

# TerraGreen

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## TERRA YOUTH

Book Review: The Great Poop War

## SPECIAL HIGHLIGHTS

The Burgeoning Problem of Trash Mountains  
Devastation in Shimla

## IN CONVERSATION

Jaya Vaidhyanathan  
CEO of BCT Digital

# Drinking Water Security in Gujarat

The Current Scenario





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The Energy and Resources Institute  
Attn: TERI Press  
Darbari Seth Block  
IHC Complex, Lodhi Road  
New Delhi – 110 003 / India

Tel. 2468 2100 or 4150 4900  
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# EDITORIAL



“ Globally, nations continue to grapple with ever increasing challenges pertaining to water scarcity, water pollution, degraded water-related ecosystems and cooperation over transboundary water basins. ”

India's G20 Presidency offered an exceptional opportunity for the country to spearhead a collective approach towards tackling multiple, complex, and interconnected challenges such as climate change, economic disparities, and the global pandemic. The G20 Summit in New Delhi emerged as a beacon of hope, providing a forum for envisioning a sustainable future. The G20's resounding call for global cooperation strongly resonates with TERI's mission, which is rooted in the belief that international collaboration is vital for addressing pressing global challenges. While fostering collaborative solutions and collective well-being, India reinforced the spirit of "World is One Family".

At this premier global forum, India also reaffirmed its faith in the SDG principles and recommitted to accelerate progress on SDGs. At this juncture, drinking water security presents itself as a significant challenge that we currently face in India. The 2030 Agenda for Sustainable Development by the United Nations emphasizes the importance of a comprehensive and human-centred approach to managing water resources. SDG 6, or ensuring access to clean water and sanitation for all, focuses on providing everyone equitable access to safe water, sanitation and hygiene by 2030. Globally, nations continue to grapple with ever increasing challenges pertaining to water scarcity, water pollution, degraded water-related ecosystems and cooperation over transboundary water basins. India's water resources are at a critical point due to factors including an increasing population, fast urbanization, declining water quality, and, competing demands for freshwater and over-extraction of groundwater without sufficient recharge. This calls for an immediate attention and collective action.

This month our cover story on drinking water security in Gujarat presents a situational analysis of drinking water scenario in Gujarat, highlighting the government's initiatives to ensure access to safe drinking water in the State. One of the key factors influencing public health is access to quality and sufficient quantity of water. Concerted efforts of the concerned institutions and strengthened public policies have made a difference and impacted lives favourably in a significant number of villages and towns of Gujarat. However, the quality of supplied water is critical to ensure usability and cannot be overlooked.

It is encouraging to see that Gujarat's initiatives and comprehensive measures at both micro and macro levels over the past two decades ensured drinking water accessibility and quality to a large extent. This kind of model indeed has a replication value and may be adopted as a preferred solution across other geographies.

With our featured cover story and other current articles of interest, we hope you enjoy reading this issue of *TerraGreen*. We eagerly look forward to receiving your feedback and reflections.

A handwritten signature in black ink that reads "Vibha Dhawan".

**Vibha Dhawan**  
Director-General, TERI



Carbon pricing has been a buzzword in environmental circles for quite some time now. Carbon markets are seen as a way to incentivize businesses and sectors to reduce their emissions. Carbon pricing shifts the responsibility for the harm caused by GHG emissions to those who caused it and can prevent it. A carbon price sends an economic signal to emitters, giving them the option of changing their activities and reducing their emissions or continuing to emit and being charged for their emissions. Forests are key to carbon markets, acting as carbon sinks by absorbing CO<sub>2</sub> and storing it in biomass and soil, making them valuable sources of carbon credits for trading. However, deforestation and degradation have reduced their effectiveness, impacting the carbon market.

India, like many other countries, is preparing for a domestic carbon market with the release of a draft carbon trading scheme. Following this, The Forest (Conservation) Amendment Bill, 2023

was introduced in the Parliament. The Bill adds and exempts certain types of land from the purview of the Act. Further, it expands the list of activities permitted to be carried out on forest land. Carbon credits can potentially play a significant role in conserving forests and promoting afforestation. However, the market mechanism is still in its early stages, and there are some issues that need to be addressed. One of the issues with carbon markets is the limited understanding of the market mechanism, which can lead to fraud and lack of accountability. For example, the Clean Development Mechanism (CDM) under the Kyoto Protocol failed due to the lack of accountability, and there have been cases of carbon credit fraud. India, too, has had its share of carbon credit fraud, as big firms faked green to mint gold. To conclude, carbon prices as of now have been far too low to motivate change. In order to make conservation profitable a financial mechanism should be incorporated where the landowners receive direct payments for conserving forests through fuel tax and water charges. It is crucial to ensure that forests are not destroyed for carbon credits and that the market mechanism is transparent and accountable. Despite their positive impacts, other green technologies are giving forest carbon credits tough competition. However, these alternative technologies do not contribute to the expansion of forest cover or the increase in carbon sinks. Carbon pricing should be used to promote nature-based solutions, ecological restoration of deserted lands, and afforestation, rather than become a competition for forests.

**Gaurav Limaye and Mansi Jain**  
Student interns at Azim Premji University

#### Editor-in-chief

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#### Production

Aman Sachdeva

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Sanjeev Sharma

#### Head office

##### TERI

Darbari Seth Block, IHC Complex

Lodhi Road, New Delhi – 110 003

Tel. +91 (11) 2468 2100 or 7110 2100

Fax +91 (11) 2468 2144 or 2468 2145

#### Regional centres

##### Southern Regional Centre

TERI, CA Site No. 2, 4th Main, 2nd Stage

Domlur, Bangalore–560 071

Email: terisrc@teri.res.in

##### North-Eastern Regional Centre

Chachal Hengrabari, Express Highway

Guwahati- 781 036

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Email: terine@teri.res.in

##### Western Regional Centre

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Alto-St Cruz, Tiswadi, Goa-403 202

Tel: 0832-2459306, 2459328

Email: teriwrc@teri.res.in

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## Shimla to Fix its Drainage to Avert another Rain Disaster

Following extensive damage caused by a “faulty drainage system” in the recent rain-induced disaster in the city, the Shimla Municipal Corporation (SMC) has decided to strengthen the existing rainwater drainage system and construct new drains, wherever required. The corporation will conduct an extensive study to find out shortcomings and areas of improvement to strengthen and streamline the drainage system with proper channelling of rainwater. The SMC has tasked Shimla Jal Prabandhan Nigam Limited (SJPNL) with getting the study conducted and preparing a detailed project report (DPR) following which the corporation will implement it.

Source: <https://www.tribuneindia.com/>

## UN Report Warns India Heading towards Groundwater Depletion Tipping Point

Some areas in the Indo-Gangetic basin in India have already passed the groundwater depletion tipping point and its entire northwestern region is predicted to experience critically low groundwater availability by 2025, according to a new report by the United Nations. Titled ‘Interconnected Disaster Risks Report 2023’ and published by the United Nations University – Institute for Environment and Human Security (UNU-EHS), the report highlights that the world is approaching six environmental tipping points: accelerating extinctions, groundwater depletion, mountain glacier melting, space debris, unbearable heat and an uninsurable future. Environmental tipping points are critical thresholds in the Earth’s systems, beyond which abrupt and often irreversible changes occur.

Source: <https://www.deccanherald.com/>



## Nationwide Survey Suggests Carbon Neutral Measures for Hospitals

The Indian healthcare sector was responsible for more than 9 per cent of all India’s commercial electricity consumption in 2019–20 fiscal, a first-of-its-kind nationwide government survey of over 600 health institutions across the States has said and suggested a wide-ranging carbon neutral measures including mandating of green building bye-laws among others to make the hospitals climate-smart to help achieve the country’s net Zero target by 2070. Thousands of hospitals, health centres and entire health systems around the world are already implementing climate-smart health care strategies. Titled ‘Towards Climate-Smart Hospitals: Insights from a National Hospital Energy Consumption Survey’ it found that the penetration of on-site solar PV is 17 per cent in private and 11 per cent in public hospitals.

Source: <https://www.dailypioneer.com/>



## Melting J&K Glaciers Threaten Livelihoods

Melting of glaciers in Jammu, Kashmir and Ladakh is going to impact the water availability in the Himalayan region with consequent adverse effect on the dependent livelihoods, a leading scientist has warned. Studies show that glaciers in the region have dwindled by 25 per cent in the last six decades, while 48 per cent of them could vanish by the century's end even with moderate climate change. Earth scientist and glaciology expert, Shakeel Ahmad Romshoo, voiced concerns, highlighting the significance of snow and glaciers for J&K and Ladakh. "We have about 18,000 glaciers, some of these glaciers are big like the Siachen glacier. The huge glaciers we have, about 500 to 600 metres thick, are huge resources in J&K and Ladakh," Romshoo told news agencies.

Source: <https://www.deccanherald.com/>

## India, Saudi Arabia Sign MoU on Grid Connection and Green Hydrogen

India and Saudi Arabia have signed a Memorandum of Understanding (MoU) for grid interconnections, green/clean hydrogen, and the supply chain for the same. The MoU was signed by the Union Minister for Power and New & Renewable Energy, Shri R K Singh, and the Minister of Energy, Government of Saudi Arabia, Abdulaziz bin Salman Al-Saud on the sidelines of the MENA Climate Week in Riyadh (October 8–12, 2023). "This MoU aims to establish a general framework for cooperation between the two countries in the field of co-production of green/clean hydrogen and renewable energy; and also establishing secure, reliable and resilient supply chains of materials used in the green/clean hydrogen and renewable energy sector," a statement from the Ministry of Power read.

Source: <https://www.business-standard.com/>



## Kolkata Mean Temperature Rose 2.6°C in 68 Years

Kolkata has recorded the highest increase in annual mean temperature, of 2.6°C, among megacities between 1950 and 2018, a recent IPCC report has said. The prediction for the future is even more dire, with the IPCC report warning Kolkata could experience a rise of 4.5°C by the end of this century from the beginning of the industrial period (1850–1900). Weather scientists say the chilling projections are real and should be taken seriously. They point to the summer of 2023 that has been one of the cruellest for the city in decades.

Source: <https://timesofindia.indiatimes.com/>



## Developed Countries to Overshoot Carbon Emissions Goal

In the run-up to a key global climate summit, an analysis shows that developed countries—responsible for three-fourths of existing carbon emissions in the atmosphere—will end up emitting 38 per cent more carbon in 2030 than they have committed to, going by current trajectories. In fact, 83 per cent of this overshoot will be caused by the United States, Russia, and the European Union, according to a study published recently by the Council for Energy Environment and Water (CEEW), a Delhi-based think tank. The UN Framework Convention on Climate Change will hold its 28th Conference of the Parties (COP28) at Dubai in November and December 2023.

Source: <https://www.thehindu.com/>



## The Best Apps for Nature Lovers

With a phone at your fingertips, the world is your oyster, or hoopoe, or oak tree. It's now possible to identify everything from mystery animal tracks to elusive birdsong via an app. Beyond that, your sightings could contribute valuable information to scientific studies and conservation efforts around the globe. 'Seek' is an app which is perfect for curious kids who are keen to categorize the different plants, animals and fungi they come across: take photos with your phone and Seek's artificial intelligence will identify the species and outline some key facts.

Source: <https://www.theguardian.com/>

## Low-income Countries Could Lose 30 Per Cent of Nutrients from Seafood due to Climate Change

The nutrients available from seafood could drop by 30 per cent for low-income countries by the end of the century due to climate change, suggests new UBC research. That's in a high carbon emissions and low mitigation scenario, according to the study published recently in *Nature Climate Change*. This could be reduced to a roughly 10 per cent decline if the world were to meet the Paris Agreement targets of limiting global warming to 1.5 to 2 degrees Celsius. The researchers examined historical fisheries and seafood farming, databases including data from UBC's Sea Around Us to find out quantities of key nutrients that were available through fisheries and seafood farming in the past, and used predictive climate models to project these into the future.

Source: <https://www.sciencedaily.com/>







## Noted Climate scientist Saleemul Huq Passes Away

Saleemul Huq, a pioneering climate scientist from Bangladesh who pushed to get the world to understand, pay for and adapt to worsening warming impacts on poorer nations, died of cardiac arrest on October 28, 2023. He was 71. "Saleem always focused on the poor and marginalized, making sure that climate change was about people, their lives, health and livelihoods," said University of Washington climate and health scientist Kristie Ebi. Huq, who died in Dhaka, directed and helped found the International Centre for Climate Change and Development there. He was an early force for community-based efforts to adapt to what climate change did to poor nations.

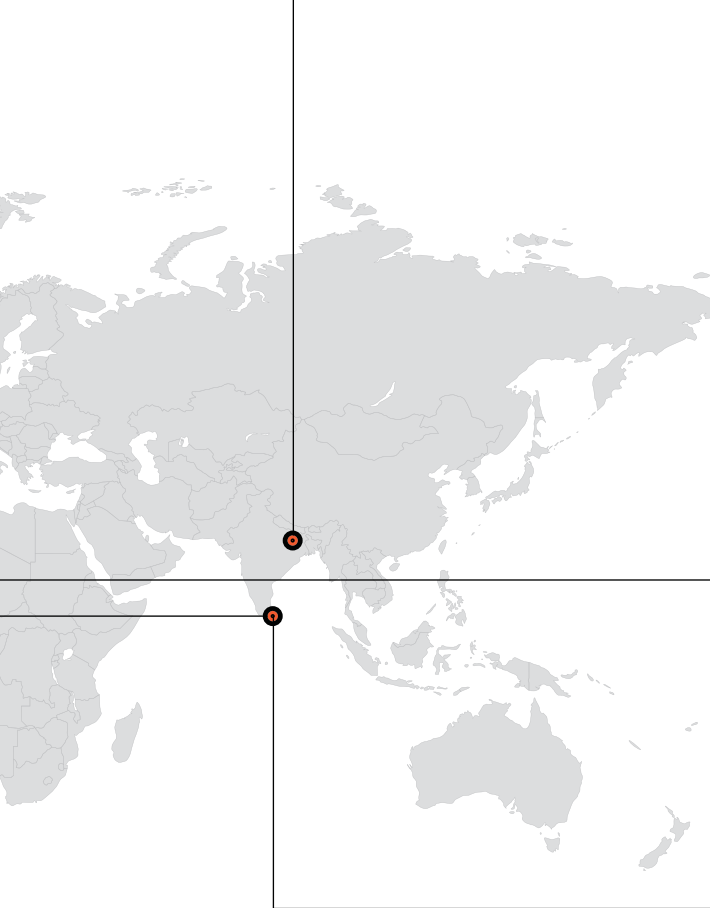
Source: <https://www.thehindu.com/>



## A Sustainable Alternative to Air Conditioning

As the planet gets hotter, the need for cool living environments is becoming more urgent. But air conditioning is a major contributor to global warming since units use potent greenhouse gases and lots of energy. Now, researchers have found in a new study an inexpensive, sustainable alternative to mechanical cooling with refrigerants in hot and arid climates, and a way to mitigate dangerous heat waves during electricity blackouts. The researchers set out to answer how to achieve a new benchmark in passive cooling inside naturally conditioned buildings in hot climates such as Southern California. They examined the use of roof materials that radiate heat into the cold universe, even under direct sunlight, and how to combine them with temperature-driven ventilation.

Source: <https://www.sciencedaily.com/>



## Burning Sugarcane Likely behind Mystery Kidney Disease in Agricultural Workers

The burning of sugarcane and rice husks may be releasing a toxic substance which is causing a mysterious kidney disease among agricultural workers in India, Sri Lanka, the US and many other countries, according to a study. An ongoing epidemic of chronic kidney disease has been observed among manual labourers in hot agricultural communities throughout the world, the researchers said. While heat stress and climate change have contributed to this epidemic, researchers have identified tiny silica particles released from sugarcane ash that can be inhaled or ingested through contaminated drinking water that cause chronic kidney damage.

Source: <https://www.deccanherald.com/>



# Agricultural Plastics

## Impact on Soil Health

Agriculture relies heavily on the extensive use of plastic. From mulching and irrigation to fishing gear and greenhouse films, plastics help farmers, foresters, and fishers in sustaining their livelihoods, increasing production, minimizing crop losses, and conserving water. However, recent research indicates that despite their numerous advantages, agricultural plastics are now posing a threat to environmental sustainability. Top of Form In this article, **Marut Nandan** discusses the impact of agricultural plastics on soil health.



In our agriculture system, materials made of toxic plastics have varied use including: single-use plastic sachets for packing seeds and fertilizers, seedling trays, mulching and greenhouse film, protective nets, irrigation pipes, and drip irrigation tapes.<sup>1</sup> It is established that

additives and chemicals embedded in plastics could potentially diminish soil porosity and hinder air circulation apart from altering microbial communities leading to reduction in soil fertility. The National Committee on Precision Agriculture and Horticulture under the Ministry of Agriculture & Farmers' Welfare (MoA&FW) prescribes use of plastic in agriculture, although assessment by

NITI Aayog states that plastic use in agriculture in India has reached 23 per cent of the total plastic consumption.<sup>2</sup> Growth in the use of plastics could result in microplastics and nanoplastics entering living organisms also, when better access to chemical fertilizers and

<sup>1</sup> Details available at <https://www.downtoearth.org.in/blog/pollution/why-agri-plastics-are-bigger-threats-than-they-appear-to-be-90007>

<sup>2</sup> Report on Alternative Products and Technologies to Plastics and their Applications, NITI Aayog, May, 2022

plastic materials for agricultural activities is already contributing to deterioration in soil health. A study in 2020 estimated that 14 per cent of the total plastics released into environment go into agricultural soils.<sup>3</sup>

In 2021, the total consumption of plastic in India amounted to approximately 21 million tonnes signalling a 23-fold increase since 1990. However, the per capita consumption of plastic in the country remains less than half of the global average.<sup>4</sup> In the past seven decades, worldwide use of plastic in agriculture has seen a rising trend with the annual global use of plastics films in terrestrial agricultural production is estimated at 7.4 million tonnes or 2 per cent of the most recent estimation of the global plastic production of 359 million tonnes.<sup>5</sup> In the early 2000s, 0.7 million tonnes of mulch film was used annually worldwide with China being the largest user, that is, approximately 80 per cent.<sup>6</sup> Plastic mulch film covers around 20 million hectares of farmland in China.

Agricultural plastics, which are dominantly in the form of plastic residues are generated from film sheets, foam, pipes, plastics used for fertilizer transportation, weed control, disease and pest control, storage, and crop conservation. The accumulation of such residues happens due to incomplete collection after use in the agriculture field from nursery to post-harvest stage, which pegs the worldwide consumption of



plastics to 2,250,000 tonnes per year.<sup>7</sup>

The widespread use of plastics in crop production is reported to affect the physical, chemical, and biological properties of soil. Persistent use of conventional plastics in the environment lead to accumulation of plastic fragments in soils over time, disintegrating into micronano plastics (MNP), which release additives negatively impacting soil health. The effects of plastics on soil properties and fertility are strongly influenced by the properties of the material (i.e., size, morphology, and chemical composition).<sup>8</sup> The residues of conventional mulch films in the soil can hinder water infiltration, decrease water holding capacity, impact microbial communities and macrofauna, and decrease soil fertility.<sup>9</sup> Aging and fragmentation of plastic material into micro and nano plastic can contribute to the dispersion of plastics in the environment enhancing the release of additives and the degraded particles. The presence of MNP in soil

has been reported to change soil chemical properties such as soil organic matter (SOM) content, pH, electrical conductivity (EC), and organic carbon.

## Impact of Microplastic on Soil Physical Health

Presence of microplastic could change soil structure, soil water-holding capacity, and soil aeration. Alteration in soil aggregates impacts soil porosity and water infiltration,<sup>10</sup> which also reduces soil aeration and water-holding capacity, negatively impacting plant growth and productivity. Microplastics can decrease soil water-holding capacity by physically blocking water movement and clogging soil pores. Soil aeration is critical for soil microbial activity, as many soil microorganisms require oxygen for respiration.

## Impact of Microplastic on Soil Chemical Health

Soil chemical health is negatively impacted in the presence of plastic residues, which changes soil pH, nutrient

<sup>3</sup> Weber, Joil Colin & Opp Christian, Spatial patterns of mesoplastics and coarse microplastics in floodplain soils as resulting from land use and fluvial processes, *Environmental Pollution*, Volume 267, December 2020, 115390

<sup>4</sup> Details available at <https://www.statista.com/statistics/1154434/india-net-plastic-consumption/>

<sup>5</sup> Plastics – the Facts 2019, An Analysis of European plastics, production, demand and waste data, 2019, <https://plasticseurope.org/wp-content/uploads/2021/10/2019-Plastics-the-facts.pdf>

<sup>6</sup> Espi E, et al. Plastic Films for Agricultural Applications, *Journal of Plastic Films and Sheeting*, Sage Publication, 2006

<sup>7</sup> Andrady AL. 2003. *Plastics and the environment*. Wiley, Hoboken, New Jersey

<sup>8</sup> Rillig M C and Lehmann A. 2020. Microplastic in terrestrial ecosystems. *Science* 368, 1430–1431

<sup>9</sup> Qian H, et al. 2018. Effects of soil residual plastic film on soil microbial community structure and fertility. *Water. Air. Soil Pollut.* 229, 261

<sup>10</sup> Qiu, Shu-Qing, et al. *Journal of Cleaner Production*, Volume, 375, 15 November 2022, 134151 Chemical profile and toxicity of the leachates from aged plastics under simulated conditions



availability, and soil organic matter. Alteration in soil pH can increase the acidity of soil by releasing acids during their degradation, leading to a decrease in soil pH with significant implications for soil microbial activity and nutrient availability.<sup>11</sup> Studies have shown that microplastics can adsorb nutrients such as nitrogen, phosphorus, and potassium, reducing their availability for plant uptake. Impact on soil health could extend to decreased plant growth and productivity, leading to a negative agricultural productivity.

## Impact of Microplastics on Soil Biological Health

Impacts on soil biological health affects soil biota, including bacteria, fungi, protozoa, nematodes, and arthropods, which play crucial roles in soil nutrient cycling, organic matter decomposition, and soil ecosystem functioning. These components affect soil biological health by altering the composition and diversity of soil microbial communities, disrupting soil food webs, and affecting soil nutrient

<sup>11</sup> Zhang S, Yang X, Gertsen H, Peters P, Salánki T, Geissen V. 2018. A simple method for the extraction and identification of light density microplastics from soil. *Sci Total Environ* 616–617:1056–1065



cycling. Changes in soil microbial diversity and composition impacting soil nutrient cycling and organic matter decomposition also happens due to clogged soil pores.<sup>12</sup> Presence of microplastics also impact soil food webs, which is a complex networks of interactions between soil biota, including predators, prey, and decomposers.

## Microplastics in Organisms

Although not understood in entirety, impact of microplastic pollution in soil has a growing body of evidence

<sup>12</sup> de Souza Machado, et al. Microplastics as an emerging threat to terrestrial ecosystems, *Glob Chang Biol*, 2018 Apr; 24(4):1405–1416. doi: 10.1111/gcb.14020. Epub 2018 Jan 31

to suggest that it can have adverse effects on soil health and the wider ecosystem. Studies on exposure of terrestrial animals to microplastics show that many organisms ingest plastics and consequently accumulate in the food chain. For example, microplastic concentrations increased from soil ( $0.87 \pm 1.9$  particles  $g^{-1}$ ) to earthworm casts ( $14.8 \pm 28.8$  particles  $g^{-1}$ ) to chicken faeces ( $129.8 \pm 82.3$  particles  $g^{-1}$ ) in home gardens in Southeast Mexico. In addition, microplastics have been found in the digestive systems of larger animals. Studies identified an average of 1000 particles  $kg^{-1}$  of faeces of sheep grazing in vegetable fields where plastic mulch has been used in the south of Spain. Calcium and phosphorous deficiency and insufficient nutritional

supplementation are identified as predisposing factors for plastic ingestion by roaming livestock.<sup>13</sup>

Furthermore, microplastics may enter the food chain via plant root uptake, microorganisms, and animals. In farmland ecosystems, the effects of microplastics on soil properties, soil environment, and plant production have potential consequences for human health by accumulating microplastics and nano-plastics and harmful compounds in the tissue of plants. This emphasizes the need for further and fast research, especially on possible entry sources. Further research should be extended to soils in general as non-agricultural soil may also be affected (e.g., by wind transport) with so far unknown consequences.

## Sustainable Use of Plastic in Agriculture

Hoffman, et al. argue that the sustainable use of plastics in agriculture will require alignment with the “3 R” waste hierarchy concept of reducing, reusing, and recycling plastics as preferred options over disposal after use. They advocate greater scrutiny in plastic applications that only have non-circular end-of-life treatment options. In their view, two additional criteria can provide guidance in determining sustainable use strategies and identify after-use treatment options for plastics in agriculture: (i) collectability of plastics after use and, (ii) duration of plastic use. According to them, less toxic and biodegradable polymers should replace conventional persistent polymers, especially in cases with a short duration of use such as mulch films or non-biodegradable polymer coatings for controlled-release fertilizers.

Restriction on usage of harmful plastic materials and the phasing out of intentionally added microplastic applications could be given priority.

<sup>13</sup> Ibrahim Sa'adu and Andrea Farsang, Plastic contamination in agricultural soils: a review, *Environmental Sciences Europe* (2023) 35:13, <https://doi.org/10.1186/s12302-023-00720-9>



For reducing use of agricultural plastics, agrichemical containers can be effectively decontaminated and reused. Provision of collecting bale wrap films, recycling mulch films through pyrolysis are a few options.<sup>14</sup> Plastic film waste from greenhouses has been directly used for laboratory demonstration of catalytic cracking to enable feedstock recycling. Furthermore, a closed-loop supply chain analysis for bale wrap collection, sorting, and recovery in Finland showed substantial economic savings and reduced global warming potential.<sup>15</sup> Biodegradation is considered a viable end-of-life option for agricultural plastic applications in which the plastics cannot be collected from the field in their entirety after use, as well as for cases where the collected plastics fractions are too weathered or soiled to allow for reuse and recycling.

## Conclusion

Rilling, et al. inform that there is still limited research on the impacts of plastic

<sup>14</sup> Madrid B, et al. 2022. End-of-life management options for agricultural mulch films in the United States—a review. *Front. Sustain. Food Syst.* 6

<sup>15</sup> Mayanti B and Helo P. 2022. Closed-loop supply chain potential of agricultural plastic waste: economic and environmental assessment of bale wrap waste recycling in Finland. *Int. J. Prod. Econ.* 244, 108347

on soil, but evidence of negative effects on soil health and productivity raises the need to adopt the precautionary principle and develop targeted solutions for stopping the flow of microplastics into the environment. Foresight brief of UNEP<sup>16</sup> advocates implementing cost-effective mechanisms for removing the microplastics from sewage sludge or during the biosolid processing to reduce soil contamination. It also argues for revisiting the farming practice that work with nature in addition to addressing the full range of ecosystem services and analysing the full cycle of each approach and product. ■

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*Marut Nandan is currently a research intern with Mu Gamma, Gurgaon, India. He is a high school student of science at Don Bosco School, Alaknanda, New Delhi. He aspires to become an engineer to solve complex problems that we face in our daily lives.*

<sup>16</sup> Plastics in Agriculture: An Environmental Challenge, Foresight Brief, UNEP, July 2022

# शिमला SHIMLA

न से ऊँचाई - 2076 मी., 6810 फीट. HEIGHT ABOVE SEA LEVEL - 2076 M - 6810 FEET



# Devastation in Shimla

## Need for a Comprehensive and Holistic Policy

Widespread devastation was caused in several parts of Himachal Pradesh due to spells of heavy rains, cloud bursts, and landslides this monsoon. Shimla, the capital town saw the kind of havoc caused by rain fury as never seen before. While climate change may be attributed to spells of heavy downpours that set off landslides, is it the reckless and unscientific construction, poor drainage system to blame for the devastation caused in terms of loss of life, roads, buildings and forests? **Sarita Brara** says a holistic strategy factoring in natural as well as human-induced causes that led to the disaster is perhaps the need of the hour.





**W**ho could have thought that a 54-hour heavy downpour would leave the tourist town of Shimla battered and bruised to the extent that people would dread the very mention of the word 'rains'. Shimla received 171.8 mm of rainfall between August 13 and 14, 2023. On August 23rd, once again, 132 mm of rainfall



was recorded. It was the intensity of the rains during this heavy downpour that triggered landslides at several locations, causing the kind of havoc Shimla had never experienced in living memory. The deluge from massive landslide triggered by these rains at the outer edge of the lawns of the Institute of Advanced Studies flowed down with such a force that it uprooted dozens of trees on the way, washed away a 50-metre railway bridge, portions of two roads and most unfortunately took the precious lives of 20 people who had gathered at a temple for prayers on the morning of August 14.

Almost every road in Shimla bore the tell-tale signs of the havoc caused by these rains as did several buildings. A large number of uprooted trees and the debris of the landslides blocked roads at several places bringing the town to a standstill. Nearly a dozen of the buildings in the town had to be vacated and almost 250 people had to be accommodated in relief camps. Several buildings developed cracks including the heritage building of Tourist Information Centre which has since been declared unsafe.

## Climate Change

Was the heavy spell of rains and cloud bursts that set off landslides in several parts of Himachal Pradesh due to climate change? The climatologists think so. According to Roxy Mathew Koll, senior scientist at the Indian Institute of Tropical Meteorology in Pune, the most significant change seen in the monsoon rainfall pattern is that instead of having moderate rain spread out through monsoon season there are long dry spells with short spells of heavy rains. Climate experts state that as the atmosphere becomes warmer, it can hold more moisture. This increase in the atmosphere's water-holding capacity leads to the formation of more droplets and results in heavier rainfall.

## Loss of Trees

Serious concern has been expressed over the uprooting of hundreds of deodars, mostly green, in and around the state capital in the recent rain-triggered landslides. More than a thousand trees were uprooted in Shimla and adjoining



areas because of landslides following the rain fury in August. The exposure of the tree roots because of construction of roads and dumping of the debris into the forest area is one of the major factors causing harm to trees. More often than not dumping sites are not identified and even if they are, the builders find it convenient to dispose of the muck at the nearest jungle—the foresters point out. Roots getting trapped in concrete walls are some of the reasons behind the drying up of trees.

## SOP for Salvage Trees

In the aftermath of the rain fury that has uprooted hundreds of trees, a new Standard Operating Procedure (SOP) has been made effective from September 1, 2023. This was done after the state government took a serious view of the unattended salvage trees (felled, damaged, and dry trees) in forests and their deterioration. The new SOP has set timelines right from the enumeration of the salvage trees to felling, conversion, and disposal. Such trees left for long deteriorate and the ground vegetation in the forests is also adversely affected. Also, their conversion into logs becomes

costlier and fetches much less price.

Although a study is yet to determine the number of aging trees, foresters estimate that nearly 70 per cent of the trees in Shimla (urban and rural) are aged, some as old as over 100 to 120 years. Such trees need to be felled at least from areas that have greater threat perceptions, the foresters say. There is currently a ban on the felling of green trees and unless the matter is taken up at the level of the Apex court weeding out these trees cannot be taken up. "Campaigns will be undertaken for plantation of soil binding Napier and vetiver grass that can help in preventing soil erosion and landslides," says Shimla Mayor Surinder Chauhan.

## Landslides: Panel to Ascertain Causes and Report

The State has seen nearly 170 landslides in the monsoon this year due to heavy rains and cloud bursts. There has been land subsidence in mountain ranges at nearly 200 points where no construction has taken place. Experts of seven premier institutes in and outside Himachal



Pradesh have been roped in to take up studies to determine the causes of cloud bursts, flash floods and landslides, which have seen a sharp increase in the State. The institutes include Geological Survey of India, Chandigarh, CSIR-CBRL Roorkee, Wadia Institute of Himalayan Geology in Dehradun, IIT Mandi, and NIT Hamirpur. Each has been assigned specific vulnerable areas. The first major landslide in Shimla occurred in February 1971, when a large portion of the famous Ridge slumped down. The city disaster management plan (2020–2021) says that overloaded slopes may initially cause only minor landslides, but at later stage could trigger larger landslides.

## Poor Drainage System

A committee set up to look into the causes behind the recent landslides and devastation in Shimla has cited poor drainage system, saturation of water retention capacity of the soil among other reasons. The members of the panel that visited nearly 20 affected sites say that construction on drains and loose strata led to the collapse of buildings. The panel submitted its report in the second week of September 2023. Various studies had recommended the need for improving the drainage and sewerage system of upper reaches.



## Channelization of Storm Water Drains

Although the need for channelization of over 60 nullahs (storm water drains) has been expressed for years, it is time that this is taken up in real earnest in the wake of the recent disaster. The encroachment and construction on nullahs has choked these drains with construction debris, trash and all kinds of garbage obstructing their smooth flow. Instead of recharging the ground water (that was the case earlier), these nullahs have become dumping ground of heaps of waste polluting the air with foul smell. The Shimla MC was planning to take it under Smart City mission but there has been no progress so far.

## Reckless and Unscientific Construction

The National Green Tribunal (NGT) had cautioned that the development being carried in Shimla, which lies in seismic zones IV and V, is unplanned and hazardous while seeking to quash the Shimla Development Plan (SDP). The NGT order was challenged by the State government. The SDP has been put

on hold by the Supreme Court till the objections raised are addressed. The Shimla Development plan had proposed to throw open 17 no construction green belts. The NGT had said Shimla is susceptible to landslides due to its terrain, soil conditions, and steep slopes. The density in construction has had a huge impact on the sewage system, water supply, collection and disposal of municipal solid waste, transportation, and environmental ecology.

Citing these and several other factors, the NGT had proposed prohibiting of new construction of any kind, in any part of the Core and Green/Forest area as defined by the SDP that was notified by the State Government.

The NGT said that even beyond the Core, Green/Forest area and the areas falling under the authorities of the Shimla Planning Area, construction should not be permitted beyond two storeys plus attic floor. Also, construction may be permitted strictly in accordance with the provisions of the TCP Act and the Municipal laws in force. The NGT said that 90 per cent of the core city area is built on slopes above 60 degrees whereas the norm is for no construction above 45 degree slope.



## Violation of Building Norms

What is perplexing is that high rise buildings have come up in several residential areas. Two years back in September 2021, a seven-storey building had collapsed like a pack of cards due to a landslide triggered by rains. Fortunately, there was no loss of life at that time but then this should have been taken as a warning sign. It is not just the construction on the slopes beyond permissible heights, other rules and norms too have been thrown to winds.

No construction can take place on the natural drains or nullahs; this norm



has been violated extensively. There are several encroachments of the nullahs in the city and the courses of many nullahs have been diverted for construction purposes. Also, the disposal of debris is choking natural drainage, which is causing drainage problems.

Houses have been built without down pipes connected to proper drains for outflow causing seepages and loosening of the soil. Construction is not permitted in less than two metres away from a tree but this norm is also flouted so much that one can find trees jutting out of the buildings at various places in the city. All this has been going on over the years despite the fact that these issues have been red flagged by experts and studies at various levels and platforms.

The Supreme Court says that an expert committee should be set for comprehensive study on the carrying capacity but the flow of the tourists has to be regulated in a manner that it does not strain the ecosystem. Shimla founded in 1819 was built for a population of just 15,000. Today, Shimla's population is nearly three lakh and added to this is the floating population of tourists in lakhs every year.

## Decongesting Shimla

A project on building a satellite town near Shimla called Jathia Devi awaits Centre's approval. The township will help in decongesting the city and reduce the burden on existing infrastructure as well as natural resources. For now Supreme Court's verdict on the Shimla Development plan is awaited and in the meanwhile an effective monitoring mechanism needs to be put in place for ensuring strict compliance of the building laws.

Factoring all the reasons behind the devastation including the climate change and other human-induced reasons, a comprehensive and holistic policy will have to be framed so that the damage and devastation to life and property is minimized in future.



Train services on the Kalka Shimla heritage rail line finally resumed after a gap of almost three months. It was on July 9, 2023 the last time that the train popularly called the 'toy train' chugged on the narrow gauge rail line between Kalka and Shimla. Heavy rains in July and August had triggered landslides at several places damaging the 96 km track at over 175 places. The train service from Kalka to Solan was restored on September 20, and it extended up to Tara Devi approximately a week later. The first train with passengers entered the Shimla railway station on October 2. For now 4 out of 7 trains are running on the track. This became possible after a temporary bridge was erected and trial runs successfully conducted on this section of the track.

It was on the fateful morning of August 14 that Arch Bridge no. 800 (stone bridge) on the UNESCO Heritage Kalka Shimla track was swept away in a massive landslide following rain fury in Shimla. The impact of the landslide and fast flowing deluge was so powerful it not only completely washed away

the bridge but also the two roads that came in the way one above and one below the rail track.

The clearance of the massive debris itself took 15 to 20 days with the help of the NDRF team. A number of railway men were roped in later to complete the task for laying the foundation and bringing equipment for the bridge. Since the connecting roads were damaged, the construction material had to be taken down at the site manually. The heavy equipment including the iron girders had to be dismantled as these could not be carried in their original form. These had to be reassembled at the site. The final launch of the bridge was carried out with expert manpower brought in from Ambala and Delhi.

Money to the tune of INR 15 crore has been sanctioned by the Centre for slope protection, strengthening of bridges, construction of drains and building formidable retaining walls so that the damage is minimized in the event of landslides in future. ■

*Sarita Brara is a Delhi-based senior journalist.*



# BCT Digital's Focus on Cleantech

Helping Organizations Stay ESG Compliant and Achieve Sustainable Growth

**Jaya Vaidhyanathan** is the CEO of BCT Digital, an award-winning global digital transformation company delivering disruptive FinTech, RegTech, and CleanTech solutions to large organizations across diverse industry verticals. Here, we are in conversation with Jaya for *TerraGreen*.

**Please throw light on the ESG scenario in India: Rising prominence, emerging trends, regulatory environment, and way forward.**

In India, environmental, social, and governance (ESG) factors are steadily gaining traction. There is increasing collaboration among government bodies and the corporate ecosystem to implement ESG principles, recognizing the urgent need to combat climate change and protect the country's natural resources. Regulatory authorities such as the Securities and Exchange Board of India (SEBI) have become instrumental in mandating ESG reporting, pushing it beyond mere compliance to focus on impactful, measurable outcomes. For example, Indian companies are taking initiatives to contribute to environmental sustainability by embracing renewable energy, waste management systems, and eco-friendly manufacturing processes. Technological solutions such as cleantech are also aiding these companies in better assessing and reporting their ESG contributions.

At the 2022 Conference of the Parties (COP26) held in Glasgow, United Kingdom, India even presented the following five essential elements of India's climate action bolstering its commitment to the sustainability agenda:

- Reach 500 GW non-fossil energy capacity by 2030
- 50 per cent of its energy requirements from renewable energy by 2030
- Reduction of total projected carbon emissions by one billion tonnes from now to 2030
- Reduction of the carbon intensity of the economy by 45 per cent by 2030, over 2005 levels
- Achieving the target of net zero emissions by 2070

However, the journey towards an ESG-focused business landscape is far from complete in India. While India has been proactive in launching several environmental and sustainability policies, such as the National Action Plan

on Climate Change and the National Clean Air Programme, what is missing is an integrated policy framework and a sense of urgency in execution. Moving forward, the key focus should be on establishing standardized frameworks, ensuring stringent enforcement, reinforcing accountability, and facilitating regular monitoring to achieve the desired impact in ESG initiatives.

**Could you help us in understanding SEBI's push for ESG accountability and its positive implications?**

SEBI has been instrumental in elevating ESG accountability within the country's corporate landscape. SEBI's recent push culminated in the mandatory Business Responsibility and Sustainability Reporting (BRSR) for India's top 1000 listed companies. This represents a significant shift from the earlier voluntary reporting frameworks and is in line with the Companies Act of 2013, which already had strengthened ESG disclosure requirements.

The BRSR framework covers an extensive range of sustainability-related information based on the National Guidelines on Responsible Business Conduct (NGRBC). The BRSR Core includes nine ESG attributes or key performance indicators covering wide topics such as greenhouse gas emissions to social welfare measures. Furthermore, this framework introduces a standardized reporting format and facilitates a direct comparison of companies' sustainability performance, empowering investors to make well-informed decisions.

SEBI's initiatives also include safeguard measures against greenwashing, such as requiring ESG schemes to invest a minimum of 65 per cent of their assets under management in listed entities that assure compliance with BRSR Core. This is complemented by mandates for third-party assurance and board-level certification for ESG compliance. Such accountability mechanisms are designed to ensure



Jaya Vaidhyanathan

transparency and authenticity in ESG investments. In addition, the regulatory body has proposed a framework for ESG rating providers, requiring them to consider local or emerging market parameters. These steps collectively enhance corporate accountability, encouraging companies to not only focus on reporting but also to actively improve their ESG performance. These moves have positive implications for responsible investing and long-term corporate sustainability in India.

**What's your take on the rising importance of discussions around ESG in the boardroom?**

There has been a pivotal shift towards responsible corporate behaviour, and the rising prominence of ESG in corporate boardrooms is indicative of the same. ESG is now integrated into the fabric of strategic governance. Companies are establishing board-level committees dedicated to ESG oversight and are investing in tools for monitoring, measurement, and compliance. Indian organizations are not just complying with local mandates such as SEBI's BRSR but are also aligning their practices with global standards set by bodies such as ISSB, GRI, and adopting cleantech-based ESG products to standardize

metrics, track performance, and report compliance effectively.

Investor engagement has been a significant driving force behind the push for ESG adherence. As responsible investment trends gain traction, investors are increasingly integrating ESG factors into their financial decisions. They are looking for standardized reporting frameworks, such as BRSR, to assess the long-term viability and sustainability of their investments. Emerging technology platforms provide a comprehensive overview of a company's ESG profile, thereby aiding not just compliance but also strategic decision-making. By fostering a more responsible corporate landscape, these developments in governance and technology are setting the stage for a sustainable future.

**Please provide some insights on the recently announced BRSR framework for ESG reporting and impact on varied stakeholders.**

SEBI's BRSR is a transformative development in India's ESG landscape. It requires India's top 1000 listed companies to mandatorily disclose a broad spectrum of sustainability-related information in their annual reports. The framework introduces a standardized reporting format, making it easier for investors to compare sustainability goals across different companies. A key feature is the BRSR Core, which introduces a limited set of KPIs for which companies must obtain reasonable assurance. This feature not only holds companies accountable for their sustainability practices but is also expected to bring an uptick in the overall level of ESG reporting. Significantly, the framework also mandates ESG disclosures and assurance for the entire value chain of listed entities, thereby broadening the scope of ESG accountability.

The BRSR framework also addresses some of the more contentious issues surrounding ESG investments, particularly the risks associated with greenwashing and incorrect selling.

By requiring validated assurances for companies' ESG claims, it adds an extra layer of credibility and authenticity to the reporting. The framework even prompts ESG rating providers to consider parameters specific to India or emerging markets, providing a more contextual and nuanced understanding of companies' ESG performance. For investors, this standardization serves as a robust tool for due diligence and risk assessment. For companies, it serves as both a roadmap and a gauge for aligning their business practices with sustainability goals. And for regulatory bodies and ESG rating agencies, BRSR sets a new, elevated standard for assessing ESG compliance and sustainability performance, making it a game-changing initiative for all stakeholders involved.

**Please elaborate BCT Digital's ESG offering and how it allows corporates to understand, measure, and manage ESG risks?**

rt360-ESG offers functionalities that streamline and automate the ESG compliance assessment process. It offers advanced analytics, dashboards, and stress testing to evaluate the impact of ESG factors on various business risks. rt360-ESG provides comprehensive solutions to help enterprises meet their sustainability objectives.

- **ESG Metrics Reporting – Automated metrics reporting with status**  
rt360-ESG enables businesses to record, track, and report various ESG metrics, empowering them to enhance compliance. Organizations can manage the various metrics for different BUs as per frameworks and standards, align the KPIs to the BU and automate data collection, metrics monitoring, and reporting.
- **Analytics and dashboards – Automated ongoing tracking and reporting**  
rt360-ESG streamlines the ESG compliance assessment process through advanced analytics and

interactive persona-based dashboards. It empowers organizations with data insights and analytics, enabling them to make informed decisions and drive continuous improvement.

- **Stress testing**  
Additionally, it facilitates ESG stress testing, which assesses the impact of ESG factors on credit risk, market risk, and operations risk. By conducting scenario analysis and stress testing based on prescribed scenarios, organizations can proactively manage risks and drive sustainable practices.
- **Materiality assessments – assess baseline, identify gaps, and set targets**  
Easily identify stakeholders to complete the materiality assessments, and generate materiality assessments dashboards to engage senior management and board leadership. rt360-ESG offers complete oversight and visibility for CXOs and senior management.

**How is BCT Digital utilizing technology in helping organizations stay ESG compliant and achieve sustainable growth?**

rt360-ESG is part of the rt360-Governance, Risk, and Compliance (GRC) suite, which has consistently topped Chartis Research RiskTech100 rankings. It comes with advanced AI/ML capabilities with predictive analytics, and future-ready architecture built on industry best practices. Our flexible deployment options, including on-premises, cloud, and hybrid, ensure compatibility with various IT infrastructures while offering budget-friendly total cost of ownership (TCO) and value for investment. We support companies in meeting their ESG-related disclosure and sustainability reporting requirements, ensuring compliance, and providing industry-specific reporting capabilities. Additionally, BCT Digital's focus on cleantech ensures that all of its solutions deliver a positive impact to India's sustainability roadmap. ■

# Empowering Sustainable & Resilient Communities



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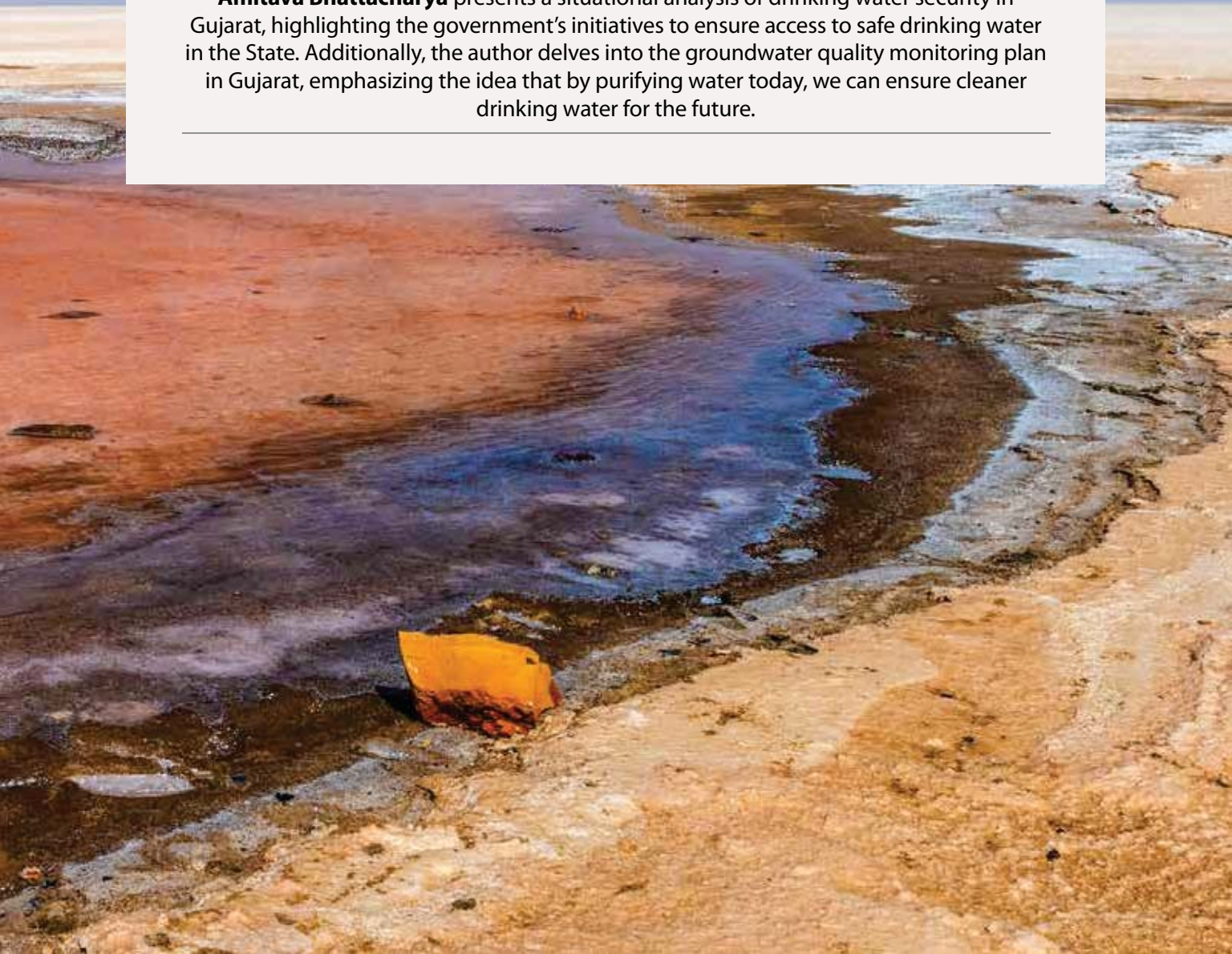
# Drinking Water Security in Gujarat

## The Current Scenario

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Water security entails guaranteeing access to safe drinking water, efficiently managing water resources, and mitigating the threat of water-borne diseases. In this article, **Amitava Bhattacharya** presents a situational analysis of drinking water security in Gujarat, highlighting the government's initiatives to ensure access to safe drinking water in the State. Additionally, the author delves into the groundwater quality monitoring plan in Gujarat, emphasizing the idea that by purifying water today, we can ensure cleaner drinking water for the future.

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**W**ater scarcity is not unusual, even in countries with ample water resources. It is obvious that climate change, along with human factors, is increasingly depriving people of their right to access to safe water and sanitation. This may be because of a number of factors, such as crumbling infrastructure and distribution systems, contamination, conflict, or inadequate management of water resources. Access to drinking water becomes restricted due to water scarcity.<sup>1</sup>

The 2030 Agenda for Sustainable Development by the United Nations makes it very apparent that everyone must participate for sustainable development to take place. It also emphasizes the importance of a comprehensive and human-centred approach to managing water resources. SDG 6, or clean water and sanitation, focuses on providing everyone equitable access to safe, inexpensive drinking water by 2030. The availability of freshwater is in an alarming state right now. Our world's water resources are at a critical point due to factors including an increasing population, fast urbanization, declining water quality, and, of course, competing demands for freshwater and over-extraction of groundwater without sufficient recharge. According to the World Bank, India is one of the nations with the

<sup>1</sup> Details available at <https://www.unicef.org/wash/water-scarcity>

worst water stress.<sup>2</sup> Today's water availability is about one-third of what it was in the 1950s. The total water demand, which was 710 billion cubic metres in 2010, has been estimated by the National Commission for Integrated Water Resource Development Plan to be 1180 billion cubic metres now. The demand for water in the nation is anticipated to double by 2030. To ensure that we can meet our future water needs, an integrated approach to water resource management has become necessary.<sup>3</sup>

## Situational Analysis of Gujarat Drinking Water Scenario

One of India's most prosperous states is Gujarat, which is situated in the country's western region. It boasts of a workforce that is fairly diverse, a diversified economy, and a relatively high per capita income. The state spans an area of 196,000 sq. km, and its geo-physiological features are quite varied, ranging from dense forests and hilly regions in the south to parched desert regions in the north and northwest.<sup>4</sup>

<sup>2</sup> Details available at <https://www.worldbank.org/en/country/india/brief/world-water-day-2022-how-india-is-addressing-its-water-needs>

<sup>3</sup> Details available at <https://www.devalt.org/newsletter/nov19/lead.htm>

<sup>4</sup> Details available at <http://www.isec.ac.in/Ensuring%20Drinking%20Water.PDF>



Gujarat is a state with a water shortage, with just 1137 m<sup>3</sup> of fresh water available per person. Even now, there are persistent water shortages in several parts of the state. Potable water is in poor supply in several areas of the state, especially in North Gujarat, Saurashtra, and Kachchh. Water security in recent years has, relatively speaking, improved from the scenario that existed earlier, with an assured water supply assisting significant economic and agricultural growth, however, concerns about an inconsistent water supply in the outlying rural communities persist. Despite efforts to supplement resources, there are still issues with appropriate water supply due to the state's geology, growing population, and rapid industrialization.<sup>5</sup>

It has been estimated that rural areas have a relatively small share in the total water supply meant for drinking and domestic use. Though the rural population constitutes about 65 per cent of the total population, it consumes about 42 per cent of the total domestic water supply. The estimation is that during the summer months of drought years (which are not infrequent in Gujarat), more than 50 per cent of villages suffer from a shortage of adequate potable water (Master Plans of different years of GWSSB). Poor quality of water supply: Another major problem of rural water supply is its quality. Gujarat Water Supply and Sewerage Board (GWSSB) has been providing data on the habitats which have excess fluoride, excess salinity, and excess nitrates in their water supply.

## Government Initiatives towards Security of Drinking Water

In view of the fact that Gujarat is prone to drought, it has been difficult for the state government to ensure that a sizable population in Kachchh, Saurashtra, and North Gujarat has access to safe and reliable drinking

water, which has forced policy planners of the state to plan for these water-starved regions. Multifarious institutions and organizations such as the Gujarat Water Supply and Sewerage Board (GWSSB), Gujarat Jalseva Training Institute (GJTI), Gujarat Water Infrastructure Limited (GWIL), Gujarat Water Resource Development Centre (GWRDC), Sardar Sarovar Narmada Nigam Limited (SSNNL), Water and Sanitation Management Organisation (WASMO) and Gujarat Infrastructure Development Board (GIDB) are responsible for ensuring that potable water is supplied to the rural population with enough quantity, which is not only safe but also affordable.

## Narmada Master Plan

A project to supply drinking water from the Narmada Canal was started through a State Wide Drinking Water Grid that provides access to water to roughly 75 per cent of the state's residents. GWSSB and Gujarat Water Infrastructure Ltd (GWIL) are working together to implement the Narmada Master Plan, which is intended to cover 9490 villages and 173 towns in Gujarat ([www.wasmo.org](http://www.wasmo.org), n.d.). GWSSB and GWIL receive water from the Narmada Nigam. By the end of March 2019, 8911 villages and 165 towns had been granted access to drinking and residential water pipelined from the Narmada. Additionally, the Narmada Nigam has been providing water directly to 28 Industries in the state as well as the Vadodara Municipal Corporation, Ahmedabad Municipal Corporation, Bharuch, Kapadvanj, and Tharad Nagarpalika.

## Jal Jeevan Mission (JJM)

The Prime Minister announced Jal Jeevan Mission – Har Ghar Jal on August 15, 2019 while addressing the nation on Independence Day. The Mission, under implementation, in partnership with the states, aims to enable every household in villages to have Functional Household Tap Connection (FHTC) by 2024. It is



<sup>5</sup> Details available at [https://www.ceeindia.org/pdf\\_files/jelsetu-report-web.pdf](https://www.ceeindia.org/pdf_files/jelsetu-report-web.pdf)



envisaged that with FHTC, each household will have potable water supply in adequate quantity (at least 55 lpcd) of prescribed quality (as per BIS 10500:2012) on regular- and long-term basis.

In October 2022, Gujarat was designated as a “Har Ghar Jal” state, which means that all rural families now have access to clean drinking water from faucets, ensuring that “No One is Left Out.” All 9,173,378 homes in the state now have access to water, according to government data.

## Atal Bhujal Yojana

The Atal Bhujal Yojana, or the Atal Jal scheme, was launched by the Prime Minister of India in 2020 with the primary objective of uplifting the institutional framework for community-based participatory groundwater management and bringing behavioural changes at the community level for the management of the nation’s groundwater resources. The plan envisions achieving this through a variety of interventions, such as awareness campaigns, capacity building, the fusion of current and new programmes, and advanced agricultural techniques. The Atal Bhujal Yojana has designated Gujarat as one of its priority states for implementation. A combination of “top down” and “bottom up” approaches are being used by the Department of Water Resources, River Development & Ganga Rejuvenation, Ministry of Jal Shakti, Government of India, to address identified groundwater stressed blocks in seven states that represent a variety of geomorphic, climatic, hydrogeologic, and cultural settings. Among them is Gujarat.

## Quality over Quantity: The Current Scenario

One of the main factors influencing public health is access to quality and sufficient quantity of water. Clean

water sources and adequate water produce significant synergy in the outcomes and outputs of human growth. Thanks to the efforts of the concerned institutions and strengthened public policies, in a significant number of Gujarati villages and towns, the availability of water has had a favourable impact on many facets of personal, household, and societal well-being. However, the quality of supplied water is critical to usability and cannot be overlooked. Much of the groundwater in Gujarat is naturally saline or has geo-morphologically occurring contaminants.

## Groundwater Quality Monitoring Plan

Monitoring groundwater quality is an essential effort to gather data on the chemical quality by representative sampling in various hydrogeological units. In May 2020, a total of 518 water samples were obtained by the Central Groundwater Board (WCR), Ahmedabad, and were monitored for the fundamental factors determining electrical conductivity, nitrate, and chloride, amongst others. According to the analytical findings, the bulk of the water samples taken from the Central Ground Water Board (CGWB) observation wells throughout a significant portion of the state fall into the desired or permitted category, making them suitable for drinking. However, it has been shown that some well waters have chemical concentrations that are over the permissible limits. Such water is unfit for human consumption and dangerous to health upon continuous consumption. The major findings of the analysis are given below.

### Electrical conductivity

A water body’s salinity or amount of dissolved salts depends on its electrical conductivity (EC), total dissolved solids, or salinity. In general, water with an





EC of 1500 to 15,000 uS/cm is regarded as fresh water, 1500 to 15,000 uS/cm as brackish water, and more than 15,000 uS/cm as saline water. The EC value is generally found to be very high, ranging from 3200 uS/cm to 15,000 uS/cm and more, in the majority of the State. Out of 539 water samples, it was found that 106 samples had an EC value greater than 3200 uS/cm, indicating a serious salinity problem in the region.

### Chloride

All waters from natural sources include chloride because it is highly soluble and easily permeates rock and soil. Except in circumstances where inland salinity is common and in coastal locations, the chloride concentration of groundwater is typically below 250 mg/l. In drinking water, the BIS has suggested an acceptable limit of 250 mg/l of chloride; in situations where no alternate supply of water is available with the necessary concentration, this concentration limit can be increased to 1000 mg/l of chloride. According to the analytical results, out of the 601 samples that were evaluated, 53 samples were found to have high chloride levels of over 1000 mg/L, indicating that most of the



state's water is saline. The state's western regions have the highest concentrations of chloride, which reach >5000 mg/l and indicate significant salinity.

### Nitrate

In the soil, nitrogen and oxygen mix to generate the naturally occurring molecule nitrate. Groundwater contamination from septic tank and sewage discharges, leaching of chemical fertilizers and animal manure, and other non-point sources are the main sources of nitrate in groundwater. The maximum recommended level of nitrate concentration in groundwater is 45 mg/l according to the BIS standard for drinking water. Despite the fact that nitrate is generally believed to be non-toxic, a high nitrate concentration in drinking water is a hazard for environmental health since it increases the risk of methaemoglobinemia, specifically in newborns. Nitrate levels have been found to be between 1 and 500 mg/l, and 193 samples out of the 601 that were analysed contained high nitrate levels (> 45 mg/L), indicating high nitrate pollution brought on by the use of nitrogen-containing fertilizers, domestic and agricultural waste, and human-made anthropogenic activities. All regions of the state have sporadic observations of the maximum nitrate levels.

### Fluoride

The majority of the fluoride in groundwater is naturally occurring and results from the weathering and deposition of air particles, the disintegration of rocks and soils, or both. It is generally known that fluoride in small doses (>1.0 mg/l) has been shown to help prevent tooth decay. Water sources in communities are frequently treated with sodium fluoride or fluorosilicates are used to maintain fluoride levels between 0.8 and 1.2 mg/l, which lowers the likelihood of dental caries. However, high quantities (>1.5 mg/l)



have caused dental enamel discolouration, and greater levels of fluoride (> 5.0 mg/l) further exacerbate the serious issues such as bone stiffness. The BIS has set a maximum desired limit for fluoride concentration in drinking water at 1.0 mg/l, which can be increased to 1.5 mg/l in the absence of a reliable alternative source of water. Water with a fluoride concentration of 1.5 mg/l or more is not fit for human consumption. Out of the 601 water samples studied, high fluoride levels of >1.5 mg/l, which are mostly attributable to geogenic circumstances ranging from 0 to 8.6 mg/l, have been found in 83 water samples.

### Arsenic problem in the state

During the weathering of rocks and minerals, which is followed by subsequent leaching and run-off, arsenic (As) is released into the soil and groundwater. Globally, hundreds of millions of people are at serious risk for grave health problems due to geogenic arsenic poisoning in groundwater.

In a study published in June 2020, Wu et al.<sup>6</sup> created groundwater arsenic hazard and risk maps for Gujarat State at a resolution of 1 km using logistic regression models of secondary groundwater arsenic data and research-informed secondary soil, climate, and topographic variables as principal predictors. They created a pseudo-contour map of groundwater arsenic concentrations by combining models based on various arsenic concentrations. However, the data generated by the private survey seems to be dated and it is desirable that the state government in the Narmada and water supply department constitutes an expert group to conduct a fairly widespread survey in the areas mentioned in the survey report by these water supply experts in 2020. In case groundwater samples in the districts of Saurashtra, North Gujarat, and central Gujarat show consistently high levels of arsenic (WHO

standards for acceptable levels of arsenic in drinking water being 0.01 mg/L), serious view needs to be taken by the state government and policy planners not only to stop groundwater supply from underground aquifers via hand pumps, stand posts or any other means but also intense door-to-door audiovisual campaign to make the villagers living in these areas aware of the dangerous side effects of using this water, not only for drinking but also for any other household activity.

Simultaneously, the reach and quality potential of surface water to these areas needs to be augmented through a distributive model using 3-tier Panchayati Raj system and also using the wide reach of WASMO in the area of water management in rural Gujarat.

### Way Forward

Gujarat as a role model among the states was the first state off the block to plan on a micro and macro level for ensuring the accessibility and quality of drinking water in general and household consumption waters in particular in the last two decades, resulting in the complete wiping out of “no source” villages, even in the arid regions of Kachchh, Saurashtra, and Northern Gujarat. However, some issues regarding quality of especially drinking water from underground sources in the form of excess fluoride, salinity, and scattered incidences of arsenic remain. The scenario, however, is far better than most states in India.

Apart from the general suggestions of improving the problems of leakage and breaking of water pipelines, especially in the arid regions of Saurashtra, North Gujarat, and Kachchh, the water management and pricing system through the WASMO model, is a model which is just and matching with the state's cooperative spirit. However, care needs to be taken to solve inter-regional, outer district/ Taluka/ village disputes about water supply, especially during summer months and lean rainfall seasons needs to be evolved apart from the usual governmental system of development commission and panchayat department solving through their field department. Perhaps, a nyaya panchayat kind of body with power to help solve inter-district Taluka/village water dispute can be set up under the district panchayat or regional level so that these problems can be solved at the grassroots level itself.

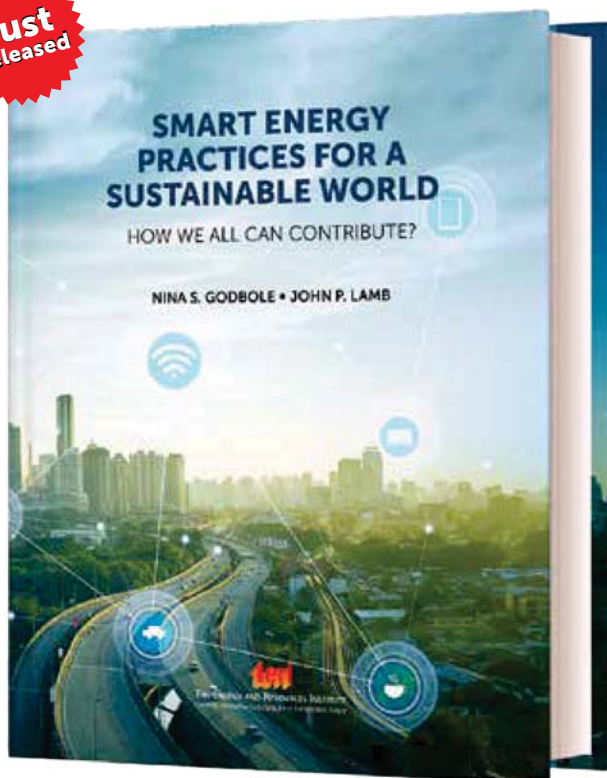
*Amitava Bhattacharyya, is a retired IAS and he was in TERI as Distinguished Fellow till September 2022. His principal areas of interest include climate change, corporate social responsibility issues, drinking water and quality, sustainability issues, and energy sector.*

*He could be approached via <bhattacharyya\_aceo@yahoo.co.in>*

<sup>6</sup> <https://link.springer.com/article/10.1007/s10653-020-00655-7>

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This book stresses the need for us to judiciously, sustainably, and smartly harness and use energy techniques in order to effectively combat climate change. The book also gives an in-depth discussion on utilization of artificial intelligence and information technology to realize energy efficiency in various sectors of economy including such as transportation, buildings, infrastructure, health care, and other services.

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Attn: TERI Press  
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IHC Complex, Lodhi Road  
New Delhi – 110 003/India

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# The Burgeoning Problem of Trash Mountains

## Some Solutions and Alternatives

The continuous piling up of trash dumped in landfills worldwide has become a pressing issue today. The rise in population and consumerism has led to a significant increase in the amount of waste being generated. Consequently, a multitude of environmental problems is afflicting the planet. In this article, **Ramya Rangnath** explores the intricacies of this issue and briefly discusses potential solutions and necessary measures to address it.

**T**rash mountains! What are they? As the name suggests, it is basically a giant pile of rubbish or trash. It is a landfill where waste or garbage is dumped and reaches heights of almost 120 feet or more. This waste that is left to rot and decompose here poses serious hazards. Trash mountains emit poisonous

gases such as methane, hydrogen sulphide, and carbon monoxide. India is home to some of the world's largest trash mountains. Methane, a greenhouse gas emitted from this decomposing waste, is 25 times more powerful than carbon dioxide. The methane emitted from these landfills is said to contribute almost

15 per cent of India's total methane emissions.

You would think that with all the investment in climate change and sustainability, this problem is on the road to being resolved. But this is far from the truth. The problem of mounting trash is just getting worse by the day. India







has risen to being the most populated country in the world. This population density brings with it a host of other problems, one of them being mounting waste. While waste management has also gained momentum in the country, it is not sufficient to catch up with the rate at which waste is being generated on a daily basis. As a result, more and more garbage is being dumped in landfills, leading to an aggravation of an already existing problem with trash management.

It is evident that we need to act fast and strategically to address the problem with India's trash mountains. Some steps that can be taken are to improve waste collection and disposal systems, recycling and composting, and using waste to generate energy. The need to solve the problem of India's trash mountains is pressing since it poses a threat not only to the country, but to the global climate change crisis as well.

## The Growing Problem of Trash Mountains

"Trash mountains"—the continuous pile up of trash dumped in landfills

world over, is turning out to be a serious problem today. Rise in population and consumerism has skyrocketed the quantum of waste being generated. This in turn results in a plethora of environmental issues plaguing the planet. The four main aspects of this problem are methane emissions, air pollution, soil and water pollution, and deforestation and land use.

### Methane emissions

Methane emissions are a major environmental concern. Incidentally, the most significant hazard posed by trash mountains is the emission of

methane gas. Landfill gas is basically what you get when organic waste in landfills decomposes anaerobically. A major portion of landfill gas is made up of methane. Now, methane is a greenhouse gas. Compared to carbon dioxide, it has a stronger capacity to trap heat over the same period of time, making it all the more dangerous when it comes to climate change. To solve this mounting problem, governments and civic bodies have devised a solution.

Here, the methane that is generated is captured using some technologies. This captured methane gas is then converted to heat or electricity, making it viable to



be utilized in renewable energy sources, and mitigating its harmful effect on the atmosphere.

### Air pollution

Apart from methane emissions, trash mountains also contribute to air pollution in other ways. Organic waste decomposes and releases a lot of volatile organic compounds and polycyclic organic matter that pollute the atmosphere. These harmful fumes result in ground level ozone formation and also release particulate matter 2.5, both of which are very hazardous to the health of living beings. Studies show that India is home to more than 3000 trash mountains that contribute 1.3 billion tonnes of waste. This is mostly old solid waste in landfills. Considering the magnitude of waste spread across the region, one can only gauge the extent of potential hazards that arise from these landfills.

### Soil and groundwater contamination

Aside from methane and air pollution, waste mountains bring with them other harmful side effects. Since this waste has been festering for long durations of time, a lot of it seeps into the groundwater and soil—thus leading to contamination.

Contaminated groundwater leads to polluted water supplies affecting people living in the vicinity. Water contaminated by landfills usually contains levels of ammonia and sulphate that are significantly higher than normal permissible levels. This makes it unfit for human consumption, making people susceptible to a range of diseases and ailments upon long-term consumption of this contaminated water.

### Deforestation

Landfills or trash mountains need acres and acres of land for their existence. This results in deforestation because more often than not, it is unutilized forest land that is used for this purpose. It also changes the way in which land is utilized across regions. Using forests as landfills disturbs ecologies and biodiversity of regions.

## Solutions and Alternatives

### Waste reduction and recycling

Waste reduction at source is a great way to minimize and manage waste. Source reduction, also called waste prevention, is a method used to decrease the quantity of waste produced or decrease

the quantity of material used during manufacture or production. This requires significant strategic decisions such as using different materials, and so on. Recycling is another means to reduce landfill waste. Removing materials that can be recycled from these dumpsites is a fraction of the solution. Reduce, reuse, recycle method not only helps in reducing the waste sent to landfills, but overall waste generated. Conservation of raw materials is another outcome of this methodology. Additionally, implement single-stream recycling. Here, all recyclable materials—be it organic, inorganic, e-waste, metals, and so on—are all pooled together in a single place. These materials are all collected together, sifted and sorted in a factory prior to being recycled. This helps promote recycling by removing the burden of sorting out materials from the end user. Promote extended producer responsibility (EPR) programmes. EPR programmes are essentially a protocol wherein the impact of a product during and after consumption becomes the onus of the manufacturer. In this context, manufacturers need to be conscious and mindful of producing products using better materials and those that create minimal environmental hazards or consequences. The waste generated from these products are also kept in check and attempted to be minimized at the production stage.

### Waste-to-Energy (WtE) Projects

Implementing waste-to-energy (WtE) projects is also a good idea. In WtE plants, organic waste is processed and fermented to generate ethanol. The best way to reduce landfill trash is to use waste and convert it into fuel or something useful. In recent times, 'circular economy' is a concept that most governments are trying to implement to achieve their Sustainable Development Goals (SDGs). Circular economy essentially is a principle wherein products are manufactured in a more conscious manner using sustainable materials and





technology to increase their lifespan in order to reduce waste generated from obsolescence. Waste-to-energy creation is a major rung of this process. Depending on various factors such as cost involved, type of waste, funding, and so on, one can implement an array of WtE processes such as anaerobic digestion (AD), gasification, plasma gasification, hydrothermal carbonization (HTC), dendro liquid energy (DLE), and more. However, these projects should be implemented in a way that strict emission norms are maintained so as to not cause any further damage or harm to the environment.

### Composting

Composting is a highly effective waste management solution, offering both individual and industrial approaches. In industrial composting, a large volume

of waste is collected from institutions and composted. This compost can then be sold to businesses or individuals who require it like nurseries, farms, apartments, and so on. Organic compost is collected from various facilities. This is then brought to a facility or a compost processor. Food waste and nitrogen-rich materials are fed into this machine. Carbon rich items are fed in to facilitate the optimum carbon to nitrogen ratio. This is curated and processed regularly until you get a nutrient rich product, which can be used in farming and gardening.

Every problem has a definite solution, if only we know where to look. If governments, civic bodies and non-profits join hands and strategize a goal to implement these processes, there's no end to what we can achieve with waste management. It will not only reduce the

accumulation at landfills but can also solve the problem of energy scarcity and insecurity. Trash mountains are a growing and complex problem with mighty repercussions. It is time to act fast and smart to tackle this and achieve our SDGs. During the G20 Summit 2023 held at New Delhi, India, a session called One Earth discussed the importance of climate action and strengthening the clean energy transition to achieve net zero emissions as pledged. Let us see what role WtE plays in this discussion, and hope for the best! The fate of our planet is in our hands! ■

*Ramya Ranganath has worked with several websites and agencies as a content specialist. She writes on clean technology and her focus is primarily on renewable energy and clean mobility. She is passionate about contributing to the adoption of clean energy for transformation and well-being of people and ecosystems.*

# Environment and the Double-Edged Axe

## An Environmental Impact Analysis of Advertising and Marketing

The free market economy has given way to ruthless competition, resulting in the diversion of significant costs towards indirect fixed expenses. In this article, **Ankur Srivastava** evaluates the impact of marketing on the economy and the environment. He endeavours to discover how the current economic set-up can evolve to avoid the wastage of resources on non-value-adding activities without compromising the ideals of healthy competition.

**T**he recent nomination of Sultan al-Jaber as president of the 2023 United Nations Climate Change Conference or Conference of the Parties to the UNFCCC (COP28) has created a lot of brouhaha from various stakeholders on the grounds that al-Jaber is CEO of an oil major— The Abu Dhabi National Oil Company or ADNOC. Many have also retorted on this as being similar to a cigarette company head presiding over a conference on cancer prevention.

A narrative appears to have ossified whereby few select industries are labelled as ‘pollution-causing’ industries while others are ‘eco-friendly’ or ‘green’. However, many of the critics end up missing the larger picture—that industries related to hydrocarbons, mining, metallurgy, etc., are only the feeder industries for other ‘greener’ industries. So, why single out an oil industry executive and not others?

### Which Industry is Greener?

There is no doubt that anthropogenic activities (including all kinds of industry) are among the prime culprits in polluting the environment and rising levels of pollution during the economic leap of recent centuries is an indisputable evidence. Irrespective of the industry, all kinds of economic activities end up polluting the environment in some way or the other, few most evident being—by destroying biodiversity while reclaiming lands from sea or forests, by using a range of chemicals which ultimately are discharged into sea or atmosphere, or by requiring energy in various forms which will ultimately be discarded into the environment as heat.

The structure of the current economic set-up appears to be focused mainly on increasing consumption and revenues rather than the stability of an organization or the sustainability of an economy. Corporations and economies are often judged against the parameters related to production and consumption. Today’s start-ups, which are giants of the future, are valued primarily on revenues rather than value addition. The prosperity of an economy is also



measured in terms of total consumption. Lengthy discussions on increasing GDPs and topline repeatedly dominate the discourse in parliamentary debates or board meetings. And such emphasis on revenue flows gives way to a price-distorting activity—marketing.

The concept of marketing—which usually manifests itself as promotional campaigns, branding events, advertising crusades, or profligate packaging—cares mainly about increasing topline of the financial statements, without giving much regard to its environmental implications. This crucial phenomenon harms the environment by increasing global economic activity in two ways—firstly, by increasing the overall consumption of the product due to the demand created, and secondly, by increasing the cost of each product unit due to heavy inputs of marketing-related resources.

## Changing Mindsets or Changing the Mindsets—the more the better

Marketing initiatives tend to herald a culture of wanton consumerism—irrespective of the actual requirement of a product. The main aim of such activities is to create a demand for the concerned product. The philosophy of Reduce–Reuse–Recycle immediately goes for a



toss when marketing departments start taking centre stage in the policymaking of corporations.

Although viewed as a symbol of healthy competition—marketing campaigns also distort the quality of competition by diverting the attention of consumers from the actual value received towards non-value-adding content. The standing armies of marketers end up luring the target consumers into paying up for that ‘vital’ product, which promises to bring their subscribers to the cloud nine. Despite increased prices due to increased costs, overall consumption soars ultimately polluting the environment. The ability, or rather the nature of marketing to create artificial demand takes hold of the natural demand—supply equilibrium. An increased price point would lead to reduced demand in an ideal set-up. However, despite increased prices, marketing activities manage to increase the overall demands.

This omniscient practice has started percolating into the deepest layers of every naive individual’s psychology. And it has morphed even ordinary individuals into marketers despite a very high price being paid by society in terms of envy, frustration, and depression. Social media—rather than expressing the realities of society (thus called social media) is more a platform to flaunt luxury, leisure, or consumption, motivating (or sometimes coercing) their consumers to spend for those ‘must live’ experiences.

## Value Addition or Sheer Wastage of Resources?

Apart from this, in the current economic set-up, for most products and services, a significant chunk of the costs is incurred on resource guzzling non-value adding activities, which helps the corporations to stand out from their competitors, thus not only increasing the price points but also rendering organizations unstable due to higher indirect fixed costs. These



costs are mainly due to lavish packaging, prodigal branding, placement-related expenses, electronic or print advertising, etc. Be it a residential flat in a posh downtown of a metropolis or a life-saving drug, rarely does their market price reflect their material value.

Another problem that wanton promotional campaigns have resulted into is waste management. Many cities face waterlogging and floods not because of heavy rains but due to gutters choked of plastic packaging. The luxurious promotional events in sophisticated convention halls and front-page advertisements in newspapers have huge environmental costs due to the resources consumed.

Marketers sometimes also try to satisfy or deviate the conscience of consumers by showcasing their affiliation with ‘green practices’ or ‘eco-friendly initiatives’ in order to create a guilt-free clientele for their products. Even after assuming that these affiliations are being implemented in letter and spirit, their ultimate target is only to create more and more demand. Seldom do these organizations focus on educating their customers on the cost structure of their products.



## And the Way Forward...

The dynamics of business has time and again proven its competence to refine itself with changing times by innovating novel mechanisms and technologies, however, so far we haven't seen serious efforts towards creating an ecosystem of value economics. The supply side has already played its hand in the form of extortionate marketing propaganda, demand side cannot remain eclipsed by it indefinitely. Although the invisible hand of the market so far has not invented a sustainable alternative, stakeholders such as governments, right groups, and ultimate consumers should not wait long to change the status quo.

It is important to nurture a tradition of informed consumership, wherein an end user buys a product only after considering the philosophy of the seller in a wholesome manner and is able to clearly identify the actual value versus the printed price. A multipronged effort is required in this direction.

The initiatives are desired at all levels—from robust curricula in elementary schools to invigorated accounting standards. Right from junior academic years, the capability to acknowledge and perceive the existence of various legal persons and their

ultimate motives should be developed in children. Fables, in lines similar to those of *Panchatantra* need to be written, which could make upcoming generations corporate-street-smarts.

Accounting standards need to be equipped with tools that can effectively calculate marketing overhead costs. The accounting practices have to be so developed so that a promotional activity could be distinguished from an R&D expense, or the difference between the cost of utility-based packaging, vis à vis extravagant packaging could be identified. Governments can look towards mandating corporations to clearly mention the marketing costs thus calculated as a percentage of the quoted price. It will make the consumers more informed about the proportion of their hard-earned money which ultimately funds flashy advertising campaigns, and fills the pockets of endorsing celebrities. For extreme cases, governments can also impose taxes on promotional activities at par with EBT (earning before tax), so that enterprises start investing their resources towards enhancing their cost efficiency.

Media/Social Media platforms, which at times appear to be distant from ground realities, are both a challenge as well an opportunity for creating a culture of informed consumership. Consumers

of media/social media feeds should be alarmed against the freebooting army of influencers so that they can distinguish advertorial content from personal one. Undoubtedly, it is a herculean task to flag such advertorials from other contents, but as a starting point, it could be implemented for contents involving identifiable commercial considerations.

## How to Tackle the Vacuum Thus Created?

Proponents of the status quo may argue that less emphasis on marketing activities could lead to reduced economic activities, resulting in unemployment and poverty. However, the current economic model is teeming with imperfections and has many negative externalities. An eco-friendly economic system will have more prosperity due to lesser damages caused by environmental causes. It will also help in making commodities more affordable due to reduced prices. Apart from this suspected economic slowdown, if at all it actually happens, may not always be detrimental to humankind if it opens up new avenues for innovation, protects the environment, and ensures that the resources are put to their best use.

If the demand-supply mechanism can come up with a system wherein non-value-adding costs could be weeded out, it will be instrumental in ensuring that businesses cause less pollution, end products are more affordable, and resources are used mainly for their intended purposes. Removing the additional costs may probably reduce the topline of corporations or GDPs of economies, but will make corporations, economies, and the environment more sustainable, ultimately providing better lives to residents of this wonderful planet. ■

*Ankur Srivastava is currently working in the International Banking wing of a prominent private bank in India. He holds an MBA from IIM Kozhikode and a BTech in Chemical Science and Technology from IIT Guwahati. His interests include environment, health, and technology-related issues.*



# Terra Youth

Joining Hands  
for a Greener  
Tomorrow

# What's the Scoop on the 'Pooper' Who Poops and Scoots?

## A Tale for Our Times

The award-winning author of children's books, **Ranjit Lal** has a new surprise for his young (and not-so young) readers in the form of a rib-tickler titled, *The Great Poop War*. Lal's commitment to raising awareness about environmental issues reflects beautifully in this laugh riot that begins with a catastrophe of sorts.

Hilarious and timely, this illustrated story is filled with unbelievable twists and innovative turns!

**Ipshita Mitra** reviews the book for *TerraGreen*.



Picture courtesy: Red Panda (Westland Books)

**Book:** *The Great Poop War*

**Author:** Ranjit Lal

**Illustrations by:** Ambika Karandikar

**Publisher:** Red Panda (an imprint of Westland Books)

**Pages:** 136

**Reading age:** 8 years and above

in the city's most 'hygienic' society. Refusing to let go of the matter easily and determined to get to the root of the 'poop' menace, the president calls for an emergency meeting in order to conduct an immediate investigation to nab the 'culprit'. However, the foremost confusion that rattles all the residents (including the furry friends) is this—Is it a dog's poo or was it a cat's deed? This sends all the pet-owners into a tizzy. The president even takes it upon himself to have the sample 'tested' in a lab! As the saying goes, *'Misfortunes never come alone'*, the 'poop fiasco'—not to be mistaken for an isolated event—takes an ugly turn and strikes right in the middle of a nationwide lockdown announced by the country's prime minister to contain the spread of the deadly coronavirus.

### Canines, Felines, and a Raging War

Soon, the matter escalates and two opposing camps emerge. Dog owners and cat lovers find themselves pitted

against each other. Every team defends its own pets with all kinds of argument and logic—some fight with rationale and scientific acumen (*like a detective at work*) while others rely entirely on sentiment and emotion. Even the animals do not shy away from holding 'private' meetings in the complex lawns to find out who had the audacity to malign the reputation of not just the residential complex but also had the nerve to question the 'upbringing' of the animals, who were raised on a healthy diet of ethical values, exemplary manners, and rules of sophistication. The pets held themselves in high esteem and cringed at the mere thought of being compared to the foulmouthed street animals and petulant strays who lacked all signs of culture and civility. The hilarity and sincerity with which Lal weaves the narrative around the animals showcase a remarkable and unique style of storytelling. The sombre expressions on the faces of the brooding dogs, the 'high-handedness' of the *majestic* cats, the *dismissive* attitude of the stray animals—mocking the 'elitist' behaviour of the 'sterilized' pets—open up a universe of animated creatures surviving in the jostling crowd of the invariably clueless and conceited humans, i.e., their masters!

### 'Serial Pooper' Dupes All

While the adults continue their bickering sessions every weekend, the children

### Who Let the 'Pooper' Out?

Sparkling Apartments, Delhi's 'Cleanest Cooperative Housing Society' is on the verge of being stripped of its glory and honour. It all begins one morning when the president of the complex's Residents' Welfare Association (RWA), Shri Gangajal Badrinath steps on poop and almost averts a nasty fall! All hell breaks loose and what unfolds is a fierce battle between dog- and cat-owners



devise their own plans to catch the criminal red-handed. Parallely, the dogs and cats are on guard and carry on with their respective patrolling duties! The felines, be it the purebred Persian or 'pedigreed' Siamese, are annoyed that they are being called *filthy* because they are almost certain that *cleanliness* is not really second nature to the unruly dogs. Contrarily, the community of dogs—Doberman, Basset Hound, Pomeranians, Indie, and Pug—is hell-bent on clearing their *good* name. So, who is going to eventually sniff out the perpetrator ('serial pooper') in this one-of-a-kind whodunnit?

All strategies and schemes fail as the 'pooper' keeps striking without being caught. There is absolute mayhem and the blame game just intensifies with each passing week. As if the COVID-19 outbreak was not enough, the unprecedented 'poop scare' uncovers bitter truths about jealous neighbours, jilted RWA members who lost previous presidential elections, and a particular scheming, cunning resident who works at the nearby medical research lab, where genetic tests and various experiments are performed on defenceless animals whose consent doesn't matter.

## The Curious Case of COVID-19 and Cow Dung

'Poopers Park', which is where the complex's pets are taken for walks so

they can relieve themselves and do their 'jobs', serves as an example of how in a bid to keep their own houses spic and span, the humankind does not think twice before mindlessly turning the adjacent areas into dump yards. The author cleverly packs in a variety of themes concerning animal care and cruelty, environmental degradation, medical emergencies, crises management, ethical and unethical use of technology, waste management, open defecation, ills of fake news, and so on. For instance, the teenagers discuss the adult members' lack of decision-making skills and the futility of recurrent meetings that actually end up being mud-slinging feasts where conflicting groups go at each other's throats and tempers fly, alas leading to no possible solutions to the existing problems. When it comes to the age-old debate between myths and facts, the children in this story—14-year-olds Bharat and Parvati—are puzzled and shocked on being fed information like "cow dung can cure COVID-19" and they even express their displeasure at the changing syllabi in school. They are worried their history textbooks will never let them "know what really happened" and instead, will force them to "just know what they want us to believe."

## Don't Be a Party Pooper

The children are the voice of sanity and reason in this tale, the pages of which are interspersed with delightful and evocative illustrations by Ambika Karandikar. Through the perspectives of Bharat and Parvati, the author highlights the urgent need for a harmonious

co-existence between human beings and wildlife. With the absence of even one member—our plants, trees, forests, rodents, canines, felines, insects, and others—the entire ecosystem risks losing its balance and sovereignty. The exploitation of natural resources is a result of humans' insatiable greed and unchecked patterns of consumption. Technological growth and scientific knowledge must be put to good and efficient use and should not lead to deprivation and destruction of our ecology, which can only sustain and grow on a healthy and friendly relationship among all living beings on this planet.

So, now, coming back to the real question: Who is the 'pooper' after all? A dog, a cat, or... a human? To unravel the mystery, dive right into the pages of *The Great Poop War*. ■

Environmentalist and author Ranjit Lal has written over 45 books. In 2019, he received the Zeiss Wildlife Lifetime Conservation Award for writing 'with exceptional literary skills' on the conservation of wildlife. *The Great Poop War* is available on Amazon. Ipshita Mitra is a Delhi-based freelancer and an independent researcher.



Picture courtesy: Red Panda (Westland Books)

## Bizarre Facts

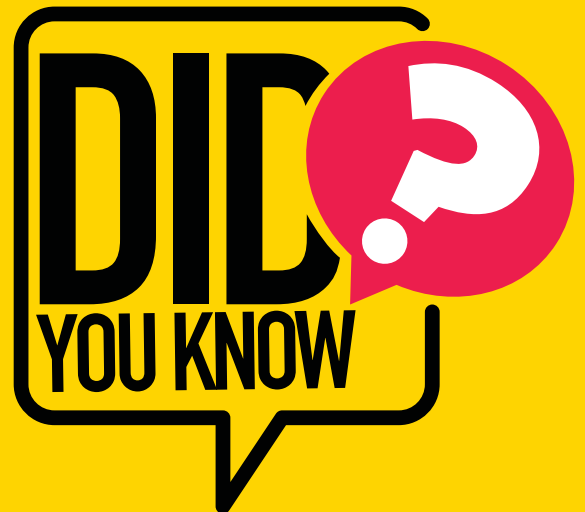


1. The Eiffel Tower can be 15 cm taller during the summer due to the expansion of the iron on hot days.
2. Cows have best friends and can become stressed when they are separated from them.
3. The world's smallest mammal is the bumblebee bat, weighing in at just barely 2 grams and measuring 1 to 1.3 inches in length, about the size of a large bumblebee.
4. Honeybees can recognize human faces. In a study, bees were shown pictures of human faces and trained to associate them with sweet treats. The bees were able to remember and recognize the faces they were shown!
5. Kangaroos can't walk backward. Their unique body structure and long tail make it impossible for them to move in reverse smoothly.
6. Chocolate was once used as currency by the ancient Aztecs.



## Did You Know?

- The sun makes up about 99.86 per cent of the total mass of our solar system.
- Venus is the hottest planet in our solar system, with surface temperatures high enough to melt lead.
- The world's smallest country is Vatican City, which is located in Rome, Italy. It is only 0.44 square kilometres in size and has a population of just over 800 people.
- The Great Wall of China is not visible from the Moon with the naked eye. It's a common myth but, in reality, it's very difficult to see the Wall from that distance without aid.
- Cats have a specialized collarbone (clavicle) that is free-floating and doesn't connect with other bones, allowing them to squeeze through tight spaces.



Source: newsgpt

# Reclamation Activities in Coal Mines

## A Pro-Active Approach by SCCL

The Singareni Collieries Company Limited (SCCL) is a Government coal mining company and is currently operating 18 opencast and 24 underground mines in six districts of Telangana State. SCCL has been implementing reclamation activities in all the opencast mines concurrent with progress of mining operations for ecological restoration of mined out areas. SCCL has committed to take up eco-restoration works including plantation activities with the involvement of top management. **Shri N Balram** has been promoting eco-friendly practices and committed to developing SCCL mining areas and colonies as sustainable and environment-friendly zones. Read more about his pioneering initiatives...

**T**he Singareni Collieries Company Limited (SCCL) is a Government Company based in Telangana, which is involved in coal mining operations for more than 134 years. SCCL is meeting the requirements of coal-based thermal power plants, cement plants, and various other industries. Singareni Collieries Head Office at Kothagudem SCCL is presently operating 24 underground mines and 18 opencast mines spread over six districts of the State. The Company produced 67.14 MT of coal during the year 2022–23 with an annual turnover of INR 33,065 crore. The Company has ventured into power generation with an installed capacity of 2x600 MW Singareni Thermal Power Plant (STPP) and is also establishing 1x800 MW super-critical unit.

SCCL has forayed into power generation from renewable energy

resources such as solar energy to reduce carbon footprint and has so far established 224 MW solar power plants in different locations. SCCL has ambitious plans of enhancing the solar power generation capacity to 540 MW to meet the entire power needs of the company for becoming a “Net Zero Energy Company”.

### Coal Mining and Environmental Aspects

About 90 per cent of coal production in SCCL comes from surface mining. The major impacts due to opencast mining are land degradation, air pollution, water pollution, noise and vibrations, and socio-economic aspects. SCCL has implemented several measures for environmental protection such as automatic dust suppression

systems, bioengineering structures on overburden (OB) dumps, conservation of biodiversity, sewage treatment plants, effluent treatment plants, etc.

But, the major impact due to surface mining is in terms of land degradation, which involves destruction of floral species and migration of fauna. As large tracts of land including forest is being diverted for coal mining operations, progressive as well as final reclamation of mined out areas is essential in restoring the ecosystem from the standpoint of sustainable development. SCCL is committed to reduce environmental damage caused by mining activity by implementing several “eco-friendly” practices in order to protect and safeguard the environment and conserve biodiversity. The Company is establishing extensive green belts including development of parks and gardens in all mining areas.

### Efforts Made by SCCL in Reclamation of Mined Out Areas

A pioneering initiative of bioengineering of overburden dumps has been taken up by the Company. The bioengineering



*Singareni Collieries Head Office at Kothagudem*

technique has transformed the mine spoil and degraded land into a sustainable landform to prevent soil erosion, siltation of water bodies, water pollution, dust pollution, and recreate the aesthetic beauty of the environment. The creation of steady nutrient cycles from plant growth and microbiological processes has resulted in long-term recovery of mining spoils.

As per the Environmental Management Plans of the mines, the relevant reclamation works both on the dump slopes as well as back filling areas are being taken up in the process of biological reclamation from time to time. During development of opencast mines, the top soil is being preserved separately and enriched by broadcasting leguminous seeds such as *Stylosanthes hamata*, *Sesbania grandiflora*, *Gliricidia*, etc. The enriched top soil is being spread on the final overburden dump or backfilled de-coaled area before raising plantations. A combination of biological and engineering methods is being followed for controlling soil erosion.



Dump area kept ready for reclamation



Reclaimed OB dump in JVR OC Mine

An integrated approach of planting indigenous forest species is adopted on OB dumps @ 2500 nos. per hectare along with dibbling/broadcasting of leguminous seeds @ 50 kg per hectare and planting of soil binders @ 2000 nos. per hectare.

Native plant species are preferred in the plantations with an objective to mimic the reclaimed plantations with the adjacent forests. All the seedlings required for plantations are being raised in 12 nurseries of the company which accounts for about 65 lakh seedling stock every year. Some of the seedlings raised in the nurseries are *Terminalia bellirica*, *Mitragyna parvifolia*, *Dalbergia latifolia*, etc.

Seed dibbling/broadcasting with leguminous seeds such as *Stylosanthes hamata*, *Acacia nilotica*, etc., is being taken up on dump which have the advantage of good regeneration capacity but also enriching the soil through rhizobial activity and in turn fixation of atmospheric nitrogen.

Contour planting with soil binders are being taken up which help in reducing the soil erosion from the slopes.



Vetiver slips on OB dumps



Saccharum munja

Apart from biological methods, certain engineering structures such as stone pitching, rock filled dams, gabions, cribs, etc., are being made in OB dumps as part of Soil and Moisture Conservation (SMC) works. These SMC works will support the plant growth as well as reducing the loss of precious top soil.

The average survival of the plantations is ranging from 80 per cent to 90 per cent with luxuriant and healthy growth of seedlings.

## Participation of Top Management in Greening Activities

SCCL has committed to take up eco-restoration works including plantation activities with the support of top management. Sri N Sridhar, IAS, C&MD and other Directors of the Company are showing keen interest in implementation of sustainable development activities including extensive plantation in the Company.



Plantation by Shri N Sridhar, IAS, C&MD, SCCL as a part of Harithaharam Programme

Plantation by Shri N Sridhar, IAS, C&MD, SCCL as a part of Harithaharam Programme In this regard, it is worth mentioning that Shri N Balram, IRS, Director (Finance) and (P,A&W) is not only dedicated to improve coal production, profits and welfare but also concentrating on greening activities of the Company. He has a passion for plantation and involved in massive plantation programmes taken up at the mines and vacant lands on regular basis. He has been directly participating in the plantation works every year and so far

individually planted whopping 15,271 saplings in the coal belt area of SCCL.

He has also participated in the multiple large-scale plantation works of State Government's flagship programme "Haritha Haram", Ministry of Coal's "Vriksharopan Abhiyan," which has motivated the public towards inculcating the habit of individual involvement in plantation activities. On every important occasion being celebrated in the Company, Shri N Balram has included plantation as a mandatory activity and encourages officers as well as workmen to take up massive plantation activities on their own.

After assuming the leadership of the Planning & Projects Department, Shri N Balram, IRS, has significantly escalated the Company's green initiatives and sustainable development efforts. Under his guidance, SCCL has introduced numerous 'eco-friendly practices' to combat environmental damage. In addition to normal plantation, he encouraged *Miyawaki* plantation in order to raise dense plantation with an exponential growth. In block plantations, 1111 nos. of seedlings of native forest species are being planted in SCCL. In case of *Miyawaki* plantation, 'high density planting' up to 10,000 nos. of seedlings per hectare is being taken up. Intensive maintenance of *Miyawaki* plantation would attain 10 times denser



Transplanted mango tree



Shri N Balram, IRS, Director (Finance) & (P,A&W), SCCL participating in plantation programme



Miyawaki plantation at Manuguru



Miyawaki plantation taken up at STPP and 30 times higher growth than conventional methods of plantations.

Shri N Balram has shown special interest in translocation of grown up trees from mine area to a suitable place—thus conserving the valuable plant species. Nearly 65 nos. of mango trees, 20 nos. of red sanders, 20 nos. of *Ficus bengalensis*, 20 nos. of *Ficus religiosa* have been relocated successfully in Ramagundam and Kothagudem areas.

Further, he has also shown interest in taking up gap plantation in the

degraded Reserve Forest (RF) areas, which are adjacent to coal mining areas and these areas became dense and matched with original RF areas. Most of these RF plantations have been developed by SCCL as non-mandatory works which shows the commitment towards environmental protection and conservation of biodiversity.

## Results of Reclamation Activities

Stabilization and reclamation of the OB dumps is a challenging task. High stripping ratios, spontaneous heating, high surface temperatures, poor fertility status of OB soil, low moisture retention, severe soil erosion are the issues which are detrimental to plant growth. In spite of such adverse conditions, SCCL has been able to take up extensive plantation in mining areas in 6,155 hectares of OB dump plantation with 3.15 crore saplings. Apart from mine spoil areas, SCCL has taken up block plantations in 7,365 hectares with 1.4 crore saplings in vacant areas and avenue plantation for a stretch of 600 km with 5.80 lakh saplings all along the roads leading to mines, townships, etc.

Reclamation of OB dumps has resulted in increase of soil microbial activity and a lot of biodiversity improvement is observed. Natural succession of many wild grasses such as *Sorghum halepense* (Johnson grass), *Cynodon* sp., etc., and shrubs/herbs like *Lantana* sp. *Dodonaea viscosa*, *Calotropis*, *Datura*, *Vigna*, etc., has occurred in the OB plantations. Improvement of plant diversity has resulted in increase of wide variety of insects from different orders, viz., isoptera, orthoptera, hemiptera, lepidoptera, coleoptera, diptera, etc. The increase in insect diversity is in turn attracting a lot of reptiles and mammals to the reclaimed areas. In turn, these measures also provided for habitat for lot of wild mammals like spotted deer, jackals, common hare, common mongoose, Bonnet macaque,

porcupines, wild boars, etc. Planting of native species and broadcasting of leguminous seeds have significant and positive impact in re-appearance of avifauna such as doves, honey bee eaters, sun birds, babblers, Indian rollers, crows, bulbul, pigeons, etc.

## Awards and Appreciations

SCCL won several awards and accolades for its meritorious efforts in protection of environment and working towards sustainable growth in its operations over the years. Some of the prestigious

awards such as TERI Corporate Environmental Excellence Award and Indira Priyadarshani Vriksha Mitra Award were bagged by SCCL for its greening efforts. State Forest Department also awarded Telangana Haritha Mitra Award to SCCL in recognition of its exemplary contribution to implementation of Telanganaku Haritha Haram. ICFRE, an autonomous council under the Ministry of Environment, Forest and Climate Change, Government of India, studied the eco-restoration works in Gautamkhani Opencast Project of SCCL and appreciated the reclamation activities.

Shri N Balram, IRS, received praise from the Hon'ble Member of Rajya Sabha, Shri Joginapalli Santhosh Kumar, for his involvement in the Green India Challenge initiative aimed at restoring degraded lands in mine spoil areas. He planted 1257 saplings in a record time of one hour, which earned him a record and placed him in "High range book of records". He has also been recognized as "Our neighbourhood Hero".

## Conclusion

Coal continues to be the major source of fuel for power generation for few more decades in order to sustain the industrial growth of the nation. However, the environmental concerns should not be disregarded. In this aspect, SCCL is playing a key role in implementing various sustainable developmental activities such as harnessing of solar energy on a large scale, carbon sequestration through massive plantation, energy conservation measures, rainwater harvesting, waste minimization by utilizing fly ash, and processed overburden in stowing of underground mines. SCCL is aiming to become a carbon neutral company in near future with all these pro-active measures. ■

*Shri N Balram, IRS, Director (Finance) & (P,A&W), The Singareni Collieries Company Ltd., Kothagudem, Telangana.*



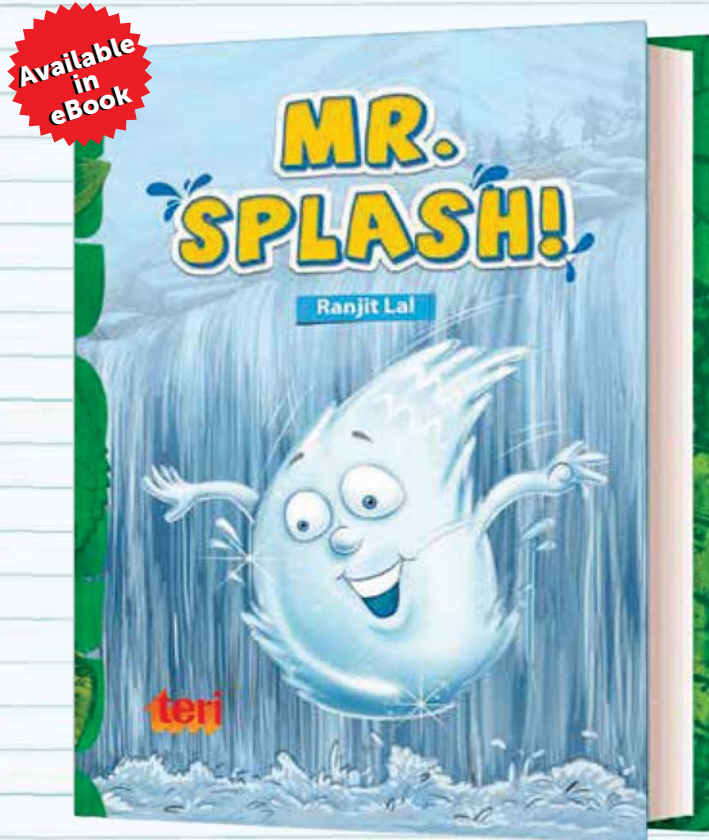
*Reclaimed OB dump in RG OC-III*



*Reclaimed OB dump in JK OC*

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Fax: 2468 2144 or 2468 2145  
India +91 • Delhi (0)11  
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# Ladakh

## The Land of Mystic and Mystery

Text by: **Ms Shakti Bishnoi**

Photos by: **A S Bishnoi**

*Continued from last issue...*



### IAF Effect

The Indian Air Force (IAF) is preparing to establish another base in Ladakh, across 500 hectares in the Changthang sanctuary area, right off the Line of Actual Control. The Standing Committee of the National Board of Wildlife, chaired by the Union Environment Minister Shri Bhupender Yadav, has given approval to the proposal.

The 'proposal for use of 508.187 ha from Changthang Wildlife sanctuary for creation of IAF base, UT of Ladakh' was taken up at the meeting and recommended for approval with the usual caveats on compensation charges, the extant laws in place and mitigation measures prescribed.

The new base proposal has already been approved by the Chief Wildlife Warden, State Board of Wildlife and the

Ladakh administration during a meeting held on June 29, 2022. But the defence project is yet to apply for environmental clearance for the base which falls in the cold desert sanctuary. The author believes it should be studied thoroughly and not at the cost of environment.

Mahe Field Firing Range (MFFR) is located in eastern Ladakh, about 40–50 km from the border, and is spread across 1257 hectare area in the Changthang



sanctuary. The MFFR is the only firing range in the entire eastern Ladakh sector where all types of weapons can be fired and tank regiments and mechanized units can prepare and train for battle engagements. It is all at the cost of environment and destruction of habitat of Tibetan wolf, fox, and other wildlife species.

## Hanle Observatory

Hanle is a village of great historical importance and is the site for the 17th century Tibetan-Buddhist Hanle Monastery. It sits at the top of a small hillock, overlooking the village and the valley. The village is located on an old branch of an ancient Ladakh-Tibet trade and pilgrimage route. A remote region in the already remote Union Territory, Hanle offers enchanting scenic views of the surrounding landscape and the great starry night skies, making it a must-visit offbeat location.

At an elevation of 14,764 feet, The Indian Astronomical Observatory established in 2001, will now be the centre of the dark sky sanctuary. This decision was announced by the Union Territory's Principal Secretary of the Planning, Development and Monitoring Department during a high-level



meeting. There has been an increase in light pollution in the region due to the proliferation of homestays and the presence of Army units. This will likely have a further impact on Hanle in terms of environmental issues. Approvals have been given to Nomadic museum in Nyoma and snow-bound ISRO road linkage to help establish NETRA optical telescope on Mt Saraswati and upgrade linkage to Astronomical Observatory at Hanle.

A dark sky sanctuary is an area, usually surrounding an observatory, that has

distinct and clear starry nights, which calls for certain measures to restrict artificial light, protect the dark night skies and ensure proper illumination, without causing excess pollution. By declaring Hanle as a dark sky sanctuary, astronomy and tourism will be promoted, but I doubt the natural environment and wildlife shall get affected in long term. Boosting the tourism shall have detrimental impact on the topography of the region in times to come.

## Geothermal Power Plant

Among the least polluting sources of energy, the geothermal plant project in Ladakh holds great potential. However, the author, as an environmentalist, remains concerned. On the drive to Changthang Wildlife Sanctuary—over 50 km away from Nyoma—the edges of the rocky, sandy mountains grow softer, and the pungent smell of sulphur in the air welcomes you to Puga Valley. It's here that India is building its first geothermal power plant, using energy from the Earth's core to produce 1 megawatt (MW) of electricity—enough to power at least 200 homes. Temperatures under the earth's surface are especially hot here, where over 80 hot springs can be found.

“Geothermal power can be used





for heating Army bunkers and people's homes, for greenhousing, which will save on import of vegetables. It can help with aqua farming; it can lead to the development of hot swimming pools. The possibilities are many," said Uday Shankar, project manager of the proposed plant. The project is sensitive to its ecological surroundings, given that it lies in a wildlife sanctuary of cultural importance. Puga valley is characterized by a dry desert climate and is home to several endangered species such as the snow leopard, Himalayan wolf, and six species of wild ungulates, among others. The Changthang sanctuary also has several high altitude wetlands that are significant for migratory birds. It is the only breeding site for the rare black-necked crane and bar-headed goose.

These are some of the most productive ecosystems in Ladakh, not only for wildlife but also for nomads who use these high-altitude grasslands for grazing and there is requirement and understanding as how this project might impact the ecosystem. The long-term impacts of geothermal plants on the environment are not very well studied, but a recent paper suggests the management of geothermal systems "should integrate use of resources while simultaneously protecting the

diversity of thermal features," to enhance ecosystem recovery.

Apart from being a source of energy, the hot springs in Puga Valley are significant sites for research into the origins of life and astrobiology, and have been used in traditional medicinal practices. The hot springs in Puga are used to help treat arthritic pain, spondylitis and infections of the stomach, eyes, and nose. "There is definitely a need for electricity in Ladakh, but I don't know how the technology works. What if it leads to the springs drying up in the long

term," felt a resident. In the nearest village to the proposed plant, Sumdo residents were concerned about the change of colour in the stream across their homes.

"We have electricity, but not in every house. We feel we will benefit if the plant comes up, but when we saw that the stream changed colour, we got worried," said Karma Yenden, a resident of the village. "Talk of geothermal energy has been going on for decades. It's difficult to work in such an area, so we will wait and watch if the plant comes up." The locals have to say.

## The Cost of Tourism in Ladakh

According to official data, nearly 2.5 lakh tourists visited Leh in June and July 2022, surpassing previous records. Environmentalists believe tourism is growing rapidly in the region, which may have adverse effects on its people and their future. The impact of climate change is so huge that the water crisis due to less snowfall has forced several desert villages to search for a new livelihood. Unrestricted flow of tourists has put further pressure on the local ecology. While water demand has increased, so has waste generation, especially plastic bottles. The rapid





increase in the construction of hotels and restaurants is decreasing the region's natural landscape.

Meanwhile, the government is actively promoting tourism. With the easing of road connectivity and transport, unchecked tourism will have a disastrous impact on Leh's future if ecological concerns are not addressed promptly. Promoting responsible tourism is the need of the hour. The region is a big attraction for motorbike rallies throughout the year, which leads to environmental damage. In

2018, wildlife enthusiasts and activists had protested about a major motorsport rally which would have affected the ecologically sensitive areas of the cold desert. This led to the organizers changing the routes of the event.

The allure of a Ladakh motorcycle ride lies in its hundreds of kilometres long arid, largely unoccupied terrain at heights averaging 12–14,000 feet above sea level—something that cannot be experienced anywhere else on the planet. From the border with China to the Siachen glacier in Nubra Valley to the

magnificent Pangong Lake—the region offers a visual spectacle unlike others.

With the uncontrolled influx of tourists, it does take a toll on the fragile ecosystem of the region. Sustainability is the only way out; it is no longer a niche. Tourists should minimize the use of plastic water bottles. Conservation, community, and commerce should work in sync. Ladakh is a desert, and water is scarce, so the government should host an awareness programme along with stakeholders.

One decade from now, you will be more disappointed by the things you didn't do than by the ones you did." For all those who seek adventure and the allure of nature at its finest, Ladakh should be a destination you must visit. With this thought in mind, you can ensure that the next generation will have the opportunity to experience the true beauty of Ladakh. Otherwise, a decade down the line, it may be a modified version of Ladakh, and its unique charm could be lost. ■



*A S Bishnoi is an ornithologist, entomologist, who has participated in Chilka bird census for 10 years. Shakti Bishnoi is a counsellor, ornithologist, botanist, wildlife photographer, marathon runner, and a silent observer. The couple follows a sustainable lifestyle and they constantly strive to bring awareness in people by planting native trees.*

# Millets

## The True 'Shree Anna'

India persuaded the United Nations General Assembly to observe the year 2023 as 'the International Year of Millets' in order to focus the important roles that millets can play in the global scene to ensure food and nutritional security to the population that is expected to reach 10 billion in 2050 from about 8 billion today.

**M**illets are referred to as 'Shree Anna' by many locals, meaning 'the honoured grains' or 'the food grains with divine grace' because these people hold millets with high esteem.

Millets had been among the staple foods for the people in Asia and Africa and particularly, for India for over 10,000 years.

However, millets were sidelined after the Green Revolution laid emphasis on

the cultivation of wheat, rice, and maize. As a result, their contribution to meet the food security of many communities in India declined from 25 per cent in the 1970s to less than 6 per cent whereas the per capita annual consumption fell from 35 kg to 13 kg over the last five decades.

India is the leading country in the cultivation of various millet varieties, producing an impressive 12.5 million tonnes in 2020. This constitutes a substantial portion of the global millet

production, which reached a total of 30.5 million tonnes that year. Following India, the Republic of Niger produced 3.5 million tonnes, China produced 2.3 million tonnes, Nigeria produced 2.0 million tonnes, Mali produced 1.9 million tonnes, Sudan produced 1.5 million tonnes, and Ethiopia produced 1.2 million tonnes. Among these millets, 'major millets' such as ragi (finger millet), jowar (sorghum), and bajra (pearl millet) take the lead. Additionally, there are



'minor millets,' which include foxtail, kodo, proso, buckwheat, brown top, barnyard millet, etc. India's significant production of millets plays a vital role in global agriculture.

These crops offer several advantages, particularly in their role as nutritious foods that promote health (see Table 1), and their environmentally friendly characteristics. For example, millets are fibre-rich (10–12%) that act as probiotics for the microflora in our gut, hydrate our colon, and prevent constipation. Besides, these also contain 7–12 per cent protein (7% in ragi and 11–12% in some minor millets), 2–5 per cent fat, 60–70 carbohydrates and are rich in minerals such as calcium and iron (calcium: 364 mg, 27.6 mg, 27.4 mg and iron: 4.6 mg, 3.9 mg, 6.4 mg per 100 gm of ragi, sorghum and bajra, respectively). Therefore, they reduce the risks of iron deficiency anaemia, type II diabetes, body mass index (BMI) and obesity as well as calcium deficiency, osteoporosis, hyperlipidemia, and other such malignancies.

As compared to rice, wheat, and maize, these warm weather crops are very hardy, with low requirement of water and thus, are highly tolerant to drought as well as weather conditions that are worsening year after year keeping pace with the global warming and climate change. Besides, millets



do not require chemical fertilizers and insecticides, irrigation and have comparatively low carbon footprints. However, while the crops can be grown in a relatively inferior soil, their growing periods are also short (about 3 months) and can be stored for longer. Therefore, these are more environmentally friendly, economical, and sustainable.

With the realization of these facts, India renewed its interest in millet cultivation in the last decade (2012) to meet the nutritional demand of its burgeoning population. So, in 2018, the Government of India and some states officially declared millets as 'nutri cereals' and observed the year as the National Year of Millets. Then in order to focus the important roles that millets can play in the global scene to ensure food and nutritional security to the population

that is expected to reach 10 billion in 2050 from about 8 billion today, India persuaded the United Nations General Assembly to observe the year 2023 as 'the International Year of Millets'.

The Union Budget of India presented on February 1, 2023 highlighted cultivation and production, domestic consumption and export of millet as one of the focus area of the Government of India. It has also taken into notice the fact that in spite of all the incentives provided by the states as well as the Central Government, in 2022–23 Rabi crop season the millet acreage has declined by 5 per cent in relation to a 5-year average even though the overall farm acreage increased by 14 per cent to 72.1 per cent million hectares. Therefore, the Union Budget has proposed a number of steps to reverse the trend. It



has announced support for the Research and Development in millets through a Centre of Excellence to be set up in the Indian Institute of Millet Research, Hyderabad. The Seven Sutras have been launched by Government of India (see Table 2). Besides, various other measures such as increase in minimum support price, improved facilities for marketing, provision of various subsidies and financial helps to the farmers, inclusion of millets in the mid-day meals of the school children and many such others have also been proposed in it. It is expected that India's millet mission will prove to be a boon for 2.5 crore farmers.

India had organized a two-day mega conference of the Agriculture Ministers and officials of 10 millet-growing countries in March, 2023. The objectives of this programme were to promote the awareness on farming millets and its long-term impacts on their economy, nutritional security, health and environment, truly justifying the name 'Shree Anna'. At various G20 events held in New Delhi in September, 2023, high-level delegates were served millet dishes for both lunch and dinner.

Many such steps initiated by India are also likely to present our country before the world as a 'role model' in millet farming and serve as a symbol of our country's responsibilities towards the 'global good' to face the twin challenges of food security of the 'Global South' (developing countries) and unsustainable food habit problems of the 'Global North' (developed countries) as envisioned by the honourable Prime Minister.



**Table 1: A brief account of the benefits and uses of some millets**

Millet	Benefits	Uses as food
Pearl millet (bajra)	Reduces cholesterol, aids weight loss	Khichdi, roti, upma, idli, paratha
Finger millet (ragi)	Helps reduce blood glucose levels, rich in calcium	Roti, dosas, upma, cookies, cakes
Amaranth (rajgira)	Rich in calcium	Flour, salads, cupcakes
Buckwheat millet (kuttu)	Rich in potassium, magnesium, folate, and calcium	Khichdi, chapatti, dosa, poori, sandwich, halwa, cutlets
Barnyard millet (sawan)	Rich source of fibre	Porridges, upma, dosa, payasam, pulao
Foxtail millet (kakun)	Good for cardiac health, skin, and hair growth	Dosas, cheelas, pancakes, breads
Kodo millet (kodo)	High fibre, rich in niacin	Idli, cheelas, khichdi

**Table 2: The Seven Sutras launched by the Government of India**

Sutra(Theme)	Name of the Ministries/Departments to lead the major role
Enhancement of production/productivity	Department of Agriculture & Farmer's Welfare (DA&FW), Department of Agricultural Research & Education (DARE)
Nutrition and health benefits	Ministry of Health/FSSAI
Value addition, processing and recipe development	Ministry of Food Processing Industries (MoFPI), Ministry of Tourism
Entrepreneurship/start-up/collective development	Ministry of Commerce, Department of Agriculture & Farmer's Welfare (DA&FW)
Awareness creation: branding, labelling, and promotion	All
International outreach	Ministry of Commerce, Ministry of External Affairs
Policy interventions for mainstreaming	Department of Food and Public Distribution, Department of Agriculture & Farmer's Welfare (DA&FW)

Article contributed by Dr Ramesh Chandra Parida, Retd. Professor, Odisha University of Agriculture and Technology, Bhubaneswar and Dr Pranab Kumar Ghosh, Assistant Registrar(T) & (E), National Institute of Rural Development & Panchayati Raj (NIRD & PR), Hyderabad.

# Innovations and Breakthrough in Energy Efficiency

## Solutions in the Water Heating Sector

In this article, **Rajesh Sachdev** explores the innovations and breakthroughs that have emerged in the field of water heating. Hot water is a vital necessity in our daily lives, and a significant amount of energy is consumed in its production. Mr Sachdev discusses the advancements and developments in water heating technologies that address this essential need while promoting energy efficiency.

**E**fficient use of energy in all our applications is at the very core of our life today. There are constant innovations and breakthroughs happening to increase energy efficiency in all the fields. So many activities such as bathing, laundry, cooking, dish washing, etc., need the generation of hot water. There are multiple sources of energy through which we can generate

hot water. These sources are electricity, air, gas, and solar energy. Nonetheless, ongoing efforts have been dedicated to harnessing these various sources in order to develop products and solutions that can deliver peak performance with the utmost efficiency. Let us know the various types of solutions within the water heating sector that are regarded as innovative breakthroughs in achieving

optimal energy efficiency.

Innovation of electronically-controlled instantaneous tankless water heaters has been one of the biggest innovations and breakthroughs in this field whereby maximum energy efficiency is achieved and wastage is eliminated by heating water on demand only, and at the same time maximum comfort is enjoyed by the user. The electronic feature can constantly variate the power output required based on our demand of hot water temperature and flow rate, maximizing the enjoyable user experience while bathing, washing hands, cleaning vessels, and simultaneously maximizing the energy efficiency of the clean energy that is used for generating the hot water.

The second big innovation in the field of hot water generation is the innovation of air to water heat pumps. The heat pump makes use of renewable energy for hot water generation. It extracts heat from the surrounding atmosphere and transfers it to water, thereby generating hot water. The coefficient of performance (COP) achieved is up to 3–4 by the heat pump. The concept is equivalent to reverse refrigeration, wherein the compressor and condenser are involved in the activity. COP of 4 means for every



unit of energy used to run the heat pump, correspondingly, the hot water generated is up to 4 times of the unit used. This is achieved as renewable energy is used to generate hot water.

The concept of heat pumps for generating hot water is generally used for centralized hot water applications, like in a private villa or a hotel where the quantum of hot water that is required per day is evaluated and accordingly the heat pump along with a water storage tank is selected for the application. Even here the future in innovation is coming through with instant domestic hot water generation through technologies of passive heat transfer wide plate heat exchangers, thereby cutting down on heat losses on account of storage of hot water for consumption and instead generating hot water instantly on demand, thereby once again maximizing energy efficiency and maximizing the comfort experience of the user.

The innovation of using solar energy in generating hot water has been around for some time, but a lot of innovative breakthroughs have been achieved in this technology too. Solar is now being used to generate energy which can be



interlinked with the electric grid making solar energy the primary energy source for our homes. The connection with the city electric grid allows excess solar energy produced to be given to the electric grid thereby maximizing energy efficiency. Heat pumps are also being developed now for making primary use of the photovoltaic energy, thereby

further maximizing the energy efficiency in the hot water generation by heat pumps.

Apart from water heating, there has been a tremendous breakthrough in a concept called mechanical ventilation with heat/energy recovery. Due to climate change and increased air pollution resulting from rapid urbanization, a significant portion of our lives is now spent indoors, whether in our homes or offices. To make ourselves comfortable we must rely on climate controlling systems such as heating, ventilation, and air conditioning (HVAC) equipment. Our homes and offices are thus being built tighter to have better control on the indoor climate by HVAC equipment and to minimize the energy consumption by this equipment. Here, the innovation of ventilation with energy recovery is playing a crucial role, as it brings in the essential controlled purified fresh air from outside, sucks out stale air from the indoors and at the same time passively exchanges the heat (temperature) and humidity to maximize energy efficiency along with hygiene and comfort of the space and the occupants.

*Mr Rajesh Sachdev, CEO, Blutherm.*





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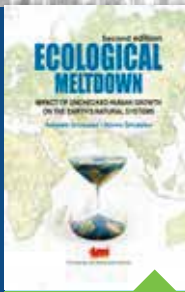
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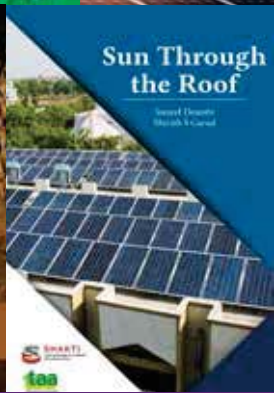
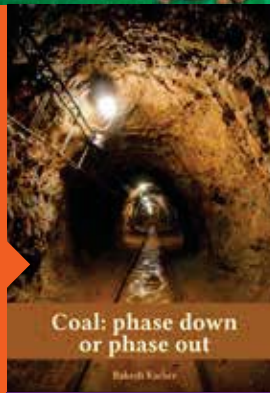


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