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How Realistic Is Low Carbon Development For Developing Countries That Is Development Without Significant Exploitation of Fossil Fuels?

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Abstract

The UK Energy White Paper and the EU's initiatives for Low-Carbon Development (LCD) underscore the significance of sustainable economic and political advancement for societal, economic, and environmental progress. The research investigates the application LCD strategies in lesser-developed nations to facilitate a transition to a low-carbon economy, concentrating on poverty alleviation and economic advancement as a countermeasure to the substantial Greenhouse Gas (GHG) emissions linked to developed countries' reliance on fossil fuels. The UK's path of industrial growth has resulted in elevated GHG emissions, leading to the formulation of energy policies aimed at fostering a low-carbon economy. Nations such as France, Japan, and Canada have adopted carbon reduction initiatives, whereas developing countries like Nigeria, China, and Algeria are engaged in discussions about transitioning to a low-carbon economy. The feasibility of LCD in developing countries largely hinges on the successful adoption and transfer of low-carbon technologies from developed to developing regions. Policy frameworks ought to prioritize the electricity sector by minimizing carbon intensity and diversifying into low-carbon alternatives such as nuclear and renewable energy sources. Drawing lessons from Russia's achievements can inform policy design, ensuring that policies are tailored to the unique circumstances of different regions and applicable low-carbon technologies. Access to financing represents the most significant obstacle to LCD, as investors are crucial in driving the shift towards renewable energy solutions. This research emphasizes the potential for successful LCD in developing nations, provided there is appropriate financing, a strong policy framework, and investment in technology.

Keywords: Exploitation, Fossil fuels, Low carbon development, Developing countries.

1 | Introduction

The UK energy white paper on our future energy-creating a low carbon economy introduced the low-carbon economy in 2003, which refers to an economy that uses low-carbon energy sources or produces little or no Greenhouse Gas (GHG) emissions while also ensuring economic growth compared to a carbon-intensive economy [1]. However, in 2008 the term Low-Carbon Development (LCD) was further introduced by the

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EU, emphasising how knowledge of planned low-carbon pathways can help to inform the global community about funding needs and priorities as well as gauge the level of global climate change action (UN [2] SDG, OECD, IEA). The idea of LCD is a new paradigm that prioritises economic and political development with the goal of lowering CO_2 emissions and achieving sustainable development of the society, economy, and environment [3].

Furthermore, it is believed that LCD is a successful response to the energy and global warming crises brought on by the revolution of developed nations that relied on fossil fuels to build their economies, causing high anthropogenic GHG emissions. According to some scholars, this is the most crucial element and the main goal if we are to create a post-fossil society carbon era and lessen the adverse effects of climate change brought on by human climate degradation [4]. In addition, from the standpoint of optimising the economic structure, creating low-carbon energy technology, enhancing the energy structure, and increasing the effectiveness of energy use, LCD is a new paradigm for development [5]. It will continue to alter social and economic development strategies in addition to altering patterns of energy generation and use [6].

Additionally, it has been noted that, as of right now, developing nations account for over 60% of all annual emissions, including six of the top ten emitters, which include China, with very high energy consumption, as shown in *Fig. 1*. They will be mostly accountable for future emissions growth. However, the question remains if it is possible for developing countries to transform into a low-carbon economy. Therefore, this study explores how developing countries can realistically transition to a low-carbon economy using an LCD strategy by leveraging the right technologies, policies, and financial mechanisms while pursuing poverty eradication and beneficial economic growth [7].

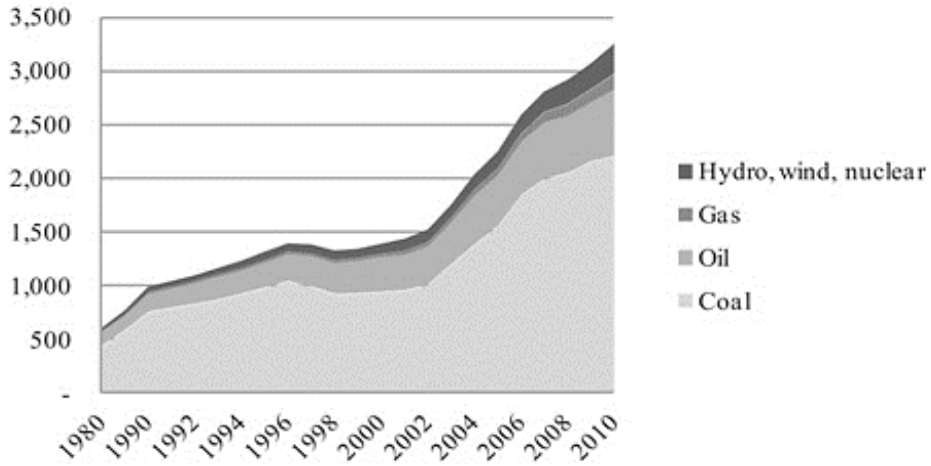

Fig. 1. The energy consumption in china from 1980-2010.

Source: national bureau of statistics of china. Research shows that the UK was a leader in industrialisation, which created high GHG emissions; it further developed energy policies that sought to create a low-carbon economy, reduce carbon dioxide emissions by 60% from 1990 levels by 2050, and make significant progress by [8]. As a result of its progress, more nations are transitioning to low-carbon economies. Countries like France, Japan, and Canada have implemented carbon reduction strategies. Meanwhile, there has been discussion about whether developing nations like Nigeria, China, and Algeria can transition to a low-carbon economy in the same way as developed nations [5].

In May 2007, the Intergovernmental Panel on Climate Change (IPCC) Working Group III released its fourth assessment report on the economic impact of climate change mitigation, emphasising that future GHG emissions depend on developmental patterns and that stabilising GHG concentrations at lower levels is economically feasible, which makes it clearer that it is very realistic for developing countries to decouple growth from global emissions [9]. Others, however, contend that if global climate targets are to be met, it is

technically impossible for developing countries to follow the same carbon-intensive growth path as the now-developed nations did. To achieve this, it is imperative for developing nations to decouple economic growth from carbon emissions significantly [10].

Therefore, the pathway to LCD remains critical to explore for developing countries. Its practicality is hinged on certain sub-themes, including but not limited to technological, policy, and financial development, as further explained below.

2|Technology and LCD Transition in Developing Countries

The practicality of LCD in developing countries is mostly dependent on the adoption and transfer of low-carbon technologies from the North to the South, where they can be utilised to prevent emissions from future economic expansion. For a process of technology transfer to support long-term, low-carbon economic growth, it is not sufficient to just sell or give a country, company, or organisation "hardware" or actual, tangible goods. It is also crucial that the technological know-how that underpins the processes of innovation in low-carbon technologies, also referred to as "software" (e.g., knowledge, procedures), be produced in developing nations or transferred to them [8].

In this model, developing nations can acquire the knowledge required to become low-carbon producers and innovators in their own right, as opposed to only being consumers of new technology who are, in many respects, dependent on continuous imports. In addition, technology transfer is not only a process that can be conducted between governments of industrialised and underdeveloped nations. Firms and other entities, such as research institutes, play a crucial role in this process, as it is them (rather than governments) who develop and sell low-carbon technologies on the market [11].

The argument is that the crucial point for technology imports into developing nations and localised innovation inside such countries are not alternatives, but rather complementing processes often required to develop inventive capacities, which also adds value to the practicality of LCD in developing countries. South Korean automakers, for instance, were able to catch up to worldwide market leaders through a combination of domestic technology creation and international technology acquisition (Sauter & Watson 2008). Therefore, the possibility of achieving sustained low-carbon growth trajectories in emerging economies hinges on the development of these new low-carbon innovation capabilities and a careful balance between international and domestic sources of these capabilities [12].

Although energy efficiency is a fundamental goal for LCD, new energy technologies and mechanisms are necessary for the transition to LCD by developing countries. The IPCC 2007 report showcases a number of low-carbon technologies in all GHG-emitting sectors, including renewable energy, CCS, CHP, and hydrogen energy, which can also reduce emissions.

3|How Policy makes LCD realistic for Developing Countries:

Good policies will make LCD realistic for developing countries. Developing countries like China have made policy advancements to show that LCD is realistic by embedding LCD strategies in its development policies [13]. This is in addition to developing policies around population growth and rural-urban (economic) migration.

It has been predicted that China's population growth will soon peak, which will likely reverse the growth trend. As China's urbanisation accelerates, hitting a record 51.3% in 2011 and anticipated to grow to 75% by 2050, low-carbon cities are essential to reducing China's carbon emissions. This is because urban energy use per capita is estimated to be three times higher than in rural areas (excluding non-commercial energy sources like biomass), and indirect energy use through infrastructure and urban consumption of goods is even higher [14].

Chinese policymakers are prioritising low-carbon urban development and low-carbon cities. The idea of LCDs is relatively new, and policies have only recently been implemented. With the increase of migration and

urban expansion, it is key to implement a low-carbon urban development strategy to help with reduction of GHG emission and reduce the impact of climate change on the cities and to ultimately help with ecological civilization. Although cities in China must choose between decarbonization and economic growth, this low-carbon city goal seeks to match industry with ecological/energy efficiency [6].

Also policies around energy diversification, reducing coal and increasing renewable energy is pertinent and that's why in early 2005, China, a major developing country in this context, passed the Renewable Energy Law, which took effect on January 1, 2006. The National Congress approved a new Medium and Long-Term National Renewable Development Plan in September 2007. China plans to produce 10% of its primary energy from renewable sources by 2010 and 15% by 2020, which will need significant increases in wind, biomass, solar, and hydropower use [3].

Although fossil fuel has been a crucial ingredient to economic growth for decades, policies critical to prioroitizing Carbon-free forms of energy that will reduce green house gas emission is being considered. This has been shown to support the efforts to decouple growth and green house gases. This will essential help to balance the relationship between GDP, energy consumption and green house gases emission. Realistic transition to LCD by developing countries must ensure that its policy framework focuses more on the electricity sector as it has been shown to be a large direct emitter of global emission in many countries and this will require driving up power generation while reducing carbon intensity of electricity and energy diversification into low carbon options such as nuclear eneregy Carbon Capture and Storage (CCS), renewable energy (wind, solar, biomass, hydrietc).

This is in addition to making energy storage effective and when these policies are designed even in the least developed countries, the political will to advance the viablity of rural electrification hinged on off-grid energy will be effective. Does this mean LCD transition in developing countries will be easy? No, it will be complicated however it is realistic [3]. Learning from Russia's growth can be critical in this case. Russia plays a critical role in global climate, being the largest country by land area. Its net GHG emission peaked in 1990. Between 1990-2000, it's GHG emission had a 53% decline driven by technology and low carbon sector growth.

Although, it is still top 5 global emitter, it also had a massive decoupling of GDP and carbon emission due to the growth of export-oriented industries. Prcaticability of LCD transitioning by "developing countries must reflect in policy design where policies need to be context specific in terms of the country, region (rural/urban, richer/poorer), and the appropriateness of different low carbon technologies for each context [15]. In other words, policies need to put into practice the principle within the Kyoto Protocol of 'common but differentiated responsibilities.

4|Financing and Investment as a Mechanism for LCD transitioning in Developing Countries

The third international conference on financing for development's addis ababa action agenda acknowledges the need for funding from all sources, including public and private, bilateral and multilateral, as well as alternative sources of finance, to be stepped up for investments in many areas, including low carbon and climate-resilient development. In low carbon development, finance is a fairly broad topic that includes public finance, banking, and market tools. Financing is by far the biggest problem for LCD, and it's gotten a lot harder because of major macroeconomic imbalances around the world [16].

With the growing need to break the link between economic growth and CO_2 emissions as the drive to mitigate climate change and reduce GHG continues, this will be very realistic with the right type and amount of financing for developing countries. Africa and other developing countries can realistically transition to LCD by taking advantage of a wide variety of financial tools and funding to pay for low carbon development, including and not limited to equity financing, venture capital financing, debt financing, revolving funds etc [17].

The international climate fund (UK), the hatoyama initiative (Japan), and the global climate change alliance (European Commission) are just a few examples of bilateral funds as shown in Table 1 that could help manage money for expanding Africa's access to clean, modern energy. In addition to bilateral funds, international development agencies like the United Nations Development Programme (UNDP) have also made multilateral funds available for projects that use renewable energy. Additionally, there is an Adaptation Fund (AF) that was created by the UNFCCC's Kyoto Protocol Parties to finance adaptation projects and programmes in developing nations that are also Kyoto Protocol Parties with 2% of the Certified Emission Reductions (CERs) issued for CDM projects and other funding sources. Another multilateral fund for developing nations and economies in transition is the Global Energy Efficiency and Renewable Energy Fund (GEEREF), which focuses primarily on investments in renewable energy and energy efficiency for the world's poor with the aim of accelerating the transfer, development, use, and enforcement of environmentally sound technologies [17].

Subsidies from national governments are also crucial in advancing innovative and environmentally friendly energy initiatives. Investment opportunities within the country are rising as a result of Sub-Saharan Africa's consistent economic growth over the past decade. It will be essential to mobilise domestic financing for low-carbon energy access in order to leverage private financing. The good thing about the above-explained innovative financing mechanism for LCD growth in developing countries is that it not only makes LCD realistic in developing countries but it accelerates its adoption.

Investment in low carbon technologies has risen significantly over the past few years as a result of the focus on sustainable energy. Quantity and quality of financial resources are essential. Since preparing for a future with lower carbon emissions will not be cheap, investments in LCD may have to come at the expense of other areas of growth, such as health and education. It's obvious that developing nations can't help poor nations fund massive low-carbon and climate-resilient development projects without receiving aid themselves. In fact, the degree of "scaled up, new and additional, predictable and adequate finance as well as increased access" was a major point of contention at COP-15 in Copenhagen in 2009. While developing nations will continue to rely on foreign aid for climate finance, as was mentioned before, alternative resources will be drawn by rising economies. These include market-based mechanisms for emissions trading, foreign direct investment, and domestic finance. This will give these developing nations peace of mind as they plot out their climate-related activities, allowing them the flexibility to craft an efficient LCD strategy [10].

Also, in 2008, investments in sustainable energy in developing nations increased by 27% over 2007, while they decreased by 1.7% in wealthy countries, according to a UNEP report. China, Brazil, and India received the majority of investment in the developing nation category in 2008, totaling $15.6, $10.8, and $3.7 billion, respectively, this quite shows that these countries are dominating the LCD sector, while it also looks like the export market is a goal for some countries especially China seeing it had invested twice as much in low-carbon energy in 2009 as the US did, overtaking the US in a league table of investments (Pew Charitable Trusts, 2010). Although domestic energy policy and renewable targets continue to be the primary impetus for growing investment in sustainable energy in emerging nations, the export market is also an important medium-term target for some of these economies.

Therefore, now is the moment to invest in transition strategies that switch out outdated, high-emission fossil fuel power plants with newer, cleaner ones. In order to make the best possible investments, investors are the driving force behind the change of the current energy and power systems. Investors want to know if it is currently possible to invest in the shift to renewable energy. Finding the ideal moment to participate in this change is crucial for this. The consequences of pertinent aspects that influence the best investment option must also be understood at the same time. For investors and the government, addressing these concerns will have significant theoretical and practical implications for achieving a low-carbon transition. It is difficult to explain the decision-making difficulty because there are many contributing elements connected to uncertainty. First, fluctuations in the price of electricity are important to investors. Investor reluctance was clearly seen in recent years due to the unpredictability and volatility of the price of electricity and fossil fuel energy [18].

5 | Conclusion

This study has reviewed multiple components that drive the realistic transition to LCD for developing countries. It is clear, however, that with the right amount of financing, the right dose of policy structure, and the right investment in technology, LCD is very feasible for developing countries.

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Data Availability

The data used and analyzed during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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