

# INDIA FOUNDATION JOURNAL



## Eco-Friendly Models of Development: A Survival Imperative

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- Technological Solutions Addressing India's Environmental Concerns - Parul Soni
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- Sandhya Jain's "Balochistan: In the Crosshairs of History" - Dhruv C. Katoch

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Editor  
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*With a team of dedicated professionals based at its office in New Delhi, the Foundation works with partners and associates both in India and overseas to further its stated objectives.*

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## Addressing the Core Issue: Reducing Population

Dhruv C. Katoch\*

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**T**he debate on the impact of population growth essentially centres around two contrary views. The Malthusian view<sup>1</sup> is predicated on the proposition that human population grows in geometric progression whereas food supply grows in arithmetic proportion. Food supply will hence run out, giving rise to the need to curtail population growth. Malthus believed that high rates of population will permanently condemn societies to a perpetual state of under development. This theory received the support of economists such as JS Mills and JM Keynes. Karl Marx, however, gave a contrary view, which was supported by sociologists. Marx stated that the widespread poverty and misery of the working class people was not due to an eternal law of nature as propounded by Malthus but to the misconceived organisation of society and by the unequal distribution of the wealth and its accumulation by capitalists.

The debate essentially revolves around four key issues:<sup>2</sup>

Do small families improve the prospects of children.

Is a rapidly growing population detrimental to economic growth?

Is high fertility a result of low income and poverty?

Is rapid population growth a symptom, rather than a cause, of poor economic performance?

Food shortages, of which Malthus expressed

concern have been largely overcome by advances in science and improved agriculture. However, this does not take away from the fact that larger populations require greater consumption, which stresses the environment, pollutes the atmosphere and causes environmental degradation, which is already causing concerns to people across the globe.

The population of the world, which stood at around 2.6 billion in 1950, took just 37 years to nearly double to 5 billion in 1987, adding an additional 2.4 billion people to the planet. The next billion was added in just 12 years, making the world's population touch the 7 billion mark in 1999. By 2050, the world's population is expected to increase to 9.7 billion, and peak at around 11 billion by 2100.<sup>3</sup>

In the Indian subcontinent, an examination of the populations of India, Pakistan and Bangladesh, between independence in 1947, to the present times, reveals that the population of India increased fourfold during this period. The population of Pakistan, for the same period, increased seven times and Bangladesh, six times. In India, the rate of population increase was not uniform, increasing about six times among the Muslim population and three times among the rest.<sup>4</sup> There is a view that the unbridled growth of population in India and in other parts of the world has adversely impacted development initiatives to reduce poverty and has also led to substantive environmental degradation.

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In her book, *Building the Population Bomb* (Oxford University Press, 2021), Emily Klancher Merchant states that overpopulation has been blamed for everything from climate change to poverty. She however posits that it is not population growth but global socio-economic inequality and environmental degradation that are the causative factors and that society incorrectly blamed a “population bomb” for problems that had other causes. “A wrong diagnosis,” she avers, produces ineffective solutions. In this, she echoes the Marxian viewpoint.

That is perhaps an oversimplification of a problem which has multiple dimensions, but Ms Merchant is not the only one who believes that reducing poverty will ipso facto, lead to a reduction in population. In their book, ‘Population and Development, Dennis Ahlburg and Robert Cassen note that, while it is believed that more rapid population growth increases poverty by reducing real wages, the relationship with poverty is ‘neither obvious nor well established’. They question the assumption that an increase in the labour force necessarily reduces wages, but caution that the relationship between population and poverty varies considerably across regions, countries, growth sectors and policy environments.<sup>5</sup>

In a study carried out, examining the link between population and per capita income growth and poverty, a case study of Uganda is instructive. Uganda achieved reasonable economic growth while also experiencing high population growth. However, the evidence garnered in the study also suggested that “the currently high population growth puts a considerable break on per capita growth prospects in Uganda”. The study further

went to state that high population growth led to low achievement in poverty reduction, which concomitantly, made it very difficult to make substantial improvements in poverty reduction and per capita growth.<sup>6</sup>

There is no gainsaying the fact that unbridled population growth hinders poverty alleviation programmes, attenuates consumption and waste and has a negative impact on societies and the world's eco-system. The examples of South Korea and Taiwan—two countries which have successfully controlled population growth, are instructive in this regard. Both these countries have seen rapid increases in per capita incomes as birth rates declined, giving them a positive demographic dividend.<sup>7</sup>

There is a need to control population growth through policy initiatives through expanding education and health care, especially for the girl child, and on implementing voluntary family planning programmes. This can succeed, as seen in an experiment conducted in the Matlab region of Bangladesh, in a controlled population group, a portion of which was provided with free services and supplies, home visits by well-trained female family-planning workers, and comprehensive media communication. The programme also had an outreach to husbands, village heads and religious leaders to obviate any backlash from the male population. The results indicated a substantial decline in fertility rates—1.5 percent— between the targeted population and the non-targeted population in the controlled area. This shows that family planning programmes can succeed in conservative societies. Other countries such as Iran and Rwanda too have shown similar results.<sup>8</sup>

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Over the years, based on empirical data, a causal relationship has been established between rising prosperity and declining fertility. Both East Asia and some countries of South East Asia are examples of this trend that as incomes rise, fertility tends to fall and between national income growth and falling birth rates as also between family incomes and fertility. Improved economic conditions, therefore, do lead to a decline in birth rates.<sup>9</sup> But for the converse to hold true, would require good governance models. In any case, the debate should now focus on both aspects: Good governance and taking measures to reduce the birth rates. Both should go hand in hand, simultaneously.

India should lay emphasis on population control measures that are enlightened and in the interest of women. Improved education and health care for the girl child, better and improved access to reproductive health control, a concerted media

campaign on the need and necessity for small families, sensitising religious and local leaders on the issue and making them part of the programme, are some of the initiatives which could be taken. Alongside, must be legislation to encourage the small family norm, through incentives and disincentives. The recent bill passed in parliament, bringing the age of marriage of girls on parity with boys to 21 years is a welcome step.

The resources of the earth are limited and population control is the need of the hour. This is also in conformity with the goals as laid down by the United Nations. While population trends are not explicitly mentioned in the SDGs, but several of the SDGs are directly or indirectly related to future demographic trends. As humans are the only polluters in the planet, restricting their unbridled growth must remain the core issue for India and the world.

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## **COP26: Can the World do more to prevent Global Warming**

Vishnu Prakash\*

India is the only big economy which has delivered in letter and spirit on the Paris Commitment<sup>1</sup> stated Prime Minister Modi in his address at Glasgow COP 26 Summit on 2nd November. He noted that India with 17% of the world's population was responsible for only 5% of greenhouse gas emissions annually. He committed India to achieve the target of net-zero emissions by 2070 and reducing CO2 emissions by 1 billion tons by 2030. In one fell swoop, he silenced the critics (except of course the professional India baiters) and assumed leadership in the battle against climate change.

If the road ahead is bound to get more difficult, the journey thus far for India (and the developing nations) has not been easy either. "India has been a late starter and much of its infrastructure remains to be built. China's emissions rise is likely to flatten as its years of intensive growth will soon be behind it, when it reaches its peak by 2030".<sup>2</sup> As such India's GHG emissions are bound to rise, attracting mounting pressure, economic and political, from the sinners' turned saints.

Climate change poses an existential crisis to mankind and is well described as Covid-like epidemic 'in slow motion'. That comprehension has finally dawned on the decision-makers and the populace at large, the world over. What is still missing is a genuine sense of urgency and

willingness to collectively put the shoulder to the wheel. Politicking, buck-passing and grandstanding, remain the order of the day, while the steady build-up of CO2 and other Greenhouse gases (GHG) in the atmosphere is choking the lungs of mother nature with ruinous consequences.

This short paper aims to look at the magnitude of the crisis, reasons for foot-dragging by the rich countries, and practical measures by the comity of nations to contain/reverse the damage. Humanity has no choice but to rise to the occasion. The only imponderable is whether or not substantive climate action will be initiated before nature's balance is disrupted irreversibly.

### **Background**

In the last 200 years, global temperature has risen by at least 1%. This is the result of the huge stock of greenhouse gases that have accumulated in the process of carbon-intensive development of the industrialised world with little regard for the environment. It is as if a thick blanket has enveloped the earth. Here it is important to distinguish between GHG stock and flow. The latter is the addition of GHG annually which currently measures a whopping 51 billion tons, while 'stock' represents the cumulative quantity of pollutants released by mankind. The restrictions imposed around the world during the Covid pandemic saw

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an overall decline in CO<sub>2</sub> emissions of 5.6% in 2020.<sup>3</sup>

GHG remains in the atmosphere for over 100 years and therein lies the foremost challenge. Even if the emissions are brought down to zero, it would take a century for the environmental poison to dissipate. Methane (CH<sub>4</sub>) is 262% and nitrous oxide (N<sub>2</sub>O) is 123% of the levels in 1750 when human activities started disrupting Earth's natural equilibrium. "The amount of CO<sub>2</sub> in the atmosphere breached the milestone of 400 parts per million in 2015. And just five years later, it exceeded 413 ppm".<sup>4</sup> Roughly half of the CO<sub>2</sub> emitted by human activities today remains in the atmosphere. The other half is absorbed by oceans and land ecosystems, which act as "sinks."

The challenge will get compounded with the addition of some 3 billion inhabitants in Africa between 2020-2100. The African population is expected to increase from 1.3 billion to 4.3 billion despite significant resource constraints, socio-political instability and security deficit. This would greatly aggravate inter and intrastate strife. Most of the increase will come in sub-Saharan Africa, which is expected to more than triple in population by 2100.<sup>5</sup> Meanwhile, the European population would shrink. The Asian population is likely to increase from 4.6 billion in 2020 to 5.3 billion in 2055, when it would start shrinking. China's population should peak in 2031, while India's should grow until 2059 to touch 1.7 billion.

In spite of damaging the environment, polluting the rivers, cutting down trees, and generating unconscionable levels of plastic waste, experts were divided about the extent of the actual impact on the climate. Many believed and some still do, that climate change is a boogie meant to extract

resources from the industrialised world and pave the way for the development of new forms of energy and technologies, to the detriment of oil-producing nations. Nevertheless, the first serious attempt at taking stock of the situation was made at the Rio conference in 1992 which recognised the need for taking corrective measures and put the onus essentially on the industrialised world under the principle of 'polluter pays'. Both mitigation and adaptation measures were envisaged. It was agreed that the rich nations will help the developing countries in curtailing pollution and enhancing energy efficiency.

The 1997 Kyoto Summit which was meant to concretise the gains of Rio turned out to be a tame affair. President Clinton signed the Kyoto Protocol but was unable to secure Senate backing. A bigger fiasco was to follow in 2017 when President Donald Trump, a climate sceptic, decided to pull out of the Paris Accord (2015). The withdrawal came into effect three years later thanks to an inbuilt stipulation that no nation will be able to quit before 3 years of signing it. Mercifully, with the change of regime, President Biden re-joined the Accord. All the same such a yo-yo approach does not augur well for effective climate action, particularly since the US is the lead actor in the matter. Given the inevitable electoral cycle in the US, the COP (Conference of the Parties) would have to brace for such disruptions, unless there is a groundswell of support for effective climate action in the US and politicians fear a voter blowback for being seen as a naysayer.

Climate solutions entail a cost, are not attractive politically and gains are intangible. In other words, climate action does not win votes, as

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it is an investment into the well-being of future generations while politics is mostly about instant gratification. There are a handful of leaders who have the vision to recognise that the present generation has a fiduciary responsibility to leave the earth habitable. Meanwhile, the industrialised world has been looking at ways to wriggle out of the commitments. They ganged up to gradually chip away at their responsibilities to facilitate mitigation and adaptation by the rest of the world. The first to be attacked was the principle of common but differentiated responsibilities (CBDR) which front-loaded action by the developed Nations.

In 2000, the biggest polluters were the US and European Union, both in terms of absolute and per capita emissions. India's per capita emissions, for example, was barely 5% of that of Europe. By 2020, the per capita gap started to shrink, emissions by the developed nations have peaked or are close to peaking while that of the developing countries are naturally rising. It may be pertinent to note here that though at the receiving end, the developing countries have not been very successful in staking out common positions nor do they have institutionalised consultative mechanisms like the G7. Just to cite one example, Brazil, South Africa, India and China constituted a group called 'BASIC' in November 2009, to co-ordinate positions on negotiations on climate change. They worked well during COP 17 in Copenhagen and COP 18 in Doha in 2012. However, China broke ranks when it outgrew BASIC. "As the run-up to the 2015 Paris climate conference showed, China's interests in climate change negotiations could now be reconciled with those of the US. It was the

China-US joint announcement and statement that largely produced the Paris outcomes" writes Shivshankar Menon.<sup>6</sup>

**The 2015 Paris Conference** introduced the concept of voluntary commitments "in the form of 'nationally determined contributions' (NDC) targets, to be communicated by each signatory to the UNFCCC. It represented "a 'bottom-up' approach where countries themselves decide by how much they will reduce their emissions" by a certain year. It essentially forces developing countries to share the burden and responsibility of climate action and dilutes the principle of CBDR reached in Rio. The Paris Agreement was signed by almost all (193) countries in the world at COP21 in Paris in 2015. Its other salient outcome was an agreement to limit the rise in the global average temperature to 'well below' 2 degrees above pre-industrial levels, and ideally to 1.5 degrees;<sup>7</sup> strengthen the ability of nations to adapt to climate change and build resilience; and align all finance flows with 'a pathway towards low greenhouse gas emissions and climate-resilient development'. The affluent nations committed to providing \$100 billion annually by 2020 which constitutes the core for climate action.

### **Glasgow Summit of COP26**

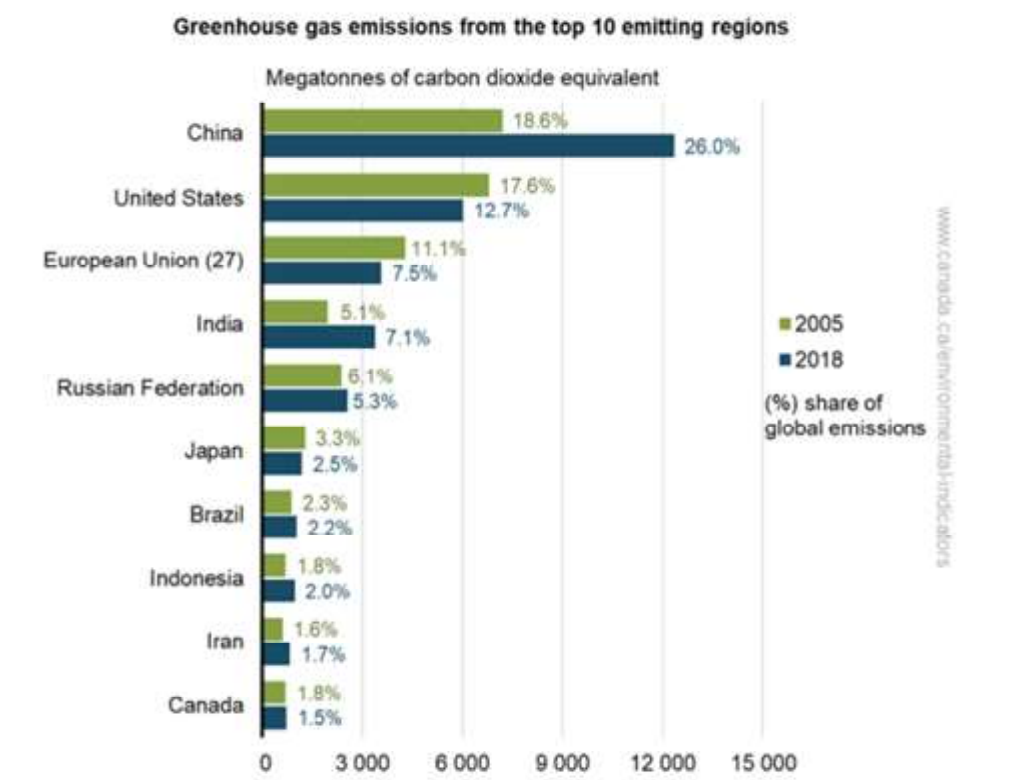
The NDCs submitted under the Paris Agreement were collectively not ambitious enough to limit global warming to 'well below' 2 degrees, forget 1.5 degrees. However, there is a provision for the signatories to submit more ambitious – NDCs every five years, known as the 'ratchet mechanism'. COP26 was the first test of this ambition-raising function. And that objective was

well served. 126 countries submitted new NDC targets while 41 countries did not, as of 12 November 2021. The new NDC targets cover 90.8% of global emissions.<sup>8</sup>

The UK has, for instance, pledged to reduce emissions by 68 per cent by 2030 compared to 1990 levels, and 78 per cent by 2035. The European Union (EU) is aiming at a reduction of at least 55 per cent by 2030 relative to 1990 levels, and the US is targeting ‘a reduction of 50-52 per cent’ compared to 2005 levels. Considerable skepticism existed among the participants at Glasgow summit. Hardly anyone spoke of climate justice and the rich nations remained hesitant to walk the talk. It further sanctified the concept of net-zero emissions.

## Magnitude of the Challenge

At the beginning of the industrial revolution, atmospheric CO<sub>2</sub> levels were roughly 280 ppm, which rose by the early 21st century to 384 ppm and by 2020 to 413.2 ppm.<sup>9</sup> The US has emitted 399 billion tonnes (bt) of CO<sub>2</sub> or 25% of the global total since 1751. China, which was a late starter, has already released 200 bt of pollutants since 1899 or 13.8% of the global total, as compared to a mere 3.21% by India over the same period. But Chinese annual emissions are now the highest at 10.17 bt annually or 20% of the global total. They will continue to rise and peak by 2030. Emissions of Europe and the US have already peaked.



*Graph: GHG emissions from the top 10 emitting regions<sup>10</sup>*

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## Security, health and economic impact

The impact would be as under:<sup>11</sup>

- By 2050, more than 143 million people could be driven from their homes by conflict over food and water insecurity and climate-driven natural disasters according to the World Bank.
- Rising temperatures threaten biodiversity, with one million species in danger of extinction that affect crop growth, fisheries, and livestock.
- Warmer temperatures could expose as many as one billion people to deadly infectious diseases such as Zika, dengue, and chikungunya.
- A warmer climate could lead to an additional 250,000 people dying of diseases including malaria each year between 2030 and 2050, as per the World Health Organisation.
- The Red Cross estimates that more than 50 million people around the world have been jointly affected by COVID-19 and climate change.
- An additional one million people could be pushed below the poverty line by 2030 due to climate change as per World Bank estimates
- By 2050 at least 300 million people who live in coastal areas will be threatened by dangerous flooding.
- A Stanford University study found that climate change has increased economic inequality between developed and developing nations by 25% since 1960.

COVID-19 pandemic is likely to exacerbate

the impact of climate-driven challenges and disrupt efforts to address them. Climate-driven disasters threaten to overwhelm local health systems at a time when they are already under extreme stress, and the costs of damage and recovery from a natural disaster when compounded with the pandemic are estimated to be as much as 20% higher than normal.

## Where does India stand?

India is the 7th most vulnerable country to climate change, according to Global Climate Risk Index 2021, both in the mainland and her over 7000 km long coastline. The good news is that India is “now ranked 10th in fighting climate change”<sup>12</sup> — and is probably the only G20 country compliant with its commitments and the Paris agreement. India has already reduced the emissions intensity of GDP by 28% over 2005 against its target of 33-35 percent by 2030 and increased her installed capacity of renewable energy to 38.5% against its target of 40% by 2030. At Glasgow, India committed 500 GW of renewable energy by 2030 equivalent to almost 50% of her capacity.

The task is cut out for India especially as the “energy investment requirement will rise from about USD 70-80 billion annually to USD 160 billion. Much of India’s wealth is yet to be created. It is estimated that 60% percent of India’s capital stock—factories and buildings that will exist in 2040—is yet to be built”.<sup>13</sup> Therefore, the adoption of green technologies is the best option for growth, to create a more responsible and sustainable economy. “USD 10 billion of FDI in the past 20 has been received in the renewable energy sector but there has been a slowdown since. Also, in the



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last 2-3 years Indian investment in the renewable energy sector especially wind energy has fallen.”<sup>14</sup> India has taken a slew of salutary initiatives to mitigate the impact of and adapt to climate change including launching the National green hydrogen mission to promote production and usage of green hydrogen across sectors; a Coalition for Disaster Resilient Infrastructure (CDRI) of 25 countries to reduce risk through research innovations and share of good practices has been established; ISA or the International Solar Alliance was unveiled in 2015 along with France which now has 101 member-countries (the US joined in Glasgow) to promote solar energy. A Rs. 400 / ton cess on coal (or carbon tax) has been quietly imposed.

India has substantial low-grade coal reserves and her dependence on coal-fired thermal plants will continue for the foreseeable future. Coal-based plants are the most polluting. Chinese coal consumption comprises 50% of the global total and India’s 11%. “For years, climate geopolitics was premised on the approach that developed economies must bear the lion’s share of mitigating climate crisis. It was considered unfeasible to impose the same burden on developing economies. India has reshaped that understanding of climate commitments fundamentally—we have shifted the global balance of power by showing that developing countries can lead the way in pledging comprehensive climate targets while also successfully meeting their socioeconomic objectives”<sup>15</sup> says Minister Puri, making a virtue of necessity.

But on the flip side, partly due to the Covid pandemic, mass poverty has risen in India from 60 to 134 million as per Pew Research Centre

measured on the yardstick of people earning up to USD 2 in PPP terms.<sup>16</sup> India has also become the 3rd largest emitter of GHG globally, contributing 6.6% of the total as against 27% by China and 11% by the US. But in per capita terms, Chinese emissions are four-fold that of India.

## **Major steps being taken to combat climate change**

### **Renewable and Nuclear Energy**

Two-thirds of global energy is generated by fossil fuels, which account for 67% of annual GHG emissions. Oil-producing countries and multinational oil corporations have considerable clout and resources to lobby the decision-makers and blunt any campaign to kick the oil addiction. The better way is to innovate and come up with green energy solutions like renewable energy which today is the cheapest form of energy. The green premium, for the generation of renewable power, especially solar, has come down dramatically. As per IEA (International Energy Agency), “The world’s best solar power schemes now offer the ‘cheapest electricity in history’ with the technology cheaper than coal and gas in most major countries”.<sup>17</sup> But battery storage poses a huge challenge as a cost is as high as dollars 200 per unit. According to IEA report the technology for energy transition up to 2030 is proven and known. But only 50% of the technology needed for the transition during 2030-2040 has been developed so far.

The Fukushima incident adversely impacted national plans of enhancing nuclear energy capacity. IEA recommends that nuclear energy

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comprise 10% of the total capacity of a nation. The reason is that, other than renewable energy, nuclear power is the cleanest. It is impossible to switch to 100% renewable energy capacity as the generation is weather-dependent. Therefore, to avoid blackouts and ensure continuous supply some amount of nuclear capacity is necessary. Taking all factors into consideration, Bill Gates in his new book also recommends nuclear power as the best non-renewable energy source.

Presently, France is the biggest user of nuclear energy comprising 70% of its total capacity; it is about 20% in the case of the US and Europe and a mere 2% in India. 4% of Chinese capacity is nuclear but could rise to 10% by 2030 as some 150 nuclear plants are proposed to be established.<sup>18</sup> Research on producing three types of hydrogen power is being stepped up. The big difference is that the burning of hydrogen produces water instead of CO<sub>2</sub>.

## **Green Buildings**

Globally, the buildings sector consumes more than half of all electricity for heating, cooling and lighting and accounts for 28 percent of energy-related greenhouse-gas emissions. Green buildings represent one of the biggest investment opportunities of the next decade—USD 24.7 trillion across emerging market cities by 2030.<sup>19</sup> Most of this growth will occur in residential construction, particularly in middle-income countries. Most of this investment potential—\$17.8 trillion—lies in East Asia Pacific and South Asia, where more than half of the world's urban population will live in 2030. The investment opportunity in residential construction, estimated at \$15.7 trillion, represents

60 percent of the market. There is a strong business case for growing the green buildings market. Construction of Green buildings could cost up to 12 percent more, which is easily offset by a reduction in operational costs up to 37 percent, higher sale premiums of up to 31 percent; up to 23 percent higher occupancy rates, and higher rental income of up to 8 percent.<sup>20</sup>

## **Climate Finance**

The transfer of “climate finance and low-cost climate technologies have become more important. India expects developed countries to provide climate finance of USD 1 trillion at the earliest. Today, it is necessary, that as we track the progress made in climate mitigation, we should also track climate finance. “The proper justice would be that the countries which do not live up to their promises made on climate finance, pressure should be put on them”, said PM Modi, who did not mince his words at the Glasgow summit.<sup>21</sup>

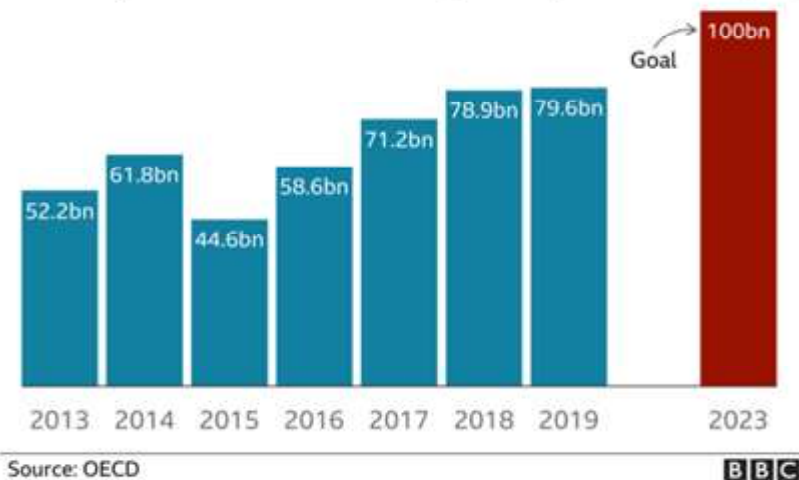
A Green Climate Fund was established in 2010 by some 190 countries to help developing countries respond to climate change. The fund has raised over USD 10 billion since 2014, and has directed resources to projects dedicated to both mitigation and adaptation. Through partnering with a number of international organisations, NGOs, and private sector companies, the fund has helped build resilience for an estimated 350 million people worldwide. Special Climate Envoy John Kerry recently stated that the United States would recommit to the Fund as part of renewed efforts to support global climate finance.

Over a decade ago, developed countries promised to mobilise USD 100 billion a year by

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## Climate finance

Amount provided and mobilised by developed countries (US\$)



2020 to help poor countries deal with the worst impacts of global warming and invest in green energy sources. In 2019, rich nations raised USD 80 billion for climate action but mostly on commercial terms. In November 2021 U.S. President Joe Biden pledged to double his contribution to USD 11.4 billion, but that money is for 2024 and hasn't been approved by Congress.

Rich countries now estimate they have raised between \$88 billion and \$90 billion annually, and are seeking to reach the \$100 billion goal in 2022.<sup>22</sup> Truth be told, there is no paucity of resources in the developed world—only a lack of political will.

## Conclusion

The solution to the climate challenge is innovation and technology, especially green technology. Significant initiatives have been taken in the last few years. Green banks are being set up. Buildings are going green. Green energy or renewable energy, especially solar, has become

the cheapest to install, generate and maintain. Even more significantly, the employment opportunities being created in establishing renewable energy facilities are more than conventional energy. But as noted above, this is just a beginning and the journey ahead is far more uphill. Availability of climate finance on soft terms is critical for the success of mitigation and adaptation measures by developing nations. The difficulty is that the need for climate justice does not weigh on the conscience of the western world.

A sticking point which has angered the poorer nations is the failure of rich countries to make good on their promise. The poorer nations rightly state that they cannot cut emissions faster without the cash. As per the figures collated by the OECD, almost no progress has been made between 2018 and 2019.<sup>23</sup> It is quite evident that despite the tall talk and half-hearted commitments to help the developing countries in adapting to climate change, the rich countries will try to get away with as little

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as possible. As most of the growth will come from emerging markets and the least developed countries, it would be efficacious if they transition straight away to Green Technologies and energy, instead of crossing the pit in two leaps, which would entail delays and higher costs. Lack of money cannot be held as an excuse. The pandemic has shown that governments can find money where necessary.<sup>24</sup>

While some amount of finance and green technologies will be contributed by the affluent nations, realistically, the heavy lifting will have to be done by the developing countries themselves,

from their own resources. And in reality, they have no choice, as the cost of neglecting climate action will be too high to bear.

A holistic approach will have to be followed entailing action and changes in every sphere especially lifestyle; aggressive recycling and cutting down on waste; creating environmental consciousness at home, school and public space; reducing and eventually eliminating green premium; increasing R&D budgets for innovation in green technologies; information exchange, adoption of best practices, imposing penalties like carbon tax and providing incentives for adoption of green practices.

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## Technological Solutions Addressing India's Environmental Concerns

Parul Soni\*

**S**teady depletion of the environment has been a global concern for the past few decades and has precipitated a climate emergency. This is especially true for countries like India where the sheer size of population increases the magnitude of the challenges of balancing development and ecology. As the world's second most populous country and a powerhouse economy, India has multi-dimensional challenges that lead to poor environmental outcomes. Considering that fulfilling a need as fundamental as food is the duty of the state and agriculture is a well-known source of pollution, fostering the practice of sustainable agriculture will remain critical in meeting the sustained demand for nutrition while adapting to the climatic changes, and securing the livelihood of farmers who make up about 43 per cent of income-generating Indians.<sup>1</sup> By the same criterion of population, India is also at risk of becoming the junkpile capital of the world, unless well-thought out and calibrated measures are taken to establish the processes to pivot it into a circular economy. It is intriguing to see that technologies like plastics or pesticides that were once indicators of development and were deemed necessary for a

better life have turned into the major contributors to pollution, affecting all aspects of human life. However, there is little doubt that in the era of the fourth industrial revolution, technology will play a vital role in mitigating the socio-economic concerns caused by environmental degradation. Technology has to be the mainstay of this transition – whether to fill the gaps or to promote innovation.

### **Sustainable agriculture for nutrition and income security**

India has traditionally been an agrarian country and is among the top 10 agri produce exporters, providing a fairly large amount of rice, cotton, soya beans and meat to the world.<sup>2</sup> In turn, Indian agri exports ensure nutrition security globally and income generation for farmers locally. However, agriculture is threatened by the changing climatic patterns – untimely rainfall and rise in sea level that increases the challenges of farmers, while increasing the demand for climate-resilient seeds, an R&D-intensive area where India is still making progress.

Agriculture is an input-intensive activity where use of water for irrigation, fertilisers and pesticides,

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farm machinery and tilling add to the adverse environmental impact. Besides, it is also an established source of greenhouse gas (GHG) emissions. A report by the International Energy Agency states that India emitted 2,299 million tonnes of carbon dioxide (CO<sub>2</sub>) in 2018, contributing about 7 per cent of the global emissions.<sup>3</sup> Agriculture and livestock owned a share of 18 per cent of gross national emissions, i.e., more than 400 million tonnes of carbon dioxide. Making agriculture sustainable will encompass using less chemicals and reducing the intensity of use of natural resources like water, and smart, frontier technologies like Internet of Things (IoT).

The term IoT refers to physical devices embedded with sensors, software, processing ability, and other technologies and are connected through the Internet or other communications networks so as to enable them to exchange data with other devices and systems. The benefits of using IoT in farming are:

- It enables remote monitoring of farm conditions and infrastructure, thereby saving time and labour on routine activities
- It helps transform information into data and improve decision making by analysing them
- It generates faster and quicker insights from data across the value-chain, and helps farmers respond to market needs
- It promotes efficiency in food production by reducing wastage and ensures safe and sustainable food to our customers through better traceability, thereby creating positive impact on a farmer's income

According to IBM estimates, IoT may help farmers increase food production by 70 per cent

by 2050. Apart from better pest management and weather forecasting, IoT, with the help of sensors, could save up to 50 billion gallons of water every year by optimizing water usage.<sup>4</sup> To drive the uptake of digital technology in agriculture, Agriculture Victoria has rolled out a 12-million dollar on-farm Internet of Things trial in four regions for sheep, cropping, dairy and horticulture farmers.<sup>5</sup>

IoT can be used for a host of agricultural activities, including:

**Irrigation and water quality management:**

India is a frontrunner in exporting rice, one of the most water-intensive crops – producing a pound of rice may need up to 2,273 litres (500 gallons) of water<sup>6</sup> and flood irrigation, a highly inefficient method, is preferred by farmers in the north-western India. This has substantially stressed the groundwater level in these states and enabling better insight about irrigation can help people counter the growing threat of drinking water. The Internet of Things is a critical ingredient in optimising water use for irrigation in farming and related activities. There are four factors which can nudge farmers to adopt smart irrigation systems. These are: integration of real-time weather forecast data, enabling synchronization of the systems with moisture sensors installed in the farm, control of the system from anywhere in the world, and reducing farmer's input cost while helping to conserve limited water resources. When combined with sensor nodes powered with wireless communication, it can help in monitoring the water quality as well. Such a system can measure the physical and chemical parameters of the water such as temperature, pH, turbidity, conductivity,

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and dissolved oxygen, and the data can be viewed on Internet-powered devices using cloud services.

**Integrated pest management:** Though agrochemical use by Indian farmers is far less than the global average, most of the farmers are unaware of which fertilizer or pesticide to use for which crop and at what stage. This often leads to problems like residue or contamination of water bodies. While the government has proposed methods like Zero Budget Natural Farming (ZBNF), the uptake across India has been sporadic. As a result, adopting integrated pest management (IPM), an effective and environmentally sensitive approach to pest management that relies on controlled use of pesticides and fertilizers, becomes imperative. It helps increase the quality of the crop even as it reduces the input cost for farmers. However, implementing integrated pest management requires real-time information on pest infestation. IoT infrastructure can play an important role by collecting disease and insect pest information using sensor nodes, and processing the data for enabling action. Even in cases where farmers are not comfortable handling devices on the system, local Krishi Vigyan Kendra (KVKs) can be connected on the platform to inform farmers about pest infestation status of their farms and guide them about the type and of pesticides they need to use.

**Soil quality monitoring:** The quality and fertility of soil are dependent on factors such as soil temperature, soil moisture, and microbial diversity. However, seemingly unrelated factors such as air temperature may also impact the quality and fertility of soil. Sensors connected to IoT systems can monitor the parameters and help

farmers make informed decisions on sowing the seeds, use of irrigation or harvesting the crop, thereby reducing manual effort and water usage, thus controlling cost and environmental impact. They are also easy to install and low maintenance. IoT systems can be used for backup data securely, review historical or instant data to track trends or predict irrigation needs, and set up reminders. It also makes overwatering or underwatering of crops less likely and may arrest depletion of groundwater by promoting water conservation.

**Other advanced technologies for sustainable agriculture:** Tractors are one of the best friends a farmer can have. It reduces the effort to prepare the ground for sowing. However, a tractor can weigh anything between 1700-2600 kg<sup>7</sup> that also exerts intense pressure on the soil. This may lead to compaction of soil, affecting its ability to hold water and making water and nutrients available to the plant. Deploying small robots instead of tractors can prevent soil's exposure to this pressure as well as help farmers to take care of their crops better – these robots can be fitted with geotagging-enabled cameras, equipment for precise broadcasting of pesticide, and planting saplings. Adopting genome editing can also help in better practice of sustainability in agriculture. Genetic modification of select crops, e.g., fruits, can have twin benefits of saving them from being plucked too raw and use chemical ripening agents for making them consumable and preventing them from rotting naturally. According to the United Nations Food and Agriculture Organization (FAO) estimates, more than 40 per cent of food produced in India is wasted, costing the country an estimated US\$14 billion every year.<sup>8</sup>



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Genome editing can help fruits like banana, which releases ethylene gas upon ripening that leads to ripening of other bananas in the proximity, to produce less of the plant hormone and remain healthy looking without any brown patches.<sup>9</sup> Owing to the volatile public sentiment towards GM crops and genome editing, a transparent and robust governance framework is necessary before implementing such measures.

### **Case study: Shepparton East orchard, Australia**

In 2015, Maurice Silverstein decided to upgrade his irrigation system to an automated drip system on his apple and pear orchard at Shepparton East, Australia. This upgraded system will allow him to access real-time soil moisture readings from sensors across the orchard and will also shift from sprays to drip irrigation, promoting more efficient and less water usage. It will alert him to problems in the system, such as blockages or leaks, and can be controlled by an app on his phone, empowering him to respond more quickly than relying on field inspections alone. This system allowed Maurice to be more efficient with his time and water, even as allowing him greater flexibility in terms of movement. Though he needs to be close at hand to fix any problems, he can manage his irrigation system and his orchard from anywhere that has internet coverage.

### **Case study: Detection of borer insects in tomatoes, India<sup>10</sup>**

A study presented at the *International Conference on Computing and Communication Systems* in Shillong in 2015 discussed an

investigation on IoT-based borer insect detection in tomatoes using a robot attached to a wireless web camera and Azure cloud service. The web camera used in the investigation took videos of tomato plantation real-time and sent the data to the Java enabled Software-as-a-Service (SaaS) where the detection in unripe tomato is done. The information was then processed by the database stored at the Azure cloud platform for matching with appropriate pesticide amalgamation, following which a robot sprayed appropriate amounts of pesticides on the tomato plants.

The process consisted of two stages. In stage 1, real-time video feed from wireless webcam, accessed at Cloud end, was converted into grayscale imagery. Image segmentation was performed later to eliminate leaves and branches, and images of tomatoes were retained by performing dilation, following which RGB images of tomatoes were retrieved using masking of dilated images. In stage 2, the number and type of pest on the tomatoes were identified, and an adequate amount of pesticide was sprayed over the tomatoes.

### **Waste management for better environment and economy**

It is not startling to realise that India is home to 17.7 per cent of the world population and as per a 2016 estimate, generates more than one-tenth of global waste. India produces an estimated 277 million tonnes of municipal solid waste every year, of which 77 per cent is disposed of in the open or end up in landfills, 18 per cent is made compost and 5 per cent is recycled. However, according to the “Swachhata Sandesh Newsletter” by the

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Ministry of Housing and Urban Affairs (MoHUA), as of January 2020, 84,475 wards of India produced 147,613 metric tonnes of solid waste every day. The tally is led by Maharashtra (22,080 MT a day), Uttar Pradesh (15,500 MT a day), Tamil Nadu (15,437 MT a day), Delhi (10,500 MT a day) and Gujarat (10,274 MT a day).<sup>11</sup>

Inefficient management of solid municipal waste and poor implementation of existing regulations have made it a major source of air and water pollution in India. New-age, smart technologies can help us integrate waste management, monitor collection and disposal, and minimize the environmental impact due to waste mismanagement. Integrated waste management systems, powered by Programmable Logic Controller (PLC) and Supervisory Control and Data Acquisition (SCADA) monitoring systems, can monitor automatically, and operate from a centralised control station to ensure efficiency and will require minimum manual intervention, reducing margin of error. Smart technologies can be used in the fields of:

**Waste segregation:** Despite several attempts, instilling a culture of segregated waste disposal remains a dream in India. Technology can help improve the situation with innovations like smart bins. These sensor-powered, pre-programmed bins can enforce waste segregation and trigger a warning when the wrong type of waste is dumped in it. The bins may also come with interactive screens to guide users on next steps for a safe disposal of that type of waste. Improving waste segregation at source is at the heart of efficient management and will play a vital role in optimising the whole chain.

**Waste collection:**<sup>12</sup> Currently, trucks carrying dumpsters to landfills are powered by fossil fuel, particularly diesel. This makes the waste disposal process a double jeopardy – while landfills themselves are a source of pollution, emissions from the trucks add to the pollutants in the air. Deploying a fleet management technology, common in the logistics sector, can optimize the waste collection step in the chain. Fleet management technologies use a network of sensors connected through GPS to create and analyse data to identify the best route for the fleet or individual vehicles, as required. This will help trucks to avoid traffic and not only reduce emissions but also enable maximum trash collection in less time. Besides, using vacuum suction to empty garbage bins through a network of underground pneumatic tubes can help in increasing the speed of waste collection and disposal.

**Other advanced collection and disposal technologies:**<sup>13</sup> Advanced economies have made substantial effort to improve their waste management measures, some of which may prove useful for India as well. One such innovation is a solar-powered waste compactor. This is a smart device that registers the bin's fill level in real time and activates an automatic waste compaction. The compactor-bin has effectively increased a normal trash bin's capacity by up to 5-8 times. A similar technology is an ultrasonic trash can sensor that regularly informs the user on how full is the container and helps in reducing the cost of overfilling a skip. Another similar intervention is an image-based trash can sensor that is connected through GPS and automatically monitors both fullness and contents. The sensor also determines

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which containers need service each day, schedules routes and allocates jobs to drivers.

**Waste-to-energy generation:** This is a well-known technology for recycling residual waste that uses combustion to provide heat and power, and in turn, reduces the speed of landfills that dot the fringes of all metropolitan and smaller cities in India. Though waste-to-energy is around for some time, the uptake has remained a challenge. There is little doubt that increasing the uptake of this technology will substantially reduce waste disposal to landfills and generate clean, reliable energy from a renewable fuel source, reduce dependence on fossil fuels and greenhouse gas emission. However, the technology faces hurdles in India due to various operational and design problems, lack of segregation of waste at source being the primary one.

### **Case Study: New York (the US) and The Hague (The Netherlands)<sup>14</sup>**

New York has one of the more complicated waste management ecosystems in North America. The city is home to about 8.6 million people and employs around 72 hundred waste collectors to keep itself clean and sanitary. Times Square alone receives a daily footfall of about 500,000 pedestrians, creating roughly 15,300 pounds of garbage. In March 2013, as part of the largest public space recycling initiative in New York City, 30 smart waste and recycling stations were deployed in Times Square. These units were capable of waste compaction, equipped with real-time fill level monitoring and collection notifications. Connected to smart stations, these units increased the total trash collection capacity by nearly 200

per cent while the frequency of collection per bin decreased by half.

In 2009, the city of Hague in the Netherlands began installing underground trash bins that can hold a larger quantity of waste. By 2017, there were 6,100 such units installed below the pavements with the top of the bin coming out of the ground at waist height. More than half of these bins are sensor-enabled, allowing officials to remotely monitor the fill levels of containers and set up 'smart schedules' for emptying them. The Hague's success with these underground containers put the city as an example of innovative waste solutions in a 2017 New York City Zero Waste Design guidelines report.

### **Case study: A zero-waste film set (India)<sup>15</sup>**

A gathering is an ideal setting for waste generation – be that a feast, a meeting, or work, e.g., shooting of a film. However, a recently-released Bollywood cinema titled 'Chandigarh Kare Aashiqui' ensured that the city, which acts as its setting, does not start a landfill with its 17,000 kgs of waste generated in three months.

Six steps followed by the team include:

- Replacing plastic water bottles with water dispensers and reusable water bottles
- Using biodegradable bamboo toothbrushes and big bottles of toiletries instead of small disposable ones
- Providing colour-coded bins for disposing solid and liquid waste and PPEs
- Deploying a trained crew for segregating waste at source
- Distributing leftover food among low-

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income families in the area

- Recycling the waste into bricks, lamps, and other products

## Conclusion

The prevailing discourse on environment-friendly technology often overlooks their hidden harms. Besides, most of these technologies are capital-intensive in nature. While COVID-19 has pushed the world to think about the environment with commitment, harnessing only capital-intensive solutions can cause ‘greenflation’ and affect overall productivity and growth of the country. For low-and-middle-income countries like India, access to advanced technologies to mitigate environmental concerns is almost always affected by lack of knowhow, adequate funds, and scepticism on part of the user. These can be addressed by focusing on easy-to-use and cost-effective technologies as well as right policy and regulatory interventions, and their implementation to promote adoption of technological solutions.

However, when it comes to environmental challenges, there is no better way to save the planet than to prevent the damage. Interestingly, though sustainable agriculture and waste management are

India’s bigger ‘trouble’s, they overlap when it comes to food waste. A UN report in March 2021 states that household food waste in India is about 68.7 million tonnes a year. Food waste alone is a major source of anthropogenic greenhouse gas emissions – the Food and Agriculture Organization of the United Nations estimates that global food loss and waste generate 4.4 Gt CO<sub>2</sub> eq every year, or about 8 per cent of total anthropogenic greenhouse gas emissions, effectively making the contribution of food wastage emissions to global warming almost equivalent to global road transport emissions.<sup>16</sup> According to the World Wildlife Fund (WWF), stopping food waste can reduce all human-caused greenhouse gas emissions by about 6 to 8 per cent.<sup>17</sup> However, the bigger concern is, wasting food also aggravates the overall greenhouse gas emissions scenario as it adds to the emissions caused during the production, processing, and marketing of these products. Besides, it adds on to India’s burgeoning and unmanageable waste burden. Therefore, in addition to sourcing or developing technologies to address the environmental challenges at hand, it is equally urgent to create awareness about the pitfalls of irresponsible consumption and nudge for behavioural change in consumers.

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## Aviation & Environment - The Way Ahead

Anil Chopra\*

The 26th session of the Conference of the Parties (COP 26) to the United Nations Framework Convention on Climate Change (UNFCCC) was finally held from 1-12 November 2021, in Glasgow, UK. With climate change intensifying, scientists are warning that humanity is running out of time to limit global warming to 1.5°C over pre-industrial levels. The Emissions Gap Report 2021 shows that new national climate pledges combined with other mitigation measures put the world on track for a global temperature rise of 2.7°C by the end of the century.<sup>1</sup> That is well above the goals of the Paris climate agreement and would lead to catastrophic changes in the earth's climate. To keep global warming below 1.5°C this century, the aspirational goal of the Paris Agreement, the world needs to halve annual greenhouse gas emissions in the next eight years.

Civil air flights continue to see very high growth especially in major developing nations and emerging economies. This includes both passenger and cargo movement. New airports are being built and old modernised to cater to the increasing demand. Aviation affects the environment in many ways: people living near airports are exposed to noise from aircraft; streams, rivers, and wetlands may be exposed to pollutants discharged in storm water runoff from airports; and aircraft engines emit pollutants to the atmosphere. India is amongst the top five fastest growing markets. Besides flight

and ground safety, environmental protection is the most important issue for all aircraft operations.

Global aviation contributes about two percent of global greenhouse gas emissions and are growing with growth in aviation. But aviation supports eight percent of the world's economic activity in terms of GDP. As a result of massive increase in air travel by 2025, it is estimated that the total CO<sub>2</sub> emission due to commercial aviation may reach around 1.5 billion tons. The amount of nitrogen oxide (NO) around airports, may rise from 2.5 million tons in 2000 to 6.1 million tons by 2025. The number of people who may be seriously affected by aircraft noise may rise from 24 million in 2000 to 30.5 million by 2025. However, analysts believe that the aviation related greenhouse gas emissions figure should peak at around 3 percent due to sustained actions being evolved by the governments and industry.

Many actions need to be taken. The aircraft engines have to be made more efficient with lesser emissions. Managing the airport construction related pollution, operating waste, e-waste, noise and chemical emissions are many of the concerns requiring technological solutions. Ecological airport redesign, changes in air and ground operating procedures, and eco-friendly initiatives can alleviate environmental pressures without causing passenger and operational stress. The terms 'Sustainable Aviation' or 'Green Aviation' are increasingly being

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used to address the technological and socio-economic issues facing the aviation industry to meet the environmental challenges of twenty-first century. The environmental programs have to be scientifically evolved specific to each airport. Balance has to be maintained between social, economic and environmental imperatives. The ultimate goal is to produce the greatest improvement in the quality of life of the citizens.

### **Greenfield Airports and Biodiversity**

Airports have considerable effect on city's urban development and have negative impacts on the environment. At a local level, even though noise seems to be the main concern, air emissions, resource (energy and water) availability, waste and water management, and ecosystems and land use planning constitute issues that are directly linked to local communities' tolerance. Environmental impact and sustainability require life cycle sustenance. Selecting a site for airport or its expansion, must look at ecological balance, bird and animal habitats, compatible land use, landscape deterioration and biodiversity damage. We need to avoid building on green spaces and work with local communities and organisations to conserve biodiversity on sites near airports.

### **Climate Change**

Internationally, aviation is considered one of the fastest growing sources of greenhouse gas emissions. Even though aircraft emissions are not included in Kyoto protocol, emissions that are directly controlled by airport operators are ground-based, and therefore are subject to national targets. Air pollution caused due to various reasons including the burning of aviation fuel greatly contributes to

climate change. Disruptive weather affects aviation the most. The most important measures require improvements in energy efficiency and conservation, ground fleet conversions, low emission power generation plants on site or renewable energy supplies. Geothermal, hydropower, solar or wind power is used to cover a significant proportion of energy needs. Many airports focus on achieving carbon neutral operations by offsetting carbon emissions that they cannot eliminate.

### **Air Pollution**

Degradation of local air quality is another issue. The most significant sources of air pollution (lead emissions) are aircraft, airside and landside vehicles, ground support equipment, fuel storage, engine testing, fire training and road traffic. Burning of aircraft wheel tyre rubber during landing and take-off contributes to particle matter in the air, and fuel transfer and storage facilities contribute to increased volatile organic compound (VOC) concentration. Key pollutants of concern include oxides of nitrogen, carbon monoxide, hydrocarbons, particulate matter, sulphur oxide and carbon dioxide. The most common applied measures to control air pollution include air quality monitoring systems, air traffic management, promotion of green transport, reduction in commercial vehicle trips to-and-from airports by providing efficient public transport like airport metro etc.

### **Noise Pollution**

Noise disturbance is a difficult issue to evaluate as it is open to subjective reactions. There are significant consequences on the surrounding areas as take-off and landings are a major source

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of noise. Large airports normally install noise monitoring systems, put operating restrictions and limits, manage air traffic, create anti-noise barriers, and support home insulation etc. Adverse effects on people living close to an airport, could include interference with communication, sleep disturbance, annoyance responses, performance effects and cardiovascular and psychophysiological effects. Aircraft flying at a height of 10,000 ft above ground do not usually produce 'significant' noise impact. Noise monitoring computer software models produce aircraft-wise noise footprints to help calculate noise levels around the airport. These noise 'contours' can then be placed on a map to see which communities are subjected to different degrees of noise levels.

All commercial aircraft are supposed to meet the International Civil Aviation Organisation's (ICAO's) noise certification standards. The 'balanced approach' is reduction of aircraft noise at source; land-use planning and management measures; and noise abatement operational procedures and restrictions. Avoiding overflying residential areas hospitals and schools as far as possible; using least affected runway(s) and routes; using continuous descent approaches and departure noise abatement techniques; avoiding unnecessary use of auxiliary power units by aircraft on-stand; building barriers and engine test-pens to contain and deflect noise; towing aircraft instead of using jet engines to taxi; limiting night operations; applying different operational charges based on the noisiness of the aircraft, are some of the measures.

### **Supersonic/Hypersonic Flights**

Concorde was the only supersonic airliner in commercial use. Many countries did not permit its

operations or even overflights in view of sonic booms and resultant high sound and vibrations. Even military aircraft are allowed supersonic training flights in restricted areas away from population centres. Sonic booms over hospitals have resulted in premature deliveries of babies. However, the human beings want to travel faster. Hypersonic flight is already a reality. Hypersonic airliner could do Mumbai to New York in just two hours. The saving grace is that hypersonic flight would normally be at very high altitudes closer to space.

### **Waste Management**

Airports generate large amounts of waste, including a considerable proportion by companies involved in cargo handling, retail, flight catering, and aircraft maintenance. As most of the waste produced at airports is generated by customers and contractors, it is important to encourage good waste management practices. A holistic waste management approach would include efficient disposal and recycling of engineering material and human waste.

### **Water Management**

As airports cover large areas of land, it creates large amounts of runoff water which has to be effectively managed to comply with environmental standards before being discharged. Water is a valuable resource, one that needs to be used sparingly. Airport water run-offs are known to contain high levels of chemicals and toxic substances coming from aircraft and airfield de-icing, fuel spillage, fire-fighting foam, chemicals and oils from aircraft and vehicle maintenance, detergents used for aircraft and vehicle cleaning etc. Waste water and effluents need proper



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management to avoid polluting the environment. Most common measures applied against these are waste-water and sewage plants, drainage systems, surface and ground water quality monitoring, oil/hydrocarbons and grease separators, use of biologically degraded de-icing and anti-icing agents etc. As infrastructure providers, airports use significant volumes of water in operations. Regular water usage monitoring, leak detection and targeting, and introducing water conservation practices are important. Airports may install various leak detection systems, install water reduction devices and implement water recycling operations to reduce the demand of potable water. Drainage and rain water harvesting have to be inbuilt.

### **Need for Green Aero-engines**

Among the many factors requiring attention, the aircraft engine requires special addressing. Most airliners nowadays fly at above 30,000 feet (9 km) altitude. Therefore, the majority of aircraft emissions are injected into the upper troposphere and lower stratosphere (typically 9 - 13 km in altitude). The resulting impacts are unique. The impact of burning fossil fuels at altitude is approximately double that due to burning the same fuels at ground level. This requires technological innovations and intervention. New aircraft and engine designs/technologies, and alternative materials need to be evolved. Interestingly, the most important role in an airplane's fuel efficiency is also of the engines. Any solution must thus look at both. The two most-widely used aircraft today—the Boeing 737 and the Airbus A320 have shown that newer models of the same aircraft, with better engines, can not only carry more passengers and payload, but do so while burning nearly 25 percent lesser fuel.

### **Sustainable and Green Aero-Engines**

Sustainable and Green Aero-Engines (SAGE) initiatives are being taken both in the European Union and in the USA, to develop aero-engine technologies, with new engine architectures that offer opportunities for reduction in CO<sub>2</sub> emissions relative to current turbofans. Emissions of CO<sub>2</sub>, H<sub>2</sub>O, O<sub>2</sub> and N<sub>2</sub> which are products of hydrocarbon fuel combustion are all function of engine fuel burn efficiency. Areas being addressed include lightweight low pressure systems for turbofans; composite fan blades and high efficiency low pressure turbine; advanced engine externals and installations including novel noise attenuation; high efficiency Low Pressure (LP) spool technology while further advancing high speed turbine design; option of an aggressive mid turbine inter-duct; high efficiency and lightweight compressor and turbine; and low emission combustion chamber for next generation rotary-craft engine. Developments in controls and electronics, lightweight metallic and composite materials, hydraulic and pneumatic systems, and novel manufacturing methods, specific aero-engine parts, like casing, tanks, pipes, high temperature materials such turbine blades, and sensors would require attention.

### **SAGE 2 Project**

European Union's SAGE 2 project headed by Rolls-Royce and Safran focuses on demonstrating the technologies such as composite propeller blades with aero-acoustic optimisation, electric de-icing system and equipment. The gas generator used in the SAGE 2 open rotor demonstrator is derived from a Snecma M88 engine. The Airbus A340-300 MSN001 aircraft is being used as a flight test vehicle, with one full size Contra Rotating Open

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Rotor (CROR) pusher engine attached to a representative pylon and engine mount. Open rotor technologies offer the potential for significant reductions in fuel burn and CO<sub>2</sub> emissions relative to turbofan engines of equivalent thrust. Open rotor engines remove the limitation by operating the propeller blades without a surrounding nacelle, thus enabling ultrahigh bypass ratios to be achieved. Installation of the open rotor engine on the airframe has its complexities, as the airflow through the propellers interacts with the supporting airframe structure in a different manner. The trend for Very High Bypass Ratio (VHBR) engines requires technology developments across a broad range of complex gas turbine systems, from fan inlet through the complete compression, combustion and turbine to exhaust.

### CAEP Targets

The aircraft engines account for most of the noise and fuel consumption characteristics of airplanes. The International Civil Aviation Organisation (ICAO) has a Committee on Aviation Environmental Protection (CAEP) since 1983. Aircraft are required to meet the engine certification standards adopted by ICAO. Of particular relevance is the Standard for NO<sub>x</sub>, a precursor for ozone, which at altitude is a greenhouse gas. Standard for NO<sub>x</sub> was first adopted in 1981. It was made more stringent in 1993, 1999, 2005 and 2011. CAEP/8 standard was set in 2010. The CAEP medium and long-term NO<sub>x</sub> technology goals was to target reduction by 45% of CAEP/6 standard by 2016; and 60% by 2026. GE clean-sheet engine GE9X class engines employ modern technologies give better specific fuel consumption (SFC). It means 10 percent lower

fuel costs even when compared to the 300ER. The engine has 15db noise levels well within stage 4 margin, and 29 percent emissions within CAEP/8 margin. Novel cycles that increase bypass ratios, incorporation of lean burn technology is evolving. ICAO is developing the first non-volatile PM (nvPM) standards (covering soot or black carbon particles) for turbofan/turbojet engines. Similarly, standards are being set for turboprops, helicopter turbo-shaft, and APU engines. The nvPM standard will help better assess impact.

### Design Considerations

Changes in engine design or operation might include ultra-high bypass turbofans; open rotor engines; use of alternative fuels; relocating engines on the body of the aircraft such that engine noise gets deflected upwards. An example of a ‘green’ design change can be seen in the blended wing and body of the subscale, flying X-48B aircraft prototype. Other concepts may include capitalising on the potential of advanced electrical power technologies such as batteries or fuel cells to reduce the amount of fuel needed. Using High-tech engines, propeller efficiency, advanced aerodynamics, low-drag airframe etc. can result in higher fuel saving and less gaseous emissions. Improvement in performance can be achieved by moving from a component-based design to a fully integrated design by including wing, tail, belly fairing, pylon, engine, high lift devices etc. into the solution. At the April 2018 ILA Berlin Air Show, a high-efficiency composite cycle piston-turbofan hybrid engine for 2050, combining a geared turbofan with a piston engine core was presented. The 2.87 m diameter, 16-blade fan gives a 33.7 ultra-high bypass ratio. The 11,200 lb. (49.7 kN)

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engine could power a 50-seat regional jet. Although the engine weight increases by 30 percent, the overall aircraft fuel consumption is reduced by 15 percent.

### **New Engine Concepts**

Two new engine concepts currently under investigation include the 'Combined Brayton Cycle Aero Engine' and 'Multi-Fuel Hybrid Engine'. Even though modern engines are supposedly very efficient, a large part of the energy input is ejected as waste heat (over 50%). Improving performance by heat recovery is the requirement. A heat exchanger integrated in a turbofan core can convert recovered heat into useful power which can be used for onboard systems or to power an electrically driven fan to produce auxiliary thrust. A dual combustion chamber, with first stage between HP Compressor and HP Turbine burning cryogenic fuel like Hydrogen/Methane or liquid natural gas, and the second combustor at an inter-stage uses kerosene/bio-fuel in the flameless combustion mode is being considered. High temperature generated in the first stage, allows flameless combustion in the inter-stage, thus reducing CO, NOx etc. Cryogenic bleed air cooling can enhance the engine thermodynamic efficiency by cooling the bleed air thus allowing increase in temperature of the fuel. contra-rotating fans (CRF) can use boundary layer ingestion to reduce both noise emission and improve propulsive efficiency.

### **Next Generation Innovations**

Developed under the US Department of Defense's Adaptive Versatile Engine Technology (ADVENT) and adaptive Engine Technology Development (AETD) programs, is the GE Adaptive Cycle Engine (ACE). Unlike traditional

engines with fixed airflow, the GE ACE is a variable cycle engine that will automatically alternate between a high-thrust mode for maximum power and a high-efficiency mode for optimum fuel savings. ACE is designed to increase combat aircraft thrust by up to 20 percent, improve fuel consumption by 25 percent to extend range by more than 30 percent, and provide significantly more aircraft heat dissipation capacity. These adaptive features are coupled with an additional stream of cooling air to improve fuel efficiency and dissipate aircraft heat load. The joint GE/U.S. Government investment of more than US\$ 1Billion, the ACE engine will incorporate both heat-resistant materials and additive manufactured components. In the ADVENT program, GE reached the highest combined compressor and turbine temperatures ever. The Adaptive Engine Transition Program (AETP) is underway. The challenge remains in going to higher overall pressure ratio engines due to increasing cooling air temperatures, constraints imposed by developing new material technologies and detrimental weight and drag impact on ultra-high bypass ratio engines. GE Aviation's Passport engines feature a higher-pressure ratio and a compressor made of new—and unnamed—advanced materials. GE predicts that the engines will achieve 8 percent lower fuel consumption and considerably lower NOx emissions. The pulse detonation engine (PDE), which has the potential to radically increase thermal efficiency, is one of the more exciting propulsion technologies being researched. PDE uses detonation waves to combust the fuel and oxidiser mixture. Instead of burning it, it explodes it. In theory it can be used up to Mach 5.0.

Some of the statistics around aero engines can

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explain the challenges of engine technologies, and why very few manufacture modern engines. Each wide-chord fan blade exerts a centrifugal force of around 70 tons, equivalent to the weight of a modern locomotive; each high-pressure turbine blade generates the same amount of power as a Formula 1 car; and the turbine discs will now have a “dual microstructure” to give different mechanical properties at the centre and at the edge of the disc.

### **Electric and Solar Engines**

A number of electrically powered aircraft, such as the QinetiQ Zephyr have been designed since the 1960s. Some are used as military drones. In 2007, France flew a conventional light aircraft powered by an 18 kW electric motor using lithium polymer batteries, and became the first electric aircraft to receive an airworthiness certificate. Solar-powered manned aircraft designed to fly both day and night without the need for fuel are already under development. Solar electric propulsion have been performed through the manned ‘Solar Impulse’ and the unmanned NASA ‘Pathfinder’ aircraft. Many big companies, such as Siemens, are developing high performance electric engines for aircraft use. Small multi-copter UAVs are almost always powered by electric motors.

### **Hydrogen Fuel Cells**

Hydrogen fuel cell technology is fast evolving. A hydrogen fuel cell is an electrochemical device that uses a chemical process to convert hydrogen to electrical power, which in turn can drive one or more electric propulsion motors on the unmanned aerial vehicle. Electricity, water and heat are the only products of this chemical process, which makes hydrogen an extremely clean fuel.

Hydrogen fuel cells are smaller, lighter, more versatile and more resilient than alternatives like batteries or small gasoline and diesel engines. Unlike batteries, hydrogen fuel cells do not need to be recharged. Simply connect a carbon fibre hydrogen storage tank to the fuel cell, and fly! Drones powered by a hydrogen fuel cell have much longer range and flight duration than a comparably sized battery-powered aircraft. Typical rotary and fixed wing platforms can fly up to three times longer with hydrogen fuel cell onboard. UAVs are already flying far beyond the capabilities of drones powered by batteries or gasoline engines. Operators of fixed-wing or multi-rotor platforms can fly up to three times longer with proven hydrogen fuel cell onboard.

The 600-watt and 1200-watt liquid-cooled hydrogen fuel cells and compressed hydrogen fuel source are ideal for military and commercial missions of all kinds, including intelligence, surveillance and reconnaissance (ISR), search and rescue, law enforcement, infrastructure and agriculture inspections, and other missions where silent operation and long duration flights are critical. The hydrogen fuel cell advantages can be summed as nearly three times the range or flight time of batteries, no need for recharging, all-temperature performance, faster turnaround times between missions, no environmental footprint, virtually noise-free, logistic simplicity, liquid-cooled technology operates more efficiently at high altitudes than air-cooled fuel cells, and longer service life. Hydrogen fuel cell technology will be increasingly used on larger aircraft.

### **Flight Planning Tools**

The flight efficiency approach requires

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choosing optimum flight routes. All aircraft operators and computerised flight plan service providers exchange and compare their flight plans with the best filed flight plan accepted by the integrated initial flight plan processing system. Special software tools show shortest route plans. Dynamism through the application of the Flexible Use of Airspace (FUA) concept, under which the military release airspace to civil aviation helps. The flight planning from aircraft start-up to switch-off can be a great tool to reduce engine use and fuel consumption. This allows substantial savings in distance flown, time, fuel and environment. The air and ground crew, the airline operator, air and radar controllers, among many others can play a significant role.

### **India's Aviation Environmental Regulations**

India's Directorate General of Civil Aviation (DGCA) which is responsible for all aspects of enforcement and regulation has an Aviation Environmental Unit. All operators such as the airlines, navigation service providers and airport authorities too, have environmental cells. It is mandatory to submit to DGCA monthly fuel consumption data to set up a carbon dioxide emission inventory. The DGCA sponsored noise study for Indira Gandhi International Airport (IGIA) Delhi has now become the standard for all major airports in India. DGCA has laid down guidelines for noise measurement and monitoring at airports, including noise mapping, validation, action plan, noise reporting and proposed aviation noise limits. The Indian Ministry of Civil Aviation's Green Aviation Policy, 2019 aims to achieve the sustainable and inclusive growth of the aviation

industry in the country and remedy the ecological concerns posed by the industry. The policy creates a regulatory framework to remedy the environmental issues created by the civil aviation industry by identifying key areas that require guiding principles and regulations.

### **Environmental Initiatives - Indian Airports**

Indira Gandhi International Airport (IGIA), New Delhi, was the first Indian green-field airport build with international best practices keeping environmental excellence and sustainable work practices in mind. The focus was on natural resource conservation, pollution preventions and environmental skill development. All the aspects and associated impacts due to services and operations is based on ISO 14001:2004 Environment Management Systems (EMS). IGIA ensured building green infrastructure, renewable energy initiatives, climate change & greenhouse gas management, followed international environmental standards and controls, and resource conservations (water, energy, & materials). Noise abatement is one of the key areas. Automatic aircraft noise monitoring System is installed in approach's of all runways and identify noisy aircraft. Distribution of aircraft movement across the three runways is based on time of the day and individual aircraft noise levels. Inputs from noise complaint system are also factored in. Continuous decent approach is followed to reduce noise. IGIA has target of net zero carbon emissions by 2030. Other major Indian airports have introduced many energy efficient technologies such as energy efficient air-conditioning and water chillers, solar water heating, solar boundary lighting, Compressed

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Natural Gas (CNG) or electric ground vehicles, LED lighting, waste water treatment plants, and high efficiency pumps. Cochin, Delhi, Mumbai and Chandigarh airports have already installed solar power plants. Bangalore and Hyderabad airport solar projects are under implementation. Ultimate aim is to make the airports carbon neutral. Bangalore has 273 hectare of green belt and 971 hectare of natural greenery. Chandigarh International airport uses only natural light during day and mostly LED lighting thereafter. It also has a transparent glass roof with low heat gain that cuts down air conditioning requirement.

## Conclusion

Advances in engine architecture, aerodynamics, and materials have resulted in today's aircraft engines consuming 40 percent less fuel — and emitting 40 percent less CO<sub>2</sub> — than engines manufactured in the 1970s and 1980s. Each kilogram of fuel saved reduces carbon dioxide (CO<sub>2</sub>) emissions by 3.16 kg. Modern aircrafts are 30-40% more efficient than those of 15 years ago. Fixed electrical ground power can reduce the amount of fuel burn used on ground power by up to 85%.

However, we cannot be satisfied with the pace

of progress from the past. The next set of engine technologies, including open fan architectures, hybrid-electric and electric propulsion concepts, and advanced thermal management concepts, offer the potential to achieve at least a 20 percent additional improvement in fuel efficiency compared to today's state of the art single-aisle aircraft engines. Industry initiatives to approve and adopt 100% Sustainable Aviation Fuel (SAF) and investigate hydrogen as the zero-carbon fuel of the future should deliver. Aero-engines of the future will be more and more fuel efficient and environment friendly. The future of flight will be defined by how the aviation industry innovates to lower emissions and improves fuel efficiency. Global warming is causing global mean sea level to rise in two ways. First, glaciers and ice sheets worldwide are melting and adding water to the ocean. Second, the volume of the ocean is expanding as the water warms. On future pathways with the highest greenhouse gas emissions, sea level rise could be as high as 8.2 feet (2.5 meters) above 2000 levels by 2100. More than 260 airports are at risk of getting submerged due to such a sea level rise or coastal flooding. Up to 20% of flight routes could be disrupted. Therefore, time to act is now, lest it becomes too late.

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## Politics and Economics of Climate Change: Opportunities for India

K. Siddhartha\*

Any event can be easily manipulated politically if the intent from the start is to set a narrative contrary to the belief of the people, the geography, culture or history. The Western world has mastered that art. History reveals the attitude of the West to first get a foothold, and then overlook well-established ideals of sustainable development used by local societies. Following a consumerist approach, they have manipulated and replaced those models for their own benefit—monetary, political and social.

By controlling the branding and shaping of perceptions they control mindsets, which enables them to propagate matters in a chosen manner. By glamourising their own lifestyles, they create new markets. Simultaneously, they sow insecurity in the minds of the target social group. Climate Change is one such notion that has been twisted into politics and economics. It is a term coined only by the West and they have succeeded in making it look or seem more attractive than it really is.

### What is Climate Change

Weather is essentially the state of the atmosphere at a particular place and time. Although a definite time scale cannot be attached to it, weather conditions can change rapidly or last for weeks. Climate is the synthesis of weather for a long enough period for reliable statistical

determination of its properties. Changes in weather are collectively known as climate. Unlike the weather, where the change is instantaneous or may last for weeks, the climate is relatively constant from year to year or century to century.

Nevertheless, there is evidence of fluctuations or variations in climate. When these fluctuations follow a particular trend, it is called a climatic trend. These fluctuations may themselves be cyclic in nature and are known as a climatic cycle. Over a longer period of time, climatic fluctuations may be such that they will shift the climate of a given area. Such changes in climate are called climate change. Various terms like climatic variations, climatic fluctuation, climatic trend, climatic cycle and climatic change refer to relevant time scales and are mostly just terminologies.

Variations in climate on geological time scales run into millions of years. Such variations in climate that occurred during recent history dating back to perhaps a few thousand years are collectively called climatic change. Changes in climate usually occur over a period of 100 to 150 years and are termed secular or instrumental changes. Other variations in climate that happen within a period of less than 30 to 35 years are used to calculate values of climatic normals. These variations are too rapid to be considered climatic change.

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## Are we in a Climate Change?

Article 1 of the United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as: “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”. Thus, the UNFCCC makes a distinction between ‘climate change’ due to human activities altering the atmospheric composition and ‘natural climate variability’ that occurs due to natural causes.

It is unanimously agreed that the earth is warming. How much of this warming can be directly attributed to or caused by human activity is not clear? Their effects are extremely difficult to assess, though accumulations of greenhouse gases like carbon dioxide are more than likely taking their toll. What is clear is that, globally, 14 of the 15 warmest years on record have all occurred in the 21st century. Each of the last three decades has been warmer than the previous one. 2001-2010 has been the warmest decade on record.

Average global air temperatures over land and sea surface in 2014 were 0.57 °C (1.03°F) above the long-term average of 14.00°C (57.2 °F) for the 1961-1990 reference period. By comparison, temperatures were 0.55 °C (1.00°F) above average in 2010 and 0.54°C (0.98°F) above average in 2005, according to WMO calculations. The estimated margin of uncertainty was 0.10°C (0.18°F).

## Is it man-made?

It’s our recklessness that we multiply uncontrollably, deforest, burn stubble and use

chemicals, knowing well that they cause destruction and degradation. We understand that if we do not take action now it will be too late! Ironically, we ourselves are products of climatic change. Had climate not changed, reptiles and mammoths would have ruled the earth and there would be no coal. We are a product of such transformations and this climate change will ultimately pave way for other ecosystems to evolve.

We cannot master the functionality of nature or its ways. What we see today might not be there tomorrow and there might be something new in the climate that we still do not know about. However, to link every event in the atmosphere to global warming defies logic. What we do know is that climate change has acquired a new dimension in the form of opening up new battles, disputes and new war including perception war.

## The Politics of Climate Change

Climate change is a natural event but the concept can and has been used to convey manipulative motives more than it has been dealt with naturally. Ever since the term came into use, it is strongly used to build narratives that are even contradictory and are altered in different regions and for various purposes by assorted groups.

When a model of change is not in sync sustainably, does not adjust naturally, and is laced with consumerism, it speaks of hidden intents and motives. When it is being done with the purpose of changing the perception of people, it is nothing but a deception of the highest order, an epidemic (infodemic) and a form of war (perception war). Solutions turn political when there are many unexplained truths and a refusal to accept change



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is woven into the scheme of things.

Climate Change is politics when its interpretation is manipulated, converted into economics and used in trade. It becomes a weapon to threaten and destabilise countries. With different narratives in mind, Climate Change is used as a power projection. Politics comes into play with the setting of a narrative and usually involves hiding the truth by justifying lies. To begin with, Climatic Change has been used by its supporters with an aim to shift blame. Secondly, when it involves treatment, it is using economics and business. Climate Change politics is about looking away from simple solutions. Thirdly, it gets converted into a tool that is used to threaten all those who do not subscribe to a particular view. Towards this end, facts are doctored, information deliberately hidden, some arrangements camouflaged, and scientific knowledge is interpreted with a hidden agenda.

### **The Industrial Revolution and Crony Capitalism**

The industrial revolution saw almost all the western economies present a consumerist model that was capital-driven and energy and resource-intensive. There was little thought given to the impact this would have on the environment. Now, having created a dirty world, the same creators are scrambling to treat the negative effects.

Crony consumerism has generated waste that required constant management. Energy use at every stage created the present man-made climate change. The industrial revolution created by Western economies has now become one of the greatest catastrophes to infest mankind. The waste generated by the combined western world in the

last 200 years still remains in the atmosphere and is now the greatest cause of global warming. It is the biggest source of all greenhouse gases and subsequent environmental degradation. Western economies have made every effort possible to hide and manipulate this fact from the world. They seek to absolve themselves from the magnitude of damage caused by them and are shifting the blame to developing economies. They have also outsourced manufacturing and thus have exported pollution and emissions to developing countries.

Having used coal lavishly during their industrial revolution phase, the Western world now wants to prevent developing countries from using this cheap source of energy. This comes at a time when the developing world wants to attain a better GDP to come to some degree of parity and has just started to use coal on an industrial scale.

### **Food Consumption Patterns**

Food consumption habits, tastes and pattern of the West leaves much to be desired. Let us examine the issue of meat production and consumption. Meat production causes global warming at a much higher rate than the cultivation of vegetables and grains. 51% of all greenhouse gas emissions come from livestock and their by-products. The industry accounts for at least 32,000 million tons of carbon dioxide (CO<sub>2</sub>) per year. Cows produce around 150 billion gallons of methane each day. Methane has a global warming potential 86 times that of carbon dioxide (CO<sub>2</sub>) and is 25-100 times more destructive than CO<sub>2</sub> over a 20-year time frame. Livestock farming is responsible for 65% of all human-related emissions of nitrous oxide – a greenhouse gas with 296 times

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the global warming potential of carbon dioxide. It stays trapped in the atmosphere for 150 years. Agricultural practices in the western world are also highly energy-intensive and without principles of ecological conservation. The higher rate of production ignores the cost involved in terms of energy and other inputs. The same goes for their livestock farming. The West carries on with it since they think they are correct and have the right to do so. To top it all, they convince the world of the correctness of this practice and shamelessly defend it too.

### **The Fashion Industry Camouflages Intent**

Unmonitored growth of the fashion industry contributes to extreme levels of greenhouse gas emissions. The western world hides the truth to maintain its superiority in branding and identity, apathetically to an extent of affecting global warming. In fact, the industry accounts for 10 percent of global carbon emissions which is more than the emissions for all international flights and maritime shipping, combined.

Carbon dioxide emissions in the manufacture of polyester are three times more than those for cotton. By 2030, such emissions from the manufacture of textile alone are projected to increase more than 60 percent.

### **Pets come with “Climatic Price” Tags**

When it comes to climate change, fondness for pets is not far behind. There are 470 million pet dogs and 370 million pet cats on the planet, and they all add to climate change. An average-size cat generates 310 kg of CO<sub>2</sub>e per year, an

average-size dog produces 770 kg of CO<sub>2</sub>e per year, and a large dog creates 2,500 kg of CO<sub>2</sub>e per year. Over 64 million tons of greenhouse gases are released only because of America’s pet cats’ and dogs’ eating habits. A minor shift will bring about change, though of a minuscule level.

### **Travel has side effects**

Travel generates huge amounts of carbon. The travel industry accounts for 8 percent of global carbon emissions and tends to grow at a rate of 4% annually. It is the need of the hour to promote carbon offsetting to compensate and reduce travel emissions. Visitors from high-income countries contribute to a majority of this footprint. Also, we indeed to promote local tourism to cut on air travel. Unless the lifestyle, GDP-oriented consumerist model, and the so-called industrial revolution-based model are changed, climate change will remain.

### **Narratives and Concealments as Politics**

It is ironic that several narratives are aided with concealments that abound in the world. While the whole world is undergoing warming at a differential rate, there are many anomalies too. The role of methane and Trifluoromethyl Sulphur Pentafluoride has been inconsistent and so has been on Ozone hole whose mechanism of formation left some in quandary and also which never grew to the desired size once the West found a market for new alternative to CFC.

The information on Arctic as well as the information and interpretation on glacier melts is inconsistent and contradictory. The causes of Arctic warming and its domino effects remain

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mired in contradictions. What is never even mentioned is that water temperature increases in the Arctic region contribute significantly to carbon dioxide and methane emissions and the resulting warming leads to more thawing—an effect called ‘positive feedback’.

One may not even know the truth behind the narrative related to petroleum reserves and their potential for the world but here too, the negative consequences are glossed over. The truth behind fusion reactors being environment friendly too are not very clear, neither is the reality behind the damage that could be caused by the lithium batteries. The impact of disposing of solar cells when they have lived their life is hidden too. The reality of the environmental impact of nuclear power, solar panels is replaced with another narrative. Misconceptions associated with limitless energy remain disguised. Such narratives are set in the name of so-called development and globalisation. It was western societies that coined the term ‘Climatic Change’. They then funded think tanks to pour doubts over global warming, and then later hired retired scientists to shower scorn over climate science. This resulted in enormous bias in their so-called researches that lacked objectivity. Though the West comes out with researches on global warming at frequent intervals the aim is to seed doubts and therefore the intent of the researchers even if the research was absolutely right.

### **Global Warming and Power Politics**

The likely impact of global warming is a scary eye-opener. Projections indicate that in the US, rising seas will render important naval bases (like Norfolk, Virginia, and Mayport, Florida) essentially

useless. A good number of islands and many coastal cities around the world are on the brink of submerging.

While the polar warming raises concern, contrastingly, the same areas will benefit from a more temperate climate. Greenland may have a flourishing agricultural industry by the middle of this century. 40 years ago, Arctic ice was near impenetrable. Submarines could navigate the Arctic Ocean, but not destroyers or cruisers. That is no longer the case. As the ice caps melt, there will be a geopolitical ocean-heist in the far north to gain control of aquatic hydrocarbons, deep-seabed mining and shipping routes. With Russia on one side of the Arctic and five NATO nations on the other (Canada, Denmark by virtue of Greenland, Iceland, Norway and the US), the possibility of conflict is likely to rise just like the ocean levels. The USA of course will be the last country to give any advantage to the Russians.

In the Arctic, where temperatures are rising doubly as the global normal, Russia, China and others are formally trying to establish a geopolitical foothold over the region. Resources here that were once under the ice, now stand exposed. The melting of permafrost in Siberia will pave way for the expansion of the agricultural area and its simultaneous effect will be felt on the food security of Russia too with an added muscle power to its politics. China can use Tibetan region and its snow cover to alter the albedo and affect the monsoons.

### **Checking Russia, China and other Choke Points**

Phasing out oil imports will help reduce the income and geopolitical power of countries like

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Russia, which currently relies heavily on the EU market. Of course, the loss of this key source of Russian revenue could lead to instability in the near term. Strategically, as oil becomes less relevant, the old strategic chokepoints — starting with the Strait of Hormuz, Bab-el-Mandeb strait will become less dangerous. These seaborne passages have preoccupied military strategists for decades. But as the oil age passes, they will be less subject to competition for access and control by regional and global powers.

### **Business Economics as Politics**

A transition, either economic, technological or perceptual is a good business proposition as it offers opportunities that never existed before. It could be in the form of technological development. To begin with, developing countries have already been converted into trash bins of recycling. Developed countries have smartly outsourced all the dirty manufacturing and made the third world a dump yard for pollutants. Energy shift and transition in the Middle East economies will mean conversion to solar energy. The new climate change politics is creating and has created two different blocks, “petra” and “electra” with a concomitant effect on control of energy politics and consequently power politics.

Greater emphasis on electric power reliance will allow China to rise and *petrostates* will fall — or so says conventional wisdom. In reality, the geopolitical fallout of a clean energy transition will be far more subtle, complex, and counterintuitive. But politics and economics will always speculate. China also dominates the market for some of the commodities—such as lithium and cobalt—that are

critical inputs for many clean energy technologies such as batteries. This naturally raises national security risks, particularly in military and communications applications, where these commodities are also crucial.

Shrinking demand for oil and gas will mean lower prices, implying that even if *petrostates* gain market share, they would still see revenues collapse. West Asia will have a lot of stranded assets to deal with once there is a shift in energy and power structure. Unable to sustain themselves, these organisations will become mere tools for negotiations. Of course, the reality is more complicated

The future scenario could will be that some *petrostates* may be tomorrow’s *electrostates*. Saudi Arabia, for example, which has abundant, low-cost solar power, announced a US\$ 5 billion project to turn renewable energy into hydrogen, and has also sent Japan the world’s first blue ammonia shipment. Other countries rich in cheap renewable power, such as Chile, may also emerge as the superpowers of a new hydrogen-based economy. Moreover, advances in carbon-capture technology could create opportunities for natural gas to play a role in a low-carbon economy, either directly or converted to other fuels such as hydrogen. Such energy transition in itself will shift power away from those controlling and exporting fossil fuels to those who master green technologies of the future. Gradually eliminating fossil fuels and reducing its dependence on energy imports will vastly improve European Union’s strategic position. In 2019, 74% of their gas and 87% of their oil came from imports. Fossil-fuel products worth US\$ 386 billion or €320 billion came from abroad that year.

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In short, the western countries used untested unsustainable energy and distributed toxic pollutants into cleaner environments. They invaded developing countries and industrialised them on their own paradigms of consumerism and crony capitalism. Then they de-industrialised themselves by exporting dirty industries. Now, citing environmental ethics, western powers are blaming the same countries to which they exported their emissions and are asking them to pay for cleaning the garbage and dirt that they themselves created everywhere! To prevent genuine forthcoming action, western funded think tanks pour doubts into minds over who is responsible for global warming. Unprincipled retired ‘scientists’ are being hired to pour scorn over climate science.

### **Politics of Solution and the Perception War**

Manmade climatic change should not have taken place in the first place. Simple sustainable solutions exist, but they are not being propagated by the polluters. Global powers keep on inserting infodemics to alter the truths, to discard genuine and easy solutions for their own purposes.

To begin with, tackling CO<sub>2</sub> emissions is simple. The Covid 19 pandemic showed us that the lockdowns imposed in 2020-21, which halted social and economic activities led to global carbon dioxide emissions dropping by 6.4% or 2.3 billion tonnes. While lockdowns are not being advocated, global warming can be tackled using simple natural systems. In order to make the transit from an energy-intensive society to a more ecocentric one, (commercially speaking to electric one), we will have to stop producing pollutants and greenhouse

gases. Reducing the carbon dioxide level in the atmosphere can be achieved through dietary changes and through innovate building designs that consume less energy. We will also have to follow environment-friendly practices like afforestation, carbon storage by expanding wetlands, expand mariculture through seaweeds and kelp farming and encourage basalt weathering.

In terms of dietary habits, a shift to reduced calorie consumption (2000 calories per day instead of 2500 calories) will suffice. Today, about 20% of the world overeats and it leads to obesity. A diet shift is also suggested to cut down the consumption of proteins to the recommended level. We need to focus more on plant-based proteins and cut down on meat-based ones. When protein requirements are to the order of 55 grams of proteins per day, there is little need to consume 75-90 grams of protein daily. In addition, cutting down on beef consumption and cattle in general from our daily diet will offer both dietary and environmental benefits. It saves agriculture for land use and reduces greenhouse gases. Rather than beef, one can choose poultry, fish, and, of course, legumes.

Other simple solutions include lifestyle changes that can be supplemented with other changes like changes to building design, curbs on commuting habits, and weekend spending. That means altering the lifestyle and brand image of the West and homogenisation of lifestyle to be closer to nature.

The world has involved itself in various conventions and concepts. These include the United Nations Conference on the Human Environment (1972), United Nations Environment Programme (UNEP) or UN Environment, UNFCCC: United Nations Framework

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Convention on Climate Change, Kyoto Protocol (COP 3; UNFCCC Summit 1997) and other important UNFCCC Summits Post Kyoto, the last one being the Katowice (Poland) Climate Change Conference 2018. They have practically achieved nothing.

The new solutions such as the Net Zero concept, bears testimony to the ongoing manipulative streak. In simple words, net-zero refers to the balance between the amount of greenhouse gas produced and the amount removed from the atmosphere. We reach net zero when the amount we add is no more than the amount taken away.

Net-zero, which is also referred to as carbon-neutrality, does not mean that a country would bring down its emissions to zero. Rather, net-zero is a state in which a country's emissions are compensated by absorption and removal of greenhouse gases from the atmosphere. Absorption of the emissions can be increased by creating more carbon sinks such as forests, while removal of gases from the atmosphere requires futuristic technologies such as carbon capture and storage.

The emission-reduction targets for 2050 or 2070, for rich and developed countries seem an eyewash. The same rich countries whose unregulated emissions over several decades are mainly responsible for global warming and consequent climate change assured the rest of the world to wait. They did nothing other than boost pollution. The net-zero formulation does not assign any emission reduction targets to any country. Theoretically, a country can become carbon-neutral at its current level of emissions, or even by

increasing its emissions, if it is able to absorb or remove more. From the perspective of the developed world, it is a big relief, because now the burden is shared by everyone, and does not fall only on them. Glorifying its net-zero targets the West is putting pressure on the developing nations. India constitutes around 18% of the global population but contributes less than 5% of pollution.

The West is under the illusion that the important target is how much you are going to put into the atmosphere, before reaching net-zero. They assume that emissions from burning coal can be compensated in real-time by protecting a forest. This is ignorance given the fact that plants need time to grow whilst cutting fossil fuel emissions has immediate results. The fact is carbon removal does not take place in real-time.

India is opposing this net-zero target since it is likely to be the most impacted by it. Over the next two to three decades, India's emissions are likely to grow at the fastest pace in the world, as it presses for higher growth to pull hundreds of millions of people out of poverty. No amount of afforestation or reforestation would be able to compensate for the increased emissions. Most of the carbon removal technologies right now are either unreliable or very expensive. In any case, India is not in a position to control emissions on account of various ongoing development projects aimed at taking the country forward. These projects are worth USD 28 trillion.

### **Opportunities for India**

The earth has enough regenerating capacity environmentally. Economically, Japan and Germany are live examples of how a country can be rebuilt

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from the rubble after the harshness of World War II. There are many advantages that a country can gain when it starts afresh because it can remodel itself, insert a lot of lateral thinking, and look at creating new opportunities.

India is in a position to take leadership in environment protection through its soft power reach to include prevention, improvement and control. This can be done through its local wisdom and knowledge, weaving indigenous people with technology and making the historical knowledge gained through millennia to get identified and respected and implemented by the world (*Gleb Raygorodetsky, Why Traditional Knowledge Holds the Key to Climate Change*)

### **Managing Indigenous Societies and their Knowledge throughout the world**

- Indigenous people and their traditional ways of life have contributed little to climate change, but ironically are the most adversely affected by it. This is because of their geographic and historic dependence on local biological diversity, ecosystem services and cultural landscapes as a source of sustenance and well-being. These indigenous people are located predominantly at the social-ecological margins of human habitation—such as small islands, tropical forests, high-altitude zones, coasts, desert margins and the circumpolar Arctic.
- The indigenous people, comprise only four per cent of the world's population (between 250 to 300 million people). They utilise 22 per cent of the world's land surface but maintain 80 per cent of the planet's

biodiversity in, or adjacent to, 85 per cent of the world's protected areas. They are the real victims of climate change.

- Indigenous lands also contain hundreds of gigatons of carbon—a recognition that is gradually dawning on industrialised countries that seek to secure significant carbon stocks in an effort to mitigate climate change.
- Indigenous observations and interpretations of meteorological phenomena are at a much finer scale, have considerable temporal depth and highlight elements that may be marginal or even new to scientists.
- Indigenous peoples' observations contribute importantly to advancing climate science, and have meaningful experiences applicable at the local level.
- Resilience in the face of change is embedded in indigenous knowledge and know-how, diversified resources and livelihoods, social institutions and networks, and cultural values and attitudes.

This local knowledge can be utilised through several mechanisms. It includes workshops with the help of several other partners (UNDP, UNESCO, and CBD) — to promote respect for the local and traditional knowledge at the national and local levels. For indigenous peoples, such workshops will provide an opportunity not only to present their experiences and knowledge about climate change in their communities, but to gain valuable information on global climate processes that are affecting their communities. Moreover, indigenous people learn about other indigenous climate change-related experiences, while

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scientists gain opportunities to ground-truth (field check) climate models and scenarios.

India can actually play a pivotal role in not only ending the suffering of indigenous people but utilising their knowledge and experience of being a 15,000-year-old actual civilisation. India can model Universities based on such experience on the lines of Barefoot College in Tilonia, but will need to create a realistic model that is visible and invisible as per its choosing. This is where India can truly be a 'Vishva Guru'. This model will help a new diplomacy for India-Eco-Diplomacy. It will also empower a lot of local communities across the globe. India is the only country that has the willingness and ability to provide a platform to showcase the indigenous genius to the entire world.

By creating an eco-centric approach that sets value and importance on the entire environment and all life in it, India can lead the whole world to make the shift! By fusing management and technology with minimal investment, India can showcase its carbon capture methods to the whole world. India needs to create self-reliant models of independent units with zero emissions that are environmentally sustainable in different agro-climatic regions. This model could be adopted by different countries with a similar climate like Mali, Cambodia, Siberia and Argentina. India can have a strong stand at the Conference Of Parties COP26 of the UN Climate Change Conference and play a major role in carrying its offshoots. She can set examples by expanding and reclaiming wetlands to capture and sequester carbon deposits. Wetlands cover about 6 to 9% of the earth's surface and sequester roughly 35% of the global terrestrial carbon.

Although forests were considered the best natural protection against climate change, recent research shows that seaweed is the most effective natural way of absorbing carbon emissions from the atmosphere. India has a large Exclusive Economic Zone (EEZ) that can be used to remove huge amounts of carbon deposits and provide protein to its citizens from seaweed. The 7500 odd km of coastline is an effective way to grow and nurture kelp—a type of seaweed whose farming is considered to be a remedy for all the ills associated with global warming. Kelp can grow as much as 20 cm every day. It not only absorbs carbon dioxide but also de-acidifies the ocean water. By drawing CO out of the waters they allow our oceans to absorb even more CO from the atmosphere.

With the largest basaltic exposure in the world, India can additionally use basalt weathering technology to absorb carbon deposits. Basalt weathering means mixing crushed basalt with soil, which slowly dissolves and reacts with carbon dioxide to form carbonates. This method would allow between 0.5 billion and 2 billion tonnes of CO<sub>2</sub> to be separated from the atmosphere each year.

Going 'local' is India's recent mantra, though this life pattern is from ancient Indian wisdom. Our distinct set of concepts and thought patterns include theories based on the revival and evolution of local wisdom that is seldom found elsewhere in the world. These concepts can be weaved with our minimalistic living lifestyle and our nature-centric development visions. They are suited for different geographical settings that can be used anywhere in the world with similar agro-climatic conditions.

Minimalistic living strives to only use things



that serve a purpose. It's about simple living and having only what one needs to go about daily life. It is a smart rendezvous of technology, attitude and curbing the desires for sustainably. The components of the model include energy management, water management, vegetarian diet management, housing using natural ingredients and zero energy agriculture linked with satellites. Rural India works like a partially closed ecosystem in which energy obtained from plant photosynthetic is used to grow crops. This in turn provides an essential energy input to grow more food and is an endless cycle. This can be co-joined with new farming technologies developed with countries like Israel, as well as agricultural technologies based on minimum energy.

The second solution is the modification and linkage of the Happiness model of Bhutan. Both these models wean away countries from a GDP-

based development model, but also provide alternative sustainable income on India's soft power platform.

The third is the extension of PM Modi's concept of 'One Sun, One World. One Grid' (OSOWOG) initiative organised along with the Chatth festival (the only festival that worships the Sun). It aims to raise awareness about various ways to harness energy from the Sun. It aims to build a transnational grid that would allow countries to source solar power from regions where it is daytime to meet their green energy needs when their own installed solar capacity is not generating energy.

India is actually at cusp of change to unleash a new knowledge to the world, cleanse the world of its infodemics on climate change, weave the world communities into making the earth a liveable, sustainable and a more beautiful place.

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## Vedic Averments for Cosmic Environmental Tranquility

Vandana Sharma 'Diya'\*

**N**ature's wrath is currently wreaking havoc on the entire planet. This situation is not only proving to be detrimental for the human race, but it is also causing severe harm to other sentient species. This undesirable state of affairs is largely caused by human beings, who have broken the cosmic laws and caused environmental degradation to an unprecedented level. All human efforts to preserve Nature in the name of planting trees, restraining the use of plastic and opting for eco-friendly products have had little impact on the health of the planet. The need of the hour, therefore, is total change, wholesome approach, holistic view, and organismic well-being.

The Vedas are the world's oldest texts. They focus on a natural code of conduct and an all-encompassing cosmic law that encompasses every spec of the universe, from a tiny ant to the massive galaxies. In contrast to Western and Abrahamic thought, where the environment is viewed as isolated and human-centric, the Vedic perspective on environment is devoid of any splits. Each life is wholesome and is a vital part of the 'One Whole Reality.' This thought makes Bhārata as not only an environmentally protective but also an environmentally conscious nation that propagates 'Unity in Diversity'. In this regard the Bhagvadgītā states,

**I equivalently indwell in all creatures. I have no likes or aversions towards any life form.<sup>1</sup>**

Further, the Īsopaniṣad asserts:

The entirety of cosmos is pervaded by Īśvara who is the 'Self' of all movable and immovable entities.<sup>2</sup>

It is therefore clear that the entire cosmos is a manifestation of the non-dual 'Ultimate.' The Vedas propound that the Divine not only envelops the entire cosmos, but also indwells all entities and manifests Himself as the dog, the sparrow, the Ganges, and the entire material and immaterial world. The following verses shed light on the same,

**I am One and I become many<sup>3</sup>**

**That Ultimate Truth is 'One' known by the wise as many<sup>4</sup>**

As white light passes through a prism and splits into seven colours, the Divine, who is non-dual, appears as assorted names and forms as a result of Māyā.<sup>5</sup> Therefore, according to the Vedas, 'Environment' should be understood with the connotation of 'Brahman'.<sup>6</sup> Thus, there exists unity among all entities that are born and nourished in the compassionate lap of 'Mother Nature'.

The term "Environment/Nature" must not be limited to trees, animals, birds, rivers and

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mountains, rather “It” is internal, external, individual, cosmic, exclusive and non-exclusive. It is to be recognised that it is human's inner contamination, unrest, and mental greed that manifests as external pollutions, and disharmony. 'Mother Nature,' nurtures every being till we respect Her. However, if we try to exploit Her, She responds internally as mental stress, physically as diseases, environmentally as natural calamities, and universally as cumulative disharmony. Outer acts of environmental protection can aid us in our mission to support the cosmos, but they are far from being a permanent cure for cosmic discord. In this regard, Svāmī Vivekānanda aptly states,

**“The miseries of the world cannot be cured by physical help alone. Unless a man's nature changes, physical needs will continue to arise and miseries will continue to be felt. No amount of physical help will cure these miseries. Ignorance is the mother of all evils and of the misery that we see. Let man have light, let them be pure, spiritually strong and educated; then alone misery will cease. We may convert every house of the country into a charitable asylum and fill the land with hospitals but the misery will continue to exist until man's character changes”<sup>7</sup>**

It is essential to recognise that each life and form has a crucial role to play in the grand scheme of the universe. Realisation of non-duality with all lives leads to harmony in the truest sense declares the Yajurveda,

**He who sees the Self in all and all in the Self has no sense of revulsion by the reason of the vision of non-duality. When all beings have been realized as the 'Self' there remains no delusion and no sadness.<sup>8</sup>**

The Vedas regard 'Nature' as all-encompassing and holds an intimate relationship with It. They refer to 'It' as not only the 'Highest Reality,' but also revere Its various manifestations (sun, moon, rivers, birds, etc.) as mother, father, protector, friend, son, and more. 'Environment' is that 'Unitary Principle' which the Vedas have spoken about repeatedly. All beings of the universe are indwelt, saturated and are that very 'Principle' which they mistakenly consider as distinct. This non-dual Vedic vision elevates 'Mother Nature' to the highest plinth. As a result, the Vedas instruct us to work for the good of all beings instead of being limited to only the human race. Let us now consider some Vedic averments about Environmental harmony.

### **The Divine Pañcamābhūtas**

'Bhūmi' is depicted by the Vedas as a compassionate, benevolent, nurturing, and bountiful 'Mother' who nurtures all creatures without discrimination. She is revered, and hymns of Her majesty adorn the entire body of the Vedas. She is the one who bestows cosmic peace and prosperity. Her grandeur can be understood by the following verses,

The 'Earth' just like the Mother Cow, confers upon all the creatures the gifts of delight. She nurtures and provides for all.<sup>9</sup> May Goddess Earth, the nourisher of all beings eradicate all evils and lead us to the highest state of being.<sup>10</sup>

'Āpaḥ' is regarded by the Vedas as 'Divine' 'Life', 'Nectar' and as the finest of 'Physicians'. It is no wonder that all important pilgrimages were set up near water bodies. The Vedas declare water as the best of medicines.<sup>11</sup> In Its absence no medicine can work and it is the greatest of healers.<sup>12</sup> It can

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cure all maladies including genetic and cardiovascular disorders. In this regard the Vedas state:

**May the 'Divine Waters' protect us and flow down on us for quenching our thirst and lead us to peace and perfection. You are You are the Mighty One.<sup>13</sup> We seek your healing powers.<sup>14</sup>**

Unfortunately, man has exploited water bodies in the most heinous manner. Water pollution causes a variety of problems, including the degradation of aquatic ecosystems caused by excessive use of chemicals and pathogens, plastic debris, sewage pesticides, industrial leaks, and hydraulic fracturing, to name a few. Water pollution has damaged the health and beauty of the water bodies, the well-being of aquatic species and the overall health of the planet. It has also negatively impacted the quality of plants, trees, and crops. It is to be remembered that in the wellness of life-enriching waters bodies lies the wellness of the entire cosmos.

**'Vāyu'** is the life force, and the cosmic breath. The Vedas contain a number of hymns that extol 'It.' The meaning of the word 'Vāyu' as the 'Uniting Ultimate Principle' has been expounded in the Śatapathabrāhmaṇa,

**The entire universe is woven in a string and that string is 'Vāyu'.<sup>15</sup>**

Therefore, the word 'Vāyu' has a broader meaning and is only casually translated as 'Air' which has a much-limited connotation. 'Vāyu' is itself living and thus 'It' becomes the essence of life. Unfortunately, the human race has done incalculable harm to 'It' while shrouded in ignorance. Polluted air not only endangers

humans, but it also harms animals, birds, and puts undue strain on trees and plants. Every year, thousands of humans, animals, and birds die prematurely as a result of air pollution.<sup>16</sup>

**'Ākāśa'** and sound are inextricably linked, and this is the source of noise pollution. Taittiriyaopaniṣad (Yajurveda) discusses two types of Ākāśa i.e., one within the body and one outside of it.<sup>17</sup> However, human has not only polluted his inner space but is going on polluting the outer spaces. All of this has not only added to the planet's pollution but in his desire to conquer outer space, he has added to space debris. The Yajurveda advises the human race:

Do not destroy the space<sup>18</sup>

**'Agni'** is both divine and purifying. 'It' is the destroyer of greed, passion, and ignorance on a philosophical level. At a mundane level, it is the destroyer of negativities and diseases. In a spiritual sense, It burns away selfish desires and leads to a state where cosmic welfare becomes one's vision and mission. According to the Yajurveda's Navagrhasūktam:

**The light of wisdom Agni! Let us be vigilant while we work for ourselves and for all creatures of the cosmos. May we all remain together, even with the departed souls of our forefathers with whom you connect us like a thread.<sup>19</sup>**

Therefore, it is clear that Fire is meant for the benefit of all. Unfortunately, humans manipulate it in the most atrocious manner. Fire is used to burn down forests and various animals that live in them in order to capture land for the sake of high-end infrastructure. It is used to incite riots and destroy national property, as well as to burn a young girl

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for dowry. All of these crimes sprout from tainted internal states, and as long as we do not burn the dirt that we hold within, we will go on destroying the world.

### **The Celestial Plant Kingdom and Forests**

The Vedic verses revere forests, trees, plants and herbs as conscious divine beings that provide Amṛta (oxygen), Ouśadhi (herbs), Anna (food), Phala (fruits), Puṣpa (flowers), Cāyā (shade), Saundarya (beauty) and Jīvan (life). Tree are encrusted with divinity and so, the five parts that they have - Jada (roots), Prakāṇḍa (trunk), Śākhā (branches), Patra (leaves), Phala (fruits) and Puṣpa (flowers) are a boon to the universe. They are called Viśadūṣaṇī<sup>20</sup> because they are the destroyers of poison (pollution). Therefore, uprooting a tree means uprooting the entire cosmos, and cutting down a tree means cutting down one's own survival. In this regard the Vedas make it clear,

**Extend no violence towards Trees.<sup>21</sup> Do not cut or uproot them for they are the destroyers of pollution<sup>22</sup> Forests, trees, herbs and mountains are said to be the protectors of all.<sup>23</sup>**

The R̥gveda further highlights,

**'The Divine trees and curative herbs appeared three Yugas before the emergence of Deities and billions of years before the origin of any other being. The 'Divine' manifested as trees, herbs and plants at various places on the earth. These Godly appearances were meant to destroy pain, suffering, ailments and heal wounds of all living creatures. They further remove infections and weakness. They have a positive and wholesome effect and lead to complete wellness. Trees and herbs nurture,**

**protect and bless all lives with material and spiritual advancement like a mother and thus they are also referred to as 'Mātraḥ'. The Holy Trees and plants lead us to Mokṣa by destroying diseases, misery and take us beyond the realm of birth and death. Trees and herbs have supreme powers and those creatures who submit to them are bestowed with lifelong wellness. Without any discrimination between man and animal, these saintly trees and herbs have equally blessed all beings.<sup>24</sup>**

The Vedas also declare that the plant kingdom is conscious and sensitive, like humans and animals. They are born, they die, they experience pain-pleasure, they sleep, they are susceptible to illness, and they bleed when they are broken, uprooted, or cut down.<sup>25</sup> The Mahābhārata in this regard states:

**"Trees and plants drink water through their roots and make their food through sunlight. They digest the food due to the presence of Vāyu and Agni that is within them. When they are injured, they experience unimaginable pain. They are affected by pleasant and foul smells. They do fall sick and feel weakness and wellness. A creeper exactly knows how and where to climb, this proves that they have a divine vision (in Indian philosophy vision and sight are separate. A being may not have sight which is connected to material eyes but it has a vision which is connected to the inner states of being). Despite being physically strong, trees are extremely sensitive to weather, kind-harsh words, pure-impure thoughts, good-bad touch'.<sup>26</sup>**

'Vana' is home to millions of celestial beings.



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Forests add to the aesthetics of the planet. The Vedas, in fact, see the entire universe as a forest in which all beings must live according to their Dharma. However, today, man has turned a deaf ear to the Vedic voices. Deforestation has resulted in the destruction of biodiversity, decreased oxygen, extinction of plant and animal species, damaged ozone layer, global warming, natural disasters, and climate change.

### **Yajña, Mañtras, Balī and Animals**

'Yajña or Havan' promotes environmental wellness, quality of life, atmospheric purity, inner and outer well-being. Scientifically, Yajña produces gases like ethyl oxide (C<sub>2</sub>H<sub>4</sub>O), propylene (C<sub>3</sub>H<sub>6</sub>), acetylene (C<sub>2</sub>H<sub>2</sub>), and others<sup>27</sup> that combat pollution and balances O<sub>2</sub> (oxygen) and CO<sub>2</sub> (carbon dioxide) in the atmosphere. The Yajurveda discusses the removal of various pollutions; tranquility, prosperity, cosmic health; glories of trees, benefits of seasons and more through Yajña.<sup>28</sup> Dr. Swami Satya Prakash Saraswati in his book 'Aum Agnihotra-An Ancient Process of Fumigation (A Study From the Chemical Standpoint)' states:

**“in the materials of Agnihotra some elements produce the formaldehyde gas(CH<sub>2</sub>O) which spreads in the atmosphere without undergoing any change. Even carbon dioxide (CO<sub>2</sub>) transforms to a large extent into formaldehyde gas (CH<sub>2</sub>O) which is a strong germicide. This gas is activated only when it comes in contact with water vapours. This is the reason why the Havankuṇḍa is sprinkled with water from all four sides.”<sup>29</sup>**

'Mañtra' is a sacred and scientific collection of words, sounds, phonemes, and syllables. It is a

codification of a certain cosmic force that links the material world and the Supreme Consciousness. Mañtras are the primordial rhythms of creation<sup>30</sup> that bring about harmony within and without, on an individual as well as on the cosmic level, in the Pañcamāhābhūtas and for the sake of Sarvbhūtahita.

'Balī' is a widely misunderstood word. If one comprehends the Vedic wisdom, he will conclude that Vedic teachings and rituals are meant for cosmic concord. This vision of coherence stems from the recognition that we are all interrelated, necessitating the development of ethical norms of behaviour toward oneself and the entire creation. Nevertheless, a few misinterpret the Vedic rituals and deem them to be such in which an animal is sacrificed in order to appease a Deity and earn rewards. In the Śābarabhāṣya inflicting of injury has been pronounced forbidden. It is said that 'Śyena' which may be interpreted as “a ceremony where the intention is to cause harm to others” is not propagated in the Vedas, rather, the text announce,

**“If a man desires Śyena (inflicting injury upon another), one must do so entirely because he wishes and not because of any text”<sup>31</sup>**

The Practice of 'Ahimsā' is the foundation of Indian thought and appears in the Śatapathabrahman as 'Non-injury' with the connotation of morality. The Vedas repeatedly instruct that animals must not be harmed. However, man's self-centred approach has driven him to purposefully misconstrue the Vedic voices. The Yajurveda declares:

**“Animals are not to be killed or harmed.<sup>32</sup>  
They are the bedrock of a prosperous society.<sup>33</sup>**

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### **Animals should be protected and must live fearlessly.<sup>34</sup>**

Today, a few deceitful scholars claim that the Vedas is in favour of animal sacrifice (paśu balī).<sup>35</sup> However, this is a blatantly fallacious elucidation. Just as in the English language there are Homonyms,<sup>35</sup> i.e. the word 'Round' could mean circle, interview round, moving aimlessly or talking in a way that confuses someone. Similarly, the word 'Balī' has many meanings. Let's have a look at the same:

- Balī' is the technical terminology for 'Wrinkles' in the Rasaśāstra (Ayurveda).<sup>36</sup>
- Balī' is one of the 108 names of Lord Kṛṣṇa.<sup>37</sup>
- Balī' is the name of the Demon King 'Mahābalī' and means 'The One With Great Power and Strength'.<sup>38</sup>
- Balī' refers to an austere or hermit.<sup>39</sup>
- Balī' connotes to 'Balīdāna' (self-sacrificing one's comforts, alms, food or time for the sake of others).
- Balī' is the name of the King of the Yādavas<sup>40</sup>
- Balī' is the name of the Vānararāja Ānav<sup>41</sup> in the great epic Māhābhārata.
- Balī' is the daily Dāna offered to sages, humans, dogs, cows, and crows.<sup>42</sup>
- The term 'Balī' also suggests a compulsory tax or levy that is given to the King.<sup>43</sup>
- Balī' refers to a Deity who protects the Pātāla-loka.<sup>44</sup>
- Balī' means a ceremonial food offering to Lord who protects all in accordance to the Śaivāgamas.<sup>45</sup>
- Balī' is used in Vāstusāstra for a diagram

with eighty-one squares and a cluster of Deities that are drawn on the ground and where the structural construction has to take place.<sup>46</sup>

- Balī' in Jainism, refers to the name of the sixth Prativāsudeva.<sup>47</sup>

Let us now also have a look at the various meanings of the word 'Paśu'.

- Paśu' is the individual soul (including human) in Śaiva Siddhānta while Patī is 'Supreme Śiva'.<sup>48</sup>
- Paśu' refers to all embodied souls (humans included) in the cosmos in the Śilpaśāstra.<sup>49</sup>
- As per Vāyupurāṇa, Ṛṣi Kaśyapa is said to be the ancestor of Paśus (humans, animals and plants) along with Gaṇḍharva, Devas and Asuras<sup>50</sup> suggesting that despite varied forms we all have the same roots.

From the foregoing, it becomes clear that the word 'Paśu' doesn't refer to merely an animal nor does the word 'Balī' mean 'killing'. Thus, Paśu Balī' cannot be interpreted as 'Animal Sacrifice'. This notion appears to be imposed on the Vedas which are far from promoting any ceremony involving violence or injury to any life. The misinterpretation of the word 'Balī' can be attributed to a variety of factors, such as:

- A lack of grasp of the original texts and the approach required to interpret them (i.e. in accordance with Deśa-Kāla-Paristhiti).
- Inadequate knowledge of Sanskrit.
- Studying the Vedas with preconceived notions and biases.
- Resolutely misinterpreting the Vedic to



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promote violence, disharmony and non-vegetarianism.

- Deliberately undermining the Vedas as a text of authority in order to destroy Vedic culture, philosophy, and history in the long run.

Today, '**Animals, Birds, and All Sentient Beings**' exist in fright. Rooted in ignorance, man has exploited them to the point of absurdity. He slaughters them savagely for their skin, organs, hanging them up as a piece of décor, or just devouring them as a meal. The pitiful condition of these celestial beings is a question mark on human morals, ethics, education and life. Contrary to this view, animals have been revered in the Vedas as 'Ṣoḍaśkalāḥ (bejewelled with sixteen celestial arts)<sup>51</sup> and as 'Maḥ (worthy of worship for their love and grace).<sup>52</sup> They have adorned Indian culture, art, architecture, philosophy, religion, traditions and life in general. The Vedic texts consider them to be the manifestation of God (Vibhūtis).<sup>53</sup> In this regard states the Vibhūtiyogaḥ of the Śrīmad Bhagwadgīta,

**Amongst the horses I am 'Ucchasvā' emerged during the churning of the ocean. Amongst the elephants, know Me as 'Airāvta', Amongst the cows, I am 'Kāmadhenu'. Amongst snakes, I am the 'King Vāsuki'. Amongst the Nāgas, I am 'Ananta' and amongst water beings, I exist as 'Varunadeva'. Amongst the animals, I am 'Mrga' 'Simha' and amongst birds, I am 'Gruda'. As a purifier of all lives, I am 'Vāyu'. Amongst the beings of sea, I am 'Magara' and amongst sacred rivers, I am 'The Gangā'.<sup>54</sup> I exist as the Ātman in the hearts of all living creatures and I am the**

**beginning, middle and end of all these beings.<sup>55</sup>**

Each animal, bird and insect is associated with a Deity and embodies Its energies. Thus, revering that animal necessitates adoring that Deity. Bulls, dogs, snakes and scorpions are associated with Lord Śiva. Elephants are worshiped as 'Ganeśa'. Lions are associated with 'Ādi Śakti Durgā'. Crocodiles are connected to 'Goddess Gangā and Yamunā'. Further, in order to re-establish Dharma, 'Mahāvisnu' appears as a Matsya, Kūrma, Varāha, Nṛsiṃha and more. Even the smallest of insect is considered Divine. 'Bhrāmarī', a wasp who ended the demon Arunāsūra is associated with 'Goddess Pārvatī'.<sup>56</sup>

Gaumātā holds an extraordinary place in Vedas. Her physical, religious, economic, environmental, social, cosmic, and spiritual value is extolled in the Vedas. She is revered as Goddess Lakṣmī<sup>57</sup> and must never be killed or harmed (Aghnayeyam).<sup>58</sup> Vedas announce Her as a noble being endowed with splendour, divinity, purity, beauty, nonviolence, tranquillity, knowledge, compassion and the ability to nourish all beings.<sup>59</sup> A society that invests in Her health and wellness flourishes by leaps and bounds.

'Ṣvāna (dog)' is declared as Godly in the Vedas. The Rudramsūkta of the Kṛṣṇa Yajurveda states,

**I bow to Rudra, who controls the dogs, who is Himself the dog and who protects the dogs.<sup>60</sup>**

The Atharvaveda associates Rudra (A fearsome form of Lord Śiva) with Dogs.<sup>61</sup> The Goddess Dog 'Saramā' appears in the R̥gveda.<sup>62</sup> The text also refers to Dogs as divine messengers and states,

**Salutations to the two Divine broad-nosed**

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**messengers (Śyamā and Śabla) who take away our souls. For the sake of leading humans to auspiciousness, you graced mankind by staying amongst them (as dogs).**

Further, in Maṇḍala five of the Ṛgveda, Dogs are described as the knower of 'Herbs' and 'All Wise' suggesting that they have high intuitive powers and high realms of existence.<sup>64</sup> They are also referred to as 'Vastoṣpati (the lord and protectors of the house)'. Mahāṣṭi Pāṇini in the Aṣṭādhyāyī, refers to them as 'Sārmeyah' (the one whose feet bring luck and prosperity). The great epic Mahābhārata starts and ends with the Divine Dog.<sup>66</sup> Further, before the battle of Mahābhārata, Arjuna prays to a Dog faced form Goddess Durgā known as 'Kokāmukha' Lord Dattātreyā who represents the unity of Brahmanā-Viṣṇu-Maheśa accepted Dogs as His Guru and Ādi Śaṅkarācārya realized Dogs as the source of all wisdom 'Vedas'.<sup>67</sup>

The Vedas in-depth talk of Simha, Aṣva, Mayūra, Garuḍa, Sarpa, Maṭṣya and other sentient beings. The Śatapathabrahman announces human as also animal.<sup>68</sup> Birds and animals in the Vedas are described as self-healers and knowers of herbs.<sup>69</sup> They can sense natural disasters and death.<sup>70</sup> The Atharvaveda mentions the establishment of Gauśālā and Pasuśālā for the protection of aged, injured, handicapped, and ill animals.<sup>71</sup> For their well-being, the society must provide these sentient beings with adequate food, medicine, food and fresh water.<sup>72</sup> The Vedas also announce that these beings live in communities and grieve the death or injury of their members.<sup>73</sup> The text further declares,

**Animals must live without any fear<sup>74</sup>**

## Conclusion

The Vedas voice that there is comprehensive harmonisation among all aspects of existence. This Vedic principle of 'Ṛta' embodies the sublime, regulated and harmonious operation of the cosmos. The text talks about an intrinsic relationship of Self-sameness between an individual and the cosmos. Therefore, just as the human body is the dwelling of an individual being, the cosmos is the divine abode of the Supreme Being and so, if anyone purposes to settle conflicts of any sort (environmental, political, social and more) he/she must initiate with the immediate rather than the mediate, proximate rather than the remote and with the visible rather than the invisible. Further, it is to be lucidly understood that one is never in conflict with others instead the conflict is always with one's own inner states. The seeds of discord, greed and animosity sprouts within us and manifests into external struggles and pollutions. Therefore, if we want global environmental peace, we must first be at peace with ourselves.

It is evident that the Vedas have a comprehensive outlook towards Cosmic Environmental Harmony. They are embellished with rites, verses, and philosophies that promote universal-welfare. The text recognises everything as being present in the Divine and the Divine being present in all entities. Along these lines, 'Environment' is just another name for that 'Ultimate Reality'. The 'Environment' that man elects to harm exists as non-dual from him and so he damages his own survival when he hurts 'Mother Nature'. This non-dualistic vision can

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develop only with an education that is scientific, forward looking and wholesome but at the same time it is rooted in ancient wisdom, spirituality and cosmic compassion.

The Vedas advocate an organic cosmology that is devoid of distinctions which makes it a universal and all-encompassing. It is crucial to recognise that these timeless scriptures are incredibly scientific and have influenced many modern breakthroughs, hypotheses, researches and studies. The Vedas are not at odds with science and technology for as long as it serves to promote overall well-being. Only when modern science wishes for human-centric development at the cost of ruthlessly destroying forests, water bodies and animals is when there is a prominent gap between Vedic thought and modern science. Only when the

entire cosmos is taken into account with unified vision of wholesome welfare of beings will science be seen as all-encompassing and complete. At present science exists in a very limited space. It is for the humans, of the humans and by the humans. All its developments stand upon the graves of innumerable sentient beings and on the delicate body of 'Mother Nature'.

As long as man exists in the realms of dualism, he will be the cause of pain, misery and destruction of the world. It is time that the human race contemplates upon the Vedic averments in order to realise tranquility within and in the entire cosmos.

***Eko vaśīsarvabhūtāntarātmā ekam rūpam bahudhāyaḥ karoti***

*(That One alone indwells all beings and That One alone becomes manifold)*

-Bṛhdāryaṇakopniṣad, V.2.3.2

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## China's Culpability for Climate Change

Sriparna Pathak\*

### Introduction

The nature of international relations has been constantly changing over decades and centuries, as the nature of threats to humankind's continued survival has been evolving. If the transition from the 19<sup>th</sup> to the 20<sup>th</sup> century saw the emergence and the re-emergence of the conflicts over physical boundaries between states comprising the international system, then the transition from the 20<sup>th</sup> to the 21<sup>st</sup> century saw the emergence of the non-state actor as a potent threat in international relations. The 21<sup>st</sup> century, as juxtaposed to the previous centuries, is undergoing a host of changes ranging from cyber warfare to increase in artificial intelligence to biological warfare to the emergence of a global scale pandemic—all of which seriously threaten the continued existence of humankind. What has also become identified as a potent threat in the 21<sup>st</sup> century is climate change. While climate change per se did not emerge overnight and is an outcome of centuries of pollution, the problem has reached alarming levels given the massive number of changes taking place owing to climate change. What is more worrisome is the fact that while climate change has been recognised as a threat to humankind, states of the international system still undertake an outdated, almost territorial approach on the issue, refusing to take responsibility for change and trying to extract maximum benefits out of the existing international system for the

fulfilment of their own narrow selfish interests.

The challenge becomes a type of protracted conflict as developed countries of the rich North constantly seek to evade their historic responsibility for polluting the world for decades, while trying to put emission caps on the developing world. For the developing world this becomes challenging as levels of development are directly proportional with carbon emissions. A halt to emissions also means a halt to economic development which in turn will jeopardise the lives of billions living in the developing world.

In the recent past India and China have often joined hands at climate change negotiations to remind the developed rich North of their historic responsibility for climate change and to negotiate caps on emissions in accordance with countries' responsibilities for global warming. However, what has also been witnessed with regards to China is a peculiarity in this context. While China is a developing country and does not have the same historic responsibility as the developed world, China currently is also the biggest emitter of fossil fuel carbon dioxide emissions, and it accounted for more than 27 percent of total global emissions in 2020 (BBC, 2021). China emits more greenhouse gases than the entire developed world, with the US being the second largest emitter at 11 percent while India was third with 6.6 percent of the emissions (*Ibid.*).

China's emissions have more than tripled in

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the past three decades. In fact, while Xi Jinping previously stated that China would strictly control coal fired generation projects, China has only been increasing construction of coal-fired plants (Volvovicci, Brunstrom and Nichols, 2021). State owned Bank of China has been constantly financing overseas coal projects with its funding reaching USD 35 billion since 2015 (Stanway, 2021). In September this year, Xi Jinping stated that China will not build new coal fired projects abroad. However, facts on the ground state something else, as the energy crisis that China finds itself amidst will push China to consume more coal to ensure continued electricity supply. Power cuts of various magnitudes have been witnessed in at least 20 provinces across China since mid-August this year. Shortage of coal supplies, tougher government mandates to reduce emissions and a greater demand from manufacturers have all contributed to the current situation (Lee, 2021). The energy crisis has halted production in various factories across China, which is going to have an impact on an already slowing economy. Therefore, China will have to balance its act between clean energy and declining growth rates. In this context, it becomes pertinent to look at some of the pledges Xi has made in the past regarding usage of clean energy.

### **Xi's pledges regarding combating climate change**

Even though Xi Jinping did not attend the COP 26 this year, he had announced last year that China's carbon emissions will begin to decline by 2030 and that China will reach carbon neutrality by 2060 (*Ibid.*). For the purpose, China introduced a dual control policy which requires Chinese

provinces to limit energy use and to cut energy intensity, which is defined as the amount of energy used per unit of gross domestic product (GDP). The dual control system was first set in China's 11<sup>th</sup> Five Year Plan (2006-10). However, it has gained in significance post Xi assuming the reins of power and committing to China peaking carbon emissions by 2030 and to becoming carbon neutral by 2060 (CGTN, 2021). The plan was to set a five-year target of energy consumption and energy intensity for different provinces, autonomous regions and municipalities in an effort to reasonably manage the indicators of total energy consumption and energy intensity (*Ibid.*).

During the 2015-2020 period, China had a national target for a reduction in energy intensity of 15 percent. The latest five-year plan adopted in March this year targeted a further 13.5 percent cut by 2025 (Gao, 2021). Because of these plans, phased goals were set in place, and it was assumed that by 2025 the dual control system would be more complete with better allocation of energy resources and better energy utilisation. In this context, it becomes pertinent to take a closer look at how Chinese provinces have performed with regard to the dual control system.

In mid-August this year, China's economic planning agency announced that 20 provinces had failed to meet their targets in the first half of 2021 (Lee, 2021). In late 2020, several provinces were reported to be struggling to meet their targets, as difficulties got exacerbated by COVID19. Some provinces even took drastic measures of cutting off power supplies to comply with the targets. This led to a realisation that an examination of the efficacy of those targets are needed. In the meantime, China's

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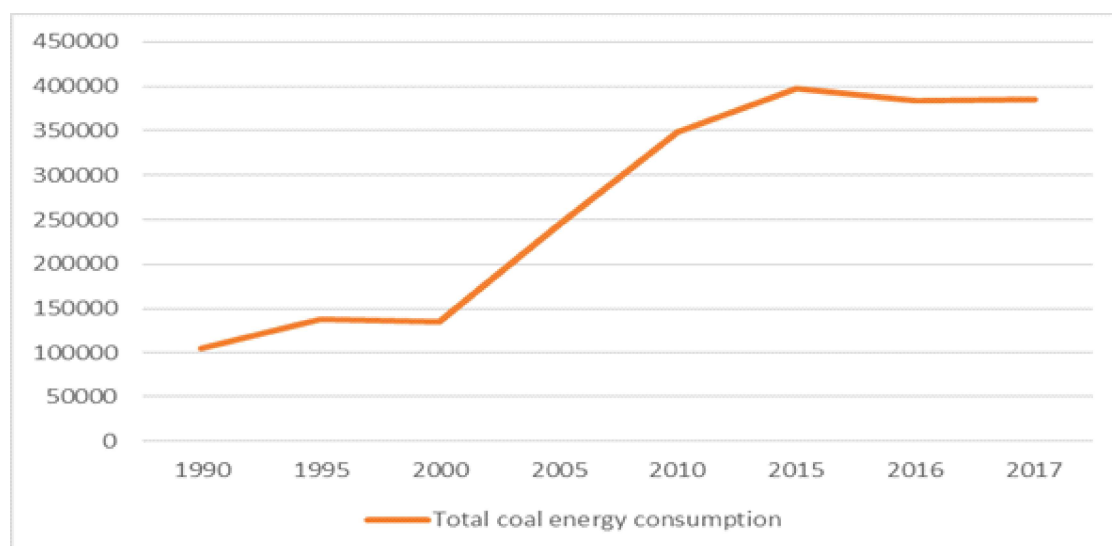
carbon emissions went up 15 percent year in year in the first quarter of 2021 (Xie, 2021).

To deal with the possibilities of further power shortages, China is pushing miners to ramp up coal production and is increasing imports so that power stations can rebuild stockpiles before the winter heating season begins (Singh and Xu, 2021). China's imports of coal jumped 76 percent in September this year from a year ago (National Development and Reform Commission, 2021). This is despite the pressures and the announcements made to meet targets for reducing carbon emissions. In addition to the impacts of the dual control policy, China's thermal coal supplies have also been impacted by the recent floods in Shanxi province which is a key coal producing province (Reuters, 2021). China is already the world's largest coal consumer and of late it has been grappling with a growing energy crisis brought on by shortages caused by natural as well as

humanmade causes. The result has been shortages and record high prices.

A closer observation at China's emissions reveals that while per person China's emissions are about half of those of the US, its 1.4 billion population and its breakneck speed economic growth, reliant heavily upon coal energy; have pushed it way ahead of other countries in terms of overall emissions. It was first in 2006 that China became the world's largest emitter of carbon dioxide in 2006 and is now responsible for more than a quarter of the world's overall greenhouse gas emissions (Brown, 2021). Instead of shutting down coalfired power stations, China is actually building new ones at more than 60 locations across the country with many sites having more than one plant (*Ibid.*). In this context, it becomes pertinent to understand China's coal reliance. The following graph shows how coal consumption has grown over the years in China.

**Graph 1: China's Total Coal Energy Consumption (Unit: 10,000 tons)**



Source: National Bureau of Statistics, China Statistical Books 1991-2018, People's Republic of China



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Beginning from the 1990s onwards, China's reliance on coal to spur economic development began. Its coal consumption has only grown over the years as seen in graph 1, in tandem with its economic growth rates. China's coal consumption grew from 1.36 billion tonnes per year in the year 2000 to 4.24 billion tonnes per year in 2013, which represents an annual growth rate of 12 per cent (Qi and Lu, 2016). By 2015 itself, China accounted for 50 per cent of the global demand for coal (*Ibid.*).

In fact, in 2020 during the pandemic, China was the only major industrial power whose carbon emissions rose, as the central government relaxed a traffic light system designed to reduce overcapacity among coal burning state owned enterprises with a plethora of coal power projects given the go ahead (Cash, 2021). Because of China's coal addiction, it faces the difficulties of energies transition. What also remains a big hurdle is the existence of big energy and manufacturing lobbies which laud the central government's placing of higher emission caps while these big polluting lobbies continue their pollution spree.

In 2019, the State-owned Assets Supervision and Administration Commission (SASAC), issued a new policy for reorganising the state-owned enterprises which dominate coal generation. The first of such an announcement was made in November 2019, followed by a more detailed statement in May 20 (Huidian Dianping, 2019). The details listed were about reorganisation efforts in the Northwest region, where coal overcapacity and financial losses are maximum. The SASAC had also stated that the plans would likely be expanded to other coal intensive parts of the

country. The plan called for stricter controls of coal capacity, elimination of outdated capacity, reductions in coal-fired capacity for the Northwestern region and mergers of SOEs to form a single coal generation SOE for each of the provinces in the region (Dupuy, 2020). While the SASAC's plans are laudable, it was argued that the plans for consolidation of ownership threaten the wholesale electricity markets that the National Development and Reform Commission was fostering and that SASAC's planned mergers would dampen competition (*Ibid.*).

Ma Jun, the director of the Institute of Planning and Environmental Affairs, which tracks environmental and climate records of big corporations stated that achieving climate targets while fulfilling other demanding targets needs a good transitioning strategy and so far, there are still major gaps (Stanway, 2021). China has a per capita level of carbon dioxide emissions that is far above that of countries with a similar level of per capita GDP (AFP, 2021). In fact, in 2019, China's per capita emissions reached 10.1 tons, almost tripling over the last two decades. This was just slightly below average levels across the OECD bloc, which stood at 10.5 tons per capita in 2019. China's per capita emissions even though significantly lower than the U.S. at 17.6 tons per capita still is significantly high. According to Larsen, Pitt, Grant and Houser (2021), China's per capita emissions exceeded the OECD average in 2020, as China's net greenhouse gas emissions grew about 1.7 percent while emissions from almost all the other countries declined sharply during the pandemic (Larsen, Pitt, Grant and Houser, 2021).

China's carbon dioxide emissions rose by 9

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percent in the first quarter of 2021 as compared to pre-pandemic levels (Reuters, 2021). This rise was driven by a carbon intensive economic recovery and massive hikes in outputs of steel and cement, which in turn rose as part of the attempts to reinvigorate and jump start the economy as part of post pandemic recoveries. Output from the industry and construction sector increased by 2.8 percent, steel by 7 percent and cement and coal mining by 2.5 percent and 1.4 percent respectively last year (Bloomberg, 2021). This raises questions whether the country can meet its 2060 carbon neutrality pledge. As such, China's energy trajectory since COP 21 contradicts the goals. Even though the new five-year plan of 2021-2025 shows a lot of intent regarding carbon neutrality, numbers give out a completely different story. In this context it becomes pertinent to analyse China's COP 21 goals.

### **China's Between COP21 and COP26: Xi's Pledges**

In 2015, at the COP 21, Xi, while urging developed countries to fulfil their commitments to providing funds to developing countries to tackle climate change, pledged that China has plans to achieve the peaking of carbon dioxide emissions around 2030 (Liu, 2015). He had also pledged that China would become carbon neutral before 2060. In 2021, even though Xi did not attend the COP26, China submitted its nationally determined contributions (NDCs) to fight climate change, which were published on the website of the United Nations Framework Convention on Climate Change (UNFCCC), which showed that China aims to see its carbon dioxide emissions peak before 2030 and it aims to become carbon neutral

before 2060. This was in tandem with the pledges Xi had made earlier. The point to remember is that the NDCs are non-binding national climate change plans that must be submitted regularly to the United Nations as part of the 2015 Paris Agreement and countries may enhance their ambitions if they are able to do so.

This year, ahead of the COP 26, China enhanced its ambitions, as it committed to raising the share of non-fossil fuels in its primary energy consumption to 25 percent by 2030, which is higher than its previous pledge of 20 percent. China also pledged to increasing its wind and solar power capacity to more than 1,200 gigawatts. China is already leading the world in renewable energy production figures, and it is the world's largest producer of solar and wind energy (OECD, 2021). It also is the largest domestic and outbound investor in renewable energy (Jaeger, Joffe, Song, 2017). In 2016 itself, a year after COP 21, four of the world's five biggest renewable energy deals were made by Chinese companies (Slezak, 2017). By 2017, China owned five of the world's six largest solar module manufacturing companies and the world's largest turbine manufacturer (Mooney, 2017). In fact, solar energy is slated to become the largest primary source of energy by 2035. China's wind and solar capacity is to rise to above 1,200 GW in 2030 from 530 GW in 2020 (Pillai, 2021).

However, what is also a factor to consider in China's futures in the realm of carbon neutrality is that urbanisation currently stands at 65 percent, and this will go up to 78 percent in 2050 (*Ibid*). Population and economic development will continue to increase as well, implying a growth in electricity

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consumption. Economic growth remains a top priority, as stated at the annual ‘two sessions’ in March (Liu, Liu and You, 2021). While China has made strides in renewable energy, fact remains that it is not adequately developed to meet the needs of the entire country. Su Wei, the deputy general of the National Development and Reform Commission stated in April this year that China’s energy structure is dominated by coal power, and that as compared to wind and solar power which are “intermittent and unstable” coal is a stable source of power. He also said that while coal is readily available, renewable energy needs to develop further in China. He added that because of this, for a period of time, China will need to use coal power (Cheng, 2021). This is in complete contrast to Xi’s statements of April this year when he had said that the country will reduce coal usage beginning in 2026 (*Ibid.*)

In addition to Su’s statement being in complete juxtaposition to what Xi had said in April regarding reducing dependence on coal, point also to note is that China, as stated previously is grappling with its worst electricity shortages in years and has asked miners to increase coal production to supply major power plants! China relies on coal-fired power generation, which is a huge contributor to carbon emissions! Also, the complete absence of Xi Jinping on COP26 also brings forth several questions on China’s seriousness regarding dealing with issues of climate change. Xi delivered a written statement to the opening session of the COP26, which however, did not offer any new climate pledges than what Xi had already made in the past.

Even though China’s 14<sup>th</sup> five-year plan (2021-26) has outlined an 18 percent reduction target for

carbon dioxide intensity and a 13.5 percent reduction target for energy intensity from 2021 to 2025, and has introduced the idea of an emissions cap, it has not really gone so far as to set one (Liu, Liu and You, 2021). However, as displayed by the power crunch this year, which prompted China to redirect support to polluting fossil fuels, China faces an immense difficulty of balancing long-term climate goals with short term energy security. The reason why China did not make any new commitments at the COP 26 is the prevailing domestic uncertainties, because of which China has been hesitant to embrace stronger near-term targets.

## Conclusion

China’s strides in renewable energy undoubtedly are laudable and in fact make it in a position to steer discussions on climate change and how to address the challenges. Because of these strides, China felt it was in a place to demonstrate global leadership, which is why after joining the Paris Agreement, China made laudable pledges to combat climate change including plans to reduce carbon dependence. The reinvigorated emphasis on the dual control policy was a step to combat coal usage in China. However, as stated previously, 20 provinces had failed to meet their targets as part of the dual control policy! Also, because of the historical dependence China has on coal, the introduction of sudden controls on coal usage led to a shortage of electricity in the country, which in turn led policymakers to revert to usage of fossil fuels. Additionally, the floods in coal producing provinces like Shanxi dealt a blow to electricity production, which in turn spurred the power outages across the country.

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China's dependence and addiction to coal is displayed by the fact that China delivered 60 train loads of coal to Henan province per day in July when the province reported urgent shortages of fuel to generate electricity, after major transport routes were blocked by an unprecedented deluge (Global Times, 2021). China's plans thus seem to be in complete contradiction with the pledges Xi had made. Also, as reflected by the failure of 20 provinces to meet coal reduction targets, there is a dangerous lack of urgency in the country. Because of the back and forth between announced policies and prevailing ground realities Chinese attempts to assert its role in the world as a leader is clearly not showing up. Achieving a material and socio-economic transformation that supports the move away from coal needs major changes in governance, policies, planning, investment and organisations practices at various levels. The Chinese political economy is dominated by vested interests and complicated by perverse incentives for unsustainable production.

SOEs in energy intensive industries along with

several officials with vested interests have zero or limited interest in curbing emissions or adhering to limitations on coal usage. Central officials often acquiesce or fail to rein them in (Green, 2020). On the contrary there have been drastic increases in coal fired power station development in the last few years (Myllyverta, Zhang and Shen, 2020). Research by the Centre for Research on Energy and Clean Air shows how hundreds of billions of dollars in the post COVID-19 stimulus being earmarked for energy intensive industrial projects. These exceed the planned spending on low carbon energy threefold!

Facts such as these call for caution regarding China's pledges on climate change; particularly its 2060 carbon neutral target. Between now and 2060 a lot can happen and from the trends it is visible that the government's medium-term targets give it space to increase emissions until 2030! China is actually culpable for greater levels of pollution and global warming, and Xi's pledges are only a cover for about another decade of fossil fuel based industrial expansion!

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## National Population Policy: A Survival Imperative

T. H. Chowdary\*

### Overview

In his monumental work, “An Essay on the Principle of Population”,<sup>1</sup> Robert Malthus postulated that while population grows exponentially, food production grows linearly. So, a catastrophe will occur, either by famine, disease or war, to bring down the population. Although the population in the world and India has been growing spectacularly, no catastrophe of a great dimension has occurred to bring down population or its growth because food production has increased more phenomenally than population growth. This is due to increase in farmland, better irrigation, use of fertilisers and pesticides, crop rotation and improved storage of food grains; in other words, application of science and technology for agriculture.

In the 1960s, food scarcity in India was overcome only through massive food aid from the US, with the then US President, Lyndon Johnson authorising food shipments to India under PL-480.<sup>2</sup> The aid was however leveraged to secure support for US foreign policy goals, with India giving assurance that it would implement agricultural reforms and temper criticism of US policy regarding Vietnam.<sup>3</sup> Importing food grains was humiliating, and in 1965, Prime Minister Lal Bahadur Shastri exhorted people to chant ‘Jai Jawan Jai Kisan’. The ‘Green Revolution’ was brought about by planting newly developed grains

(wheat and rice) and using fertilisers. This raised the yield, though it did not improve food grain availability per person. However, the spectre of famine vanished, largely due to better distribution. Improvement in irrigation facilities and rapid economic growth also helped to drought proof the country.<sup>4</sup> Today, India feeds over 800 million “poor” people by giving them free/subsidised food items. The amount spent detracts from investments needed for overall development—economic and social.

An increase in food grain availability may stop starvation but not ill health, illiteracy, lack of proper housing and work and employment and improvement in standards of living and achievement and respect for the country in the comity of nations. Poverty reduction by controlling growth in population, as was done by China, is hence an imperative for national development. As humans are the only species in the planet who consistently degrade the environment, a reduction in population will concomitantly also lead to the preservation of the environment. India must, therefore, have a population policy which can ensure the achievement of development goals—economic, social and security. Family size must hence be regulated through positive and negative incentives and disincentives respectively and be made applicable uniformly across the board, to all sections of people, regardless of religion, region,

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caste and economic status. Uneven growth of population as between sections of people leads to social strife and demographic disequilibrium, which is best avoided.

### **Impact of India's Population Growth**

India's population, which stood at 35.69 crore in 1951<sup>5</sup> increased to 121.08 crore in 2011<sup>6</sup> and is estimated to be 139.9 crore in 2021.<sup>7</sup> An increase of four times since 1951, clearly puts unsustainable pressure on the land and water resources, which remain constant. To sustain the growing population, forest lands are being depleted, disturbing the eco-system leading to multiple negative consequences.

Soon after independence, the redoubtable industrialist and statesman, JRD Tata, raised the issue with Nehru, of the importance of population control. "But Jeh", replied Nehru, "population is our strength!" Undeterred, JRD raised the subject again in 1951, but got little traction, and so Mr Tata, through the agency he founded, the Family Planning Association of India, pursued a campaign to promote family planning.<sup>8</sup> JRD's advocacy of population control not only in and for India, but on a world-wide scale got for him the United Nation's Population Award in October 1992.<sup>9</sup>

Dr. Ambedkar, too, understood the linkage between poverty and population. His views on birth control are reflected in the speech which Mr. P. J. Roham delivered, but which was written, as stated by Roham, by Dr Ambedkar. Here, Ambedkar called for limiting the family units, and urged the government to carry on an intensive propaganda in favour of birth-control among the masses.<sup>10</sup> In the Manifesto of the Scheduled Caste Federation (SCF) for General Elections to Lok Sabha in 1952,

he wrote about his party's policy in regard to poverty and population. "The problem of poverty", he wrote, "is a problem of controlling the excessive growth of population... for the purpose of reducing population it (SCF) would advocate an intensive propaganda in favour of birth control among the people. It will advocate the opening of birth control clinics in different parts of the country. It regards the growing rate in the increase of population in the country so grave and evil that it would not hesitate to advocate more drastic methods of controlling it".

India has, unfortunately, paid little heed to the sage advice of both JRD Tata and Dr Ambedkar. But it is time to think seriously on this subject, both as a poverty alleviation measure and also as an instrument of protecting the environment. While the Chief Minister of Assam, Shri Himanta Biswa Sarma as well as the Chief Minister of Uttar Pradesh Shri Yogi Adityanath are now advocating population control measures, the initiative needs to be taken on a national level. Unfortunately, population control measures are denounced by some Muslim leaders and their allies, ostensibly on the grounds that it violates Muslim personal law.

China's rise has been aided by its success in controlling its population. They had a one child policy from mid 1970s and two children per family from 2015 which has now been increased to three children per family. India faces multiple challenges in attempting the Chinese model, due to religious differences, caste fragmentation and differences in economic and educational levels. This gets exacerbated due to India being a multi-party, periodically election-conducting nation-state, wherein politicians exploit differences to garner



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the popular mandate. That notwithstanding, the need for a population policy is dire and can no longer be overlooked.

### **A National Population Policy for India**

India is a welfare state where large doles are given for food, education and other social welfare schemes. As part of the policy, such assistance could be restricted to those having two children or less. Curbs could also be placed on those having more than two children in applying for government jobs or for selling public office.

Extensive educative campaigns must be undertaken to explain the consequences of runaway growth in population and that too unevenly among different sections before promulgation and periodic revisions in national population policies. The following needs to be highlighted:

- All people must always have despite droughts, famine and floods and epidemics, earthquakes, storms and cyclones and such natural disasters adequate fuel and food so that there are none or fewest deaths at all times.
- People must be well nourished, healthy, educated and able and willing to work to earn their livelihood and live in reasonable comfort.
- People must have adequate housing, either of their own or within affordable rent.
- Death at birth and infant mortality must be nil or nearly so and life expectancy should be rising.
- The use of natural resources below and above the ground—minerals, rivers, forests,

air, fauna should not lead to unliveable conditions for humans, through reckless exploitation, which leads to environmental degradation. Most importantly, the civilisational and cultural heritage of Bharat, must be preserved.

- Different rates of growth of populations as between states, regions, castes and religions should not lead to dissonance within society.
- The population and its growth rate in the country should be related to the means of sustenance and economic well-being of the people.
- The environment must be preserved.

### **Demographic Shifts:**

The current conflict in Lebanon between Christians and Muslims is a result of demographic changes that have taken place over the last few decades. In India, demographic changes could lead to communal strife on a very large scale, if not corrected even at this late stage. While India's population since independence has increased four times, this increase is not spread evenly across religious groups. The Muslim population has grown six times during this period as against the population of other religious groups increasing only three times.

Muslim population growth relative to Hindus should be a matter of serious concern as it is driven both by political and theological considerations. This has already led to population inversion in some parts of India, especially in the states of Assam, Bihar, West Bengal, Kerala, leading to fissures within society.

### Changes in religious demographics over time in India

Religious group	Population % 1951	Population % 1961	Population % 1971	Population % 1981	Population % 1991	Population % 2001	Population % 2011 <sup>[60]</sup>
Hinduism	84.1%	▼83.45%	▼82.73%	▼82.30%	▼81.53%	▼80.46%	▼79.80%
Islam	9.8%	▲10.69%	▲11.21%	▲11.75%	▲12.61%	▲13.43%	▲14.23%
Christianity	2.3%	▲2.44%	▲2.60%	▼2.44%	▼2.32%	▲2.34%	▼2.30%
Sikhism	1.79%	▼1.79%	▲1.89%	▲1.92%	▲1.94%	▼1.87%	▼1.72%
Buddhism	0.74%	▼0.74%	▼0.70%	■■■■0.70%	▲0.77%	■■■■0.77%	▼0.70%
Jainism	0.46%	▼0.46%	▲0.48%	▼0.47%	▼0.40%	▲0.41%	▼0.37%
Zoroastrianism	0.13%	▼0.09%	■■■■0.09%	■■■■0.09%	▼0.08%	▼0.06%	n/a
Others/Religion not specified	0.43%	■■■■0.43%	▼0.41%	▲0.42%	▲0.44%	▲0.72%	▲0.9%

### Unequal Rates of Growth Among States and Communities

Population increase in Southern states like Tamil Nadu and Andhra Pradesh is much slower than states in the North, such as Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh. This could lead to a North-South divide, as seat allocation in Parliament is done on the basis of population.

Article 81 of the Constitution requires that each state receive seats in proportion to its population. The Seventh Amendment (1956) capped the maximum number of elected seats at 520. After adjustments under the Fourteenth Amendment (1962), the Thirty-First Amendment (1973), and the Goa, Daman and Diu Reorganisation Act (1987), the Lok Sabha now has a maximum sanctioned strength of 552 (530 from the states,

20 from the UTs, and two presidentially appointed members from the Anglo-Indian community) making a total of 545 representatives. The seats were to be revised every 10 years, but this revision was suspended by the Forty-Second Amendment enacted in 1976, until after the 2001 Census. In 2002, parliament, through the Eighty-Fourth Amendment, extended the suspension till the census to be held post 2026, which in effect means to 2031.<sup>11</sup>

The aspect of seat allocation based on population has grave implications. The states that have performed well in controlling the population stand to lose as against the states that have performed poorly. If such a policy is implemented, the loss of political power to states that have performed well, will likely create a cleavage

### Comparison of Growth between some North and Southern States

	Assam	Bihar	UP	WB	Kerala	TN	AP
1951	8,029,100	29,085,900	60,274,800	26,300,670	13,549,000	30,119,680	31,115,000
1961	10,837,700	34,841,490	70,144,160	34,926,000	16,904,560	33,687,100	35,983,480
1971	14,625,157	42,126,800	83,849,775	44,312,017	21,347,300	41,199,170	43,502,710
1981	18,041,250	52,303,000	105,113,300	54,580,650	25,453,680	48,408,080	53,551,030
1991	22,414,320	64,531,200	132,062,800	68,077,970	29,098,523	55,859,300	66,508,170
2001	26,638,600	82,879,910	166,053,600	80,221,300	31,839,000	62,111,390	66,508,170
2011	31,169,272	103,804,630	199,581,477	91,347,736	33,387,677	72,138,958	49,386,799
2021	36 mln	127 mln	241 mln	10.19 mln	35.8 mln	78.8 mln	54.6 mln
Growth multiple over 1951	4.5	4.4	4.0	3.9	2.65	2.62	1.76

between those that have fared better, leading to political turmoil and upheaval. It is thus important that all states take urgent steps, not just to stabilise population growth, but to reduce the same.

### Preserving Territorial, National and Cultural Integrity

India's population policy should not only aim at controlling the growth of population but also preserve the integrity, sovereignty and civilisational and cultural heritage of the country. History gives examples of destruction of a country's cultural milieu by differential growth of the populations aimed at claiming political separation and superiority as seen in Lebanon. In Netherlands, the Catholics were in a minority. They wanted to become the majority, so they nurtured large families and over time, the protestants were reduced to a minority. The same phenomena appears to be

happening in parts of India: Kerala, West Bengal, Assam and certain other parts of India. In these states as well as in others, Muslims have been able to prevail upon the ruling parties through group voting strength, to carve out Muslim majority districts: Malappuram in Kerala, Mewat in Gurugram and Malerkotla in Punjab are examples. The motive is political power. Writing in the Jamaat-e-Islami weekly, "Radiance," Dr Omar Khalidi, stated: "we need Muslim districts for three reasons. First, concentrated areas provide security; second, to provide an environment that is conducive to our cultural independence; third, to provide a political base through which our people can be elected...at preset, our numbers don't add up to elect adequate legislators. Hyderabad and Rangareddy in Andhra Pradesh and Gulbarga (Karnataka) and certain Thalukas could be merged to create Deccan province (with Muslim majority).<sup>12</sup>

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## Different Treatment to different Religions

India's populations are dealt with differently in some respects, based on among others, religion, language and caste considerations. Article 30 of the Indian Constitution grants to religious and linguistic minorities, certain rights and privileges with respect to establishing and managing any type and number of educational institutions, a right and privilege not available to the Hindu majority. What percent of the total population qualifies to be reckoned as minority is also not specified in the Constitution nor by the Supreme Court. While Hindus on an all India basis are the majority, they are a minority in several states (J&K, Punjab, Nagaland, Mizoram, Meghalaya and very soon in Kerala and Arunachal Pradesh). Minority Commissions are established only in Hindu majority states; not in Hindu minority states. Muslim personal law permits a man to have four wives and inheritance is also dictated by their personal law. There is a need to look into such issues, and for the nation to be governed by a uniform civil code, so that all people can be treated alike. The minority status is discriminatory as it affects the economic and welfare prospects of people. Governments in States and in the Centre have Minority Welfare Departments and Minority Finance Corporations, funding not only education, welfare and commercial ventures of minorities but also their places of worship. This militates against the very concept of secularism, as enshrined in the Constitution.

## Conclusion

Population growth is impacting negatively on

India's cities, all of which have grown far beyond the capacity of the civic agencies to provide adequate amenities. Growth of population has also impacted negatively in the rural areas, where land holdings are diminishing and are becoming smaller. Population growth is also impacting on job availability, which is getting more severe due to mechanisation, automation and robotisation. Population reduction is therefore a necessity, which needs to be pursued with full zeal, through a dynamic national population policy.

Inter alia, such a policy must focus on:

- Extensive and intensive education and information about the perils of large families and large populations which negate poverty alleviation efforts, increase unemployment, lead to under-nourishment among women and children, and create conflict in the scramble for limited resource availability.
- Humans are the only polluters in the planet. Reducing the population will ipso facto, lead to reduction in pollution level, reduction of the carbon footprint, and help in preservation of the environment.
- Limiting family size must now be a national imperative. Appropriate legislation to that effect must be made, to include legislating incentives and disincentives to promote small family norms.
- Legislate Uniform Civil Code as mandated by the Directive Principles of the Constitution and criminalise polygamy. Preserve the millennial Indian culture and civilisation values of Vasudhaiva Kutumbakam, Loka Sangraha and Dharma.

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## Why Are Our Cities So Ugly?

Neeraj Mahajan\*

*“There are few things certain in life – one is death, second is change and the other is waste. No one can stop these things in our lives.” - unknown*

### Introduction

Why are our cities so ugly? The answer has much to do with the way we live. Let us look at some statistics:

- According to Time magazine, humans produce 290 billion kg of faeces and 1.98 billion litres of urine per year.<sup>1</sup>
- An average person excretes or generates about 0.74 kilograms of solid waste per day, worldwide.<sup>2</sup>
- Every year an estimated 16 billion injections are administered worldwide, more than half of these needles and syringes are dangerously thrown away or disposed of thereafter.<sup>3</sup>
- Liquid waste - dirty water, wash water, organic liquids, detergents and rainwater is usually found in households, businesses, and industries.
- Approximately 1,400 sq. km landfill area would be required for dumping municipal solid waste in India by 2047—almost equal to the combined area of Hyderabad, Mumbai and Chennai—3 of the 5 most populous cities of India.<sup>4</sup>

Any unwanted solid, liquid or gaseous substance discarded or thrown out by households, or commercial establishments can be considered as waste. According to the Press Information Bureau, waste can be segmented into three

categories:

- Biodegradable or organic waste (food and kitchen waste, green waste vegetables, flower, leaves, fruits and paper, etc.).
- Inert and non-biodegradable waste (construction and demolition waste, dirt, debris, etc.).
- Recyclable waste (plastic, paper, bottles, glasses, etc.).

Waste management is a universal issue that affects every single individual or government providing civic amenities to its people. Almost 50 per cent of India’s population is projected to live in urban areas by 2050 leading to a five per cent growth in the volume of waste generated per year.<sup>5</sup> As towns and cities develop economically, and the population grows, waste generated is expected to increase drastically from 2.01 billion tons today to 3.40 billion tons in 2050.

As of date over 377 million people—31 per cent of the Indian population—live in 7,935 towns and cities and generate around a massive amount of 277.1 million tons of solid waste per annum. According to a 2019 India Today report, the country produces more than 1.50 lakh metric tons of solid waste daily. This is increasing every day with the burgeoning economy, urbanisation and population.<sup>6</sup> India today produces more than 80 per cent of waste generated in South Asia and 13 per cent of the world per annum.<sup>7</sup> According to a World Bank

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study, India is one of the world's highest waste-generating nations.<sup>8</sup> As a result most Indian towns and cities are ugly to look at and littered with garbage.

## **Waste Management**

Human activities are the cause behind most kinds of waste, and the way it is stored, collected and disposed of poses a risk to the environment and public health. According to Planning Commission, Maharashtra generates the highest (22,080 MT per day) and Sikkim generates the lowest (89 MT per day) amount of waste. Among the Union Territories (UTs) Delhi produces the highest amount of waste, while Daman & Diu are the lowest waste generators.<sup>9</sup>

According to the World Bank's What a Waste 2.0 report, the world generates 2.01 billion tons of municipal waste annually at least 33% of which is not managed in an environmentally safe manner.<sup>10</sup> Improper handling and disposal of waste harms the environment and public health. It is a leading cause of soil, water and air pollution. Unsafe disposal of hazardous waste contaminates the soil and water causing serious health problems and leading to air pollution in the surrounding area.

Uncontrolled or mismanaged waste lying around attracts flies, rats, and other creatures which spread infectious diseases. The polluted environment and ineffective waste management serves as a breeding ground for disease vectors and leads to several respiratory problems and diseases like Japanese Encephalitis, jaundice, cholera, colitis, diarrhoea, worm, dysentery, and skin diseases. The US Public Health Service has identified 22 diseases including asthma, heart attack, and emphysema due to burning garbage

and faecal matter in municipal waste. Unmanaged and decomposed garbage attracts rodents, which lead to diseases like dengue and malaria.

Environmental contamination is a global issue. Poorly managed waste is contaminating the world's oceans, clogging drains and harming humans, plants and animals. All over the world, about one million plastic bottles are purchased every minute and some 5 trillion single-use plastic bags are used once and thrown away every year. Ten of the world's biggest rivers flush around eight million tons—more than 90 per cent of the plastic waste into the oceans every year.<sup>11</sup>

The real magnitude of the problem is for everyone to see. This phenomenal amount of plastic waste is enough to fill up 2,400 Olympic stadiums or 4.8 million olympic-sized swimming pools. It weighs equal to 3.4 million adult blue whales or 1,376 Empire State Buildings. Imagine that's just 12 per cent of the total waste generated each year.<sup>12</sup> Already, according to the 'World Air Quality Report, 2020', prepared by Swiss organisation IQAir, Delhi is the world's 10th most polluted city and most polluted capital city globally.<sup>13</sup> Ghaziabad in Uttar Pradesh is the second most polluted city in the world after Hotan in China.<sup>14</sup>

Twenty-two of the world's 30 most polluted cities are in India. India, Pakistan and China collectively account for 94 out of the top 100 most polluted cities in the world. The largest number of cities in the list of top 10 most polluted cities in the world is in India.<sup>15</sup> India ranks highest with 46 of the world's 100 most polluted cities followed by China (42), Pakistan (6), and Bangladesh (4) in terms of air quality index. These include Noida, Greater Noida, Lucknow, Kanpur, Meerut, Agra, Bulandshahr, Birsakh, and Muzaffarnagar (in Uttar

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Pradesh), Faridabad, Jind, Fatehabad, Bandhwari, Gurugram, Yamuna Nagar, Rohtak, Dharuhera and Hisar (Haryana), and Bhiwadi (Rajasthan).<sup>16</sup>

According to the Delhi Pollution Control Committee, people in Delhi breathe the worst air between November 1 and November 15 every year followed by Noida (488), Ghaziabad (486), Greater Noida (478), Faridabad (460), and Gurugram (448).<sup>17</sup> As per a scientific paper on the health and economic impact of air pollution, 1.7 million deaths—i.e. 18 per cent of the total deaths in the country in India in 2019 were attributable to air pollution.<sup>18</sup>

Managing waste properly is essential for building sustainable and liveable cities, but it remains a challenge for many developing countries and cities. Effective waste management is expensive, often comprising 20%–50% of municipal budgets. Operating this essential municipal service requires integrated systems that are efficient, sustainable, and socially supported.

### **Is Garbage-Free India a Distant Dream?**

Solid waste management is one of the necessities to keep the town and cities clean. Solid waste management is a serious problem in India not just because of environmental concerns but also because of the enormous quantities generated every day. Experts believe that India is following a flawed system of waste disposal and management. Almost all municipal authorities indiscriminately dump solid waste in dump yards within or outside the city. Waste dumping and open burning continue to be the principal methods of waste disposal in India. These dump yards are known to frequently catch fire. An 18-ft high inferno at Deonar<sup>19</sup> in Mumbai in 2016 went on

for three months, pumping tons of cancer-causing smoke caused by burning plastic and leather. Burning garbage is the third biggest cause of greenhouse gas emissions in India.

Heavy metals and toxic liquid in the rotten garbage is absorbed into the soil or water bodies. This leads to contamination of the entire food chain and rivers, endangering humans, plants and animals. According to data from the Ministry of Environment and Forests, only about 75–80% of the municipal waste is collected scientifically and only 22–28% of this waste (27,000 MT per day) is processed and treated. The remaining 80 per cent (1,08,000 MT per day) is dumped in an unhygienic manner in landfill sites leading to health and environmental degradation.<sup>20</sup> The stench and ugly sight of garbage dumped on the roadside, clogging of the drains and garbage floating on the surface of the rivers, particularly during the rainy season, is a common sight in India.

It is estimated that urban municipal solid waste will increase to 387.8 million tons in 2030 and 543.3 million tons by 2050.<sup>21</sup> At the rate at which we are littering hazardous waste we would need about 88 sq. km of land—the size of New Delhi—just to dump it by 2050, according to an ASSOCHAM and PwC joint report.<sup>22</sup> “This will eventually render the land unfit for any other use for as long as a half-century before it can be stabilised for other uses,” says the report, ‘Waste Management in India: Shifting Gears.’

The solution lies in a garbage-free India as a part of the ‘Swachh Bharat Abhiyan’.

### **Objectives of Waste Management**

The main objective of waste management is to reduce the harmful effects of the discarded pile



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of waste on health and the environment and improve the quality of life of people living or working in the vicinity. The philosophy behind waste management is governed by 3R's namely, Reduce, Reuse and Recycle. In other words, only a minimal amount of waste should be generated, and a substantial amount of this waste should either be reused or recycled. To do so, it is particularly important to:

- prevent the generation of waste.
- promote reuse of waste.
- promote biological recovery of waste and recycling of materials.
- promote energy use of waste not suited for recycling.
- ensure that the treatment and disposal of waste does not cause any harmful impacts.

According to a recent report by the Associated Chambers of Commerce and Industry of India (ASSOCHAM)-NEC, India is among the top five countries in the world, in terms of e-waste generation next only to China, the USA, Japan and Germany.<sup>23</sup> The study concludes that, though India generates 2 million tons of e-waste—discarded electronic devices and gadgets like computer monitors, mobile phones, chargers, compact discs, headphones, televisions, air conditioners, and refrigerators, only 4.3 lakh tons is recycled per annum.

The e-waste products contain toxic substances like lead, cadmium, mercury, hexavalent chromium, plastic, PVC (polyvinyl chloride), BFRs (brominated flame retardants), barium, beryllium, and carcinogens such as carbon black and heavy metals which can cause severe health problems to those handling the waste. Mismanagement of e-waste and prolonged exposure to pollutants

released by e-waste adversely affects the crops, and drinking water, consumed by both humans and animals. They can also lead to kidney damage, respiratory diseases, skin disorders, and lung cancer.

### **The Stumbling Blocks - Drawbacks of the Present System**

India is predicted to reach an estimated 125 million tons of waste, making it the largest waste contributor in the world by 2048. The current waste management practice in India involves collecting waste from sources through a community collective bin system, which gets transported to a low-lying landfill system with intermediate processing of Municipal Solid Waste. The open dumping practice leads to problems like pollution and health hazards.

The major problems affecting solid waste management are unscientific treatment, improper collection of waste, and ethical problems. This in turn leads to hazards like environmental degradation, water pollution, soil pollution, and air pollution. Some of the other bottleneck areas include:

- No storage of waste at source
- No system of primary collection from doorsteps
- Irregular street sweeping
- Waste storage depots are a problem
- Transportation of waste is not satisfactory
- Processing of waste: only a few cities have been practicing this
- Disposal of waste is a neglected area and the current practices are grossly unscientific

### **Waste to Wealth**

Waste is a valuable resource with the potential to generate innumerable environmental and

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monetary benefits if properly treated. For instance, did you know that recycling 5 PET bottle produces enough fibre for making one t-shirt? The Waste Management market in India is said to be a USD 14 billion opportunity by 2025.<sup>24</sup> India has the potential to generate 3GW of electricity from waste by 2050. Some of the sunshine areas of waste management include municipal solid waste, electronic waste, bio-medical waste, and agricultural waste. This is both a challenge as well as a golden opportunity. India is set to become the world's most populous country as per projections of the United Nations with 7 new megacities by 2027. At this growth rate, India would need landfills almost 90 per cent of the size of Bengaluru for dumping the waste if left untreated.

### **Case Studies: Best Practices of Solid Waste Management around the World**

Waste is generally viewed as dirty with no value; this limited thinking is why waste management is not given the weightage it deserves. Every city is different when it comes to solid waste generation and management. Here are some of the fascinating, innovative and eco-friendly waste management strategies being implemented all over the globe.

#### **Kamikatsu, Japan:**

There is a Japanese word 'mottainai' which in other words means "don't waste anything worthy". The spirit behind it is to use all things as long as possible. It represents the island nation's commitment towards waste management and 'zero-waste'. Kamikatsu, a small town approximately 40 kilometres from Tokushima city in the mountains of Shikoku Island in Japan, signed

a 'zero-waste' declaration in 2003. Today, Kamikatsu is a 'zero waste' town without even a trash collection system. The residents themselves segregate the waste into 45 categories. 80 per cent of this waste is recycled and only 20 per cent goes to landfills. The residents voluntarily wash, sort, and carry their trash to the recycling centre and make sure that it lands up in the right bin. Kamikatsu's heroic efforts have inspired other communities in Japan to take up the zero-waste challenge.

#### **Mexico City, Mexico**

Bordo Poniente dump, just outside Mexico City used to be one of the world's biggest open-air landfills. Hundreds of trucks were used to dump more than 12,000 tons of waste each day. In 2011, Mexico City authorities decided to close down the 927-acre Bordo Poniente landfill. The idea behind this was to convert millions of tons of garbage to energy and reduce greenhouse gas emissions by 2 million tons annually. BMLMX, a power company, signed a contract with the Mexican government to utilise the biogas from the landfill site to generate 250 GWh electricity—enough to illuminate about 35,000 homes and the streets of Mexico for 25 years. This is, apart from the creation of short and long-term jobs for contractors, service providers and labour in the construction, operation and maintenance of the landfill gas capture system. As yet another spin-off, a cement company agreed to buy 3,000 tons of dry waste daily to burn as fuel as well as produce organic fertiliser for the city's parks and gardens in the composting plant.

#### **Malang City, Indonesia**

With a garbage output of 200,000 tons a day,

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Indonesia ranks as the second-highest generator of plastic waste worldwide. Almost half of the population of Indonesia earns less than USD 2 a day and a majority of them do not have any health insurance. Though both the issues—waste management and healthcare may seem unconnected, Dr Gamala Albinsaid, the CEO of Indonesia Medika, a healthcare company, saw this as an opportunity and created Garbage Clinical Insurance (GCI), a micro health insurance program that lets people trade garbage for medical services and medicines. There was a time when people used to think that garbage is worthless and healthcare is expensive, but now they feel that garbage can be valuable and after all healthcare isn't necessarily so expensive.

## Sweden

Over the last few decades, Sweden has emerged as one of the global leaders in waste management. Strange though it may sound, it is a fact that Sweden has run out of trash and is now asking other countries for their garbage to keep its recycling plants running. Less than one per cent of Sweden's household waste goes into the landfill dump. Over 50 per cent of the waste generated in Sweden is burned in waste-to-energy facilities. The 32 waste management plants in Sweden produce heat for 810,000 Swedish households and electricity for about 250,000 private homes in the freezing Swedish winter. The country has adopted a recycling policy that funnels all the energy generated by burning waste into the national heating network.

## Semakau Landfill, Singapore

The word 'landfill' immediately creates the image of a smelly mountain of rubbish. But Semakau Island, created by reclaiming land between two small islands, eight kilometres off the coast of Singapore, is different. The world's first offshore landfill site (island) was created entirely from the sea space at USD 399 with a capacity of 63 million cubic meters. Semakau landfill receives about 1,400 tons of incineration ash and 600 tons of non-incinerable waste every day and is expected to meet Singapore's need for landfill space beyond the year 2040. The landfill operation will eventually create an island made almost entirely of waste. Semakau landfill has been constructed to contain all wastes within the landfill area and keep the surrounding marine ecosystem and sea waters pollution-free. Great care has also been taken to keep the landfill clean, and odour free. Semakau landfill was opened to members of the public for recreational activities. Since then, the island has gained popularity with nature lovers due to its rich biodiversity.

## Conclusion

The world is not our personal ashtray. When we throw anything, it must go where it is meant to be. As has rightly been stated, if we don't want to live in a trash can, we should stop making it one.

Waste management is not a complex, unsolved puzzle. Many solutions already exist. What is needed is urgent action at all levels of society. We ourselves are the cause and cure behind the dumps of garbage. It is time now, to get our act together and as a society, keep our environment clean and green.

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## COP 26: The Indian Viewpoint

An Interview with **Shri Bhupender Yadav\***, Union Cabinet Minister of Labour and Employment, Environment, Forest and Climate Change

Gaurie Dwivedi\*

### Gaurie Dwivedi

Thank you, Mr. Yadav for speaking to India Foundation. The talking point across the world is about the COP 26 milestones, the decisions that have been taken, and more importantly, the parallel narrative that is being built about how India pulled down a collective effort. How do you first view the larger effort that is currently on and then we can get onto the nitty-gritty of India's position?

### Shri Bhupender Yadav

A major milestone for the United Nations Framework Convention on Climate Change (UNFCCC) negotiations was the Paris Agreement in 2015. In principle, it was accepted by almost all the nations across the globe. There were two basic spirits of the Paris Agreement. First is Common But Differentiated Responsibilities (CBDR) and the second is climate finance. Due to the increasing global warming, every nation was concerned and had concurring opinion that solutions needed to be implemented for its mitigation and adaptation. For the question about 'how' to implement these solutions, the answer was 'Common but Differentiated Responsibility'. We all have the same target, that the world should be saved from climate change, but every nation would have to take decisions based on their national circumstances. That is why even the targets set in

the Nationally Determined Contributions (NDCs) were based on individual national circumstances of different countries. Second, the major countries, the ones who captured maximum carbon space during the industrial development, committed that they would give compensation and climate finance for these contributions. This is why, when this discussion came up in Glasgow, it was asserted that as per 'CBDR,' each country has the right to take decisions about energy production. A fundamental of 'Climate Justice' is also poverty eradication. In fact, India is one of those countries who impose maximum tax on fossil fuels. Our petrol and diesel tax is among the highest. On the other hand, we provide 'Ujjwala' subsidies to 12 crore women.

This way, the smoke that would be created in their rooms due to biofuel combustion is decreased. This has brought change in the lives of 12 crore women. For this reason our point was, and not just us but all the BASIC countries (Brazil, South Africa, India and China)—and even other developing countries had this common point—that the principle of CBDR be accepted. Common but differentiated responsibility according to national circumstances and subsidy will be continued, subject to the poverty eradication and vulnerability of the local society. We only presented this

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principle, the voice of the developing countries in front of the world.

**Gaurie Dwivedi**

When I said that a narrative is being built, it has to be seen that India's per capita emission is just one-seventh or one-eighth of the US and is also even lower than China's. Considering how big a polluter China is, they must take bigger steps. But, when the negotiation was on in COP 26, India was connected to these countries, considered alongside China, which somehow undermines our efforts. How do you view the situation?

**Shri Bhupender Yadav**

India is among those countries who achieved the NDCs they declared in Paris. And not just achieved, we also fixed ambitious targets. In our renewable energy production, we reached 165 GW. We now took a target of 500 GW. Even before that we targeted 450 GW. We said that we will take our renewable capacity to 40%, and we achieved that goal and now we are moving to 50%. We said that we will reduce carbon emissions and we did reduce them. The biggest point is that under our Honourable PM, Shri Narendra Modi Ji's Panchamrit, India presented a new action-oriented example to the world. We will cut our carbon emissions due to development by 1 billion tonnes by 2030. It is a cumulative effect and is being done very scientifically. We believe in action along with vision. After 2015 Paris Agreement, India joined three major action programmes with regard to climate change. First, we started International Solar Alliance with France. Today, 102 nations of the world are members of the Solar Alliance. This significant achievement happened in Glasgow, and is not limited to International Solar Alliance alone.

We are now moving towards 'One Sun, One Grid, One World'. Countries like France, UK, Australia, US and others have come forward for this. Second, we are working on how to promote green technology in sectors which are major carbon emitters like cement, aluminium and others. Corporates and various countries are coming together to deliberate on this issue, on the platform of Lead IT that we have created along with Sweden for this purpose. Third, India has also been doing great work on the Disaster Resilient Infrastructure platform that we have with UK. This time our honourable PM came together with the PM of Australia and the PM of UK to create the IRIS platform to help small island nations with their vulnerabilities. This once again shows both our vision and action.

**Gaurie Dwivedi**

According to you, what are the major steps that India needs to take in the next five to eight years and what are the steps for which the world needs to put in collaborative effort?

**Shri Bhupender Yadav**

One crucial issue is the target of Panchamrit that our honourable PM Modi ji has shown. Second is technological development. How do we move towards green energy? We are working on increasing our solar energy generation capacity and alongside have also initiated a National Hydrogen Mission. We also have to look into changing and adapting our lifestyle practices. Simultaneously, we also have to increase the global carbon sink. I believe that the developed countries, who not only have a moral responsibility but also a pledge, should come forward for technology transfer and climate finance. They must accept

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their large amounts of carbon emissions and historical wrongdoings that they have committed. In this matter, India fervently leads all the developing countries.

**Gaurie Dwivedi**

If developed countries need to move ahead in this direction, there needs to be a realisation that 2009 level of fundings cannot be expected in 2021 or 2030. In this regard, how are the developed countries being pushed to fulfil their responsibilities in terms of funding?

**Shri Bhupender Yadav**

India has been exerting a great deal of pressure on this issue. You earlier talked about making collective efforts. Our honourable PM gave the mantra of 'environment-friendly lifestyle'. If this time, there were six or seven decisions taken in this direction, it was because of India's strong representation of the voices of developing countries. Firstly, in Glasgow, all developed countries expressed deep regret that they couldn't provide climate finance. Now they would have to do more for this responsibility. Besides expressing deep regrets, they also need to take action. Second, an ad-hoc committee was discussed for deliberating the definition of climate finance. Discussion also took place over continuation of long-term finance. A draft would also be prepared about adaptation, between the time-frames from Glasgow to Sharm el-Sheikh. Most importantly, we have always held that if they do not carry forward the CDM (Clean Development Mechanism) and the CERs (Certified Emission Reductions) from the Kyoto protocol, then there would be no credibility to the issue of carbon credits that they wish to raise. We believe that this issue raised by

India and other developing countries has been fully accepted as part of Article 6 of the rule book of Paris Agreement. We still hold that developed countries should come forward to fulfil their responsibilities.

**Gaurie Dwivedi**

Recently, Germany announced a funding commitment of 1.2 billion Euros for India to fight climate change. Do you believe that issue of environment leadership that India has been raising would give an impetus to increase funding and solve this problem of funding?

**Shri Bhupender Yadav**

With regard to funding, I believe that there needs to be more clarity on climate finance. This must happen with pace. As far as India's initiatives are concerned, India has not only set ambitious targets, but has also fulfilled them. One of the major threats of climate change is desertification of land; to address that we are running a joint-programme of eight ministries. We are undertaking major projects such as NCAP to solve the problem of air pollution. Over ten of our ministries are working on various initiatives with regard to environment including Swachh Bharat mission, Ujjwala Yojana, Unnati project etc, as well as work in the agriculture sector. All those techniques, adaptation practices and mitigation measures that are needed to be taken by modern societies are being implemented by India.

**Gaurie Dwivedi**

Do we need to change our perspective about environment? We need to be careful, conscious and aware that when we talk about environment or climate, it is one of the foremost threats to the world at large. Do you think that this larger

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transformation has not happened by now? It is an ongoing process and would not happen in a day but do you think that there should be more work in this direction by the civil society, academia, research and other?

**Shri Bhupender Yadav**

This is a fact that environment awareness needs to come and environment education has to be pushed. Climate Justice also needs to be brought to the fore. The issue of lifestyle should also be raised. We have 17% population of the world but account for just 4% of total carbon emissions. Hence, our per capita emissions are very low. There is also an issue of lifestyle, which must be discussed. Our honourable PM has also focused on this issue. Besides lifestyle changes, we also need to put impetus on our biodiversity, flora, fauna and our other issues. The world needs to rapidly progress in adoption of green technology, which is environment-friendly, through technology transfer. Meanwhile, nations must also fulfil their responsibilities towards their citizens. This is such a balancing act in which all nations need to work together, because the impact of climate change transcends geographical boundaries and has a cumulative global effect. That is why every country must contribute, based on their national circumstances. India strongly believes in these thoughts and regularly asserts them. Climate Justice is an important part of Climate Change. Eradication of poverty is a crucial part of Climate Justice. That is why every country must take this into account while going forward.

**Gaurie Dwivedi**

There is a great deal of concern that technology transfer is not taking place. What do

you think should be the roadmap ahead? Should it include public-private partnerships, or B2B or remain only in government-government (G2G) sector?

**Shri Bhupender Yadav**

This should be open and include all forms and modes. The way we are digitally empowered across the world, knowledge-sharing, transfer and knowledge base are fundamental but what is important is that we become more open, responsible and poor-friendly towards knowledge sharing.

**Gaurie Dwivedi**

Would the government focus more on the idea of green-hubs or do you believe that this can be just one aspect of the solution while a holistic solution needs to be 360 degrees?

**Shri Bhupender Yadav**

We need a 360 degree solution. Green sink must rise but along with that we also need to look at desertification of land, problems in coastal areas, adoption of new agricultural practices, threats from rising emissions from new cities and other critical aspects. Our earth is under a layer of gases and rising emissions of CO<sub>2</sub> and other gases is having a significant impact on the same. Even in this regard, nations need to take action considering their national circumstances. Just few months back, India's Cabinet also approved the Kigali amendment which talks about phasing down of these hydrofluorocarbons. Such decisions are being taken across the globe, but what is necessary is that it involves capacity building of all countries. This is why, when the issue of loss and damages, time-framework and measurement methods was raised in Glasgow, India put forward the point that developing countries should be equipped with both



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capacity and finance and this was agreed to. I believe that if our framework to gauge global warming is strengthened, the world would be better able to face the upcoming threats in a collective manner.

**Gaurie Dwivedi**

When we talk about India in the context of climate and environment, a major issue that comes up is of air pollution. Now it has passed the phase of challenge and evolved to become an emergency. What kind of measures do you think need to be taken? How much do you envisage the role of states and the federal structure? Is there going to be a holistic solution to it or will people continue to suffer?

**Shri Bhupender Yadav**

Indeed, there are solutions. You have asked an important question. I wish to point out that air pollution and climate change are two different aspects. But since you have asked this question in the context of India, I will answer. The 15th Finance Commission has announced a Rs 4,400 crore package that we have also started distributing to states. Our honourable PM has also started National Clean Air Mission Programme and we have started regional meetings for it as well. Recently, we had the first meeting in Mumbai and we are going to conduct more meetings across the country. We have selected 138 cities which are reeling with air pollution. We have signed MOUs with their municipalities and released certain guidelines for them which covers issues including garbage combustion, vehicular pollution, dust pollution, thermal power plant mitigations, industrial pollutions. We have chalked out plans for these issues and even worked out a method for measurement.

Second, under environment ministry we have also released the 'Prana portal' for public awareness on the issue. Indian government has also brought a Special Act for Delhi-NCR region. For the first time, we have given legal recognition to air sheds. To manage Delhi's pollution, we moved from BS-IV to BS-VI petrol and nationally, we have introduced a scrapping policy. In Delhi, we have diverted traffic to eastern peripheral expressway and western expressway and brought policy to measure dust pollution. We are shifting the entire industry to PNG to reduce industrial pollution. In a few days, our National Air Quality Control Authority, which has technicians and experts, is going to bring forth a mega programme to solve the pollution of Delhi-NCR region. We have also introduced few new ways to deal with stubble burning to reduce its pollution. First, we have distributed machines to end the stubble. Nearly Rs 700 crore have been expended by the Central Government for the same. Second, the government worked, both independently as well as in collaboration with various groups, on decomposition of the stubble to convert it to manure. This was done on nearly 1 lakh acre land in both Punjab and Haryana and about 6 lakh acre land in Uttar Pradesh. Thirdly, we also worked on utilising it as biofuel. Nearly 1,500 tons was acquired by NTPC, which was a pretty big tender. To utilise it as animal fodder in future, a small pilot project was run to dispatch it to Kutch and Western Rajasthan, where there are cattle in large numbers but lack of fodder. Even though it was at a small scale, the pilot project did take place. In COP 26, one Indian youth got award for Takachar, a firm that works on converting stubble to product while

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in the cutting phase itself, and then directly sending it for biofuel. In future, there would be more such experiments. Comprehensively, we nudged and appealed to the farmers to not simply burn the stubble but to rather utilise it to increase their production and incomes or use it as manure. In light of the four-five new initiatives, I believe we would be better able to handle the problem in future.

**Gaurie Dwivedi**

My last question: As 2021 draws to a close, what would be the two-three defining initiatives by your ministry in the post-COP26 world, in 2022, in light of all the developments of this year?

**Shri Bhupender Yadav**

Our Ministry has brought forth changes in two Acts which have been forwarded to various committees of the Parliament. First, we are providing approval to the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) Treaty in the Wildlife Act, to uphold the international standards of wildlife protection in our country. Second, biodiversity is one such field that can help our farmers and tribals to prosper through the rich flora of our country.

We are working on increasing their productivity through innovation and academic research of international standard. Third, there are a lot of lakes in our country. We are targeting to get Ramsar Convention status to 75 lakes. As of now, we have been successful in getting 47 lakes registered. Ten of our beaches have got blue tag and we plan on working more for their conservation. Similarly, we are looking into the issue of Western Ghats. We also aim to push forward our National Clean Air Programme with more sincerity. We have great institutions in our country like Biological Survey of India and Zoological Survey of India, which efficiently raise the issues of flora and fauna, and we plan on strengthening such institutions. 14 of our tiger reserves have got accreditation so we aim to work with more rigour in this direction. To make our environment clearances more nature friendly and development based, we are also working to improve our Parivesh portal. I believe that with these targets we would be able to protect our biodiversity, lead to more afforestation, and push forward an environment-friendly development in the country.



## “Together, We Win”: Regional Military Cooperation for HADR

Rajat Mohan Bhatt\*

On Dec 07, 2021, the late Gen Bipin Rawat, CDS, highlighted the importance of simplifying defence cooperation within a region. He was addressing delegates from BIMSTEC Nations at a Curtain Raiser event held at Delhi, for PANEX-21- an HADR (Humanitarian Aid and Disaster Relief) exercise envisioning greater regional cooperation.<sup>1</sup>

PANEX-21 is the third in the series of BIMSTEC HADR exercises, and is groundbreaking in two ways. Firstly, the theme of the exercise is ‘Response to Natural Disasters in the backdrop of a Pandemic’, exploring the new challenge where existing rescue and relief SOPs must be modified in line with pandemic management protocols. Secondly, the militaries of the member nations are participating for the first time, indicating that the role of the Armed Forces is expanding into Operations Other Than War (OOTW) to include HADR. The motto for the exercise, quite aptly, is “Together, We Win”.

### Why Do We Need Regional HADR Cooperation?

In the past, western developed nations were the leading providers of humanitarian assistance, leveraging their economic and military prowess to project “soft power” across the globe. However, the changing world order, the increased

interdependence on multilateral issues within a region and the economic rise of nations (especially in South and South East Asia) has seen a reversal of western ‘expeditionary’ HADR operations, with regional groupings providing similar assistance.

For example, to enhance ASEAN’s collective response to disasters, member states developed the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) and established the AHA centre for coordinating disaster management issues. Catalysed by experiences gained and lessons learnt during the 2013 Typhoon Haiyan experience, the “One ASEAN-One Response” Declaration was inked in September 2016 to “increase the speed, the scale and the solidarity of ASEAN’s response”. Mr. Said Faisal, former Executive Director of the AHA Centre, has said “**Speed** is about how fast we can move. **Scale** is about how big the resources that we can mobilise. **Solidarity** is about doing this together. **It is about a united response in the region**”.<sup>2</sup>

Many experts believe there is a clear case for regional cooperation for Disaster Management because the primary impacts of large-scale disasters are often felt across national borders. Second and third order impacts on economy, healthcare and rebuilding are definitely of regional concern. Speaking at a seminar during PANEX-

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21, Mr. Md. Mosharaf Hossain, Director, Connectivity and Security Division, BIMSTEC Secretariat, said that there was a need to explore the feasibility of a “One Region-One Response” policy.<sup>3</sup>

The diversity of capabilities, expertise and structures in different nations in a region can be leveraged as an opportunity for promoting regional cooperation on disaster response by sharing of information, experiences and best practices. From Disaster Risk Reduction technologies to pooling of resources by trusted partners within a region, a joint approach can make better facilities available as well as speed up response times—all leading to saving valuable lives and limiting disaster damage. Finally, regional cooperation in “Building Back Better” would catalyse a rebound for the regional economy.

### **Why include the Military?**

Militaries have expertise in surveillance & reconnaissance, evacuation, restoration of communications, debris clearance & quick construction, medical and surgical assistance in field conditions, setting up of relief infrastructure, green field supply chain establishment and so on. The UN urges that militaries should be used during humanitarian situations only as a “last resort” for international responses, but their deployment to manage disasters is quite common in the Indo-Pacific region.

The military’s capabilities to mobilise in the disaster aftermath, provide logistics support and human resources, their disciplined approach and set command and control structures, have always been useful in disaster situations. With limited resources during disasters, almost every developing nation leverages its Armed Forces for HADR.

The militaries, in turn, have acquitted themselves exceedingly well in all spheres in HADR operations, and earned the goodwill of the citizens of their own countries. Trans-border deployments have also taken place under bilateral arrangements, including after the 2004 tsunami, the 2005 Pakistan earthquake, cyclones Nargis (2008) and Mora (2017) and the Rohingya refugee crisis (2018).

Among the quickest to respond to the devastating earthquake in Nepal in 2015, India garnered worldwide praise for ‘Operation Maitri’ by deploying specialised medical and relief teams from the Army and Air Force. In 2020, Indian Naval Ship Kesari was dispatched with military medical teams, essential medicines and food items to the Maldives, Mauritius, Madagascar, Comoros and Seychelles following separate requests from these countries during the pandemic. Hence, there is a strong case for inclusion of military components when creating a regional apparatus for HADR cooperation. Apart from the humanitarian angle, there are spin-off advantages for the militaries, as well: -

- **Military Diplomacy.** This is a good outreach to extend support and increase the area of influence. It is also a form of military cooperation without a “security” connotation. It provides opportunities for militaries in the region to train and operate jointly and increase military-to-military contact, without the raised eyebrows associated with a “military exercise” or a military grouping. The significant goodwill generated can smoothen the way for other alliances, activities and even interventions.

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- **Military Messaging.** Mobilisation of military assets for HADR deployments is showcased as soft-power outreach, but essentially, HADR readiness is also a pointer of operational readiness. The speed and scale of deployment sends the right messages.
  - **Research and Innovation.** While actual deployments would be based on the scope and nature of disaster, routine joint training and sharing of best practices in the Preparatory Phase of the Disaster Management Cycle itself is a major platform for showcasing the research, innovations and best practices from the Defence Research as well as private manufacturers. For example, “Raksha Kawach”, a simple but effective innovation by Lt Col Paul of the Armed Forces Medical College, Pune, India<sup>4</sup> was showcased at PANEX-21. The mechanism is for reducing the contagious aerosols from a COVID patient and minimising the risks to HCW as well as other patients, which would be beneficial to other countries in the region. Similarly, from passive DRDO innovations like a quick deployable isolation hospital to “Dual Use” technologies for surveillance, communications and rescue operations can be showcased, in an increasingly competitive world.
  - **Maintenance of Peace.** The Disaster aftermath is often a breeding ground for law-and-order problems, and the presence of a disciplined and respected force quells despair that forces the community to sink

into lawlessness. By a limited stretch of imagination, a quick response to contain the damage in the recipient country also messages inimical forces. Disasters also expose certain socio-economic and security vulnerabilities of the affected area, where adversaries with specific agendas would rush to fill the void and gain traction for specific narratives. Military deployment for HADR ops under the regional umbrella can thwart this threat to a considerable extent for the greater good of both the recipient nation as well as the donor.

### When to use the Military

It is important to lay down terms of reference for the employment of militaries for this secondary role, to obviate sensitivities and respect jurisdictions. Military operations for HADR must always be in support of a regional or national HADR agency, as a tool to supplement the existing relief mechanism.

Deployment must always be at the request of the recipient state, under a Regional Framework Agreement. The regional grouping HQ or secretariat may take the decision for regional military deployment based on:

- The scale of the disaster
- Nature of response/aid needed
- Proximity and capability of other responders
- Need for specialised military equipment.

The final utilisation and deployment must be under the aegis of the recipient state, with a regional control cell coordinating the regional and global relief efforts. Necessary clearances and readiness of humanitarian support and relief

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material, teams and equipment must be worked out in the preparatory phase itself. This calls for institutionalisation of diplomatic and legal protocols for regional humanitarian response.

### **One Framework for 'One Region- One Response'**

The offer of military assets to another country for HADR operations is usually coordinated through bilateral offers of disaster assistance. The pooling in of military resources at the regional level is certain to result in economy of effort and optimising the efficiency of response.

ASEAN has already done so with its Concept Paper on the ASEAN Militaries Ready Group (AMRG), a coordinated military capacity that would deploy under the 'One ASEAN, One Response' framework. The 'Expert Working Group' of ASEAN Defence Ministers developed standard operating procedures to streamline the management of multilateral military teams for rapid and coordinated deployment to disaster areas. The concept for AMRG was thus born.<sup>5</sup>

A similar arrangement exists in the Caribbean, where 'CARICOM Disaster Relief Unit' is a regional response mechanism that mobilises and deploys to CARICOM States after disaster strikes, but the AMRG model is more evolved, resulting in a truly multilateral approach to HADR and showcasing ASEAN as the pioneer in multilateral military cooperation for OOTW.

The complexity of regional military support for HADR involves synchronisation of regional efforts for risk assessment, institutionalisation of contributing assets, jurisdictional issues, security and legal sanction for other militaries, coordination

of move and deployment and harmonisation of response plans. Thus, there is a need to set up a regional organisational structure and framework treaties.

### **Regional Organisational Structure**

For HADR to move away from bilateral or multilateral trappings to a truly regional paradigm, an organisational structure with embedded channels of control & communications is a prerequisite. The common ground of agreement in a humanitarian crisis scenario needs to be deliberated, found, accepted and evolved into a regional institutional & legal framework to ease coordination of relief efforts in a dynamic, chaotic post disaster environment.

Since different nations have different capacities and capabilities, a mapping of these military assets volunteered by member countries will need to be done, recommended under the following heads:

- **Mobility Assets:** Ships, transport aircraft, vehicles, engineering and plant equipment.
- **Communication Assets :** Quick deployable towers, satellite communication sets, radio sets.
- **Surveillance and Reconnaissance Assets :** Drones, Quadcopters, Unmanned Ground Vehicles, radars, surveillance aircraft.
- **Search, Rescue and Evacuation Assets:** Special Forces, Heartbeat sensors, rafts, Helicopters.
- **Medical Assets:** Quick deployment teams and medical/surgical equipment or medicines, field hospitals or surgical centres, diagnostic laboratories etc.

- **Survival Assets:** Relief aid packages including foodstuff, blankets, tentage, storage shelters, mobile sanitation arrangements, electricity generators etc.
- **Human Resource Assets:** Experts in technology, communications, debris clearance, logisticians, doctors.
- **Capacity Building Assets:** Training facilities, conduct of exercises, SOPs etc.

To harmonise efforts of multiple stakeholders from transnational to local levels for containment, mitigation and response in the event of a disaster, the regional grouping must evolve and formalise **institutional and legal frameworks** for information dissemination, mobilisation of resources, interoperability, channels of communication & cooperation to include military assets.

On occurrence of a disaster that needs a regional response, the affected member state may requisition the regional coordinator. This may be for specific assistance or a general call for help. In the latter case, an 'Empowered Group of Experts' may lay out the specifics. Based on the prioritisation and time of requirement of specific assets, their movement from donor members will be coordinated under the ratified framework.

Hence it is imperative that the militaries of all nations be co-opted in the formulation of the institutional arrangements. They must also participate in various HADR exercises at national and regional levels to enhance training and interoperability.

### **A Note of Caution**

Governmental and military organisations historically prefer structures that are strictly

hierarchical, promoting clear channels of information flow (Need to Know) and accountability through Chain of Command (executive orders). However, Disaster Response is an arena where information is scanty and fragmented, communications are jeopardised, and decisions made will affect lives. Effective incident response is relative to four key capabilities<sup>6</sup>:

- Rapid adaptation in response to changing conditions.
- Management of distributed information.
- Effective coordination between responders.
- Emergent collective action.

Philippines experience in response to the Typhoon Washi (2010) by the existing hierarchical response structure failed to build relationships between responding agencies at the ground level which were severely restricted due to bureaucratic protocols<sup>7</sup>.

An organisation with great degree of formalisation requires more time and effort just to comply with bureaucratic protocols. For disaster response, rigid and hierarchical structures must be changed in favour of flexible organisational structures based on shared leadership, making it possible to adapt faster to dynamic situations.<sup>8</sup>

Hence, it is imperative that the regional apparatus must facilitate rapid bonding of contingents, ensure reliable common operating picture/situational awareness, quick decision making in a chaotic disaster environment, without infringing perceived national jurisdictions and trespassing on the local sensitivities.

Interoperability would be key, which needs evolution of a common vocabulary for overcoming language barriers, compatible communication

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systems and simple protocols, participative training and military to military coordination by joint HADR exercises as well as open channels of communication. All the above requirements point towards a flat and modular structure and not a tall and hierarchical one.

### **Why should we start with BIMSTEC?**

BIMSTEC is substantial. BIMSTEC accounts for 22% of the global population - over 1.5 billion people - and has a combined economy of USD 2.7 trillion (GDP).<sup>9</sup> It is often repeated that the grouping has potential to interface between South Asia and South East Asia (read ASEAN) or even bridge South East Asia with the Gulf Countries.

BIMSTEC is relevant. With the effectiveness of SAARC being watered down,<sup>10</sup> all eyes are now on BIMSTEC towards fructification of the Neighbourhood First and Act East policies. This was also signalled by PM Modi's invitations to BIMSTEC leaders for the swearing in ceremony for his second term, in place of SAARC leaders whom he had invited the first time.

BIMSTEC is Disaster Prone. The "World's Hazard Belt", the Indian Ocean Region, is naturally prone to disasters due to a combination of hydrological and geological factors. Within Asia, 30% of all natural disasters in Asia affect the BIMSTEC grouping. Disasters in the past five years affected 1.28 billion people and resulted in damages of over USD 154 billion<sup>11</sup> and this is not counting the COVID pandemic.

Leadership is Aligned. BIMSTEC leaders have already encouraged closer cooperation in disaster

management through info-sharing, adoption of preventive measures, joint action on relief and rehabilitation and capacity building.

Initiatives have already been taken. BIMSTEC has already taken baby steps in HADR collaboration by way of three joint exercises, the latest one being PANEX-21 at Pune. The BIMSTEC Centre for Weather and Climate (BCWC) is established and provides information and capacity building assistance to member nations. India is also providing Disaster Early Warnings and has set up a link between BIMSTEC countries through the Tsunami Early Warning Centre.<sup>12</sup>

This is an opportune time. The Draft Charter of BIMSTEC secretariat is likely to be ratified in the 5th Summit likely to be held soon. 14 erstwhile shared areas of interest are being whittled down to 7 sectors, with a Member State as lead country in coordinating activities in each sector.

Disaster Management will be clubbed under the Security Sector with India as the Lead Country. This is a golden opportunity to press for greater regional cooperation, because "Together, we win!" the cooperation model, once validated, can be suitably modified for other regional groupings.

CDS Gen Bipin Rawat's last public appearance was when he addressed delegates for the PANEX-21 Curtain Raiser. He spoke about highlighted the importance of drawing 'Common Legal Frameworks and Information Sharing Mechanism' to simplify Defence Cooperation among BIMSTEC Nations.<sup>13</sup> The time has come for this vision to be realised.



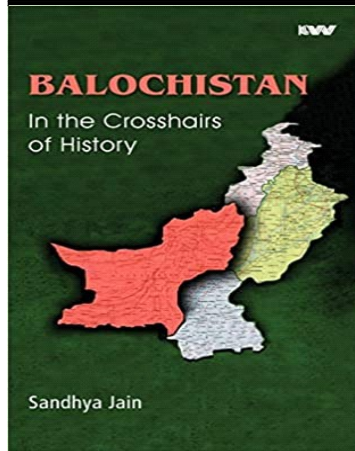
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## BOOK REVIEW



### **Balochistan: In the Crosshairs of History**

*Author:* Sandhya Jain

*Publisher:* K W Publishers Pvt Ltd;

*Hardcover:* 346 pages

*Book Review by:* Maj Gen Dhruv C. Katoch\*

The book, "Balochistan: In the Crosshairs of History," authored by Sandhya Jain, is an exceptionally well researched treatise on Balochistan. Brilliantly researched and presented in a very readable format, the book covers in its swathe the entire gamut of Baloch identity and history, the machinations which led to the Baloch lands being hived off to Iran and Afghanistan, and the traumatic manner in which Balochistan was forcibly merged with Pakistan. Thereafter begins the quest by the Baloch people to regain their independence from the stifling oppression of the Pakistani state, a quest which continues upto the present times, in the hope that someday, the Baloch people will finally regain their freedom.

Spread over 347,190 square kms Balochistan is the largest of Pakistan's four provinces, with 43.6 percent of the total land mass. But in terms of population, it is Pakistan's smallest province with less than five percent of the total population. The contrast between territory and population largely shapes Balochistan's particular situation and

problems. It contains most of Pakistan's mineral and energy resources but its small population gives it little say both in Pakistan's national politics and over how its huge resources are developed.

In the Middle Ages, the decline of the Caliphate in the 11th century CE led to the rise of the Baloch in Makran. Mir Chakar, the leader of the Rind Tribe, laid the foundation for large scale Baloch migration into those lands in the late 15th Century after he had briefly conquered Punjab and Sindh. However, the present land boundary of Balochistan was a creation of British imperialism largely for geographical, administrative and security reasons. It was an artificial construct which divided the Baloch lands between the British Empire of India and the Persian Empire to the West, when the Goldsmid Line was drawn in 1871, giving away almost a quarter of Baloch territory to Iran. The Durand Line, drawn in 1893, further ceded a strip of Baloch land to Afghanistan. The British then divided the Baloch areas under their influence into three parts, one of which became the Kalat State, with Lasbela, Kharan and Makran as its vassals.

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One part became British Balochistan and the third was the tribal areas. Sir Robert Sandeman, who later became the Chief Commissioner of Balochistan, was the architect of British strategy in the region and he negotiated a number of treaties with the Khan of Kalat during 1854 to 1901. Through these treaties the British Government gained control over the leased territory of Chaghi, Bolan Pass, Quetta and other areas.

The principality which Baloch Nationalists regard as the historic Baloch national state was that of Kalat, founded in 1638. In 1876, the British signed a treaty with the Khan of Kalat by which Kalat and its dependant territories came under British suzerainty. In a meeting held in Delhi on 4th August 1947 between Lord Mountbatten and the Khan of Kalat, and which was attended by Mr Jinnah, Lord Mountbatten assured the Khan that the state of Kalat would revert to its pre 1876 status and become independent on 15 August 1947. The rulers of Kharan and Lasbela were informed by the British that they had been placed under the suzerainty of the Khan. Control over the Marri and Bugti regions was also reverted to the Khan thereby bringing the entire Baloch areas of British India under the direct or indirect control of Mir Ahmad Yaar, the Khan of Kalat. The Khan declared his independence on 15 August 1947 and offered a special relationship to Pakistan in the field of defence, foreign affairs and communication. But the state was usurped by Jinnah, with the Khan of Kalat being forced to sign the instrument of accession. The legal entity of Kalat was abolished and most of the members

of the Balochistan cabinet were arrested or exiled from Balochistan. Thus began the resistance to Pakistani rule.

The quest for independence is an ember which the Baloch people have kept lit in their hearts. The various insurgencies which keep erupting from time to time is a testament to the spirit of freedom which the Baloch people keep in their breasts despite the ruthlessness with which the Pakistani state continues to suppress them. This aspect is highlighted by the author along with her prognosis for what the future holds. A combination of geo-political factors have, unfortunately placed Balochistan in an unenviable position wherein both their neighbours—Iran and Afghanistan—are actually wary of Baloch independence as this will ignite passions in the Sistan and Baluchestan province of Iran as well as in the Baloch population in Afghanistan, which may seek merger with the larger Baloch grouping. Baloch independence thus appears to be a chimera, as external support, which is an essential component of such movements, is not available. India can do little to help as it lacks land connectivity to Balochistan.

The author has also delved into the economic exploitation of Balochistan and how the development of the China-Pakistan Economic Corridor (C-PEC) is aggravating tension amongst the Baloch people, especially with Gwadar being developed as a port by China. Balochistan's coastline with the Arabian Sea has five official ports, but it also has several unofficial natural small jetties which are exploited by smugglers and drug traffickers, which adds to the volatility in the region.

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In the final chapter of her book, the author has delved into the geo-strategic significance of the region and the interplay of regional and global dynamics which continue to pan out to the detriment of Balochistan.

This is a book which must be read by a wide audience, from college students to military personnel, from diplomats to researchers in think tanks and from history buffs to the lay reader. The author brings out with amazing clarity, the interplay of social dynamics within the various Baloch

communities as well as within Pakistani society as a whole and juxtaposes these into the regional and global dynamics that are continually playing out in the region.

A great deal of scholarship has gone into the writing of this book as evidenced by the extensive footnotes at the end of each chapter. Besides its eminent readability, it is also a great scholarly work, which can be used as a reference book and thus eminently qualifies to adorn the bookshelves of all libraries.





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