantly compliant to the extant climate change action resolutions (Cavcic, 2022).

### 4. Commercialized CNG

Compressed natural gas (CNG) is basically fossil fuel, sourced from the associated natural gas in the gaseous stream from very rich natural gas liquids (NGLs) and it consists of about 80%-90% CH<sub>4</sub>. It is gaseous, unlike the liquefied petroleum gas (LPG) which is a liquid consisting of a compressed mixture of propane (C<sub>3</sub>H<sub>8</sub>) and butane (C<sub>4</sub>H<sub>10</sub>) in liquid form (IEA, 2021). Economically, its commercialization and consumption as a cleaner energy, when compared to the other traditional energy sources, coal and crude oil, that are relatively dirty for power generation and consumption, both for domestic and industrial uses, is affordable. The CNG production and usage as green fuel is one of the means to decarbonize the environment as a low carbon emitter, while economic and commercial activities on oil & gas value chains go on.

CNG is an environment-friendly alternative automotive fuel. It is safer than gasoline/petrol and diesel because it is non-toxic and does not contaminate ground water. In case of leakage, CNG vaporizes into the atmosphere and evenly mixes easily in the air because, it is lighter than air. It is compressed under pressure, to enable more of it occupy lesser volume in fuel tanks (less than 1% of its volume at atmospheric pressure); and stored in high gauge seamless cylinders, certified with so negligible chance of leakage (BPCL, 2022).

## 5. Near Green and Economic Advantages in CNG Consumption

The consumption of CNG as a cleaner fuel plays an important role with so many advantages, by significantly reducing vehicular greenhouse gas (GHG) emissions and environmental pollution. CNG is commonly referred to as the “green fuel” because of its lead (Pb), benzene (C<sub>6</sub>H<sub>6</sub>) and sulphur (S) free characteristics. CNG being environmental friendly reduces harmful emissions, and being non-corrosive it also enhances the long life of spark plugs. It does not have Pb fouling effect on spark plugs and the Pb or C<sub>6</sub>H<sub>6</sub> pollution is also eliminated. Practically, an increased life of lubricating oils has been observed, as CNG does not contaminate and dilute the crankcase oil (Alike, 2016). The operational cost of vehicles running on petrol and diesel is comparatively higher than those running on CNG, which is far much cheaper, especially when high inflation is pushing costs of fuels very high. Accidental ignition on hot surfaces and combustion is very unlikely with CNG, because of its high ignition temperature of 540 °C and its narrow range (between 5% to 15%) for inflammability, respectively (BPCL, 2022).

## 6. Discussions

Innovation on fossil fuels for cleaner energy addition is considered the key to future global sustainable energy production and consumption (energy security). The reason is that change is a constant because in life, nothing is ever static. In chemical sciences, elements and new chemical reactions and formulae are still being discovered. The same applies to trendy chemical nomenclatures, for different generations based on scientific discoveries made through continuous research. The time value of innovation is trend, which comes through creative ideas on products and services. To catch up with the trend on chemical sciences in products discovery for commercialization involves having commercial chemists to compete as entrepreneurs with their contemporaries. It also deals with those with better and superior skills that demand re-planning in strategy to enable them surmount future threats in a competitive market. The skills exhibited by promoters or entrepreneurs critically require constant enhancement for sustainable energy business, on the basis of UN policies and action against GW impact. Creative ideas also come as solutions from technological advancement, by applying new technology that replaces old fashioned pattern, which necessarily trends as chemical sciences R&D, and discoveries. They are better achieved through innovation teams that are engaged in continuous research activities. Such innovation packages and tasks are made available through the creative roles and knowledge of the leaders promoting the chemical business ventures.

This discourse on “maximum energy, minimum emissions strategy”, gives an insight on the importance of innovation through great ideas that can be turned into competitive advantage, by choice and selection of affordable energy component in the energy-mix portfolio, with healthy competitions among contemporaries in the energy industry.

Successful businesses and economies globally, take cognizance of the fact that R&D is very important towards achieving the energy business-inspired goals and the global environmental sustainability (Hammond et al., 2011). It is through such studies that knowledge is updated and gotten, discoveries made; about the true position and status on the products’ integrity tests and performances. Results from the studies carried out would therefore, advice the management further on which option is deemed to be dropped or followed next (Lam, 2011). That is the strategic action plan that shall be subsequently made in the course of a sustainable future in the commercialization of products in chemical sciences. Businesses and economies generally survive, and saved from total collapse once the above modes of operation are continuously applied. Such innovation formulae severally applied by different industries, normally make them to be stable where imminent threats are noticed early enough, and duly adjusted.

## 7. Conclusion

The ongoing UN climate action currently taken against the devastating impact of global warming, which has posed a threat to the sustainable existence of man on the planet earth, through policies to mitigate global warming, brought about measures and different technological methods that include carbon emissions reduction/decarbonization. Also, the energy transition process by renewable energy productions from different sources, has in addition, an innovatively proposed initiative of sourcing cleaner energy from fossil fuels, known as “maximum energy, minimum emissions” strategy, towards a net zero climate target. This therefore, appears

the most feasible energy transition approach that the world needs, especially for the oil and gas exporting nations, and particularly among their contemporaries in Africa. It is a template required in the dynamics of the global energy solutions management for energy-mix module, on energy/power initiative. It is composed of sourcing and usage of fossil fuels, renewable energies and hydrogen electrolyzer for energy generation. Based on the rising cost of energy, options are considered along the range in the energy-mix value chain. This consideration is majorly by pricing affordability for all energy consumers. Looking at costs of diesel, PMS, LPG, kerosene, both for domestic and industrial uses; CNG appears the most favored optional product, sourced from fossil fuel.

From the discussions in this paper, “maximum energy, minimum emissions” is ultimately an attractive and innovative strategy for a net zero climate target, as low carbon emissions concept towards a sustainable energy availability and affordability, without further heating up the planet earth. The global rise in population obviously, mounts pressure through global energy demands on energy security that needs to strategically avoid the incidences of global energy poverty. The circumstance invariably supports the concept of “energy addition” (York and Bell, 2019) from newer sources with application of technology to reducing carbon emissions in cleaner energy sourced from fossil fuel (like the commercialized CNG) that makes optimal contribution to the energy-mix portfolio in the global energy solutions value chain. It is recommended from this review that more research on further utilization of fossil fuels that would support the policy of carbon neutrality be conducted. The successful research findings also, would be expected to foster economic benefits with readily available access to affordable cleaner energy/green fuel, in the future global energy production and consumption business activities, without further aggravation of climate change.

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