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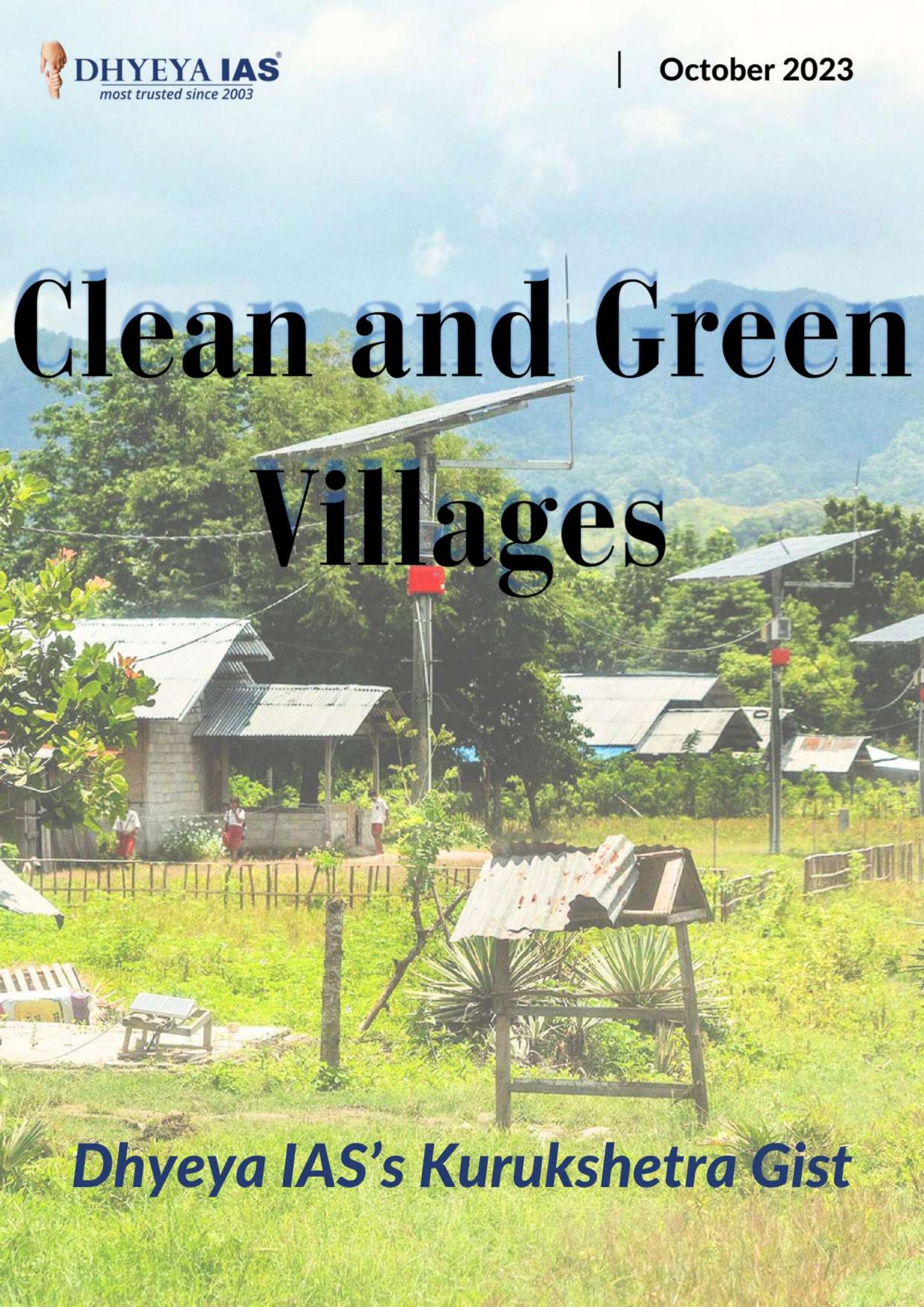
Clean and Green Villages



Dhyeya IAS's Kurukshetra Gist

Vision of Green and Clean Rural India

Prime Minister Shri Narendra Modi's One-Word Movement at COP26, "LiFE" (Lifestyle for Environment), unites people for sustainable living and environmental conservation. The Ministry of Panchayati Raj actively supports this initiative, aligning with the "Whole of Government, Whole of Society" approach and the UN's Sustainable Development Goals (SDGs).

India, as a signatory to the SDGs 2030 Agenda, is committed to achieving these goals and targets in a timely manner. The country has also played a crucial role in shaping the SDGs and is focusing on localizing the SDGs (LSDGs) in panchayats and villages across nine themes, encompassing the 17 SDGs. This effort ensures meaningful engagement and participation of various stakeholders at the grassroots level to achieve the SDGs and create a more sustainable and equitable world. This is being done under 9 themes, of which Clean and Green Villages is one.

Key Interventions

To implement the 'Clean and Green Village' theme effectively, these key actions are necessary:

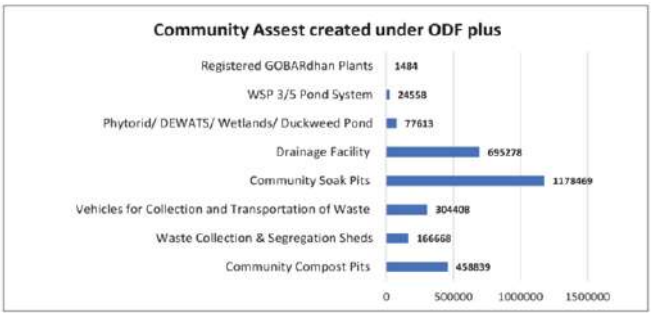
- Raise awareness about waste reduction, sustainable energy consumption, and environmental impact reduction.
- Encourage pollution reduction measures, like reducing plastic use in the village.
- Educate the community about climate change and its effects.
- Map land use, water bodies, forests, and biodiversity.
- Establish sustainable resource utilization norms for common lands, water bodies, and forests.
- Assess water sources, waste generation, and sanitation goals.
- Select suitable technology for water supply and sanitation.
- Maintain public spaces and toilets.
- Develop a comprehensive energy program based on needs.
- Promote the adoption of the Mission LiFE Resolution for Panchayats.

Role of Gram Panchayats in Achieving Clean and Green Villages

To achieve the goal of a Clean and Green Village, Gram Panchayats should focus on the following points:

- Prioritize the preservation and maintenance of water and land resources.
- Promote the generation and consumption of clean energy.
- Effectively manage solid and liquid waste.
- Maintain Open Defecation Free status.
- Prevent water source contamination.
- Engage in ecological, economic, and equity concerns through community participation.
- Participate in activities like tree plantation, organic farming, and renewable energy promotion for a self-reliant and eco-resilient rural India.
- Address climate change effects and consequences through Panchayat initiatives.
- Undertake natural resource management, biodiversity protection, afforestation, waste management, and soil and land resource management.
- Encourage local economic development, including LED bulb production, smokeless stove manufacturing, and organic farming.
- Support Self Help Groups (SHGs) for additional employment opportunities.
- Aim for carbon neutrality as a goal for self-sufficient Panchayats.

- About 52% of villages, approximately 425,691 in total, have sustained their Open Defecation Free (ODF) status.
- These villages have also implemented either solid or liquid waste management systems.
- Specifically, 222,637 villages have arrangements for Solid Waste Management.
- Additionally, 360,103 villages have arrangements for Liquid Waste Management.
- The establishment of community assets in these villages has significantly contributed to their ODF plus status.



Gram Swaraj Abhiyaan

- The Ministry of Panchayati Raj has partnered with the Ministry of New and Renewable Energy to involve Gram Panchayats in renewable energy schemes.
- This collaboration aims to transform Gram Panchayats into self-sufficient energy producers rather than just consumers.
- Widespread adoption of renewable energy in rural areas can generate own sources of revenue (OSR) and employment opportunities for local youth.
- Under the Gram Urja Swaraj Abhiyaan, Gram Panchayats have implemented renewable energy projects with various models and support from state agencies.
- Examples include Odanthurai Panchayat's windmill in Tamil Nadu, Thikekarwadi GP's Biogas plant in Maharashtra, and Meenvallam's micro hydel power project in Kerala.
- Many Gram Panchayats have embraced solar energy models such as solar rooftops, kitchens, street lighting, and high-mast lighting.
- As of now, 2,080 Gram Panchayats have taken up and implemented renewable energy projects.
- About 2,020 Gram Panchayats have functioning solar energy systems, while 60-70 have hydel and wind energy systems. Additionally, 106 Gram Panchayats have existing biogas energy systems.
- Numerous Panchayats are interested in advancing clean and green energy and participating in the Gram Urja Swaraj Abhiyaan across multiple sectors.

Particulars	Solar Energy Systems	Hydel Energy Systems	Wind Energy Systems	Biogas Energy Systems
Number of Gram Panchayats	4202	296	296	366

Source: https://egramswaraj.gov.in/urjaDashboard.do

Mission LiFE

- Mission LiFE at COP26 promotes global sustainable living.
- It advocates a shift to a 'circular economy' through eco-friendly practices.
- The strategy begins with 'Change in Demand,' encouraging simple actions and policy changes.
- Panchayats play a vital role in implementing eco-friendly practices at the grassroots level.
- In its inaugural year, Mission LiFE focuses on 'Demand Shift,' urging adoption of 75 specific eco-actions.
- These actions prioritize ease, minimal supply reliance, and economic compatibility.
- Panchayats can drive change through community involvement in eco-friendly initiatives.
- They champion actions like waste reduction, renewable energy adoption, and sustainable agriculture.
- Collaboration with Panchayats leverages local expertise, resources, and governance mechanisms, aligning with Mission LiFE's grassroots-driven approach to sustainable living.

Success Stories and Best Practices

Best practices of various Gram Panchayats in promoting sustainability and eco-friendly initiatives:

- **Kundal Gram Panchayat in Palus, Maharashtra**, stands out for its commitment to environmental sustainability. With a population of 18,287, it has achieved 100% solid and liquid waste management, ensuring a clean environment for all households. Moreover, it has implemented innovative practices such as greywater treatment and rainwater harvesting, effectively addressing

water scarcity. The use of LED lights, water treatment plants, and afforestation initiatives further contribute to its eco-friendly efforts.

- **Syasanambagam Gram Panchayat in Hinjilicut, Odisha**, is dedicated to maintaining a clean and green environment. Their door-to-door garbage collection, segregation, and recycling programs have made significant strides in waste management. The Panchayat also actively engages in afforestation and sustainable energy solutions, showcasing a holistic approach to environmental conservation.
- **Sultanpur Gram Panchayat in Eligaid District, Telangana**, exemplifies the impact that proactive community engagement can have on sustainability. They have constructed waste management sheds and implemented composting, making efficient use of waste resources. The Panchayat has undertaken extensive plantation drives, encouraging a green and clean environment. Achieving 100% Open Defecation Free (ODF) status and supporting water conservation adds to their impressive efforts.
- **Meenangadi Gram Panchayat in Kerala** serves as a remarkable model for carbon neutrality. Their innovative schemes include promoting tree planting through interest-free loans and conserving soil and water resources by planting bamboo trees on riverbanks. Efficient waste and energy management, such as composting and waste audits, showcase their dedication to sustainability. The Panchayat's endeavors have earned them the prestigious Carbon Neutral Vishesh Panchayat Puraskar.
- **Palli Gram Panchayat in Jammu and Kashmir** has been recognized for its relentless efforts against climate change. Collaborating with experts and stakeholders, they have developed a local climate action plan that encompasses solar installations, energy and waste auditing, and conservation efforts. Notable achievements include a 500-kilowatt solar plant, 79 solar streetlights, and efficient greywater management systems.
- **Thikekarwadi Gram Panchayat in Thane, Maharashtra**, has earned recognition with the Gram Urja Swaraj Vishesh Panchayat Puraskar. Additionally, they are committed to becoming a Carbon Neutral Gram Panchayat, emphasizing their role in promoting sustainability and environmental conservation.
- **Hasudi Ausanpur Gram Panchayat in Siddharthnagar, Uttar Pradesh**, is actively working toward achieving 'Carbon Neutrality.' Their focus on afforestation, renewable energy interventions such as solar streetlights, and installation of a smog tower reflects their commitment to sustainable practices in a bid to combat climate change.

Capacity-building Initiatives

- The Revamped Rashtriya Gram Swaraj Abhiyan (RGSA) promotes PRIs to be more responsive to local development needs and SDGs.
- RGSA encourages evidence-based planning, technology adoption, and efficient resource utilization.
- Thematic training is a significant part of capacity building at the Gram Panchayat level.

Convergence of Plans

- Achieving Clean and Green Panchayats requires collaboration among various ministries and departments, along with involvement from NGOs, students, and youth organizations.
- State Panchayati Raj Departments should map available resources and implement Panchayat Action Plans within the Gram Panchayat Development Plan.
- Collective efforts at both Central and State Government levels are crucial for addressing climate change challenges and achieving the Local Sustainable Development Goals (LSDGs) by 2030.
- Under Prime Minister Shri Narendra Modi's leadership, India has made historic strides in rural sanitation through initiatives like Swachh Bharat.
- India has achieved significant progress in renewable energy capacity, ranking globally in installed capacity, with rural areas contributing significantly.

Preserving the Green Cover of Indian Villages

India's villages, steeped in cultural heritage, play a vital role in the country's identity. The unique vernacular systems of village life are deeply rooted in Indian society, showcasing rich diversity. The architectural aspect of villages is crucial in creating sustainable and harmonious village communities. Furthermore, villages offer niche tourism opportunities, especially for urban dwellers seeking the novelty of green landscapes.

- **Transformation Challenges**: Many Indian villages are urbanizing and losing their traditional character with paved streets, ornate courtyards, and parking congestion, resembling urban areas.
- **Risk to Village Identity**: The idyllic image of Indian villages surrounded by green farmland is at risk, endangering the cultural heritage and values they represent. Collective efforts are needed for village revival.
- **Government Initiatives**: The Indian Government recognizes the importance of villages through Sustainable Development Goals (SDGs) and the 'Clean and Green Villages' focus in the Local Indicator Framework (LIF). Grassroots effectiveness remains a challenge, requiring motivation and inclusivity.
- **Preserving Village Heritage**: The age-old Indian tradition of 'living with nature' in villages can guide modern settlement planning. The article explores challenges in 'greening villages' and suggests alternative pathways to strengthen the 'village system' for the future.

Help from the Top

- Ministry of Panchayati Raj (MoPR) interfaces with 278,000 Panchayati Raj Institutions (PRIs).
- Revised Rashtriya Gram Swaraj Yojana (RGSY) empowers PRIs to pursue social goals for sustainable development.
- Government provides budgetary support to enable PRIs to achieve tangible outcomes.
- **Comprehensive Local Indicator Framework (LIF)**
    - LIF includes various themes like poverty-free livelihoods, community health, water sufficiency, infrastructure, good governance, and more.
    - These indicators are interrelated, emphasizing the interconnectedness of various aspects of village life.
    - For example, green cover contributes to livelihoods, health, and water sufficiency.
- **Inspiration from Tilonia, Rajasthan**
    - Tilonia serves as an integrated model for village revitalization, led by social activist Sanjit 'Bunker' Roy.
    - Indigenous techniques were employed to bring healthcare, green solutions, solar energy, electricity, water, education, income generation, women empowerment, and ecological conservation to the village.
- **Measurable Outcomes with Interactive Pathways**
    - Outcomes are measurable, but the approach recognizes that pathways to these outcomes are interactive and iterative.
    - India's diverse villages provide opportunities for learning and adaptation, with challenges in one village serving as a strategy for success.
    - Sharing emerging success stories is essential for continual improvement and knowledge exchange.

Engagement of Village Communities

- **Importance of Long-Term Commitment**
    - Trees have a long maturation process and aging cycle, requiring timely replacement.
    - Consistent, ongoing, and long-term afforestation efforts are crucial for effectiveness.
- **Inclusive Engagement Across Generations**
    - Engagement in green cover preservation should involve all age groups in the village community.
    - Influencing the next generation's values is essential for long-term preservation, such as through stories like the Chipko movement.
- **Cultural Bonds and Medicinal Values**
    - Incorporating cultural significance, like the sacredness of the Deodar tree in Hindu temples, can enhance green cover preservation.

    - Recognizing the medicinal properties of trees and their role in life aligns with the emphasis on alternative medicine, creating opportunities for the village economy.
- **"Green Village" for Sustainable Transformation**
    - The Ministry of AYUSH's eco-system can catalyze the village economy, making India's herbal plants a valuable resource.
    - "Green village" is an all-encompassing approach for the sustainable transformation of villages in the development paradigm, aligning with Ayurveda-based livelihoods and holistic development.

Construction with Local Materials

- **Importance of Local Materials**
    - Use of environmentally appropriate construction materials is essential for green villages.
    - Transporting materials over long distances contributes to environmental pollution and contradicts sustainability goals.
    - Industrially manufactured materials often lack viable recycling technologies, while local materials naturally recycle.
- **Local and Sustainable Alternatives**
    - Architects promote locally sourced materials like clay, mud, stones, grasses, leaves, bamboo, and wood for walls and roofs.
    - Local materials align with the local context in terms of geography and climate, providing both aesthetics and climatic response.
    - Industrial materials like concrete and masonry blocks have higher heat absorption, leading to increased energy consumption, while local materials offer insulation and thermal mass for indoor comfort.
- **Inspirational Examples**
    - Villages in Ladakh, Rajasthan, and the Himalayan regions use locally sourced materials with minimal energy needs.
    - Architects like Didi Contractor, Laurie Baker, and Dr. G. Shankar have designed eco-friendly buildings and advocated for local material-based architecture.
    - Laurie Baker emphasized that indigenous architecture and local materials are essential to address local challenges.

Protecting the Green Cover

- **Promoting Sustainable Village Architecture**
    - Village inhabitants sometimes adopt urban building designs with industrial materials, driven by competitive aspirations.
    - Sustainable architecture should integrate local design elements, motifs, and carvings to empower local communities and instill pride.
    - Village architecture, using locally sourced materials, should focus on quality designs for the village community, challenging the traditional architecture practice model.
- **Architectural Education and Innovation**
    - Professionals need to understand contemporary village challenges, including sanitation, water conservation, thermal comfort, and ventilation.
    - Proactive architectural interventions are critical to counter the preference for town-building architecture in village settings.
    - The holistic thinking process and architectural education must align for comprehensive solutions.
- **Minimum Damage to Green Cover**
    - Construction is essential but should minimize damage to the green cover.
    - There are no guidelines to ensure the health of trees and their contribution to groundwater management.
    - Green cover, including trees and specific flora varieties, plays a vital role in stabilizing rainfall patterns and preventing runoff, preserving the ecosystem.
    - Traditional practices of drawing groundwater sustainably and respecting the balance between agriculture and the ecosystem must be conserved.
    - Preservation of green cover is essential for sensitive village living and can benefit from traditional Indian knowledge and wisdom.

Villages embody a harmonious relationship with nature and cultural diversity, and architecture is pivotal in shaping sustainable communities. They offer potential for eco-tourism due to their lush green surroundings. Preserving green cover means revitalizing biodiversity, rethinking development with a focus on green principles. Educating communities about their settlements is essential for active participation in this journey.

Integrated Solar Village Scheme for Inclusive Development

States should create integrated solar village development schemes to enhance rural economic growth by improving power supply, income, education, healthcare, and employment opportunities through solar energy integration.

India's updated Nationally Determined Contributions (NDCs) emphasize citizen-centric climate action and sustainable development, with rural India offering significant potential for solar energy adoption. Several states, including Gujarat, Bihar, and Odisha, have begun solarizing villages, ensuring reliable electricity supply for households and vital institutions.

Solar energy reduces costs for power distribution companies (discoms) by curbing power procurement, losses, and network upgrade expenses. To fully realize solar villages, integration of economic development, livelihoods, and social infrastructure is crucial. This approach aligns with India's commitment to sustainable, inclusive clean energy adoption, empowering rural areas to combat climate change and enhance economic well-being.

Empowering Rural India with Distributed Renewable Energy

- Distributed Renewable Energy (DRE) technology provides a modular and accessible power supply to remote areas. It transforms communities into 'prosumers,' capable of generating and consuming solar and biomass energy.
- DRE technology enhances various aspects of rural life, including healthcare, education, internet access, livelihoods, and resilience against climate events. Installing distributed solar creates job opportunities, with the potential to generate thousands of jobs in the coming years.
- Both central and state governments have promoted rooftop solar and DRE livelihood applications. Initiatives like capital subsidies for residential rooftop solar and simplified application processes have driven the installation of 11 GW of rooftop solar in India by August 2023.
- DRE has the potential to impact 37 million livelihoods in rural India, particularly in agriculture and textiles, with a market potential of around USD 50 billion.
- Several states, such as Jharkhand and Uttarakhand, have introduced incentives and policies to facilitate DRE adoption in rural areas, aiming to create affordable, reliable, and clean energy solutions for their communities.
- It is essential for policymakers, industry stakeholders, and developers to work together to translate these visions into concrete actions, promoting the integrated development of rural India.

Rural Energy Needs for Development

- The United Nations Development Programme's 'Energy Plus' framework highlights that access to electricity is crucial but insufficient for rural livelihood development.
- Reliable electricity is essential for households, service delivery (health and education), and creating livelihood opportunities.
- India achieved nearly 100% household electrification by March 2023, but power supply quality remains a challenge.

Current Electricity Supply Situation

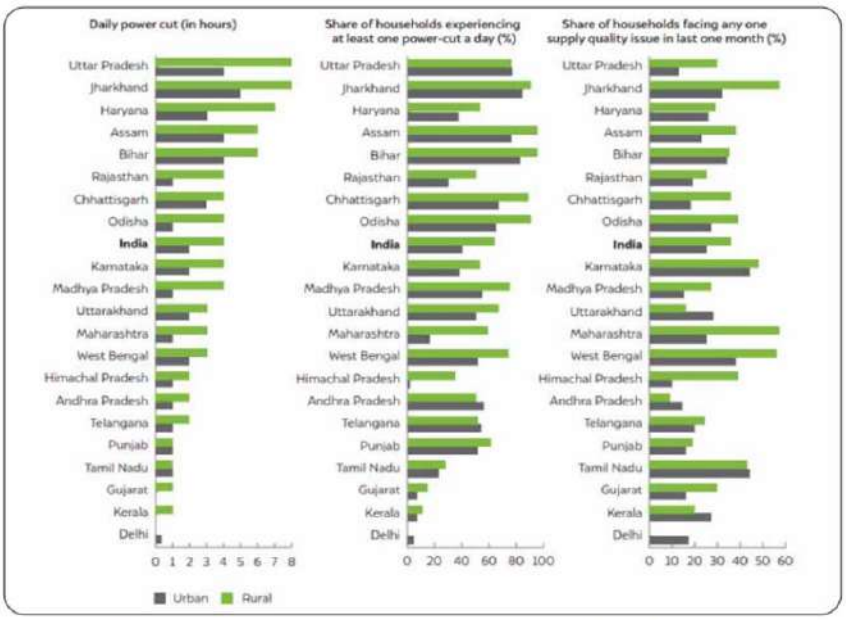
- There is variation in power supply progress among states and between rural and urban areas.
- Rural India experiences more power supply outages (average of 20 hours of supply) compared to urban areas.
- Rural households face power quality issues like long blackouts, low voltages, and appliance damage due to voltage fluctuations.

Electricity Supply to Healthcare and Education

- Some healthcare institutions in rural areas (e.g., primary health centres) operate without electricity (5%).
- Many schools lack electricity facilities, with 10% yet to be electrified and 13% lacking functional electricity.
- Climate change-induced extreme events, like the 2018 Kerala floods, further disrupt healthcare and education facilities.

Learning from Solarization of Villages

States like Gujarat, Odisha, and Bihar have worked on solarizing villages, providing lessons for expanding clean energy in other villages.



Source: Agrawal, Shalu, Sunil Mani, Abhishek Jain, and Karthik Ganesan. 2020. State of Electricity Access in India: Insights from the India Residential Energy Consumption Survey (IRES) 2020. New Delhi: Council on Energy, Environment and Water.

- **Dharnai Village, Bihar:** In 2014, a 100 KW solar mini-grid powered Dharnai Village, Bihar, serving 400 households, health centres, schools, training centres, and commercial establishments. After three years, operational issues, including battery failure, rendered the system non-functional. Lack of exclusive ownership led to maintenance problems.
- **Barapitha Village, Odisha:** Barapitha, near Bhubaneswar, became Odisha's first 100% solar village in 2015, with a 1 KW solar system, street lights, and solar lamps for 61 households. It provided a community centre, LED TV, and set-top box. Damaged by Cyclone Fani in 2017, the system wasn't repaired, leaving villagers reliant on the grid.
- **Modhera Village, Gujarat:** Modhera solar village in Gujarat is a successful initiative. It features a 6 MW ground-mounted solar project with a 15 MWh battery system and 1 KW rooftop solar systems on 1,400 households. This project provides round-the-clock power to over 1,700 households in three villages, significantly reducing electricity bills and supplying excess power to the grid for additional revenue.

Integrated Solar Village Development Scheme

- The 'Integrated Solar Village Development Scheme' should focus on improving power supply reliability, boosting rural income, and strengthening education and health services through solar integration.
- Demand Assessment is crucial, covering residential households, agriculture, and various government buildings. It helps identify solarisation opportunities.
- Innovative business models should be explored, including rooftop solar for pucca houses and community solar for unsuitable rooftops or high upfront costs.
- Integration of livelihoods through decentralized productive appliances, targeting areas like agriculture and animal husbandry.
- Alignment with existing state solar schemes and collaboration with relevant departments to support rural economic development.
- Skill development and capacity building, particularly for youth as "Surya Mitras," with a focus on gender-inclusive opportunities.
- Establishment of village-level committees (VLC) in shortlisted villages, involving Gram Panchayat members, self-help groups, and youth groups, to ensure the scheme's implementation and sustainability.

The clean energy transition has primarily benefited urban areas, and it's time to redirect our focus towards rural regions. We should align rural policies with the goals of poverty reduction and clean energy promotion. While large-scale renewable energy projects are essential for meeting targets quickly, we must also prioritize the rapid deployment of distributed renewable energy (DRE) to ensure a sustainable and community-driven energy transition.

Crop Residue Management

Ecologically sustainable management of agricultural waste, known as crop residues (CR), presents a significant challenge in India. Various plant materials like stubbles, stalks, stover, husk, bran, bagasse, and molasses fall under the category of CR. These materials, once considered waste, are now recognized as valuable resources with versatile applications, such as livestock bedding, animal feed, bio-gas generation, and more. Despite these options, a substantial amount of CR is burned on farms, adversely affecting soil properties, air quality, and food security. The government has implemented legal and strategic measures to curtail on-farm CR burning, promoting the adoption of recycling and reusing technologies. Collaboration between the Central Government, state governments, NGOs, and relevant institutions aims to raise awareness and combat CR burning.

Challenges of Crop Residue

- India annually produces approximately 683 million tonnes of crop residues (CR), with cereal crops contributing about two-thirds of this total.
- While around 500 million tonnes of these residues are recycled in various sectors, there is still a surplus of 178 million tonnes that remains unused.
- Nearly half of this surplus CR is burned on-farm, mainly in states like Punjab, Haryana, and Uttar Pradesh, with rice and wheat residues being the most significant.
- On-farm CR burning leads to severe environmental problems and negatively impacts human health, particularly soil health.
- It results in the loss of organic matter, soil nutrients, and beneficial soil organisms, leading to reduced soil fertility and productivity.
- The burning of CRs also contributes to the emission of greenhouse gases and particulates that worsen air quality and can cause respiratory and health problems.
- Farmers in north-western India often resort to burning paddy stubbles due to labor shortages during critical field operations, a short window for preparing fields for the next crop, and the use of combine harvesters that leave behind stubble.
- While there are implement options to manage stubbles in the field, many farmers still prefer burning as a convenient and cost-saving practice to prepare fields quickly for the next crop.

Solutions

- India annually generates about 683 million tonnes of crop residues (CRs), with the majority coming from cereal crops, specifically rice and wheat.
- Approximately 500 million tonnes of CRs are recycled, while the remaining 178 million tonnes are often burned on farms.
- Punjab, Haryana, and Uttar Pradesh are significant contributors to on-farm burning.
- On-farm burning of CRs negatively impacts soil health by depleting organic matter and essential soil nutrients like nitrogen, phosphorus, potassium, and sulfur. This practice also results in the loss of organic carbon and disrupts soil microbial populations.
- Burning CRs is a source of greenhouse gases, further contributing to climate change.
- It releases harmful pollutants, including carbon dioxide, carbon monoxide, methane, sulphur dioxide, and nitrogen oxides, along with particulate matter that poses health risks.
- Paddy stubble burning in neighbouring states significantly contributes to air pollution, especially in regions like the National Capital Territory of Delhi.
- The National Green Tribunal (NGT) imposed a ban on CR burning in specific regions, and violators are subject to punitive actions and environmental compensation.
- The Central Government has introduced schemes to promote environmentally safe CR management and alternative technologies.
- These schemes provide financial assistance to farmers for the purchase of CR management machinery and establish Custom Hiring Centres to make machinery available to farmers.
- CR management machinery includes straw management systems, seeders, mulchers, reapers, and balers.
- The Central Government has revised guidelines for off-site CR management to create a paddy straw supply chain. This initiative aims to collect and utilize paddy straw for various purposes, including power and heat generation, bio-CNG, and bio-ethanol production.

- The Indian Council of Agricultural Research has developed the Pusa Decomposer technology to biologically decompose paddy stubbles, promoting faster soil preparation and enhancing soil quality.
- Various treatments and techniques are available to improve the nutritional value of crop residues, and they can be utilized for animal bedding, compost, mushroom cultivation, biochar production, soil mulching, and more.
- Implementing short-duration crop varieties and diversifying crops in the traditional wheat-rice system are suggested solutions to reduce CR burning.

Pusa Decomposer

- The Pusa Decomposer is a microbial solution designed for managing paddy straw, offering a long-term sustainable solution.
- It is available in two forms: liquid and capsules, providing flexibility for application.
- Four capsules can be used to create 25 liters of the liquid formulation.
- The recommended application is 25 liters per hectare, which is equivalent to 10 liters per acre. This is suitable for fields with 4-5 tonnes of straw per acre.
- The cost of a pouch containing 4 capsules is Rs 20.
- The Pusa Decomposer accelerates the decomposition of paddy straw, making the field ready for wheat sowing in just 25 days.
- This technology has been successfully demonstrated in farmers' fields in regions including Punjab, Haryana, Uttar Pradesh, and the National Capital Region (NCR).
- One of the key benefits of its use is enriching the soil with organic carbon (OC), essential nutrients, and improving soil biological and physical properties, contributing to better soil health.

Other Alternatives

- Banana pseudostems are wasted in major banana-producing states: Tamil Nadu, Maharashtra, Karnataka, Kerala, Andhra Pradesh, and Gujarat. These pseudostems are a rich source of natural fibers.
- Banana fibers are biodegradable, have a shiny appearance, and blend well with other natural fibers like cotton, rayon, and silk. They are used in sarees, fashion garments, shipping cables, power transmission ropes, cordage, fishing nets, bio-pesticides, fertilizers, banana paper, and handicrafts.
- Banana fibers are suitable for making high-value paper with a shelf-life of over 100 years. They are used in low-cost sanitary pads, including reusable options.
- In Odisha, a startup makes electric vehicle batteries from crop residues, offering fast charging, longer battery life, and 30-40% cost savings. These batteries are 100% biodegradable and reduce crop residue burning.
- Crop residues like rice straw can produce 300 cubic meters of bio-gas from anaerobic digestion per tonne. One tonne of paddy biomass yields 300 kwh of electric energy through gasification.
- Rice straw is a potential source for bio-ethanol production. Rice-straw briquettes for brick kilns and straw pellets for domestic use are also energy production options.

The combined efforts of the Central Government, Punjab Government, NCR State Governments, and various stakeholders have made significant strides in reducing crop residue (CR) burning. Monitoring data following standard ISRO protocols shows a substantial decrease in CR burning events from 78,550 in 2021 to 53,792 in 2022, marking a 31.5% reduction in Punjab, Haryana, Delhi, NCR districts of Uttar Pradesh, and Rajasthan between September 15 and November 30, 2022. The Central Government has disbursed over Rs. 3,062 crore from 2018-19 to 2022-23 to State Governments for effective CR management. These states have procured a substantial number of machines and established Custom Hiring Centers. The contribution of farm fires to daily PM 2.5 levels in Delhi reduced from 48% in November 2021 to 34% on November 3, 2022. The average Air Quality Index (AQI) of Delhi also improved from 376.50 in November 2021 to 320.60 in November 2022, a reduction of approximately 56 points. Besides technical and financial support, educational campaigns and awareness initiatives are essential for the most significant impact.

Water for Clean and Green Village

India's commitment to the United Nations' 2030 Agenda for sustainable development involves reimagining the Sustainable Development Goals (SDGs) at the local level. The Ministry of Panchayati Raj has mapped the 17 SDGs into 9 key themes for Gram Panchayats, focusing on achieving these goals through collective efforts. One of these themes is "Clean and Green Village."

This theme aligns with Mahatma Gandhi's vision of self-reliant villages, emphasizing the interplay between societal needs and environmental support systems. Clean and green villages encompass more than basic cleanliness; they include comprehensive village sanitation, improved water supply, sanitation facilities, indoor air quality, and effective solid waste management.

A green village is one that can economically develop while harnessing natural resources like solar and wind energy without harming the environment. These practices are essential for sustainable village development, reflecting India's commitment to holistic and inclusive progress under the UN's 2030 Agenda.

Components of a Clean and Green Village

A "Clean and Green Village" is dedicated to sustainability, including open defecation-free environments, clean and green educational institutions, effective solid waste management, affordable clean energy sources, eco-friendly agriculture practices, and more. It prioritizes conservation, efficient resource management, and environmental protection for future generations.

- Open Defecation Free Village.
- Clean & Green Schools.
- Clean & Green Anganwadis.
- Scientific management of solid waste.
- Waste Water management.
- Affordable & Clean energy including solar & wind energy.
- Greening Development.
- Promotion of organic farming and progressing reduction of chemical fertilizers & pesticides.
- Celebrate clean and green living.
- Strengthening local committees and enhancing larger participation.
- Supply of clean & safe drinking water.
- Improvement of indoor air quality.
- Energy conservation.
- Rainwater conservation including Rainwater Harvesting.

Government Initiatives for Clean and Green Villages

- **Swachh Bharat Mission**: Launched to improve access to water, sanitation, and hygiene with the aim of saving lives and achieving universal sanitation coverage. It was initiated as a national movement in India, with a vision to make India clean and hygienic by October 2, 2019.
- **Open Defecation Free (ODF) Goals**: The mission aimed to achieve ODF status by eliminating visible faeces in the environment, providing safe technology options for faeces disposal, and ensuring every household uses safe toilet facilities.
- **Mass Movement for Swachh Bharat**: Aiming to engage everyone in the task of cleaning homes, workplaces, villages, cities, and surroundings in a collective quest.
- **Behaviour Change Communication (BCC):** Emphasizing the importance of changing behaviour and generating social norms to promote toilet use and sanitation.
- **Inter-Personal Communication (IPC):** Focused on using IPC for triggering demand and promoting toilet use through social and behavioural change communication and house-to-house interventions.
- **Gains Achieved**: Substantial improvement in access to drinking water and the construction of household toilets, leading to a rise in cleanliness and sanitation facilities across the country.

- **ODF Maintenance**: Effective maintenance of ODF status, solid and liquid waste management, grey water treatment, and preventing water source contamination.
- **Green Village Initiatives**: Focused on ecological, economic, and equity issues, promoting activities like plantation, organic farming, conservation of village ecosystems and biodiversity, water conservation through Jal Shakti Abhiyan, and promoting new and renewable energy sources.

These government initiatives play a significant role in promoting clean and green villages, enhancing the quality of life in rural India, and aligning with Sustainable Development Goals (SDGs).

Jal Shakti Abhiyan and Catch the Rain Campaigns

- **Jal Shakti Abhiyan (2019):**
  - Launched in 2019 as a national call to action to make water conservation and recharge everyone's responsibility.
  - Implemented in 1,592 water-stressed blocks in 256 districts of India.
- **Jal Shakti Abhiyan: Catch The Rain (JSA:CTR 2021):**
  - Launched on World Water Day (March 22, 2021) to encourage stakeholders to create and maintain Rainwater Conservation Structures.
  - Focused on all districts, rural and urban, with the theme "Catch the Rain, where it falls when it falls."
  - Included interventions like rainwater harvesting, water conservation, water body inventory, setting up Jal Shakti Kendras, afforestation, and awareness generation.
- **Jal Shakti Abhiyan: Catch The Rain-2022 (JSA:CTR-2022):**
  - Launched on March 29, 2022, by the President of India.
  - Implemented in all districts across the country.
  - Focused on similar themes but added new interventions, including spring shed development, wetland development, catchment area protection, and creating/rejuvenating Amrit Sarovars in every district.
  - Acknowledged for reducing water runoff and raising the water table throughout India due to successful implementation.

Khonoma: India First Green Village

- Khonoma, a village in India, was declared India's first green village out of around 700,000 villages in the country.
- The recognition was made possible through the collaborative efforts of the indigenous inhabitants of Khonoma, the Government of Nagaland, and the Government of India.
- The transformation was initiated through the 'Green Village project,' which received INR 30 million in funding in 2005.
- The indigenous tribes of Nagaland, known for their warrior culture, transitioned from traditional practices like headhunting and consuming various forms of wildlife.
- To become green, self-reliant, and sustainable, the villagers adopted practices like jhoom cultivation, terraced farming, forest conservation, and bamboo handicrafts.
- They actively engage with and utilize government initiatives and funds allocated for schemes such as Swachh Bharat Abhiyan, MGNREGA, and others.
- In addition to environmental efforts, Khonoma also preserves its cultural heritage, traditions, and unique way of life.

Role of Gram Panchayat

- **Awareness Generation**: Educating citizens about the importance of reducing wastage, promoting sustainable production and consumption, and mitigating adverse environmental impacts

- **Environmental Pollution Reduction**: Implementing measures to minimize environmental pollution, including reducing plastic usage within the Gram Panchayat (GP) area.
- **Climate Change Awareness**: Building a comprehensive understanding of climate change and its effects among the Gram Sabha, Panchayat committees, and community volunteers.
- **Land Use Mapping**: Surveying land use patterns, identifying water bodies, forests, hill slopes, wetlands, and degraded forests within the GP.
- **Sustainable Resource Utilization**: Developing guidelines for the sustainable use of resources from common lands, water bodies, and forests, including non-timber forest produce, sand, fish, and water.
- **Water Resource Assessment**: Evaluating water needs, sources, schemes, and solid and liquid waste generation, and creating District and Village Water Conservation Plans.
- **Water and Sanitation Goals**: Establishing water and sanitation objectives for the Gram Panchayats.
- **Technology Selection**: Choosing suitable technology for water supply and sanitation based on participatory assessments in markets and GP premises.
- **Infrastructure Maintenance**: Ensuring the maintenance of public spaces and toilets, including those in markets and GP premises.
- **Comprehensive Energy Program**: Developing an energy program tailored to local needs and requirements.

India is taking significant steps to develop its villages into sustainable, self-sufficient models, aligning with Mahatma Gandhi's vision of 'Clean & Green Villages.' Khonoma village stands as an exemplar, becoming India's first green village, with social reformers like Anna Hazare and Popatrao Pawar contributing to village development in Ralegaon Sidhi and Hiware Bazar. Various government initiatives, NGOs, and public efforts have addressed challenges in water supply, sanitation, solid waste management, indoor air quality, and solar energy. Programs like the 'National Mission for a Green India,' 'Jal Jeevan Mission,' 'Swachh Bharat Mission,' and 'Jal Shakti Abhiyans' aim to make villages clean and green. Encouraging Gram Panchayats, despite the diversity in awareness, education, and water resources, is crucial for achieving this national goal. Convergent actions at all government levels are essential to protect the planet's future, meet SDGs by 2030, and address climate change challenges.

Leveraging Agroecological Approaches for Clean and Green Villages

Rural India, home to about 65% of the nation's population, plays a pivotal role in India's socio-economic development and the pursuit of Sustainable Development Goals (SDGs). With over 6,40,000 villages and a population of 83.3 crore, it presents a prime opportunity for transformation, aligning with the vision of "Viksit Bharat by 2047" articulated by Prime Minister Narendra Modi.

The increased workforce participation of rural women and dynamic agroecological approaches that focus on sustainable food systems, resource preservation, and climate mitigation are central to this transformation. Various government schemes and initiatives are driving equitable grassroots development, with agroecology playing a vital role in fostering rural well-being, food system sustainability, and contributions to the UN SDGs.

Clean and Green Villages

- "Clean and Green Village" is one of the nine themes adopted by the Ministry of Panchayati Raj to transform rural ecosystems through the Gram Panchayat Development Plan (GPDP).
- In this context, "Green" signifies sustainable management and conservation of natural resources like oceans, land, and forests, with the aim of improving livelihoods, ensuring food security, and protecting the environment for future generations.
- "Clean" relates to providing access to safe and sufficient drinking water and sanitation services, in a low-pollution, low-emission environment, fostering cleaner air, water, and oceans that enable healthy and productive lives.
- Multiple ministries, including the Ministry of Jal Shakti, Ministry of Agriculture and Farmers Welfare, Ministry of Fisheries, Animal Husbandry and Dairy, Ministry of Environment, Forest and Climate Change, Ministry of New and Renewable Energy, Ministry of Rural Development, and Ministry of Panchayati Raj, collaborate to realize the goals of clean and green villages.
- The Government of India has launched a range of schemes and programs aimed at comprehensive rural development, with agroecological approaches playing a central role in transforming rural ecosystems and achieving clean and green village objectives.

Agroecological Approaches

- Agroecology is a comprehensive approach that combines ecological and social principles to design and manage food and agricultural systems. It aims to optimize interactions between plants, animals, humans, and the environment.
- According to the High-Level Panel of Experts (HLPE) on Food Security and Nutrition, agroecological approaches prioritize natural processes, limit the use of external inputs, promote closed cycles with minimal negative impacts, emphasize local knowledge and participatory processes, and recognize the interconnectedness of agrifood systems.
- Agroecology comprises ten key elements, including diversity, synergies, efficiency, resilience, recycling, co-creation, sharing of knowledge, human and social values, cultural and food traditions, responsible governance, and a circular and solidarity economy.
- Agroecological practices encompass various processes such as nutrient cycling, biological nitrogen fixation, soil health improvement, water conservation, biodiversity preservation, carbon sequestration, biological pest control, diversification, intercropping, waste management, and more.
- The Green and Clean Village initiative focuses on activities like tree planting, organic farming, biodiversity conservation, promoting new and renewable energy sources, and eco-friendly innovations. The Green Village aims to address ecological, economic, and equity concerns by encouraging community-level social regulations, cooperation, and proactive participation for a sustainable, clean, low-carbon, and self-reliant rural India.

- Agroecological practices like natural farming, organic farming, biofuel production, agroforestry, and waste recycling can contribute to achieving the goals of green and clean villages and the Sustainable Development Goals (SDGs).

Organic and Natural Farming

- Organic and natural farming practices align with agroecological principles and exclude synthetic or chemical inputs. They resonate with India's traditional agricultural heritage and livestock integration.
- These practices offer chemical and pesticide-free food grains, improve soil health, and reduce environmental pollution. They contribute to the conservation of natural resources, enhance livelihoods, and provide safe, nutritious food.
- Organic and natural farming can boost women's participation in agriculture, create rural employment opportunities due to labor intensity, and support rural industries through value chain development and marketing.
- The Government of India promotes organic farming through dedicated schemes, including Paramparagat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development for the North Eastern Region (MOVCDNER). PKVY has converted 11.85 lakh hectares of land into organic farming since 2015-16, involving 16.19 lakh farmers.
- MOVCDNER has brought 1.73 lakh hectares of land under organic farming, benefiting 1.89 lakh farmers, and has established numerous Farmer Producer Organizations (FPOs) and collection and processing units.
- Natural farming is promoted through Bhartiya Prakratik Krishi Paddhati (BPKP), a sub-scheme under PKVY, with 4.09 lakh hectares of land being converted to natural farming.
- The PM Programme for Restoration, Awareness Generation, Nourishment, and Amelioration of Mother-Earth (PM-PRANAM) aims to reduce chemical fertilizer use and promote sustainable farming practices. It rewards states/UTs that reduce chemical fertilizer consumption with a grant.
- Initiatives like constructing soak pits, vermicompost/NADEP pits, and waste-to-wealth projects, including recycling non-biodegradable waste, are promoted under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) by the Ministry of Rural Development to enhance village cleanliness.
- Increasing green coverage in villages is encouraged through agroforestry, an economical land management system that combines crops, trees, and livestock, providing economic and environmental benefits to small and marginal farmers.

Waste to Wealth

- **Biogas Technology:**
  - Converts agricultural, industrial, animal, and municipal wastes into energy, agri-inputs, and other useful forms.
  - Addresses energy needs, regulates greenhouse gas emissions, reduces pollution, and enhances waste management.
- **GOBARdhan Program:**
  - Launched in 2018 as part of Solid Waste Management under Swachh Bharat Mission (Grameen).
  - Converts organic and biodegradable waste into biogas and bio-slurry.
  - Implements a 'waste to wealth' approach, generating bio-gas or CBG and bio-slurry or bio-fertilizer.
  - Aligns with the circular economy and Mission LiFE (Livelihood Incomes, Food, and Environment) initiatives.
  - Provides financial assistance of up to Rs. 50 lakh per district for community-level biogas plant(s) setup.
  - Offers multiple benefits such as eco-friendly energy, nutrient-rich slurry for soil enhancement, reduced dependence on chemical fertilizers, improved sanitation and health

conditions, reduced GHG emissions, reduced crude oil imports, employment opportunities, and income augmentation for farmers.

- **MNRE Support for Biogas Plants:**
  - The Ministry of New and Renewable Energy (MNRE) supports biogas plant installation, particularly for cooking purposes.
  - The National Biogas Programme was initiated in November 2022 with a budget of Rs. 1715 crore for implementation from April 2021 to March 2026.
- **Sustainable Alternative towards Affordable Transportation (SATAT):**
  - Launched by the Ministry of Petroleum and Natural Gas in October 2018.
  - Assures the offtake of Compressed Biogas (CBG) through Oil Marketing Companies (OMCs) for use as automotive fuels.
- **Budgetary Plans for CBG Plants:**
  - Union Budget announcement for 2023-24 includes plans to establish 200 CBG plants, including 75 in urban areas, and 300 community- or cluster-based plants.
  - Aims to promote the circular economy.
- **Organic Fertilizer Production:**
  - Fermented Organic Manure (FOM) and Liquid Fermented Organic Manure (LFOM) are produced from the slurry leftover after biogas extraction.
  - Receives market development assistance according to the Fertilizer Control Order (1985).

Rural Industries

- **Agroecological Practices for Rural Industries:**
  - Agroecological practices have the potential to enhance rural industries through biogas and manure production, processing, marketing, and waste management.
  - They support clean and green initiatives and integrate well with animal husbandry and dairy activities.
- **Biogas as a Promising Renewable Energy Industry:**
  - Biogas, a clean and renewable energy source, is emerging as a promising industry in India.
  - It's labor-intensive and offers employment opportunities for skilled and unskilled workers.
  - It meets rural energy demands and produces organic waste with high nutrient content, benefiting agriculture.
  - Successful biogas plant examples include SUMUL dairy, Navapur, Bhagirath Gramvikas Pratisthan in Maharashtra, Ms Goverdhannathji Energies LLP in Gujarat, and Mahindra Waste to Energy Solutions Ltd. in Andhra Pradesh.
  - There are over 1200 Biogas Plants spread across 450 districts in India.
- **Job Creation by the Biogas Industry:**
  - According to the Indian Biogas Association, the biogas industry creates various job opportunities.
  - This includes approximately 55,000 skilled plant designers and site engineers, 200,000 semi- and low-skilled workers for construction activities, 10,000 highly skilled engineers for administration and data monitoring, and 150,000 unskilled workers for routine plant operation and maintenance.
- **Role of Organic and Natural Farming:**
  - Organic and natural farming practices improve rural livelihoods and create value chains for natural and organic commodities.
  - The government plans to establish bio-input resource centers to scale up Bhartiya Prakratik Krishi Paddhati (BPKP) as part of the National Mission on Natural Farming, aiming to facilitate 1 crore farmers in adopting natural farming.

The acceleration of Clean and Green Village goals can be achieved by expanding agroecology-based programs and initiatives and executing them at the local level with the backing of panchayats, cooperatives, Self-Help Groups (SHG), and women's SHGs.

Harnessing the Power of Digital Technology for Greener Villages

India is making strides in using digital technologies to empower rural communities and promote green villages. Various stakeholders, including government agencies and non-profits, are using digital tools to disseminate information on sustainable practices. Rural India faces environmental challenges, from inadequate waste disposal to pollution, deforestation, and soil degradation.

The Digital India initiative has expanded broadband internet access to many rural areas, narrowing the digital divide. This empowers rural communities with information and opportunities for a sustainable and interconnected future.

Environmental issues affect both urban and rural India. Rural regions, with their strong ties to agriculture and nature, bear the brunt of these problems. Despite legislative measures and initiatives, the effective enforcement of environmental laws faces obstacles.

However, technology can help overcome these challenges by enhancing law enforcement, spreading awareness, and addressing environmental issues. India has the opportunity to use emerging technologies for sustainable rural development and environmental protection.

Role of Digital Technology

- **Technology for Sustainability**: Technology holds the potential to drive a greener, more sustainable future in both urban and rural India.
- **Rural Digital Transformation**: Recent data shows that rural India has seen a surge in internet users, surpassing urban areas.
- **Digital Tools for Environmental Awareness**: Digital technologies can be harnessed to raise awareness about environmental issues and promote sustainable practices.
- **Empowering Farmers**: Farmers, even in remote areas, can access digital platforms for insights on sustainable farming methods and weather forecasts.
- **Remote Environmental Monitoring**: Digital technology enables remote monitoring of air and water quality, deforestation tracking, and identification of ecological red flags.
- **Social Media for Environmental Messaging**: Social media and telecommunication technology play a vital role in disseminating environmental messages to rural communities.
- **Examples of Digital Transformation**: Numerous examples illustrate how digital technology is making rural areas more eco-friendly through improved crop management, renewable energy adoption, and waste reduction.
- **Sustainable Agricultural Practices**: Digital initiatives are equipping farmers with sustainable agricultural practices, leading to increased yields, water conservation, and eco-friendly farming.
- **Waste Management Initiatives**: Initiatives like the Swachh Bharat Mission use digital tools such as geotagging and mobile apps for efficient waste management and community engagement.
- **Bridging the Digital Divide**: The Digital India initiative connects rural villages with broadband internet, providing access to information and opportunities, underscoring India's commitment to a sustainable and connected future.

Government’s Approach

- **Government's Multifaceted Strategy**: The Government of India adopts a multifaceted strategy to employ digital technologies for environmental protection and awareness.
- **Social Media Platforms for Dissemination**: Platforms like Facebook, Twitter, and Instagram are used to disseminate information about environmental policies, initiatives, and successes. This approach increases awareness among the public.
- **Educational Mobile Applications**: The government has developed mobile applications that serve as educational tools. These apps provide information on environmental issues and solutions, empowering citizens to take meaningful actions.

- **Role of Digital Maps and Data**: Digital maps and data play a crucial role in tracking progress towards environmental goals. They enable informed resource allocation and identify areas needing further attention.
- **Direct Citizen Engagement**: Online platforms are used to directly engage citizens in environmental protection efforts. Feedback is gathered, innovative ideas are solicited, and individuals are mobilized for active participation in environmental conservation initiatives.
- **Building an Environmentally Conscious Society**: The Government employs digital tools to champion environmental causes, shaping an informed and environmentally conscious society committed to sustainability.
- **Challenges Faced:**
    - **Lack of Awareness**: Many people in India still lack awareness about environmental issues, making engagement in environmental protection and awareness efforts challenging.
    - **The Digital Divide**: A significant portion of the rural population faces challenges in terms of digital access, connectivity, power supply, and digital literacy.
    - **Resource Limitations**: Due to the country's size, there are limitations in resources, such as funds and human resources, which need to be prioritized.
    - **Coordination Issues**: Lack of coordination among different stakeholders, including government agencies, non-profits, rural bodies, communities, and the private sector, can lead to duplication of efforts and a lack of focus.

Use of Social Media

- The Ministry of Environment, Forest and Climate Change (MoEFCC) in India uses social media platforms like Facebook, Twitter, and Instagram, as well as a multilingual website, to educate villagers about environmental issues such as pollution and deforestation.
- They also share stories of environmental successes and encourage people to take action.
- In addition to digital outreach, the MoEFCC conducts workshops and training sessions in villages to enhance environmental awareness and empower residents to engage in environmental protection efforts.
- The ministry provides financial support to villagers for various environmental projects, including tree planting and rainwater harvesting systems.
- Challenges include limited internet access among villagers and illiteracy, which can hinder some from fully benefiting from the available resources and initiatives.
- Despite these challenges, the MoEFCC is committed to raising environmental awareness among villagers and addressing these obstacles to promote a greener and more sustainable future for rural India.

Namami Gange Project

- The Namami Gange project aims to revitalize the Ganga River and employs digital technologies for its clean-up mission.
- Satellite imagery is used to monitor pollution levels in the Ganga River, helping to identify severely affected areas and prioritize clean-up efforts.
- Geospatial technologies are essential for mapping the river's course, aiding in planning and monitoring clean-up activities.
- Social media platforms like Facebook and Twitter are leveraged to engage citizens, disseminate project information, gather feedback, and mobilize individuals to participate in the clean-up efforts.
- The project illustrates how digital technologies can play a crucial role in environmental protection, offering the potential to make a significant positive impact on the condition of the Ganga River.

The Watershed Organisation Trust

- Watershed Organisation Trust (WOTR), established in 1993, is a well-known nonprofit organization and think tank focusing on the multifaceted challenges faced by vulnerable rural communities in India.

- WOTR's mission centers on ensuring water and food security, livelihoods, and income stability to support sustainable development and well-being for disadvantaged rural populations.
- Their focus areas include watershed management, natural resource conservation, and community capacity building, contributing to improved water resource management, reduced soil erosion, and biodiversity preservation.
- WOTR employs digital technologies, including geospatial tools such as satellite imagery and GIS for mapping water resources and land use, information and communication technologies (ICTs) like mobile phones and the internet for communication, information sharing, and training, and social media platforms like Facebook and Twitter for raising awareness and engaging communities on environmental issues.
- The innovative use of digital technology by WOTR has led to improved water availability, reduced soil erosion, and biodiversity conservation in rural India. They have also empowered communities with the skills and knowledge needed for effective natural resource management.
- WOTR's work demonstrates the potential of digital technology in advancing environmental sustainability, and as technology evolves, we can expect even more innovative approaches to building sustainable and resilient rural communities.

Centre for Environment Education

- The Centre for Environment Education (CEE) is a non-profit organization founded in 1984, dedicated to promoting environmental education and sustainable development in India.
- CEE operates with a vast network of over 1,000 partner organizations across the country, employing various strategies to raise environmental awareness and drive positive change.
- CEE promotes environmental awareness nationwide through innovative programs, educational materials, and building capacity in Education for Sustainable Development (ESD).
- They actively use social media, including Facebook, Twitter, and YouTube, to extend their reach in rural India and share environmental information, promote initiatives, and engage with communities.
- CEE's strategic use of digital platforms amplifies awareness of environmental issues, enabling cost-effective mass outreach, precise demographic targeting, real-time information sharing, and mobilization for addressing environmental concerns.

Digital Green Initiative

- Digital Green, a global development organization, improves smallholder farmers' lives through digital tools and local partnerships.
- Their main focus is promoting sustainable farming practices and enhancing food security.
- They use video, mobile phones, and data analytics to provide farmers with relevant agricultural information.
- Digital platforms connect farmers to markets and financial services.
- They also work on environmental protection, advocating sustainable practices and monitoring soil health, water quality, and deforestation.

India is making impressive strides by utilizing digital technologies to empower its rural communities in building green villages. Government agencies, non-profits, and other stakeholders are employing digital tools to spread valuable knowledge on sustainable practices, promoting environmental awareness and action. These initiatives utilize social media and innovative technology to actively engage village communities. As these efforts expand, India is moving towards a greener, more sustainable future where rural populations thrive in harmony with the environment.

Strengthening Rural Economy with Clean and Green Initiatives

India has enacted the National Action Plan on Climate Change, composed of eight missions targeting diverse sectors like solar power, energy efficiency, and sustainable habitats. The nation aims to attain energy independence through clean technology by 2047, with a strong focus on the 'Make in India' initiative.

Our natural environment is an invaluable legacy we must preserve for future generations. India boasts diverse landscapes and habitats, which necessitate long-term clean and green initiatives to ensure their sustainable flourishing. A 2019 World Bank report revealed that vast populations lack access to electricity, improved drinking water, and sanitation facilities. It is imperative to address these issues through green development strategies. Adopting green technologies is vital, particularly considering the significant portion of the global population depending on forests for their livelihood and the 1.2 billion people in tropical regions relying on nature for their basic necessities.

Need of Clean and Green Technologies

- **Health Impact of Clean Cooking**: According to the World Health Organization (WHO), approximately 3.8 million people die prematurely each year due to indoor air pollution. The majority of these deaths occur in impoverished countries where people still rely on wood, coal, charcoal, or animal dung for indoor cooking, exposing women and children to toxic smoke that penetrates deep into their lungs.
- **Promotion of Bottled Cooking Gas**: India's large-scale initiative to switch to bottled cooking gas has been lauded by WHO as an effective measure to save lives by reducing indoor air pollution.
- **Clean and Green Initiatives for Human Development**: Initiatives focused on clean and green practices play a crucial role in improving the overall human development index and ensuring sustainable development.
- **Importance of Sanitation, Hygiene, and Clean Water**: Adequate sanitation, hygiene, and access to clean drinking water are vital for human development. Poor water quality, sanitation, and hygiene contribute to approximately 1.4 million annual deaths and shorten the lives of 74 million individuals.
- **Global Sanitation Challenges**: Almost half of the global population, approximately 3.6 billion people, lacks access to safe sanitation facilities, according to WHO and UNICEF reports from 2021.
- **Benefits of Clean Water Access**: WHO estimates that ensuring safely managed drinking water for all households in India could prevent nearly 400,000 deaths related to diarrheal diseases and avoid approximately 14 million Disability Adjusted Life Years (DALYs), resulting in substantial cost savings of up to $101 billion.
- **Positive Impact of the Har Ghar Jal Programme**: India's Har Ghar Jal program has substantially increased rural tap water connections, rising from 16.64% in 2019 to 62.84% in 2023. This achievement has averted 13.8 million DALYs, signifying an improvement in the human development index.

Potentials of Renewable Energy

- **Solar Potential Assessment**: The National Institute of Solar Energy estimates India's solar potential at around 748 GW, utilizing 3% of wasteland areas for solar installations.
- **National Solar Mission**: Part of India's National Action Plan on Climate Change, the National Solar Mission aims to promote ecologically sustainable growth while addressing energy security challenges.
- **Cumulative Installed Renewable Capacity**: As of July 2023, India has achieved a cumulative installed renewable capacity of 179.322 GW. Solar energy contributes 67.07 GW, and wind energy contributes 42.8 GW.

- **2030 Renewable Energy Goals**: India aims to reach 500 GW of installed renewable energy capacity and produce five million tonnes of green hydrogen by 2030. This initiative will be supported by 125 GW of renewable energy capacity.
- **Solar Parks**: India has approved 57 solar parks with a total capacity of 39.28 GW to bolster its renewable energy efforts.
- **Strategic Solar and Wind Advantage**: India's location along the equator, providing over 300 days of sunshine annually, presents a strategic advantage in solar energy production. Additionally, India's 8,000-kilometer coastline offers significant potential for wind energy.
- **Hydropower Potential**: India's abundant rivers across the country offer vast hydropower potential, estimated at over 100,000 MW.
- **Rural Prosperity**: Initiatives like Modhera village in Gujarat, powered entirely by solar energy, demonstrate the potential for rural prosperity through renewable energy. Surplus power generation can be sold back to the grid, reducing energy bills and creating income sources.
- **State Initiatives**: States like Himachal Pradesh are progressing toward green energy development, with initiatives such as installing 500 MW of solar energy in the financial year 2023-24. The state is also developing green Panchayats in each district with 500 KW to one MW installations.
- **Job Creation**: Green development initiatives in rural areas can create jobs, stimulate rural economies, preserve ecosystem services, and enhance climate resilience. India could generate approximately 3.4 million jobs by installing 280 GW of solar and 140 GW of wind capacity on the path to achieving 500 GW non-fossil electricity generation capacity by 2030.
- **Skill Development**: To support the renewable energy workforce, India has implemented a skill development program. Between 2015 and 2021, over 100,000 people received training, with 78,000 trainees certified under the national-level solar energy Suryamitra training program.

Government Policies and Initiatives

- Union Budget 2023 allocates Rs. 35,000 crore for capital investment in energy transition and Net Zero goals.
- Rs. 10,222 crore allotted to the Ministry of New and Renewable Energy to reduce reliance on fossil fuels and promote clean energy sources.
- Budget allocates Rs. 5,331.5 crore for the solar sector.
- Rs. 20,700 crore designated for the inter-state transmission line for grid integration of 13 GW of Ladakh's renewable energy.
- National Action Plan on Climate Change with missions targeting solar power, energy efficiency, sustainable habitats, and more.
- India aims for energy independence through clean technology by 2047, emphasizing the 'Make in India' initiative.
- Foreign direct investment (FDI) of up to 100% allowed in the renewable energy sector.
- Waiver of inter-state transmission system charges for solar and wind power sales.
- Trajectory for renewable purchase obligation up to 2029-30.
- PM-PRANAM initiative promotes alternative fertilizers, reducing chemical fertilizer usage.
- Green Hydrogen Mission to reduce emissions and cut industrial coal imports by 95%.
- Introduction of energy trading platforms GTAM and GDAM for renewable power sales.
- UJALA LED bulb campaign significantly reduces emissions, saving 40 million tonnes annually.
- Skills Council for Green Jobs incorporates environmental awareness into job training.

Emerging Opportunities with Green Development Initiatives

- Market opportunity in India's rural economy for mechanization through clean energy innovations in farming sectors like pesticide spraying, rice transplanting, and grain harvesting with a total market potential of about USD 40 billion.
- Clean energy innovations can transform enterprises involved in custom tailoring, food processing, poultry, and livestock rearing, among other activities.

- Various rural livelihood appliances, including solar pumps, solar-powered milking machines, and sewing machines, can effectively operate on decentralized renewable energy (DRE), leading to cost savings in crop production.

Focus Areas to Accelerate the Use of Renewable Energy

- Development of farming equipment reliant on renewable energy sources for efficiency, considering existing appliances are designed for unreliable and subsidised electricity.
- Reduction in battery costs and the creation of cost-effective, super-efficient, small-sized motors to enhance the economic viability of DRE.
- Expansion of the market for smaller livelihood solutions, which are currently fragmented and cluster-based, requiring numerous small and medium-scale enterprises to capture the same market.
- Establishment of initial financial support systems for rural farmers as customer awareness and financing pose significant barriers to adopting clean energy solutions for livelihood applications.

Challenges for the shift to Green Tech

- **Global Funding Needs**: Meeting the annual global investment requirement of at least $4 trillion until 2030 for renewable energy is a monumental challenge.
- **Initial Investment Hurdles**: While significant, investments in technology and infrastructure are essential for transitioning to a low-carbon path but can be cost-prohibitive upfront.
- **Securing International Support**: Gaining support from international organizations, like the World Bank, and developed nations is crucial for India's transition to low-carbon development.
- **Path to Net Zero**: Achieving net-zero emissions by 2070, as estimated by the International Energy Agency, demands a substantial annual investment of $160 billion until 2030, a threefold increase from current levels.
- **Market Growth**: Growing the low-carbon technology market in India to an estimated $80 billion by 2030 poses both opportunities and challenges.
- **Sustainable Capital Access**: Access to low-cost, long-term capital is vital to realize the goal of net-zero emissions, a challenge that requires innovative financing mechanisms.
- **Yearly Investment Fluctuations**: The significant fluctuations in renewable energy investments from year to year, such as India's $14.5 billion investment in 2022, demand consistent support and commitment.
- **Economic and Environmental Benefits**: Making the case for investing in low-carbon technologies based on long-term cost savings and environmental benefits is a challenge.
- **Resource Allocation**: Prioritizing and allocating resources to renewable energy initiatives among competing development goals and demands is a complex undertaking.
- **Sustainable Growth**: Ensuring that renewable energy investments result in sustainable growth, economic development, and social well-being is a multifaceted challenge.
