YOJANA SUMMARY

10 YEARS OF SWACHH BHARAT MISSION

OCTOBER 2024

SWACHH BHARAT MISSION: IMPACT ON RURAL SANITATION & SMART APPROACH FOR SUSTAINED SANITATION SUCCESS

Introduction: A Historical Perspective on Sanitation in India

- Sanitation in India dates back to the advanced waste management systems of the Indus Valley Civilization.
- However, modern India struggles to provide adequate sanitation, with only 39% coverage in 2014, leaving over 55 crore people, especially in rural areas, reliant on open defecation.
- This has disproportionately impacted women and children, leading to health, safety, and socio-economic challenges.

India's Journey Towards Improving Sanitation

- **The Central Rural Sanitation Programme (CRSP)** launched in 1986 focused on toilet construction.
- **The Total Sanitation Campaign (TSC) in 1999** emphasized creating demand through Information, Education, and Communication (IEC) activities.
- **The Nirmal Bharat Abhiyan (NBA) in 2012** promoted community-led sanitation.
- **The Swachh Bharat Mission (SBM) launched in 2014** introduced a shift in focus, emphasizing behavior change, community participation, and public financing.
    - Its goal to make India Open Defecation Free (ODF) by 2019 was successfully achieved.

Why Swachh Bharat Mission (SBM)

- **Health Impact**
    - Inadequate sanitation causes waterborne diseases like diarrhoea, cholera, and typhoid, leading to high morbidity and mortality, especially among children under five.
    - Before the SBM, poor sanitation caused around 3 lakh child deaths annually.
    - However, SBM has significantly reduced infant mortality, preventing 60,000-70,000 child deaths each year, according to a recent Nature Report.

- **Impact on Women and Children**
    - Women in rural areas often face harassment and assault when forced to defecate in the open.
    - Girls miss school during menstruation due to lack of sanitation facilities, contributing to higher dropout rates.
    - A study shows that SBM improved nutrition and productivity, with 58% higher cases of child malnutrition in non-ODF areas.
    - SBM also enhanced women's safety and dignity, with women feeling safer after gaining access to toilets at home (UNICEF).

- **Environmental Impact**
    - Open defecation and poor waste management cause environmental degradation, contaminating water bodies, harming ecosystems, and polluting soil and air, which worsens health risks.
    - According to a UNICEF report, SBM reduced the likelihood of groundwater contamination from human sources in ODF villages by 12.70 times, helping protect the environment.

- **Economic Impact**
    - A World Bank study estimated that India lost approximately 6.4 per cent of its GDP in 2006 due to poor sanitation, amounting to over USD 38 billion annually.
        - These losses were primarily due to health costs, reduced productivity, and lost educational opportunities.
    - As per a UNICEF report, Rs 50,000 was saved annually by a household in an ODF village due to health costs avoided.

SWACHH BHARAT MISSION GRAMEEN
A Journey of Resilience and Achievements

Phase I Achievements
- Over 100 million individual household toilets constructed.
- Rural sanitation coverage increased from 20% in 2014 to 100% in 2019.

Phase II Achievements
- 11 crore household toilets built to date.
- 3.90 lakh villages reported arrangements for Solid Waste Management.
- 4.96 lakh villages reported arrangements for Liquid Waste Management.
- 5.53 lakh villages declared Open Defecation Free (ODF).
- 2.34 lakh villages aspiring for ODF status.

Swachh Bharat Mission and UN SDGs

- **SDG 6**: Clean Water and Sanitation, which aims to 'ensure availability and sustainable management of water and sanitation for all' by 2030.
  - <u>India's achievement of being declared Open Defecation Free (ODF) in 2019, 11 years ahead of the global deadline.</u>
- **Target 6.2 of SDG 6** emphasises ending open defecation and providing access to adequate and equitable sanitation for all.
  - The construction of over 116 million household toilets under SBM directly contributed to achieving this target.
- SBM also supports **SDG 3 (Good Health and Well-being)**, as improved sanitation reduces the incidence of waterborne diseases and child mortality.
- The mission also aligns with **SDG 5 (Gender Equality)** by ensuring that women have access to safe and private sanitation facilities, which enhances their dignity and safety.

Focus Areas of Swachh Bharat Mission

- The SBM, which initially focused on ending open defecation, has now expanded its scope in Phase II (2020-2025) to ensure the sustainability of its achievements and tackle broader sanitation issues. The key focus areas include:
  - **ODF Sustainability:** Ensuring that villages declared ODF maintain their status through regular monitoring and community engagement.
  - **Solid and Liquid Waste Management (SLWM):** SBM Phase II focuses on managing solid and liquid waste by constructing compost pits, waste stabilisation ponds, Phytorids, and community soak pits.
    - Villages are encouraged to adopt waste-to-energy technologies and plastic waste management to reduce environmental degradation.
  - **Visual Cleanliness:** SBM-G promotes not only functional toilets but also litter-free public spaces, proper drainage, and household waste segregation. It encourages rural communities to take ownership of their surroundings, aiming for Sampoorna Swachhata (complete cleanliness).
  - **Community Engagement and Capacity Building:** Engaging Self-Help Groups (SHGs), local leaders, and Panchayati Raj Institutions (PRIs) is vital for the long-term success of SBM. The mission offers capacity-building programs to equip communities with skills to manage sanitation infrastructure and drive behavioral change.

A SMART Approach for the Future

- As the Swachh Bharat Mission approaches its 10th anniversary, its success depends on a SMART strategy:
  - **S**: Focus on sustainability through continuous monitoring, community-led initiatives, and climate-resilient systems.
  - **M**: Ensure women remain central, continuing their leadership in sanitation efforts and operations.
  - **A**: Accelerate private sector involvement to scale innovations like solid waste management and waste-to-energy technologies.
  - **R**: Strengthen communication with digital tools and Behaviour Change Communication (BCC) to promote sanitation as a lifestyle choice.
  - **T**: Provide training and introduce technological interventions to improve efficiency and sustainability in sanitation practices.

The Road Ahead: Achieving Sampoorna Swachhata

- The Swachh Bharat Mission aims to achieve ODF Plus Model villages by 2024-25, focusing on solid and liquid waste management, visual cleanliness, and sustained behavioural change.
- Phase II shifts from ODF to ODF Plus, emphasizing complete cleanliness. SBM's success lies in the infrastructure and the cultural shift it promotes, making cleanliness a shared responsibility.
- As India strives for Viksit Bharat 2047, SBM will continue to improve public health, empower women, protect the environment, and drive economic growth.

SPECIAL CAMPAIGN 4.0 FOR INSTITUTIONALISING SWACHHATA AND REDUCING PENDENCY IN GOVERNMENT

Special Campaign 4.0: Vision and Objectives

- The Special Campaign 4.0, launched by PM Modi, focuses on institutionalizing swachhata (cleanliness) in government offices, reducing pendency, and adopting technology.
- It aims to transform office spaces into clutter-free, aesthetically pleasing environments while promoting environmental sustainability and efficient use of resources.

Achievements of Previous Campaigns

- Over the past three years, significant progress has been made with: 404,776 office spaces covered; 355.5 lakh square feet of space freed; Rs 1162.49 crore revenue earned from scrap disposal; 96.1 lakh files weeded out.

Key Features

- **Implementation and Digital Platform**
  - The campaign is driven by the digital platform **www.specialcampaign.gov.in**, where ministries and departments track and manage pendency in categories like public grievances, record management, and cleanliness.
  - It encourages public-private collaborations and promotes innovations like Swachh ATM's and waste-to-wealth practices.

- **Environmental and Community Initiatives**
  - **3R's Approach**: Focus on reducing, reusing, and recycling.
  - **Vidyanjali**: Refurbishing of computers and printers for rural schools.
  - **Outreach**: Initiatives such as vermi-composting for farmers and awareness about single-use plastic at railway stations.

- **Preservation and Archiving of Historical Records**
  - The campaign also emphasizes the preservation of important historical records, such as those from the 1938 and 1947 organizational restructuring.
  - Records are archived on the **Abhilekh Patal** platform.

- **Improving Public Interface and Service Delivery**
  - The campaign has improved citizen interaction with government services, including:
  - **Aaykar Sewa Kendras**: Rejuvenation of tax offices for better public access.
  - **Pensioner Lounges**: Operationalized in banks for enhanced pensioner services.
  - **Public Grievance Redressal**: Digital portals and the new policy reducing grievance resolution time from 30 to 21 days.

- **Public Trust and Grievance Redressal**
  - Over the past three years, 70 lakh public grievances were redressed, with 101,675 officers mapped on the **CPGRAMS** portal.
  - The **Public Grievances Policy 2024** further streamlines grievance redressal.

- **Media and Communication Plan to raise awareness**
  - A focused media campaign will involve over 1 lakh social media posts, 300 PIB statements, and panel discussions to raise awareness about the campaign and its benefits.

Conclusion

- The long-term impact includes digital empowerment of citizens and the digital transformation of institutions, contributing to the goal of a **Viksit Bharat (Developed India)** by 2047.

SWACHH BHARAT MISSION SUCCESSFULLY TRANSFORMS INDIA'S SANITATION LANDSCAPE

- Launched on 2 October 2014, the Swachh Bharat Mission (SBM) aimed to make India 'open-defecation free' (ODF) by 2019, the 150th birth anniversary of Mahatma Gandhi.

- The initiative focused on improving hygiene and sanitation by building over 100 million toilets in rural India, revolutionizing the country's approach to sanitation and becoming a global model for community-driven reforms.

Swachh Bharat Mission Grameen: Phase I (2014-2019)

- This phase marked the largest behavioural change movement in the world, aiming to end open defecation through awareness campaigns, education, and infrastructure development.

Swachh Bharat Mission Grameen: Phase II (2019-2025)

- SBM-G Phase II was launched to sustain the ODF status and manage solid and liquid waste by 2025.
- This phase focuses on 'Sampoorn Swachhata, or complete cleanliness, which includes creating ODF Plus villages that maintain and improve sanitation standards.

Achievements of SBM-G Phase I
- The WHO reported 300,000 fewer diarrheal deaths in 2019 compared to 2014, directly attributable to improved sanitation.
- Families in ODF villages saved an average of INR 50,000 annually on health costs.
- A significant reduction in groundwater contamination was noted in ODF areas.
- With better access to sanitation facilities, 93% of women reported feeling safer at home.

Achievement of SBM

- As of September 2024, over 5.87 lakh villages in India have achieved ODF Plus status, with significant progress in solid and liquid waste management.
- The initiative has led to the construction of over 11.64 crore household toilets and 2.41 lakh community sanitary complexes.
- The Swachh Bharat Mission (Urban) (SBM-U) has also made notable strides, with over 63 lakh household toilets and more than 6.3 lakh public toilets built, transforming urban sanitation and cleanliness across India.
  - SBM-U was also launched on 2 October 2014.

SBM's Unique Approach

- SBM's strategy integrates toilet construction with extensive IEC and community engagement, setting it apart from previous efforts.
- The recent Swachhata Hi Seva (SHS) campaign 2024, marking a decade of SBM, mobilized public participation, promote sustainable cleanliness, and recognize sanitation workers (Safai Mitras).
- Future SBM initiatives will focus on behavior change, strengthening community involvement, expanding waste management infrastructure, and ensuring continuous efforts at grassroots and policy levels, while fostering inclusivity and recognizing sanitation stakeholders.

INDIA'S ODF MILESTONE: THE SANITATION REVOLUTION

- On 2 October 2014, the Government of India launched SBM to eradicate open defecation and improve solid waste management.
- Since then, India has made rapid progress in **water, sanitation, and hygiene (WASH)**, with nearly 50 crore people no longer defecating in the open.
- On 2 October 2019, India was declared open defecation-free.

UN Concerns and SDG 6

- In 2015, the United Nations set 17 Sustainable Development Goals (SDGs), including SDG 6, which aims to ensure water and sanitation for all by 2030.
- Open defecation leads to the spread of faecal matter, causing diseases like diarrhoea, trachoma, and schistosomiasis, and is linked to stunting.
- In 2015, WHO estimated 520 million people in India were defecating in the open, a significant problem in rural areas where 69% of households lacked toilets in 2011.

Achievements of SBM Phase I

- Sanitation coverage in India increased from 39% in 2014 to 100% in 2019. According to WHO data, 3 lakh diarrhoeal deaths were avoided by 2019.

- SBM improved nutrition, productivity, and the safety of women, with 93% of women reporting feeling safer after getting a home toilet.
- Households in ODF villages saved Rs 50,000 annually by avoiding health costs.
- The environment also benefited, with 12.7 times less likelihood of groundwater contamination in ODF villages.

Transition to ODF Plus Villages

- By 2024-25, the government aims to transform India into **ODF Plus**, where villages sustain their ODF status and implement solid or liquid waste management systems.
- By May 2023, 2.96 lakh villages were declared ODF Plus.
- Among these, 2.08 lakh villages have either solid or liquid waste management, 32,030 have both, and 56,285 are ODF Plus Model villages, which maintain ODF status and manage both solid and liquid waste while ensuring visual cleanliness.

Phase II of SBM (G)

- Key components of Phase II include:
  - Sustaining Open Defecation Free Status (ODF-S)
  - Solid Waste Management (biodegradable and plastic)
  - Liquid Waste Management (LWM)
  - Faecal Sludge Management (FSM)
  - GOBARDHAN initiative
  - Information, Education, and Communication (IEC) for behavior change
  - Capacity Building

Swachh Bharat Mission - Urban (SBM-U)

- **About SBM-U**
  - SBM-U, launched by the Government of India, aims to eliminate open defecation and ensure 100% scientific management of municipal solid waste in 4,041 towns.
  - SBM-U's second phase, launched on 1 October 2021, seeks to make all cities "Garbage Free" by 2026.
- **Achievements**
  - Since its inception, SBM-U has revolutionized urban sanitation by constructing over 70 lakh toilets, benefiting women, transgender communities, and persons with disabilities.
  - Digital innovations like SBM Toilets on Google Maps have enhanced accessibility. By 2019, urban India was declared open defecation free, and over 3,300 cities were certified ODF, with over 960 achieving ODF++ certification.
  - The mission also promotes Water+ certification, focusing on wastewater treatment and reuse.
  - Waste processing in India increased from 18% in 2014 to 70% by 2024, significantly improving scientific waste management.
  - Over 5.5 lakh sanitation workers have been linked to social welfare schemes.
- **Extension of the scheme**
  - The Union Cabinet had approved the continuation of SBM-U till 2025-26.
  - The focus is on sustainability of ODF outcomes, achieving scientific processing of solid waste in all cities, and managing wastewater in cities with less than 1 lakh population in Census 2011 cities not covered under Atal Mission for Rejuvenation and Urban Transformation (AMRUT).

Challenges in Sustaining ODF Status in India

- Despite India's significant progress under the Swachh Bharat Mission, reports suggest some reversal of the Open Defecation Free (ODF) status.
- A 2023 Joint Monitoring Programme (JMP) report by the WHO and UNICEF revealed that 17% of India's rural population still practiced open defecation in 2022, and a quarter lacked basic sanitation. In crowded urban areas, around 7% of people also defecate in the open.

- JMP defines "basic" services as improved sanitation that households do not share, aligning with the government's ODF target. However, discrepancies between official data and global reports raise questions about India's true ODF status.
- Accurate measurement tools and metrics for behavioral change are needed to confirm and sustain ODF achievements.

GANGA REJUVENATION AND WATER CONSERVATION

Since the 20th century, the river Ganga has suffered severe pollution and environmental damage. To meet this challenge, the Government has launched several initiatives, including the famous Namami Gange project, which aims to clean and rejuvenate the river.

### Ganga: Epicentre of Cultural and Spiritual Bharat & Saviour of Bharat

- The Ganga River, spanning 2,525 km from Gangotri in the Himalayas to Devprayag in Uttarakhand, is a symbol of India's cultural heritage.
- Known for its high dissolved oxygen levels, the Ganga's water has unique qualities. Its river basin **contributes over 40% to India's GDP** and provides nearly one-third of the nation's surface water, with 90% used for irrigation.
- Despite this, over 200 million people living in the Ganga basin remain in poverty.

Why Is Ganga Under Threat?

- Industrialization along the Ganga has severely degraded its water quality due to the discharge of sewage, industrial waste, and solid waste.
- Extensive human activities, coupled with poor infrastructure, weak environmental governance, and a reliance on Western development models, have further contributed to the river's pollution.


Past Efforts - Ganga Action Plan (GAP)

- GAP was launched in 1986 to reduce pollution in the Ganga by setting up sewage treatment plants, improving sanitation, and controlling industrial effluents.
    - It aimed to improve water quality, control pollution sources, encourage research and development, adopt new technologies, and restore biodiversity.
    - It focused on treating domestic sewage, industrial waste, and contaminants before entering the Ganga.
- However, its success was limited due to inadequate infrastructure, weak implementation, and low public awareness.
- Despite efforts to treat sewage and industrial waste, challenges such as insufficient financial resources, poor governance, weak legislation, and inadequate monitoring led to the plan's failure in effectively addressing pollution in the river.
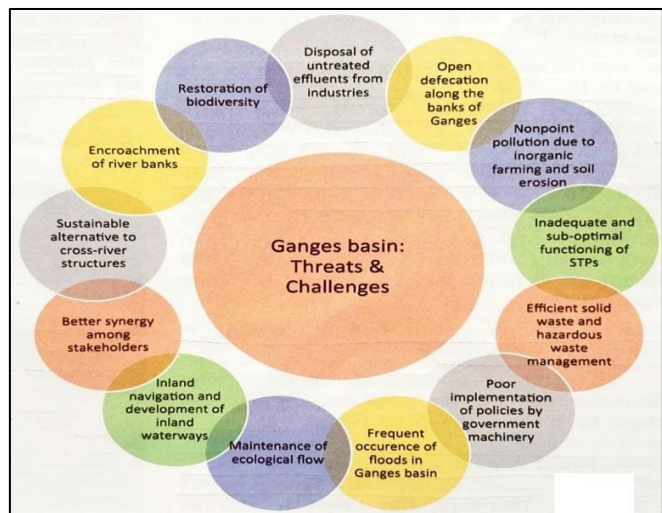
Namami Gange (Clean Ganga Mission): A Journey Towards Purity

- **Background**
    - In a 2014 speech at New York's Madison Square Garden, PM highlighted the economic significance of cleaning the Ganga, which benefits 40% of India's population.
- **Launch of Namami Gange Programme**
    - In 2014, the Government of India initiated the Namami Gange mission, focusing on rejuvenating the Ganga through pollution control and sustainable development.
    - The mission emphasizes both environmental rejuvenation and economic growth.

- **Establishment of National Council for River Ganga**
  - In 2016, the National Council for River Ganga was established to protect and rejuvenate the Ganga Basin.
  - The council focuses on sewage treatment, river cleaning, afforestation, industrial effluent monitoring, and more.
- **Achievements in Sewage Treatment Infrastructure**
  - From 2015 to 2021, 815 sewage treatment plants (STPs) were installed or proposed to reduce untreated sewage impact, including seven STPs in Varanasi.
  - Sustainable sanitation practices have been promoted through these initiatives.
- **Community Engagement and Knowledge Development**
  - Local communities are engaged in the mission through platforms like Ganga Vichar Manch and Ganga Praharis.
  - The Ganga Knowledge Centre and the Centre for the Management and Studies of the Ganga River Basin (cGANGA) promote sustainable development and improve program management.
- **Key Activities under Namami Gange**
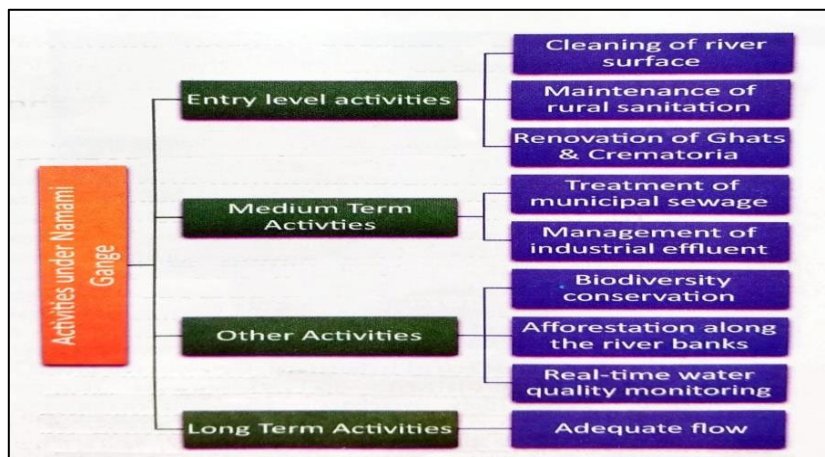
- **Key Milestones of Namami Gange Programme**
  - The Namami Gange programme has achieved significant milestones, with 200 sewerage projects approved and 116 successfully implemented.
  - It also focuses on riverfront development, managing floating solid waste, and restoring indigenous and endangered species in the Ganga River ecosystem.
- **Public Awareness and Effluent Monitoring**
  - In addition to infrastructure projects, the programme has launched public awareness campaigns and monitors industrial effluents to ensure the health of the Ganga River drainage system.

More Efforts Are Required

- **Shortcomings in Namami Gange: 2017 CAG Report**
  - The 2017 Comptroller and Auditor General (CAG) audit highlighted major deficiencies in the financial management, planning, execution, and monitoring of the *Namami Gange* project.
- **Monsoon Challenges and Sewage Treatment**
  - India's heavy monsoons, which deliver 80% of the annual rainfall from June to September, create two challenges:
    - During the monsoon, sewage treatment plants (STPs) are overwhelmed by rainwater and sewage, reducing their processing capacity.
    - In the dry months, the river's low water levels increase pollutant concentration, as the river struggles to dilute contaminants due to insufficient water flow.
- **Pollution Management and Industrial Issues**
  - Many industries contributing to river pollution, especially those closed due to contamination of tributaries, often resume operations illegally, exposing inconsistencies in pollution control enforcement.

- **Groundwater Extraction and Future Threats**
  - Studies indicate that groundwater extraction within 2-3 kilometres of the river, if not regulated, could lead to sections of the Ganga drying up in the coming decades.
  - This could severely impact river ecology and communities dependent on the Ganga for irrigation, drinking water, and industrial use. Climate change could further reduce river flow.
- **Financial Support for River Restoration**
  - Restoring the Ganga is complex due to its socio-economic and cultural importance.
  - The **Clean Ganga Fund** encourages public financial contributions, as government funding alone may not be enough for river restoration efforts.
- **Role of Individuals in Ganga's Restoration**
  - Individual contributions can also aid in Ganga's restoration, with emphasis on reducing water consumption, managing waste efficiently, and reusing and recycling resources.
  - Poor domestic waste management exacerbates water pollution, so reducing waste can alleviate pressure on the river.

DID YOU KNOW?
- **Sanitation for All: Building a Cleaner Ganga Basin** - Sanitation efforts have led to the construction of over 8,53,397 toilets in 1674 Gram Panchayats along the Ganga.
- **Rooting for a Greener Ganga** - Forestry interventions along the Ganga have been implemented over 1,34,106 hectares, improving the flow and conserving biodiversity.
- **Global Recognition** - Namami Gange has been Internationally recognized by the United Nations as one of the Top 10 World Restoration Flagship' initiatives, earning Global acclaim!

CONSTRUCTION AND DEMOLITION CIRCULAR ECONOMY SOLUTIONS

- Sustainable waste management follows the principles of a circular economy, focusing on minimizing waste generation (reduce), extending product life span (reuse), converting waste into resources (recycle), reclaiming energy and materials (recover), and safely disposing of the remaining residue (dispose).
- These steps aim to create a closed-loop system, reducing environmental impact and maximizing resource efficiency.

Linear and Circular Economic Systems

- **Linear Economic System: Take-Make-Waste Model**
  - The linear economic system involves extracting raw materials from the environment, manufacturing products, consuming them, and discarding waste.
  - This model assumes unlimited resource availability, leading to resource depletion, environmental degradation, biodiversity loss, and waste accumulation.
  - Waste generated during resource extraction and production often ends up in landfills, incinerators, or polluting natural environments, posing health and environmental hazards.
- **Consequences of the Linear Economy**
  - Resource Depletion: Continuous extraction of raw materials.
  - Environmental Degradation: Pollution and biodiversity loss.
  - Waste Generation: Landfills and incineration increase environmental and health risks.
- **Circular Economy: A Sustainable Approach**
  - The circular economy seeks to reduce waste and pollution by keeping products and materials in use for as long as possible.
  - It promotes a closed-loop system, minimizing the use of virgin resources and maximizing reuse and recycling.

- **Key Features of a Circular Economy**
  - **Minimizing Waste**: Product design and industrial processes reduce waste generation.
  - **Maximizing Resource Use:** Materials are reused and recycled to create a perpetual flow, reducing reliance on new resources.

Construction Sector in India and Circular Model

- **Growing Importance of India's Construction Sector**
  - Construction in India contributes to about 20% of total material demand and over 8% of GDP.
  - With the sector expected to become the third largest globally, <u>India faces an affordable housing shortage projected to reach 38 million units by 2030</u>.
  - To meet its urbanisation needs, India must construct 700-900 million square metres of new commercial and residential space annually.

- **Government Initiatives Driving Construction Growth**
  - Government programs such as the Smart Cities Mission, industrial corridors, the Swachh Bharat Mission, and the AMRUT city renewal schemes are accelerating urban infrastructure investment, further boosting the construction sector.

- **Waste Challenges in the Construction Sector**
  - **Construction and demolition (C&D)** waste is a significant concern, contributing to about one-third of India's total solid waste and one-fourth of Municipal Solid Waste (MSW).
  - Much of this waste ends up in landfills or on streets, missing opportunities for material recovery and environmental benefits.

- **Benefits of Recycling Construction Waste**
  - Recycling construction waste can <u>reduce the demand for virgin materials and lower greenhouse gas emissions by 40% compared to processing virgin aggregates</u>.
  - Up to 95% of C&D waste can be reused or recycled if processed scientifically, aligning with the circular economy's 3R principle—reduce, reuse, recycle.

Benefits of implementing circularity in C&D waste management		
Economic and Social Benefits	1.	Scientific C&D waste management prevents the mixing of C&D waste into the MSW stream, thus reducing processing costs and increasing the efficiency of MSW.
	2.	C&D waste management prevents clogging of drains and water bodies, therefore averting flooding in urban areas.
	3.	Proper management and recycling of C&D waste leads to saving of precious land by reducing the volume of inert going to landfill.
	4.	C&D waste processing and recycling generates employment through new enterprises.
	5.	Use of C&D recycled products helps in reducing the demand and requirement for virgin material and natural resources.
Environmental Benefits	1.	Scientific C&D waste management suppresses dust generation. Thus, it significantly reduces air pollution.
	2.	Prevention of unauthorised dumping of C&D waste in drains and hydrological channels reduces chances of flooding.
	3.	Utilisation of recycled products from processed C&D waste helps in reducing the environmental impacts of mining.

- **Addressing Infrastructure Gaps**
  - India lacks sufficient infrastructure to process C&D waste, leading to much of it being disposed of in landfills or mixed with MSW.
  - <u>NITI Aayog, along with other ministries, is promoting maximum recycling and reuse of C&D waste to address these issues and capture the economic and environmental benefits</u>.

Conclusion

- The introduction of a circular economy in the construction sector offers opportunities to reduce raw material use and waste.
- Adopting circular economy principles in building and infrastructure development can help avoid inefficient resource use in the long term.

- By 2050, full adoption could generate annual benefits of Rs 4.9 lakh crore (US$ 76 billion) and reduce the need for virgin materials by 37%, water consumption by 24%, and land use by 18%.
- It would also cut greenhouse gas emissions by 40% during construction and reduce energy consumption for cooling.
- The **C&D Waste Management Rules, 2016**, have aligned the construction sector with circular economy practices, supported by government initiatives. T
- his creates a strong case for India to fully embrace circular economy principles across all sectors.

SMART GRIDS AND RENEWABLE ENERGY: POWERING RURAL SANITATION

- A stable power supply is crucial for clean water availability and sanitation, especially in rural areas.
- The integration of smart grids and renewable energy offers solutions for improving rural sanitation.

Smart Grid: Modernizing Power Supply

- **About**
  - A Smart Grid is an automated electric system that monitors and controls power flows, integrates renewable energy, reduces transmission losses, and enables real-time load management.
  - It features automated outage management, dynamic pricing, and bi-directional movement of power, allowing consumers to track and reduce consumption while supporting renewable energy producers.

- **Benefits: Enhancing efficiency and reliability**
  - Smart grid solutions integrate consumer and renewable power sources, reduce transmission and distribution losses, and improve peak load management.
  - They offer features such as faster restoration during outages via automated systems, and real-time monitoring of power usage, enabling dynamic pricing based on 'Time of the Day' consumption patterns.
  - Higher tariffs during peak hours discourage consumption, while lower tariffs incentivize off-peak usage.
  - Consumers can track and manage their consumption through web portals or mobile apps.
  - Smart grids support bi-directional energy flow and net metering, allowing prosumers to connect safely to the grid.
  - These systems also provide utilities with better control over distribution networks and asset management, enhancing overall grid efficiency and reliability.

Microgrid: Flexible Energy System

- A Microgrid is an integrated energy system that can operate independently or alongside the main grid.
- It includes renewable energy sources like solar and wind, making it ideal for rural areas with limited access to traditional power grids.

Jal Jeevan Mission: Ensuring Safe Drinking Water

- The Jal Jeevan Mission aims to provide safe and adequate drinking water to all rural households by 2024, with a focus on sustainability through rainwater harvesting, groundwater recharge, and community-based water management.

Rural Sanitation: Addressing Water Scarcity

- Under the Swachh Bharat Mission (SBM), India has declared all rural areas open defecation free (ODF).
- However, sustainable use of toilets requires a consistent water supply. Using graywater or recycled water for flushing can help reduce the demand for clean water in rural areas.

PM-Surya Ghar: Muft Bijli Yojana

- Launched in February 2024, the PM-Surya Ghar Yojana aims to boost solar rooftop capacity and empower households to generate their own electricity.
- Under the scheme, Central Financial Assistance will be provided to consumers via a national portal.
- The government has allocated Rs 1000 crores to incentivize urban local bodies and Panchayati Raj Institutions to promote residential rooftop solar (RTS) installations.

- These local bodies are responsible for raising awareness, mobilizing communities, and coordinating with stakeholders and financial institutions to maximize installations.
- Their role is pivotal in generating demand, facilitating support, and working with DISCOMS for smooth implementation.

Renewable Energy and Rural Sanitation

- Key elements of rural sanitation include maintaining hygienic and functional toilets, isolating human waste, and managing solid and liquid waste properly.
- Renewable energy, particularly solar power, plays a crucial role in ensuring a consistent water supply for sanitation systems through smart microgrids.
- Solar electricity is more affordable than traditional DISCOM rates. Many states and UTs support a net-metering system, allowing households to generate solar power, track net consumption, and adjust electricity bills accordingly.
- Surplus energy can be carried forward, and annual settlements ensure cost savings while promoting renewable energy use for rural sanitation.

India's Renewable Energy Goals and Rural Biomass Utilization

- India aims to achieve 50% of its installed electric power capacity from non-fossil fuel sources and reach net zero by 2070.
- Surplus biomass and other rural wastes can be used to generate electricity, offering not only renewable energy but also significant cost reductions in waste management.
- This approach provides multiple social and environmental benefits, such as reducing pollution of air, water, and land, while promoting cleaner energy in rural areas.

Meeting Electricity Demand with Solar PV Systems

- Installing solar PV systems in rural areas can reduce the strain on distribution networks.
- Microgrids with smaller solar capacities can help meet local electricity demands for sanitation and other infrastructure, contributing to India's goal of carbon neutrality by 2070.

Renewable Energy: A Path to Carbon Neutrality

- The integration of smart grids with renewable energy sources is essential for rural sanitation and overall energy efficiency.
- Expanding renewable energy use will support rural power needs and contribute to India's carbon neutrality goals.

DID YOU KNOW?

PM KUSUM initiative empowers barren and fallow land to generate solar energy and supports farmers with additional income from their unused land.

Solar Pumping Water Systems generate more solar electricity. Farmers with USPC not only irrigate fields but also solarize other farm applications like chaff cutters, cold storage, dryers, etc.

INDIA'S BIOFUEL REVOLUTION: EFFICIENT, SUSTAINABLE, AND CLEAN

- The use of fossil fuels contributes to environmental crises like **carbon emissions** and **global warming**, prompting countries to focus on renewable energy research.
- **Biofuel** is a key alternative energy source, and it receives strong support from the **Swachh Bharat Mission (SBM)**, which promotes its development as part of efforts to address environmental concerns and foster sustainable energy solutions.

Celebrating World Biofuel Day with PMJIVAN Yojana — Achievements in Ethanol Blending: Achieved 15% ethanol blending by June & July 2024; Targeting 20% blending by 2025-26; Saved ₹ 1 lakh+ crore in forex and reduced 528 lakh MT of CO₂ emissions

Present Scenario of Fossil Fuel Consumption in India

- As of 2023, **fossil fuels** account for **70-75%** of India's energy consumption, with **coal** being the dominant source (55% of electricity generation).
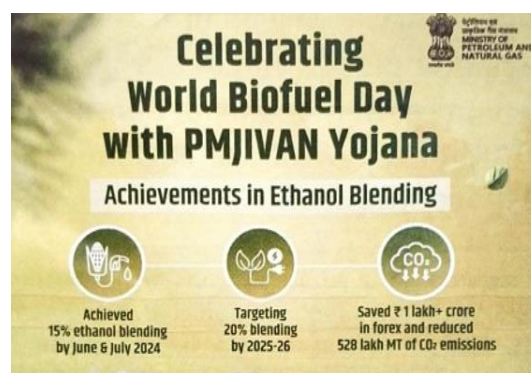
- **Oil** is the second-largest energy source, with India being the **third-largest importer of crude oil**, relying on imports for about 85% of its needs.
- **Natural gas** usage is increasing but still constitutes only **6-8%** of the energy mix.
- India is actively pursuing **renewable energy** and has set a target of achieving **500 GW of non-fossil fuel-based power by 2030**, aiming to reduce fossil fuel dependency and transition to cleaner, more sustainable energy solutions.

Fossil Fuels: Advantages and Disadvantages

- Fossil fuels (coal, oil, and natural gas) are non-renewable energy sources formed from decomposed ancient plants and animals over millions of years.
- They offer several **advantages**, such as providing **large amounts of energy** for industrial use, transportation, and electricity generation.
- The global infrastructure for fossil fuels is well-developed, making them **convenient** and **reliable**. Fossil fuel industries also significantly contribute to **national economies** and employment.
- However, there are **disadvantages**.
    - Fossil fuels emit large amounts of **carbon dioxide (CO_2)** and other **greenhouse gases**, leading to **climate change**.
    - They cause **air and water pollution**, harming health and ecosystems.
    - As **non-renewable** resources, they are rapidly depleting, raising concerns about **energy security**.
    - Moreover, their uneven global distribution causes **geopolitical tensions** and dependency on foreign imports for energy.

Biofuels: A Ray of Hope

- **Benefits**
    - Biofuels, derived from organic materials like crops and algae, are considered renewable.
    - Common types include **ethanol (from sugarcane or corn)** and **biodiesel (from vegetable oils)**.
    - Biofuels emit <u>fewer greenhouse gases than fossil fuels</u> because the <u>carbon dioxide released during combustion is partially offset by the plants' absorption of CO_2 during growth</u>, helping mitigate climate change.
    - Biofuels offer several advantages, such as reducing dependence on imported fossil fuels, enhancing energy security, and stimulating rural economies.

- **Challenges**
    - However, producing <u>biofuels can compete with food production</u>, require significant land, water, and energy inputs, and may reduce the overall environmental benefit.
    - Additionally, **biofuels generally have lower energy content than fossil fuels**, requiring more fuel to produce the same amount of energy, and they are often more expensive to produce.
    - While fossil fuels offer high energy density and established infrastructure, they have significant environmental and sustainability challenges.
    - Biofuels provide a cleaner, renewable alternative but face limitations in efficiency, scalability, and land use.
    - A balanced approach involving biofuels, fossil fuels, and other renewable sources is essential for a sustainable energy future.

Steps to Promote Production of Biofuels

- **Intervention of Used Cooking Oil Van to Boost Biofuel**
    - The Council of Scientific and Industrial Research-Indian Institute of Petroleum (CSIR-IIP) in Dehradun leads research in converting used cooking oil (UCO) into biodiesel in India.
    - UCO, a waste product from households, restaurants, and food industries, poses significant health and environmental risks when improperly disposed of.
    - India generates millions of tonnes of UCO annually, but only a small fraction is collected for reuse.
    - CSIR-IIP has developed a technology to convert UCO into biodiesel, a clean, renewable fuel.

- A key challenge is UCO collection, but CSIR-IIP has established partnerships with local authorities and food outlets to create a collection network.
- **Collaboration with the Government and Industry**
  - The project aligns with the National Biofuel Policy (2018), which aims to achieve 5 per cent biodiesel blending in diesel by the year 2030.
  - CSIR- IIP has partnered with the Food Safety and Standards Authority of India (FSSAI) under the Repurpose Used Cooking Oil (RUCO) initiative, which encourages businesses to supply UCO for conversion into biodiesel.
- **TDB and CSIR's 'Recycling on Wheels' bus to Promote 'Waste-to-Wealth'**
  - The **Technology Development Board (TDB)**, in collaboration with **CSIR**, has launched the **'Recycling on Wheels' bus** to promote recycling and the **'Waste-to-Wealth'** concept across India.
  - This mobile unit, equipped with advanced recycling technologies, travels to various locations, offering **hands-on demonstrations and educational sessions** to raise awareness about waste segregation and recycling materials like plastic, paper, and metal.
  - The initiative supports the **Swachh Bharat Mission** and aligns with India's goals of **environmental sustainability** and a **circular economy**.

Other Research Interventions in India to Promote Biofuels

- **Biodegradable Waste Management Technologies**
  - Researchers are developing efficient solutions to manage biodegradable waste like kitchen scraps and agricultural residues.
  - Biogas and composting plants use anaerobic digestion to convert organic waste into biogas (a renewable energy source) and organic compost (natural fertilizer).
  - The Institute of Himalayan Bioresource Technology (IHBT), a CSIR lab, has created a portable biogas plant that transforms food waste into energy and manure, promoting clean energy generation while effectively managing waste.

- **Plastic Waste Recycling**
  - Research organizations, including **CSIR-National Chemical Laboratory (NCL)**, have developed innovative **plastic recycling technologies**.
  - These include **chemical recycling** to produce high-value materials like **fuel and chemicals**.
  - CSIR has also advanced **plastic pyrolysis**, a process that converts plastic waste into **oil and gas**, helping reduce the accumulation of **non-biodegradable plastics**.

- **Water Conservation Technologies**
  - Research has led to the development of greywater recycling and rainwater harvesting systems, which contribute to water conservation in urban and rural areas.
  - CSIR's National Environmental Engineering Research Institute (NEERI) has developed models for community-level greywater treatment and reuse, which is crucial for water-scarce regions.

- **Low-cost Sanitation Solutions**
  - **CSIR-Central Building Research Institute (CBRI)** has developed **low-cost, eco-friendly toilets** made from **locally available materials**, reducing construction costs while ensuring durability.
  - Additionally, **CSIR-NEERI** has designed **biodigester toilets** that decompose human waste using **bacterial cultures**, helping reduce environmental contamination and improve hygiene.

- **Public Health Monitoring and Wastewater Surveillance**
  - Research efforts in **wastewater-based epidemiology** focus on monitoring pathogens, pollutants, and harmful substances in wastewater to track **disease outbreaks** and **environmental pollution**.
  - This approach offers real-time data, aiding public health monitoring.
  - These interventions align with the **Swachh Bharat Mission's** goals of **cleanliness**, **sanitation**, and **waste management**, supporting biofuels as an efficient, sustainable energy source while promoting a healthier India.