



Gist of Essential Magazines

*(Yojana, Kurukshetra, Down to Earth and
Science Reporter)*

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GIST OF YOJANA

Topic

Energy Sector in India

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PM-KUSUM : EMPOWERING FARMERS WITH SOLAR ENERGY SOLUTIONS

Recognizing the need to integrate sustainable energy solutions, with agriculture the Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahabhiyan (PM-KUSUM) was launched by the Ministry of New and Renewable Energy (MNRE) in March 2019, to reduce the carbon footprint of agricultural activities while enhancing farmers' income.

Key Highlights of PM-KUSUM

- To promote the adoption of solar energy in agricultural practices to reduce dependency on conventional energy sources like diesel and grid electricity.
- Over 5,02,000 solar pumps have been installed across India, helping prevent the release of 1.02 million tonnes of CO₂ annually.
- Lower energy costs and the ability to sell surplus solar power to the grid, boosting farmers income beyond traditional farming activities.

Trends in Energy Use for Irrigation

Electric Pumps : Increased significantly from 39% in 1986-87 to 76% in 2017-19, reflecting enhanced rural electrification and adoption of electric-powered irrigation systems.

- **Diesel Pumps** : Declined from 30% to 22% over the same period, indicating reduced reliance on fossil fuels.
- **Other Sources** : Dropped from 31% to just 2%.

This trend signifies a gradual shift towards cleaner, more sustainable energy sources, with

solar energy playing an increasingly important role.

Benefits of Solar Power Irrigation

Solar power irrigation offers numerous advantages over traditional diesel or electric pumps :

- Reliable and cost-effective.
- Lower operational costs.
- Reduce dependence on fossil fuels.
- Contributing to climate change mitigation efforts.

Future Outlook and Challenges

Despite making significant progress, challenges remain in scaling up solar energy adoption, such as :

- High initial installation costs for solar pumps.
- Need for awareness and technical training among farmers.
- Ensuring reliable maintenance and after-sales support.

However, government incentives, subsidies and increased awareness are steadily addressing these challenges, making solar energy an integral part of India's agricultural landscape.

Conclusion

The PM-KUSUM scheme is a transformative step towards sustainable agriculture, clean energy adoption and climate resilience. By empowering farmers with solar energy solutions, it not only reduces the environmental footprint of agriculture but also enhances farmers' income and energy security.

THE NATIONAL SOLAR MISSION : PROGRESS, CHALLENGES AND THE PATH FOR RENEWABLE ENERGY BY 2030

The National Solar Mission, launched under India's National Action Plan on Climate Change (NAPCC), aims to position India as a global leader in solar energy. With ambitious targets, policy support, and initiatives like PM-KUSUM and PM Surya Ghar : Muft Bijli Yojana, India is rapidly expanding its renewable energy sector. However, challenges remain in achieving large-scale adoption and sustainability by 2030.

Progress Under the National Solar Mission

1. Installed Capacity Growth : As of November 2023, total renewable energy capacity

stood at 158.55 GW, with solar energy at 94.17 GW.

2. Government Policy Support : Phased approach with targets of 100 GW solar energy by 2022 (grid-connected and off-grid). **Expansion in 2015** : The Target increased to 175 GW of renewable energy, including 100 GW of solar. **Future Expansion** : Aiming for 500 GW of non-fossil fuel energy by 2030.

3. Impact on Economy and Energy Security : Supports Make in India and the transition towards self-reliance in energy. Helps reduce reliance on fossil fuels and promotes green energy solutions.

Key Initiatives in Solar Energy

1. PM-KUSUM Scheme : Encourages the installation of solar pumps for farmers to reduce diesel dependency. Supports solar power generation in rural areas, enhancing agricultural productivity.

2. PM Surya Ghar : Muft Bijli Yojana : Free solar electricity for households, reducing consumer electricity costs. Enhances domestic solar adoption for sustainable energy consumption.

3. Solar Manufacturing & PLI Scheme : Production Linked Incentive (PLI) Scheme promotes domestic solar panel manufacturing. Aims to reduce import dependency and support India's solar industry.

4. Development of Solar Parks & Ultra Mega Solar Power Scheme : Large-scale solar projects facilitating rapid expansion. Infrastructure investment for seamless integration into the national grid.

Global Renewable Energy Investment and Challenges

1. Investment Trends : Increased foreign direct investment (FDI) in India's renewable sector. Growing interest from global companies and financial institutions.

2. Challenges in Solar Energy Expansion :

Land acquisition issues for large-scale solar projects. Intermittency and storage challenges affecting grid stability. High initial investment costs despite falling solar tariffs. Supply chain dependence on imported solar components.

The Path for 2030 : Towards a Greener and Sustainable Future

- Strengthening grid infrastructure and battery storage solutions.
- Expanding research and development in solar technologies.
- Encouraging public-private partnerships for large-scale adoption.
- Implementing better policy incentives for decentralized solar solutions.

In Conclusion, India's National Solar Mission has transformed the renewable energy landscape, pushing the country towards a sustainable future. With strategic policy interventions, technological advancements, and continued investments, India is on track to achieving its 500 GW renewable energy target by 2030, ensuring a greener and more sustainable future for all.

THE PERFORM, ACHIEVE AND TRADE (PAT) SCHEME

The Perform, Achieve, and Trade (PAT) scheme, under the National Mission for Enhanced Energy Efficiency (NMEEE), is a market-based mechanism designed to enhance energy efficiency in energy-intensive industries.

PAT Design Framework

The National Mission for Enhanced Energy Efficiency (under NAPCC) lists PAT mechanism for driving Energy Efficiency (EE) in industrial and allied sectors. The Bureau of Energy Efficiency (BEE) under the Ministry of Power designed and Implemented PAT. Designated Commons (DCs) Mandatorily participate in PAT. A Specific Energy Consumption (SEC) target is issued for each DCs. A PAT cycle is typically three years, at the end of which the DC's SEC would be recomputed.

Performance Across Cycles

- PAT has been implemented in multiple cycles, each driving significant reductions in energy consumption and CO₂ emissions.
- For instance, the initial PAT cycle I (2012-2015) achieved savings equivalent to 8.67 million tonnes of oil, reducing CO₂ emissions by 31 million tonnes.
- **Renewable Energy Contribution :** India's renewable energy installed capacity

accounts for 46% of the total installed power capacity, indicating a steady shift towards non-fossil fuel energy sources like solar, wind, hydro, and nuclear.

- **Energy Efficiency Measures :** Policies such as the Energy Conservation Act, 2022, strengthen the PAT scheme by providing a legal framework for designing and implementing energy-saving initiatives across energy-intensive sectors.

Lessons and Way Forward

- Majority of the DCs exceeded their targets but buyer demand was much lower than supply of ESCerts, leading to low prices.
- Setting of energy savings targets needs careful analysis of technical and economic parameters for creating balanced markets of ESCerts.
- Continuous transformation of PAT to accommodate more sectors, including MSME.
- Buildings sector need to be integrated to EE from design stage through PAT and other mechanisms.
- PAT can play complementary role in decarbonisation transition through adoption of Carbon Credit Trading System (CCTS).

SMART CITIES MISSION AND THE ROLE OF ENERGY EFFICIENCY IN URBAN DEVELOPMENT

With cities contributing to 50–60% of global green-house gas (GHG) emissions, the need for a low-carbon economy has never been more urgent. The Smart Cities Mission (launched in 2015) aims to integrate infrastructure and technology to enhance energy efficiency in urban areas, making cities more sustainable and livable.

Energy Efficiency as a Key Driver

1. Energy-Efficient Buildings : Building sector accounts for more than 1/3rd of India's energy consumption. Green building standards, such as GRIHA (Green Rating for Integrated Habitat Assessment) and LEED (Leadership in Energy and Environmental Design) can ensure efficient sustainable construction practices.

2. Energy-Efficient Water Management : Climate Smart Cities Assessment Framework 2.0 (CSCAF 2.0) has introduced 'Energy Efficient Water Supply' indicator to guide cities in reducing energy consumption and costs while promoting profitable urban water systems.

3. Energy-Efficient Waste Management : Effective waste management systems can drastically cut energy consumption during waste collection, processing and disposal. Innovations like waste-to-energy plants and circular economy approaches help transform waste into resources while reducing environmental impacts.

4. Energy-Efficient Transportation : Transportation is a major contributor to urban emissions. Promoting public transport systems, non-motorized transportation and electric vehicles can drastically reduce energy consumption while improving connectivity in cities.

Policy and Regulatory Framework

The trajectory of energy efficiency policies in India has been impressive. It began with the Energy Conservation Act (2001), which introduced a foundational framework for energy-saving measures. Building on this, India's Nationally Determined Contributions (NDC) and Long-Term Low-Emissions Development Strategy (LT-LEDS) have focused on creating climate-resilient and energy-efficient urban infrastructures.

Harnessing Momentum for the Way Forward

- Co-production approach needs to be adopted for establishing knowledge system for energy efficiency in smart cities.
- Target of national initiatives like NAPCC and NMEER to be integrated and addressed in city and regional master plans.
- Leveraging cutting-edge technology like smart grids, advanced energy storage, IoT-enabled sensors, GIS & GPS for adoption of energy efficiency in sector-specific technologies such as waste-to-energy solutions, EV infrastructure, smart lighting, etc.
- National Mission for Enhanced Energy Efficiency can be hybridized with Energy Efficiency Financing Platform, Green Growth Equity Fund and Venture Capital Fund for Energy Efficiency for incentivizing investments and reducing financial risks.
- Action-Oriented and quantitative targets for defining performance targets, benchmarks and outputs for effective execution of policies.

SCOPE & OPPORTUNITIES FOR RENEWABLE ENERGY IN RURAL INDIA

India has witnessed remarkable growth in renewable energy capacity, increasing by 165% in the past decade, increasing from 76.38 GW in 2014 to 203.1 GW in 2024. Rural areas, which house 67% of the population and contribute 37% of GDP, are central to this transformation. Recognizing energy as a priority sector, the government has allocated ₹ 68,769 crores for renewable energy initiatives.

Key Measures Include

Pradhan Mantri Surya Ghar : Muft Bijli Yojana : This program aims to install rooftop

solar panels in 1 crore households, providing up to 300 units of free electricity per month.

- **Emphasis on Distributed Solar Power :** Strong government support for decentralizing solar energy generation.
- **National Green Hydrogen Mission :** A target of producing 5 million metric tonnes of annual green hydrogen capacity by 2030.

India is also exploring advanced solutions such as hydrogen energy, energy storage, carbon capture, and sustainable aviation fuels, marking its commitment to combating pollution and transitioning to a greener economy.

NATIONAL GREEN HYDROGEN MISSION (NGHM)

1. Advancing Energy Independence and Sustainable Development

- NGHM aims to make India as a global hub for Green Hydrogen production, usage and export.
- It supports India's energy self-sufficiency and Net Zero goals.
- Helps decarbonize industrial sectors and long-haul mobility.

2. Objectives of the National Green Hydrogen Mission (NGHM)

- Achieve a Green Hydrogen production capacity of 5 MMT annually by 2030, with the potential to expand to 10 MMT per year.
- Reduce CO₂ emissions by 50 MMT annually.
- Strengthen India's position in global hydrogen markets.

3. Scaling Green Hydrogen Production : Leveraging Renewable Resources and Innovative Tech

- Utilizing solar and wind power for hydrogen production.
- Enhancing electrolyzer efficiency and infrastructure.
- Promoting R&D for cost-effective hydrogen production.

4. Phased Implementation : Laying the Foundation for Green Hydrogen Expansion

- **Phase I (2022-23 to 2025-26)** : Focuses on infrastructure, pilot projects, and R&D.
- **Phase II (2026-27 to 2029-30)** : Expansion of commercial-scale hydrogen production and export markets.

5. Coordinated Efforts : A Multi-Ministry Strategy for NGHM's Success

- Ministry of New & Renewable Energy (MNRE) leads implementation.

- Collaboration with ministries of power, petroleum and industry.

6. Key Components of NGHM

- **SIGHT Programme** : Strategic Interventions for Green Hydrogen Transition (SIGHT) aims to provide financial incentives to scale production and manufacturing of electrolyzers. ₹ 17,490 crore allocated for subsidies and incentives.
- **Pilot Projects** : ₹ 1,466 crore for testing technologies.
- **R&D** : ₹ 400 crore for research and innovation.
- **Other Components** : ₹ 388 crore for eco-system development.

7. Effective Risk Management Strategies

- Developing robust regulatory frameworks.
- Ensuring safety standards in hydrogen storage and transport.
- Addressing financial and technological risks.

8. Comprehensive Governance Structure for Successful Execution

- Centralized policy framework with state-level participation.
- Performance monitoring and periodic reviews.
- Public-private partnerships to accelerate implementation.

9. NGHM : Transformative Economic and Environmental Outcomes

- Job creation in clean energy sectors.
- Boosts India's green economy and industrial growth.
- Strengthens global competitiveness in hydrogen exports.
- Contributes to a cleaner, sustainable future.

BIOFUELS AS A PROMISING SUBSTITUTE FOR HIGH CARBON ENERGY SOURCES

Transition from Fossil Fuels to Renewable Energy

- Fossil fuels are becoming non-viable, leading to a shift towards renewable energy sources like wind and solar.
- Biofuels, derived from renewable biomass, provide a strategic advantage for sustainable development and energy security.

National Policy on Biofuels (NPB) 2018

- Aims to enhance biofuel production and create a sustainable ecosystem.
- *Jatropha curcas* is identified as a key non-edible feedstock for biodiesel production.

Importance of Clean Energy

- Affordable and clean energy is essential for health, development and well-being.

- Solar energy has played a major role in improving rural energy access in India.

Nature's Principles for Sustainability

- Nature runs on sunlight, uses only what it needs and recycles everything.
- Promotes cooperation, diversity and local expertise for a balanced energy approach.

Conclusion

- Biofuels and renewable energy sources are crucial for India's transition to a low-carbon future.
- The exponential growth of solar installations signals a shift towards an ecologically sustainable energy landscape.

PRAGATI : DRIVING INDIA'S DEVELOPMENT WITH PURPOSE

- **Study Report** : From Gridlock to Growth : How Leadership Drives India's PRAGATI Ecosystem, published by Oxford University's Saïd Business School and the Gates Foundation, highlights the success of PRAGATI.
- **Launch & Objective** : Initiated on 25 March, 2015, PRAGATI follows the 'Minimum Government, Maximum Governance' approach, leveraging Digital-First Leadership for efficient governance.
- **Impact** :
 - ❑ Reviewed 340 stalled projects worth ₹ 17.05 lakh crore (\$ 205 billion).
 - ❑ Focus on collaboration, transparency, and technology to fast-track infrastructure and governance outcomes.
 - ❑ **Global benchmark** for developing nations.
- **Leadership** : PM Narendra Modi's leadership in PRAGATI meetings underscores its role as a key governance initiative.

CULINARY SCIENCE AND FOOD TECHNOLOGY IN ANCIENT INDIA : INSIGHTS FROM PĀKASĀSTRA

- **Focus** : Explores the rich tradition of Pākasāstra, covering its socio-cultural, medicinal, religious and spiritual dimensions.
- **Key Themes** :
 - ❑ The overlap of food discourses in Hindu life and the significance of dietetics.
 - ❑ Importance of pure & regulated eating habits, as reflected in texts like the *Srimad Bhagavad Gita* & *Caraka Samhita*.
 - ❑ Role of cooking utensils and plant-based leaves in food preparation and their health impact.
- **Relevance Today** :
 - ❑ Modern research validates traditional knowledge and highlights the need for further exploration of Pākasāstra.
 - ❑ Emphasizes the therapeutic value of food, supporting the view that food is medicine in Indian tradition.
- **Related Concept** :
 - ❑ *Pathyāpathyaviniścaya* (Dietetics)—The application of nutrition science in managing health and disease.

GIST OF KURUKSHETRA

Topic

Horticulture and Prosperity

**February
2025**

FRUIT-BASED FARMING SYSTEMS FOR IMPROVED INCOME AND LIVELIHOOD

In 2023-24, the estimated production of horticulture sector has been estimated at 353.19 million tonnes, while production has reached 112.73 million tonnes, which is targeted to reach 244 million tonnes by 2047.

Benefits of Fruit-Based Farming Systems

- **Economic Upliftment** : Enhances income through high-value crops and export potential.
- **Balancing Environmental Sustainability** : Reduces soil erosion, promotes carbon sequestration and enhances biodiversity.
- **Contribution to Better Health** : Increases availability of nutrient-rich foods, improving public health.
- **Livelihood Diversification** : Reduces dependence on traditional crops and creates employment opportunities.
- **Encouraging Agroforestry and Mixed Cropping** : Enhances soil fertility and farm productivity.
- **Promotion of Horticulture Tourism** : Provides additional income through fruit farms and agro-tourism.
- **Protected Cultivation of High-Value Fruit Crops** : Ensures year-round production and climate resilience.
- **Cultivation of Future Fruits** : Focus on exotic and climate-resilient future crops.

Key Components for Fruit-Based Farming

- **Crop Selection and Zoning** : Identifying region-specific fruit crops.
- **Production and Distribution of Quality Planting Materials** : Ensuring high-yielding varieties.
- **Research and Development** : Developing climate-resilient and high-yield varieties.
- **Infrastructure Development** : Investments in cold storage, transport and packaging.
- **Adoption of Climate-Resilient Crop Cultivation** : Reducing climate risks.

- **Capacity Building** : Training farmers in modern cultivation techniques.
- **Development of Market Linkages** : Strengthening supply chains and exports.
- **Schemes for Financial Support** : Subsidies and credit schemes to encourage investments.

Challenges and Gaps in Establishing Fruit-Based Farming

- **Land Fragmentation** : Reduces economies of scale.
- **Knowledge Gaps** : Lack of awareness about scientific fruit cultivation.
- **High Initial Investment** : Infrastructure and technology costs.
- **Climate Vulnerability** : Unpredictable weather patterns affect yields.
- **Post-Harvest Losses** : Insufficient storage and processing facilities.
- **Market Instability** : Price fluctuations impact farmers' earnings.

Way Forward

- Strengthen R&D for climate-resilient fruit crops.
- Expand horticulture cooperatives for better market access.
- Promote public-private partnerships (PPP) in fruit processing.
- Improve post-harvest infrastructure and export facilitation.
- Enhance agroforestry models integrating fruit trees with staple crops.

In Conclusion, Fruit-based farming is a key driver of rural development, ensuring income security, ecological balance and health benefits. With strategic investments, policy support and farmer empowerment, India can position itself as a global leader in fruit production and exports, fostering a greener and more sustainable future.

BEEKEEPING : GENERATING EMPLOYMENT OPPORTUNITIES

Beekeeping is a crucial agro-based industry that not only supports pollination and biodiversity but also serves as a source of employment and rural development. India, with its diverse flora and rich biodiversity, has immense potential to become a global leader in honey production. The National Beekeeping and

Honey Mission (NBHM) aims to modernize beekeeping, enhance productivity and establish market linkages.

Key Aspects of Beekeeping Development

1. **Capital Infrastructure** : Expansion of modern beekeeping units, processing plants, cold storage facilities and quality testing labs.

Strengthening National Beekeeping and Honey Mission (NBHM) for structured growth. Promotion of honey clusters and farmer cooperatives.

2. Human Capital : Skill development programs to train rural youth and farmers in scientific beekeeping practices. Support for women-led beekeeping enterprises to promote gender inclusivity. Promotion of migratory beekeeping practices to improve productivity.

3. Revolutionizing Beekeeping in High-Altitude Regions : Encouraging beekeeping in Himalayan and tribal regions to utilize unique floral diversity. Development of high-value honey varieties like Manuka and multifloral honey. Promotion of winter beekeeping techniques to ensure year-round production.

4. Digital Initiatives : Establishment of e-marketing platforms and digital traceability to ensure fair pricing. Use of AI and IoT for hive health monitoring and climate adaptation. Strengthening NBHM portal for farmer registration and assistance.

5. Safeguarding the Domestic Honey Industry : Implementation of Minimum Export Price (MEP) to prevent dumping and price distortions. Encouragement of organic honey production for premium pricing. Regulation of honey imports to prevent adulteration and market instability.

6. Quality Standards : Stringent testing mechanisms to eliminate adulteration and enhance credibility. Collaboration with FSSAI for uniform national standards. Promotion of GI-tagged honey varieties to enhance branding and exports.

7. Tapping Export Potential of Value-Added Products : Promotion of honey-based

pharmaceuticals, cosmetics and nutraceuticals. Expansion into global markets for organic and medicinal honey varieties. Strengthening supply chains for international honey exports.

8. Beekeeping in Agriculture and Pollination Services : Use of honeybees for pollination in crops like mustard, sunflower and orchards. Collaboration with farmers to integrate beekeeping with crop cultivation. Increasing awareness of the role of honeybees in ecosystem conservation.

9. Encouraging Sustainable Practices : Adoption of environmentally friendly practices like organic beekeeping. Protection of natural bee habitats and biodiversity. Encouragement of beekeeping in forested and tribal regions.

Future Roadmap

- Strengthening public-private partnerships for research and innovation.
- Boosting international collaborations for best practices and market expansion.
- Enhancing financial incentives and credit support for small beekeepers.
- Promotion of honey tourism to create rural employment opportunities.
- Encouraging scientific research on honey-based medicinal products.

Conclusion

With focused policy interventions, technological advancements, and skill development, beekeeping is set to transform rural economies, ensure environmental sustainability and position India as a global leader in the honey industry. By integrating modern practices, value addition, and quality control, India can fully tap into its beekeeping potential for economic growth and employment generation.

CLEAN PLANT PROGRAMME : REVOLUTIONIZING INDIAN HORTICULTURE

As the second-largest producer of fresh fruits and vegetables globally, India holds immense potential in meeting both national and international demand. However, challenges such as low productivity, virus-infected planting materials and declining crop quality have necessitated strategic intervention. Recognizing this, the Union Cabinet approved the Clean Plant Programme (CPP) on August 9, 2024, under the Mission for Integrated Development of Horticulture (MIDH), with an investment of ₹ 1,765.67 crore. This initiative aims to provide virus-free, high-quality planting material to

farmers, thereby boosting productivity and ensuring sustainable horticultural practices.

1. Objectives of the Clean Plant Programme

The Clean Plant Programme (CPP) is designed to :

- Provide disease-free, high-quality planting material to farmers.
- Improve horticulture crop yields by reducing the spread of plant diseases.
- Enhance the quality of fruits and vegetables for domestic and export markets.
- Promote sustainable agricultural practices for long-term productivity.

2. Need for the Programme

- Low-quality planting material has been a major bottleneck in horticulture productivity.
- Viral infections and diseases in plants lead to lower yields and reduced farmer incomes.
- The lack of efficient nursery infrastructure limits access to superior planting materials.
- Global competition in horticulture requires India to adopt high standards in cultivation and production.

3. Implementation and Investment

- The Union Cabinet approved the programme as part of MIDH (Mission for Integrated Development of Horticulture).
- Investment of ₹ 1,765-67 crore has been allocated to support the development of high quality nurseries and research facilities.
- The programme will ensure equitable access to improved planting materials for farmers,

regardless of their landholding size or socio-economic background.

4. Expected Benefits

- Increased productivity and improved crop resilience.
- Higher income for farmers due to better-quality produce.
- Reduction in imports of disease-free planting materials.
- Strengthening of India's position as a leading horticulture producer.

Conclusion

The Clean Plant Programme marks a transformative step in Indian horticulture, ensuring sustainable growth, economic prosperity and enhanced agricultural output. By providing virus-free planting materials, it aims to boost farmer productivity, improve crop quality, and strengthen India's presence in global horticulture markets.

FOOD PROCESSING OF HORTICULTURAL CROPS

Food processing plays a crucial role in achieving food and nutrition security, especially in a country like India, which is the second-largest producer of fruits and vegetables globally. The industry contributes significantly to reducing post-harvest losses, improving shelf life, ensuring food safety and enhancing nutritional value. India's food processing sector contributes 32% to the total food market, making it a key driver of economic growth and employment.

Importance and Scope of Food Processing in Horticulture

1. Reduction of Post-Harvest Losses : A large proportion of horticultural produce is lost due to short shelf life and improper post-harvest handling. Studies indicate that 6-7-15-8% of fruits and 4-5-12-4% of vegetables are wasted due to spoilage.

2. Economic Growth & Employment : The food processing industry boosts rural employment and enhances farmer incomes.

3. Export Potential : Processed horticultural products increase India's competitiveness in global markets.

4. Nutritional Enhancement : Advanced food fortification techniques help in addressing malnutrition and micronutrient deficiencies.

Achievements Under PM Formalisation of Micro Food Processing Enterprises Scheme (PMFME)

- A total of 46-643 Loans have been sanctioned under the credit linked subsidy

component of the PMFME scheme, since January 2024.

- An amount of ₹ 254-87 crore has been sanctioned as seed capital assistance to 71,714 Self Help Group (SHGs) members.
- 2 Incubation Centres approved and 11 Incubation Centres have been completed/ inaugurated/commissioned during the period providing product development support to grass-root Micro Enterprises.
- 4 proposals of Marketing & Branding have been approved to provide branding support to the micro enterprises.

New Technologies in Food Processing

1. Non-Thermal Technologies : High-Pressure Processing (HPP) : Uses high pressure to inactivate microbes while preserving nutrients, texture and flavour. **Cold Plasma Technology :** A novel method to disinfect food surfaces and packaging materials without altering food quality. **Pulsed Electric Field (PEF) Technology :** Enhances food preservation by disrupting microbial cells without heat, ensuring nutrient retention.

2. Food Fortification : Addition of essential nutrients like iron, zinc, and vitamins to processed foods to address dietary deficiencies. Government initiatives like FSSAI's Food Fortification Standards are promoting fortified food consumption.

3. AI, Automation, and Robotics in Food Processing : AI-powered quality control ensures minimal waste and better sorting of fruits and vegetables. Automation in packaging and sorting enhances efficiency and reduces human errors. Robotics in food processing units improves hygiene, precision and production efficiency.

4. Advanced Food Packaging Technologies : Modified Atmosphere Packaging (MAP) extends the shelf life of horticultural products by controlling oxygen and carbon dioxide levels. Edible Coatings and Biodegradable Packaging improve food safety while reducing plastic waste.

5. IT and Blockchain for Food Traceability : Blockchain technology ensures real-time tracking of food supply chains, reducing food fraud and improving transparency. IT-driven solutions enhance logistics, cold chain management, and market linkages for farmers.

Government Initiatives for Food Processing

- **Pradhan Mantri Kisan Sampada Yojana (PMKSY) :** Aims to create modern infrastructure for food processing industries.
- **Operation Greens :** Supports value addition and processing of perishable items like tomatoes, onions and potatoes.

- **Mega Food Parks Scheme :** Establishes integrated food processing zones with common facilities.

- **PLI Scheme for Food Processing :** Provides financial incentives to boost domestic manufacturing and exports.

Way Forward

1. Expansion of Cold Chain Infrastructure to minimize post-harvest losses.
2. Promotion of Sustainable Packaging Solutions to reduce environmental impact.
3. Encouraging Startups & Innovation in AI-driven food processing and blockchain traceability.
4. Skill Development Programs to train the workforce in handling advanced food processing technologies.
5. Public-Private Partnerships (PPP) for infrastructure development and export promotion.

Conclusion

By integrating emerging technologies, AI, automation, and advanced packaging solutions, India can further strengthen its position as a global leader in processed horticultural products. With strong government support and private sector participation, the future of food processing in India looks promising.

NUTRITIONAL AND HEALTH SECURITY THROUGH HORTICULTURE

The term 'nutrition security' emerged in the mid-1990s and emphasized food consumption at the household or individual level and how food is utilized by the body. This principle extends beyond food security, as horticultural crops are rich sources of nutritional bioactive compounds. These crops serve as vital sources of protective nutrients like vitamins, minerals, antioxidants, folic acid and dietary fibers, thus playing a significant role in achieving nutritional and health security.

Horticulture Crops for Nutritional Security

Horticultural crops—fruits, vegetables, spices, medicinal plants and plantation crops—contribute significantly to nutritional security due to their high content of vitamins, minerals, dietary fiber and bioactive compounds.

Dietary Fiber in Horticultural Crops

Dietary fiber is essential for gut health, digestion, and disease prevention. Key horticultural sources of dietary fiber include :

- **Fruits :** Apples, guava, pears, papaya, bananas.

- **Vegetables :** Carrots, pumpkin, spinach, cabbage, peas.

- **Legumes :** Beans, lentils

Sources of Energy and Proteins

Horticultural crops also serve as energy-rich foods and contain proteins essential for muscle growth and repair.

- **Energy Sources :** Bananas, mangoes, potatoes, sweet potatoes.

- **Protein-Rich Crops :** Peas, beans, lentils, nuts and mushrooms.

Growing Health : Horticulture in India

India, being one of the largest producers of fruits and vegetables, plays a crucial role in global nutrition security. With a total horticulture production of 353.19 million tonnes, the country is focusing on developing nutrient-rich horticultural varieties to combat malnutrition.

Vitamins and Minerals in Horticultural Crops

Horticultural crops are packed with essential vitamins and minerals :

- **Vitamin A :** Carrots, papaya, mango.

- **Vitamin C** : Citrus fruits, guava, amla.
- **Iron & Calcium** : Green leafy vegetables, figs, almonds.

Nutraceutical Value of Horticulture Crops

Nutraceuticals are bioactive compounds that offer medicinal and health benefits beyond basic nutrition. Examples include :

- **Lycopene** (Tomatoes)—Cancer prevention
- **Resveratrol** (Grapes)—Cardiovascular health
- **Curcumin** (Turmeric)—Anti-inflammatory properties

Antioxidants and Carotenoids

Antioxidants help reduce oxidative stress and prevent chronic diseases. Carotenoids, found in yellow, orange, and red fruits/vegetables, are precursors of Vitamin A.

- **Lycopene** (Tomato, watermelon)
- **Beta-carotene** (Carrots, sweet potatoes, pumpkins)

Natural Pigments and Flavonoids

- **Anthocyanins** (Berries, grapes)—Improve brain function
- **Flavonoids** (Tea, citrus fruits)—Anti-inflammatory benefits

Improved Nutritional-Rich Varieties

Scientists are developing biofortified varieties of horticultural crops to enhance their nutrient content. Examples :

- Iron-rich Spinach
- Beta-carotene-rich Sweet Potatoes
- High-protein Pulses

Mushroom : An Emerging Industry for Nutritional Security

Mushrooms are a low-fat, high-protein food and a rich source of Vitamin D, B-complex and antioxidants.

- Varieties like Oyster and Shiitake mushrooms are gaining popularity for their medicinal properties.

Biofortification of Horticultural Crops

Biofortification is the process of enhancing the nutritional quality of crops through breeding, genetic modification, or agronomic practices :

- Golden rice (Vitamin A-fortified rice)
- Iron-fortified beans
- Zinc-rich wheat and lentils

Nutritional Garden for Farming Communities

To ensure rural households have access to nutritious food, the concept of nutritional gardens is being promoted. These gardens :

- Provide year-round fresh vegetables and fruits
- Reduce dependency on market food
- Promote diversified diets

Horticulture Extension for Nutrition Security

Horticulture extension services play a vital role in :

- Educating farmers about high-yield and nutrition-rich crop varieties
- Promoting sustainable farming techniques
- Strengthening market linkages to improve farmers' incomes

Conclusion

With advancements in biofortification, nutraceuticals, and sustainable farming, India can strengthen its fight against malnutrition while ensuring a healthier population.

SUSTAINING RURAL LIVELIHOODS THROUGH HORTICULTURE

Trends in Horticulture Production and Trade in India

- **Rising Production** : India's horticultural production has surpassed food grain production in recent years, driven by increased demand for fruits, vegetables, spices, flowers and medicinal plants.
- **Export Growth** : India exports fresh and processed horticultural products to global markets. Major export items include mangoes, bananas, grapes, spices, and processed products like jams and juices.
- **Technological Advancements** : Improved seed varieties, micro-irrigation techniques,

and greenhouse farming have boosted productivity.

- **Organic Farming** : Increasing consumer preference for organic produce is driving growth in organic horticulture.

Potential of Horticulture in the Rural Economy

1. **High-Value Crops** : Compared to traditional crops, horticultural produce fetches higher market prices.
2. **Employment Generation** : The sector provides jobs in farming, processing, packaging and marketing.

3. **Allied Industries** : Growth in horticulture supports industries like food processing, cold storage and logistics.
4. **Climate Resilience** : Horticulture crops like fruits, vegetables, and spices are more adaptable to climate change than traditional grains.
5. **Export Potential** : Expanding global demand for Indian horticultural products provides significant export opportunities.

Challenges for Livelihood Creation in the Horticulture Sector

Despite its potential, the horticulture sector faces several challenges :

- **Fragmented Landholdings** : Small and scattered farms reduce economies of scale.
- **Post-Harvest Losses** : Lack of cold storage and efficient supply chains leads to high wastage.
- **Limited Market Access** : Small farmers struggle with access to organized markets and fair pricing.
- **Water Scarcity** : Certain horticultural crops require high water input, making them vulnerable to climate change.
- **Credit Constraints** : Limited access to institutional credit affects investment in modern horticulture practices.

Role of the State in Supporting the Horticulture Sector

To overcome these challenges, the Indian government has launched various initiatives :

1. National Horticulture Mission (NHM)

- A centrally sponsored scheme aimed at increasing horticulture production, improving post-harvest management and ensuring better market linkages.
- Promotes high-density plantations, micro-irrigation and organic farming.

2. Horticulture Mission for the North-East and Himalayan States (HMNEH)

- Special focus on boosting horticulture in hilly and remote areas.

- Encourages cultivation of niche crops like kiwis, apples, walnuts and spices.

3. National Horticulture Board (NHB)

- Supports cold chain infrastructure, market intelligence and value addition.
- Provides credit-linked subsidies for horticulture entrepreneurs.

4. Coconut Development Board (CDB)

- Focuses on increasing productivity and value addition in coconut farming.
- Supports research and development of hybrid coconut varieties.

Way Forward

To further strengthen the horticulture sector and enhance rural livelihoods, the following measures are necessary:

1. **Infrastructure Development** : Expansion of cold storage and efficient logistics to reduce post-harvest losses.

2. **Market Reforms** : Strengthening e-NAM (National Agriculture Market) for better price discovery and direct farmer-market linkages.

3. **Technology Adoption** : Promoting precision farming, high-yielding varieties and climate-resilient horticultural practices.

4. **Credit and Insurance Support** : Easier access to institutional credit and crop insurance to safeguard farmers from market fluctuations.

5. **Public-Private Partnerships** : Encouraging investments from private players in processing, packaging and export-oriented horticulture.

Conclusion

Government initiatives like NHM, NHB, and HMNEH are crucial in driving this transformation. However, infrastructure, market access and credit facilities need further improvement. By addressing these challenges, India can position itself as a global leader in horticulture while ensuring prosperity for its rural population.

GIST OF DOWN TO EARTH

Topic

- Future of Waste (1-15 Feb)
- Is India on track for a green transition (16-31 January)

**February
2025**

SHITLAKHET MODEL FOR FOREST FIRE PREVENTION

1. Introduction to the Shitlakheth Model

- A community-led initiative in Shitlakheth village, Almora district, Uttarakhand, aimed at preventing forest fires.
- Recognized by Uttarakhand CM Pushkar Singh Dhami (2022) and officially acknowledged by the Head of Forest Forces (2024).

2. Role of Jungle Ke Dost

The community group consisting of women and young farmers was formed in 2019; for undertaking following preventive measures through WhatsApp :

- Clearing dried grass and leaves before fire season.
- Encouraging farmers to complete field burning by March 31 to prevent wildfires.
- Providing iron ploughs to reduce tree felling for wooden ploughs (with support from Vivekananda Hill Agriculture Research Institute).
- Promoting assisted natural farming for forest regeneration.

3. Achievements & Impact

- Collective efforts since 2004, formally organized in 2019.
- 500 hectares of forest conserved in the past 12 years.
- Supported by Plus Approach Foundation (Delhi), which provides awards and financial aid to women in 10 villages.

4. Future Needs & Challenges

- Year-round conservation efforts require more government support.
- Requests for insurance, fire-resistant clothing, and better firefighting equipment from the State government and fire department.

5. Key Takeaways

- The Shitlakheth Model showcases public participation in forest conservation.
- It emphasizes early intervention, community awareness, and sustainable farming practices.
- Scaling up this model across Uttarakhand could significantly reduce forest fire damage.

CALIFORNIA WILDFIRES : A SYMPTOM OF A WARMING WORLD

The recent wildfires in California have highlighted the increasing intensity and frequency of forest fires, driven by climate change.

Key Findings on California Wildfires

1. Scale and Impact of the Wildfires :

- In January 2025, 255 wildfires broke out across Los Angeles, Riverside, San Diego and Ventura counties.
- Over 50,000 hectares were burned within three weeks, leading to 28 deaths and mass evacuations.
- The largest fires were reported in Palisades (Santa Monica mountains), Eaton (Altadena area) and Hughes (Castaic Lake region).
- The Hughes Fire alone covered 4,000 hectares in two hours, displacing 50,000 residents.

2. Role of Climate Change :

- Scientists at ClimaMeter attribute the severity of fires to climate-driven factors like higher temperatures and drier conditions.
- Weather conditions were 5°C warmer, 15% drier, and 20% windier than previous years during similar fire events.

- Southern California has experienced hydroclimate whiplash—shifting between extreme wet and dry conditions—doubling the fire risk.
- The fire season has extended beyond traditional months, with wildfires becoming more frequent and intense.

3. Global Trends and Comparisons :

- A 2024 European Commission report noted that wildfires burned nearly 500,000 hectares in Europe, West Asia and North Africa in 2023.
- Countries like Cyprus, Norway, and Switzerland experienced record-breaking wildfires in areas previously unaffected.
- A 2024 Nature Climate Change study estimated that climate change has increased global burnt areas due to fires by over 15% since 2003.
- Western North America, Northern Australia, and Southeastern South America have all seen significant rises in wildfire activity.

4. Greenhouse Gas Emissions and Climate Feedback Loop :

- Wildfires naturally release carbon, but under normal conditions, 80% is reabsorbed by vegetation.
- Due to climate change, a 'fire-climate feedback loop' has emerged : Rising temperatures → Extreme weather & drought → Increased wildfires → More carbon emissions → Worsened climate change.
- The January 2025 California wildfires emitted 1 megatonne of carbon (3.67 million tonnes of CO₂-equivalent), surpassing 22 years of January records.
- These emissions are nearly half of what California's forests sequester in a year (7.39 million tonnes of CO₂).

- Studies indicate wildfires are converting carbon sinks into carbon sources, undermining global climate goals.

Conclusion

The increasing frequency and intensity of wildfires, particularly in California, underscore the urgent need for climate action. The interplay of rising temperatures, hydroclimate instability, and human-induced environmental changes has made wildfires more destructive than ever. Addressing these challenges requires a combination of mitigation strategies, better forest management, and global cooperation to limit temperature rise and prevent further environmental catastrophes.

THREAT TO SURVIVAL : HOLLONGAPAR GIBBON SANCTUARY IN ASSAM

The Hollongapar Gibbon Sanctuary in Assam, home to the endangered Hoolock gibbon and diverse biodiversity, faces serious ecological threats.

Key Threats to the Sanctuary

1. Railway Electrification :

- The railway track cutting through the sanctuary, laid in 1887, is now set for electrification.
- This could increase noise pollution, electrocution risks, and habitat disturbance for gibbons and other species.
- Fragmentation of the canopy could force arboreal species to the ground, making them vulnerable to predators.

2. Hydrocarbon Exploration :

- An exploratory drilling project, approved in 2024, is located 13 km from the sanctuary in its eco-sensitive zone (ESZ).
- The site falls within an elephant migration route, historically used since the Ahom kingdom era.
- While authorities claim the project won't affect elephant corridors, environmentalists warn of habitat destruction.
- Potential risks include contamination of groundwater with heavy metals and increased pollution from drilling activities.

Impact on Biodiversity

1. Hoolock Gibbons :

- India's only ape species, listed as 'Endangered' by IUCN, relies on uninterrupted forest canopies.
- Habitat fragmentation and increased human activity threaten their survival.
- Past incidents, such as the 2020 Baghjan blowout, have shown oil exploration's devastating effects on gibbon populations.

2. Elephants and Other Species :

- Seasonal elephant movements could be disrupted, leading to increased human-wildlife conflicts.
- Other species, such as the endangered white-winged duck, may suffer habitat degradation.

3. Pollution and Ecosystem Damage :

- Oil exploration brings risks of chemical spills, heavy metal contamination and noise pollution.
- Tree felling for infrastructure development will further shrink wildlife habitats.

The electrification of the railway track and hydrocarbon exploration pose severe ecological threats to the Hollongapar Gibbon Sanctuary. Stronger environmental safeguards and alternative strategies are needed to balance development with conservation.

WATER BUDGETING IN KOTHA JAHANGIR, MAHARASHTRA

The village faced severe water shortages, leading to seasonal migration for work. Since 2014, water budgeting has helped in sustainable

water management, enabling year-round crop cultivation.

Water Budgeting Process

- **Twice a Year Exercise** : Conducted before kharif (May) and rabi (October) seasons.
- **Community Participation** : A 17-member Village Water Management Team oversees the process, ensuring transparency.
- **Planning Based on Availability** : Water availability is assessed through rainfall data, groundwater levels and storage capacity.
- **Crop Planning** : Farmers decide which crops to cultivate based on water availability, prioritizing less water-intensive crops.

Water Conservation Measures

- **Infrastructure Development (2014-16)** :
 - ❑ Compartment bunding
 - ❑ Nullah deepening
 - ❑ Dugwell cleaning
 - ❑ Check dams
 - ❑ Drip irrigation
- **Impact** :
 - ❑ 99% farmland utilization (up from 70%)
 - ❑ Groundwater availability extended from December-January to March-April
 - ❑ Reduced dependence on water tankers

Sustainable Farming Practices

- **Borewell Ban** : Only dugwells (15m deep) are used for irrigation.

Efficient Irrigation :

- ❑ Drip irrigation & sprinklers mandatory for certain crops
- ❑ Plastic mulching for chilli cultivation
- ❑ Promotion of vermicomposting

Inter-Village Aquifer Management

- **Common Aquifer** : 14 villages share the Malegaon aquifer.
- **Collaboration** : Villages work together to manage groundwater sustainably.
- **Conflict Resolution** : An Aquifer Management Committee ensures equitable water distribution.

Economic & Agricultural Benefits

- **Crop Diversification** : Farmers now grow soybean, toor, chilli and green vegetables.
- **Higher Profits** : Chilli cultivation offers quicker returns than cotton. Reduced input costs and risk of crop failure.

Water budgeting model in Kotha Jahangir in Marathwada demonstrates utility of community driven model of water management for drought prone regions, driving agricultural productivity and economic stability.

INNER STEEL : SUSTAINABLE WASTE MANAGEMENT IN INDIAN INDUSTRIES

Steel production is one of the most resource and carbon-intensive industries, emitting approximately 1.8 tonnes of CO₂ per tonne of steel and generates substantial waste, particularly steel slag, which poses significant environmental challenges.

Challenges of Steel Slag

- Steel slag contains free lime, leading to expansion and cracking in construction materials.
- High phosphorus content affects concrete setting time and strength.
- Over 15 million tonnes of steel slag are stockpiled in India, increasing environmental risks.
- Improper disposal leads to groundwater contamination due to heavy metals.

Industry Initiatives for Circularity

- **Bhilai Steel Plant (SAIL)** : Uses steel slag for kachha roads and paver blocks, saving ₹ 1.25 million annually.
- **Tata Steel, Jamshedpur** : Developed Tata Aggreto (for construction) and Tata Nirman

(for fly ash bricks and cement). Uses steam aging to accelerate slag maturation.

- **JSW Steel, Vijayanagar** : Converts slag into construction aggregates and slag fines for cement and agriculture, reducing CO₂ emissions and river sand demand.

Policy Recommendations

- The Bureau of Indian Standards and the Ministry of Steel should establish usage standards for steel slag.
- Plants should process new slag within a year and clear legacy slag by 2027.
- Steam aging should be promoted, supported by a government-backed supply chain for road construction.

Fly Ash : Environmental Concerns and Utilization

- **Definition** : A coal combustion residue from thermal power plants, containing toxic substances.
- **Impact** : Long-term exposure can cause bronchitis and fibrosis; improper disposal contaminates water bodies.

- **Production Increase** : From 173 million tonnes (2013-14) to 271 million tonnes (2021-22) due to higher coal consumption.

Utilization & Regulations

- Used in cement, bricks, road construction, mine filling and land reclamation.
- Fly Ash Notification (1999) mandates 100% utilization, achieving 95% usage in 2021-22.
- Challenges include fugitive emissions, slurry leakages and unregulated disposal.

Sector-Wise Utilization (2021-22)

- Cement industry : 25%
- Roads & flyovers : 17%
- Land reclamation : 13%
- Mine filling : 3% (though highly effective)
- Other uses : 23% (unclear categorization)

Recommendations

- Full implementation of Fly Ash Notification.
- Better monitoring to curb dumping (currently, 4% fly ash is discarded).
- Promoting fly ash-based industries and increasing its share in Portland Pozzolana Cement (PPC) and road construction.

FGD Gypsum : An Alternative to Natural Gypsum

- **Definition** : Gypsum is a calcium sulfate dihydrate used in cement, fertilizers and construction materials.
- **Current Scenario** : India imported 9.2 million tonnes of gypsum in 2021-22, producing only 3.5 million tonnes domestically.

Flue Gas Desulfurization (FGD)

- A pollution control technology that removes sulphur dioxide (SO₂) from power plant emissions.
- Produces FGD gypsum, which can replace natural gypsum.

Potential Benefits

- If fully implemented, 12-17 million tonnes of FGD gypsum can be produced, reducing import dependency.
- **Cost-effective** : ₹ 850 per tonne (compared to ₹ 3,000 per tonne for imported gypsum).

Implementation Challenges & Recommendations

- Only 9 power plants have installed FGD systems; implementation delays persist.
- Strict CPCB guidelines for 100% utilization of FGD gypsum.
- Scaling up NTPC's initiatives in soil reclamation and construction.

India's Sugar Industry and Waste Utilization

Overview

- India is the world's largest sugar producer and consumer.
- In 2022, 357.4 million tonnes of sugarcane were crushed, producing 39.4 million tonnes of sugar.
- Three major by-products :
 - ❑ Bagasse
 - ❑ Press Mud
 - ❑ Molasses

1. Bagasse : A Renewable Energy Source

- **Definition** : Fibrous residue left after extracting sugarcane juice.
- **Annual Production**: ~90 million tonnes.
- **Uses** :
 - ❑ Fuel for co-generation power plants.
 - ❑ Paper industry raw material.
 - ❑ Cattle feed alternative.
- **Future Scope (2030)** :
 - ❑ Expected to generate 130 million tonnes of bagasse.
 - ❑ Can replace 46.8 million tonnes of coal, reducing 5.6 million tonnes of CO₂ emissions.

2. Press Mud : From Waste to Biofuel

- **Definition** : Residual material after sugarcane juice filtration.
- **Annual Production** : ~14.3 million tonnes.
- **Uses** :
 - ❑ Bio-manure (mixed with spent wash).
 - ❑ Compressed Biogas (CBG) production.
- **Future Scope (2030)** :
 - ❑ 15.6 million tonnes of press mud could produce 624,000 tonnes of CBG.

3. Molasses : Key Ingredient for Alcohol and Ethanol

- **Definition** : By-product of sugar crystallization.
- **Annual Production** : ~5% of sugarcane crushed.
- **Uses** :
 - ❑ Alcohol production (ethanol, industrial alcohol).
 - ❑ Animal feed additive.

Waste Circularity & Sustainability

- **Policy Initiatives** : 5-10% biomass co-firing in thermal power plants (Ministry of Power, 2017). **Coal and coke ban** in Delhi-NCR industries (2021) to promote biomass.
- **Challenges** : Slow adoption of biomass co-firing (<1% in Delhi-NCR coal plants). Supply chain issues in biomass pellet production.

● **Key Recommendations :**

- ❑ Expand CBG production using press mud.
- ❑ Develop pipeline infrastructure for CBG transportation.
- ❑ Utilize surplus bagasse for industrial co-firing.

Hazardous Industrial Waste : A Resourceful Challenge

Scale of Waste :

- India generated 12.35 million tonnes of hazardous waste in 2021-22, with 7.6 million tonnes recycled.
- 41% of hazardous waste is co-processed in cement plants, reducing coal consumption.

Challenges & Innovations :

- Companies like Re Sustainability preprocess waste for cement plants.
- Financial burden : Cement plants charge pre-processors for accepting waste.

Stone Slurry Waste : Turning Dust into a Resource :

- **Environmental Impact :** Rajasthan's stone-cutting industry generates 5-6 million tonnes of slurry annually, affecting air quality and soil fertility.

● **Innovative Utilization :**

- ❑ **Cement Industry :** Mangalam Cement replaces mineral gypsum with stone slurry.
- ❑ **Tile Industry :** Gujarat's Morbi district replaces feldspar in tiles, reducing costs.

Policy Interventions & Key Takeaways :

- NGT and CPCB guidelines promote better waste utilization.
- Cement and tile industries offer viable reuse options, reducing environmental impact.
- Regulatory push and industry initiatives are crucial for sustainable waste management.

LASTING SOLUTIONS

UNCCD-COP16 and Indigenous Knowledge

- The 16th Conference of Parties (COP16) to the UN Convention to Combat Desertification (UNCCD), held in Riyadh, Saudi Arabia (December 2024), was a game changer.
- For the first time, the UN formally recognized the role of indigenous communities in tackling aridity and land degradation.
- Experts emphasized integrating traditional knowledge with modern science for effective solutions.

Findings from UNCCD Report

- 77% of land has experienced drier conditions in the last three decades.
- 4.3 million sq km of drylands have expanded, affecting former humid regions due to human-induced climate change.
- 67% of global land will store less water by 2100.
- Agricultural impact : By 2040, global yields could decline—maize (–20 million tonnes), wheat (–21 million tonnes), rice (–19 million tonnes).

Action Agenda at Riyadh

- Restore 15 million sq km of degraded land by 2030.
- Protect 30% of land and inland waters.
- Enhance ecosystem integrity to benefit 500 million people.
- Rainwater harvesting was recommended as a key adaptation strategy.

India's Role in Combating Desertification

- India has multiple national and state-level schemes for land and water conservation.
- The Desertification Cell under the Environment Ministry coordinates efforts.
- Traditional water conservation methods like tankas in Rajasthan play a crucial role.
- MGNREGS and Amrit Sarovar have been instrumental in reviving water bodies, improving soil moisture and increasing groundwater levels.
- Andhra Pradesh and Madhya Pradesh have implemented the highest number of water conservation projects.

BANKING ON FLAWED DRUG VOLUNTARY LICENCES

Hetero Drugs (Hyderabad, India) received FDA approval for a generic version of nilotinib, a cancer drug initially patented by Novartis. The Medicines Patent Pool (MPP), a UN-backed

agency, hailed this as a major achievement. However, nilotinib's patent had already expired 18 months earlier, making the celebration questionable.

The Role of MPP in Drug Licensing

- MPP negotiates Voluntary Licences (VLs) with pharma companies to enable generic production in low- and middle-income countries (LMICs).
- VLs aim to expand access to medicines by bypassing strict patent regimes.
- India plays a crucial role, with 28 out of 53 MPP partner companies being Indian generic manufacturers.

Flaws in MPP's Voluntary Licence for Nilotinib

1. No Patent Barrier :

- The VL was signed in October 2022, months before nilotinib's patent expired in most markets.
- By July 2023, any company could freely manufacture and sell the drug.

2. Limited Territorial Reach :

- The VL allowed supply to 44 countries, but after patent expiry, nilotinib could be sold in 108 LMICs and 22 high-income countries anyway.
- Only seven countries had valid secondary patents, with minimal patient demand.

3. Alleged Influence of Big Pharma :

- The deal was facilitated by the Access to Oncology Medicines (ATOM) Initiative, involving pharma industry players like the International Federation of Pharmaceutical Manufacturers and Associations (IFPMA).
- MPP's own expert panel criticized the deal, warning it set a low standard for future NCD drug licenses.

Concerns and Questions Raised

- The VL provided little real benefit to global drug access.
- Why did three Indian pharma firms—Hetero, Dr. Reddy's, and Eugia—join this agreement when they could legally produce nilotinib without a licence ?
- MPP's association with ATOM and Big Pharma risks damaging its credibility.

Conclusion

- The nilotinib VL is an example of a flawed agreement that benefits pharmaceutical corporations more than public health.
- Future MPP deals for non-communicable diseases (NCDs) should ensure genuine access benefits rather than being symbolic agreements with limited impact.

150 YEARS OF INDIA METEOROLOGICAL DEPARTMENT (IMD)

Genesis and Early Years

- Established in 1875 due to the need for scientific weather forecasting after disasters like the 1864 Bengal cyclone.
- Integrated 80 meteorological systems under a central authority.
- H.F. Blanford set up IMD's first office in Shimla, and India became the first country to develop long-range monsoon forecasts in 1886.

Agricultural and Hydrological Contributions

- Agricultural Meteorology Division operational since 1856, aiding in crop yield forecasting and drought studies.
- Hydrological services began with the Cuttack station in 1867, leading to the standardization of rainfall measurement in 1890.

Role in Aviation

- Supported India's first flight in 1911 (Allahabad to Naini).
- Provided forecasts for the Royal Air Force (1921) and air mail services (1929).

- Launched an online meteorological briefing system in 2007.

Technological Evolution

- Introduced Doppler Weather Radars, GPS-based radiosonde systems, and satellite meteorology (INSAT series).
- Pioneered atmospheric research, including ozone measurements since 1928.
- Developed the Air Quality Early Warning System for Delhi.

Communication and Forecasting Improvements

- Shifted from postal and telegraphic reports to All India Radio broadcasts (1936) and digital forecasting (since 1960).

Future Roadmap : Vision 2047

- Focus on expanding observation networks and real-time weather data availability.
 - Commitment to high-quality, granular data for improved forecasting and disaster preparedness.
- IMD has transformed from a colonial-era department into a cornerstone of India's climate resilience strategy.

WEALTH INEQUALITY AND BILLIONAIRE COLONIALISM

Economist Lucas Chancel, lead author of World Inequality Report, explained that half of the global population lack assets or basic wealth and faces immense challenges in escaping poverty vortex, fuelling modern day colonialism.

Key Findings from the Oxfam Report (2024)

- **Wealth Concentration** : Billionaires' wealth grew **three times faster** in 2024 than in 2023. 204 new billionaires were added, with the top 10 billionaires gaining \$ 100 million per day.
- **Inheritance vs. Entrepreneurship** : In 2024, all billionaires under 30 inherited their wealth. In 2023, inheritance created more billionaires than entrepreneurship for the first time. By 2055, \$ 5.2 trillion will be transferred among billionaires as inherited wealth.

Modern Colonialism and Historical Parallels

- **Unfair Wealth Distribution** : Inheritance remains largely **untaxed** in most countries.

Wealth transfer ensures that the rich remain rich while the poor struggle to break free.

- **Comparison with Colonial Times** : During the British Empire, the richest 10% in the UK controlled over half of all income. The UK extracted \$ 64.82 trillion from India, with \$ 33.8 trillion benefiting the richest 10% in Britain. In 2023, the richest 1% in the Global North received \$ 263 billion from the Global South, continuing economic exploitation.

Conclusion

- Oxfam calls this trend 'billionaire colonialism', where wealth accumulation mirrors the exploitative colonial wealth extraction system.
- Wealth inequality persists due to unchecked inheritance and financial dominance by the elite. The current system enables the rich to secure future gains, further deepening economic disparities

16-31 January

EXTENSION OF DAP SUBSIDY AMID RUPEE DEPRECIATION

On January 1, 2025, the Union Cabinet approved an extension of the ₹ 3,500 per tonne subsidy on di-ammonium phosphate (DAP) under the Nutrient-Based Subsidy (NBS) scheme. This decision comes amid rupee depreciation and a global rise in DAP prices.

Key Details of the Subsidy Extension

- The subsidy of ₹ 3,500 per tonne is in addition to the ₹ 21,911 per tonne under NBS.
- With DAP's market price at ₹ 27,000 per tonne, companies can now realize ₹ 52,411 per tonne.
- However, the landed import cost of DAP has increased to ₹ 54,213 per tonne, and

with additional costs, it reaches ₹ 60,000 per tonne.

- Companies face a loss of ₹ 7,000 per tonne, which may lead to reduced imports, affecting wheat, mustard and pulse production.

Impact of Rupee Depreciation

- India's rice export prices fell to a 17-month low of \$ 436-\$ 442 per tonne.
- Analysts predict higher import costs for edible oil and pulses, impacting domestic prices.

Conclusion

The extension aims to stabilize fertilizer availability but may not fully offset the rupee depreciation's effects on agriculture and imports.

BURDEN OF PROOF

The ongoing e-KYC verification drive, aimed at eliminating fake ration cards and ensuring the rightful targeting of beneficiaries under the National Food Security Act (NFSA), has inadvertently led to the exclusion of vulnerable sections of society. Senior citizens, manual laborers, and marginalized communities are among those disproportionately affected.

Key Issues Identified :

1. Digital Exclusion : Many elderly individuals and daily wage labourers, whose fingerprints have worn out due to age or hard work, are unable to pass biometric authentication. As a result, their ration cards are being deactivated, cutting off access to essential food supplies.

2. Outdated Census Data : The continued reliance on the 2011 Census for determining NFSA beneficiaries is problematic, as it excludes over 100 million eligible individuals who should have been covered under the scheme.

3. Impact on Welfare Schemes : The mandatory e-KYC requirement is not just affecting ration distribution but also disrupting access to pensions, scholarships, LPG subsidies and other government welfare programs.

4. Arbitrary Deletions : Many ration shop dealers have been given the authority to remove names from beneficiary lists, leading to wrongful exclusions even before the official verification deadline.

5. Limited Bypass Mechanisms : While there is a provision for manual approval of

ration distribution in case of authentication failures, its implementation remains inconsistent and severely restricted.

6. Frozen Bank Accounts : Many beneficiaries are facing difficulties in accessing their scholarships and pensions due to KYC-related issues with their bank accounts, leading to financial hardships.

Conclusion

While the e-KYC initiative aims to improve efficiency and eliminate fraud, its rigid implementation has resulted in food insecurity and financial distress for some of the most vulnerable sections of society. The government must adopt a more inclusive and flexible approach to ensure that no genuine beneficiary is left behind.

CAPTURING SIANG

The proposed Siang Upper Multipurpose Project (SUMP) in Arunachal Pradesh has sparked concerns among the Adi tribal community, who fear displacement and loss of ancestral land. While, India sees it as a countermeasure to China's upstream dam on the Yarlung Tsangpo, locals resist due to environmental and social concerns.

Key Issues :

- **Strategic & Developmental Aspect :** India's 11.2 GW dam project aims to regulate Siang's flow and counter China's 66 GW project on the river's upper course.
- **Tribal Resistance :** Communities argue the dam will submerge 27 villages, dis-

rupt livelihoods and destroy cultural heritage.

- **Use of Force :** The government plans to deploy security forces to assist with pre-feasibility surveys, triggering protests.
- **Human Rights & Environmental Concerns :** Activists highlight geopolitical tensions, lack of consent and risks to the Himalayan ecosystem.

Conclusion

Experts warn of irreversible damage to indigenous communities and fragile ecologies if the India-China dam race continues without a bilateral river-sharing agreement.

ON SHAKY GROUND

Key Findings of the India State of Forest Report 2023

- India's total forest and tree cover has increased by 1,445 sq km, reaching 25.17% of its total geographical area.
- However, only 156.41 sq km (11%) of this increase comes from forest cover, while 89% is due to improved tree cover outside recorded forests.
- The increase in forest cover within officially recorded forest areas is negligible (7.28 sq km).

Concerns Over Degradation

- A new Forest Cover Change Matrix reveals significant degradation of natural forests into non-forest areas :
 - ❑ 9,500 sq km of recorded forest areas are lost.

- ❑ Loss of 231.18 sq km of 'very dense' forest and 2,246.83 sq km of 'moderately dense' forest.

- Experts question the reported increase in 'very dense' forests, calling it ecologically improbable.

Regional Impact

- Northeast India is the most affected :
 - ❑ Arunachal Pradesh lost over 1,000 sq km of forests.
 - ❑ Mizoram and Nagaland also saw significant forest loss.
- The Western Ghats recorded a loss of 58.22 sq km in the last decade.

Policy and Implementation Issues

- Despite significant funding under schemes like the Green India Mission (₹ 624.71 crore

allocated), deforestation continues at a high rate.

- Green Credit Programme allows private agencies to plant trees on degraded lands in exchange for credits, enabling forest diversions for non-forestry activities.
- Concerns that agricultural land within forest areas is wrongly classified as forest cover.

CLEAN ENERGY TRANSITION IN INDIA

India has committed to a significant clean energy transition, aiming to reduce its emissions intensity by 45% by 2030 (compared to 2005 levels) and achieve 50% of its cumulative electric power capacity from non-fossil fuel sources. Under its Nationally Determined Contributions (NDCs) to the Paris Agreement, India targets 500 GW of non-fossil energy capacity by 2030, emphasizing renewable energy over coal-based power. However, challenges persist in defining "clean energy" and ensuring a smooth transition.

Current Energy Scenario and Targets

- As of October 2024, India ranked 4th globally in renewable energy capacity, exceeding 190 GW.
- The share of installed non-fossil energy capacity has increased from 32% in 2014 to 45% in 2024.
- The Central Electricity Authority (CEA) projects energy demand to rise to 2,440 billion units (BU) by 2030, requiring 777 GW of installed capacity.

Projected Energy Mix by 2030

- The share of fossil fuels in total installed capacity is expected to decrease from 55% in 2024 to 36% by 2030, but will still generate 56% of electricity.
- The share of new renewables (solar, wind, biomass, small hydro) is projected to increase from 33% in 2024 to 55% by 2030.
- Solar energy will be the primary driver, contributing 23% of total electricity by 2030.

Challenges in the Clean Energy Transition

1. Definition of 'Clean Energy' : The Indian government includes large hydropower and nuclear power under non-fossil energy but often interchanges this with renewables, leading to inconsistencies in classification.

2. Disparity Between Installed Capacity and Generation : While new renewables account for 32% of installed capacity, they generate only

Conclusion

- While headline figures suggest an increase in forest cover, the degradation of natural forests, especially in ecologically sensitive areas, remains a major issue.
- Experts warn that misclassification, policy loopholes and ineffective conservation efforts are driving long-term damage to India's forests.

12% of electricity due to intermittency and storage limitations.

3. Persistent Coal Dependency : Despite growth in renewables, coal still dominates, supplying 76% of electricity in 2023-24, similar to 2014-15 levels.

4. Stagnation of Old Renewables : Large hydropower and nuclear power growth have slowed, with hydropower's share declining due to environmental concerns and seasonal variability.

Role of SECI in India's Solar Energy Transition

The Solar Energy Corporation of India (SECI) plays a crucial role in renewable energy implementation by acting as an intermediary between power developers and state distribution companies (DISCOMs), ensuring risk mitigation and financial security.

SECI's Key Contributions

- Issues tenders for solar and wind projects through competitive bidding.
- Signs long-term Power Supply Agreements (PSAs) with DISCOMs and Power Purchase Agreements (PPAs) with developers.
- As of 2022-23, SECI has signed PSAs for 48-352 GW, covering 40% of India's total renewable energy capacity and 72% of solar capacity.

Challenges Faced by SECI

- **Financial Risks** : SECI bears the risk of non-payment by DISCOMs, leading to potential financial instability.
- **Delayed Projects** : Around 34-5 GW of solar, wind, and hybrid projects with signed PPAs remain uncommissioned.
- **Transparency Issues** : The lack of publicly available data linking PSAs with PPAs creates accountability gaps.
- **Regulatory Concerns** : Allegations of bribery in solar project approvals raise governance issues.

Clean Energy Transition Strategies

1. Shift Towards Round-the-Clock (RTC) Renewable Projects :

- To address intermittency in solar and wind power, India is adopting RTC projects with battery or pumped storage.
- The Economic Survey 2023-24 highlights the Ministry of Power's guidelines on 'firm and dispatchable power' (FDRE).
- However, RTC projects are costlier (₹ 4-64-5-96 per kWh) compared to standalone solar (₹ 2-6-2-74 per kWh), raising viability concerns.

2. Strengthening Renewable Purchase Obligations (RPOs) :

- The Electricity Act, 2003 mandates RPOs, requiring states to source 43-3% of electricity from renewables by 2030.
- Many states (22 out of 28) have failed to meet their annual solar RPO targets due to legacy PPAs with thermal power plants.
- Only Karnataka, Andhra Pradesh, Gujarat, Punjab, and Uttar Pradesh consistently meet their solar RPOs.
- Lack of penalty enforcement and data transparency further hinder progress.

3. Incentivizing Green Energy States :

- States like Himachal Pradesh, Jammu & Kashmir, and Sikkim, which generate 100% non-fossil energy, could be rewarded through green credits or Finance Commission grants.

4. Strengthening Domestic Solar Manufacturing

- To reduce dependence on Chinese imports, India has implemented :
 - 40% customs duty on imported solar modules and 25% duty on solar cells.
 - Mandatory use of domestic materials in government projects.
 - Production Linked Incentive (PLI) scheme to boost local manufacturing.
- India's solar PV module manufacturing capacity stands at 60.5 GW as of October 2024.
- However, concerns remain about whether domestic production can meet rising demand at competitive costs.

Decentralized Renewables and Rooftop Solar as Game Changers

1. Need for Decentralized Renewable Energy :

- Despite progress, energy poverty persists due to economic constraints.
- Clean cooking energy remains a challenge, with 2.6 billion people globally still relying

on biomass, leading to pollution and health hazards.

- Land scarcity necessitates rooftop solar and agro-photovoltaics for localized energy generation.

2. Potential of Decentralized Renewable Energy :

- Off-grid solar pumps and solar feeders can enhance livelihoods and income generation.
- Consumer-driven electricity generation reduces transmission losses and promotes efficiency.
- Key challenges include storage solutions, integration with DISCOMs and affordability for low-income households.

3. Rooftop Solar : A Promising Alternative :

- Rooftop solar can ease pressure on DISCOMs and lower household electricity costs.
- India's rooftop solar capacity reached 14 GW as of October 2024, contributing 17% of total solar capacity.
- Challenges include :
 - Reliance on the grid for night-time electricity.
 - Financial viability concerns, as subsidized grid power is often cheaper.
 - Fragmented data between consumers and DISCOMs.

4. Government Initiatives and Policy Evolution :

- **Jawaharlal Nehru National Solar Mission (2010) :** Targeted 2 GW of rooftop solar.
- **Net Metering Policy (2012) :** Allowed consumers to sell excess power to the grid.
- **Opex Model (2013-14) :** Enabled solar companies to finance installations, with consumers paying for usage.
- **Discoms as Nodal Agencies (2019) :** Increased financial assistance up to 40% for small rooftop solar installations.
- **PM-Surya Ghar Scheme (2024) :** Aims for mass adoption of rooftop solar with subsidies.

Conclusion

India's clean energy transition is progressing steadily, with significant growth in renewables, particularly solar energy. However, challenges such as coal dependency, intermittency, grid integration, financial constraints, and regulatory concerns must be addressed. Strengthening RPO enforcement, incentivizing high-performing states, and ensuring affordable domestic solar manufacturing are essential.

AN EXTRAORDINARY CRUSADE AGAINST NEGLECTED DISEASES

Jimmy Carter, often referred to as the 'peanut farmer from Georgia', was an unusual ex-president. After leaving office, he became a global humanitarian, advocating for peace and public health. Former US President Jimmy Carter's decades-long campaign to rid Africa of a painful parasitic disease is unmatched.

Fight Against Neglected Diseases

- Carter, through The Carter Centre, led efforts to combat neglected tropical diseases, notably Guinea Worm Disease (Dracunculiasis).
- His mission-mode approach targeted diseases overlooked by pharmaceutical companies due to low profitability.

Guinea Worm Eradication

- WHO reported 3-5 million cases in 21 countries (1980s), but Carter's work brought cases down to just 14 in 2023.

- Negotiated a 'Guinea Worm ceasefire' in Sudan (1995) to allow medical aid during civil war.
- India eradicated Guinea Worm in 1996, becoming the second country to do so after Pakistan.

Broader Health Contributions

- Carter expanded efforts to fight trachoma (leading cause of blindness), schistosomiasis and lymphatic filariasis.
- Influenced Melinda Gates and the Gates Foundation, shifting their focus towards neglected diseases over future vaccines.

Carter's work left a lasting impact on global health, proving that healthcare is a human right, especially for the neglected and impoverished.

INDIA'S POVERTY ESTIMATES

1. Lack of Official Poverty Data :

- India has not had an official poverty estimate based on consumption expenditure surveys since 2012.
- Despite the need for updated data, there has been silence on poverty levels, leading to reliance on unofficial estimates.

2. SBI Research Estimate (2025) :

- Based on the "Household Consumption Expenditure Survey : 2023-24" by the Ministry of Statistics and Programme Implementation.
- Estimates India's poverty at 4-5%, the lowest ever recorded.
- Monthly Per Capita Consumption Expenditure (MPCE) :
 - ❑ Rural : ₹ 4,122 (₹ 137/day)
 - ❑ Urban : ₹ 6,996 (₹ 233/day)
- Poverty line (2023-24) :
 - ❑ Rural : ₹ 1,632 per month
 - ❑ Urban : ₹ 1,944 per month

3. Controversies Around Poverty Estimation :

- SBI Research follows the 2009 Tendulkar Committee methodology, which was criticized for underestimating poverty.

- The Rangarajan Committee (2014) recommended higher poverty lines, resulting in higher poverty estimates.
- UPA-II rejected the Rangarajan estimates, and the current government dismissed both Tendulkar and Rangarajan estimates.

4. Alternative Estimates Based on Rangarajan Methodology (2024) :

- **Poverty lines (2022-23) :**
 - ❑ Rural : ₹ 2,515 per month
 - ❑ Urban : ₹ 3,639 per month
- Estimated poverty levels :
 - ❑ Rural : 27.4%
 - ❑ Urban : 23.7%
 - ❑ Overall : 26.4%

5. Key Takeaways :

- The SBI Research estimate suggests near-eradication of poverty, while alternative estimates using a more realistic poverty line indicate that over one-fourth of India's population remains poor.
- The absence of official data allows for conflicting narratives on poverty in India.

GIST OF SCIENCE REPORTER

Topic

Science Communication in
Regional Languages

**February
2025**

SCIENCE COMMUNICATION IN REGIONAL LANGUAGES : A NEED OF THE HOUR

Role of Science in Daily Life

- Science and technology impact every aspect of modern life, from gadgets and medicine to AI and genetic research.

Challenges Requiring Scientific Awareness

- Issues like pandemics (COVID-19, malaria, dengue), climate change and natural disasters demand public engagement with science.

Importance of Science Communication

- A science-literate society helps solve social problems and fosters innovation.

- Scientific knowledge should be accessible to all for **inclusive development**.

Need for Regional Language Communication

- Bridging the language gap ensures better public understanding of scientific advancements.
- Localized communication makes science culturally relevant and accessible to wider sections of society.

Way Forward

- Promoting science education in regional languages will enhance scientific temperament and national progress.

MISSION MAUSAM : INDIA'S LEAP TOWARDS WEATHER-READY AND CLIMATE-SMART FUTURE

India's Union Cabinet approved 'Mission Mausam' on 11 September, 2024, allocating ₹ 2,000 crore to enhance weather and climate forecasting by 2026. Led by the Ministry of Earth Sciences (MoES), the mission aims to strengthen resilience against climate change and improve disaster preparedness.

Key Highlights of Mission Mausam :

- **Objective** : Improve weather forecasting systems to tackle climate-related challenges.
- **Implementation** : Spearheaded by MoES, with involvement from IMD, NCMRWF and other agencies.
- **Technology Boost** : Deployment of advanced forecasting models, AI-driven analytics and high-performance computing.

- **Infrastructure Development** : Upgrading Doppler radars, automatic weather stations, and satellite-based observation systems.

Significance of the Initiative

- **Disaster Preparedness** : Strengthens early warning systems for cyclones, floods and extreme weather events.
- **Agriculture & Economy** : Enhances climate-smart farming practices and mitigates weather-related economic losses.
- **Public Safety** : Improves air quality monitoring and health advisories.
- **Climate Resilience** : Supports India's commitments to the Paris Agreement on climate action.

Mission Mausam is a transformative step toward making India weather-ready and climate-smart, ensuring sustainable development and disaster risk reduction.

HUMAN METAPNEUMOVIRUS (HMPV)–ANOTHER SEASONAL THREAT

With the world still dealing with the after-effects of COVID-19, seasonal respiratory infections continue to pose serious health risks. Human Metapneumovirus (HMPV) has recently gained attention due to a rise in detected cases, though it has existed for years.

Key Highlights :

- **What is HMPV ?**
 - A respiratory virus that causes symptoms similar to the flu and other seasonal infections.

- Primarily affects young children, the elderly and immunocompromised individuals.

- **Symptoms and Impact :**

- **Mild cases** : Cough, fever, nasal congestion and sore throat.
- **Severe cases** : Pneumonia, bronchitis, and respiratory distress.

- **Why is it a Concern Now ?**

- Increased testing and surveillance have led to a surge in reported cases.
- Lack of specific antiviral treatment or vaccine makes prevention crucial.

Conclusion

- HMPV is a growing seasonal health threat, particularly for vulnerable populations.
- Preventive measures, such as hygiene, avoiding close contact with infected individuals, and strengthening immunity, are essential to mitigate its spread.

ERDOS NUMBER, MATHEMATICIANS AND THE NOBEL LAUREATES

Paul Erdős (1913–1996), a Hungarian mathematician, was one of the most prolific researchers of the 20th century. His research spanned over 60 years, during which he published nearly 1500 papers, a record still unmatched.

Comparative Perspective

- For reputed mathematicians, publishing 100–150 papers in a lifetime is considered exceptional.
- Even Leonhard Euler (1707–1783), a foundational figure in modern mathematics, published 800 papers, placing him second to Erdős in terms of research output.

Erdős Number Concept

- The Erdős Number measures collaborative distance from Erdős in terms of co-authored research papers.
- Mathematicians and Nobel Laureates are often assessed based on their Erdős number, indicating their academic lineage and research collaborations.

Conclusion

- Erdős' immense contribution to mathematics and collaborative research continues to influence academics.
- His legacy lives on through the Erdős Number, which remains a unique metric of mathematical collaboration.

WPS : A HACKER'S GATEWAY TO YOUR ROUTER

Wi-Fi Protected Setup (WPS) is a network security standard designed for easy and quick connectivity of devices to a Wi-Fi router without requiring a password. It aims to simplify wireless setup for non-technical users.

Security Risks of WPS

- WPS prioritizes convenience over security, making routers vulnerable to hacking.
- Attackers can exploit WPS PIN-based authentication through brute-force attacks.
- Once breached, hackers can gain full access to the network, compromising sensitive data.

Preventive Measures

- Disable WPS in router settings to enhance security.
- Use strong, unique Wi-Fi passwords and WPA3 encryption.
- Regularly update router firmware to patch vulnerabilities.

Conclusion

- While WPS simplifies Wi-Fi connectivity, its security flaws make it a potential entry point for hackers.
- Users should disable WPS and follow best security practices to protect their network.

VIRTUAL WATER

Water scarcity and conflicts over water are becoming increasingly prevalent, with reports of 1,473 instances of water-related violence and issues worldwide between 1990 and 2023.

- Future conflicts may shift focus from oil to water due to its crucial yet uneven distribution.

Types of Water Conflicts

- Water conflicts can arise at both intrastate (within a country) and interstate (between countries) levels.
- Interstate conflicts occur when countries share transboundary freshwater sources like rivers or groundwater, leading to competition over access and control.

Virtual Water Concept

- Virtual water refers to the water embedded in the production of goods and services.
- This includes the water used in the production of food, clothing, and industrial goods, which indirectly influences water usage and its distribution globally.

Conclusion

- With water becoming a scarce resource, conflicts over its access are likely to increase, emphasizing the importance of understanding the concept of virtual water in managing global water resources and resolving disputes.

WHITE HYDROGEN, THE ULTIMATE SOURCE OF CLEAN ENERGY

The Paris Climate Agreement (2015) aims to limit global temperature rise to below 2°C, ideally targeting 1.5°C, compared to pre-industrial levels.

Global Shift to Renewable Energy

- White Hydrogen is a naturally occurring form of hydrogen found in the Earth's crust.
- The world is urgently transitioning from carbon-based fossil fuels to alternative renewable energy sources.

- White hydrogen is emerging as a promising solution for clean energy, serving as an ultimate energy source to meet global energy demands while minimizing environmental impact.

Conclusion

White hydrogen could play a pivotal role in achieving the climate goals set by the Paris Agreement, offering a clean energy alternative in the global race to combat climate change.

SUBMARINE GROUNDWATER DISCHARGE : A UNIQUE PHENOMENON OF FRESHWATER SPRINGS IN SALTY COASTAL SEAS

The concept of freshwater in salty coastal seas might surprise many, but it is a known phenomenon where freshwater springs exist offshore, under the sea. This occurrence is called Submarine Groundwater Discharge (SGD).

Historical References

- Strabo, a Greek geographer, and Pliny the Elder, a Roman naturalist, both mentioned the presence of freshwater sources in coastal seas.
- Romans relied on these freshwater springs for their daily water needs.

Submarine Groundwater Discharge (SGD)

- SGD is the process by which freshwater flows from the underground aquifers into the coastal seas, creating a unique phenomenon.
- This groundwater discharge can occur naturally along coastlines, offering a hidden freshwater source even in salty seas.

Conclusion

SGD highlights the dynamic interaction between freshwater and saltwater in coastal areas, a phenomenon historically acknowledged and still crucial for understanding coastal water systems.

DO NOT WASTE THE 'WEALTH' OF WASTE

Waste is often viewed as a useless byproduct from various activities, including manufacturing, daily human, animal and plant activities.

- Waste can exist in liquid, gas, or solid forms and is often discarded without thought.

The Subjectivity of Waste

- What is waste for one person may be a resource for another. For example, perspiration is considered waste but serves important physiological functions.
- The exact composition of waste is often unknown, making it a complex and subjective concept.

Waste as a Resource

- The idea that waste should not be discarded without consideration is gaining importance.
- Upcycling and resource recovery from waste are crucial for sustainable development.

Conclusion

Waste management is a key area of focus for future sustainability, emphasizing that waste should not be wasted but rather seen as potential wealth for recycling, repurposing, or redistributing resources.

BIOPLASTICS : A SUSTAINABLE HOPE FOR NON-DEGRADABLE PLASTICS

Plastic is essential in modern life, but its non-degradability poses significant environmental challenges. The term 'plastic' originally referred to materials that are malleable and easily shaped, but now, it mostly involves synthetic polymers made from petroleum and fossil fuels.

Environmental Concerns with Plastics

- Plastic waste is difficult to dispose of because it does not easily degrade, leading to significant environmental pollution.
- A large amount of plastic waste is released into the environment each year, contributing to growing pollution.

Bioplastics : A Sustainable Alternative

- Bioplastics are being explored as a potential solution to the environmental issues caused by conventional plastics.
- They are derived from renewable sources like plants and algae, and are designed to degrade more easily, offering hope for reducing plastic pollution.

Conclusion

Bioplastics could be a sustainable hope in addressing the environmental challenges of plastic pollution, providing a greener alternative to the non-degradable plastics dominating our daily lives.

Pratiyogita