Volume: 1 Issue: 11 Pages: 36-40

International Journal of Research in Academic World

E-ISSN: 2583-1615
Impact Factor: 4.714

Received: 21/June/2022 Int. J Res. Acad. World. 2022; 1(11):36-40 Accepted: 28/July/2022

Energy Transition: Mitigation for Climate Change

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Abstract
Climate change has been one of the most important areas of research at current times. The rise in global average temperature needs mitigation strategies. The countries have been on a transition path to lessen the impact of climate change by phasing out fossil fuels, natural gas and oil reducing the carbon emissions. The adoption of greener technologies is another way to mitigate the impacts. This paper tries to get in brief where the world is and how India is performing on various aspects. The paper also tries to get some ideas over just transition debate.

Keywords: Climate change, energy transition, just transition

Introduction

The current historical juncture demands a nuanced consideration of climate change, which manifests as a multifaceted challenge encompassing social, economic, and political dimensions. The trajectory of the rise in average global temperature remains uncertain, devoid of definitive outcomes with increased level of variabilities. Over decades, the Intergovernmental Panel on Climate Change (IPCC), a major organization working in the domain of climate research, meticulously documented the substantial risks associated with climate change. In its important October 2018 report titled "Global Warming of 1.5° C," it underscored the imperative for immediate action to tackle the issue of climate change, delineating specific targets for achieving a sustainable climate trajectory. Central to this report was the urgency of restricting the rise in the average global temperatures within 1.5 degrees Celsius above pre-industrial levels by 2100.

To attain the target set by the IPCC, drastic reductions in global carbon dioxide (CO2) emissions are imperative. The IPCC's 2018 report stipulated that to stabilize the targeted average global temperature above pre-industrial level to be at 1.5 degrees Celsius by 2100, global net CO2 emissions by different sectors must fall by about 45 percent by 2030 and reach net zero emissions target level by 2050. CO2, the primary greenhouse gas, accounts for a substantial proportion among various greenhouse gas emissions, with methane and nitrous oxide contributing significantly as well.

Addressing the disproportionate effect of irreversible climate change occurring globally on vulnerable communities and ecosystems, the Global Green New Deal emerges as a comprehensive climate stabilization initiative. Diverging from the neoliberal economic paradigm dominant over the past four decades, the Global Green New Deal prioritizes equity and environmental sustainability.

The Global Green New Deal encompasses four key components: the gradual phase-out of global consumption of fossil fuel by 2050, substantial investments in clean energy amounting to around 2.5 percent of global GDP annually, provisions for a just transition to support the disadvantaged groups of workers and communities. Heavily reliant on fossil fuel consumption can be altered with the replacement of deforestation and industrial focus with afforestation and sustainable agricultural practices. Given the pivotal role of energy in the development of the world, which is predominantly fueled by fossil fuels, in driving greenhouse gas emissions, this paper will primarily examine the first three components related to global energy operations. Fossil fuel combustion alone contributes significantly to greenhouse gas emissions, emphasizing the urgency of transitioning towards sustainable energy alternatives.

Fossil Fuels Phase Out

The objective is to gradually eliminate the use of coal, oil and natural gas for energy production so that by 2050, there will be no consumption of fossil fuels for energy purposes. Consequently, carbon dioxide (CO2) emissions as a result of burning fossil fuels will also decrease to zero by 2050. However, the recent dataset from the International Energy Agency (IEA) indicates a concerning trend. Global CO2 emissions stood at approximately 36 billion tons in 2021, marking a staggering 70% rise since 1990 and a 14% rise since 2010. Projections suggest that emissions will hardly decrease by 2030 and are unlikely to meet the zero emissions target level by year 2050.

Under this projection, global CO2 emissions are forecasted to remain stagnant by 2030 and decrease only by approximately 13% to 31.6 billion tons by 2050. In essence, if we heed the warnings of climate science, this scenario paints a dire picture of the future. The IEA outlines a pathway to achieve zero emissions by 2050. The variance between the IEA's Stated Policies and Announced Pledges scenarios compared to their Net Zero Emissions by 2050 scenario is termed an "ambition gap" (IEA). Closing this gap is pivotal to achieving zero emissions.

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It's imperative to completely detach energy consumption and economic activity from fossil fuel consumption. This entails a consistent decline in fossil fuel consumption, even as energy demands are met. Economies can grow, as seen in India and China, while simultaneously advancing climate stabilization efforts, provided growth is disconnected from fossil fuel consumption. Over the past two decades, several European nations, including Italy, Czechia, the UK, France, Sweden, Finland, Germany, and Romania have demonstrated the feasibility of this decoupling, both in production and consumption levels. While this progress is encouraging, it represents only a fraction of the necessary strides forward.

Natural Gas, Oil and Carbon Capture as Clean Energy Source

The idea that carbon capture technology, nuclear energy, and natural gas provide practical substitutes for achieving a zero world emissions economy is widely accepted. We examine the following assertions, talking about each alternative technique in turn.

Natural Gas: Significant variations exist in the emission levels produced by burning coal, natural gas and oil, with natural gas emitting roughly 40% fewer emissions for the same energy output as coal and approximately 15 percent less than oil. This has led to the assertion that natural gas could serve as a transitional fuel towards a cleaner energy landscape, particularly by transitioning from coal to natural gas for electricity generation. However, these assertions fail to hold up under close examination. Even under the most optimistic scenario of a global shift where 50 percent of the fuel is switched to natural gas, emissions would only decrease by 8 percent.

Nuclear Energy: While nuclear power is thought to be a clean energy source which indeed generates electricity without emitting CO2, it comes with significant environmental and public safety risks. These concerns were magnified following the Fukushima Daiichi power plant meltdown that happened in March 2011 and further heightened when Russia took control of the Zaporizhzhia and Chernobyl nuclear power plants during its 2020 invasion of Ukraine. Moreover, from a purely economic standpoint, the average cost for generation of a kilowatt energy of electricity using nuclear technology is currently approximately twice as high as that from renewable sources, aligning it closely with fossil fuels in terms of cost.

Carbon Emission and Sequestration (CCS)

The term includes a variety of measures, yet among them, only one has demonstrated both effectiveness and safety thus far: tree planting. Specifically, I'm referring to afforestation, which involves increasing forest cover of the regions or the density of trees in areas previously devoid of forests or that have undergone deforestation. Reforestation, a component of afforestation, falls within this category. The fundamental principle behind afforestation's efficacy lies in the fact that living trees absorb CO2, contrasting with deforestation, which releases CO2 into the atmosphere and exacerbates global warming.

Despite decades of incentives provided to fossil fuel companies to develop alternative technologies, only afforestation, notably tree planting, has proven effective and safe. In the process of preparing the draft of the latest IPCC report, significant lobbying efforts were made by fossil fuel-producing nations to promote carbon capture technologies as one of the primary climate solutions. However, the IPCC report ultimately concluded that the deployment rates of carbon capture globally are insufficient for meaningful climate stabilization. The report underscored various barriers to implementation, including institutional, environmental, ecological, technological, economic, and sociocultural challenges. Moreover, as carbon capture technologies become more prevalent, the risks associated with carbon leakages from poor transportation systems or the storage systems are poised to rise, particularly as profit incentives may compromise safety standards.

Just Transition and Job Losses

The transition towards a clean energy economy is often misunderstood as a job killer, despite the inherent potential for job creation. This shift involves substantial investments in enhancing energy efficiency along with expanding renewable energy sources, which inherently generate employment opportunities. The key consideration lies in comparing the job creation potential of green economy initiatives with the job losses resulting from phasing out fossil fuel infrastructure.

There are two primary channels that explain how a clean energy transition fosters job creation: investment spending and energy import substitution. Investment spending applies universally, while energy import substitution is relevant for net energy-importing nations. Countries reliant on fossil fuel production will witness a fall in employment options in such sectors. However, research across various nations such as Brazil, South Africa, India, Indonesia, China and the United States reveals that clean energy investments typically result in a higher percentage increase in job creation compared to fossil fuel investments.

Although countries heavily reliant on fossil fuel exports may face challenges in balancing job increases and losses, evidence suggests that dependence on fossil fuels does not necessarily translate to superior economic growth or employment outcomes. The phenomenon of the "resource curse" exemplifies this, indicating that economies with extensive fossil fuel resources may not fare better in terms of growth and poverty reduction. Therefore, for nations heavily dependent on fossil fuel exports, transitioning to clean energy offers opportunities for economic diversification and job expansion.

Just Transition

Workers and communities reliant on oil, coal, and natural gas face inevitable losses during the transition to clean energy. Just transition policies are not only morally justified but also crucial for avoiding resistance that could impede climate stabilization efforts. These policies should guarantee displaced workers three key assurances: a new job, comparable pay to their previous positions, and pension security regardless of industry phase-out. Recent implementation of just transition policies in Germany, the European Union, and to some level, the United Kingdom, highlights progress, albeit limited, in addressing worker concerns. However, proposals for similar initiatives in Canada, Japan, and the U.S. are still in nascent stages. Nonetheless, existing policies mainly focus on relocation support, retraining and job search, and lack the necessary guarantees for workers.

Carbon Tax and Rebates

Carbon taxes offer a dual benefit in climate policy by raising fossil fuel prices and generating government revenue for clean energy investments. However, their regressive impact

disproportionately affects low-and middle-income individuals. James Boyce's proposal for an equal shares rebate ensures equitable distribution of the tax burden across all income groups. This approach promotes fairness while maintaining the efficacy of carbon pricing in curbing emissions.

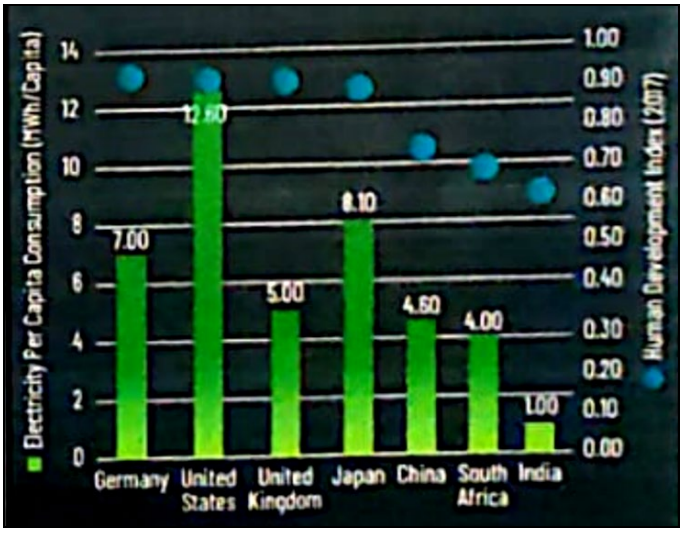
India's Case in Energy Transition

The pivotal role of affordable, reliant and sustainable energy in driving India's economic development underscores its potential to address myriad developmental challenges. Particularly in countries like India with lower Human Development Indices (HDIs), even a modest enhancement in electricity access significantly improves community health and education, thereby elevating the HDI.

India's historical carbon emissions have been relatively minor, with per capita CO2 emissions well below global averages. However, due to its vast population exceeding 1.2 billion, India ranks as the third-largest emitter of CO2 in the world. Furthermore, India's CO2 emissions have doubled from 2005 to 2020, fueling concerns about its share in overall global greenhouse gas emissions. The country's apprehension regarding its emissions is compounded by its susceptibility to climate change impacts, attributed to factors such as high population density, pronounced spatial and temporal rainfall variability, and a significant portion of impoverished individuals vulnerable to climate fluctuations, as highlighted in 'India in a Changing World', 2019 by Jayaraman Srinivasan.

Just Transition in Case of India

While the notion of just transitions has only recently gained traction in India, it offers valuable insights into the convergence of development, energy, and climate considerations. It serves as a platform to unite various core concepts and movements influenced by labor, government and civil society in India. Within the Indian context, several practices and concepts prioritize distributional impacts and social inclusion.



Source: *Gupta V. 2020*

Fig 1: Correlation between electricity consumption and human development index

One such concept, 'environmentalism of the poor', originated from community mobilization against private sector and governmental encroachments on the natural resources vital to such affected communities. Additionally, climate justice and climate sustainability are influential approaches. Climate justice underscores the vulnerabilities of the marginalized sections of the society, often leading to conflicts with governmental and corporate agendas. Climate sustainability aligns with government and business development agendas, focusing on green growth and climate-friendly technology.

In India, labor unions are gradually embracing the idea of just transitions, that majorly emphasizes the 'right to develop', which in turn links emissions to both social development and economic growth. The country has underscored climate justice concerns regarding unequal contributions to climate change causes and varying vulnerability to its impacts. India's Nationally Determined Contributions (NDCs) reflect this stance with the subtitle "Working towards climate justice". While the government prioritizes climate sustainability, given the severe vulnerabilities of a large proportion due to climate change impacts, issues of climate justice remain prominent on the national agenda.

Significance of Coal in Energy Transition in India

Transitioning away from coal-dependent economic structures poses challenges for communities entrenched in such livelihoods, despite the benefits of cleaner energy sources. Consequently, meticulous consultations are essential to delineate the benefits, harms, and their distribution across local, national and international scales over time.

The coal sector of India has undergone a convoluted history, marked by colonial control, nationalization, and recent privatization. Issues persist across ownership models, encompassing distribution and price controls, environmental degradation, poor working conditions, black market activities, and supply uncertainty. Coal's pivotal role in India's development, spanning urbanization, industrialization, trade, and electrification, has rendered it an ever important national symbol.

Source: *CEA report on installed capacity from 2015-2019*

Fig 2: Power Capacity Mix Trends in India

In 2019, coal accounted for approximately 45% of India's total primary energy requirements, followed by oil and natural gas at approximately 31%. While oil predominantly fuels the transport sector, coal predominantly powers electricity generation, with over two-thirds allocated for this purpose and 25 percent for industries particularly steel and cement. Despite the necessity for significant transitions in response to climate change, coal's predominant role in electricity generation necessitates paramount attention for a just and low-carbon transition for countries like India.

India's Case in Just Transition

The Annual Budget in India for February 2020 proposed the closure of old thermal power plants that had carbon emissions breaching the norms set by the National Clean Air Program. Its proposition entails shutting down coal-fired power plants, totaling 166,000 MW in power generation capacity, potentially affecting the livelihoods of millions directly and indirectly dependent on coal incomes/subsistence across India's coal belt. The formal employment in Coal India Limited(CIL) has declined over time due to mechanization and increased usage of contract labor, with India's coal sector employing an estimated 1.2 million workers, excluding those in coal transport.

The coal sector's significance extends to both road and rail transport, with coal contributing about 40% of revenue of India's rail network and formally employing around 1.3 million people in this rail sector. Additionally, the coal trucking industry employs around 0.5 million people. The impact of coal-related incomes spans across formal and informal sectors, particularly concentrated in coal-producing states like West Bengal, Jharkhand, Madhya Pradesh, Chhattisgarh, Odisha, and Telangana.

The proposed closure of old coal plants often includes suggestions for repurposing the land for alternative energy purposes. However, ensuring a 'just' transition away from coal necessitates mapping socio-economic effects, implementing systematic protections and providing financial incentives. A systematic approach to re-employment, especially for informal labor, is imperative, given their precarious employment conditions. Without adequate planning, the transition from coal can lead to significant negative impacts on workers' incomes and communities, highlighting the urgency for economic diversification in regions of coal-dependency. Examples like the closure of the Badarpur Power Plant underscore the need for governance and stakeholder collaboration to mitigate adverse impacts on affected workers and communities. Studies indicate potential long-term unemployment and earnings reductions with the phasing-out of coal.

Conclusion

The transition to cleaner energy sources, as exemplified by the case of India, presents multifaceted challenges intertwined with socio-economic implications. While initiatives like the closure of old thermal power plants aim to address environmental concerns, they also raise significant livelihood issues for communities reliant on coal-related industries. Just transition policies are essential for navigating this transition equitably, necessitating careful consultations and systematic protections to ensure fair distribution of benefits and harms. Furthermore, the Indian context underscores the importance of mapping socio-economic impacts and developing re-employment strategies, particularly for informal laborers vulnerable to economic dislocation. Collaborative efforts among stakeholders are crucial for mitigating adverse effects and fostering sustainable development in coal-dependent regions. By embracing a holistic approach and prioritizing socio-economic justice, India and other nations can successfully transition towards a cleaner and more sustainable energy future while safeguarding the well-being of affected communities.

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