

NET-ZERO, CLIMATE CHANGE AND INDIA'S QUEST FOR GREEN ENERGY

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ABSTRACT

The emission of greenhouse gases in the atmosphere has caused global warming to an unprecedented level endangering human life on earth. It is strongly felt by the experts and the world leaders alike that curtailing of carbon emissions is most necessary to bring down temperature to the target fixed by the Paris Agreement. Net-zero emission or carbon neutrality is now the buzzword of every climate talk. A majority of countries have declared the year 2050 as their target to achieve the net-zero emission level. India has consistently opposed to this proposal. It has now set the target for 2070. India is a fast-developing economy, and its energy demand is also increasing exponentially. However, India's focus is on developing the green energy sources other than coal. This paper explores the various options of green energy being adopted by India and its approach towards carbon-neutrality.

Keywords: Net-zero, carbon-neutrality, climate finance, green energy, greenhouse gases.

INTRODUCTION

Net-zero is also referred as carbon-neutrality which does not imply that the countries would bring down its emission to zero. It signifies that all remaining greenhouse gas (GHG) emissions, which are generated by human endeavour, are balanced by removing GHGs from the atmosphere. In other words, in the state of net-zero, a country's emissions are compensated by absorption and removal of greenhouse gases from the atmosphere. Absorption of the emission requires creation of more and more carbon sinks such as forests and the remaining green cover. Removal of greenhouse gases from the atmosphere needs futuristic technologies like carbon capture and storage. In this context, it may be stressed here that this term was not mentioned in the final draft of the Paris Agreement of 2015. The goal set by it was to keep global temperatures from rising beyond 2°C compared to pre-industrial times. The Paris Agreement only requires the signatory countries to take the best climate action in this regard. Countries were expected to set five- or ten-year climate targets for themselves and to achieve them for others to see. However, net-zero emission target became the new buzzword in climate diplomacy later. About 60 countries have announced net-zero emission targets. The protagonists of this viewpoint argue that global carbon neutrality by 2050 is the only way to achieve the Paris Agreement target of keeping the global temperature from rising beyond 2°C compared to pre-industrial times. For the last two years, a very vigorous campaign is doing rounds. It is worth-mentioning here that the world is 1.09°C hotter at present than the average for 1850- 1900.¹ It is estimated that current policies and actions being taken to reduce emissions would not help to prevent a 3°C-4°C rise by the turn of the century.²

Thus what is urgently required is to suck CO₂ out of the atmosphere rather than to argue about the reduction of their emissions by the developing countries and the duration within which that can be achieved. The target of emission reduction can be achieved through renewable energy, better urban planning, infrastructure design and lifestyle changes which should be pursued relentlessly. However, carbon removal is specifically the job of the governments. According to the IPCC, the amount of carbon requiring removal to contain global warming amounts to 700 billion tonnes by 2100. This is the bounden duty of each rich nation to take responsibility for removing their respective shares to the cumulative total of man-made greenhouse gas emissions. However, this is going to be a very costly affair. One way is to make the captured CO₂ the raw material for industrial processes that generate value. Carbon dioxide is already

being used to pack meat, give soda and beer their fizz and increase the yield inside greenhouses. The first two options end up in releasing the gas back into atmosphere. Hence, it is imperative to develop such technology as would convert the CO₂ into carbon fibre and something useful in other forms through a series of chemical reactions. Presently, Iceland has a direct air capture plant that is capable of sucking some 4,000 tonnes of carbon a year. But this is very small amount in comparison to the 40 billion tonnes of CO₂ the world continues to add to the atmosphere.³

INDIA'S STAND

Despite the constant pushing and exerting pressure by the U.S., the Indian Government has not yet acceded to the demand of net-zero emission target. On the contrary, India is the only one opposing the emission-reduction target by 2050 as that is bound to affect India's development growth immensely. India's objections are many which can be enumerated as such:

1. According to various studies conducted in this regard, India is the only G-20 country whose actions are compliant to the Paris Agreement goal of keeping global temperatures from rising beyond 2°C. Its performance is better than the European Union countries whose actions have been considered 'insufficient'. Thus, India is already doing more on climate as compared to many other countries.⁴

2. Over the next two to three decades, it is expected that India's emissions are likely to grow at much faster pace than many countries. It is because the country is making rapid strides with the pious aim of pulling out the teeming millions out of poverty. In such conditions, no amount of afforestation or reforestation would be able to compensate for the increased emissions. Moreover, the carbon removal technologies presently available are neither reliable nor cheap. These will entail a heavy burden on the exchequer.

3. It has been pointed out by India repeatedly that the developed nations have ever failed to deliver on their past promises and commitments. For example, no major country has achieved the target of cutting-down emissions assigned to them under the Kyoto Protocol, preceding the Paris Agreement. Some countries even walked out of the Protocol openly without consequences. No performance was recorded by any country on the promises made by them for the year 2020. Their track record is worse even on their commitment to provide finances

and appropriate technology to developing and poor countries in order to enable them to deal with the adverse impacts of climate change.⁵ Under the principle of "common but differentiated responsibility", richer countries must lead in paying for their historically high emissions.⁶

4. India does not rule out the possibility of achieving net-zero target by 2050 or 2060, but at the same time, it does not want to make an international commitment so much in advance.⁷

GREEN ENERGY AS AN ALTERNATIVE & INDIAN SCENARIO

1. Solar energy

As per the sixth assessment report (AR6) Climate Change 2021: The Physical Science Basis, of August 2021 released by the United Nation's Inter-Governmental Panel on Climate Change (IPCC), the global warming is on track to hit 1.5 degrees Celsius around 2030, and the levels of carbon dioxide in the atmosphere have reached the highest in the past 800,000 years. At 1.5 °C global warming, it is projected that the heavy precipitation and associated flooding will intensify and is likely to occur more frequently in most regions of Africa and Asia. In order to put a halt to the disastrous situation in the future, it is strongly required to make strong and sustained efforts to reduce effectively the emissions. At present, global energy sector consisting of power, heat and transport, account for around 73% of total emissions.⁸ Further, the per capita energy consumption which is much lower as compared to the global average, is likely to grow in the emerging and developing economies.

Solar energy is largely considered to be the ideal solution to reduce emissions globally. Solar is the cheapest source of electricity today, and it is the smartest choice for new power capacities. In 2019, the total investment in solar was 131 billion dollars. Its global capacity has grown by more than 26 times since 2009 and the sector is expected to support 22 million jobs by 2050.⁹

India is currently the top three nations in energy use, though its per capita consumption is very low. The demand of energy is likely to grow exponentially in the world over the next 20 years. According to the International Energy Agency (IEA), the population in India is anticipated to grow by 270 million over the next two decades. It will result in the increased demand for carbon-intensive industries such as cement and steel for the housing needs of the Indian people.

Moreover, India is also vulnerable to the climate crisis. This is visible in the form of melting of the Himalayan glaciers and also in the changing monsoon pattern. Hence, it is necessary to move towards a low-carbon and regenerative economy.¹⁰ In 2019, India ranked fourth globally in installed renewable power capacity. Solar and wind power have been the major pillars. A target to generate 450 gigawatts of renewable energy by 2030 has been fixed by the Government of India in this regard. This is five times the current capacity and amount to 60% of its total electricity generation from non-fossil fuel sources as against its pledge made at Paris climate conference in 2015.¹¹ Solar energy appears to be a viable solution and salvation to the continuously increasing problem of emission. India can be a leading country worldwide as far as solar electricity is concerned backed by about 300 sunny days. Such electricity will be less expensive than coal-fired power by 2030, even when paired with battery storage. Prime Minister of India, Sri Narendra Modi launched the Green Grids Initiative-One Sun One World One Grid (GGI-OSOWOG), the first international network of global interconnected solar power grids, jointly with his UK counterpart Boris Johnson, at COP26, Glasgow. "One Sun, One World & One Grid will not only reduce storage needs but also enhance the viability of solar projects. This initiative will not only reduce carbon footprints and energy cost but also open a new avenue for cooperation between different countries and regions", PM said while delivering his remarks at the "Accelerating Clean Technology Innovation and Deployment" event at COP26.¹² Both Modi and Johnson also released the One Sun declaration, which stated, "Realising the vision of One Sun One World One Grid through interconnected green grids can be transformational, enabling all of us to meet the targets of the Paris Agreement to prevent dangerous climate change...these efforts can stimulate green investments and create millions of good jobs. The declaration has been endorsed by 80 International Solar Alliance (ISA) member countries". India also gave a presentation on its third Biennial Update Report (BUR) during the 11th Facilitative Sharing of Views (FSV) at the COP26 Climate Summit at Glasgow. It stated that India's solar energy capacity stands at about 45 gigawatts after it increased 17 times in the last seven years, asserting that although the country represents 17 per cent of the global population, its historical cumulative emissions are only 4 per cent. The key highlight of the discussion on this report was the achievement of 24 per cent reduction in emission intensity of its Gross Domestic Product (GDP) over the period of 2005-2014, and the significant increase of its solar programme.¹³

CHALLENGES BEFORE THE OSOWOG

1. The transmission of power across vast distances requires large capital investment to set up long transmission lines with power transmission which are very expensive across great distances.

However, the first step of OSWOG would be solar power transfer between neighbouring countries. India, Bhutan, Bangladesh, Myanmar and Nepal share transmission capacity for energy transfer across borders.¹⁴

2. In view of the changing nature of geopolitics, any change in relationship between countries can affect the grid;
3. Dealing with different governments and market forces can be a challenging experience for the developers;
4. Maintaining grid stability with renewable generation would be technically complex.
5. The One Sun One World One Grid project's focus is on integrating RE plants across the world into one single grid. It can prove to be a really difficult and challenging task in view of the complex geopolitical and economic implications. Moreover, it attempts to create a highly centralised system when decentralised solutions have proved their efficacy and usefulness.¹⁵
6. According to a report (Solar Investment Action Agenda) by ISA, World Resources Institute, and Bloomberg Philanthropies, solar investment lags far behind global needs today. The average annual solar photovoltaic investment will need to be double through 2050 if solar energy is to achieve climate-mitigation potential and the world is to achieve net-zero emission by then.¹⁶ has supported a lot of central and regional governments for improving techno-economic feasibility of solar power. It is helping the most challenged countries to initiate solar projects.¹⁷ The ISA has also commissioned a study regarding the feasibility of OSOWOG that will assess on a country-by-country basis, projected power demand and supply as well as renewable resource potential.¹⁸
7. The Government of India has set an ambitious goal of developing a high-quality solar manufacturing hub in India under the Atmanirbhar Bharat Abhiyaan, It will provide a safety cover to solar sector from future shocks. At present, India has 3 GW and 10 GW of solar cell and photovoltaic (PV) module capacity respectively. The focus is on

creating an ecosystem for the manufacture of ingots, wafers, and cells and modules. Thus, the emphasis is on backward integration, along with on employment generation. Here, it is worth mentioning in this context that the progress of solar rooftop in India is not encouraging so far. Against the target of installing 40 GW of rooftop solar, it has been a struggle to reach even the 10 per cent mark of this target. However, under the Kisan Urja Suraksha evam Utthan Mahabhiyan (KUSUM) scheme, the government is preferring solar to agricultural energy needs. It is also creating, at the same time, a market for domestically manufactured solar modules. Solar pumps are providing farmers reliable electricity and also reducing government's burden on subsidy.¹⁹

2. Wind energy

Wind energy owns a large share in renewable energy in India, which stands fourth in the world with 38 GW of installed capacity. The sector has experienced noteworthy growth from 1985-2015. India has set up an ambitious goal of installing 175 GW of renewable energy by December 2022. Out of this, a limited space of 60 GW was accorded to wind energy as the focus majorly shifted to solar power. India's installed capacity of the wind energy was 25 GW at that time, with almost 75 per cent of its supply chain served by domestic manufacturing. That implied about 5 GW annual addition for the next seven years. However, due to policy shortcomings, this modest target seems to be unachievable. According to the rating agency ICRA, India's wind capacity will reach the figure of 45 GW by 2022. Wind, being a natural resource, require specific sites which are not easily available for the developers. Evacuation of such sites is also a nagging problem. Further, Government's policies concerned with repowering old power plants, solar-wind hybrid plants and offshore wind farms, aimed at recovery of sectoral growth, remained hazy. It is estimated that India can potentially add 20-30 GW of capacity by repowering old wind farms situated on the windy sites but employ low-capacity turbines. However, a lot of policy issues are needed to be resolved in this connection.²⁰ Of late, the preference is fast-changing from onshore to offshore wind energy. Open seas facilitate better wind speeds and quality over longer periods resulting in improved electricity generation. Capacity utilisation factor (CUF) of offshore wind (29-52 per cent) is higher than that of solar PV (10-21 per cent) and onshore wind (23-44 per cent). The first offshore wind turbine was installed in Denmark in 1991. By

2019, the share of offshore was 5 per cent of wind installations in the country. Offshore wind power is assuming mainstream role in many countries of the world. The sector is expected to grow at a compound annual growth rate (CAGR) of over 18 per cent between 2019 and 2024. The case of offshore wind power has been furthered by the supportive policies and technological advancements. According to a recent International Energy Agency report, global offshore wind capacity is set to rise fifteen-fold by 2040 to reach about US \$1 trillion of cumulative investments. With a long coastline, India's immense offshore wind potential remains largely unexploited. As per the National Offshore Wind Policy, notified in October 2015, the target to be achieved is the installation of 5 GW of offshore capacity by 2022, and a further 30 GW by 2030. In this context, the National Institute for Wind Energy (NIWE), an autonomous body under the purview of Ministry of New and Renewable Energy (MNRE), carried out an assessment of offshore wind energy potential by deploying Light Detection and Ranging (LIDARS). A few sites in eight zones with a potential of 70 GW have been identified so far off the coasts of Gujarat and Tamil Nadu through a programme called Facilitating Offshore Wind in India (FOWIND), which has been launched by the MNRE in December 2013. However, despite favourable conditions and the interest shown by the private sector and multi-laterals, development is taking place in slow speed.²¹

3. Green hydrogen

In the recent past, zero-carbon ("green") hydrogen has reached from the margins to centre stage of India's energy infrastructure planning. Showing a clear intent of not lagging behind in adopting new cutting-edge renewable technologies, India has announced a National Green Hydrogen Mission (for grey and green hydrogen) on the Independence Day this year. Not only this but also, at the International Climate Summit at New Delhi this year, the theme was "Powering India's Hydrogen Ecosystem". Investing in green hydrogen is prudent as it could allow to cut emissions in those sectors where existing strategies for clean electricity are likely to prove inadequate, such as long-distance transportation or steel manufacturing.²²

Grey hydrogen obtained via steam reforming can be gainfully blended with CNG in bus fleets for much benefits to the environment and economy. Studies suggest that 18%

hydrogen blending in CNG, or H-CNG, can bring down carbon monoxide emissions by as much as 70% and raise fuel efficiency too. It is necessary in this regard to scale up nationally the pilot project of Indian Oil Corporation for H-CNG in Delhi. IOC has developed innovative technology for H-CNG by using catalysts for reforming natural gas partially so that a target percentage of hydrogen is directly produced in the mixture, the rest being unconverted CNG. Hydrogen required, globally, for blending in CNG is generally produced via electrolysis of water, followed by high-pressure blending with gas, which are energy-intensive processes.²³

4. Biofuels

Currently, India's consumption of energy is only one-third of the global average. 84% of oil and 56% of gas for domestic use are imported. In this context, the role of biofuels has assumed larger proportions. Blending of ethanol in petrol is the new hope for cutting down carbon emissions. Presently, the target is to achieve 10% ethanol blending in petrol by 2022 and 20% by 2030. It will help in cutting down carbon emissions in vehicles. However, this target of 20% has been advanced by five years to 2025 by an announcement made by the Prime Minister of India on the World Environment Day (June 5) this year. Ethanol-blending programme is one of the seven key drivers identified for India's energy map. Ethanol is ethyl alcohol that is made from molasses, grains, and farm waste.²⁴

In regard to biodiesel, the National Policy on Biofuels in 2018 targets 5% blending of biodiesel in diesel by 2030. The policy encourages setting up of supply chain mechanisms for biodiesel production from non-edible oilseeds, used cooking oil and short gestation crops, which can be cultivated easily on barren or not fit for edible crops on land in many states. This will also augment income of the farmers. Biodiesel procured by oil marketing companies (OMC) for blending high speed diesel has increased from 11.9 million litres in 2015-16 to 105.5 million litres in 2019-20.²⁵

In October 2018, the Sustainable Alternative Towards Affordable Transportation (SATAT) scheme was launched to establish an ecosystem for production of compressed biogas (CBG) from various waste biomass sources in the country. Under SATAT, 5000 CBG plants with a total production capacity of 15 million metric tonne per annum (MMTPA), which is equivalent to 54 MMSCMD of gas by 2023, has been envisaged.

This initiative is expected to bring a potential investment of about Rs. 1.75 lakh crore and is likely to generate about 75,000 direct employment opportunities. Crop residue such as paddy straw and biomass as feedstock for production of CBG will be used in many of the proposed plants, especially in the States of Haryana, Punjab and Uttar Pradesh. SATAT scheme will be beneficial in controlling greenhouse gas emissions. It will also reduce burning of agricultural residue which is one of the major causes of significant air pollution in cities like Delhi.²⁶

5. Green Transport

Heavy and uncontrolled plying of vehicles on road is a major cause of emissions. In this context, India is fast-moving towards its e-mobility transition, and thereby adopting the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles Scheme. The government has also announced a number of incentives for customers and companies to promote e-vehicles. Here, it is noteworthy that India has leapfrogged from Bharat Stage-IV (BS-IV) to Bharat Stage-VI (BS-VI) emission norms by April 1, 2020, the latter being originally scheduled for adoption in 2024. Meanwhile, a voluntary vehicle scrapping policy to phase out old and unfit vehicles has been launched to supplement these schemes. At the same time, Indian Railways is also moving ahead in this direction by fixing a target of full electrification of all broad-gauge routes by 2023.²⁷

6. Clean energy

(i) LPG connections: Under the Pradhan Mantri Ujjwala Yojna, 88 million households have been provided with LPG connections. This is indeed, a striking example in the deployment of clean energy.²⁸

(ii) LED : More than 367 million LED bulbs have been distributed under the UJALA scheme, leading to energy savings of more than 47 billion units of electricity per year and a reduction of 38.6 million tonnes of CO₂ per year. By adopting these and other measures, India has achieved a reduction of 24 per cent in the emission intensity of its GDP between 2005 and 2016. It is also on its way to meet its target of 33 to 35 per cent by 2030. This target has now been increased to 45 per cent.²⁹ Switching to LEDs also helps the government in meeting its carbon dioxide emission reduction targets, since lower power consumption will eventually result in lower power

production and hydrocarbon use. According to the website of the Domestic Efficient Lighting Programme (DELP), the government has sold 9.17 crore LED bulbs which would result in reduction of 26,451 tonnes of carbon dioxide per day, or almost 10 million tonnes a year. In other words, 10 million tonnes of CO₂ is equivalent to nearly 54 million railcar worth of coal burned.³⁰

CHALLENGE OF PHASING OUT COAL AS A MAJOR ENERGY SOURCE

One way to achieve carbon neutrality is to reduce dependence on coal. Coal is the most polluting among fossil fuels, and hence, its use in particular has come under intense scrutiny by the activists and the environmentalists world over. Currently, coal in India is used to meet over 70% of India's electricity needs. Most of this coal is extracted from domestic mines. India has fought attempts by developed countries to impose a cap on its emissions. It has argued that stringent measures to reduce carbon emissions can drag down growth and will severely affect the poverty alleviation programmes. In an interview, Mr. Partha Sarathi Bhattacharya, former chairman and managing director of Coal India, stated that 'Important to minimize carbon footprint, but India can't shed coal for next 25 years...' His argument is that 'if India has to develop, it has to have more power, and that is not possible without coal. Coal has to be there, particularly for the base load....coal-based power will have to continue for quite some time in the country'. However, at least a thinking has started to phase down coal as major source of energy and that will certainly bear fruits in near future.³¹

GREEN ENERGY CORRIDOR

As part of India's green energy push, green energy corridors are being set up in two phases for supplying electricity from renewable energy projects. Under its first phase, 9,700 km of transmission lines and 22,600 MVA of substations are being constructed at an estimated cost of Rs. 10,141.7 crore. On January 6, 2022, The Cabinet Committee on Economic Affairs (CCEA) approved the second phase of the Green Energy Corridor scheme. In this phase, about 10,750 circuit kilometres (ckm) of transmission lines and around 27,500 mega volt-amperes

(MVA) of sub-station capacity will be installed to facilitate electricity evacuation of around 20 giga watt (GW) of renewable energy projects in Gujarat, Himachal Pradesh, Karnataka, Kerala, Rajasthan, Tamil Nadu and Uttar Pradesh. The estimated cost of this scheme is Rs. 12,031 crore, and 33% of the project cost-around Rs. 3,970.3 crore will be met as central financial assistance. The transmission system will be created between FY 22 and FY 26. This decision comes in the backdrop of India's pledge at the COP 26 summit in Glasgow last year in November to meet 50% of its energy requirements from renewable energy by 2030 and increasing non-fossil fuel power generation capacity to 500 GW by the end of this decade.³²

CONCLUSION

Thus, from above discussion it is crystal clear that the problem of rising emissions, especially of greenhouse gases, has assumed alarming proportions. Nearly all the climate talks, be it Kyoto Protocol, Paris Agreement or the recently held Glasgow Summit, have put it on top of its agenda. Targets are set but the lack of sufficient will power on behalf of the rich and developed countries in particular, has resulted in abysmally low progress in this regard. In contrast, India's progress till now has been slightly better. Despite being a developing economy where energy consumption is growing day by day, a wholehearted effort to bring down emissions has been initiated. India's emphasis on solar energy, in particular, is a welcome step in this direction. However, India's journey on the low-carbon pathway towards net-zero goal can only be achieved through the active participation of all the stakeholders in the country. Sustainable lifestyle needs to be followed by the conscious citizens. Climate justice is also the core principle of this arduous journey. Moreover, a lot more investment will be needed for research and development processes, especially in case of solar and wind energy. Large scale investments pose a big challenge keeping in view the negation of promises by the rich countries of providing climate finance to the poor and developing countries, India has set net zero target for 2070. Currently, coal is the main source of energy. Hence, it will be required to phase out coal systemically and till then, sincere efforts will be needed to make its use efficiently with low emission norm. For this, constant monitoring and technological input will be required. But all the bottlenecks and the difficulties will have to be thrashed out in systemic manner without losing much time and with maximum will power on the part of the successive governments. Cumulative emissions are bound to spell disaster of unforeseen magnitude.

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