



INDIAN BUILDING CONGRESS

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HOW TECHNOLOGY CAN HELP IN BUILDING SUSTAINABLE INFRASTRUCTURE

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WHAT IS SUSTAINABLE INFRASTRUCTURE?



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Infrastructure that is designed, built, and operated to minimize environmental impact

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Emphasizes energy efficiency, resource conservation, and long-term sustainability



Supports economic and social development

WHY IS SUSTAINABLE INFRASTRUCTURE CRUCIAL?



MITIGATES CLIMATE CHANGE BY
REDUCING CARBON EMISSIONS



PROMOTES EFFICIENT USE OF
NATURAL RESOURCES



ENHANCES RESILIENCE TO
ENVIRONMENTAL AND ECONOMIC
SHOCKS

GLOBAL IMPACT AND URGENT NEED FOR SUSTAINABILITY



Infrastructure accounts for 70% of global greenhouse gas emissions



Rapid urbanization demands sustainable development



The construction industry consumes about 40% of the world's raw stone, gravel, and sand, and 25% of virgin wood annually.

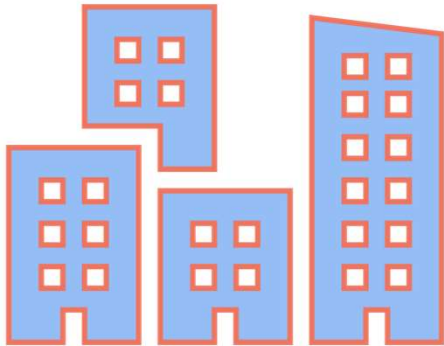


Accounts for 40% of global energy use and 16% of water usage.



Need for balancing growth with environmental stewardship

TECHNOLOGY AS A CATALYST FOR SUSTAINABLE INFRASTRUCTURE



Technology enables efficient
resource utilization

Innovation drives sustainable
practices in construction and
operation

Supports data-driven
decision-making for long-
term sustainability



TECHNOLOGICAL ADVANCEMENTS

DIGITAL TOOLS FOR INFRASTRUCTURE
PLANNING AND MONITORING

SMART GRIDS AND ENERGY STORAGE SYSTEMS

BUILDING TECHNOLOGY

RENEWABLE ENERGY TECHNOLOGIES LIKE
SOLAR AND WIND

USE OF INTERNET OF THINGS



Internet of Things (IoT) is using sensors for real-time data collection

Used for Energy and Water management, and overall optimization.



USE OF ARTIFICIAL INTELLIGENCE

- ✓ Artificial intelligence (AI) is revolutionizing the way we design, build, and operate sustainable infrastructure.
- ✓ AI-powered systems can optimize energy efficiency, predict maintenance needs, and enhance overall resource utilization to create a greener, more resilient future.

BIM AND SUSTAINABLE DEVELOPMENT



Building Information Modeling (BIM) plays a crucial role in supporting sustainable development by enabling data-driven design, construction, and operation of buildings and infrastructure.

BIM integrates real-time data to optimize energy efficiency, resource utilization, and life-cycle performance.



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CONSTRUCTION CLOUD AND PROJECT MANAGEMENT

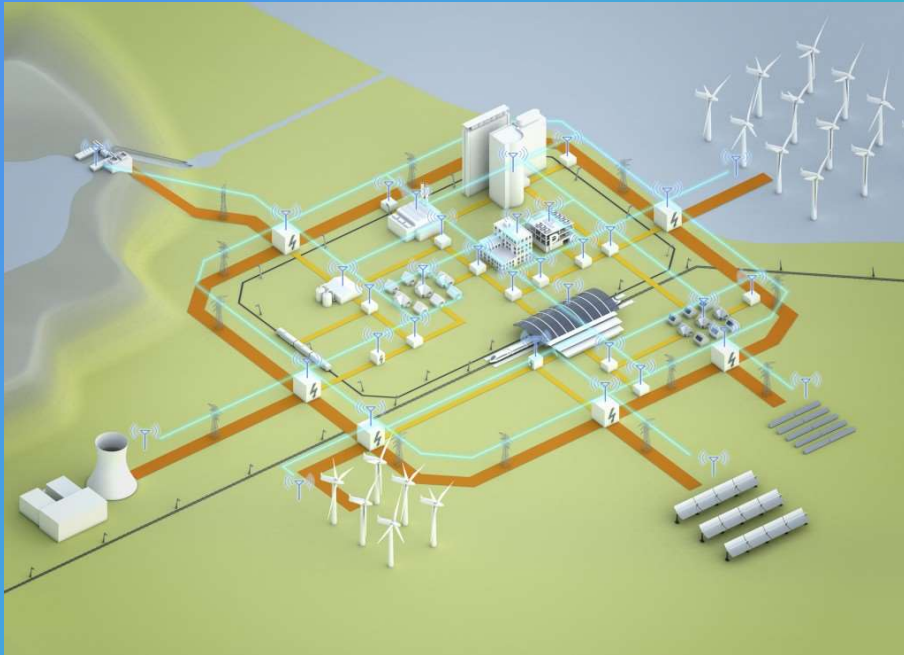
- Real-time Updates and Centralized Documentation
- Optimized Resource Allocation and Cost management
- Examples- Autodesk Construction Cloud (ACC), MS Projects, Procore, SAP, ERP, Procol, Primavera



Augmented Reality and Virtual Reality



- Augmented Reality (AR) and Virtual Reality (VR) are revolutionizing the way we design, plan, and execute infrastructure projects.
- **AR** allows us to overlay digital information onto the physical world, enabling real-time visualization of projects and facilitating better decision-making during construction.
- **VR** provides immersive experiences that allow architects, engineers, and clients to walk through virtual models of buildings and infrastructure projects before they are constructed.



SMART GRID TECHNOLOGY

- Real-Time Monitoring

Smart grid sensors track energy usage and identify inefficiencies, allowing for immediate adjustments to improve efficiency.

- Automated Responses

Smart grids can automatically adjust power distribution and reroute energy based on demand, reducing waste and ensuring reliable service.

- Grid Modernization

Upgrading aging infrastructure with modern, digital technologies enables better integration of renewable energy sources and more efficient energy distribution



AIR QUALITY MONITORING AND CONTROL

Technology enables real-time air quality monitoring through sensors and IoT devices, while advanced filtration systems and smart urban planning help control and reduce pollution.

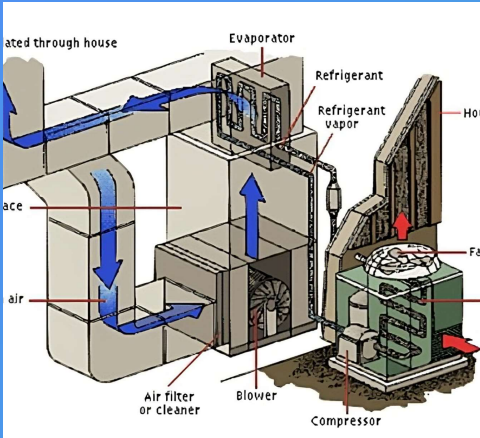
This integration supports healthier environments and informed policy-making for a sustainable future.

AUTOMATION FOR ENHANCED SUSTAINABILITY

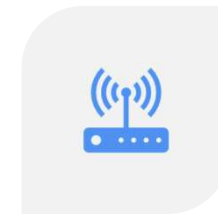
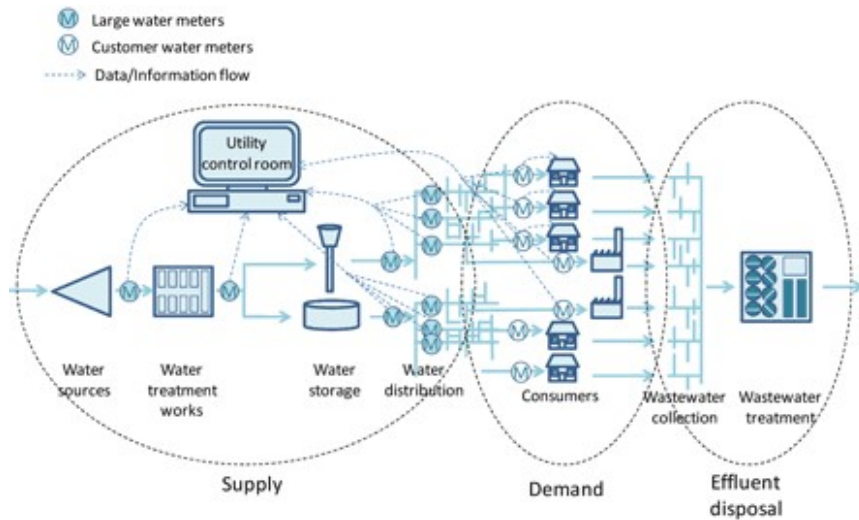
Smart HVAC systems for optimal energy use

Automated lighting controls

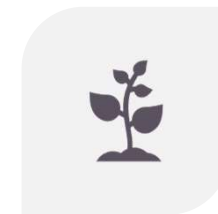
Building management systems for resource monitoring



SMART WATER MANAGEMENT TECHNOLOGIES



IOT-ENABLED WATER
MONITORING
SYSTEMS



SMART IRRIGATION
SYSTEMS FOR
AGRICULTURE

SUSTAINABLE BUILDING TECHNOLOGIES

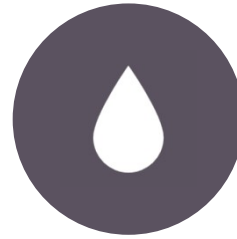
Innovative building materials, energy-efficient systems, and smart design principles are revolutionizing the construction industry to create more sustainable, environmentally-friendly structures.



CONSTRUCTING ECO-FRIENDLY STRUCTURES



Energy Efficiency - Innovative building materials, insulation, and smart technologies can significantly reduce energy consumption and lower carbon emissions.



Water Conservation - Water-efficient plumbing, rainwater harvesting, and greywater recycling systems help conserve this precious resource.



Renewable Energy - Integrating solar panels, geothermal systems, and other renewable energy sources can make buildings self-sustaining or even net-zero in energy use.



Sustainable Materials - The use of eco-friendly, recycled, and locally sourced materials reduces the environmental impact of construction and building operations.



WHAT ARE GREEN BUILDINGS?



BUILDINGS DESIGNED TO
MINIMIZE ENVIRONMENTAL
IMPACT



USE OF SUSTAINABLE
MATERIALS AND ENERGY-
EFFICIENT SYSTEMS



GREEN MATERIALS IN SUSTAINABLE INFRASTRUCTURE

Sustainable infrastructure relies on the innovative use of eco-friendly building materials to reduce environmental impact and promote long-term resilience.

These materials offer improved energy efficiency, lower carbon footprints, and enhanced durability.

Examples- Fly-ash Bricks, Low VOC paints, low carbon concrete, etc.



SOLAR PANELS AND SOLAR FARMS



BENEFITS: LOW
EMISSIONS, ABUNDANT
ENERGY SOURCE



EXAMPLE: SOLAR-
POWERED BUILDINGS
AND COMMUNITIES

BEYOND SUSTAINABLE INFRASTRUCTURE



TRANSPORTATION



WATER
MANAGEMENT



WASTE
MANAGEMENT

Beyond Sustainable Infrastructure – TRANSPORTATION

THE RISE OF ELECTRIC VEHICLES



EVs as a solution to
reduce carbon
emissions



Infrastructure needs:
Charging stations,
smart grids



Beyond Sustainable Infrastructure – TRANSPORTATION

INNOVATIONS IN PUBLIC TRANSPORT



Electric and Hybrid
buses



Electric Railway
Systems



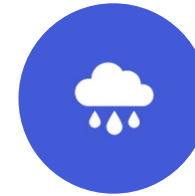
Autonomous Vehicles
and Shared Mobility

Beyond Sustainable Infrastructure – WATER MANAGEMENT

WATER CONSERVATION IN INFRASTRUCTURE



WATER EFFICIENT
FIXTURES – LOW FLOW
FAUCETS, TOILETS AND
SHOWER HEADS



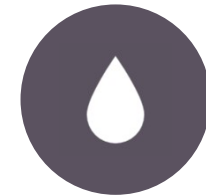
RAINWATER HARVESTING



WATER CONSERVING
/PERVIOUS PAVEMENTS



DROUGHT RESISTANT
LANDSCAPING



DRIP IRRIGATION OR
SPRINKLERS

Beyond Sustainable Infrastructure – WATER MANAGEMENT

TECHNOLOGIES TO REDUCE WATER WASTE



Greywater recycling systems- collect and reuse water from sinks, showers, and washing machines to reduce waste and conserve fresh water.



Smart leak detection technologies- use sensors and data analytics to quickly identify and alert users to leaks in plumbing systems, preventing damage and waste.



Smart Water Grids- uses digital technology and sensors to monitor, manage, and optimize water distribution and usage in real-time.

Beyond Sustainable Infrastructure – WASTE MANAGEMENT

WASTE MANAGEMENT AND RECYCLING



Waste Reduction- minimizing waste generation through efficient resource use, recycling, and redesigning processes to support long-term environmental and economic health.



Reuse and Repurpose- extending the lifecycle of materials and products to conserve resources, reduce waste, and minimize environmental impact.



Recycling and Recovery- processing used materials to create new products and extracting valuable resources from waste to reduce environmental impact and support sustainability.

Beyond Sustainable Infrastructure – WASTE MANAGEMENT

ADVANCED RECYCLING TECHNOLOGIES



Technologies for sorting
and processing waste



Role of AI in optimizing
recycling processes



Innovations in Bio-
degradable materials

CONSTRUCTION AND DEMOLITION WASTE

Refers to the materials generated from the construction, renovation, and demolition of buildings and infrastructure.

Sustainable Practices-

- Adopting Green Building Standards
- Innovative Recycling Technologies
- Adopting Circular Economy Model



CHALLENGES IN BUILDING SUSTAINABLE INFRASTRUCTURE



TECHNOLOGICAL



FINANCIAL



REGULATORY

TECHNOLOGICAL BARRIERS TO SUSTAINABILITY



High costs of new technologies



Integration of existing systems
with new technologies



Example: Challenges in scaling
up renewable energy

FINANCIAL HURDLES IN SUSTAINABLE INFRASTRUCTURE



High initial investments
required

Difficulty in securing
funding for large-scale
projects

Example: Funding
challenges in developing
countries

REGULATORY AND POLICY CHALLENGES



Lack of clear regulations and policies



Challenges in implementing international standards



Example: Regulatory hurdles in green building certification

SOLUTIONS TO ADDRESS IMPLEMENTATION CHALLENGES



COLLABORATION BETWEEN PUBLIC AND PRIVATE SECTORS- POOLING RESOURCES, EXPERTISE, AND INNOVATION TO ADDRESS ENVIRONMENTAL AND SOCIAL CHALLENGES EFFECTIVELY AND PROMOTE LONG-TERM ECONOMIC GROWTH.

INNOVATIVE FINANCING MECHANISMS LIKE GREEN BONDS- RAISE CAPITAL SPECIFICALLY FOR PROJECTS THAT ADDRESS ENVIRONMENTAL CHALLENGES AND PROMOTE SUSTAINABLE INFRASTRUCTURE, OFFERING INVESTORS A WAY TO SUPPORT ECO-FRIENDLY INITIATIVES WHILE GENERATING RETURNS.

EXAMPLE: PUBLIC-PRIVATE PARTNERSHIPS IN SMART CITY PROJECTS

EMERGING TECHNOLOGIES IN SUSTAINABLE INFRASTRUCTURE



Advanced materials like self-healing concrete



Use of AI and robotics in construction



Example: 3D-printed buildings for low-cost, sustainable housing

PREDICTIONS FOR THE FUTURE OF SUSTAINABLE INFRASTRUCTURE



Increased integration of renewables- expanding the use of clean energy sources like solar, wind, and hydro to reduce reliance on fossil fuels, lower greenhouse gas emissions, and support a sustainable energy future.

Greater use of AI and machine learning- leveraging advanced algorithms to analyze data, optimize processes, and drive innovations across various sectors, enhancing efficiency, decision-making, and problem-solving capabilities.

Global collaboration on sustainability goals- countries and organizations working together to address environmental and social challenges, share knowledge, and implement strategies to achieve shared objectives for a sustainable future.

EMBRACING TECHNOLOGY FOR A GREENER FUTURE



Integrated Approach Combining innovative technologies across different sectors is key to creating truly sustainable infrastructure and communities



Continuous Innovation Ongoing research and development in areas like renewable energy, smart grids, and green building design will drive further advancements.



Collaboration and Partnerships Cooperation between governments, businesses, and citizens is essential to implement and scale sustainable solutions effectively.



Public Awareness Educating the public and fostering a culture of sustainability will help drive widespread adoption of eco-friendly technologies and practices.

THANK YOU