SUSTAINABLE FUTURE

Cotton Waste Textile Industries

This report contains Cotton waste industry current quality and infrastructure limitations.

Contents

Sustainable Future – Cotton Waste Textile Industries

Introduction

The Cotton waste industry is currently experiencing significant growth, primarily by global awareness of sustainability. And this is leading to a pressure on the Textile industry to reduce waste and optimum use of the cotton waste.

Key Challenges:

- **Quality Degradation:** Mechanical recycling and separating process, shortens and weakens cotton fibers, resulting in lower quality yarns that are often suitable only for low-value products.
- **Lack of Infrastructure:** Primarily the Electricity availability and cost.

The objective of this report is to study **Current State (As-Is) and identify the GAPS to meet the Industry standard and maintain the Global** Compliances. And **Propose (To-Be) Initiatives.**

Amroha – **Current State (As-Is)**

The cotton waste industry in Amroha is facing significant decline due to rising costs, falling demand, and lack of government support, leading to a drastic reduction in the number of active factories and a sharp drop in the industry's annual turnover.

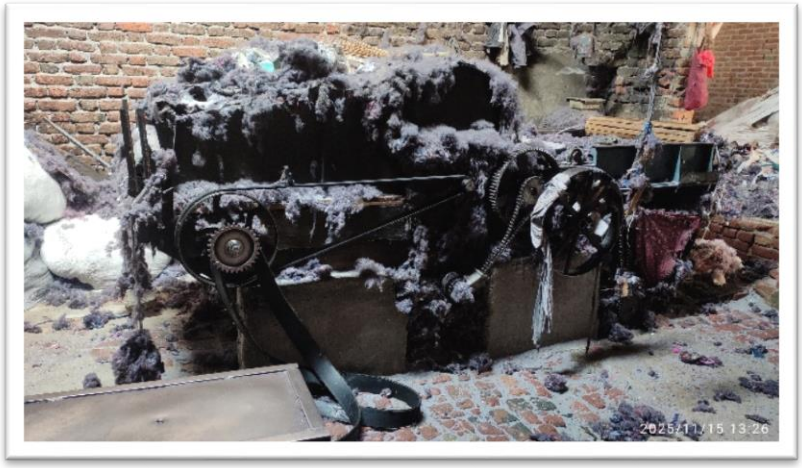
Current Status and Challenges

- **Rising Costs and Falling Demand:** Manufacturers face rising raw material costs and falling demand for their primary products.
- **Local Challenges:** Residents of Amroha still experience power cuts. These are often due to localized distribution and transmission bottlenecks, routine maintenance (planned outages), and illegal activities like electricity theft ("Bijli Chori"), which is actively being monitored and acted upon.
- Though **localized distribution challenges** like planned maintenance outages and electricity theft still occur.

In summary, while the traditional cotton waste industry is struggling with economic and policy challenges, there is potential for revival through integration into modern, sustainable, and circular economy initiatives with national and international support.

Present Status of Cotton Waste Textile Machines in Amroha

MTR Machine with 7 Steps



MTR Machine With 7 Steps

Spin Machine

Amroha – **Proposed (To-Be)**

To increase electricity availability in **Amroha,** Uttar Pradesh is implementing various initiatives focusing on **infrastructure development**, **renewable energy adoption (especially solar)**, and **improving distribution efficiency**

Infrastructure Development

The government is investing in strengthening the conventional power transmission and distribution network to reduce losses and ensure reliable supply.

- **Construction of new power stations:** Plans include building 13 new power stations (substations) across Amroha, including in the Amroha, Naugawan Sadat, Gajraula, and Hasanpur subdivisions.
- **Capacity upgrades:** The capacity of 103 existing power stations in the district is being upgraded to meet the growing demand, particularly during peak seasons like summer.
- **Network rehabilitation:** Under schemes like the Asian Development Bank (ADB) funded Uttar Pradesh Power Distribution Network Rehabilitation Project (UPPDNRP), bare conductors are being replaced with Aerial Bunched (AB) cables in rural areas to reduce technical and commercial losses and enhance reliability.
- **Enhanced services:** New systems are in place for the expedited replacement of damaged transformers (within 24-48 hours if there are no outstanding bills) and easier new connections under the "Sugam Sanyojan Yojana"

Renewable Energy Initiatives

A major push is being made for clean energy, leveraging Amroha's ample sunlight.

- **PM Surya Ghar Yojana:** This Central Government scheme, supplemented by state initiatives, provides significant subsidies (up to ₹1,08,000) for households to install rooftop solar panels, making solar power more accessible and affordable. Amroha has seen high participation in this initiative, with some villages becoming 100% solar-powered for domestic needs.
- **Solarization of agriculture feeders:** The Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) scheme focuses on solar-powered agricultural pumps and feeder-level solarization to provide reliable and cost-effective power to farmers.
- **Electricity distribution in Amroha** falls under the purview of the Pashchimanchal Vidyut Vitran Nigam Limited (PVVNL), which manages the supply and maintenance across various divisions, including Amroha, Gajraula, and Hasanpur.

Solar Initiatives

Solar systems for the commercial sector are repositioning the clean energy market to flourish based on how the Renewable Energy sector operates: predictable energy costs, significant savings, and a great return on investment (ROI).

To improve the overall electricity conditions in Amroha, the focus should shift from the grid to developing a robust, hybrid system for solar energy. By combining government initiatives with local action, Amroha can achieve a more reliable and sustainable power supply.

Here are key suggestions leveraging solar systems:

Implementing **Decentralized Renewable Energy (DRE)** Solutions

- **Develop Solar Mini-Grids in Amroha:** Identify villages within the Amroha district that frequently experience prolonged outages.

Solar Systems under RESCO and CAPEX Model:

Solar Systems are implemented as below mentioned Models:

RESCO Model (A developer owns the system)

The RESCO model is a Renewable Energy Service Company based business model for Solar Energy where a third-party company funds, installs, and maintains a solar power plant on a consumer's premises.

The Customer pays for the electricity generated at a pre-agreed tariff, and the RESCO company handles all initial costs, operations, and maintenance, often transfers ownership after a set period. This allows consumers to use Solar power without upfront investment.

Process and Usefulness

- **Best for:** Businesses that want to avoid upfront costs, prefer not to manage maintenance, or have capital constraints.
- **How it works:** A third-party Renewable Energy Service Company (RESCO) installs, owns, and operates the system on your property, and you pay a pre-decided tariff for the electricity you consume.
- **Pros:**
  - No upfront investment required.
  - The RESCO handles all maintenance and operational risks.
  - Lower tariff than grid electricity, and you can start enjoying savings immediately.
- **Cons:**
  - Long-term power cost per unit may be slightly higher compared to CAPEX.
  - You do not own the asset and cannot claim tax benefits like accelerated depreciation.
  - You are locked into a Power Purchase Agreement (PPA) , typically for 10-25 years

CAPEX Model (Beneficiary own the system)

The CAPEX model requires an upfront investment, either with your own capital or a solar loan. You own the system and are responsible for its operation and maintenance (O&M).

- **Best for:** Businesses or individuals with available capital who want long-term ownership, maximum savings, and control over their energy assets.

- **Advantages:**
  - **Ownership & Control:** You own the asset outright and have full control over the system and its maintenance.
  - **Maximum Long-Term Savings:** After the initial payback period (typically 3-6 years), the electricity generated for the system's 25-year lifespan is nearly free, leading to greater overall savings.
  - **Tax Benefits:** Commercial and industrial owners can benefit from tax incentives like **accelerated depreciation** and **GST input credits**, which enhance the return on investment.
  - **Hedge Against Tariffs:** Provides a complete hedge against rising grid electricity prices over the long term.

- **Disadvantages:**
  - **High Upfront Cost:** Requires significant initial capital expenditure.
  - **Responsibility:** You bear all performance and maintenance risks, requiring dedicated resources or an O&M contract

Process and Usefulness

- **Best for:** Businesses with available capital, a desire for full control, and those who want to maximize long-term savings by taking advantage of tax benefits.

- **How it works:** You purchase the system outright, either with upfront payment or financing.

  - **Pro**
    - Immediate ownership and asset creation.
    - Ability to claim tax benefits and incentives like accelerated depreciation.
    - Lowest long-term power cost after the initial investment is recovered.
    - Full control over the system and its operation.
  - **Cons:**
    - Requires a significant upfront investment.
    - You are responsible for all maintenance, operations, and risks.

Solar Systems Under CAPEX Model

There are three main types of solar energy systems—**On-Grid, Off-Grid, and Hybrid—each serve specific needs based on location, budget, and power requirements.**

On-Grid Solar Systems

On-grid (or grid-tied) systems are connected to the public electricity grid and do not use batteries for storage.

- **Best For:** Urban and suburban areas with a **stable and reliable power supply**.
- **Key Uses:**
  - **Reducing Electricity Bills:** The primary use is to lower monthly utility bills by using solar power during the day.
  - **Net Metering:** Excess energy generated is exported to the grid in exchange for credits or payment, which helps maximize savings (policies vary by region).
  - **Residential, Commercial, and Industrial Use:** Highly suitable for homes, offices, retail outlets, and factories with high daytime energy consumption.
  - **Cost-Effectiveness:** Due to the absence of expensive battery storage, the initial installation cost is the lowest, offering a faster return on investment.
- **Limitation:** The system **automatically shuts down during a power outage to ensure the safety of utility workers**, meaning no power backup during blackouts unless a specific, approved backup system is installed.

Off-Grid Solar Systems

Off-grid (or standalone) systems operate entirely independently of the utility grid and rely on battery storage to provide continuous power.

- **Best For:** Remote locations **where grid access is unavailable**, unreliable, or prohibitively expensive to connect to.
- **Key Uses:**
  - **Rural Electrification:** Providing power to remote homes, farms, and villages far from main power lines.
  - **Complete Energy Independence:** Ideal for users seeking full self-reliance and freedom from utility bills and grid fluctuations.

- **Essential Services in Isolated Areas:** Powering critical infrastructure like telecommunication towers, remote healthcare facilities, and water pumping for irrigation.
- **Mobile and Temporary Applications:** Used for RVs, boats, camping, and disaster relief efforts where quick, independent power is needed.
- **Limitation:** Higher initial cost and maintenance requirements due to the need for a large battery bank and charge controller.

Hybrid Solar Systems

Hybrid systems **combine the benefits of both on-grid and off-grid systems**. They are connected to the grid but also incorporate battery storage.

- **Best For:** Areas with frequent power cuts or fluctuating electricity rates, where an uninterrupted power supply is essential.

- **Key Uses:**

  - **Reliable Backup Power:** Provides seamless, automatic power backup during grid outages, which is crucial for critical loads like medical equipment or data centers.
  - **Optimal Energy Management:** Allows users to store excess solar energy and use it during peak-rate hours (time-of-use tariffs) or at night, further maximizing savings.
  - **Energy Security and Flexibility:** Offers a balance of grid reliability and energy independence, allowing the system to adapt to varying energy needs and grid conditions.
  - **Future-Proofing:** An on-grid system can often be retrofitted into a hybrid system later by adding batteries and a hybrid inverter.
  - **Limitation:** More complex and costly than a standard on-grid system due to the added battery and sophisticated inverter technology

    - **On-Grid:** Install On-Grid Inverter System when there is rarely Power Shutdown.
    - **Off-Grid:** When Grid availability is not possible then Off-Grid System is installed and needs Battery Storage systems.
    - **Hybrid System:** Install Hybrid Inverter System where there is Power Shutdown more than 3 to 4 hours in a day. This installation requires Battery Storage system.

Conclusion: **The best model depends on your financial capacity, risk tolerance, and goals**

Benefits of Solar Systems

- Lower Electricity Bills
- Energy Independence
- Reduced Carbon Foot Print
- Boost Property Values
- Getting extra space under the roof top for numerous use.
- Low Maintenance cost
- Net Metering / Net Billing
- Government Incentives: CFA – Central Financial Assistance
- Reliable Power
- Financial Savings

Environments Benefits:

- Reduced Carbon Foot Print
- Less dependency on Fossil Fuels

Conclusion: Installing a solar energy system offers a powerful blend of financial, environmental, and practical benefits, making it a smart long-term investment for Textile waste Industries.

Proposed Roof Top Solar Systems on the Roof of the Textile Industries.

Finally a Positive Environment Initiative for NET ZERO.

Global Compliances

What are GLOBAL COMPLIANCES?

"Global compliances for net zero" refers to the complex and evolving landscape of international agreements, national laws, and voluntary standards that guide countries and entities towards achieving net-zero greenhouse gas (GHG) emissions.

International Frameworks and Agreements

The primary global framework is the **Paris Agreement**, where nations commit to limiting the global temperature increase to 1.5°C above pre-industrial levels. While the agreement itself encourages net-zero targets by mid-century, it does not impose a single, legally binding global compliance mechanism for every entity. Instead, it relies on Nationally Determined Contributions (NDCs) and long-term strategies.

Key international bodies and initiatives shaping compliance include:

- **United Nations Framework Convention on Climate Change (UNFCCC):** Oversees the Paris Agreement and initiatives like the "Race to Zero" campaign for non-state actors, which sets rigorous criteria for credible net-zero pledges.
- International Maritime Organization (IMO)**:** Approved the IMO Net-Zero Framework in April 2025, which introduces mandatory fuel standards and a carbon pricing mechanism to get the global shipping sector to net-zero by around 2050. This is a rare example of a binding, sector-specific global regulation.
- **International Civil Aviation Organization (ICAO):** The aviation industry, through the International Air Transport Association (IATA), has a voluntary commitment to "Fly Net Zero" by 2050, relying on sustainable aviation fuels, new technology, and carbon capture/offsets.

National Laws and Regulations

The transition from international commitments to mandatory compliance often happens at the national level.

- **Legally Binding Agreements:** As of 2022, a limited number of countries have enacted domestic net-zero legislation, including the
  UK, France, Denmark, New Zealand, Sweden, and Hungary
- **Proposed Legislation:** Other nations, such as Canada and the EU Member States, have proposed legislation or in-policy documents to implement their net-zero targets.
- **No National Mandate for Companies:** There is currently no national regulation in any country that universally requires all companies to achieve net-zero, though specific regulations (like those related to building efficiency or energy sources) compel action.

Voluntary Standards and Corporate Compliance

In the absence of comprehensive global or national laws for companies, voluntary standards play a crucial role in ensuring the credibility of corporate net-zero claims:

- **GHG Protocol:** This widely used set of standards classifies emissions into three scopes (Scope 1: direct; Scope 2: purchased energy; Scope 3: value chain) to ensure comprehensive accounting and reporting.

Key Compliance Components

Credible net-zero compliance generally requires:

- **Comprehensive Scope:** Covering all material GHG emissions (Scopes 1, 2, and 3).
- **Science-Based Targets:** Setting both near-term (e.g., halving emissions by 2030) and long-term (net-zero by 2050) goals aligned with climate science.
- **Prioritization of Emission Reduction:** Focusing on eliminating emissions at the source rather than relying heavily on offsets.
- **Transparent Reporting:** Publicly disclosing verifiable information on emissions inventories and progress.
- **Use of Removal Technologies (as a last resort):** Employing permanent carbon removal and storage only for unavoidable residual emissions

NET Zero Initiative

The **Net Zero initiative** refers to the global effort by countries, corporations, cities, and financial institutions to balance the amount of greenhouse gases emitted into the atmosphere with the amount removed, in order to stabilize global temperatures and avert the worst impacts of climate change. The scientific consensus is that global emissions must reach net zero by 2050 to keep the global temperature increase limited to 1.5°C above pre-industrial levels.

Key aspects and major initiatives of the Net Zero movement include:

Global Frameworks and Targets

- **Paris Agreement Goal:** The core objective guiding these initiatives is to limit global warming to well below 2°C, and preferably to 1.5°C, compared to pre-industrial levels.
- **United Nations Net Zero Coalition:** This is a growing group of actors committed to achieving net-zero emissions, emphasizing that this requires a complete transformation of how we produce, consume, and move about.
- **Race to Zero Campaign:** The UNFCCC's Race to Zero campaign is a global initiative that mobilizes a coalition of non-state actors (including companies, cities, regions, and financial and educational institutions) to take rigorous, immediate action to halve global emissions by 2030 and reach net zero by 2050.
- **Science Based Targets initiative (SBTi):** The SBTi provides the world's only framework for corporate net-zero target setting in line with climate science. It requires companies to set both near-term targets (halve emissions by 2030) and long-term targets (reduce at least 90% of emissions by 2050), and neutralize only the small fraction of residual emissions with permanent removals.
- **Net Zero Tracker:** This research consortium tracks the quantity and quality of net-zero pledges by nations, states and regions, cities, and major corporations globally to ensure transparency and accountability.

National and Sector-Specific Initiatives

- **National Government Pledges:** As of June 2024, 107 countries have adopted net-zero pledges in some form, covering approximately 82% of global greenhouse gas emissions. For example, India has announced a target to achieve net zero by 2070, while many developed nations target 2050.

- **Net-Zero Government Initiative:** This initiative accelerates the decarbonization of national government operations to serve as a catalytic example for the broader economy.
- **Financial Sector Alliances:** UN-convened alliances like the Net-Zero Banking Alliance (NZBA) and the Net-Zero Export Credit Agencies Alliance (NZECA) unite financial institutions committed to aligning their lending and investment portfolios with net-zero pathways.
- **Industry Initiatives:** Sector-specific efforts include the IATA's "Fly Net Zero" commitment for airlines to achieve net zero by 2050, and the "Net Zero Carbon Events" initiative for the events industry.
- **US Department of Energy's Net Zero World Initiative:** This program provides expertise and support from U.S. national laboratories to partner countries to accelerate their clean energy transitions.

Core Strategies for Achievement

Achieving net zero involves a combination of strategies:

- **Rapid and Deep Emission Cuts:** Prioritizing the maximum possible reduction of direct and indirect emissions through energy efficiency and switching to renewable energy sources like wind and solar.
- **Carbon Dioxide Removal (CDR):** Using both nature-based solutions (like afforestation and wetland restoration) and technological solutions (like direct air capture and storage) to absorb unavoidable residual emissions from the atmosphere.
- **Finance and Innovation:** Tripling annual clean energy investment and fostering innovation in technologies that are currently in the demonstration or prototype phase are considered essential to bridge the gap to 2050 goals.
- **Policy and Regulation:** Strong government policies and transparent, robust standards are crucial to ensure commitments translate into meaningful, verifiable action and avoid greenwashing.

Future Readiness

"Future Readiness on NET ZERO" refers to the comprehensive preparation by countries, corporations, and other entities to effectively transition their operations and economies to a state where **greenhouse gas emissions are balanced by removals from the atmosphere by a target date** (e.g., 2050 globally, 2070 for India). This involves a strategic and systemic transformation, moving beyond mere pledges to credible, action-oriented roadmaps.

Key Aspects of Net Zero Readiness

- **Science-Based Targets (SBTs):** Readiness means setting ambitious, measurable, short-term (e.g., by 2030) and long-term targets aligned with the 1.5°C global warming limit, validated by expert frameworks like the Science Based Targets initiative (SBTi) Net-Zero Standard.

- **Deep Decarbonization First:** The core of future readiness is prioritizing direct emissions reductions (Scope 1 and 2, and the majority of Scope 3) within an organization's own operations and value chain. Offsets are used only for the small percentage of residual, unavoidable emissions.

- **Technological Innovation and Adoption:** Ready entities invest in and scale up low-carbon technologies, such as renewable energy (solar, wind), electric vehicles, heat pumps, green hydrogen, and carbon capture, utilization, and storage (CCUS), many of which are still at a demonstration or prototype phase.

- **Financial Flow Alignment:** Capital allocation is shifting, with increasing investment in sustainable projects. Future readiness involves attracting "green finance" through mechanisms like green bonds and implementing internal carbon pricing to guide investment decisions.

- **Policy and Governance Integration:** Effective national and corporate action requires a clear, stable policy framework and strong governance. This includes mandatory reporting (e.g., SEBI's BRSR in India), clear regulations, and leadership accountability (e.g., tying executive pay to climate goals).

- **Supply Chain and Stakeholder Engagement:** A significant portion of emissions (often over 80% for corporations) lies within the supply chain (Scope 3). Readiness involves robust engagement with suppliers, customers, and employees to ensure a collective transition.

Current Global Status

Despite growing momentum in target-setting among countries and companies, the world is not on track to meet the 1.5°C goal. A "significant gap" remains between pledges and credible action plans, particularly in "hard-to-abate" sectors like steel and cement. The transition is underway, but a transformative change, rather than incremental measures, is needed to accelerate progress.

Achieving net zero requires a two-pronged approach: drastically **reducing greenhouse gas (GHG) emissions** as close to zero as possible and **removing** any unavoidable, residual emissions from the atmosphere. This necessitates a rapid and systemic transformation across all sectors of the economy, including power, transportation, industry, buildings, agriculture, and forestry.

Key actions to achieve net zero include:

1. Transitioning to Clean Energy

Moving away from fossil fuels is a critical step, as the burning of coal, oil, and natural gas is the main source of global GHG emissions.

- **Investing in Renewable Energy**: Scaling up sources like solar, wind, hydro, and geothermal energy to provide 90% of electricity generation by 2050.
- **Enhancing Energy Storage**: Developing efficient battery and other storage systems to manage the intermittency of renewable energy sources.
- **Phasing out Fossil Fuels**: Stopping the development of new oil and gas fields and coal mines.

2. Improving Energy Efficiency

Doing more work with less energy is a cost-effective way to reduce emissions and decrease energy demand.

- **Upgrading Buildings**: Mandating green building codes, retrofitting older buildings with better insulation, and replacing fossil-fuel-powered heating and cooling systems with highly efficient heat pumps.
- **Optimizing Industrial Processes**: Implementing energy-saving technologies and practices in manufacturing and industrial operations.
- **Using Energy-Efficient Appliances**: Adopting energy-saving devices and LED lighting in homes and businesses.

3. Decarbonizing Transportation

The transportation sector needs to shift to low- or zero-emission alternatives.

- **Electrification**: Promoting the use of electric vehicles (EVs) for personal cars and trucks and expanding charging infrastructure.

- **Investing in Public Transit**: Encouraging the use of clean, public transportation systems, as well as walking and cycling infrastructure.
- **Developing Sustainable Fuels**: Investing in biofuels and green hydrogen for hard-to-abate sectors like aviation and shipping.

4. Implementing Carbon Capture and Removal

For the residual emissions that are difficult to eliminate (e.g., from some agricultural and industrial processes), actions must be taken to actively remove carbon from the atmosphere.

- **Natural Climate Solutions**: Protecting existing forests and undertaking large-scale afforestation (planting new trees) and reforestation projects, as trees naturally absorb CO2.
- **Technological Removal**: Developing and scaling technologies like Direct Air Capture and Storage (DACS) and Bioenergy with Carbon Capture and Storage (BECCS).

5. Cross-Sector Collaboration and Policy

- **Governmental Frameworks**: Implementing supportive policies, regulations, and incentives (e.g., carbon pricing) to encourage businesses and individuals to transition to a low-carbon economy.
- **Supply Chain Engagement**: Businesses working with their suppliers to track and reduce "Scope 3" indirect emissions across the entire value chain.
- **Individual Action**: Making conscious lifestyle choices such as reducing air travel, minimizing waste, and supporting companies with strong sustainability credentials.
- **Investing in Innovation**: Channeling investment into the research and development of new climate technologies to address current performance gaps in decarbonization

what actions can achieve the goal of NET ZERO

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What are steps taken in India for NET ZERO

India has a comprehensive plan to achieve net zero emissions by **2070**, centered around a "Panchamrit" (five nectars) strategy announced at the COP26 summit. This strategy is supported by various national policies and schemes across key sectors to transition to a low-carbon economy.

Key Targets and Strategy ("Panchamrit")

India's climate action is framed by specific, ambitious targets for 2030, with a long-term goal of net-zero by 2070:

- Achieve 500 GW of non-fossil fuel energy capacity.
- Source 50% of its energy requirements from renewable sources.
- Reduce total projected carbon emissions by one billion tons from now until 2030.
- Reduce the carbon intensity of its economy by 45% below 2005 levels.
- Achieve the target of net-zero emissions by 2070.

Major Actions and Initiatives

India's Long-Term Low-Carbon Development Strategy (LT-LEDS) outlines key transitions across multiple sectors:

- **Renewable Energy Expansion**: India has actively scaled up its renewable energy capacity, surpassing the 200 GW mark by October 2024, and has already achieved its initial NDC goal of 40% non-fossil fuel power capacity well ahead of the 2030 deadline. Key initiatives include:
  - **PM-KUSUM**: A scheme to subsidize farmers for installing solar irrigation pumps.
  - **Pradhan Mantri Surya Ghar Muft Bijli Yojana**: A grant scheme targeting the installation of rooftop solar panels in one crore (10 million) homes.
  - **Solar Parks Development**: The development of large-scale solar parks across various states.
  - **Waiver on Inter-State Transmission Charges**: A policy to encourage the inter-state trading of renewable power.

- **Decarbonizing Transportation**: The government is promoting a shift to cleaner transport systems:
    - **Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME) Scheme**: Provides subsidies for electric vehicles and supports the development of charging infrastructure.
    - **Bharat Stage (BS) Emission Standards**: The country leapfrogged from BS-IV to the stricter BS-VI norms for vehicles and fuel to reduce air pollution.
    - **Sustainable Alternative Towards Affordable Transportation (SATAT)**: An initiative to promote Compressed Bio-Gas (CBG) as an automotive fuel.
- **Industrial Efficiency and Green Fuels**: Actions target the industrial sector, including "hard-to-abate" areas like steel and cement:
    - **National Green Hydrogen Mission**: Aims to make India a global hub for the production, use, and export of green hydrogen, targeting 5 million metric tonnes of production annually by 2030.
    - **Perform, Achieve, and Trade (PAT) Scheme**: A market-based mechanism to enhance energy efficiency in large energy-intensive industries.
    - **Carbon Credit Trading Scheme (CCTS)**: Launched in July 2024 to create a domestic carbon market, incentivizing industries to adopt cleaner practices.
- **Enhancing Natural Carbon Sinks and Circular Economy**:
    - **National Mission for a Green India (GIM)** and **Nagar Van Yojana**: Schemes to support afforestation and increase forest cover.
    - **Ban on Single-Use Plastics**: A national ban on identified single-use plastic items was imposed from July 1, 2022.
    - **Circular Economy Action Plans**: Committees have been established to develop circular economy action plans for various waste categories (e.g., plastic, e-waste).
- **Lifestyle and Individual Action**:
    - **Mission LiFE (Lifestyle for Environment)**: A mass movement to nudge individual and community behavior toward environmentally conscious practices and sustainable consumption patterns.

These actions, along with heavy investment in research and innovation and a focus on international cooperation, form the backbone of India's long-term strategy to balance economic growth with environmental sustainability.

Annexure – 1: Return on Investment (ROI)

In this report Commercial Solar System of a 50 kW capacity is considered for this study. Commercial solar system in India, the estimated payback period is typically **3 to 5 years**, with an impressive **annual Return on Investment (ROI) often exceeding 25%**. This strong financial performance is driven by high commercial electricity tariffs and significant tax benefits, such as accelerated depreciation.

Investment and financial returns

- **System Cost**: The initial investment for a 50 kW commercial on-grid solar system in 2025 is estimated to be between ₹20–₹25 lakh, excluding GST.
- **Annual Savings**: Based on an average commercial electricity tariff of ₹9 per unit and an estimated annual generation of around 70,000 kWh, the annual energy savings can exceed ₹6.3 lakh.
- **Accelerated Depreciation**: Businesses can leverage accelerated depreciation provisions under Section 32 of the Income Tax Act. This allows them to claim up to 40% depreciation in the first year, significantly reducing taxable income and enhancing cash flow.
- **Faster Payback**: The combination of substantial annual energy savings and the cash flow benefits from accelerated depreciation shortens the payback period compared to residential installations.
- **Long-Term Gains**: After the initial investment is recouped, the system produces free electricity for its remaining 25+ year lifespan, leading to sustained savings and long-term financial returns**.**

Factors influencing ROI

- **Electricity Tariff**: Businesses with higher commercial tariffs stand to gain more, as the savings from solar generation are more pronounced.
- **Location and Irradiation**: The amount of sunlight received in a specific location affects the system's energy generation. States with high solar potential, like Rajasthan and Gujarat, can offer a better ROI.
- **Maintenance**: While generally low, ongoing operation and maintenance costs slightly influence the overall return.
- **CAPEX vs. OPEX**: Choosing between the Capital Expenditure (CAPEX) model, where the business owns the system, or the Operational Expenditure (OPEX) model, where a developer owns and maintains the system, impacts the ROI. The CAPEX model typically offers the highest long-term ROI due to asset ownership and tax benefits.

For commercial enterprises, a 50 kW solar system is not just an environmental choice but a sound financial investment that hedges against rising electricity costs and provides a strong, predictable return**.**

Illustration for a 50 kW Capacity System (Commercial)

This example provides typical estimates for a 50 kW commercial solar system in India. Actual figures will vary based on location, equipment quality, and local electricity tariffs.
Assumptions

- **Initial Investment Cost:** ₹22,00,000 (approx. ₹44,000 per kW, net of any potential subsidies for commercial use)
- **Estimated Annual Energy Generation:** 75,000 kWh
- **Average Electricity Tariff Rate:** ₹8 per kWh (Commercial rates vary widely)
- **System Lifespan:** 25 years
- **Annual Maintenance Cost (AMC):** ₹25,000 (approx. 1% of the initial cost)

Step-by-Step Calculation

1. **Calculate Annual Energy Savings:**
    - Annual Savings = Annual Energy Generation x Electricity Tariff Rate
    - Annual Savings = 75,000 kWh x **₹8/kWh = ₹6,00,000**
2. **Calculate Total Lifetime Energy Savings:**
    - Total Lifetime Savings = Annual Savings x **System Lifespan**
    - Total Lifetime Savings = ₹6,00,000/year x **25 years =₹ 1,50,00,000**
3. **Calculate Total Lifetime Operational Expenses:**
    - Total O&M Expenses = AMC x System LifeSpan
    - Total O&M Expenses = ₹25,000/year x 25 years = **₹6,25,000**
4. **Calculate Net Lifetime Savings (Net Profit):**
    - Net Lifetime Savings = Total Lifetime Savings - Total O&M Expenses
    - Net Lifetime Savings = ₹1,50,00,000 - ₹6,25,000 = **₹1,43,75,000**
5. **Apply the ROI Formula:**

    ROI (%) = (Net Lifetime Savings / Total Initial Investment) x 100

    ROI (%) = (1,43,75,000 / 22,00,000) x 100

    ROI (%) = (6.53 / 100) x 65.3 %

Additional Metric: Payback Period
The payback period is the time it takes for annual savings to equal the initial investment, indicating when the system starts generating pure profit.

- Payback Period (Years) = Total Initial Investment / Annual Savings
- Payback Period (Years) = ₹22,00,000 / ₹6,00,000 = **~3.67 years**

Key Factors Affecting ROI

- **Location and Sunlight:** More sun hours mean greater energy generation and higher ROI.
- **Electricity Tariff:** Higher commercial electricity rates mean faster and greater savings.
- **Government Incentives:** Subsidies, tax credits (like accelerated depreciation for businesses), and net-metering policies significantly improve ROI by reducing upfront costs or allowing the sale of excess power.
- **System Quality:** High-efficiency panels and inverters ensure better performance and longevity, leading to higher lifetime savings.
- **Maintenance:** While generally low, unaccounted maintenance costs can slightly impact net savings.

Annexure – 2: Commercial Proposal

In the Commercial Proposal below mentioned to be included:

1. Executive Summary and Company Information

This section introduces the project and the installer's credibility.

- **Executive Summary:** A concise overview of the proposed solution, highlighting the main benefits, total cost, estimated savings, and projected return on investment (ROI).
- **Client Needs Analysis:** A section demonstrating an understanding of the client's current energy usage, specific goals, and pain points (e.g., high electricity bills).

2. Technical System Design and Scope

This section details *what* will be installed and *how* it will perform.

- **Site Analysis & Suitability:** An assessment of the property's suitability for solar installation, including factors like roof condition, orientation, sunlight exposure, and shading issues.
- **System Description:** An explanation of the proposed system's specifications, such as size (in kW), type (e.g., grid-tied), and configuration.
- **Equipment Specifications:** An itemized list of all major components with manufacturer brand names and model numbers:
  - **Solar Panels (PV Modules):** Type (mono/poly), efficiency, and warranty.
  - **Inverter(s):** The technology used to convert DC to AC power.
  - **Mounting System:** The racking and structure used to secure the panels.
  - **Balance of System (BOS):** Wiring, safety disconnects, and monitoring systems.
- **Energy Production Estimates:** Projections for the system's expected energy output annually and monthly, often presented with charts or graphs.

3. Financial, Contractual, and Logistical Details

This section covers the investment, timeline, and terms of the agreement.

- **Financial Analysis & Savings:** Projections for energy savings, the payback period, and overall ROI. This should also mention eligible financial incentives and tax credits.
- **Financing Options:** An explanation of available payment options, such as cash purchases, solar loans, or Power Purchase Agreements (PPAs).
- **Project Timeline:** A step-by-step schedule from contract signing to final commissioning and net metering activation.

- **Warranties and Support:** Details on manufacturer warranties for components and the installer's guarantee on workmanship.
- **Terms, Conditions, & Acceptance:** The legal framework for the agreement, including payment terms, scope of work, and a dedicated space for the client's signature