

TerraGreen

₹70

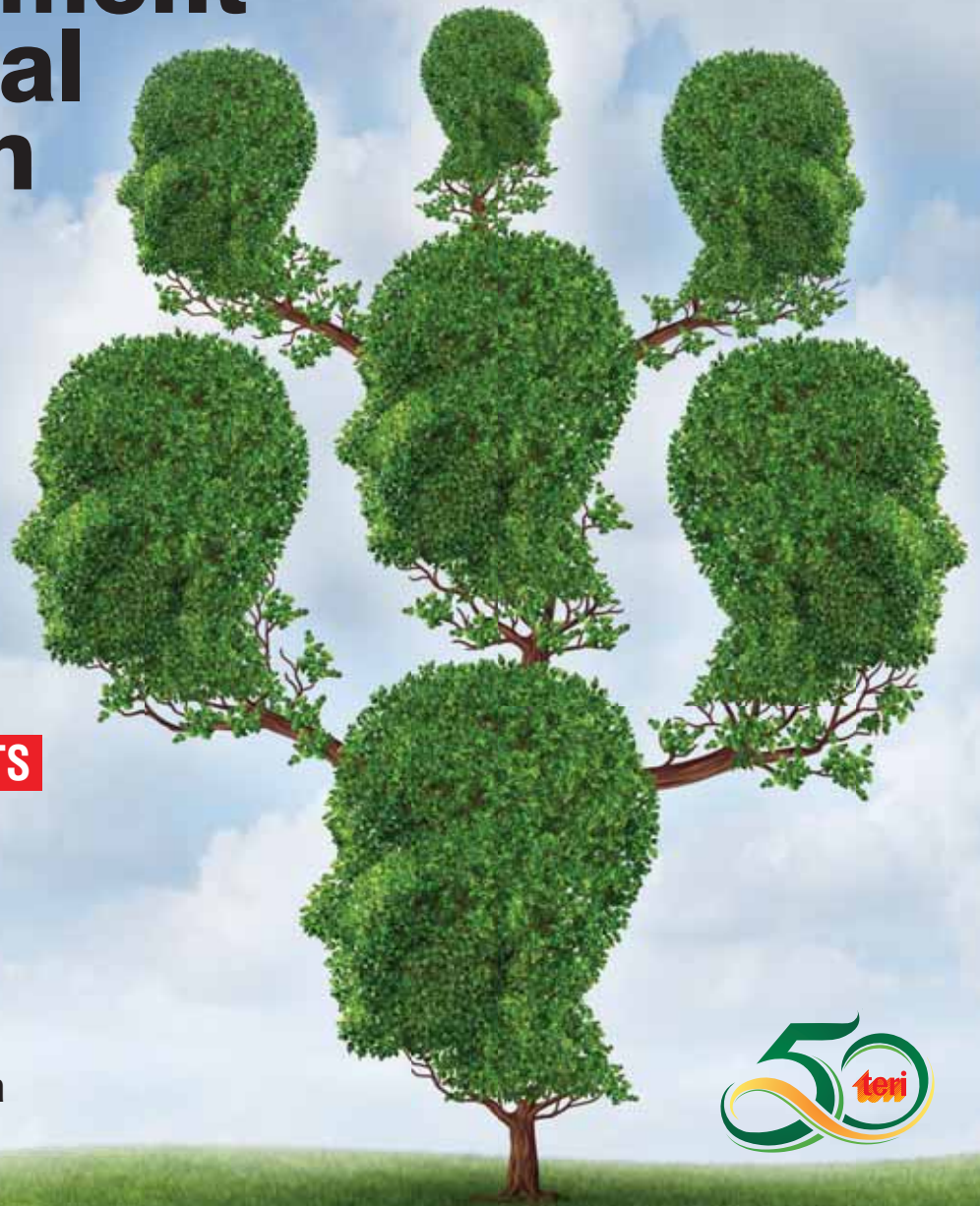


Subscriber's copy

VOLUME 16 | ISSUE 5-6 | August-September 2023

Educating about Environment is of Dual Concern

Sustenance and
Sustainability



TERRA YOUTH

Kai Po Che

SPECIAL HIGHLIGHTS

50 Years of TERI
Carbon Accounting and CBAM

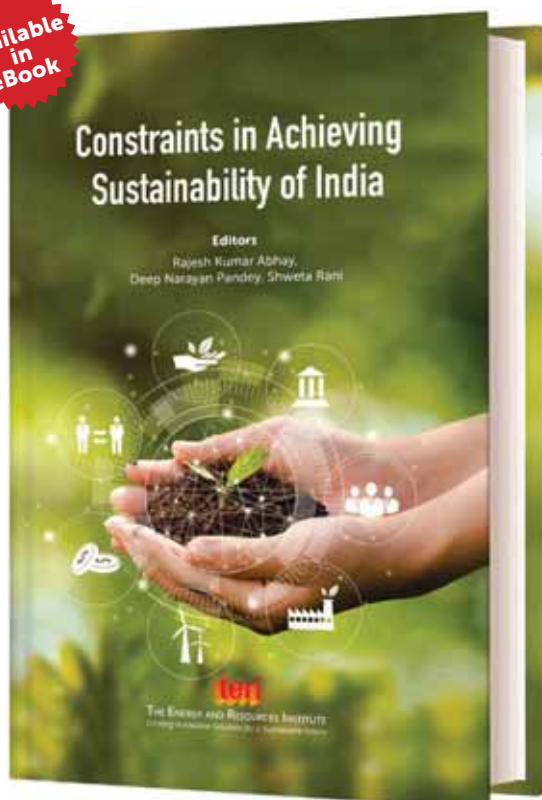
IN CONVERSATION

H.E. Jan Thesleff
Ambassador of Sweden to India



Study of the challenges to sustainable development via scientific means

Available
in
eBook



Major topics covered

- Sustainable Development: concept, components and history
- Environment, Culture, and Sustainable Development
- Sway of Indian Cinema in Diffusing Environmental Sentience
- Poverty Lines and Poor in India
- Sanitation Workers and Associated Problems for the Sustainability of Religious Events
- Assessment of Basic Infrastructure Development and Associated Issues in India

ISBN: 9789394657120 • Price: ₹550.00

Purpose of the book is to develop, contribute, and disseminate scientific knowledge pertaining to the issues related to sustainable development. The chapters are developed so that the contents can facilitate comprehension of the major constraints in achieving sustainability including but not limited to environmental, social, economic, and governance-related issues from local, regional, to national level. Resource management, climate change, agriculture, population, education, women, poverty, infrastructure, crime, corruption, governance, are the other relevant topics that have been both identified and suitably discussed. *Constraints in Achieving Sustainability of India* can be utilized as a guiding tool for realizing sustainability in development, especially, in the Indian context.

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
Fax: 2468 2144 or 2468 2145
India +91 • Delhi (0)11
Email: teripress@teri.res.in
Web: <http://bookstore.teri.res.in>

To purchase the book, visit our online bookstore at <http://bookstore.teri.res.in> or send us your demand draft or cheque in favour of TERI, payable at New Delhi (outstation cheques are not accepted).

EDITORIAL



“*TerraGreen* has been integral to our journey and consistently contributing to the dialogue that upholds the intent of ensuring common good and building a resilient planet.”

T*erraGreen* is dedicated to disseminating information and knowledge concerning environmental issues, energy, and sustainable development to its perceptive readers. Since its launch in 2004, the magazine’s primary objective has been to provide readers with analytical narrative, comprehensive reportage, on-the-ground insights from around the world, and recent updates pertaining to developmental and environmental matters. The core content encompasses a wide range of topics such as environmental health, wildlife conservation, and future energy trends.

It is an opportune moment to release a special edition of *TerraGreen* (August–September 2023) as TERI commemorates its 50th anniversary. *TerraGreen* has been integral to this journey and consistently contributing to the dialogue that upholds the intent of ensuring common good and building a resilient planet. This issue delves into a diverse range of current and compelling environmental topics. These include, but are not limited to, environmental education, carbon accounting, the connection between lightning and climate change, urban flooding, cost-effective cooling solutions, repurposing plastic bottles to reduce greenhouse gas emissions, promoting eco-friendly commutes, the intersection of climate change and animal behaviour, and much more.

In this issue, our cover story sheds light on the significance of environmental education and making the youth future ready with green skills. As we look ahead to the potential opportunities of green jobs in the future, there is a vital need for a proactive investment in Education for Sustainable Development (ESD). ESD functions as an immersive tool that not only facilitates the comprehension of environmental concerns but also endeavours to equip and empower our present generation and especially grooms young minds. It does so by fostering a comprehensive understanding of how to address their requirements through a harmonious alignment of economic, social, and environmental dimensions within the framework of sustainable development. Through this, ESD plays a pivotal role in preparing individuals to meet the challenges of tomorrow while maintaining equilibrium among diverse aspects of our world.

We aspire for our readers to not only find enjoyment in reading the articles but also to gain a deeper understanding of the ecological crisis that demands united efforts. We sincerely believe that this issue ignites a sense of hope within you to effect positive change. We enthusiastically await receiving your valuable feedback and insightful reflections, which would go a long way in strengthening the ongoing dialogue.

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

Vibha Dhawan
Director-General, TERI



I liked reading the July 2023 issue of *TerraGreen*. I am writing to express my concern and advocate for the development of comprehensive heat wave action plans in India. As we continue to witness the adverse effects of climate change, heat waves have become increasingly common and severe, posing significant threats to the health and well-being. It is imperative that we take proactive measures to address this growing issue and ensure the safety of our residents. Recent heat waves across the world have had devastating consequences, leading to heat-related illnesses, hospitalizations, and even fatalities. Vulnerable populations, including the elderly, children, and individuals with pre-existing health conditions, are particularly at risk. The scorching temperatures, combined with the urban heat island effect, can make our cities unbearably hot during these periods, exacerbating the problem. Addressing heat waves and their associated risks is a shared responsibility that requires

coordinated efforts from all stakeholders, including local governments, healthcare providers, community organizations, and residents themselves. By proactively developing and implementing comprehensive heat wave action plans, we can protect the well-being of our community and reduce the human and economic costs associated with extreme heat events.

Aniruddh Sharma
New Delhi

The July 2023 issue of *TerraGreen* offers captivating reading material. It was nice to read that India has taken commendable strides in the pursuit of sustainable energy solutions and reducing carbon emissions. The nation's commitment to phasing out oil, gas, and coal is a significant step towards mitigating the adverse effects of climate change. Several government corporations, such as the Indian Oil Corporation, Gas Authority of India, and Indian Railways, have formulated comprehensive action plans with clear timelines aimed at achieving net-zero carbon emissions. This proactive approach showcases India's dedication to environmental responsibility. Furthermore, India is making substantial investments in renewable energy sources. Notably, the development of offshore wind-power projects off the coasts of Tamil Nadu and Gujarat represents a promising avenue for clean energy generation. These projects have the potential to harness the abundant wind resources along India's vast coastline. In addition to offshore wind power, India has ambitious plans for large-scale solar power projects.

Sumit Kapoor
Kolkata, West Bengal

Editor-in-chief

Vibha Dhawan

Editorial Board

K Ramanathan

S K Sarkar

Suneel Pandey

Publishing Head

Anupama Jauhry

Editorial Team

Abhas Mukherjee

Sachin Bhardwaj

Shreya Mago

Design & Illustration

Santosh Gautam

Vijay Nipane

Production

Aman Sachdeva

Marketing, Sales & Distribution

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

Tel: 0361-2334790, Fax: 0361-2334869

Email: terine@teri.res.in

Western Regional Centre

House No. 233/GH-2, Vasudha Housing Colony,

Alto-St Cruz, Tiswadi, Goa-403 202

Tel: 0832-2459306, 2459328

Email: teriwrcc@teri.res.in

Published by Dr Ajay Mathur on behalf of The Energy and Resources Institute, Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi – 110 003. Editor-in-chief Dr Vibha Dhawan

© The Energy and Resources Institute. All rights reserved.



<http://www.terragreen.teriin.org>

Contents

VOLUME 16 • ISSUE 5&6 • AUGUST-SEPTEMBER 2023

- 4 **NEWS**
- 12 **FEATURE**
Carbon Accounting and CBAM
- 20 **IN CONVERSATION**
H.E. Jan Thesleff,
Ambassador of Sweden to India
- 26 **COVER STORY**
Educating about Environment is
of Dual Concern
- 34 **SPECIAL REPORT**
Lightning Linked to Climate
Changes

- 42 **GREEN CHALLENGES**
Rajasthan's Rooftop Solar Sector
- 54 **TERRA YOUTH**
- 64 **WILDLIFE**
Ladakh: The Land of Mystic and
Mystery
- 68 **PIONEER**
- 78 **GREEN EVENTS**

12
FEATURE



30
SPECIAL REPORT



10 TERI ANALYSIS



37 TERRA YOUTH



22
COVER STORY



G20 Leaders Adopt Green Development Pact

G20 leaders adopted a Green Development Pact to accelerate the steps needed to tackle the challenges of environment and climate change. The Green Development Pact recognizes that global warming can be limited to 1.5 degrees Celsius through reductions in global greenhouse gas emissions by 43 per cent by 2030, compared to the 2019 levels. The G20 Leaders' Declaration for the first time formally recognizes the quantum jump in finance necessary for the world to transition to a

renewable energy economy. The Declaration "noted the need for USD 5.8–5.9 trillion in the pre-2030 period required for developing countries....as well as USD 4 trillion per year for clean energy technologies by 2030 to reach net zero by 2050".

Source: G20 News Digest_2023, TERI

Launch of the Global Biofuel Alliance

Prime Minister Shri Narendra Modi along with the leaders of Singapore, Bangladesh, Italy, USA, Brazil, Argentina, Mauritius and UAE, launched the Global Biofuel Alliance on September 9, 2023, on the sidelines of the G20 Summit in New Delhi. The Global Biofuel Alliance (GBA) is an initiative by India as the G20 Chair. The Alliance intends to expedite the global uptake of biofuels through facilitating technology advancements, intensifying utilization of sustainable biofuels, shaping robust standard setting and certification through the participation of a wide spectrum of stakeholders. The alliance will also act as a central repository of knowledge and an expert hub. GBA aims to serve as a catalytic platform, fostering global collaboration for the advancement and widespread adoption of biofuels.

Source: <https://www.g20.org>



New Delhi Declaration Accepts Disproportionate Impact of Climate Change on Women

The G-20 nations on September 9 resolved to increase women's participation and leadership in climate change mitigation and adaptation, and support gender-responsive solutions to build resilience to the impact of climate change. The G-20 declaration adopted in New Delhi accepted the disproportionate impact of climate change on all women and girls, and decided to accelerate climate action with gender equality at its core. "To this end, we will support and increase women's participation, partnership, decision-making and leadership in climate change mitigation and adaptation, and disaster risk reduction strategies and policy frameworks on environmental issues, support gender-responsive and environment-resilient solutions, including water, sanitation and hygiene (WASH) solutions," the declaration said.

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



India Proposes G20 Satellite for Climate Observation to Help Countries of Global South

Prime Minister Narendra Modi said India has proposed to launch 'G20 Satellite Mission for Environment and Climate Observation' during the first day on G20 Summit in New Delhi. The proposal was put forward to launch a 'G20 Satellite Mission for Environment and Climate Observation' with an aim to help the countries of the global south. Modi during the summit said that the G20 satellite mission would be beneficial for all of humanity just as the data obtained from India's successful Chandrayaan moon mission. "With the same spirit, India is proposing the launch of the G20 Satellite Mission for Environment and Climate Observation," he said.

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

By 2080, India Could Lose Groundwater by Three Times the Current Rate: Study

The rate of groundwater depletion could triple by 2080, if Indian farmers continued to draw groundwater at the current rate, which could threaten the country's food and water security, according to a new study. Warming climate has compelled farmers in India to adapt by intensifying the withdrawal of groundwater used for irrigation, the study led by the University of Michigan, US, found. As a result, the reduced water availability could endanger the livelihoods of more than one-third of the country's 1.4 billion residents and thus, could have global implications, the study published in the journal Science Advances said.

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



Five Indian Youths Named Among 2023 International Eco-Hero Award Winners

Five youths from India have been named among 17 teen environmental activists from across the globe to receive the 2023 International Young Eco-Hero Award who have taken initiatives to tackle the world's most pressing environmental challenges. The young ecowarriors who were recognized for their efforts by the US-based non-profit organization, "Action For Nature", are Eiha Dixit from Meerut, Manya Harsha from Bengaluru, Nirvaan Somany and Mannat Kaur from New Delhi, and Karnav Rastogi from Mumbai. The International Young Eco-Hero Awards programme recognizes and encourages children and teens from ages 8 to 16 who have taken action towards solving the most critical environmental issues.

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



Biden’s Climate Act to Cut US Emissions by 2030 by 35–43 Per Cent: EPA

The US economy is on track to spew between 35 per cent and 43 per cent less carbon dioxide by 2030 from 2005 levels as a consequence of the Inflation Reduction Act (IRA), a US government report released recently showed. President Joe Biden’s IRA, which took effect in August 2022, provides billions of dollars in tax credits to help consumers buy electric vehicles and companies produce renewable energy. The Environmental Protection Agency (EPA) report analysed the impacts on an estimated \$391 billion of support under the IRA for climate and clean energy programmes and incentives through 2031.

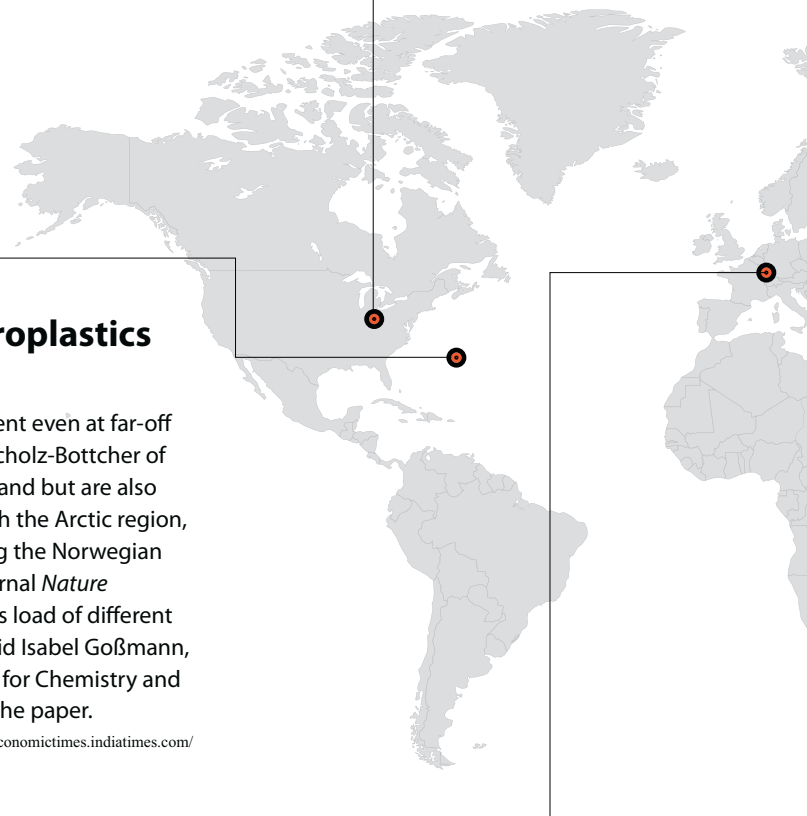
Source: <https://www.indiatoday.in/>



Study Finds How Oceans Release Microplastics into Atmosphere

Microplastic waste can be discovered in the marine environment even at far-off places in the world. According to research led by Dr Barbara Scholz-Bottcher of the University of Oldenburg, these tiny particles originate on land but are also released back into the atmosphere by the sea. In order to reach the Arctic region, the researchers collected air samples from several points along the Norwegian coast. The recent findings were published in the academic journal *Nature Communications*. “With our study, we present data on the mass load of different types of plastic in the marine atmosphere for the first time,” said Isabel Goßmann, a doctoral candidate at the University of Oldenburg’s Institute for Chemistry and Biology of the Marine Environment (ICBM) and first author of the paper.

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



Air Pollution Kills 1200 Children a Year: EU Agency

Air pollution still causes more than 1200 premature deaths a year in under 18’s across Europe and increases the risk of chronic disease later in life, the EU environmental agency said recently. Despite recent improvements, “the level of key air pollutants in many European countries remain stubbornly above World Health Organization” (WHO) guidelines, particularly in central-eastern Europe and Italy, said the EEA after a study in over 30 countries, including the 27 members of the European Union. The report did not cover the major industrial nations of Russia, Ukraine and the United Kingdom, suggesting the overall death tolls for the continent could be higher.

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





Lowest Emission Nations Hit Hardest by Unprecedented Heat in June-August Period

Countries with the lowest historical emissions experienced three to four times higher than seasonal temperatures this June-August days than G20 countries, according to an analysis conducted by an independent US-based group of scientists using a metric called the Climate Shift Index (CSI). The three-month June–August 2023 season was the warmest on record globally and the analysis by Climate Central indicates that human-caused climate change made the unprecedented heat far more likely across the globe.

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



Addis Ababa Faces Growing Climate Change Risks such as Heat, Drought and Floods

Addis Ababa, Ethiopia's capital city, will likely face increased heat waves, droughts and severe flooding over the next 67 years. These changes will pose risks to public health and infrastructure. They'll also be felt most acutely by the city's most vulnerable residents: those living in informal settlements. The increase in the city's population will be absorbed by informal settlements, the prime destination for most migrants.

Source: <https://phys.org/>

Australia Records Warmest Winter

Australia's winter of 2023 was the warmest since official records began in 1910, with average daily temperatures 1.53°C above the long-term average. According to data from the Bureau of Meteorology, the 2023 winter beat the previous record of 1.46°C above the average set in 1996. Every winter since 2012 has been warmer than the 30-year average calculated from 1961 to 1990. Global heating and weather conditions that delivered sunny days were behind the record, scientists said. For maximum temperatures, the 2023 winter was 1.85°C above average, ranking second behind the mark of 1.94°C set in 2017. The eastern region of the continent was particularly hot this year, with the temperature 2.03°C above average.

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



A photograph of the TERI building, a large, modern, multi-story structure with a curved facade and numerous windows. The building is surrounded by a well-maintained lawn and various plants, including a central fountain area. The sky is clear and blue.

50 Years of TERI

Pioneering Sustainability and Shaping the Future

As TERI celebrated its 50th year in June 2023, it reached a significant milestone in commemorating its extensive and prominent legacy as a think tank engaged in sustainable development, energy, and climate change. In this article, **Rumpa Banerjee** takes us on this remarkable journey.



As TERI entered its 50th year in June 2023, it marked a significant milestone in celebrating its extensive and prominent legacy as a think tank involved in sustainable development, energy, and climate change. TERI's mission is to usher transitions to a cleaner and sustainable future through the conservation and efficient use of energy and other resources and innovative ways of minimizing and reusing waste. These activities reflect TERI's commitment to promoting sustainable development, addressing energy challenges, and advancing environmental conservation through research, policy engagement, capacity building, technology development, and on-the-ground projects.

Our visionary abilities have been apparent from the beginning even when we started out as the Tata Energy Research Institute almost 50 years ago. During a time when energy and sustainable development were scarcely discussed in the mainstream discourse, we were at the forefront, dedicating ourselves to research and dialogue on these crucial subjects.

From the visits of high-level dignitaries such as H.E. King Charles in 2003 and H.E. Ursula Von der Leyen,

President of the European Commission acknowledging TERI's contribution to accelerate and enhance India's climate action efforts to being recognized amongst the top eight think tanks working in the climate and energy space globally, we have made an indelible mark as a research and technology think tank not only in India but internationally.

However, the achievements of TERI extend far beyond the recognition and honours it has garnered throughout its five-decade journey. We have actively promoted international cooperation in sustainability efforts through the establishment of numerous platforms and forums. This is accomplished by effectively transforming our research into technological innovations, technical services, policy advocacy, and extensive outreach. Our overarching vision for the world revolves around fulfilling multiple commitments through our endeavours. By steadfastly pursuing these commitments in our work, we aim to make significant contributions to a future that is both sustainable and equitable for all.

Beginning our five-decade-long journey as a Documentation and Information Centre at Bombay House, Mumbai, TERI set forth a mission to create a sustainable and cleaner world for all. TERI has grown into a globally renowned institution, pioneering sustainable development and environmental research. With over 1000 employees, TERI stands at the forefront of the sustainable development discourse, continuously striving to find solutions for the present and future while learning valuable lessons from the past.

In 1981, our remarkable journey as a thought leader commenced when Dr R K Pachauri took on the role of Director, while Mr Darbari Seth assumed the position of Chairman of TERI's Governing Council in 1984, marking the start of an extraordinary expedition.

TERI has experienced substantial growth. A pivotal moment in TERI's history and a testament to

International Conference on Global Warming and Climate Change was organized by TERI in 1989



the transformational work that the organization had been undertaking was when the Haryana Urban Development Authority granted 69 acres (now 100 plus) of degraded land in Gurugram's Gwal Pahari village in 1985. The campus, which was inaugurated by Late Hon'ble Prime Minister Shri Atal Bihari Vajpayee in 2002, serves as a model exemplifying the TERI's state-of-the-art capabilities to design sustainable architecture ensuring resource efficiency.

Holding true to being a pioneering institute that mainstreamed the global discourse of sustainability and sustainable development in India, TERI demonstrated its ambition and commitment to work for the planet by organizing an International Conference on Global Warming and Climate Change in 1989—a first-of-its-kind to be held in a developing country. In addition to assembling stakeholders from across the globe, including international representatives, government officials, members of civil society, and business leaders, the conference bolstered TERI's pivotal position as a catalyst for climate action and the advancement of sustainable development.

As the prevailing paths of development were marked by continuous and unabated resource consumption, we began researching technological interventions to mitigate its adverse environmental impacts. Our technology products such as Oilzapper have cleaned polluted land in several parts of India and internationally.

Contributing to carbon emissions, buildings, construction, and transport sectors have emerged as the most significant contributors. As a developing country with almost two-thirds of its infrastructure yet to be developed along with an increasingly aspirational middle class, we had been wise to India's potential for green and inclusive growth through the establishment of the GRIHA rating system for buildings.

With the aim of transforming our policy recommendations and



technological advancements into effective and customized solutions at the grassroots level, TERI has broadened its presence nationally and internationally by establishing regional centres. The objective is to foster a beneficial transformation in the lives of people worldwide.

Initiated in 2001, the World Sustainable Development Summit (then known as the Delhi Sustainable Development Summit) and TERI's presence grew exponentially beyond the sub-national and national landscape to the global stage. It was under TERI's Founder-Director Dr R K Pachauri's extraordinary leadership that the Intergovernmental Panel on Climate Change (IPCC) received the Nobel Peace Prize in 2007 for the body's remarkable efforts in raising awareness on the detrimental impacts of climate change and the need for urgent climate action at a global scale further positioning TERI at the forefront of the global sustainability movement.

Coming to the corporate sector, TERI's engagement with the corporates has played a decisive role in shaping policies by bringing together the top players in the industry. Acting as an

interface between our research and the corporate world through the TERI Council for Business Sustainability, we have highlighted the core issues businesses need to undertake to build the necessary impetus for sustainable development.

In 2008, TERI launched the "Lighting a Billion Lives" campaign to provide clean and affordable lighting solutions to remote areas of the country, emphasizing the importance of on-the-ground impact.



Mr Darbari Seth: The Visionary Founder of TERI

Acknowledging the crucial role of youth in driving systemic change and expediting environmental action, TERI established the TERI School of Advanced Studies (TERI SAS) in 1998, becoming one of India's leading academic institutions in sustainable development and environmental studies. Alongside this, TERI introduced various initiatives, including the renowned GREEN Olympiad launched in 1999, which stands as India's premier environmental quiz for school students. These endeavours, among several others, were aimed at fostering environmental awareness, nurturing a deep sense of connection with nature, and cultivating a generation of environmentally conscious individuals.

We've woven ourselves through threads of innovation, collaboration, impact, and meaningful action to develop a community of researchers, scientists, policymakers, and change-makers dedicated to creating a sustainable and equitable future.

While the globe continues to confront urgent environmental challenges, the legacy and endeavours of TERI serve as a reminder of the transformative and unwavering dedication required to achieve a climate-positive world. Our



Dr Vibha Dhawan, DG, TERI addressing the audience on the occasion of the celebration of 50 years of TERI on June 23, 2023

research and research-based solutions have had a transformative impact on industry as well as communities. TERI has persistently pushed the frontiers of knowledge, instigated profound change, and advocated for policies that promote sustainable progress over the past 50 years. Through these endeavours, TERI has been steadfast in revitalizing our planet and nurturing a greener, more livable, and resilient world for future generations.

Our success and impact lie in identifying and working on concepts and ideas that will hold relevance tomorrow. Continuing our remarkable journey, spearheading sustainability solutions and sustainable development discourse in India and Global South, working hand in hand with communities, forging partnerships with bilateral, multilateral organizations, and the government, we at TERI intend to stay strong to our vision, mission, and promise to create innovative solutions for a sustainable future for all.

As TERI's expertise has grown, so has its ambition to drive change across the country and globally. Over the years, TERI has expanded its reach in India with its regional centres in Bengaluru, Mumbai, Goa, Gurugram, Guwahati, and Mukteshwar in Uttarakhand. Enhancing its presence internationally, TERI also set up its international centre in Japan. As we look back on TERI's history, we see a tapestry woven with threads of innovation, collaboration, and impact. We observe a collective of researchers, scientists, policymakers, and advocates who have committed their lives to crafting a future that is both sustainable and equitable future. ■

Rumpa Banerjee, Communications Associate, Communications and Stakeholder Engagement, TERI, New Delhi.



The Hon'ble Prime Minister of India, Shri Narendra Modi, delivering the Inaugural Speech at WSDS 2018



Carbon Accounting and CBAM

Assessing Impact and Implications for Developing Nations

Carbon accounting and trading mechanisms have gained significant attention as effective tools to manage and mitigate carbon emissions. In this article, **Siddhartha Ramakanth Keshavadasu** aims to explore the impacts of these mechanisms on developing and underdeveloped nations, focusing on India, and consider the aspects of climate justice and energy equity.



With the intensifying impact of climate change, a wide array of measures are being undertaken globally to reduce greenhouse gas (GHG) emissions. Carbon accounting and trading mechanisms have gained significant attention as effective tools to manage and mitigate carbon emissions. However, these policies have varying implications, especially for developing and underdeveloped countries. Among them, the European Union's Cross-Border Adjustment Mechanism (CBAM) is of particular significance.

Carbon Accounting: The Bedrock of Emissions Management

Carbon accounting is a system to measure and track GHG emissions and reductions. It provides a quantitative

basis for understanding, managing, and disclosing climate change-related risks, facilitating the setting of emission reduction targets, tracking progress, and formulating mitigation strategies. It encompasses various methods, including corporate level, product level, and national level accounting, taking a comprehensive approach towards managing emissions.

Carbon Trading: Turning Liability into Opportunity

Carbon trading, or emissions trading, is a market-based approach to control pollution by providing economic incentives for reducing the emissions of pollutants. Under this system, governments or international bodies set a limit or cap on the amount of a



pollutant that can be emitted. Companies are issued emission permits and are required to hold an equivalent number of allowances, which represent the right to emit a specific amount. Companies that need to increase their emission allowance must buy credits from those who pollute less.

The EU's Cross-Border Adjustment Mechanism: A Potential Game-Changer

The Cross-Border Adjustment Mechanism (CBAM) is a component of the European Union's comprehensive strategy to combat climate change known as the European Green Deal. The CBAM is designed to reduce the risk of 'carbon leakage', where companies transfer their operations to countries with less stringent emissions regulations to circumvent the cost of compliance within the EU.

Structure and Implementation

Under the CBAM, the EU will impose a carbon cost on certain goods imported from non-EU countries that do not have

equivalent carbon pricing measures.

This implies that if the exporting country does not charge its producers for carbon emissions in the same way the EU does, those producers will have to pay a fee—the carbon adjustment—when they sell their goods into the EU.

The mechanism is expected to apply to sectors that are both high in emissions and exposed to international competition. This includes industries such as cement, steel, aluminium, electricity generation, and chemical production.

The EU intends to implement the CBAM in two phases. Initially, importers will be required to report their emissions, followed by the full-fledged application of the carbon border adjustment from 2026.

Potential Impact and Implications

The CBAM has profound implications beyond the primary goal of mitigating carbon leakage. By placing a carbon cost on imports, the CBAM can potentially drive decarbonization efforts globally, as it incentivizes non-EU countries to adopt robust emissions reductions strategies. The mechanism can also



reshape international trade and climate governance. By introducing carbon pricing into the global trading system, it has the potential to make the cost of carbon a standard consideration in international trade. This could catalyse the establishment of similar mechanisms in other jurisdictions, thus promoting global carbon pricing and emissions reductions.

Concerns and Criticisms

However, the CBAM has also sparked concerns and criticisms. There are apprehensions about its compliance with World Trade Organization (WTO) rules, particularly the principle of non-discrimination. While the EU asserts that the mechanism will be designed to comply with WTO rules, this remains a contentious issue.

Additionally, developing and underdeveloped countries express concerns that the CBAM could impose significant burdens on their industries, affecting their competitiveness and potentially hindering their economic growth. These countries argue that the mechanism might not account adequately for their differential capacities and responsibilities in addressing climate change, raising issues of climate justice and equity.

While the CBAM represents a potentially game-changing approach to reducing global emissions, it also brings complex challenges. Its final design and



implementation will need to carefully balance the imperative of climate action with the principles of fairness, equity, and compliance with international trade rules.

Implications for the Developing and Underdeveloped Worlds

At the forefront of concerns is the potential economic impact of the CBAM on developing and underdeveloped countries. Many of these nations heavily rely on their export sector as a significant source of national income. The addition of a carbon cost on their exports to the EU could have a significant effect, potentially reducing the competitiveness of these products in the European market. This could lead to a decrease in export revenues, negatively impacting the national economies of these countries.

The implications of the European Union's CBAM for developing and underdeveloped countries are manifold, and their potential impact can be illustrated using some key data points.

Economic Burden on Export-oriented Economies

Many developing countries have export-oriented economies with a significant portion of their GDP coming from exports. For example, in 2021, Vietnam's exports accounted for about 105 per cent of its GDP, and in Bangladesh, it was about 17 per cent of its GDP. Particularly concerning is that much of these exports are from carbon-intensive industries.

Under the CBAM, if a carbon cost is imposed on these imports into the EU, it could significantly impact these countries' economies. A study conducted by the European Roundtable on Climate Change and Sustainable Transition (ERCST) suggested that developing countries could see a reduction in their



exports to the EU by up to 3.2 per cent.

In addition, the adverse effects could trickle down to the local communities in these countries. Lower demand for their exports could result in job losses in sectors that are often major employers. This could potentially exacerbate poverty and inequality, posing significant socio-economic challenges.

Environmental and Health Consequences

Another significant concern is the potential environmental and health impacts of the CBAM. While the mechanism aims to prevent carbon leakage to the EU, it could inadvertently incentivize carbon-intensive industries to relocate to developing countries with less stringent environmental regulations. This could lead to a surge in local pollution, with severe health and environmental consequences for these countries.

Moreover, increased local pollution could further exacerbate the challenges these nations face in dealing with climate change. Many developing and underdeveloped countries are already particularly vulnerable to the impacts of climate change, and increased pollution could exacerbate these vulnerabilities.

Consider the steel industry, one of the most carbon-intensive sectors. In 2020, China, a developing country, produced

56.5 per cent of the world's crude steel. If industries like this shift even more production to countries with lenient regulations, it could lead to a significant increase in global emissions.

Administrative and Institutional Challenges

Finally, the implementation of the CBAM could pose significant administrative and institutional challenges for developing and underdeveloped countries. Complying with the CBAM requirements will necessitate robust carbon accounting systems, which many of these countries currently lack. The task of setting up these systems could be overwhelming, particularly for countries with limited institutional capacities.

According to the World Bank, as of 2020, only about 58 per cent of countries globally (mostly developed nations) have comprehensive GHG emission inventories. For many developing nations, building this capacity will require significant resources and time.

Furthermore, verifying emissions and calculating the carbon cost of products requires technical expertise and resources that may not be readily available in these countries. This could result in significant capacity-building needs, requiring support from the international community.

The Need for Equity and Support

While the CBAM presents a potentially powerful tool for global climate action, its implementation must carefully consider the particular challenges and vulnerabilities of developing and underdeveloped countries. To ensure a just transition to a low-carbon economy, measures such as the CBAM must be accompanied by significant support for capacity-building and technology transfer, as well as provisions to safeguard the competitiveness of these nations in the global market. Only through such a balanced approach can the world achieve the twin objectives of effective climate action and equitable economic development.

Climate Justice and Energy Equity: A Balanced View

Climate justice refers to the ethical and political issue that, while the impacts of climate change are felt by everyone, they are not distributed equally. The least developed nations, which contribute the least to global emissions, often suffer the most from climate change's impacts. In this context, the CBAM offers a dual narrative. On the bright side, the CBAM could potentially motivate developing



countries to hasten their transition to greener technologies and practices. By factoring in the carbon cost into the price of goods, the CBAM makes low-carbon technologies more competitive, creating an economic incentive for cleaner production methods. This could lead to significant global emissions reductions, contributing to the fight against climate change.

However, from a climate justice perspective, the CBAM could also be seen as exacerbating existing global inequities. Developed countries, which historically have contributed the most to global emissions, are effectively exporting the cost of carbon mitigation to less developed nations through CBAM. These nations, already grappling with the

adverse impacts of climate change, are thus faced with the additional burden of adapting to the carbon cost imposed by the CBAM.

Global Inequities in Carbon Emissions

Historically, developed countries have contributed the most to global GHG emissions. According to the World Resources Institute, as of 2011, the United States and the European Union were responsible for approximately 52 per cent of total cumulative carbon dioxide emissions since 1850. Meanwhile, India accounted for just 3 per cent, despite having a much larger population.

This highlights the inequity at the heart of climate change—countries that have contributed the least to the problem are often the most vulnerable to its impacts. A mechanism such as the CBAM, which imposes a carbon cost on imports, could exacerbate these inequities if not carefully designed and implemented.

Energy Equity: The Challenge of Fair Transition

Energy equity, a fundamental principle of fair energy access and affordability, could also come under strain due to CBAM. Achieving energy equity involves



ensuring that everyone has access to affordable, reliable, and sustainable energy sources.

As many developing countries are in the midst of their energy transition, the introduction of CBAM could create new challenges. If these countries are unable to quickly shift to low-carbon technologies due to lack of resources or technical capacity, they may face increased costs for their energy-intensive goods. This could hamper their energy transition, making renewable energy sources more expensive compared to traditional, fossil fuel-based energy, thereby undermining the goal of energy equity. On the other hand, the CBAM could also potentially stimulate investment in renewable energy technologies in these countries. Making carbon-intensive goods more expensive might incentivize the shift to renewable energy sources, thereby accelerating their energy transition.

However, this positive outcome will require substantial support from the international community in the form of financial resources, technology transfer, and capacity-building.

The Challenge of Energy Equity

Energy equity is another crucial aspect. The International Energy Agency reported that as of 2020, nearly 770 million people globally did not have access to electricity, and 2.6 billion people lacked clean cooking solutions. Most of these people live in Sub-Saharan Africa and developing Asia, indicating significant regional disparities in energy access.

Implementing the CBAM could potentially hamper the energy transitions of developing nations. If the additional carbon costs associated with the CBAM make renewable energy sources relatively more expensive compared to fossil fuel-based energy, it could impede efforts to improve energy access and equity.



Renewable Energy Costs and Potential

However, there are also potential benefits to consider. The cost of renewable energy technologies has been falling rapidly. The International Renewable Energy Agency (IRENA) reported that between 2010 and 2019, the cost of electricity from solar photovoltaics decreased by 82 per cent, and onshore wind costs fell by 39 per cent.

This trend could potentially offset some of the increased costs associated with the CBAM, and even spur a faster transition to renewable energy in developing countries. In turn, this could contribute to both climate mitigation and energy equity.

Striking a Balance

While the CBAM holds potential as a tool to promote global emissions reductions, it also presents challenges in terms of climate justice and energy equity. A balanced approach is required to ensure that CBAM does not unfairly burden the developing and underdeveloped nations.

This could involve providing financial and technical assistance to these nations to develop their carbon accounting systems, invest in low-carbon technologies, and strengthen

their capacity to adapt to a low-carbon economy. Moreover, special considerations might be needed for the least developed and most vulnerable countries, to protect them from potential adverse impacts.

As the global community moves towards implementing CBAM, it is vital to ensure that this mechanism contributes to a fair and equitable transition to a sustainable, low-carbon world.

India's Stance and Implications

India, a rapidly developing country, faces the twin challenges of uplifting its vast population out of poverty and mitigating climate change. With a population of over 1.3 billion, India's energy demands are huge and growing. Over 70 per cent of its electricity is generated from coal, a highly carbon-intensive source. While India has ambitious renewable energy targets, achieving these targets while meeting its development needs presents a complex challenge.

Potential Impacts of CBAM on India

Given India's energy landscape, the implementation of the CBAM by the EU could have significant implications for

India's economy. India's exports to the EU, particularly in energy-intensive sectors such as steel, cement, and chemicals, could become less competitive due to the added carbon cost. This could result in lower export revenues, potentially affecting jobs and income levels in these sectors.

Moreover, the costs associated with upgrading to low-carbon technologies or purchasing emission permits under the CBAM could place additional strains on Indian industries. Many of these industries operate on low-profit margins and could struggle to bear these additional costs. This could potentially lead to industrial stagnation or even decline, with adverse consequences for India's economic growth and employment levels.

The Silver Lining: Opportunities for a Green Transition

Despite these potential challenges, the CBAM could also present opportunities for India. By increasing the cost of carbon-intensive goods, CBAM could

encourage Indian industries to accelerate their transition to greener technologies. This could stimulate innovation and investment in India's renewable energy sector, potentially unlocking new opportunities in the global low-carbon market.

Additionally, the CBAM could incentivize the Indian government to enhance its climate commitments, leading to stronger emission reduction targets and policies. By aligning its development strategies with global climate goals, India could position itself as a leader in sustainable development.

Navigating the Challenges: The Need for a Balanced Approach

However, navigating these challenges and seizing these opportunities will require a balanced approach. India would need to build its capacity for carbon accounting and emissions verification to comply with CBAM requirements. This would require financial resources, technical expertise, and institutional capacity, requiring support from the

international community.

Moreover, India could engage in negotiations with the EU to ensure that CBAM is implemented in a way that recognizes the differential capacities and responsibilities of developing countries in addressing climate change. This could involve advocating for special provisions for developing countries, such as phased implementation or financial and technical assistance.

While the CBAM presents significant challenges for India, it also opens up new possibilities for accelerating its green transition. With strategic planning, international cooperation, and a balanced approach, India can turn this challenge into an opportunity for sustainable development.

Towards a Just and Equitable Carbon Market

In principle, the CBAM presents a significant step towards a more effective global carbon market, internalizing the environmental cost of carbon-intensive goods and creating economic incentives for emission reductions. However, for it to truly succeed, it must be equitable and supportive of developing nations.

Developing nations, which often have fewer resources and capacities to address climate change, require additional support to participate effectively in global carbon markets. This could take various forms such as:

Capacity-building for carbon accounting: The CBAM requires robust carbon accounting and verification systems. Developing nations would need support in building the necessary institutional and technical capacities to implement these systems effectively. This could involve technical assistance, training programmes, and partnerships with international bodies and institutions.

Technology transfer: Reducing emissions often requires access to advanced low-carbon technologies, which can be expensive and out of reach



for many developing nations. Technology transfer from developed to developing countries could facilitate the adoption of greener technologies and practices, reducing emissions and enhancing competitiveness in the low-carbon market.

Financial support: The additional costs associated with transitioning to low-carbon technologies or complying with CBAM requirements could be challenging for developing nations. Financial support, such as grants, concessional loans, or special funds, could help offset these costs, enabling these countries to participate in the carbon market without compromising their economic development.

Flexibilities for least developed countries: The least developed countries, which often have the least capacity to deal with climate change, may need special considerations. This could involve phased implementation of the CBAM, allowing these countries more time to adjust to the new requirements, or exemptions for certain sectors or goods.

Balancing Climate Action and Socio-Economic Development

However, even with these support measures, it is crucial to strike a balance between climate change mitigation and socio-economic development. Developing countries are often grappling with the dual challenges of reducing emissions and lifting their populations out of poverty. Therefore, climate policies such as the CBAM must be designed and implemented in a way that does not hamper their development aspirations.

This could involve integrating climate action with development planning, ensuring that emission reductions go hand in hand with job creation, poverty reduction, and economic growth. For example, investments in renewable energy could create new jobs, increase energy access, and reduce emissions simultaneously.



Conclusion: Towards an Equitable Low-Carbon Future

In conclusion, while mechanisms such as the CBAM have the potential to be instrumental in tackling global emissions, they must not exacerbate existing inequalities. As the world steers towards a low-carbon future, ensuring that all nations are on board is not just a matter of fairness, but a necessity for achieving the collective global goal of climate change mitigation.

Creating a just and equitable carbon market will require international cooperation, mutual support, and a commitment to both climate justice and energy equity. With these principles at the forefront, carbon accounting and trading mechanisms can pave the way for a sustainable, equitable, and low-carbon future.

References

World Bank. (2023). World Bank Open Data. Details available at <https://data.worldbank.org/>
European Roundtable on Climate

Change and Sustainable Transition. (2023). Development impact of EU's CBAM. Details available at <https://netorgft4529571-my.sharepoint>.

World Steel Association. (2021). World Steel in Figures 2021. Details available at <https://www.worldsteel.org/media-centre/press-releases/2021/world-steel-in-figures-2021.html>

World Resources Institute. (2014). World Resources Report: Creating a Sustainable Food Future. Details available at <https://www.wri.org/publication/world-resources-report-creating-sustainable-food-future>

International Energy Agency. (2021). Energy Access Outlook 2021: From Recovery to SDG7. Details available at <https://www.iea.org/reports/energy-access-outlook-2021>

International Renewable Energy Agency. (2020). Renewable Power Generation Costs in 2019. Details available at <https://www.irena.org/publications/2020/Jun/Renewable-Power-Costs-in-2019> ■

Siddhartha Ramakanth Keshavadasu, Assistant Professor, Centre for Energy Studies, Administrative Staff College of India, Hyderabad, Telangana, India.



75 Years of Sweden– India Bilateral Ties

Building–Consolidating–Accelerating

Central to Swedish values is the belief that cooperation and co-creation are key. This principle is strongly advocated by Jan Thesleff, the Swedish Ambassador to India, who emphasizes the crucial role of bilateral diplomacy in shaping international relations. As Sweden and India celebrate the 75th anniversary of their diplomatic relations this year, it is imperative to send a resounding message to strengthen this partnership. The partnership is critical to ensuring sustainable supply-chains and promoting competition in emerging markets. This can be achieved by working together closely and by resource sharing.

Under the Swedish Presidency of the Council of the European Union (EU), from January to June 2023, there have been notable efforts to go beyond the traditional bilateral framework and build relationships with external individuals and groups. By hosting events and working with experts in various fields, including health, environment, science, innovation, and international affairs, Sweden has been able to identify key principles and strategic opportunities for expanding business opportunities in India. In addition to working with Heads of State, EU member Governments, the host Government, and other diplomatic communities, Sweden's approach has provided leadership. Bilateral relations between Sweden and India are based on mutual respect and have a long tradition of over 100 years of Swedish economic presence. Here, *TerraGreen* editorial team is in conversation with **H.E. Jan Thesleff**, Ambassador of Sweden to India. In this interview, he talks about the importance of bilateral diplomacy and the continued growth of India-Sweden relations.



Sweden and India are engaged on many fronts—environmental, economic, and social. Picking up on the environmental theme, could you highlight key developments in this area and explain how your work with Indian companies is having a sustainable impact in an integrative way?

Sweden is, if I may say so, a pioneer in the field of environmental policy. With its evolved social system and innovation-driven economy, the country is known for its unwavering commitment to

environmental protection. The first world conference to make the environment a major issue was held in Stockholm in 1972 and was called the United Nations Conference on the Human Environment. Sweden's comprehensive policy framework demonstrates the country's single-mindedness to using cutting-edge technologies and pricing methods that discourage environmentally harmful practices. When it comes to prioritizing sustainability in policy, Sweden is at the forefront.

Numerous private sector companies exemplify the combination of innovative Swedish design and inventive Indian methods to address challenges such as waste management. To cite just a few examples: IKEA has ingeniously incorporated rice straw into its product design, while Ericsson has collaborated with the Indian Institute of Technology Kanpur to develop information and communications technology solutions to monitor pollution. In addition, Tetra Pak and Bioendev have made great strides in producing sustainable biochar by using plant-based polymer packaging in collaboration with the Office of the Chief Scientific Advisor and the National Agri-Food Biotechnology Institute of the Indian government. These examples are representative of the wide range of promising solutions currently being implemented in this area.

The Swedish-EU Presidency considered climate change as an urgent environmental policy issue and as one of its priorities. To avert a global catastrophe, decisive and comprehensive measures must be taken worldwide to shift to a sustainable energy supply that reduces dependence on fossil fuels. The seriousness of the issue is demonstrated by the recurring natural disasters involving loss of life, significant material damage and psychological distress. Therefore, recognizing the urgency of this situation is non-negotiable.

Another Swedish Indian government initiative, the Leadership Group for Industry Transition (LeadIT), a joint



H.E. Jan Thesleff, Ambassador of Sweden to India

initiative of the Swedish and Indian governments in collaboration with the World Economic Forum during the United Nations Climate Action Summit in September 2019, is dedicated to working with nations and businesses committed to implementing the Paris Agreement. It is exciting to see that Tata Steel has recently joined LeadIT to strengthen its carbon neutrality efforts. Another implemented targeted initiatives such as the India-Sweden Innovations Accelerator, which aims to bring Swedish green SME-based solutions to India, and the India-Sweden Green Transition Partnership, which leverages proven solutions from large companies to accelerate green transformation in priority sectors are worth the mention.

In continuation to the above question, many would argue that combating climate change is a green dream that is simply too costly to achieve. Also, because switching to green technologies is costly. What are the Swedish initiatives and positions on climate change, including renewable energy and broader investments in technologies that can help create a decarbonized economy and sustainable growth?

Addressing climate change issues is at the heart of our work as a country and as a diplomatic mission. We support

projects where we can. The Swedish government views climate change as an imminent global threat. We believe the world must take action now to radically reduce greenhouse gas emissions, ideally limiting the average global temperature rise to 1.5°C above pre-industrial levels. In Sweden, we have committed to being carbon neutral by 2045.

In today's world, businesses are striving for sustainability and sustainability-minded consumers are demanding greener options. It is well understood that sustainable, green products often come at a higher price. The important thing here is to understand the value of green technology and how it can be implemented. After all, tomorrow's climate goals cannot be fully met with yesterday's technologies.

Two Swedish competencies, a well-known Swedish concept, Symbiocity, and a technology based on a vacuum-enabled waste collection and management system, are a small but hopefully significant step towards more efficient waste management process and reduced greenhouse gas emissions, to name just two examples. At the same time, many of the Swedish measures are helping us to start a dialogue on how to deal with environmental issues in fast-growing urban areas.

To give you another example, Sweden is a leader in renewable energy and



has largely banned fossil fuels from its electricity and heating industries and has the highest share of renewable energy in the European Union. We are committed to improving energy infrastructure and maintaining Sweden's position as a world leader in smart grids and green transition. The alliance between Sweden and India in the field of renewable energy is of utmost importance. By signing of a Memorandum of Understanding, both countries intend to explore the possibility of microgrids powered by sustainable energy sources.

In summary, I hope that the relationship between Sweden and India will be strengthened, and that this very

positive development will continue in the context of the green transition, and that India's interest in Sweden will increase—adding value to both countries.

Sweden is at the forefront with its share of knowledge, state-of-the-art technologies, and innovations. As a country, you are constantly looking for partners to further develop technological interventions for the benefit of Sweden, India, and also other countries. Mr Ambassador, how do you assess the Swedish innovation ecosystem and how do you see Swedish innovation performance in different areas and parameters?

When the Hon'ble Prime Minister of India, Narendra Modi, and our then Prime Minister, Stefan Löfven, announced the Sweden-India Innovation Partnership in 2018, they put the enabling power of innovation at the heart of our bilateral relationship.

First of all, the Sweden-India Innovation Partnership has developed steadily in recent years, and several high-level diplomatic visits have strengthened interest in bilateral cooperation between the two countries. The partnership has generated a lot of interest among innovators in both countries. Sweden is committed to promoting



entrepreneurship and is equally eager to facilitate meaningful work with international companies within its borders. This is an exciting opportunity for aspiring entrepreneurs who want to stand out from the crowd.

The Swedish business concept offers a significant advantage to foreign investors, as the country provides a favourable environment for entrepreneurs and makes a strong case for doing business in Sweden. Both countries strive towards making it easier in practice for innovators, start-ups, incubators, and investors to connect and collaborate. The Manthan platform developed by India is interesting in this regard, as it facilitates collaboration between industry and the scientific research and development ecosystem at scale. Sweden is known for its research and innovation, and has led to successful start-ups such as Skype, Spotify, Truecaller, and King. Numerous Swedish start-ups are making a name for themselves around the world by developing innovations such as crowdsourced fishing apps and e-commerce platforms such as TicTail. With a proven track record and bright prospects, Sweden is a reliable choice for business and innovation.

And to your question about how I envision the path of innovation between Sweden and India, I must emphasize that Sweden and India have made a joint commitment to establish and support bilateral innovation. Both countries have launched joint projects in industrial research and development (R&D) and technological innovation projects to address challenges and opportunities identified by both sides. To name a few examples, in 2019, the Department of Science and Technology (DST) and Vinnova (Swedish Agency for Innovation Systems) launched a jointly funded industrial R&D programme in the field of smart cities. In addition, the DST and the Swedish Energy Agency have launched a jointly funded smart grid programme. A joint programme on the



circular economy is underway, involving no less than five Swedish and four Indian funding agencies.

With the launch of the National Smart Cities Mission – in 2015 – India has joined hundreds of countries around the world that have jumped on the bandwagon of developing smart cities. By investing in innovative smart technologies to develop green and sustainable urban centres, India aims to build at least one hundred smart cities across the country. Where do you see Swedish connections in terms of establishing collaborations to develop next-generation sustainable solutions for cities that can be tested in local conditions?

The way we build our cities, use energy, transport people and goods, and manage our landscapes must change fundamentally. Sweden and India recognize that sustainable smart cities, e-mobility, and infrastructure are critical to spur and reignite growth, achieve the 2030 Sustainable Development Goals, and mitigate climate change risks in line with the Paris Agreement.

Since Prime Minister Modi's visit to Sweden in 2018, the innovation partnership has become the flagship of Swedish relations and has gained

strength—a common thread running through all areas of collaborations—for example, artificial intelligence, smart sustainable city, etc. Swedish enterprises and the government have already been in collaboration with various industries in India.

Sweden ranks 2nd in the Global Innovation Index and 1st in the Global Sustainability Index. Sweden's long history of innovation in design, energy efficiency, ICT, and recycling processes, as well as its national commitment to climate change mitigation and natural resource conservation, make it a perfect partner for India. Sweden and India are now entering a new era of responsible and disruptive technological innovations that engage everyone, care for the planet and make a difference. It is important to see how Sweden and India can work together to address this crisis and create a sustainable future for both countries. Therefore, research collaboration between leading research institutions and universities from Sweden and India will play an important role in developing next-generation smart city solutions that can be tested in local conditions.

Digital technologies offer a number of critical tools for businesses—tools that can ensure greater efficiency and



provide access to new opportunities. Innovation leading to a new era is at the core of the Sweden-India partnership. Digitalization is a truly innovative area that fits very well into your bilateral relationship. How and in what ways do you see working with India to develop joint solutions for the benefit of all?

Let me answer it this way. We live in a world where technology is becoming the norm for change, in society and industry. Our innovation partnership with India has strengthened our exchanges with the world's major emerging economies. However, the main focus is to use the innovation partnership to develop further long-term partnerships based on the three key principles of co-financing, co-development, and co-creation of innovation.

In the age of globalization, digital platforms have become an important tool for businesses. Over the past two decades, well-known companies have established their own platforms to manage relationships with their suppliers, facilitate communication and data sharing among their employees worldwide, and engage with their customers. The digital landscape also includes a variety of public platforms, including social networks, e-commerce

sites, and online marketplaces that connect individuals and businesses around the world.

India represents a major opportunity for Swedish companies in the areas of digital literacy, innovation, security, infrastructure, and management. Sweden is therefore committed to working with India in the long-term to connect our innovation systems and promote opportunities for the benefit of both countries and global companies.

I come to an important question about trade. How do you think bilateral trade between Sweden-India has developed and do you foresee a robust economic and development partnership in the coming years? Also, is Sweden considering exploring new business opportunities with India and expanding manufacturing, research and development, innovation, and services?

Sweden has long been recognized as a leader in trade with a strong commitment to research, development, and innovation. Our multinational companies have been instrumental in building a solid R&D infrastructure, attracting top talent and creating a domestic market for high-quality products and services. Bilateral trade

between India and Sweden is currently growing rapidly, with companies increasingly investing across borders. Over the centuries, Sweden's economy and development have benefited from international trade.

The exchange of knowledge and the use of comparative advantages is beneficial to all parties. Sweden's generous contribution to World Trade Organization (WTO) technical assistance to help officials from developing countries increase their expertise in international trade is a testament to its commitment to the international trading system.

We support a mutually beneficial agreement in the ongoing free trade negotiations between the EU and India. Sweden has confidence in India's future and believes that Indian companies have good reason to trust Sweden. Most Swedish companies operating in India are planning to expand their operations in the next three years.

I now come to the second part of your second question. I would like to say a few words about the importance of trade. I have been involved in trade-related issues for many years in various countries, and I cannot emphasize enough how much it brings countries closer together and contributes to economic development.

If I may add, economic growth is a prerequisite for addressing social challenges too. There are simply not many examples of countries in the world that have achieved sustained economic growth without opening up to trade. We could take Sweden as a good example of the crucial role that trade can play in sustainable economic growth.

There are clear signs of willingness and optimism to achieve desired goals in science and technology, trade, climate, and interpersonal relations. What do you expect from further expansion of cooperation in all areas and further deepening of constructive and strategic dialogue between the two

countries?

And yes, this year is an important year: bilateral relations between Sweden–India have been established for 75 years, Sweden held the Presidency of the Council of the European Union, and India holds the G20 Presidency. When you sum up the meaningful moments of all these years and look ahead, what conclusions do you draw?

I see these bilateral relationships as a space for in-depth reflection, analysis, and insight into diplomacy. The milestones you mentioned give us a moment to reflect. Rather than focusing on the many past accomplishments of bilateral diplomacy, many of which involve issues of international trust, the need for global solutions, and the value of local partnerships, let us focus on optimism in addressing national, regional, and global challenges.

Cooperation and partnership offer numerous advantages for both sides. To sustain the bilateral relationship that has existed for 75 years, trust and cooperation must remain strong. Mutual openness and cooperation should be paramount to enable the exchange of knowledge and experience and to learn from each other's successes and setbacks. Under the current circumstances, Sweden and India can greatly benefit

from improving their economic relations through more intensive cooperation and partnership, even if they are different in nature.

The Swedish Embassy in New Delhi is committed to the further development of India–Sweden relations. The goal is for the positive trend to continue and for India's interest in Sweden to grow. This symbiotic relationship will be a rewarding experience for both our nations.

Before I conclude, I would like to hear your thoughts on what we have heard about the transition from an era of "engagement and cooperation" to a new era of "competition and cooperation" in international diplomacy. What do you think about this changed and intricate landscape?

This shift, if it is real, is a reminder that international diplomacy is not above politics. The Sweden–India bilateral relationship also exemplifies an exceptional commitment to undertaking important and critical activities. These strong relationships are designed to instil a sense of commitment to social, economic, and environmental concerns. As Sweden and India celebrate 75 years of tireless bilateral cooperation, it is clear that no one can bear the burden of responsibility alone. Together, they are



determined to strengthen cooperation in areas such as economics, trade, culture and the environment for the benefit of both countries and their citizens.

As Swedish EU Presidency culminates, it is an ideal time to assess important areas such as competitiveness, environment and energy progress, and democratic values. It is also an opportunity to lay the foundation for a promising future that utilizes innovative technologies, modern infrastructures, and hardworking workforce. While believing that there is ample scope for both our countries to align our goals and capacities in the coming decade, it is at the same time critical to note that this is more than just business-as-usual, as India and Sweden face enormous challenges that require both parties to engage and leverage their expertise.

And, if I may add...

I am lucky to be representing Sweden here in India—in this fantastic country with all its possibilities and promises. I could not imagine a more interesting and exciting place to be.

I am very happy about the good relations between our countries and how trade between us, both in goods and services, has continued to grow, even in times of financial turmoil experienced during the COVID-19 crisis. With this, I look forward to many more promising years of strong bilateral relations and joint efforts between Sweden and India. ■



A close-up photograph of a hand using a green marker to draw a globe on a grid-lined notebook. The word 'EARTH' is written in large, green, outlined letters to the left of the globe. Several other markers in yellow and blue are scattered on the desk surface. The background is a light green desk.

EARTH

Educating about Environment is of Dual Concern

Sustenance and Sustainability

In this article, **Dr Livleen K Kahlon** says that acquiring green skills has become an essential requirement of our time as green skills pave the way for job opportunities that contribute to the preservation of ecosystems and biodiversity. Design of quality education and training opportunities for young people is a pre-requisite for enhanced employability under the sector of green skills. Institutions design activities and projects to meet the rising expectations of the young minds. To be able to match requirements of green jobs to be created in future, a timely investment in Education for Sustainable Development (ESD) is therefore highly recommended.





The year 2023 will be recorded as a year of many firsts. India takes over the position of world's most populous country. India is moving ahead from *Chandrayaan* and planning for *Gaganyaan*. India has assumed the G20 Presidency and will convene the G20 Leaders' Summit for the first time in the country. India also now has the highest youth population in the world, harbouring 66 per cent of the overall population under the age of 35 years. The development canvas at 76th year of India's independence is thus vibrant with exponential, political, economic, and technological growth. A burgeoning population of millennials and GenZ is force to reckon with, offering both an opportunity and a challenge. The point here is that the millennial generation measures time by the nanoseconds and hence, they are in a constant need of new products and services. Change is thus the only constant in the 21st Century. In this context, the role of youth is critically important as they are the most significant building blocks of the society, and important sources of creativity, enthusiasm, and drivers of social change. Benjamin Disraeli (British politician and author) has rightly said, "Youth of a nation are the trustees of posterity. We must prepare them for the coming hour."

Education has a major role in enhancing the preparedness of the youth to tune their skills and

achievements to enter the job market of the future. As per the findings of the World Economic Forum, nearly half of employed workforce will need to reskilled by 2025. Soft skills will play a major role in retaining jobs and also be engaged in self-management through resilience, stress tolerance, and active learning. This reminds one of the state of Alice in the famous bestseller novel by Lewis Carroll, "*Alice in Wonderland*." "It takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!" The youth of today have to work harder to get out of the existential crisis to be able to engage in real progress. Getting equipped with green skills is a need of the hour, and this needs a philosophy of *Unlearn, Relearn, and Learn*. Green skills open up opportunities of jobs that help to protect ecosystems and biodiversity, reduce energy, materials, and water consumption through high efficiency strategies, decarbonize the economy, and minimize or altogether avoid generation of all forms of waste and pollution.

Natural resources are being over-utilized. Climate is changing. Habitats are being altered. Biodiversity is impacted due to human actions. Need for 'development over growth' cannot be underscored. But amongst all these conditions that we cannot control, is the education system that we can orchestrate and curate

as per the changing requirements. To move away from a narrative that will create eco-anxiety, anthropocene (current planetary epoch) is therefore an opportunity that supports creativity and new ideas to counter the long standing impacts of environmental and socio-economic fallouts. The ILO report also projects an increase of millions of new jobs by 2030 through the adoption of green and blue policy measures. Design of quality education and training opportunities for young people is a pre-requisite for enhanced employability under the sector of green skills. Green talent in the workforce is rising worldwide. The share of green talent increased from 9.6 per cent in 2015, to 13.3 per cent in 2021 (growth rate of 38.5 per cent). This growing hype about green skills is a blessing for the young, as it provides an early opportunity to change their academic and training trajectories to focus on competencies and skills that will make them more employable in future. A favourable ecosystem is being created by people actively acquiring new skills and pursuing new ventures, and many employers reinventing business models and creating new markets. Green skills rest on our competencies to reimagine the future of work. A speeded transformation in the availability of types of skills and jobs is a prerequisite for a greener transition.

In the above context, institutions design activities and projects to meet the rising expectations of the young minds. To be able to match requirements of green jobs to be created in future, a timely investment in Education for Sustainable Development (ESD) is therefore highly recommended. It acts as an experiential tool that facilitates learning on environment issues. It also aims to educate, empower and prepare our current generations to meet their needs using a balanced approach towards the economic, social and environmental dimensions of sustainable development.



All students must study climate change, sustainability

August 2023

All students at India's universities will have to study subjects such as environmental education and climate change in order to graduate, starting from the about-to-begin 2023 to 2024 academic year, according to guidelines from the University Grants Commission (UGC), the country's higher education apex body. The new course will include the national obligation to achieve the United Nations Sustainable Development Goals. As per UGC guidelines issued on the direction of the Ministry of Education, the course design should be based on community engagement and service, practical understanding of threats to the environment and 'value-based' education to learn about environmental protection and sustainable development.

TERI upholds a robust Environment Education and Awareness (EEA) programme with a mandate to raise awareness, enabling young people to understand their relationship with the environment and actively participate in its conservation. This aims to create a 'quality' environment that leads to improved standards of living. Started as an enabling unit under Policy Analysis Division (PAD) of TERI in 2002, this unit has transformed into a division, maintaining an intense engagement with students, teachers and youth in promoting environmental sustainability and supporting them in value-based learning for creating environmentally responsible citizenry and self-reliance in communities. Projects implemented by EEA are value-based initiatives, as the impact of any ESD (education for sustainable development) is primarily a change in lifestyle. EEA reaches out to nearly 25,000 schools and 10,000 colleges in India annually through various activities and programmes on environmental sustainability. The team comprises of ESD professionals with specializations in Social Work, Environment Science, Environment Management, Economics, Rural Marketing and Management, Political Science, Sociology, and Life Sciences.

History of Environment Education

The foundation for Environmental Education was laid in the 18th century by Jean-Jacques Rousseau the French Philosopher and Louis Agassiz a Swiss naturalist who

stressed the importance of environmental awareness with education that focused on the “study of nature, not books”. In the late 19th and early 20th century, environmental education was imparted using fables and moral lessons, which aimed to help students realize the importance of the environment and appreciate its natural state. Anna Botsford Comstock from Cornell University wrote the *Handbook for Nature Study* in 1911 to educate children on cultural values using principles of Nature. During the 1920s and 1930s, Conservation Education emerged as a new field, which was different from the earlier Nature Study as it focused primarily on a scientific approach to Nature rather than the study of its history and characteristics. The 1960s and the 1970s saw a growing awareness of the harm caused by pesticides and radiation and the rise in the air and water pollution. The concern about the health risks had risen, which further led to the growing popularity of the subject. It was understood that the greater population is required to make a difference in the environment, and active participation of the common people was possible only when it was well informed. Moving on further, in 1970 Earth Day was celebrated on April 22 for the first time. In 1972, Environment Education was declared to be a must to address the growing global environmental issues by The United Nations Educational, Scientific and Cultural Organization (UNESCO) in the UN conference held in Stockholm, Sweden. This was also known as the Stockholm Declaration. Belgrade Charter was chalked in the year 1975, which further added principles, objectives, and goals for environmental education aimed to educate the general public. This was followed by the Tbilisi Declaration in the year 1977, which



“noted the unanimous accord in the important role of environmental education in the preservation and improvement of the world’s environment, as well as in the sound and balanced development of the world’s communities.” The same year the intergovernmental conference on Environmental Education laid out various goals, objectives and principles for the improvement of this essential subject. In 2005, United Nations Decade of Education for Sustainable development (UNDESD) was formed to further encourage the growing concern towards the environment. The year 2014 saw the happening of the World Conference on ESD and a formal launch of Global Action Programme (2014–2019). Post 2019, the UNESCO has announced ESD for 2030.

Environment Education at a School Level

Environment Education in the formal educational system in India is handled at three levels. It is a composite subject called Environmental Studies (EVS) at the primary school level; it is infused into the Science and Social Science curriculum at the middle and secondary school level; and it is taught as a separate subject at the college level. Teachers play a very important role in spreading awareness about environmental problems and ensuring action. Students learn, but are helpless to overcome the frightening gap between ideas and reality and this is where the teacher’s role is crucial.

Who is an Environment Educator?

An environment educator professional has the basic understanding of the theory, practice, and history of EE to build a strong base leading from what they practice and teach. They have an in-depth understanding about values, skills, and attitudes associated with

environmental learning. They display abilities to learn about, evaluate, and act on environmental issues and be able to differentiate between advocacy and education. This is an upcoming profession and a one that youth can aspire for. ESD is a Higher-order thinking skills (HOTS), and its purpose is to take away the rote memorization mode, and in its place introduce amongst learners' skills related to analysis, reasoning, comprehension, application, and evaluation. Trainers should focus on action projects and demonstrate how these are linked with sustainable living. Entire teaching-learning needs to focus on activities, games, discussions, and adoption of best practices from global arena. Within TERI, there are several opportunities of engaging with youth to enhance their environment quotient.

S. No	Sector	Specific skills that are addressed through TERI's research community
1	Soft skills	Leadership skills, vision building and goal setting, EQ and mindfulness, time management and advance planning, resilience and change management, conflict resolution, and team building
2	Industry-based green skills	Awareness about solar, wind, geothermal, and biomass. This sector also includes traditional, non-renewable sources of energy undergoing significant green technological changes (e.g., oil, coal, gas, and nuclear), increasing energy efficiency, making energy demand response more effective, constructing 'smart grids'
3	Ecopreneurship around green skills	Starts-ups to support sustainable agriculture, waste and water management, construction and manufacturing, transport, regulatory and consultancy-based occupations



Opportunities of Promoting ESD through TERI's Thematic Strengths

An enabling environment

In August 2023, University Grants Commission (UGC), the country's higher education apex body, has come out with a mandate for students to study compulsory subjects such as environmental education and climate change in order to graduate. This ruling will be effective from 2023–24 academic year and is a step towards meeting the national obligation to achieve the United Nations Sustainable Development Goals.

The course design encourages community engagement and service, practical understanding of threats to the environment and 'value-based' education to learn about environmental protection and sustainable development. According to the UGC, the proposed credits for the course can be acquired over six to eight semesters.

The way forward

India currently has 253 million students enrolled in schools and 34 million youth pursuing higher



education. By 2030, these students will add up to the existing 'young' population and will be the key decision-makers in all walks of life. Hence, it is of utmost importance that their behaviour is shaped in a manner that they promote sustainable choices in decision making. TERI believes that the time to develop their mindsets and attitudes is when they are in their learning phase and can understand, experiment and act on concepts of sustainable choices. The Government of India is initiating new and novel schemes to benefit the citizens and education-based reforms have done a strong comeback. After the implementation of the National Education Policy (NEP, 2020), a scheme called PM SHRI (PM Schools for Rising India) was also launched on September 7, 2022. It supports "high-quality education in an equitable, inclusive and joyful school environment that takes care of the diverse background, multilingual needs, and different academic abilities of children and making them active participants in their own learning process as per the vision of NEP 2020".

The Energy and Resources Institute (TERI) was founded in 1974 with the mission of developing solutions to global problems in the fields of energy, environment, and sustainable development. TERI remains ahead of time when it comes to design and implement sustainability-driven solutions. But, it is clearly evident that this perfection needs to percolate to every section of society so that future workforce is made

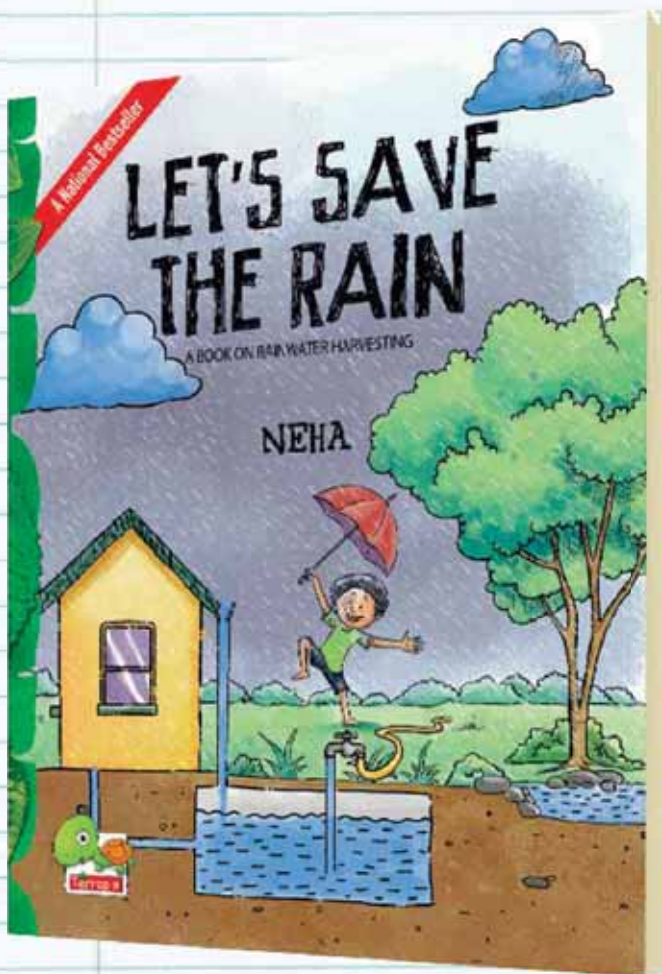


aware of contemporary environmental issues and also trained with skills that will enhance their employability. TERI's outreach initiatives are a step in this direction wherein a strong relationship has been built with schools and colleges across the country through its ESD initiatives. TERI conducts the GREEN Olympiad project (www.teriin.org/olympiad) with school students since 1999. Strong associations with the Ministry of Environment, Forest and Climate Change (MoEFCC), UNESCO, Central Board of Secondary Education (CBSE), National Council of Educational Research and Training (NCERT), Kendriya Vidyalaya Sangathan (KVS), Navodaya Vidyalaya Samiti (NVS), and other educational institutions and state educational boards are maintained through this initiative. TERI's model of operation within the sphere of school projects is with a dual approach—top down and bottom up. While GREEN Olympiad benefits from a top down strategy in terms of endorsements from major stakeholders, initiatives such as The Green School project (supported by Tata Steel Foundation), Youth Climate Conclave (supported by Delegation of the European Union to India, and GIZ), Eco Next Investigation for Youth (supported by National Council for Science & Technology, DST), Ocean Matters (supported by US Consulate General Chennai) and other projects are need based, and designed to meet locale-specific requirements. Innovative initiatives such as Green Hackathon, UNESCO Leadership Training on ESD, ViJaYo (Vidyuth Jagruthi Yojana), Climate EduXchange, SEARCH (Sensitization, Education and Awareness on Recycling for a Cleaner Habitat), Hope to Action (Bamcroft Arnesen Explore (BAE), have created inroads to touch and influence lives of millions of children and youth across the country. With NEP as a guiding principle TERI is promoting "green skills" within the education landscape. ■

Dr Livleen K Kahlon, Associate Director- EEA, TERI.



Rain Is Gain When We Harvest Rainwater



Ages: 12-14 years • ISBN: 9789386530073 • Price: ₹150

- Introduces children to the importance of conservation
- Talks about the traditional and modern rainwater harvesting systems
- Showcases how rooftop rainwater harvesting is beneficial for the socio-economic condition
- Explains the technique and various types of rainwater harvesting systems
- Beautifully elucidated with experiments, DIYs, and easy calculations

Lightning Linked to Climate Change

Kills Thousands in India

Climate change impacts are transforming the already-terrifying phenomenon of lightning into a more deadly climate hazard than it was before. In this article, **Athar Parvaiz** casts light on a recent spike in deaths due to lightning in the country, along with suggesting probable mitigation tactics.

It has been two months since a lightning strike killed four villagers in Budgam and Pulwama districts of Kashmir in two separate incidents—two of them were killed while herding their sheep in a pasture, while a young couple succumbed to the lightning strike in their farm. People in the Budgam village hit by these lethal strikes on May 6, 2023 were scared out of their skins as they “have never seen someone getting killed by lightning in and around their villages.”

As many as 2863 extreme weather events in J&K have killed 552 people, between 2010 and 2022, besides causing heavy damage to infrastructure and livestock, says a study ‘Extreme Weather Events induced mortalities in Jammu and Kashmir, India during 2010–2022’

published in the *International Journal of Disaster Risk Reduction*.

Interestingly, out of the total extreme weather events, 1942 are the lightning events—forming the bulk of the overall extreme weather events—followed by 409 heavy rainfall events, 186 landslides, 168 flash floods, 48 heat waves, 42 heavy snowfall events, 37 cold waves, and 31 windstorms in the time period analysed in the study.

Mukhtar Ahmed, lead author of the aforementioned study, said that there has been an increase in extreme weather events, especially lightning, over the past two decades, which is seen as a manifestation of global warming and human-caused climate change.

Ahmed said that deaths due to

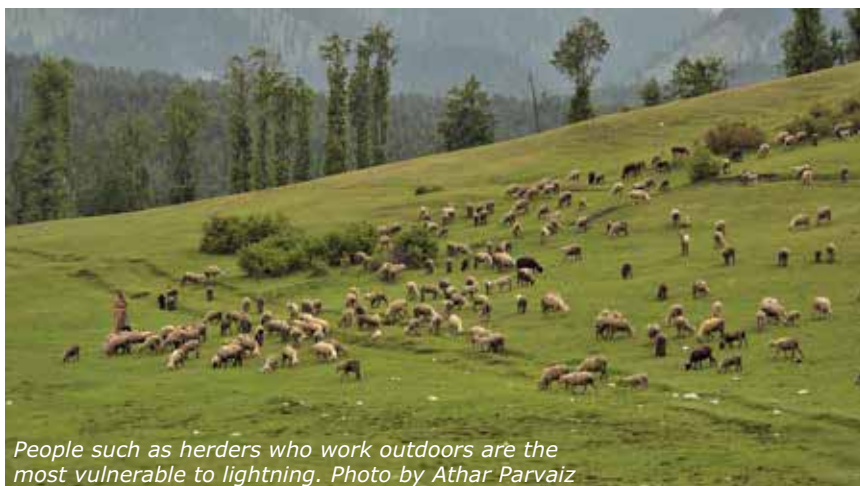
extreme weather events have also increased over the years. He, however, added that despite the increase in extreme weather events, deaths due to heavy rain and snow have decreased, which is mainly attributed to better early warning, weather forecasts and improved disaster management. “Otherwise, such mortalities would have been manifold,” Ahmed said.

“In order to develop better disaster management programmes and policy planning, there is a need to study and explore all major types of extreme weather events during the last 10–15 years. Keeping in mind the increased frequency and mortality due to these events, [they] need to be critically studied,” he said while quoting from the study.

When Clouds Send People Running!

For the villagers in Gurweth, Budgam, the lightning strike was a bolt from the blue which sent shivers down their spines. “Lightning has never killed anyone in our village despite being a forest village. But that incident on that fateful day has shocked us all as it took away two lives from our village,” villagers from Gurweth said.

“People are scared following the [May 6th] incident. Everyone switches the phone off and rushes home when the



People such as herders who work outdoors are the most vulnerable to lightning. Photo by Athar Parvaiz



weather turns bad,” said Saif-u-Din Dinda, a villager. Dinda was among the first few who saw the bodies of two villagers killed by lightning in the Mujpathri pasture.

“We saw them lying lifeless on the ground around this tree when we got here,” Dinda said about the incident, while pointing at the tree which was struck by lightning. “Soon we informed other villagers and shifted the bodies to

the village in an ambulance.”

Dinda and some elderly villagers said that they have never heard of any such incidents in the area in the past. “We used to witness light thunderstorms while herding our sheep. No one was ever killed by lightning. This was the first time that lightning killed our dear ones,” said Khadija Begam whose husband, Mohammad Sultan Chopan, was one

among the four people killed in the May 6th lightning incidents.

Begam’s next-door neighbour, Ashfaq Ahmad Chopan, who lost his mother in the lightning strike on the same day, said that despite the scare caused by two lightning deaths, the villagers cannot afford to remain indoors every time in overcast conditions. “We should be informed in advance about such dangers so that our livelihoods aren’t affected,” Chopan said. Ahmed, however, said that his department continuously issues warnings about extreme weather events via traditional and social media.



Upsurge in Lightning Deaths in India

Across the country, National Disaster Management Authority (NDMA) identifies lightning as a weather hazard in recent years, with most of the deaths happening in rural areas. Central government officials say that



measures such as establishing lightning detection centres, early warnings early, and providing people area-specific information about lightning via a mobile phone application are being taken, but lightning strikes continue to kill people across the country. According to official records, lightning strikes kill an average 2500 people annually across the country.

The 2021 report¹ of the National Crime Records Bureau (NCRB) about accidental deaths reveals that out of 7126 deaths due to natural forces across the country, such as floods, avalanches, lightning, cyclones, and landslides in that year, 40 per cent deaths were caused by lightning alone. In recent years, lightning deaths have formed the largest percentage in the annual tally of deaths due to natural forces—39 per cent in 2020, 35 per cent in 2019, and 34 per cent in 2018—and

these figures are way higher than 10 per cent in the year 2012 and 12 per cent in 2013.

In July 2021, as many as 68 people were killed² by lightning on a single day in three different states in India. In a single week in July last year, as many as 50 people were killed³ by lightning in Uttar Pradesh. In May 2021, a herd of 18 elephants⁴ was killed by lightning in Assam.

“Most of the victims who are caught unawares by lightning strikes include farmers, herders, fishermen, and construction workers who always work

outdoors,” said Ahmed. “Our major challenge remains people who work outdoors—farmers, herders, fishermen, and children in rural schools—especially in states such as Bihar, Uttar Pradesh, and Madhya Pradesh”, said Sanjay Srivastava, convener of the Lightning Resilient India Campaign and member of the National Panel of Experts on Lightning in National Disaster Management Authority (NDMA). He added that 80 per cent of lightning deaths in India occur in these states.

The main focus of the Lightning Resilient India Campaign, he said, is to create awareness among people. “We keep repeating that the best defence against lightning is avoiding staying outdoors during lightning”, Srivastava said adding that the government will also create safe shelters in lightning prone districts in India to reduce lightning deaths besides a massive awareness campaign through a National Lightning Programme, which will be launched soon.

¹ Details available at https://ncrb.gov.in/sites/default/files/ADSI-2021/ADSI_2021_FULL_REPORT.pdf

² Details available at <https://www.indiatoday.in/india/story/pm-modi-grief-lightning-rajasthan-cm-ashok-gehlot-ex-gratia-kin-1826807-2021-07-12>

³ Details available at <https://apnews.com/article/storms-india-state-governments-monsoons-climate-and-environment-5dc8c7a10f610700eadaff8681094e92>

⁴ Details available at <https://www.bbc.com/news/world-asia-india-57106852>



According to Srivastava, a reduction in lightning deaths is expected this year due to the measures taken in recent months. "Some states such as Andhra Pradesh, Odisha, and Jharkhand have adapted by instituting practices such as improving forecasting, creating safe shelters, and installing lightning sensors," Srivastava said.

Lightning and Climate Change

Citing the data from NCRB, Sunil Pawar, a scientist at the Indian Institute of Tropical Meteorology (IITM), said that there has been 100 per cent increase in lightning deaths across India. According to Pawar, frequency of lightning strikes has also increased ranging from 20 per cent to 35 per cent in different regions, as per the analysis of lightning data by him and his colleagues at IITM. "We observed that lightning frequency has increased in various regions such as Himalayas," Pawar said and added that surface heating and moisture availability is increasing due to global warming which, along with air pollution, is causing the increase in lightning strikes. "Surface temperature, increase in moisture, and pollution particles are all favourable factors for

lightning formation," he said.

A paper published⁵ by *Atmospheric Chemistry and Physics (ACP)* in July 2021, has revealed that surface warming is causing more frequent and stronger lightning events in India. The paper has projected that lightning frequency and intensity values are expected to increase by 10–25 per cent and 15–50 per cent, respectively, by the end of the century in India, identifying pollution as one of the contributing factors.

Published research has shown that pollution and global warming are impacting lightning in other parts of the world as well. Sander Veraverbeke, Earth and climate scientist at Amsterdam Sustainability Institute, said that the prevalent ignition source of wildfires in boreal forests is lightning and "lightning is increasing because of climate change."

India suffers abundant human casualties as a result of lightning, as compared to the developed regions of the world. Rohit Chakraborty of Divecha Centre for Climate Change, at the Bangalore-based Indian Institute of Science, said that research, awareness, and adaptability has helped bring down

fatalities due to lightning considerably in countries such as the US⁶ which needs to be replicated in India as well. "You need to make people aware of what to do during lightning. In the USA, Australia, European countries, and Hong Kong, they have developed measures to save people from lightning strikes. In the Indian region, some places have some measures, but they work for urban centres and not for rural areas. South Asian countries can learn from the USA and other countries, who have really very good measures in place," said Ashraf Dewan, School of Earth and Planetary Sciences, Curtin University, Australia. He has carried out extensive research on lightning.

In terms of casualties, he said that more deaths occur in countries where people do more outdoor activities. "For example, India and Bangladesh experience more deaths because more people work outside especially for agricultural activities. This means population exposure to lightning has increased considerably which is causing more deaths," he said. ■

Athar Parvaiz is an environment and science journalist based in Kashmir.

⁵ Details available at <https://acp.copernicus.org/articles/21/11161/2021/>

⁶ Details available at <http://lightningsafetycouncil.org/LSC-LSAW.html>

Can Climate Change Influence Animal Behaviour?

Let's Try and Find Out!

Does climate change influence the behaviour of animals, particularly dogs?
Dr Rina Mukherji endeavours to find out in this thought-provoking article.

Dogs have always been considered man's best friend. But the last few years have seen a spate of attacks by dogs—both strays and pets—that have forced us to re-examine our love for these creatures.

In February 2023, a horrifying video surfaced showing a 4-year-old boy getting mauled by street dogs in a Hyderabad housing society. The boy succumbed to his injuries when taken to hospital. The following month, two brothers aged 7 and 5 years, were mauled to death by strays in Ruchi Vihar, near Vasant Kunj in Delhi when they went to the nearby forest tract to relieve themselves. In June 2023, a girl

was attacked and dragged by strays in Koppal, Karnataka.

In 2022, there were over 5500 cases of dog bites reported daily from all over India. Of these, 30–60 per cent occurred in children under 15 years of age. Between 2019 and 2022, India reported 16 million cases of stray dog bites, as per data released during a Parliamentary debate in November 2022. Maharashtra led in the number of dog bite and attack cases, with 346,318 cases. This was followed by Tamil Nadu with 330,264 cases, and Andhra Pradesh with 169,378 cases. But even states such as Kerala, which did not figure among the top three, saw many gruesome attacks

by stray dogs across its towns and cities, with 137,137 cases reported within 5 months of 2023. The situation was so grim that the Kerala government recently approached the Supreme Court to allow the culling of violent strays, especially those with rabies.

But, bites and assaults have not been confined to strays alone. There have been many bites and attacks by pet dogs too, from various parts of the country. In May 2017, there was a horrific attack by a pitbull, which beheaded its owner in Chikmagalur, Karnataka. In August 2022, a domestic help was attacked by Dogo Argentina, and suffered serious injuries. The incident saw the District Consumer Disputes Redressal Forum direct the Municipal Corporation of Gurgaon to ban 11 foreign dog breeds, cancel their registrations, and take them into custody. Additionally, strays were to be rounded up and confined to dog pounds. This year, there was a spate of attacks by pet dogs all over India. In June and August 2023, two little girls were attacked by German Shepherds in their respective Bengaluru neighbourhoods. Another 11-year-old was mauled by a pet dog in Jayanagar, Bengaluru. In two different incidents in Delhi-NCR, a 55-year-old woman was attacked by her neighbour's dog, while a 6-year-old was attacked by a pet dog in a lift. In June 2023, a



ghastly attack by a pitbull left its owner's octogenarian mother dead in Lucknow. In August 2023, a 63-year-old man out to buy some flour was attacked by a pet dog in Lucknow.

Rise in Dog Bites

Incidentally, the rise in dog attacks has gone hand-in-hand with a rise in temperatures all around the globe. The situation was the same all over India. And now a Harvard University study, "*The risk of being bitten by a dog is higher on hot, sunny and smoggy days*," by Tanujit Dey, Antonella Zanobetti and Clas Linnman points out that the risk of being bitten by a dog is higher on hot, sunny, and smoggy days.

The researchers admit, that "it is unclear if dog behaviour is directly altered by ozone and heat, or, is a consequence of altered behaviour on the part of the human victim or dog owner." But high temperatures and atmospheric pollution have been proven to have an effect on human behaviour.

Heat Wave Conditions

India has been experiencing heat wave conditions on a regular basis over the last decade, particularly in its northern states. In India, a heat wave is declared when the maximum temperature of a location reaches 40°C in the plains, and at least



30°C in the hills. When the departure from normal temperature is 4.5–6.4°C, it is considered a normal heat wave. If the departure from normal is over 6.4°C, the heat wave is classified as a severe heat wave.

In 2016, severe heatwave conditions affected Bihar, Jharkhand, Gangetic West Bengal, Odisha, Punjab, Haryana, Chandigarh, Delhi, Rajasthan, Maharashtra, western Madhya Pradesh, and Gujarat. However, 2022 and 2023 have been particularly bad. In 2022, India experienced many heat wave days in March and April, with temperatures in

early April hovering around 42.4°C.¹ By May 2022, Delhi witnessed temperatures as high as 49.2°C. This year, the heat stress was felt in early April, and a belated monsoon saw temperatures soar to as high as 43–44°C in Uttar Pradesh and Bihar.

Effect of Heat Wave on Dogs

So, could these high temperatures have increased the incidence of dog bites and attacks? What do veterinarians, dog trainers, and dog behaviourists have to say? Veterinarian Dr Soorej K, Director, and Chief Consultant at the Cochin Pet Hospital, feels that climate change could have a bearing on the aggression being displayed by stray and pet dogs in India. "As a veterinarian who has been practising for the last 25 years, besides being associated with a prominent charitable non-governmental organization, Humanity for Animals for the past 13 years, I feel disturbed to see the kind of terrible attacks by strays on innocent people. We always felt that strays are the guards of our streets, but things have changed of late. There is something more at play, which needs to be studied to understand the behaviour

¹ Details available at <https://www.who.int/india/heat-waves>



of these dogs. Researchers in India too, need to study this problem adequately and note the role that climate change may be playing here.”

Animal Therapist Suvarna Arun Pansare, who runs the Make New Life animal shelter and hospital on the outskirts of Pune, is in agreement with this. But she does not blame heat wave conditions alone for this. “There is a proliferation of the stray dog population in cities, owing to the government’s flawed Animal Birth Control programme. When there is a shortage of food, what do you expect? Dog bites do not only rise during the summers, but in the monsoon too, when food gets scarce,” she told *TerraGreen*.

Attributing the rising population of strays in Kerala to a flawed Animal Birth Control programme, Dr Soorej also blames the proliferation of illegal slaughterhouses, easy availability of food—particularly raw meat, and improper waste management for the increase in the canine population.” However, not all professionals are in agreement with the study. Mumbai-based Shirin Dhabhar, who has been a trainer and dog behaviourist for over two decades, finds the study flawed and inconclusive. “I have been a trainer for the past 27 years, and to my knowledge, weather has no effect on the aggression shown by any dog. Even where dogs like Siberian huskies and furry European breeds



are concerned, one must understand that if they are insulated from the cold, their fur also insulates them from the heat. Besides, a heat wave can also exhaust a dog. So, how can it make a dog aggressive? If a dog wants to bite, an air-conditioner will not deter it. Aggression is dependent on the genetic makeup of a dog, its ancestry, the situation it finds itself in, and whether it is frightened, insecure, or ill. Even training cannot control a dog’s aggression if it is descended from parents who are predisposed to biting. A dog that is ill, frustrated, frightened, or suffering from a hormonal imbalance will bite.”

Kolkata-based dog behaviourist Atreyee Chatterjee, who runs a dog grooming parlour-cum-clinic-cum crèche, Woofs and Wags, says, “Heat stress can never get a dog to bite. Of course, I primarily deal with pet dogs. A dog needs to be trained and disciplined from 3 months onwards. By 6 months, it must be given all the exposure it can get. Its energy needs to get channelized, and the animal needs to know that it can only bite and tear into certain things. A dog bites when it is insecure, abandoned, or frightened. My own dog reacted when I moved back to India from abroad. He could not adjust to the relocation, the noise, and the congestion. His frustration and confusion got him to bite people. Dogs are animals; they react in this manner to unknown stimuli.” Referring to several cases of bites and assaults by pet dogs all over India, she says, “People ought to know that a big dog needs exercise, and an open space. If you confine a German Shepherd, Rottweiler, or a St Bernard to a cramped apartment, it is bound to react. An apartment is suitable for a small dog, not a giant.”

Kolkata-based veterinarian Koyel Choudhury is also not in agreement with the study. As regards attacks by pet dogs, she points out, “You will notice that these attacks are on the rise





post-pandemic. That is because very few owners really care for their dogs. A fancy imported breed is now a status symbol. They do not care to understand their pets. A lot of couples adopted pets during the pandemic when they were working from home. Once they got back to regular work, most could not cope, and abandoned their pets. A few got caregivers for their pets. Certain bigger breeds, such as Rottweilers, can only attach themselves to their owner/parent. They cannot adjust to anyone else. A dog is like a baby. If you need to leave the dog home alone, when you are at work, the adjustment must be gradual, a few hours at a time, until the dog gets to understand that you will be away for a good part of the day. The sudden absence of a pet parent can be traumatic, and can upset the dog; it will end up attacking or biting in frustration."

Both Dhabhar and Chatterjee feel biting by pet dogs is not because of the particular breed. "A Rottweiler can be a very friendly dog, while even a Labrador can end up biting people. It all depends on the circumstances and the situation it finds itself in." Choudhury points out, "There are people who buy a Rottweiler or a German Shepherd to elevate their status and then cannot manage to control their dog. They end up being harsh with the dog, and beating it up. This can boomerang on you someday."

Where strays are concerned, Chatterjee condemns misplaced

compassion, which can result in attacks. "If you want to feed strays, you ought to earmark a place to do the same. The strays will confine themselves to that particular place. I live in a housing society where a gentleman has housed some strays under the stairs, and let them move around freely within the compound. The strays have been urinating all over and marking their territory. They attack pet dogs and are making a nuisance of themselves."

The Best Solution

Notwithstanding the problems faced all over the country, veterinarians, trainers, and animal rights are against culling. Dr Soorej feels, "It is inhumane; we cannot resort to this. Culling can only give us temporary relief; the drop in the number of dogs in any area will only result in dogs from other parts coming in. Very soon, the numbers will rise up; it is Nature's way of achieving a balance. What is required is a scientific, well-planned, far-sighted animal birth control programme. What is currently being done by the government's Animal Welfare Board leaves much to be desired. We need to come up with better, well-thought-out solutions. Unfortunately, in this era of artificial intelligence, we continue to use methods that were in vogue 50 years ago." Dhabhar condemns culling as "unscientific", and points out, "It has been proven to be unsuccessful

to control the canine population. It is a myopic solution; a knee-jerk reaction to a problem."

Pansare too, condemns culling. "The animal birth control programme has been handed over to contractors, who are hardly doing their job. There is no supervision by the authorities. Let the government hand it over to civil society and professionals, and you will see the difference." In hindsight, these professionals are right, going by reports on the sterilization exercise. In Pune, which reported 33,000 dog bites in 2022, and 7000 dog bites in the first four months of 2023 in the Pune Municipal Corporation (PMC) and Pimpri-Chinchwad Municipal Corporation (PCMC) limits, averaging 90 bites a day, the sterilization exercise has covered a very small fraction of the canine population, especially in the PCMC areas. Admitting to the lapses, officials have blamed the shortage of cages to keep dogs that are rounded up. The situation is not too different in other cities, either.

Controlling the Spread of Rabies

As for the rise in rabid dogs in Kerala and elsewhere, Dr Soorej says, "Rabies is a disease that spreads from urban wildlife. There are a lot of foxes and jackals around. Encroachment into forest areas has brought us to this state. I do not want to comment on the reasons behind this. But stray dogs get infected, and spread the disease into the population when they bite humans." In Delhi, too, settlements in the vicinity of forested tracts have resulted in strays entering the forest.

Encroachment into forest tracts is an ongoing problem, notwithstanding the clamour to conserve greenery in the face of climate change. But given the imperatives involved, it is high time that we let our forests remain undisturbed. ■

Dr Rina Mukherji regularly contributes articles in TerraGreen.

Rajasthan's Rooftop Solar Sector

The Regulatory Bottlenecks

Even though Rajasthan has the third highest solar installation (835 MW) in the country, after Gujarat and Maharashtra, when it comes to rooftops, the number of residential grid-connected solar PV rooftop systems in Gujarat is 4.5 lakh whereas in Rajasthan, it's a mere 25,000. Experts believe this is mainly due to the electricity duty imposed on the consumer and an almost indifferent approach to the rooftop sector in the state, finds **Sapna Gopal**. Read on to know more...

Subhash Agarwal, owner of a small-scale unit, Asso Minerals in Bandikui, Dausa, Rajasthan, installed two sets of solar panels on his roof (115 kW), but a solar meter was attached to only one of them—reason being that the distribution company (Discom) did not approve installation of a single meter

for both plants. He was also told that charges would be as per net metering, but discom officials were unclear about it. "Later, with my conjunction, the export unit was more than what the solar meter reflected. When I approached the discom, they harassed me for 4 months and did not give me a set-up for the export

units/excess power that my panels had produced. I told them it was their fault when it came to installing the meter and that if they wanted to calculate the energy produced by both panels, they should have had a combined meter that would reflect the same. They then suggested that I combine both panels



and gave me the set-up after a lot of pleading. Furthermore, they charged me electricity duty (ED) taking into account the maximum power generated by my panels. I requested that they should take the average unit produced by rooftop solar (RTS) as the base and then charge ED, but they insisted on taking the maximum,” revealed Subhash.

He requested that since his panels are 150 metres apart, he would need a cable to reduce the gap. Despite requests for two solar meters, they refused and finally, he was forced to spend INR 1 lakh. His is not an isolated case however. There are many others who have had unpleasant experiences as well. Upendra Chaturvedi, a retired employee, installed a RTS plant in October 2021 and says the fixed charges, including urban cess, is INR 3.75. “The irony is that they are providing subsidy to those who spend power in excess, but the ones who save power, end up spending more—there is no subsidy for rooftop. Instead, the consumer who opts for RTS, ends up being harassed.”

He laments that even the billing system is defective and discoms never clarify on it. “Moreover, they also charge us excess ED. The bureaucracy is unable to understand the advantages RTS provides and this is a huge impediment.”



Yet another retired engineer from the Electricity Department of Rajasthan who requested anonymity, recalls, “I installed the RTS on April 1, 2021, and thought that I would recover my investment in 3 years. However, it looks like it will take more than 4 years. Since consumers are not getting adequate returns, they do not see RTS as a viable proposition. Therefore, RTS is not being adopted by most residents in Rajasthan.”

According to Tushar Moad, Advocate and Legal Consultant, Rajasthan HC, “An order was issued by the Discom on June 30, 2021 and we have challenged that order because it states that 0.60 paise will be imposed on the consumption of self-generated energy. In 2014 and 2016, the Rajasthan government issued/ notified the policies, which states that ED cannot be charged (a clause exempts the ED from being charged). So, what cannot be done directly, is being done indirectly—it’s also called colourable legislation legally.”

Due to this dual policy, a number of people have stalled installation of solar panels. The solar policy of 2019, Clause 16.4 states, “Exemption and relaxation from ED—the electricity consumed by the power producer from captive use within the state will be exempted from payment of ED, for 7 years from CoD.”

Moad added, “We have submitted 10–12 petitions in the honourable High Court. Though we have got an interim relief from the court, that ED cannot be charged, the final adjudication is awaited as arguments from the discom side are remaining. There’s a general policy that those who are a party to any matter/ petition, only they will be granted relief as it is not a Public Interest Litigation.”

Elaborating why, he clarifies, “If the state issues an order and says it is removing the ED order, passing a fresh one which states this duty will not be applicable on anyone, only then it applies to all. Till then, it applies (exemption from ED) only to those who have approached the court.”

Concurring there are a number of challenges that confront the RTS sector in Rajasthan, Ajay Yadav, president of Renewable Energy Association of Rajasthan (REAR), said, “To add to consumers’ woes, urban cess and fuel surcharge are imposed on the total imported units—earlier, if there were 100 units of net export, it would be carried forward. Now, if one unit is exported, the consumer gets INR 2.17 paise, but it isn’t carried forward.”

As far as allegations of discoms acting as a barrier to the implementation of RTS are concerned, he added, “The



regulations concerned with net metering are well-defined—however, there are inefficiencies in processing applications. There's a lot more that the discoms can do to make it more consumer and developer friendly such as automating the release of No objection Certificate (NoC) as per the available feeder capacity for RTS integration."

Challenges

According to Yadav, one of the main problems in Rajasthan is that discom officials believe that RTS is a loss making proposition. "This, despite being told that their losses are almost 40 per cent and these can be prevented

by promoting rooftop."

Chaturvedi feels those at the helm of affairs are willing to buy electricity at INR 8 a unit, but from those who have installed solar, they buy it at INR 2 a unit. "Lands of almost 1,000 acres are being given to developers for 30 odd years, but they are taking a mere INR 2 from the consumer. In such a scenario, where is the break-even point for the consumer? The cost that the consumer has incurred can be retrieved only after 7 or 10 years," he rued.

Subhash laments that there is no investment subsidy or interest subsidy that the Rajasthan government provides, as far as RTS is concerned. Yadav explains,

"Rules entail that however small the project is, two solar meters must be installed. The reality is they are not being installed anywhere. Also, at times, existing meters are taken away and no refund is given. The specification for a solar meter and the one that is already existing (energy meter), is the same. This was discussed in the Rajasthan Electricity Regulatory Commission <https://rerc.rajasthan.gov.in/> and they said that if the specification is the same, then it can be used as a solar meter. Instead, the discom insists on one more meter and attributes it to a Central Electricity Authority (<https://cea.nic.in/?lang=en>) regulation."

Lamenting unnecessary delays, he adds, "In the portal on RTS <https://rooftopsolar.rajasthan.gov.in/>, there are 11 steps. Also, in the state of Rajasthan, the NoC takes 15 days—during that period, discoms cannot be questioned. The aim of a NoC is to see whether the transformer has the capacity to install solar or not. A project in Rajasthan takes around 5 days to set up and then it takes 15 days to get the NoC. This is why we are lagging behind."

Gujarat versus Rajasthan

While neighbouring state Gujarat has made news for being highly successful as far as rooftop solar installations in India are concerned, Rajasthan is still struggling. In terms of solar installation, Gujarat is way ahead of other states—as per the Ministry of New and Renewable Energy, it had a total installed capacity of



8887.73 MW as on February 28, 2023, of which around 2365 MW is RTS. In fact, of the total 8.5 GW of solar rooftop installed capacity in India, Gujarat accounts for almost 2.365 GW (around 28 per cent).

Elaborating why Gujarat has been successful, Deepak Gadhia, Chairman, Sunrise CSP India Pvt Ltd, explained, "In Gujarat, there's a law wherein no discom can deny buying power—therefore, they have to buy whatever power is generated from the rooftop. Also, people here are entrepreneurs, so for them it is a very simple calculation—if they put money in the bank, the return is about 7 per cent whereas by investing in RTS, they will gain about 15 per cent to 20 per cent interest, as it is a proven technology. Moreover, in Gujarat, there's a very large base of suppliers who are trying to create business for rooftop."

Concurring, Dr Debajit Palit, Professor of Energy, NTPC School of Business, attributes it to the support by electricity discoms in the state. "Apart from building a large base of empanelled Engineering Procurement and Construction (EPC) contractors and suppliers, consumer awareness was created by leveraging media platforms to spread the word

about the utility of RTS and available subsidies for the same. Moreover, from registration to subsidy, everything was done through the RTS portal. The digitization of due processes simplified the consumers' and suppliers'/vendors' roles, thereby enabling transparent and streamlined transactions. Also, there was also timely disbursement of subsidy and all these factors helped Gujarat leapfrog in this sector."

In Gujarat, the number of residential grid-connected solar PV rooftops systems is 4.5 lakh whereas in Rajasthan, it's a mere 25,000. Mr Gadhia feels this is because in Rajasthan, there is not enough population, unlike Gujarat which is densely populated. "Also, there's a lot of dust in Rajasthan, since it is a desert area. This means it needs a lot of maintenance and that means a lot of water, which is a challenge. Owing to high temperatures, the efficiency of solar PV reduces—hence, in terms of efficiency also, the plants are more efficient in Gujarat than in Rajasthan. Also, in Rajasthan, the focus is not so much on small plants, as it is for bigger ones—there's a lot of land available there and officials feel putting up a 2 MW plant makes more sense."

Moreover, discoms try and disintegrate the consumer and even if the RTS is installed, they make things difficult for the consumer. There is corruption, bureaucracy, and for excess power that needs to go into the grid, a lot of time is taken to give permission. So, most people feel there is no point getting into this hassle, just for a 1 kW or 2 kW plant, reasons Mr Gadhia.

Admitting Rajasthan has a long way to go, Simran Grover, CEO, Centre for Energy, Environment and People, a research organization based in Jaipur, clarifies that discoms are not to be blamed. "Gujarat is a very different state and it won't be fair to compare it with Rajasthan. Its Gross State Domestic Product is much higher than Rajasthan and when it comes to the electricity consumer mix, the share of commercial and industrial consumers is much bigger in Gujarat."

"Moreover, in Rajasthan, discoms are positioned differently. Discoms in Gujarat have relatively healthy cash flows and balance, whereas the ones in Rajasthan are fighting a very different battle. Even though they are taking some initiatives to promote RTS, including launch of





a portal to invite applications, as an electricity consumer myself, I rather have them focussing on more important issues. Moreover, why should a public distribution utility market for private sector players when the incentives aren't aligned for them?" he questions.

Way Forward

The Rajasthan Renewable Energy Corporation (RREC) tendered around 50 MW of RTS and these are to be installed in the rooftops of buildings owned by the state government. This is a good sign, but Dr Palit believes it is important to see how this is implemented. "In the state budget (Feb. 2023), an installation of 11GW was proposed. Out of this, the target for decentralized renewable energy was 4000 MW by 2025. From an overall perspective, the intent looks good—30 GW by 2025, of which the

state has achieved 21 GW. With another 11 GW proposed, it can easily cross its set target in the next 2 years. However, in the overall target, the one for RTS is only 300 MW, so the Rajasthan Government is giving priority to utility scale solar—by creating evacuation infrastructure, substations specifically for the purpose. Maybe, within the RTS sector, the incentives are missing," believes Dr Palit.

Looking at the state of RTS in Rajasthan, REAR insisted on the creation of a solar cell. It also suggested that some of the subsidy which comes from the MNRE should be allocated to the cell. Mr Gadhia suggests that the best way to ensure compliance is where discoms cannot refuse RTS and if they do, they will be penalized. Also, authorities need to ensure that discoms do not misbehave with the consumer.

According to Grover, "The penetration

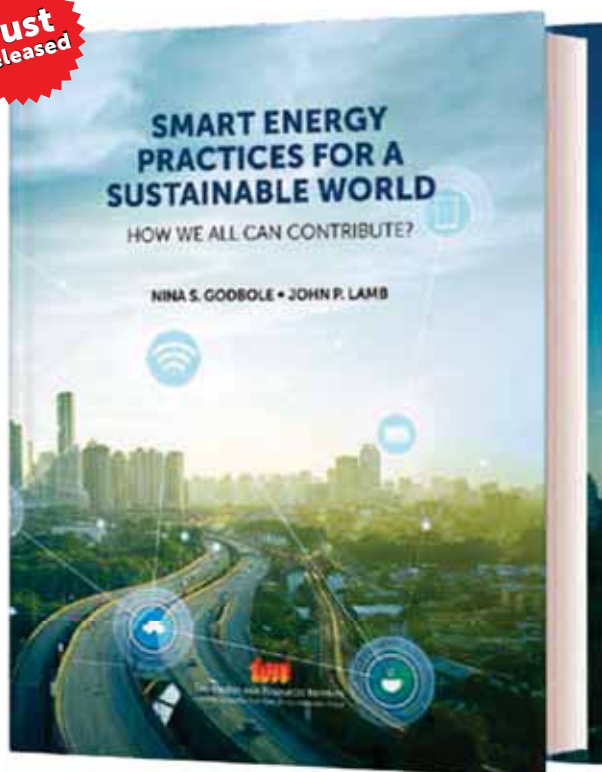
of RTS is just about 0.8–1 per cent. Moreover, despite efforts, solar rooftop financing has not become mainstream, especially for small consumers. Therefore, these are some of the challenges that must be addressed."

He feels the net metering policy places an unfair burden on discoms in some ways. "Efficient and effective recovery of fixed costs of discoms is a legitimate concern, which can be addressed through tariff rationalization. In the recent tariff order, the regulator has taken steps to rationalize fixed chargers to some extent, but further rationalization of feed-in incentives may be needed to prevent socialization of costs and shield discoms from unfair negative impacts," explains Grover. ■

Sapna Gopal has been writing on issues pertaining to the RE sector since 2010 and contributes to TerraGreen on a regular basis.

Energy-efficient techniques for realizing sustainability

Just Released



Major topics covered

- Smart Energy Systems
- Impact of Electronic Equipment on Energy Use and Carbon Footprint
- Standard Energy Use and Carbon Footprint Metrics
- Smart Buildings
- Sustainable Practices for Green Health Care Services
- Knowledge and Behaviour for a Smart Planet
- Worldwide Case Studies for Green Practices

ISBN: 9789394657113 • Price: ₹1195.00

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.

Text is supplemented by case studies that depict ground-level reality to facilitate comprehension of the subject matter. The appendices serve as an extended learning of the concepts discussed in the chapters. The publication would serve as a valuable reference for both scholars and researchers engaged in the domain, in addition to, being a guide to industry and the academic world.

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
Fax: 2468 2144 or 2468 2145
India +91 • Delhi (0)11
Email: teripress@teri.res.in
Web: <http://bookstore.teri.res.in>

To purchase the book, visit our online bookstore at <http://bookstore.teri.res.in> or send us your demand draft or cheque in favour of TERI, payable at New Delhi (outstation cheques are not accepted).

Urban Flooding Woes

As City Streets Turn into Rivers

In this article, **Ayuj Purohit** says the efficiency of the current water systems has seen a downward slope which can be related to the rapid urbanization that has undermined the sustainability of the environment. The mismanagement of water-related infrastructure and the problems faced because of it have led to a peculiar predicament of flooding in urban areas, that is, 'urban flooding' where the roads and surrounding areas get inundated with water.

As early as the civilizations of Harappa and Indus Valley, societies have been cognizant of drainage systems for both sanitation and flood-prevention reasons. Leading water to the outskirts of the cities through an impeccable feat of engineering, the ancient cities of Lothal and Mohenjodaro thrived and demonstrated in their city planning world's earliest drainage systems including underground sewage systems and the magnificent great baths—a fine example of proper water supply, rainwater harvesting, and water drainage systems.

Compared to these, the efficiency of the current water systems has seen a downward slope which can be related to the rapid urbanization that has undermined the sustainability of the environment. The mismanagement of water-related infrastructure and the problems faced because of it have led to a peculiar predicament of flooding in urban areas, that is, 'urban flooding' where the roads and surrounding areas get inundated with water.

Urban flooding can be connected to two major reasons: poor infrastructure and maintenance, coupled with rapid climate change. This year's flooding made Delhi the Venice of India as amid these heavy spells of rainfall, several parts of Delhi had been well submerged in water. Improper road construction greatly contributes to these floods as drains across the city are often constructed at



Photo by Deepak Kumar on Unsplash

heights higher than the ground level negating their purpose. To make it worse, newer roads are impervious to water. Mismanagement of plastic waste can also be seen as a cause of urban flooding, given how it chokes the drains in turn exacerbating the problem.

Until recently, India's stormwater drains were designed as per the Central Public Health and Environmental Engineering Organization (CPHEEO) guidelines. They are designed for rainfall intensities of once in one year to once in two years return periods. If rainfall records are unavailable, rainfall intensity

is usually adopted in the range of 12 mm/hr–20 mm/hr. In the revised CPHEEO guidelines, 2019, the design parameters were changed to 2–5 years of return periods or a maximum of 25 mm/hr—still significantly lower than rainfall intensities in the recent past.¹

As climate change impacts manifest themselves in unpredictable rainfall

¹ International Centre for Environment Audit and Sustainable Development. Climate Change Adaptation in India in the context of Urban Flooding. 2022. Accessed from: <https://iced.cag.gov.in/wp-content/uploads/Climate%20Change%20Adaptation%20in%20India%20in%20the%20context%20of%20Urban%20Flooding.pdf>

patterns, the infrastructure today is increasingly susceptible to issues such as urban flooding. As the rising surface and ocean temperature alter the water cycle, weather patterns; the frequency and intensity of rainfall are predicted to increase significantly. From floods in Kerala in 2019 to recent incidents of record-breaking rainfall, the effects of climate change are here and now.

With increasing waste management problems, as exemplified by the foam in the Yamuna River in Delhi, the aftermath of urban flooding often manifests as a public health crisis. Inundated areas can become breeding grounds for water-borne diseases. Floodplain encroachment due to unabated urbanization and resulting in increased run-off can be cited as another leading cause of urban flooding. Temporary relocation of people, damage to civic amenities, deterioration of water quality, and risk of epidemics are part of the widespread impacts.

Lack of proper water resource preservation and mismanagement of infrastructure can be seen due to the misplacement and neglect of the existing freshwater plants, as well as the deficiency of water cleaning plants. An earlier study by the Central Pollution Control Board (CPCB) revealed that there is no uniform pattern or standard of operation and maintenance of water treatment plants.² In a recent report published by them in March 2021, the CPCB observed that India's current water treatment capacity is 27.3 per cent and sewage treatment capacity is 18.6 per cent (with another 5.2 per cent capacity being added). Though India's waste and sewage treatment capacity is higher than the global average of around 20 per cent, considering the enormity of the problem,

² Central Pollution Control Board (Ministry of Environment and Forests). Status of Water Treatment Plants in India. Accessed from: <https://cpcb.nic.in/openpdffile.php?id=UmVwb3J0RmlsZXMvTmV3SXRlbV8xMDNfc3RhdHVzZ2Z3YXRlcjF1YXwpcDhlwYWNrYWdlLnBkZg==>

Photo by Dibakar Roy on Unsplash



it is far from adequate.³ The poor sewage facilities are unable to hold the sewage water, leading it to mix with freshwater supplies and contamination of the available freshwater.

“Urban areas are also centres of economic activities with vital infrastructure that needs to be protected 24x7. In most cities, damage to vital infrastructure has a bearing not only for the state and the country, but it could even have global implications. Major cities in India have witnessed the loss of life and property, disruption in transport and power, and incidence of epidemics. Therefore, the management of urban flooding has to be accorded top priority.”⁴

Considering the mishaps faced in

³ Central Pollution Control Board (MoEF&CC). Annual Report 2019-20. Accessed from: <https://cpcb.nic.in/openpdffile.php?id=UmVwb3J0RmlsZXMvMTI0M18xNjE2NTYxOTAxX21lZGlhcGhvdG8xMTgzNi5wZGY=>

⁴ National Disaster Management Authority. Urban Floods. Accessed from: <https://ndma.gov.in/Natural-Hazards/Urban-Floods#:~:text=Urban%20flooding%20is%20significantly%20different,in%20a%20matter%20of%20minutes>

recent times, the government should establish trade routes that would not be this susceptible to floods. This would help ensure that these kinds of adversities do not hamper the transportation of both resources and people. Simultaneously, the government should actively work on proper water management and improvement of current drainage systems to give a path for the water which tends to accumulate, allowing it to traverse and successfully assimilate into the environment.

People form an essential element of the environment, and therefore, need to be more active and play a vital part in flood prevention in urban areas. Both inside and outside their houses, people can engage in small but crucial steps by doing proper waste disposal, helping with regular cleanups of their surroundings (including the sewers, rivers, and roads), and respecting their shores to not further the damage. ■

Ayuj Purohit is an intern with the Communications and Stakeholder Engagement team of TERI and an undergraduate student at Dr B R Ambedkar University Delhi (AUD).

Global Food Security Summit, 2023

India's Opportunity to Lead G20 Nations in Boosting Foodbanking for Global Food Security

With the world losing \$1.6 billion a year to food loss and waste and about 2.3 billion people in the world today being food insecure, food security is a pressing global issue. The Global Food Security Summit brought together cross-sectoral stakeholders to drive conversations around holistic solutions to achieve global food security goals. Keep reading to know more...

Leading voices in the field have urged G20 nations, under India's presidency, to embrace food banks as a solution to the pressing issues of food loss and food waste. To drive this narrative forward, The Global FoodBanking Network (GFN) and Thinkthrough Consulting (TTC) hosted the Global Food Security Summit 2023, on August 8–9, 2023 under the aegis of G20 fostering diverse dialogues across sectors to establish sustainable ecosystem and pave the way for ensuring

universal access to #FoodForAll.

During the two-day summit, experts highlighted the global surge in adopting the food banking model, a crucial link that connects an increasing number of individuals in need with surplus food resources. Recent UN data revealed that an additional 122 million people worldwide face food shortages in 2022, underscoring the seriousness of the issue.

Lisa Moon, President and CEO of The Global FoodBanking Network (GFN),

emphasized the financial impact of food banking, stating, "Foodbanking addresses two huge challenges, within the global food system. The First pertains to food loss and waste, with a staggering one-third of worldwide food production never reaching people's tables. This loss occurs throughout the supply chain, from farms to the consumer stage, resulting in significant economic implications—amounting to staggering \$1.6 billion annually. The Second challenge is food security, with approximately 2.3 billion people worldwide currently facing food difficulties, and roughly 3 billion unable to afford a nutritious diet. Foodbanking is creating surplus to address both these problems by acting as a logistical expert of food, operating as both as a social enterprise and a non-profit entity, collaborating with producers across supply chain to save food."

"Food waste is a global challenge that requires collective efforts from all stakeholders," said Parul Soni, Global Managing Partner, Thinkthrough Consulting, "We want to work with the producers of food—farmers, corporations, FMCG companies—to get surplus food to foodbanks and process it to reach the underprivileged. Through this Summit, we aim to promote food



Discussions during Global Food Summit 2023

security and mitigate climate change through the concept of food banking.”

The Summit was also about highlighting the opinions of thought leaders within the ecosystem and the work done by changemakers to mitigate food insecurity and the climate crisis. Various High Commissioners, Ambassadors, and Senior Officials of the G20 member countries and nine guest countries invited by India, including Bangladesh, Egypt, Mauritius, The Netherlands, Nigeria, Oman, Singapore, Spain, and UAE, collectively participated to spread awareness and express their viewpoints. Multilateral and Bilateral Organizations such as World Bank, Asian Development Bank, United Nations Environment Programme (UNEP), and Industry Thought Leaders like Federation of Karnataka Chambers of Commerce & Industry (FKCCI), Invest India, the Federation of Indian Chambers of Commerce and Industry (FICCI), the Confederation of Indian Industry (CII), and the Indian Council for Agricultural Research (ICAR), among others, had representation in the discussions at the Global Food Security Summit.

Some of the key recommendations were as follows:

Nagendra Nath Sinha, IAS, Secretary, Ministry of Steel said, “The issue of food security is too big to be tackled alone. The realization of our nation’s challenges becomes feasible only through collaboration between the private sector, civic societies, government, and corporates. Effective collaboration, rooted in regional focus, dialogue, commitment, and defined roles, is key to addressing the issue of food security.”

Emily M Broad Lieb, Clinical Professor of Law at Harvard Law School said, “Currently, many different countries are struggling with really trying to figure out how do we get out of the situation of food loss and food waste. It is a problem that has impact on environment, on people, and on the economy. India has been a part of our research to understand



the best practices across the world. One of the things that have been going well here is the involvement of the Food Safety and Standards Authority of India. India’s leadership has been proactive on awareness around food safety perspective, and I believe there are many opportunities here in the country.”

Mr Mohammed Asif, Executive Director Plan India said, “8 million children are living with extreme hunger worldwide. The reasons occurring are fragility, conflict, supply chain

disruptions, climate change recognition, and economic and social challenges faced worldwide, but the most important of them all is the notion of vulnerability.”

Mr Padmanaban Gopalan, Founder, No Food Waste said, “In a city with a growing population, the amount of food we produce and we waste is more than 20 per cent. By mapping surplus food resources like wedding halls, restaurants, retail stores, and supermarkets inside the supply chain and establishing hunger spots for the people who need food on



Lisa Moon, CEO & President, Global FoodBanking Network



the demand side, we bridge the gap and match demand and supply.”

Nidhi Pundeer, VP, Global CSR, HCL Foundation said, “At the micro level we need to plan and work with the community, self-help groups and Mother’s groups. Very successful work was done in Nagaland where Mother’s groups played a critical role in organizing local food, what should people eat, what can be fed to the children.”

Raman Chauhan, Founder, Blazen Photonics said, “Today we are seeing food warehouses in the middle of the desert, in the Middle East. The food we eat on an Emirates airplane is grown at one of their warehouses. With newer technologies and innovation in solar, wind, energy, technology we have the ability to produce energy efficient, healthy, and organic ready locally sourced and produced food across the world.”

Satish Kumar, President and Executive Director, *Alliance for an Energy Efficient Economy (AEEE)* said, “To feed the entire hungry population of India, we would need 70,000 back houses in the country. Currently, we have just 5000.

The private sector needs to work with the Government to build technologies to scale up and be more efficient.”

The global food crisis has been further aggravated by conflicts, climate change, and the COVID-19 pandemic. This has led to a rapid rise in the cost of food and fertilizers, putting enormous pressure on vulnerable and low-income communities. This dire situation demands urgent action, which begins with raising awareness and engaging in open dialogue with all stakeholders.

Prioritizing food security is one of the main agendas of the country, therefore, it is imperative to comprehend the significance of food banking, which is a pivotal step towards ensuring food security. Furthermore, food safety is also a crucial objective of the UN’s Sustainable Development Goals.

About The Global FoodBanking Network

The Global FoodBanking Network supports community-led solutions to alleviate hunger in nearly 50 countries.

While millions struggle to access enough safe and nutritious food, nearly a third of all food produced is lost or wasted. The Global FoodBanking Network believes food banks directed by local leaders are key to achieving Zero Hunger and building resilient food systems.

About Thinkthrough Consulting

Thinkthrough Consulting (TTC) is a purpose-led, multidisciplinary professional services firm that specializes in providing advisory support for sustainable development initiatives. They engage with clients to address critical challenges by providing access to the best possible expertise and solutions for achieving efficiency and creating the desired impact. Their solution sets alignment with the SDGs (the ‘Global Goals’) and is custom-made to cater to the specific needs of clients from diverse business sectors. ■

For further information please contact: Katie Lutz, Communications Manager, GFN kelutz@foodbanking.org.

Terra Youth

Joining Hands
for a Greener
Tomorrow

The Cardoso Malcorada

A Mango Quite Unlike Any Other

The summer months herald the luscious mango season for us Indians! A plethora of varieties and species from different states flood all the markets across the country. In this article, **Dr Marianne Furtado de Nazareth** tells us that out of the 74 varieties of mangoes found in Goa, the Malcorada has been considered the leading variety and prized across the state as the best table fruit. There is always a rush for this premium variety of mango, in preference to other varieties.

The mango is a versatile fruit that is sought out by people across all age groups. Most of us are mango lovers and enjoy them, just by cutting them open into two cheeks and a seed. Then hands and fingers are the way to attack and devour the succulent, flavourful fruit! Or you can enjoy them in salsas, smoothies, mousse, salads or chutneys. But it's the little state of Goa which harbours in its warm and humid bosom, some of the best



varieties and species known all over the world and desired and sought after by mango aficionados. Goa's wonderful red laterite soil and humid conditions seem to bring out the best in the fruit, making its mangoes celebrated and acclaimed the world over. Today, the mango has emerged in Goa as a cash crop, especially for export. Two scientists Rego and Kazi wrote a paper in 1979, where they cited there were 77 named and known varieties of mangoes in Goa. However, there may be more on isolated trees in unknown gardens, which the owners protected from indiscriminate multiplication.

According to an remarkable publication by the Indian Council of Agricultural Research (ICAR), "Goa, the History of Mango Cultivation," cultivation of this fruit dates back to the Portuguese era, when Goa was a colony. The large number of varieties present in such a small state is due to the patronage extended to it by the Portuguese. Most of the earlier trees tracked down by the ICAR were old and massive, found in homes or in between coconut and cashew plantations. There were no dedicated orchards with only mango, like those prevalent in other states.

In the same paper by Rego and Kazi, the technique of grafting mangoes was



introduced by the Portuguese in the 16th century. Mango seedlings from any mango were used as root stocks and a side grafting of a scion was performed. Wet mud was plastered over the joint to prevent drying. But the success rate was very low and grafters who had higher success rates were considered skilled. The Jesuit priests were credited for having introduced this skill and by this method the scions of prized mangoes were shared to form new varieties. However,



ICAR says indiscriminate grafting has led to high variability among clones. And today there are more modern techniques of grafting prevalent.

Out of the 74 varieties found, the Malcorada has been considered the leading variety and prized across the state as the best table fruit. There is always a rush for this premium variety of mango, in preference to other varieties. According to ICAR, the origin of the fruit is unknown, but the Portuguese named it Malcorada, which means poor coloured. In common parlance, today it is known as Mancurad. Many varieties of Malcorada are found growing across the state but a lot of variation exists because of indiscriminate propagation. Exclusively eaten as table fruit, it is one of the most expensive fruits in the market and the most sought after.

Among all the Malcorada varieties in Goa, the most delicious Malcorada fruit

is the Cardoso Malcorada—a superlative fruit growing on a tree of the late Dr A B Cardoso of Mapusa, in Bardez. Fausto Cardoso, the current owner of the tree, recounts that during their youthful days, he and his cousins were perched on the wall, likely around 1958, enjoying mangoes. It was during this time that his cousin casually discarded a mango seed in the compound. The seed sprouted, but being too close to the wall his mother moved the young seedling to its present place. The tree started fruiting after 5 years and Fausto's family just enjoyed them and thought nothing of the tree. Then a cousin visited and after eating the fruit persuaded the family to enter it in the Lions Club of Margao mango show in 1992 where it was exhibited as an improved Malcorada. To their utter elation, the mango took the first place and was catapulted into the Hall of Fame.

Fausto says he shares the scions of

his tree with ICAR, Goa and a Mango grafter—Nestor Rangel. "I would like to share our mango with everyone and that can be done by grafts, which have been planted across Goa. Instead of losing such a wonderful fruit, I am happy that clones of it are being made and many more people get to enjoy the Cardoso Malcorada, which is our family's legacy to Goa. We feel exhilarated when our grafts grow and do well in other farms and homes. The mother tree is about 6 stories high today and I see that it is manured and fertilized every year. My family has been happy to share the joy of our 'chance seedling' and skilled grafters like ICAR and Nestor have been able to clone the variety exactly like the mother tree, in their farm."

Former Goa agricultural officer, Miguel de Braganza, who has doggedly pursued goals of sustainable agriculture for over four decades and is an executive

committee member of the Botanical Society of Goa (BSG) was all praise for the Cardoso Malcorada and said, “the mango was presented in a paper named ‘Cardozo Mankurad—a breakthrough in Mango (*Mangifera indica* L.) Selection’ in Tel Aviv by P A Mathew, D G Dhandar.” He said most Malcoradas are tangy in taste but the Cardoso is uniformly sweet. These mangoes are really tasty with an attractive red blush on its shoulder. “The size is large with flesh that is succulent and smooth, and the best part is that it is fibreless.” The variety has been granted a Certificate of Plant Germplasm Registration in 2011 by the Plant Germplasm Registration Committee (PGRC) of ICAR.

The Cardoso Malcorada mother tree consistently yields 1500–3000 fruits annually, characterized by their substantial size and oval shape. Notably, these fruits exhibit no lingering ‘deek’ aftertaste upon consumption. It has a very attractive colour and it lasts longer than other malcoradas. According to comments from ICAR, there is a belief that the fruit could potentially be a spontaneous hybrid between a Malcorada and a Bardez Mussarat or Udgo, both well-recognized mango species. To cite the paper by P A Mathew and D G Dhandar (1997)—“The new selection ‘Cardozo Mankurad’ has originated from a seedling of the most popular cultivar ‘Mankurad’, possessing big fruit size, attractive colour, regular bearing, high yield and quality of the mother tree. Thus, this selection has great potential for commercial cultivation.”



Dr A R Desai, Principal Scientist Horticulture, ICAR says Malcoradas when ripening take 3–4 days, when taken off the tree, but the Cardoso Malcorada has a shelf life of 8–10 days, which is excellent for a commercial fruit. ICAR monitored the Cardoso tree and found an important characteristic that this mango is an early variety and could even have fruit ready for consumption in February or March. “This is a wonderful fruit to give to friends and family during the season should you have a tree,” he advises.

Nestor Rangel the graft producer says his grafts produce mangoes as close to the mother tree as possible. He believes after fruiting all mango trees need to be trimmed and then grafts are made

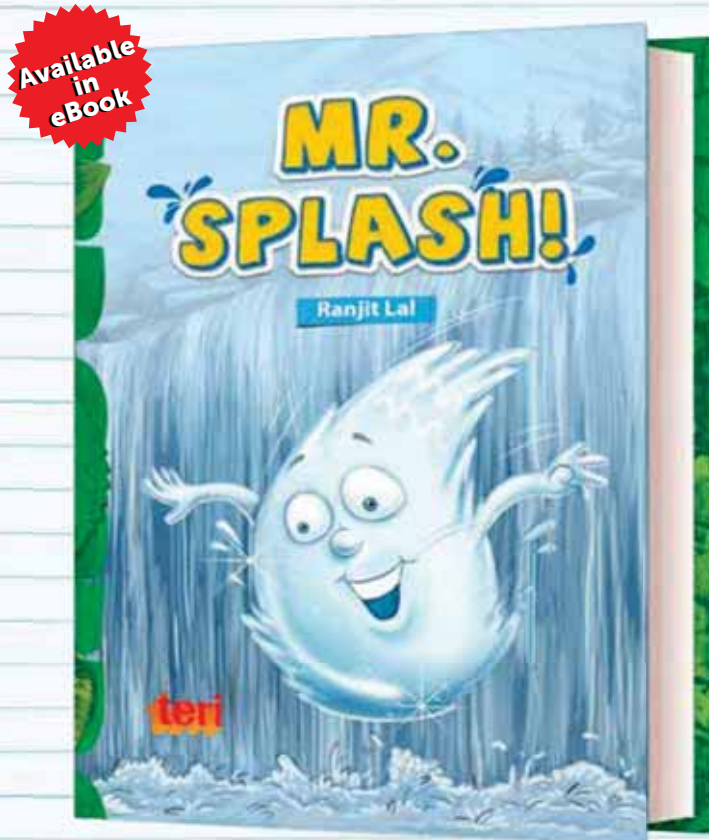
from the scions. “I am happy that a Goan variety of mango is going out for more people to grow and enjoy,” he says. And we say Amen to that!

That is indeed great news for all mango lovers, that this special variety through the generosity of the family where the mother tree grows, allows clones to be made every single year. This unique Malcorada fruit variety will joyfully extend its sweetness throughout not only Goa but also across the entire nation. ■

.....
Dr Marianne Furtado de Nazareth is former assistant editor – The Deccan Herald, Bangalore; adjunct faculty SJCC, MCC & JNC colleges, Bangalore; and freelance science and environment journalist.

**Join Rashika and Rohan on their
life adventures in**

Ranjit Lal's signature style!



Ages: 8-10 years • ISBN: 9789394657007 • Price: ₹225*

What's life like when you're a drop of water like Mr Splash? Well for one, you travel the world, you can get very dirty and sick, you can be a nasty killer or a lifesaver, you can be flushed down the toilet, pass through disgusting intestines, be a part of that great natural spectacle: the monsoon, and share great power with the oceans! All that and much more. Mr. Splash has been there and done it all plus a lot more as he recounts his roller-coaster life adventures to his two new friends, Rashika and Rohan.

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
Fax: 2468 2144 or 2468 2145
India +91 • Delhi (0)11
Email: teripress@teri.res.in
Web: <http://bookstore.teri.res.in>

Bank details for NEFT:
The Energy and Resources Institute
Bank: State Bank of India
A/c Number: 62002345487
IFSC Code: SBIN0020511

**Price is subject to change*

Bizarre Facts

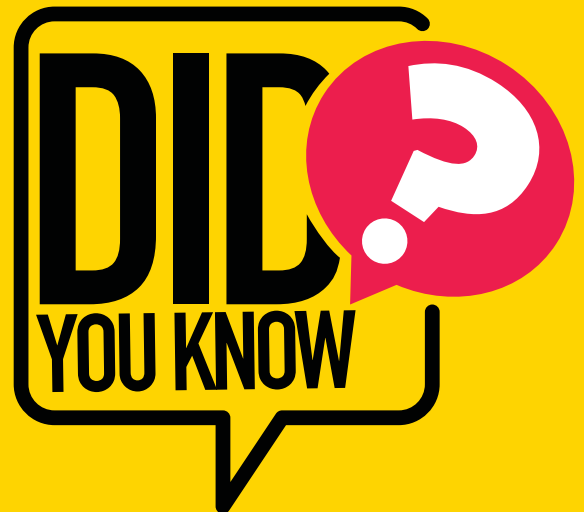


1. In Switzerland, it's illegal to own just one guinea pig because they are prone to loneliness. You must have at least two.
2. The Eiffel Tower can be 15 cm taller during the summer due to thermal expansion.
3. The smallest bone in the human body is the stapes bone, located in the ear, and it's roughly the size of a grain of rice.
4. Butterflies taste with their feet. This helps them find the best plants on which to lay their eggs.
5. A group of flamingos is called a "flamboyance."
6. Sharks are the only fish that can blink with both eyes.
7. A "jiffy" is an actual unit of time, equal to 1/100th of a second.
8. Octopuses have three hearts: two pump blood to the gills, while the third pumps it to the rest of the body.



Did You Know?

- There's a species of jellyfish known as *Turritopsis dohrnii* or the "immortal jellyfish" that can revert back to its juvenile form after reaching maturity, effectively making it biologically immortal.
- Honey never spoils. Archaeologists have found pots of honey in ancient Egyptian tombs that are over 3000 years old and still perfectly edible.
- Some cats are allergic to humans. It's rare, but feline reactions to human dandruff are possible!
- Wombat faeces are cube-shaped, which helps prevent them from rolling away and marks their territory to attract mates.
- Cats have five toes on their front paws, but only four on their back paws.



Source: newsgpt

Natural Farming through a Wide-Angle Lens

Groundbreaking Comparative Study Reveals Natural Farming Leads for Yields, Livelihoods and Health

Andhra Pradesh Community-Managed Natural Farming (APCNF) is a state-wide agroecological transformation of the farming practices of its 6 million farmers over 6 million hectares and 50 million consumers. It is the largest transition to agroecology in the world, with 630,000 farmers already addressing multiple development challenges: rural livelihoods, access to nutritious food, biodiversity loss, climate change, water scarcity, and pollution.

A pioneering new study analysing the costs and benefits of different farming systems gives new evidence to support agroecological natural farming as a key approach to help feed communities and transition farmers to nature-positive outcomes in support of the Sustainable Development Goals (SDGs). This first-of-its-kind research, led by impact data and analytics provider GIST Impact

and supported by the Global Alliance for the Future of Food, used True Cost Accounting methods to compare the major economic, social, and health impacts of natural farming with the three existing and still dominant farming systems in the Indian State of Andhra Pradesh—tribal farming, rainfed dryland agriculture, and chemically-intensive farming in the delta region.

The report, "Natural Farming Through a Wide-Angle Lens: True Cost Accounting Study of Community Managed Natural Farming in Andhra Pradesh, India," shows that farms using natural inputs achieved equal or higher yields compared to the other farming systems—on average, these farms saw an 11 per cent increase in yields—while maintaining higher crop diversity. This effectively refutes the idea that chemically-intensive farming methods are necessary to meet the food production demands of a growing population.

As a result of lower input costs and higher incomes, community-managed natural farming in Andhra Pradesh (APCNF) also improved farmer livelihoods, with net incomes averaging 49 per cent higher. Furthermore, it led to better health outcomes and stronger communities. Villages with a higher take-up of natural farming also had higher female workforce participation.

The results highlight the positive return on public investment resulting from natural farming, with strong evidence that natural farming offers a better alternative to the existing farming

systems. "Given the ongoing climate impacts, it is imperative to scale inclusive and climate-resilient agricultural models," said Pavan Sukhdev, CEO of GIST Impact and project director. "By using a True Cost Accounting framework, policymakers can now assess the costs and benefits of different farming systems, considering economic, social, environmental and human health factors that were previously overlooked in conventional metrics focussed solely on yields and profits." "Our research provides a blueprint for environmentally-friendly agricultural development that supports social and economic goals while mitigating climate and biodiversity challenges," said Sukhdev. The study also highlights the social impacts of natural farming. A virtuous cycle of increased economic gains, trust, cohesion, and reciprocity was observed, with women playing a significant role in enhancing social capital. Smaller farms and those practicing natural farming exhibited higher social capital scores, emphasizing the importance of smallholder farmers in community development.

Additionally, those practicing natural farming experienced fewer on-farm health risks, losing 33 per cent fewer working days to illness compared to farmers using other methods. The use of chemical pesticides and fertilizers in other practices correlated with higher health costs and productivity losses, further underscoring the benefits of natural farming on human health. ■



Kai Po Che

The Kite's Flight or Bird's Plight?

In this article, **Inderdeep Kaur** and **Manju Tomar Balhara** delve into the fascinating world of kite flying—a captivating sport and recreational activity that occasionally engages entire families. With a rich historical backdrop, kite flying competitions in various countries hold a significant place, representing longstanding traditions. The authors advocate for a revival of the “patangbaazi” spirit, while also emphasizing the importance of showing compassion towards the well-being of birds, prone to injuries both in the sky and on the ground, as well as animals with hooves and paws that might suffer harm from discarded manjha strewn on the ground.

Every year around August–September, one can see colourful kites of various shapes and sizes stacked in Delhi markets. The tricolour kites adorned with streamers beautifully reflect the patriotic sentiments of the boys on Independence Day. On Rakshabandhan, the joy is twofold as boys and young men proudly showcase their wrist adorned with a rakhi while taking control of the soaring lightweight ‘aircraft’.

Occasionally, some young gentlemen also join this outdoor activity accompanied by the lady of the house, assigned the job of holding the spool while the kids cheer them up. The kite after its take off ‘dances’ in harmony

with the wind conforming to the laws of aerodynamics. Feeling exhilarated by the sky full of lightweight colourful objects gracefully swaying in the air, one is thrilled. The joy multiplies when this simple kite flying turns into ‘patangbaazi’ with a challenging kite emerging from nowhere and entering a fight with a ‘random competitor’. Within seconds of adrenalin rush, the silence breaks into—‘Kai Po Che’ (in Gujarati it means—I have cut) and one of the kites after losing an aerial battle, drifts freely falling back on the ground. The winner kite then soars higher to take up yet another challenge.

Besides being a physical activity, which involves kinesthetic coordination and fine motor skills, kite flying is an

engrossing sport and a recreation which engages occasionally the entire family. The sport has a long history and several countries have kite flying competitions that signify the longstanding traditions.

The history of kite flying around the globe is quite interesting. In China, where kite flying is said to have originated, it is known as Feng Zheng. It is believed that a general named Han Hsin flew the first kite to measure the distance for a tunnel his troops were to dig against the enemy during the attack. In 1748, a Scottish meteorologist Alexander Wilson is said to have measured air temperature at a height of about 3000 ft above the ground by tying a thermometer to the kite. In Japan, ‘paper hawks’ were used as messengers. As Japan had good quality bamboo, excellent paper and hemp, it was easy for them to popularize kite flying. The art of kite making was later modified and subsequently colours and printing techniques were used to make kites more attractive. In certain regions, kite flying is also associated with warding off evil spirits, for sending prayers, Easter celebrations, while the monks have been using silk kites in the past for religious and ceremonial purposes.

However, with internet boom, people moved to indoor activities and a large number now engages in video and digital gaming. As a consequence, the art



of kite flying seems to have edged out by this change. But still flying kite is an inseparable part of special occasions in India (especially in Gujarat and Lucknow), Pakistan, Vietnam, Afghanistan, Indonesia, China, Japan, Chile where kite flying and kite cutting—patangbaazi—as it is known in India, is enjoyed as a sport as well as a recreation. There are more than a dozen festivals devoted to kite flying all over the world such as in Sydney, Australia (Annual festival of the winds), Portsmouth International Kite festival in the UK, and so on. In Bali, special kites are made which have a vibrating bow called Guwang that makes a humming sound. Hamamatsu Giant Kite Festival is unique tradition of Japanese, where a couple blessed with a baby boy, writes the name of the baby on the kite and colours it with images of a warrior or tortoise which signify strength and long life, respectively. The kite is then flown to soar high in the sky and it is believed the child will be blessed with

qualities written on the kite.

The simple sport with long history and tradition now seems to be marred by the popularization of *manjha*. This 'killer string' has generated a lot of objection from PETA (People for Ethical Treatment of Animals). In earlier times, people used the string made of basic cotton thread which was later improved upon by a coating of isabgol husk, wood powder or *gumchi* (Indian liquorice) resulting in a stronger thread popularly known as 'Saddi'. These threads were biodegradable and could break off easily when encountered by another kite braving the wind. But the recent transformation of patangbaazi which has become more competitive for the contesting kites has popularized *manjha*. The synthetic nylon thread coated with glass powder, metal and chemicals, is invisible to the eye at a height, and is non-biodegradable. This *manjha* has played havoc on our avian friends and has put the sport under scanner of



A pigeon hangs dead on the electric wire after its wings get cut by the deadly manjha

animal activists. These strings not only cut through the wings of the birds, but even through their bones, leaving them either maimed for rest of the life or inflict a painful death. The strings get entangled in trees and when the birds perch on the branches, their feet get injured due to entangled *manjha* and some birds may never be able to fly again. The strings also obstruct the path





of birds in the sky and the disoriented birds then fall on the ground only to be caught by animals and get killed.

Considering the statistics of bird injury and deaths every year due to manjha, the National Green Tribunal (NGT) of India has strictly banned sale of all forms of manjha. People however, continue to use manjha, ignoring the appeals of PETA to 'Save the Feathery Friends'. The bird rescuers lend a healing touch and rush them to Delhi's Shri Digambar Jain Lal Mandir Bird Hospital, Chandni Chowk which during kite flying season is compelled to work beyond its capacity. The NGOs train young people to give first aid to the injured birds and spread awareness not to remove the entangled manjha from the birds' body as it requires expertise. The injured bird should be just wrapped in a cloth and brought to the hospital for treatment.

Kites in most parts of the globe have become mechanized; from small paper hawks they have evolved into aircrafts, and with machines attached, are similar to drones. Similarly, the kite flying has

given way to kite surfing, which needs to be regulated by strict rules. Though such mechanized kites are not popular back home, the Indian Aircraft Act of 1934 was modified in 2008 which is extended to kites also. Unfortunately, we need to address the issue of manjha and birds' plight.

Since children are the main consumers of manjha, the best safety measure should be to have education campaign in the schools. They should be made aware of the fact that this sport also has its rules and regulations, though not elaborately documented. Besides their own safety while flying kites, the animals should also be our concern. The examples of countries such as Denmark and Japan can be cited where kite flying is not only popular activity immersed in the culture (International Kite Festival Fanoe, Denmark, and Hamamatsu Kite Festival in Japan) but it is highly mechanized—with wrist leash, kite lines that are not coated with glass powder or chemicals and also devices to know the wind velocity and direction while

flying. In these countries, kite flying is organized in an open ground, at the time when there are not many birds in the sky (avoiding morning and evening). The kites are allowed to soar to a particular height only, and activity is not allowed in congested areas and near electric poles. It is an entertainment for all present, even those who do not fly the kite but relax in the ground watching colourful display of art and aerodynamics.

Shouldn't we consider rekindling the spirit of "patangbaazi," while also being more considerate towards the well-being of the birds (which can sustain injuries both in the sky and on the ground), as well as animals with hooves and paws (who can be harmed by the abandoned manjha on the ground)? Perhaps we can draw inspiration from countries like Denmark and Japan, learning from their approaches to give "patangbaazi" a fresh and more compassionate perspective. ■

Inderdeep Kaur, Professor in Botany, Sri Guru Tegh Bahadur Khalsa College, University of Delhi, Delhi, and Manju Tomar Balhara, Assistant Professor, Shivaji College, University of Delhi, Delhi.



Scientists Predict Effects of Rising Seas on Coastal Habitats

The rapid sea-level rise and resulting retreat of coastal habitat seen at the end of the last Ice Age could repeat itself if global average temperatures rise beyond certain levels, according to an analysis by an international team of scientists from more than a dozen institutions, including Rutgers.

In a study published in *Nature*, scientists reported how ancient coastal habitats adapted as the last glacial period ended more than 10,000 years ago and projected how they are likely to change with this century's predicted sea level rise. They conducted their analysis by examining the ocean sediments of ancient shorelines from a time when oceans rose rapidly, mainly because of melting ice sheets in the Northern Hemisphere. This examination allowed them to infer how ancient coastal habitats changed and formed the basis of improved predictions about the present.

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

Scientists Invent a Bright Way to Upcycle Plastics

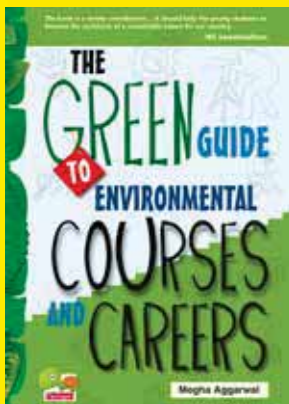
Scientists from Nanyang Technological University, Singapore (NTU Singapore) have created a process that can upcycle most plastics into chemical ingredients useful for energy storage, using light-emitting diodes (LEDs) and a commercially available catalyst, all at room temperature. The new process is very energy-efficient and can be easily powered by renewable energy in the future, unlike other heat-driven recycling processes such as pyrolysis.

This innovation overcomes the current challenges in recycling plastics such as polypropylene (PP), polyethylene (PE) and polystyrene (PS), which are typically incinerated or discarded in landfills. Globally, only nine per cent of plastics are recycled, and plastic pollution is growing at an alarming rate. The biggest challenge of recycling these plastics is their inert carbon-carbon bonds, which are very stable and thus require a significant amount of energy to break. This bond is also the reason why these plastics are resistant to many chemicals and have relatively high melting points.

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



To know more... Read



ISBN: 9788179935699

THE GREEN GUIDE TO ENVIRONMENTAL COURSES & CAREERS

Megha Aggarwal

As India gradually moves towards a "green" economy, new avenues of employment are opening up for today's youth. For students thinking about future course and career options, this one-of-its-kind handbook offers a rich body of information required to turn a green interest into a future opportunity. From environmental engineering, environmental science, and environmental law to agriculture, climate science, and zoology – it profiles a range of undergraduate and postgraduate courses, and the broad spectrum of careers they lead to. Peppered with anecdotal accounts from well-known professionals and a handy listing of useful resources, *The Green Guide to Environmental Courses and Careers* is a must-have for any student keen on harnessing a green passion.

Available at: [amazon.in](https://www.amazon.in) [flipkart](https://www.flipkart.com) [amazon kindle](https://www.amazon.in/kindle) [Google play](https://www.google.com) [teri bookstore](https://www.teribookstore.com)

Ladakh

The Land of Mystic and Mystery

Story by: Ms Shakti Bishnoi

Photos by: A S Bishnoi

Ladakh is recognized as the “the roof of the world” because it stands 4.8 km above sea level and is bordered by imposing mountain ranges. The southern part of the Tibetan Plateau is surrounded by the Greater Himalayan ranges and a part of it is identified as Ladakh. Apart from the mighty Indus originating in Mahasarovar Lake of Tibet, the other important rivers are Shyok and Nubra.

Ladakh, often referred to as the “land of passes” as well, is a territory known for its enigmatic and globally endangered snow leopards, as well as its picturesque and spectacular trans-

Himalayan landscapes. The Indian cold desert extends through Ladakh in Jammu & Kashmir, Lahaul Spiti in Himachal Pradesh, to north Sikkim. The region is considered to be one of the highest inhabitable regions in the world, with the lowest human density. The inhabitants are either nomadic pastoralists or agropastoralists, e.g., the Changpa nomads. Being the largest city of Ladakh, Leh enjoys maximum tourism. It not only links one of the sleepy hamlets and valleys of the district, but is also one of the few remaining Buddhist destinations in South Asia.

Our Continued Journey in the Mystic Land

Of all the places I have visited in India, Ladakh stood out as unique, primarily because of its spectacularly different and beautiful landscape comprising rugged stony-brown mountains, with the occasional snow-capped peaks and deserts. Combined with its delectable cuisine and the outstanding locations and homestays, it was undeniably one of my best vacations ever. Being a cold desert, this arid terrain experiences drastic weather changes. The temperatures are so extreme that



while in winters, the temperature ranges between 0°C and 28°C, in summers one gets to face temperatures in the range of 3°C to 30°C. Since the temperatures are diverse and the altitude only gets higher, travellers need to get acclimatized before embarking on their journey. We have been visiting this mystic land in search of the elusive mountain cat for the last three years, with no sightings in our luck.

Ladakh gives you feeling of being at home and in the lap of nature. Once our daughter—just 3 years old—started speaking, she said, “Our home is in Ladakh, what are we doing here in the city?” I had to tell her that being in the Armed forces meant that we keep moving like a gypsy, but our final destination will be this place (Ladakh). She has accompanied us for all the trips; however arduous or inaccessible the terrain, she is the one who takes lead and we just enjoy her company. In fact, she was more comfortable than us at that altitude and with minimum necessities.

Visits

Our first visit into this hinterland was to explore the monasteries and tourist locations, which are usually mentioned on the maps distributed to tourists. It was a wonderful trip that explored length and breadth of Ladakh. The next visit was

equally enchanting, but with a focus on sighting the elusive cat, coupled with having a homely feeling. The stories of sighting narrated by the people at the Rumpak homestay, were as if it was a daily chore for them to spot the snow leopard. They were unaware of the fact that an entire world of adrenaline-seeking humans is eager to catch a glimpse of it, and so were we. We stayed there for two days, keeping our eyes fixed on the peaks throughout the day, and relishing the elusive cat from a distance. But we were glad to sight other species, such as blue sheep, Ladakh urial, Asiatic ibex, etc. We also sighted some beautiful birds including some Tibetan species uncommon in other parts of the country, such as Golden eagle, Lammergeier, and Himalayan Griffon vulture, which rule the Rumbak valley. Many other local species such as Chukar, Tibetan Partridge, Tibetan Snowcock, Tibetan Snowfinch, Streaked Rosefinch, Robin Accentor, etc., dot the valley as well.

We have seen the landscape change in the few years during our visits to Ladakh. This time, during our third visit, we decided to explore the eastern sector of Ladakh and we visited Hanle, Umling La, Nyoma, and lesser known tourist destinations such as Tso Kar, Sundu valley, Puga valley, Tso Moriri,



Changthang region, Chilling, etc.

However, our experiences of Ladakh have slowly started deteriorating over a period of time.

The Chinese Effect

The looming threat presented by China has intensified, with their continued deployment of armed forces into remote and previously inaccessible regions, raising concerns. Post the Galwan crises and the 1962 war (lesson learned the harder way), the Indian armed forces never want to take any chance with them. Certainly, the imperative to protect our borders and territorial integrity is undeniable. However, it is essential to acknowledge that such conflicts are also exacting a toll on the environment and local wildlife in the region. This requirement to position the armed forces at borders for security comes at the cost of the environment—building infrastructure which consumes the resources that are scanty, along with disturbing wildlife and threatening flora and fauna at the same time.



The wilderness has been converted into a dwelling for humans and their ammunition.

The Dog Menace

I have noticed that the dog menace has increased manifold in the adjoining areas, where there are temporary settlements of army units and permanent army units as well. They feed them and their population increases at a faster rate. If you pay a visit to these units, you will notice at least 20–30 dogs wandering there at all times. I have noticed them forming packs to attack wolves and foxes, and even black-necked cranes. Even nomads keep dogs, but they keep moving which limits the scope for a population surge. The dog menace if not addressed now, shall have ever-lasting impacts on the wildlife in the region.

Concrete Jungle

Considering army settlements expanding in the region, the locals are looking for profit by increasing the constructing business. But creating this concrete jungle comes at a price. The real estate business is booming like never before in regions that were once considered uninhabitable. However, this growth has led to the destruction of wildlife. While wildlife photographers and scientists seek perfect shots of rare species,



their contribution to preservation or conservation is almost negligible. Now, we hardly see any black-necked cranes and other migratory birds in the same habitat which were abundant with these animals almost a decade ago. Tso Kar, and Tso Moriri had countable birds visiting the habitat. Tso Kar has almost dried up and the government is unbothered. The locals used to sight so many birds visiting the sanctuary and now only countable visit this very lake. The lake, a source of salt for Ladakhis once upon a time, is now drying at a faster pace. More homestays/hotels in the region are coming up. Road construction is rampant in all the regions to have better connectivity. I believe that

the region should be left undisturbed as far as possible, in order to retain its flora and fauna and ensure environmental stability.

Increased Tourism due to Better Connectivity via Zaskar Valley

Ladakh has now emerged as a new tourist destination for Indians from every corner of the country and the place is especially a bikers' heaven. However, this tourism is at the cost of flora and fauna. However, this tourism boom comes at the expense of the region's flora and fauna. Not only are more hotels and homestays springing up, but people are also acquiring land for additional constructions, primarily aimed at catering to tourists. The increased accessibility to the region, thanks to affordable airfare, has led to a surge in tourists flocking to Ladakh. This influx is also accompanied by road construction efforts aimed at connecting remote villages along the China border to the mainland, serving both infrastructural development and national sovereignty interests. The presence of humans is threatening the very existence of endemic species; and I believe that the locals are a part of the endemic species too.





Climate Change

Six Tibetan families from the village of Upper Kulum, decided to leave their homes over 10 years ago and migrate to the nearby town of Upshi—about 5 km away—for a better chance of securing their livelihoods. One of these families has established a grocery shop along the road leading to the Puga hot springs, earning their livelihood from the stream of tourists who visit their store.

The experience of water scarcity in Kulum has been enough to alarm Ladakh's district authorities and NGOs, serving as a warning for what the future of the region could hold if measures to mitigate climate change are not put in place immediately. Kulum is glacier-fed, depending on the water that dribbles down the mountains from snowmelt, but over the last few decades, the source of this water has been waning because of

global heating.

The Hindu Kush Himalayan Region—in which Ladakh is located—is also called the third pole because of the volume of glacial ice it stores. These glaciers, which are the source of 10 major river systems, are warming much faster than the global average.

There is a lot of stress on Ladakh's water sources, and the melting or erosion of glaciers is going to become a huge challenge. If we don't act now, there will be more outmigration and more abandoned villages. The most obvious sign of global warming in Ladakh is the changing face of the mountains themselves.

Scientists have recorded a retreat in both snowfall and glacial mass in Ladakh over the last few decades. Snowmelt and rainfall in the months of March and April would irrigate their fields enough

to sow barley, wheat, peas, and potatoes. However, with lower levels of snowfall, the sowing season has gone awry.

Now snowmelt is happening much earlier and so the peak of discharge is happening in spring, leading to a shortage in the summer season. There is also a reduction in soil moisture, which can cause springs to dry. The lack of spring water and shift in the monsoon towards the winter months has made agriculture completely unviable. Even within the range of a few kilometers, topography in the village varies greatly. ■

To be contd...

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.

Beat the Heat

Time for Low-Cost Cooling Solutions

Ashden is a UK-based climate solutions charity with a mission to accelerate transformative climate innovations and build a more just world. Ashden helps tell the stories of climate and energy pioneers in the UK, Africa, Middle East, Asia and South America through its annual Ashden Awards plus other programmes. Read more to know about partners at Ashden which work on cooling systems for buildings that are low carbon/low energy.

As scorching temperatures sweep across the world, communities are finding themselves in the grip of an unprecedented heatwave, shattering records and triggering widespread concerns about public health, environmental impacts, and strain on essential services. The costs of a rapidly changing climate, particularly rising temperatures, fall hardest on poor and marginalized people. The heat challenges they face include dangerously hot buildings and those with less money generally face higher indoor temperatures.

Traditional air conditioning using fossil fuels cannot be the go-to in a decarbonizing world, but for those on low incomes, they do not have an option

anyway. And without access to cooling measures heat stress increases the risk of death, and physical and mental illness.

The climate solutions charity, Ashden, has coordinated a Fair Cooling coalition of organizations dedicated to passive cooling solutions. They also highlight organizations working on low-carbon solutions in the global South through their annual Ashden Awards, which showcase clean energy and low-carbon solutions. Collaborators with Ashden from Egypt and India provide examples of how to keep buildings cool using highly effective, affordable, 'passive design' methods such as shading, ventilation, heat-reflecting materials, and incorporating cooling water systems and planting.

Cooling Innovation in Egypt and India

ECONsult Architects, Egypt provide green and cool architecture in desert conditions. ECONsult Architects designed Linah Farms in Egypt Western Desert—accommodation for tea farm workers, which provides cool and healthy living conditions—a vast improvement on the often unbearably hot living spaces many workers go back to at night. Green Architects ECONsult in Egypt design affordable and accessible green buildings to improve comfort and livelihoods and have the largest portfolio of green certified buildings with the first carbon neutral project in Egypt.

Founder and CEO, architect Sarah El-Battouty, is one of Egypt's leading green entrepreneurs and ECONsult's success has put her on the global stage—she is a UNFCCC climate champion ambassador, senior advisor on Climate & Sustainability to the Egyptian Presidency, designed the COP27 Pavilion in Egypt and is now an advisor for COP28.

"ECONsult has shown what's possible in terms of creating buildings which keep people cool and healthy. For instance, we designed a sustainable housing complex for tea farm workers in Egypt's Western Desert. We drew on traditional knowledge and used locally available materials such as porous limestone and sandstone that allow air

ECONsult Architects, Egypt - Linah Farms in Egypt and is supported by the EBRD





to flow through the walls and provide shade to protect people at high risk of heat stress. “Workers’ accommodation is generally very poor quality and heat exhaustion is very common. These homes transformed their lives, and safeguard both workers and employers by decreasing heat-related health issues and deaths.”

El-Battouty points out that as the housing sector is very vast, many stakeholders need engagement—something that can only be done by governments and that the costs of inaction are huge. “Governments have a key role in steering public interest and should give a very clear roadmap of the priorities they want to invest in. Climate change will only become integrated in development if it is not treated as a secondary ‘extra pointer’ rather an existing problem.” ECONsult were part of the Fair Cooling coalition.

CBalance Solutions, India – Training Students in Future-Proofing Buildings for Heat

Indian social enterprise CBalance Solutions advocate for cooling solutions

for India’s vulnerable communities. They implement pilot projects with passive-design roof retrofits in informal settlements and also update curricula in architecture and engineering schools. By 2026, around 50 architecture colleges, 10,000 students, and more than 1000 professors annually are expected to engage in devising passive design solutions for urban poverty.

CBalance Solutions work on highlighting the relationship between wealth and cooling, and the urgent need for what’s been termed ‘cooling justice’ or ‘fair cooling’. People in poor communities who are enduring oppressive, unrelenting heat are often living alongside large high-rise buildings with huge AC systems. CBalance insist that fair cooling is about tackling power structures as well as introducing new technology. By October 2025, CBalance aim to implement passive design solutions in 5–10 per cent of informal housing in four major Indian cities, through government or city utility-funded programmes and women’s cooperative micro-businesses. This could mitigate 0.5–1 million tonnes of CO₂e annually, providing thermal comfort for about 1.5–3.0 million people. CBalance were part of the Fair Cooling coalition.

Mahila Housing Trust – Low-Cost Cooling Solutions and Extreme Weather Warnings for Poor Communities

Mahila Housing Trust, India: Women in slum communities support each other to take up practical and affordable home cooling solutions. The Mahila Housing Trust assists impoverished women in Indian cities in coming together to address social challenges, such as overheating in slum communities. Their initiatives have included simple measures such as the installation of reflective, cooling roofs or cost-effective alternatives such as sun-reflective white paint. They also set up early warning systems for heatwaves and floods, water quality testing, cleanliness drives, and various other activities.

Their interventions have influenced the lives of over two million people and have trained more than 21,000 construction workers. Siraz Hirani, Senior Programme Management Specialist at Mahila Housing Trust, said: “In the scorching battle against rising temperatures and climate change impacts, the urban poor stand as the

most vulnerable and marginalized. Passive cooling emerges as a beacon of hope in this quest. Integrating green spaces, reflective surfaces, and cross-ventilation into our designs can mitigate heat stress and offer comfort amidst blistering urban heat islands. By investing in these solutions, we breathe life into the vision of a cooler, safer, and healthier urban habitat for the less privileged.” Mahila Housing Trust were winners of the 2021 Ashden Award for Cooling in Informal Settlements.

Ahmedabad Heat Action Plan, India – Local Authorities Working Together to Give Warnings to the Most Vulnerable

The Ahmedabad Heat Action Plan—an early warning system and heat preparedness plan aimed at saving lives—first developed in 2013 by a coalition between the Natural Resources Defence Council (NRDC), the Ahmedabad Municipal Corporation (AMC), and the Indian Institute of Public Health—Gandhinagar (IIPHG) is an exemplar of how joined-up action can effectively tackle heatwaves in cities for the most vulnerable.

Dr Vijay Limaye, Senior Scientist at Natural Resources Defense Council says: “Ahmedabad’s innovative Heat Action



Inside a home in Pune, ‘wood-wool panels’ have been installed under the roof which cool down the room. Picture credit: CBalance Solutions

Plan is helping to strengthen local resilience to intensifying heat hazards in India through improved heat forecasting, public health risk communication, medical professional training, and municipal coordination.”

Over the past decade, the Ahmedabad approach has since expanded to other heat-prone cities and states through leadership from India’s National Disaster Management Authority. Ahmedabad Heat Action Plan were winners of the 2020 Ashden Award for Cool Cities.

Action in Every Corner of Society

In developing countries with growing populations, the demand for new

housing is immense. Alongside improving the quality of new constructions, existing housing also urgently needs enhancement. Chhavi Sharma, International Programme Manager at Ashden insists that the combination of life-threatening temperatures and rising housing demand means cool, sustainable, and affordable building designs can no longer be ignored. A collective effort in cooling innovation is urgently required with backing from policymakers, funders, investors, and development partners committed to local and global equity.

“Affordable, sustainable cooling techniques, independent of costly fossil fuels, must be accessible to all. To achieve this, partnerships are key—with innovators, funders, policymakers, and communities all working together to implement widespread, cutting-edge and fair solutions. This will help tackle the challenges of extreme heat on a large scale, support pioneers working in passive cooling and make sure that people across all segments of society can stay comfortable and healthy in extreme heatwaves.” ■



A community outreach worker gives advice to a mother about handling heat stress, Ahmedabad. Picture credit: NRDC

For more information, please connect with francesca.tute@ashden.org

“Reaching 50 Per Cent Energy from Renewables by 2030”

A Summary

During COP26 and COP27, India demonstrated its commitment to combating climate change by making significant pledges. One of the key commitments was India’s goal of achieving net-zero emissions by 2070. As part of its Nationally Determined Contributions (NDCs), India set a target of having approximately 50 per cent of its cumulative electric power installed capacity generated from non-fossil fuel-based sources by 2030.

The state of Tamil Nadu launched its own Climate Change Mission in December 2022, which focused on reducing emissions by harnessing green and renewable energy sources. In line with this mission, the state government announced ambitious plans to add 20 GW of solar energy by 2030.

Taking their commitment even further in March 2023, the Tamil Nadu government pledged that 50 per cent of the state’s energy would be sourced from renewable sources. This ambitious target positions Tamil Nadu as a frontrunner in climate action both nationally and

internationally. The state aims to attract investment and establish itself as a prominent export hub by leveraging the increasing pressure on industries to reduce carbon emissions and transition to renewable energy. By accelerating its transition to clean energy, Tamil Nadu can enhance its competitiveness and appeal to various industries.

During the fiscal year 2021–22, Tamil Nadu generated a total of 117,553 million units (MU) of energy. Out of this total, renewable energy sources, including solar, wind, bioenergy, and hydro, accounted for 22 per cent. However, coal power remained the dominant energy source, comprising 70 per cent of the overall generation. The energy generated can be categorized into two groups: energy procured by the Tamil Nadu Generation and Distribution Corporation (TANGEDCO) and energy under Open Access. TANGEDCO procured 83 per cent (97,297 MU), while the remaining 17 per cent (20,266 MU) was obtained from Open Access sources.

It is worth noting that TANGEDCO

sourced only 16 per cent of its energy from renewables, while 52 per cent of the energy under Open Access came from renewable sources. Around 51 per cent of the energy procured by TANGEDCO was derived from TANGEDCO or Central-owned coal power plants. Another category, labelled “Short term and others,” accounted for 24 per cent of the energy, likely primarily sourced from coal power.

To achieve the 2030 renewable energy target, an additional 60,637 MU of renewable energy needs to be generated in 2030. This is equivalent to adding approximately 28 GW of wind energy capacity or 32 GW of solar energy capacity. Meeting this goal requires an average annual renewable energy capacity addition of 4.80–5.50 GW, starting from the fiscal year 2023–24. However, the average annual renewable energy capacity addition in Tamil Nadu from 2018 to 2023 was only 1.21 GW.

Achieving the 50 per cent renewable energy target will require a collaborative effort among key stakeholders in the power sector, including the distribution licensee, the Electricity Regulatory Commission, the Energy Department, independent power producers, and consumers/prosumers. It is crucial for the state to develop a comprehensive energy policy that aligns policy targets with operational strategies and establishes a clear long-term vision for decarbonizing the power sector. Such an approach will ensure Tamil Nadu’s successful transition to a sustainable and renewable energy future. ■

Link to access the report: <https://www.aurovilleconsulting.com/reaching-50-energy-from-renewables-by-2030/>



Future Belongs to Innovation

Repurpose Plastic Bottles to Curtail GHG Emission

We can significantly reduce greenhouse gas (GHG) emissions by simply redesigning single-use plastic bottles, which account for approximately 5 per cent of the total plastic production. In this article, **Ashok V Gadewar** explores why and how innovation can effectively tackle this issue.

Global warming is on the verge of exceeding the critical threshold of a 1.5°C temperature rise, highlighting the urgent need for comprehensive efforts to curtail further temperature increases. The Plastic and Climate: Hidden Costs of Plastic Planet (2019, CIEL publication¹) states that one of major contributors to global warming is plastic life cycle from its production to end of its use and eventually discarded. But, it is not true because plastic continues to pollute long after its use though the quantitative estimates for greenhouse gas (GHG) emissions from different plastic waste management methods are not well documented or scarce. If plastic production and use grow as currently planned, by 2030, these emissions could reach 1.34 gigatonnes per year and by 2050, 10–13 per cent of the entire remaining carbon budget. We are producing around 380 million metric tonnes plastic annually and roughly half is destined for single-use products.² In India, 43 per cent of all plastics produced are used for packaging, majority being



Photo by Jonathan Chng on Unsplash

single-use plastic.³ Over a million single-use plastic water bottles are bought every minute and its consumption is likely to hit half a trillion every year. It is disheartening that only 9 per cent of used bottles are recycled, with the remaining 91 per cent being discarded, littered, or even burned. This massively jeopardizes our environment and the planet's oceans. Ponder what will happen

to climate if all these bottles (0.5 trillion) are burnt after use. One kilogram of plastic on burning releases 2.9 kilogram CO₂e. In total they will weigh 10 million tonnes and on burning release 29 million tonnes of CO₂e in the atmosphere every year.

Presently, we manage plastic waste in three ways. 1. Land filling; 2. Recycling (recover materials without altering the molecular structure); and 3. Incineration. Disposing of single-use plastics, however, is far from a walk in the park. Recycling and incineration involve multi-step,

¹ Details available at <https://www.ciel.org/wp-content/uploads/2019/05/Plastic-and-Climate-FINAL-2019.pdf>

² Details available at <https://www.earthday.org/fact-sheet-single-use-plastics/>

³ Details available at <https://www.drishtiiias.com/current-affairs-news-analysis-editorials/news-editorials/2021-12-28/print/manual>

Photo by Markus Spiske on Unsplash



laborious, and time-consuming processes that can take months and require a significant amount of energy. All these three methods involve the following steps⁴:

- **Step 1:** Collection of waste plastic and its transportation to desired site and purpose
- **Step 2:** Sorting of plastics into categories
- **Step 3:** Washing to remove impurities
- **Step 4:** Shredding and resizing
- **Step 5:** Identification and separation of plastics
- **Step 6:** Compounding

CIEL publication 2019 had given model climate impact (kgCO₂e/metric tonne) of plastic waste disposal. Let us quantify GHG emission from energy used in the process of waste disposal of

10 million tonne weight of 0.5 trillion waste bottles as above. Emission (CO₂e) rates for collection are 45, 35 and 35 kg/metric tonne for recycling, landfill, and incineration, respectively. For material handling it is 650, 25 and 38 kg/metric tonne for recycling, landfill, and incineration, respectively. Thus, collection and material handling of waste bottles would release 695,000; recycle, 60,000; land fill, 730,000; incineration tonne of Co₂e in atmosphere every year. For further processing, energy use for recycling and incineration would emit 2090 and 2894 kg CO₂e/tonne of waste, respectively. For 10 million plastic waste it will be 20.9 (recycling) and 28.9 million (incineration) tonnes. We can avoid/curtail 60,000 to 730,000 tonnes CO₂e gas emission per year from bottle waste just by changing attitude and providing utility to product avoiding collection and its transport as discussed below.

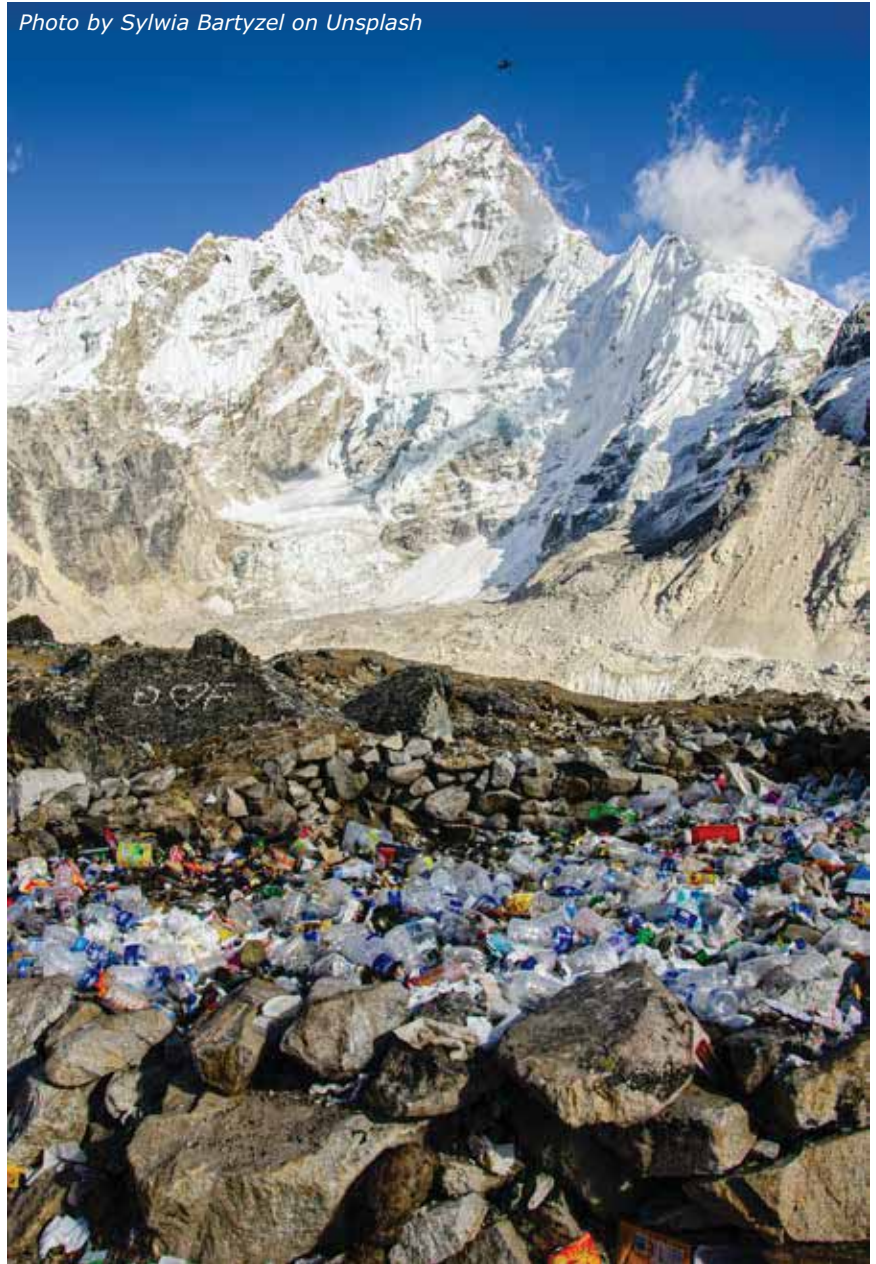
Water bottle waste is generated due to the manufacturing and marketing of bottles designed for single-time use. As a result, the prevalent practice is to use and then discard them, which contributes to environmental pollution and is a source of climate change. These bottles can be found ubiquitously, from mountains to seas, despite comprising just 2.6 per cent of the total 380 million tonnes of plastic produced and constituting 5.3 per cent of single-use plastic (based on the assumptions mentioned above). User finds no economic value, purpose (personal or social) or may not be aware of ill effect(s) on environment. Single-use water bottles do not end just in environment (considered as number one large impact pollutant) but also contribute in global warming during its disposal phase. It has the potential to release 29 million tonnes of CO₂e into the atmosphere annually

⁴ Details available at <https://www.conserve-energy-future.com/recyclingplastic.php>

when burned, particularly in areas where no disposal facilities are available. The collection and material handling of waste bottles for recycling, landfilling, and incineration would release 695,000, 60,000, and 730,000 tonnes of CO₂e into the atmosphere, respectively. For further processing energy use for recycling and incineration would emit 2090 and 2894 kg CO₂e/tonne of waste respectively. For 10 million plastic waste it will be 20.9 (recycling) and 28.9 million (incineration) tonnes.

We can come over these unwanted dangerous undesired effects just by changing/altering design of existing plastic bottles (available as IPR India Design No. 334215-001 Class 23-01, Water Bottle Drip Irrigator to support carbon sequesters; i.e., green vegetation). Current water bottles often do not dispense water as desired, and users may only achieve success by chance. Manufacture them with a dual-purpose design: initially for filling with primary content and, once emptied, for reuse in secondary applications (in present case irrigator/fertigator). Waste collection is the first step in waste management. Redesigned bottles will not be treated by user as waste as it has purpose to reuse. Secondary purpose preferably should match the huge availability of used waste emptied bottles with acceptance, applicability and utility (huge requirement in green vegetation cultivation). With the new design of bottles serving a post-use purpose, users tend to develop a psychological inclination to value the water bottle, preventing irresponsible disposal, and instead, choosing to retain it for their own future use. This helps deter littering and significantly reduces the amount of discarded material that becomes an environmental pollutant, mitigating its flow into rivers, oceans, or dumping sites. At least user will dump it at proper place. Secondly, waste collector is motivated and encouraged to pick up the bottle that has still higher value than existing. A newly redesigned bottle would be

Photo by Sylwia Bartyzel on Unsplash



easily identified for picking waste. Waste bottles will find buyers, customers, retail shops, and buy-back kiosks, collected just like other commodities at local places everywhere. This is because they are used in individual households, by farmers, and by a wide range of people (IPR India Design No. 334215-001, Class 23-01, with proven prototype performance).⁵ This will

⁵ Details available at <https://lnkd.in/gNW6JvrN>

stop transport to distant places saving energy on transport. It is a potential way to curtail CO₂e emission. Once this mindset takes place over a period of short time, we will be able to eliminate water bottle stock for steps 1 and 2 in waste management also. ■

Ashok V Gadewar is Retd. Principal Scientist (ICAR) and former Principal of Agricultural College, Maharashtra.

Green Commute

Gaining Prominence in Indian Mobility

Why must a price-conscious customer commit to a starting premium, should electric vehicle car value chains have a magnifying surveillance on grounds of emissions, and how can the ecosystem make EVs as mainstream on the roads? These are some pressing questions **Nimish Trivedi** tries to answer in this article.

The ecologically sound and economically promising future of electric vehicles (EVs) heralds a new era for Indian mobility. This shift is driven by the growing adoption of EVs among private vehicle owners, cab service providers, and public transportation systems. A combination of factors, including policy support, advancements in battery technology, expanded charging infrastructure, and the introduction of captivating models

by the automobile industry, is driving the significant growth in electric vehicle (EV) sales.

As the projected global demand of electric-powered cars shall start to outpace the demand for gasoline powered cars, according to Bloomberg's EVO Report 2022, a vehicular audit of the functional fleet on roads must emerge to discern how to make EV cars attainable to the average car buyer.

Are EVs a Panacea?

The environmental efficacy and lifetime savings offered by EVs cannot be paralleled by fuel-powered cars. In terms of efficiency, EVs can convert approximately 60 per cent of the electrical energy obtained from the grid into powering the wheels. In contrast, petrol or diesel cars can only convert around 17 per cent to 21 per cent of the energy stored in the fuel into wheel





power. This stark contrast results in an inefficiency that leads to wastage of approximately 80 per cent.

Considering electricity production in the equation, petrol or diesel vehicles emit 3 times the amount of carbon dioxide compared to the average EV. We must also keep in mind that EVs are not a zero-emission endeavour, because innovation is yet to arrive in establishing a clean energy source for procuring electricity for charging EVs. India has set an ambitious goal to achieve approximately 40 per cent of cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030.

Hence, EVs are the logical choice for the future of transportation in India, and the switch needs to be seamlessly realized.

The Cost-Benefit Analysis

When considering buying an EV, many are deterred by seeing the premium pricing. Exports, battery production, and shrunken clientele are some of the reasons that the purchase price of the EV appears hiked more than a conventional internal combustion engine (ICE) car. However, to accelerate EV adoption,

global governments including India are brainstorming and sanctioning policies that make this switch even more attainable.

Government efforts among the likes of the FAME policy allow procuring two-, three- and four-wheeler EVs, at government subsidies. Registration fees and road tax on purchasing EVs are lesser than petrol or diesel vehicles. The cost-efficiency of EVs improves as you drive more kilometres. While ICE vehicles offer approximately 40 per cent efficiency, EVs boast an efficiency of nearly 90 per cent.¹ Moreover, the range and efficiency of EVs continue to enhance over time. Consequently, owning an EV may result in lower overall costs.

Strides in Complimentary Infrastructure

A crucial aspect of promoting EV adoption is the development of robust charging infrastructure. To make it easier for EV drivers to charge their vehicles, industry players are playing a key role and expanding it across the nation. The Union Ministry of heavy industry recently released funds worth INR 560 crore to

facilitate setting up 7432 public fast charging stations across the country.²

Development in the avenues of a robust supply chain operating domestically, legacy manufacturers setting up plant in the country, engineers and mechanics lending expertise in servicing electrical transport, finding a clean energy alternative for generating electricity for EVs, emergence of EV cab aggregators to normalize electrically powered micro mobility and much more, pose as opportunities for the EV industry, and promises the boom of the EV business and job creation.

Many cab service providers are putting out EVs for facilitating cab calling. Cab aggregators are investing in partnerships with automobile manufacturing giants to expedite and ease the procurement of EVs, to include them in their functional fleet. Such partnerships normalize the optic of EVs on the road, which subtly directs an ICE car owner to understand that EVs are dependable, even when you are stuck in heavy traffic on Indian roads and battling road congestion. ■

Nimish Trivedi, CEO & Co-Founder, Evera.

¹ Details available at <https://e-vehicleinfo.com/>

² Details available at <https://pib.gov.in/PressReleaseDetailm.aspx?PRID=1911394>

SUBSCRIBE

TerraGreen

INDIA'S
LEADING
MONTHLY
ENVIRONMENTAL
MAGAZINE

<http://terragreen.teriin.org>



TerraGreen promotes the concept of sustainable development. Launched in June 2004, this magazine from TERI is an effort to bring forth information and knowledge in the fields of energy, environment, and sustainable development. The magazine is in keeping with our mission to expand the base of environmentally conscious readers and popularize sustainability issues at the local level. TerraGreen aims to provide the readers with the necessary inputs to enable them to be a part of the process of change. The magazine stays away from all jargon, so that the educated, informed, yet lay readers are updated on all that happens around them everyday.

Tick one	Term (yrs)	No. of issues	Cover price		You pay		You save	
			₹	US\$	₹	US\$	₹	US\$
	1	12	840	122	800	116	40	6
	2	24	1680	234	1510	211	170	21
	3	36	2520	302	2270	272	250	30

*Name of the Customer (IN BLOCK LETTERS).....

Designation..... Company / Organization.....

City..... State..... PIN..... Country.....

Email.....

PAYMENT PROCEDURE

Enclosed a Cheque/Draft number.....drawn in favour of 'TERI' payable at New Delhi for

₹/.....for 1/2/3/ year subscription of TerraGreen.

To SUBSCRIBE or make online payment, visit: <http://bookstore.teri.res.in/TerraGreen>

For subscription related queries,
contact: +91 11 2468 2100 / 7110 2100
Email: teripress@teri.res.in

THE ENERGY AND RESOURCES INSTITUTE
Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi – 110 003
Tel. 2468 2100 or 7110 2100, Fax 2468 2144 or 2468 2145, India +91 • Delhi (0) 11
<http://terragreen.teriin.org>



Green events

AUGUST-
SEPTEMBER
2023

International Conference on Circular Economy - Green Energy

September 24, 2023

New Delhi, India

Website: <https://10times.com/>

Smart Mobility Expo

October 10, 2023

New Delhi, India

Website: <https://smartmobilityexpo.com/>

India Water Week

October 10-14, 2023

New Delhi, India

Website: <https://www.eworldtrade.com/>

India eMobility Show

October 11-13, 2023

Bengaluru, India

Website: <https://indiaemobilityshow.com/>

Sustainability Summit 2023

October 13, 2023

New Delhi, India

Website: <https://events.tie.org/>



FEEDBACK FORM

PLEASE TICK YOUR CHOICE.

1. Which section(s) did you find the most interesting?

- TERI Analysis Environmental Research Feature
 In Conversation (Interview) Cover Story Special Report
 Green Challenges Terra Youth Review

2. In your opinion, which section(s) need(s) improvement?

- TERI Analysis Environmental Research Feature
 In Conversation (interview) Cover Story Special Report
 Green Challenges Terra Youth Review

3. What do you think about the look and feel of TerraGreen?

- Brilliant Design is not a priority, content is
 Average Needs improvement

4. In your opinion, what aspect(s) of TerraGreen need(s) improvement?

- Choice of stories Handling of issues Language
 Design Presentation

5. Please rate TerraGreen on a scale of 1-5 (5 being the best).

- 1 2 3 4 5

6. What issues would you like TerraGreen to cover?

.....
.....

7. Which other environmental magazine(s) do you read?

..... None

8. Any further suggestions?

.....
.....

YOUR DETAILS

Name:

Profession:

Tel.:

E-mail:

The most innovative suggestion will get a surprise gift.

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

Tel. 2468 2100 or 7110 2100
Fax: 2468 2144 or 2468 2145
India +91 • Delhi (0)11
Email: teripress@teri.res.in
Submit online: <http://bookstore.teri.res.in/terragreen>

August-September 2023



ADVERTISE IN...

TERRAGREEN

Circulation information

Industries, Ministries, PSUs, Corporates, Multi and Bilateral Agencies, Universities, Educational Institutions, and Research professionals. Readership of 40,000

Technical specifications

Finished size: 20.5 cm × 26.5 cm
 Non-bleed ad size: 17.5 cm × 23.5 cm
 Half page ad size: 17.5 cm × 11.75 cm
 Bleed size (3 mm bleed on all sides): 21 cm × 27.5 cm
 Artwork preference: Print ready, minimum 300 dpi (tiff, eps, pdf, or cdr) files with all fonts with high quality print proofs and progressives for colour reference.

General information

- Monthly
- All colour
- Matte paper
- Number of pages: 56



Advertisement tariffs (₹)

Position	Card rate for single issue(INR)	quarter contract (3 issues) (INR)	bi-annual contract (6 issues) (INR)	annual contract (12 issues) (INR)
Advertorial (per page)	100,000	255,000	480,000	900,000
Back Cover	100,000	255,000	480,000	900,000
Inside Back Cover	75,000	191,250	360,000	675,000
Inside Front cover	75,000	191,250	360,000	675,000
Inside Full Page	50,000	127,500	240,000	450,000
Inside Half page	30,000	76,500	144,000	270,000

GST & taxes additional as applicable

Subscription

One year ₹840 / \$122 • Two years ₹1680 / \$234 • Three years ₹2520 / \$302

ENERGY FUTURE

Circulation information

Industries, Ministries, PSUs, Corporates, Multi and Bilateral Agencies, Universities, Educational Institutions, and Research professionals. Readership of 25,000.

General information

- Quarterly
- All colour
- Matte paper
- Number of pages: 96



Technical specifications

Finished size: 20.5 cm × 26.5 cm
 Non-bleed ad size: 17.5 cm × 23.5 cm
 Half page ad size: 17.5 cm × 11.75 cm
 Bleed size (3 mm bleed on all sides): 21 cm × 27.5 cm
 Artwork preference: Print ready, minimum 300 dpi (tiff, eps, pdf, or cdr) files with all fonts with high quality print proofs and progressives for colour reference.

Advertisement tariffs (₹)*

Ad location	Back cover	Inside back cover	Inside front cover	Inside full page	Inside half page	Inside quarter page	One-sixth page
Single issue	60,000	50,000	50,000	40,000	20,000	12,000	7,000
Two issues	114,000	95,000	95,000	76,000	38,000	22,800	13,300
Three issues	171,000	142,500	142,500	114,000	57,000	34,200	19,950
Four issues	228,000	190,000	190,000	151,000	76,000	45,600	26,600

Subscription

One year ₹800 / \$80 • Two years ₹1600 / \$160 • Three years ₹2400 / \$240

Contact details

Sanjeev Sharma

Email: sanjeev.sharma@teri.res.in
 <Extn 2543>

Bank details for NEFT:

The Energy and Resources Institute
 Bank: State Bank of India
 A/c Number: 62002345487
 IFSC Code: SBIN0020511
 Website: <http://bookstore.teri.res.in/TerraGreen>



The Energy and Resources Institute

Darbari Seth Block, IHC Complex
 Lodhi Road, New Delhi - 110 003
 Tel: 011 2468 2100 / 7110 2100
 Fax: 011 2468 2144 / 2468 2145
 Website: <http://bookstore.teri.res.in>

OPEN YOURSELF TO A WHOLE NEW WORLD OF ENVIRONMENT INTELLIGENCE!

PRESERVE • CONSERVE
INSPIRE • LEARN

**ORDER
YOUR COPY
TODAY**

ENVIRONMENT STUDIES AND SUSTAINABLE DEVELOPMENT



ECOLOGY, ENVIRONMENT, AND FORESTRY



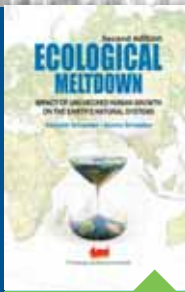
SUSTAINABLE ARCHITECTURE



LIFE SCIENCES

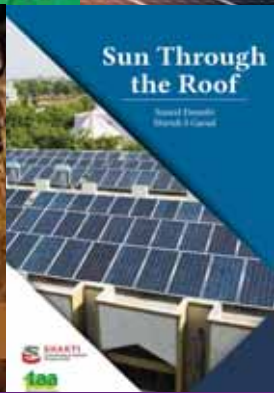
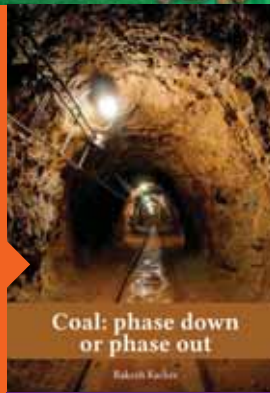


ENVIRONMENT ENGINEERING



CLIMATE

ENERGY



CHILDREN BOOKS



TERI publications also available at



For more information, log on to <http://bookstore.teri.res.in>