7 PM COMPILATION

3rd and 4th week May, 2026

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- Comprehensive coverage of a given current topic
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India-UAE Relations – Explained Pointwise

India and the United Arab Emirates share a long-standing relationship shaped by trade, cultural exchanges, and strong community connections across the Arabian Sea. Trade in pearls, dates, spices, textiles, and fisheries connected western India with the Gulf region for centuries. Recently, PM Narendra Modi had a brief stopover in Abu Dhabi, days after UAE came under Iranian missile & drone attacks. Criticizing the attack on the Emirates, PM Modi said that India stands shoulder to shoulder with the UAE.

Source: ForumIAS

Evolution of India-UAE Relations:

Historical & Maritime Foundations (Pre-1971)	• The bond predates the formation of the UAE. For centuries, the Malabar coast and the Arabian Peninsula were linked by maritime trade. • Indian seafarers exchanged spices, textiles, and precious stones for dates and pearls. • Until 1966, the **Gulf Rupee** (issued by the Reserve Bank of India) was the official currency in the region, illustrating the deep economic integration.

Diplomatic Launch & The "Oil-Labor" Era **(1971–2014)**	• India was among the first countries to recognize the **UAE federation** in **1971**, establishing **formal diplomatic relations** in **1972**. • The discovery of oil in the UAE drastically altered the trade dynamic. The UAE became a vital anchor for India's energy security, while India provided the vast blue-collar workforce required to build the UAE's modern infrastructure. This era saw a massive influx of Indian blue-collar workers. • By the early 1990s, as India opened up its economy through liberalization and Dubai positioned itself as a global logistics and re-export hub, bilateral trade began expanding beyond traditional commodities.
The Strategic Leap **(2015–Present)**	• The visit of PM Narendra Modi in 2015 (first by an Indian PM in over three decades) marked a "renaissance" in bilateral ties. • **Comprehensive Strategic Partnership (2017):** The relationship was formally elevated during MBZ's visit as the Chief Guest for India's Republic Day. • The signing of the **Comprehensive Economic Partnership Agreement (CEPA)** in 2022 transformed the economic landscape.

What are the various initiatives to boost India-UAE relations?

Energy Security	• **Strategic Petroleum Reserves (SPR) Expansion:** The Abu Dhabi National Oil Company (ADNOC) and Indian Strategic Petroleum Reserves Limited (ISPRL) have entered into structural pacts to store millions of barrels of Emirati crude in India's underground strategic reserves. This guarantees India emergency access to oil during geopolitical supply chain chokepoints. • **Long-Term LPG & LNG Sourcing:** Moving away from volatile spot-market purchases, Indian Oil Corporation (IOC) and ADNOC finalized robust, long-term supply agreements for Liquefied Petroleum Gas (LPG) and Liquefied Natural Gas (LNG) to ensure structural price stability for Indian consumers.
Economic	• **CEPA (Comprehensive Economic Partnership Agreement):** Implemented to eliminate or drastically reduce tariffs on over 90% of products, this agreement successfully pushed bilateral merchandise trade past **$100 billion** for the first time in the 2025–2026 fiscal year. Bolstered by this success, both nations have officially committed to an ambitious target of **$200 billion in bilateral trade by 2032.**

	• **Local Currency Settlement System (LCSS):** This operationalized mechanism allows Indian and Emirati businesses to bypass the US dollar entirely, settling trade invoices directly in Indian Rupees and UAE Dirhams. • **Digital Payment Linking (UPI & JANI/Jaywan):** India's Unified Payments Interface (UPI) has been interconnected with the UAE's instant payment platform. This integration allows seamless cross-border fund transfers and card swiping for travelers, dramatically reducing transaction costs for the massive Indian diaspora.

Security	• **Joint Military Exercises:**
	  ○ **Desert Cyclone (Army):** This is the flagship joint military exercise between the Indian Army and the UAE Land Forces. It focuses explicitly on **urban warfare, counter-insurgency, and desert combat operations.**
	  ○ **Zayed Talwar (Navy):** A bilateral naval exercise designed to enhance interoperability between the Indian Navy and the UAE Navy. It focuses on maritime search and rescue, anti-piracy operations, air defense tracking, and securing vital Sea Lines of Communication (SLOCs) in the Persian Gulf and Arabian Sea.
	  ○ **Desert Eagle (Air Force):** Periodic tactical fighter exercises where the Indian Air Force (IAF) and the UAE Air Force engage in simulated, high-intensity aerial combat maneuvers.
	• **Zero Tolerance on Extremism:** Both nations have created a joint working group on counter-terrorism. This has led to highly effective intelligence sharing regarding online radicalization, the movement of transnational terrorists, and the tracking of extremist recruitment networks across the Middle East and South Asia.

Technological	• **8-Exaflop Supercomputing Cluster:** A breakthrough technological initiative signed between India's C-DAC and the UAE's AI giant, G42, to co-develop an ultra-high-speed, sovereign supercomputing cluster to advance AI research, climate modeling, and data analytics. • **Integrated Space Ecosystem:** Moving beyond simple satellite launches, both nations have agreed on an initiative aimed at full-scale commercialization of the space sector. This includes building end-to-end infrastructure, launching joint space missions, and fostering cross-border aerospace startups. • **Project SHANTI (Civil Nuclear Cooperation):** Enabled by India's legislative advancements in advanced energy, both nations have established a roadmap to collaborate on advanced reactor systems, small modular reactors (SMRs), and mutual maintenance workflows for nuclear power plants.

Misc	• **I2U2 Food Security Corridor:** Funded by UAE, this initiative integrates Israeli water-saving technology with Indian agricultural land. High-tech **Food Parks** are being built across India to process and package crops directly for dedicated, cold-chain export corridors to the UAE, creating guaranteed demand for Indian farmers and food security for the Gulf. • **Global Off-shore Campuses:** Elevating cultural and academic soft power, elite Indian institutions have physically expanded into the UAE, highlighted by operational offshore campuses of the **Indian Institute of Technology (IIT) Delhi in Abu Dhabi** and the **Indian Institute of Management (IIM) Ahmedabad in Dubai.**

What is the Significance of India-UAE Relations?

Geopolitical Significance	• **Bridge to the Arab World:** The UAE, under its visionary leadership, is a pivotal state in the Gulf Cooperation Council (GCC) and the wider Islamic world. Strong ties with the UAE enhance India's standing and diplomacy across the Middle East. • **Balancing Act in a Multipolar Region:** Both nations share a preference for strategic autonomy. The partnership helps balance other regional powers and provides India a stable, influential partner amid complex regional dynamics (e.g., Iran-Saudi tensions). • **Counter-Balancing:** The partnership provides India with a stable anchor in West Asia, especially as a counterweight to shifting dynamics like the 2025 Saudi-Pakistan defense pact. • **Multilateral Forums:** The UAE is a key partner for India in mini-laterals like the **I2U2 Group** (India-Israel-UAE-USA) and within BRICS and the UN. This amplifies India's voice on global issues.
Economic & Trade Significance	• **Trade Powerhouse:** The UAE is India's **3rd largest trading partner** (after US and China) and **2nd largest export destination**. Bilateral trade reached **$100 billion** in FY 2024–25, aided by the landmark **Comprehensive Economic Partnership Agreement (CEPA)** signed in 2022. • **Investments:** UAE sovereign wealth funds are major investors in India across infrastructure, renewable energy, technology, and logistics. The UAE committed to a **$75 billion investment** in India's infrastructure, signaling a move from being just a trade partner to a long-term stakeholder.

	• **Gateway to West Asia & Africa:** The UAE's world-class logistics hubs (like Jebel Ali Port) serve as a critical **trade and connectivity corridor** for Indian goods to the Middle East, Africa, and Europe.
Energy Security	• **Energy Supplier**: The UAE is a **stable and reliable energy supplier** for India, meeting a significant portion of its crude oil and LNG needs. Last year, UAE was 4th largest source of crude oil, meeting nearly 11% of the requirement. UAE is the largest source of LPG, catering to ~40% of the requirement. • **Strategic Petroleum Reserves (SPR):** The Abu Dhabi National Oil Company (ADNOC) was the first foreign mega-corporation to invest in India's underground strategic oil reserves (such as the Mangaluru facility). • **Renewable Energy**: Growing collaboration in **renewable energy**, with UAE investing in India's massive solar energy sector.
Diaspora & Remittances	• The **3.5 million-strong Indian community** in the UAE (~35% of its population) is the **largest expatriate group** and the backbone of the UAE's workforce, contributing significantly to its economy and society. The diaspora has transitioned from predominantly blue-collar labor to high-earning white-collar professionals, tech entrepreneurs, and academics. • The UAE is the **largest single-source of remittances to India** (over **$15-18 billion annually**), vital for India's foreign exchange reserves and household incomes in states like Kerala, Tamil Nadu, and Uttar Pradesh. • The community acts as a **living bridge**, fostering deep people-to-people ties and cultural understanding.
Strategic & Security Cooperation	• **Counter-Terrorism & Intelligence:** Close cooperation on counter-terrorism, deradicalization, and intelligence sharing is crucial for regional stability and for addressing mutual security threats. • **Defense Ties:** Regular joint military exercises (air force 'Desert Eagle', naval exercises), port calls, and defense dialogues. The UAE is a key security partner in the volatile Gulf region. • **Maritime Security:** Collaboration to secure vital sea lanes in the Western Indian Ocean and the Gulf, which are lifelines for India's energy and trade flows.
Cultural & Soft Power	• The inauguration of the **BAPS Hindu Mandir in Abu Dhabi** is a historic symbol of religious tolerance and deep cultural respect, significantly boosting India's soft power.

What are the Challenges in India-UAE Relations?

1. **Economic & Trade Frictions:**
    - **Trade Imbalance:** While trade volume is huge, the balance often tilts toward the UAE (due to oil & gold imports). India's exports to the UAE are heavily dominated by traditional sectors like gems, jewelry, textiles, and refined petroleum. Expanding India's share in high-value manufacturing, engineering goods, and technology services remains slow due to non-tariff barriers.
    - **Non-Tariff Barriers (NTBs):** Indian exporters, particularly in the agricultural and pharmaceutical sectors, frequently encounter strict sanitary and phytosanitary (SPS) measures. Despite the CEPA, issues like stringent product standards, certification hurdles, and customs procedures can act as de facto barriers for Indian exporters.
    - **Oil Dependency:** While the relationship is diversifying into renewables and nuclear (under the SHANTI Law), the bulk of trade is still anchored in hydrocarbons. This makes both economies vulnerable to global oil price shocks and the accelerating global shift toward green energy.
2. **Geopolitical Tightrope:**
    - **UAE-Pakistan Relations:** The UAE has historically close ties with Pakistan, including military cooperation and hosting of Pakistani diaspora. While the relationship with India has grown, the UAE continues to engage with Pakistan, which can be a source of sensitivity, especially during India-Pakistan crises (e.g. post-Pulwama or Operation Sindoor).
    - **Iran-UAE Tightrope:** Following intense geopolitical flare-ups in the region – such as the recent missile and drone strikes targeting the UAE – India has had to walk a narrow diplomatic tightrope. Indian Prime Minister explicitly condemned the strikes, standing "shoulder-to-shoulder" with Abu Dhabi. However, India must simultaneously manage its vital strategic relationship with Tehran, particularly regarding the operation of the Chabahar Port and transit access to Central Asia.
    - **China's Growing Role in the UAE:** China is the UAE's largest trading partner. The UAE is a key node in China's Belt & Road Initiative (BRI). Chinese ports, tech companies (Huawei, 5G), and military cooperation in the UAE create strategic competition for India, which sees the UAE as a partner for the India-Middle East-Europe Corridor (IMEC).
    - **Vulnerability of Maritime Chokepoints:** The modern maritime crisis underscores a shared vulnerability. A major portion of India's energy imports passes directly through the **Strait of Hormuz**. Any blockade or escalation by regional actors directly threatens India's domestic energy security and food corridor logistics with the UAE.
3. **Diaspora-related Issues:**
    - **Economic Vulnerability of Blue-Collar Workers:** Despite a massive shift toward high-skilled white-collar professionals, a significant portion of the diaspora remains in low-wage construction and domestic sectors. Issues related to harsh working conditions, delayed wage payments, and the strict *Kafala* (sponsorship) system require constant diplomatic intervention.
    - **Visa and Labor Reforms:** The UAE's evolving labor laws (like the **"Emiratization" Policy** *[increase the national workforce in the private sector]*) and visa regulations, while progressive, can create uncertainty for the large Indian workforce, especially blue-collar workers.

What should be the Way Forward?

1. **Deepen the Economic Integration**: The current CEPA is a foundation, not the ceiling. The focus must shift to **value-added sectors** and **financial integration.** Move beyond raw materials (oil, gems) and low-skill exports. Target co-production in:
    - **Pharmaceuticals & Medical Devices:** Create a joint regulatory fast-track for Indian generics and medical devices to access UAE ports for re-export to Africa and the Middle East.
    - **Aerospace & Defense:** Move from joint exercises to joint manufacturing (e.g., co-developing UAVs, cybersecurity hardware, or maintenance hubs for Indian military platforms in UAE).
    - **Semiconductors & Electronics:** Leverage UAE sovereign wealth and Indian talent to build chip design or assembly units under India's semiconductor mission.
2. **Manage Geopolitical Frictions Maturely**:
    - **On China:** Instead of demanding the UAE to choose sides, offer a superior "India-UAE model" (democracy + market + technology) versus the "China-UAE model" (autocracy + credit + infrastructure). Let the UAE benefit from both while tilting towards India on strategic issues (like IMEC).
    - **On Pakistan:** Institutionalize a "no-surprises" protocol. The UAE should inform India in advance of any high-level military or political engagement with Pakistan, and India should similarly share its concerns. This builds trust without requiring the UAE to break ties.
    - **On Iran:** Maintain a "separation of tracks." Both nations can cooperate on maritime security with the US while continuing trade with Iran. A joint India-UAE working group on sanctions compliance will help navigate US secondary sanctions.
3. **Institutionalize a 2+2 Ministerial Dialogue:** Like India has with the US and Australia, a regular dialogue between the Indian External Affairs & Defence Ministers and their UAE counterparts (Foreign & Defence) to coordinate on maritime, air, and cyber security.
4. **Operationalizing IMEEC and MAITRI:** Both nations must expedite the technical and customs integration of the **India-Middle East-Europe Economic Corridor (IMEEC)** and Project **MAITRI**. This includes harmonizing digital custom clearances and container-tracking systems to ensure that goods move seamlessly from Indian ports to Jebel Ali, and onward via rail.
5. **Scaling the Local Currency Settlement System (LCSS):** While the framework to trade in Indian Rupees and UAE Dirhams exists, its adoption must be scaled beyond major oil and gold conglomerates. Incentivizing small and medium enterprises (MSMEs) to use the LCSS will drastically reduce dollar-dependence and transaction costs.
6. **Joint Skill-Mapping and Certification:** As the UAE pushes its "Emiratization" policy and transitions toward a high-tech economy, India's National Skill Development Corporation (NSDC) should partner with UAE authorities to align Indian vocational training with modern Emirati job requirements. This will ensure that Indian workers transition from low-wage manual labor to high-value technical and service roles.
7. **Digital Upgradation of Worker Portals:** Integrating India's *e-Migrate* system directly with the UAE's Ministry of Human Resources and Emiratisation (MoHRE) digital platform will eliminate predatory middle-men, automate contract verification, and guarantee transparent wage payouts, effectively insulating vulnerable blue-collar workers.

UPSC GS-2: International Relations
Read More: The Indian Express

Energy Storage Systems – Significance & Challenges – Explained Pointwise

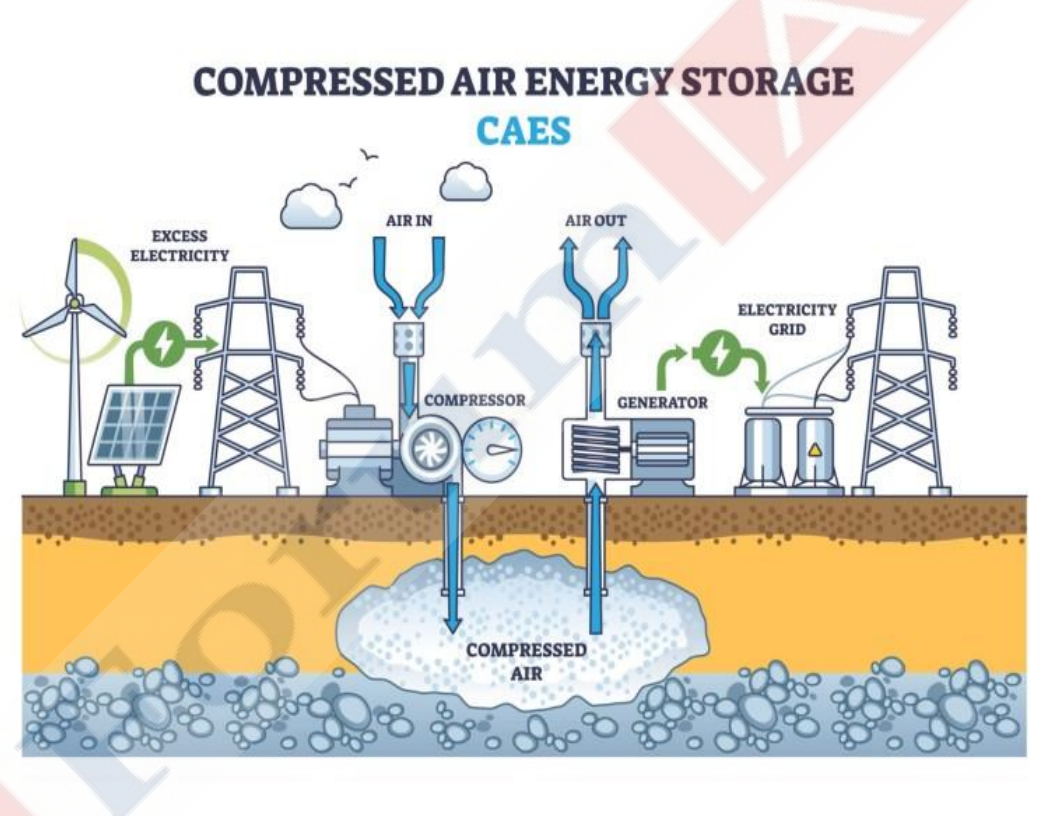
With the world shifting toward renewable energy like solar and wind, energy storage has become the missing puzzle piece for a clean energy future. India, which is rapidly expanding its renewable energy capacity, is facing a key challenge due to the vast gap between its actual operational capacity & its ambitious project pipeline.

What is energy storage?

- Energy storage refers to systems that can store excess renewable electricity during periods of high generation & discharge it when demand rises but power generation remains low.
- At its core, energy storage systems convert electricity from renewable sources such as solar & wind, when it is available, into forms that can be stored.
- Energy storage systems are required because of the core problem associated with the renewable energy: **Supply-Demand Mismatch**. Renewable energy sources like solar and wind are **intermittent** — they generate power only when the sun shines or the wind blows, not necessarily when people need electricity. Demand, on the other hand, follows human patterns (mornings, evenings, seasonal peaks) that rarely align with natural generation patterns.
- Energy storage is one of the most critical challenges in the **transition to clean energy**.

What are the different types of energy storage technologies?

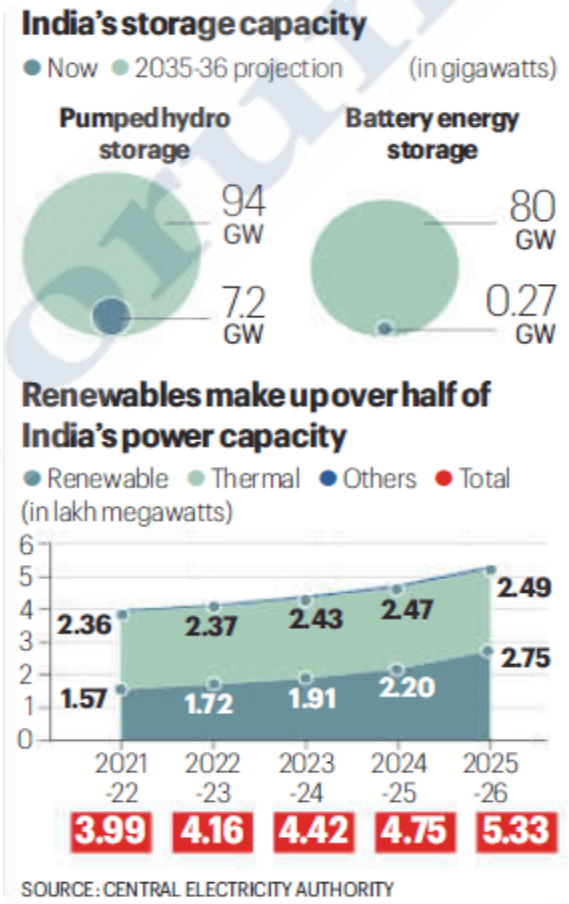
Pumped Hydro Storage (PHS)	Two reservoirs at different elevations. When energy is cheap/excess, water is pumped to the upper reservoir. When energy is needed, water is released back down through turbines to generate electricity.
Battery Energy Storage (BESS)	Stores electricity chemically & discharges it through chemical reactions when needed. Lithium-ion batteries, particularly **lithium iron phosphate (LHP) batteries**, are the dominant technology because of their falling costs, high efficiency & long operational life. This is currently the fastest-growing sector of energy storage.

Concentrating Solar-Thermal Storage Systems	This technology uses mirrors that capture & focus sunlight onto a receiver. As the receiver gets heated, materials such as molten salt are circulated inside the receiver to store the heat. The stored heat can later be used to produce steam. This steam is converted into mechanical energy in turbine, which powers a generator to produce electricity.
Compressed-Air Energy Storage Systems	Excess electricity powers a compressor to pump air into a sealed underground cavern (salt dome, aquifer, or depleted gas field). To retrieve energy, the compressed air is released, heated (natural gas is often used to reheat it), and expanded through a turbine.  Compressed air energy storage or CAES power production outline diagram.
Flywheel Energy Storage Systems	A large, heavy rotor (flywheel) is spun at very high speeds (up to 50,000+ RPM) in a near-frictionless vacuum. Energy is stored as rotational kinetic energy. To extract power, the flywheel's momentum drives a generator, slowing it down. Flywheels can discharge almost instantly, making them perfect for stabilizing short-term grid fluctuations.

Gravity Energy Storage Systems	GESS use electricity to lift heavy weights to higher elevations. When electricity is needed, the weights are lowered, converting gravitational energy back into electrical through generators.

What is the status of energy storage capacity globally & domestically?

- **China** continues to dominate, accounting for **~60%** of new installations in 2025, followed by the **United States** at **16%** .
- Globally, PHS & BESS are two most widely deployed electricity storage technologies. While batteries are growing fast, **pumped storage hydropower (PSH)** remains the largest source of grid-scale energy storage worldwide, with approximately **160 GW of operating capacity** and a massive pipeline of prospective projects.
- India has approximately **7 GW of operational Pumped Storage (PSP) capacity** & **under 1GW of BESS operational capacity**. The total planned capacity of **174 GW** is expected to support a national grid with **509 GW of solar** and **155 GW of wind** by 2036, this includes **80 GW of BESS & 94 GW of PHS**.



Source: Indian Express

What is the need for energy storage?

1. **Smoothing Out Variability:** Solar panels produce peak power at midday; wind turbines may generate most at night or in storms. Without storage, this surplus is wasted. Storage captures excess generation and dispatches it when needed.
2. **Grid Stability & Frequency Regulation:** Power grids require near-perfect real-time balance between supply and demand. Traditional fossil fuel plants can ramp up or down on demand. Renewables cannot. Storage acts as a buffer, absorbing or injecting power within milliseconds to keep frequency stable.
3. **Replacing "Peaker" Plants:** To handle sudden spikes in energy demand (like hot summer afternoons), utilities rely on **peaker plants**. These are typically natural gas plants that sit idle most of the year but can be turned on quickly. Because they only run occasionally, they are very expensive to operate and are often the dirtiest, most polluting plants on the grid. Battery storage can serve the same role more cheaply and cleanly.
4. **Enabling Higher Renewable Penetration:** Without storage, grids become unstable above ~30–40% renewable share. Storage is what makes 70–100% renewable grids physically possible — it's the bridge between generation and consumption.
5. **Reducing Curtailment (Wasted Energy):** When wind turbines or solar farms produce more electricity than the grid can safely handle, grid operators are forced to intentionally shut them off or disconnect them. This is called **curtailment** — wasting clean energy. Storage eliminates this waste.
6. **Energy Independence & Resilience:** Stored energy provides backup during outages, reduces reliance on fuel imports, and makes microgrids and remote communities self-sufficient.
7. **Transmission Congestion Relief:** Storage located near load centers can reduce the need for expensive long-distance transmission upgrades by serving local demand directly.

What are the challenges associated with energy storage?

1. **Massive Gap Between Capacity & Deployment**: India's storage ambitions on paper vastly outpace what's actually been built. India's limited domestic cell manufacturing base means that only 219 MWh of BESS capacity is operational from 12.8 GWh auctioned between 2022 and May 2025, largely reflecting execution gaps driven by high financing costs and aggressive underbidding.
2. **High Upfront Capital Costs (CapEx):** Building a grid-scale battery farm or a pumped hydro station costs billions of dollars. Unlike a gas turbine, which can be built in phases, a pumped hydro plant requires the entire dam, reservoir, and turbines to be built before it generates some revenue.
3. **Round-Trip Efficiency Losses**: No energy storage system is perfect; energy is always lost when converting it from one form to another and back again. This is known as **round-trip efficiency. Batteries** are highly efficient, retaining about 80% to 90% of the energy put into them. **Hydrogen Storage** is the least efficient. Generating hydrogen via electrolysis, compressing it, storing it, and later converting it back to electricity via a fuel cell or turbine results in a round-trip efficiency of only **30% to 45%**. This means more than half of the clean energy captured is lost as waste heat.
4. **Geopolitical Monopolies:** The mining and processing of essential battery materials—such as **lithium, cobalt, nickel, and manganese**—are concentrated in just a few countries. For instance, a vast majority of the world's cobalt is mined in the Democratic Republic of Congo, and China dominates the global refining capacity for almost all of these minerals.
5. **Degradation and Limited Lifespan**: Unlike a coal plant or a hydroelectric dam that can operate for 40 to 100 years with regular maintenance, chemical batteries wear out. Most grid-scale batteries only last about **10 to 15 years** before their capacity drops significantly and they need to be replaced. This

limited lifespan introduces a recurring long-term cost for grid operators who must constantly plan for battery replacement.

6. **Recycling Hurdles:** Spent lithium-ion batteries are very difficult and expensive to recycle due to their complex chemical mixtures. As millions of electric vehicles and grid batteries reach the end of their lives over the next decade, managing this wave of electronic waste is a massive looming challenge.

What are various government initiatives to promote battery storage?

1. **Advanced Chemistry Cell (ACC) PLI Scheme:** Overseen by the Ministry of Heavy Industries, this ₹18,100 crore Production-Linked Incentive scheme aims to establish 50 GWh of competitive domestic battery manufacturing.
2. **Viability Gap Funding (VGF) Scheme:** Provides financial support to make BESS projects commercially viable and accelerate early deployment. The government is aggressively deploying VGF to lower project costs for developers.
3. **Energy Storage Obligations (ESO):** Similar to Renewable Purchase Obligations, the government has legally mandated that power distribution companies (DISCOMs) must source a specific percentage of their electricity from storage-backed systems, scaling up to **4% of total energy consumption by 2030.**
4. **Transition from Plain Renewable Tenders:** Renewable Energy Implementing Agencies (like SECI, NTPC, and NHPC) have been directed to stop offering standard solar or wind contracts. Instead, they are pushing **"Round-the-Clock" (RTC)** and **"Firm and Dispatchable Renewable Energy" (FDRE)** tenders, forcing developers to integrate batteries to guarantee stable power delivery.
5. **Waiver of Inter-State Transmission System (ISTS) Charges:** To lower operational expenses, the government has waived inter-state transmission fees for electricity utilized by energy storage systems, making it cheaper to transport stored green energy across state lines.
6. **India Battery Storage Vision 2047:** Looking long-term, ministries are already formalizing a policy framework to introduce financial backing and interest subventions specifically for **Long-Duration Energy Storage (LDES)** technologies to manage seasonal energy shifts.

What should be the way forward?

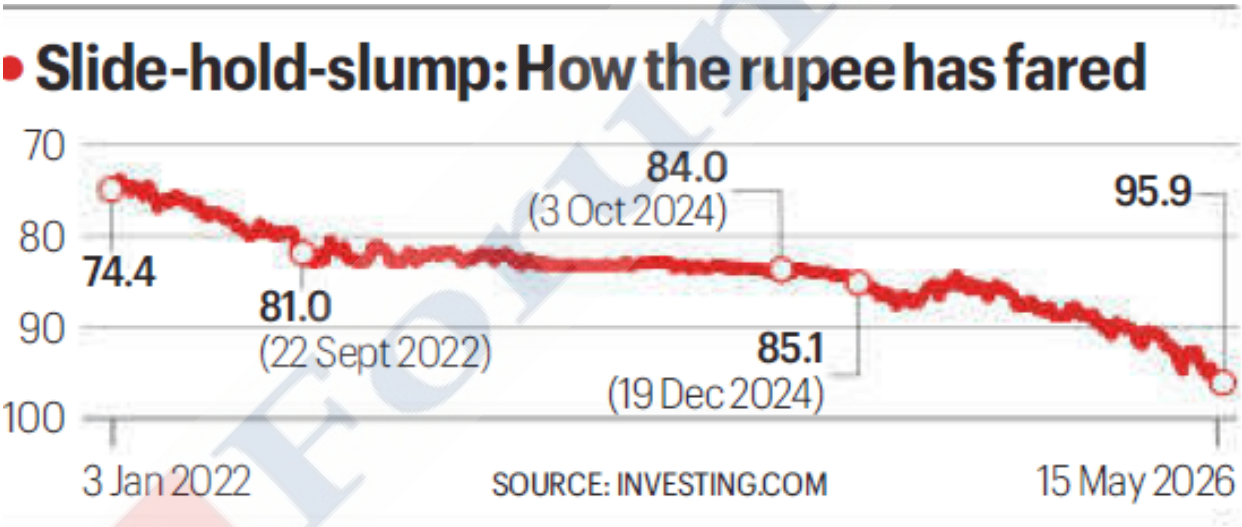
1. **Scale Domestic Manufacturing**:
   Relying entirely on imported battery cells (predominantly from China) poses a massive geopolitical and economic risk. India must build its own manufacturing ecosystem. The government's **Advanced Chemistry Cell Production-Linked Incentive (PLI) scheme** is a great start.
   However, since India has limited domestic lithium reserves, the country must heavily fund research and commercialization of alternative chemistries like **Sodium-ion** and **Zinc-air** batteries, which are well-suited for stationary grid storage.
2. **Leverage Massive Pumped Hydro Projects (PHS)**: While chemical batteries dominate short-duration needs (2–4 hours), India has immense natural topography suited for Pumped Hydroelectric Storage, which is ideal for long-duration storage. Unlike lithium-ion batteries, PHS projects have a lifespan of over 50 years and do not rely on scarce critical minerals.
3. **Decentralize Storage**: Large battery farms aren't the only solution; storage needs to be deployed at the consumer level. Farmers using solar water pumps and residential homes with rooftop solar should be incentivized to add small battery packs. This turns consumers into "prosumers" who can support the grid locally.
4. **Accelerate Grid Infrastructure**: Storage without grid readiness is futile. Investments under the Green Energy Corridor programme are expanding transmission infrastructure to connect renewable-rich regions with demand centres, reducing curtailment risks and improving system integration.

5. **Replacing Diesel Generators:** India has mandated a phased shift away from highly polluting diesel generator sets for backup power in commercial buildings. Incentivizing these buildings to switch to Battery Energy Storage Systems (BESS) will drastically cut urban air pollution.
6. **Build a Battery Recycling Ecosystem**: India must get ahead of the end-of-life problem before it becomes a crisis. A circular economy framework — including second-life battery applications (e.g., retired EV batteries repurposed for grid storage) and formal recycling infrastructure — will reduce material costs, environmental harm, and long-term import dependence.

UPSC GS-3: Energy Infrastructure
Read More: Indian Express

Weakening of Rupee – Causes & Consequences – Explained Pointwise

The Indian rupee has recently fallen past the 96-per-dollar mark, hitting a new record low. The rupee has declined by nearly 5.2% against the dollar since the Iran-US conflict began in late February. There is a strong possibility of it crossing the psychological level of 100 per dollar, which could further weaken investor sentiment.



Source: Indian Express

There are several factors responsible for the weakening of the Indian rupee, even as the currencies of many other emerging market economies are strengthening against the dollar. In this article, we will try to understand the major causes and consequences of the weakening of the rupee.

What are the factors responsible for weakening of the Rupee against Dollar?

1. **Domestic Factors:**
    a. **Widening Current Account Deficit (CAD):** The structural gap between India's imports and exports has expanded significantly. Beyond the massive energy bill, high international prices for other essential commodities have bloated India's overall import costs. A widening trade deficit creates a natural imbalance, leaving the country with an increased systemic demand for foreign currency.
    b. **Foreign Capital Outflows (FII & FPI Sell-offs):** With better returns available in the US and high valuations in Indian equity markets, FPIs and FIIs have become major net sellers. As foreign investors withdraw billions of dollars from Indian stocks and government securities (G-Secs) and send the money back to the US, they sell Rupees to buy Dollars, which puts further pressure on the Rupee to weaken.
    c. **Importers Are Buying Dollars in Advance**: Indian companies dependent on imported goods and raw materials have increasingly started securing dollars in advance to protect themselves against further currency depreciation. This precautionary demand for dollars has added additional pressure to the forex market during volatile sessions.
    d. **Limited Export Competitiveness**: While sectors like IT and pharma can benefit from a weaker rupee, the overall benefit is limited because many Indian exports rely on imported components, which have become more expensive.
    e. **Inflation & Growth Headwinds:** Even though, the long-term growth outlook remains strong, but, the slower near-term GDP growth & very low inflation level have acted as negative economic indicators, dampening investor confidence in Rupee's short term stability.
2. **External & Global Factors:**

a. **India-USA Trade Tensions & Tariffs:** USA is India's one of the top trading partners. However, the imposition of 50% tariff on Indian goods by the Trump administration has severely impacted the export competitiveness of Indian goods & has increased the market risk perception – making Indian rupee the worst performing currency in Asia for the year.
b. **Geopolitical Tensions**: Wars, conflicts (e.g. Russia-Ukraine, US-Iran War), or global crises trigger risk-off sentiment, pushing investors toward the dollar. Geopolitical conflicts in the Middle East and supply-chain anxieties around the Strait of Hormuz have pushed Brent crude oil prices past the $100–$110 per barrel mark.
c. **High Crude Oil Prices & Import Dependence:** India imports almost 80-85% of its crude oil, thus, it is highly vulnerable to global energy spikes. The rise in the crude oil prices & that of the important commodities imported by India like gold – lead to widening of India's trade deficit & weakening of INR.
d. **Strengthening of USA Dollar:** Despite the US Fed Reserve beginning its rate-cut cycle, the US Dollar has maintained persistent strength, reflecting its status as global reserve currency & a safe haven asset during a period of geopolitical uncertainty. During global market anxiety and geopolitical warfare, international investors flee emerging markets in search of safety which leads to strengthening of US dollar against major currencies & puts pressure on INR.

3. **Monetary Policy Factors:**
   a. **US Federal Reserve's Monetary Policy:** The US Federal Reserve's decision to increase interest rates makes USD-denominated assets more attractive to investors. This leads to capital outflows from emerging markets like India, further weakening the rupee.
   b. **RBI's Stance:** The RBI has chosen a **Neutral Policy Stance** & kept the repo rate unchanged for most part of the year 2025 – prioritizing domestic liquidity management & growth oven an aggressive defense of the Rupee.

What are consequences of weakening of the Rupee?

1. **Impact on Consumers:**
   a. **Inflationary Pressure (Imported Inflation):** As the INR weakens, the Oil Marketing Cos. have to pay more Rupees for the same barrel of oil. This increased cost is eventually passed on to the consumers through higher prices for petrol, diesel, and natural gas. This high fuel cost then triggers a cascading effect – contributing to broader consumer price inflation.
   b. **Rising Cost of Living:** The price of other key imports, such as electronics, gold, industrial chemicals, and fertilisers, also rise – intensifying the inflationary pressure & eroding the purchasing power & savings of the average household.
   c. **Foreign Travel & Education:** Foreign travel & education will become significantly expensive.
2. **Impact on Trade (Imports/Exports):**

The WINNERS	a. **Increased Competitiveness:** A weaker rupee makes the Indian goods & services cheaper for foreign buyers who pay in Dollars. This can boost the competitiveness of Indian exports in global market. b. **High Profitability for Exporters:** Indian exporters, particularly the IT Service Sector, benefit significantly. Weakening of the INR directly boosts their profit margin & revenue growth.

	c. **Boost to Domestic Investment:** Rise in export revenue can lead to increased domestic investment as exporters look to expand capacity to meet the higher demand.
The LOSERS	a. **Higher Import Bill:** Weakening of the Rupee against Dollar puts upward pressure on the net import bill. b. **Wider Trade Deficit:** The cost of essential imports outweighs the revenue gain from exports. A significant rise in import bill can lead to a widening of the Trade deficit. c. **Rising External Debt Burden:** India's foreign currency-denominated debt becomes more expensive to repay. For every dollar owed, more rupees are needed — increasing the **debt servicing cost.**

3. **Impact on Corporates (External Debt):**
    a. **Increase in Debt Servicing Cost:** The Indian Corporates who have taken ECBs denominated in USD & have not fully hedged their exposure, face a major risk. A weaker rupee means that a company has to pay more amount of INR for the USD-denominated debt.
    b. **Divergent Fortunes:** The corporate sector witnesses a divergence – while the export-oriented cos. see higher profits, the import-dependent cos. & highly indebted cos. face significant financial strain.
4. **Macroeconomic Impact:**
    a. **Worsening Trade Deficit & Pressure on Reserves:** The RBI often intervenes (spot intervention) in the forex market to prevent excessive depreciation of the Rupee. The RBI sells USD to absorb the excessive Rupee liquidity. However, it leads to reduction in the national reserve buffer.
    b. **Capital Flight:** Withdrawal of funds by FPI & FIIs is one the causes for the weakening of the INR. If the Rupee continues to weaken, it could signal greater macroeconomic instability which may increase the rate of capital flight from India – creating a self-perpetuating cycle of depreciation.
    c. **Higher Subsidy Burden:** Government spending on fuel and fertilizer subsidies rises sharply when import costs increase, worsening the **fiscal deficit.**
    d. **Delayed $5-Trillion Economy Goal**: A depreciating currency fundamentally shrinks the size of India's economy when measured in global dollar terms. For every ₹1 of depreciation knocks off an estimated 20 to 25 basis points (about $48 to $59 billion) from India's nominal GDP in USD terms. Projections warn that a sustained slip past ₹95–96/USD could push the timeline for India hitting the landmark $5-trillion milestone back toward FY30.

How India is responding to the weakening of the Rupee?

1. **Direct and Indirect Forex Interventions:** The RBI's first line of defense has been selling US dollars from India's foreign exchange reserves, which have declined to around $697 billion from over $720 billion before the recent crisis . The RBI has asked state-owned oil refiners (the largest buyers of dollars) to curb their spot market purchases and instead use a dedicated foreign currency credit line, effectively reducing immediate demand on the rupee.
2. **Curbing Speculation and Volatility:** To prevent excessive speculation from driving the rupee's fall, the RBI has also tightened regulations. This includes imposing a **mandatory daily limit of $100**

million on Authorised Dealers' Net Open Position (NOP) to limit excessive currency market positioning.

3. **Attracting Foreign Capital:** To increase the supply of dollars, authorities are looking to attract more foreign investment. This includes potentially reviving **special deposit schemes for Non-Resident Indians (NRIs).** Policymakers are working to make Indian G-Secs more lucrative for global institutional investors.
4. **Permitting Fuel Price Increase:** To improve its fiscal situation, India has allowed small increases in domestic fuel prices. By aligning fuel prices with the high global crude oil prices of $110–$120 per barrel, the government aims to reduce the losses faced by State-run Oil Marketing Companies (OMCs), which are struggling with costly crude oil imports and a weak Rupee.
5. **Shielding Consumers from Inflation:** To prevent a sharp spike in petrol and diesel prices, the government reduced the central excise duty by **₹10 per litre**. This move helps control inflation but comes at a fiscal cost, estimated at around 0.4-0.5% of GDP in foregone revenues.
6. **Taxing Non-Essential Imports**: Because crude oil imports cannot be easily cut, the Indian government is targeting the second-biggest drain on its foreign exchange: **precious metals**. The Centre recently hiked import duties on gold and silver categories.
7. **Public Appeal for Austerity:** In a significant move, Prime Minister Narendra Modi has made a public appeal to citizens to adopt "austerity measures" to conserve foreign exchange. He specifically urged people to **reduce gold purchases and avoid non-essential foreign travel** for a year.

What should be the way forward?

1. **Strengthen Domestic Macro-fundamentals:**
    - **Energy Security:** Aggressive domestic oil & gas exploration (Vedanta's $5 bn commitment), scaling ethanol blending (E20 target achieved), expanding renewable energy. India must prioritize domestic exploration blocks and completely optimize its Strategic Petroleum Reserves (SPR) to store oil when prices see temporary dips.
    - **Reduce Import Dependence:** Boost domestic production of electronics, chemicals, and capital goods to cut imports.
    - Contain **fiscal and current account deficits** through better tax mobilisation, rationalised subsidies, and export diversification so external financing needs remain credible.
2. **Manage External Vulnerability:**
    - **Expand Rupee Vostro Accounts:** India needs to accelerate its bilateral trade mechanism—paying for oil, gas, and commodities in Indian Rupees (INR) or localized currency swaps with major trade partners like Russia, the UAE, and alternative non-Western energy suppliers.
    - **Internationalizing the UPI-RuPay Stack:** Forging deeper cross-border payment links shrinks the need for US Dollars in retail, tourism, and remittance corridors.
    - **Forex Reserves:** Maintain **adequate forex reserves and flexible exchange rates** so the RBI can smooth volatility without defending unsustainable levels, reassuring markets about India's shock-absorbing capacity.
3. **Upgrade Export Competitiveness:** Upgrade export competitiveness with reforms in **logistics, trade facilitation, skilling, and industrial policy**, focusing on high-value manufacturing and services instead of low-margin commodities.
4. **Attract Stable Foreign Capital Inflows:** Attract stable **FDI and long-term portfolio flows** by improving contract enforcement, regulatory predictability, and financial-sector depth, reducing reliance on short-term "hot money".
5. **Safeguard Vulnerable Sectors & Households:**

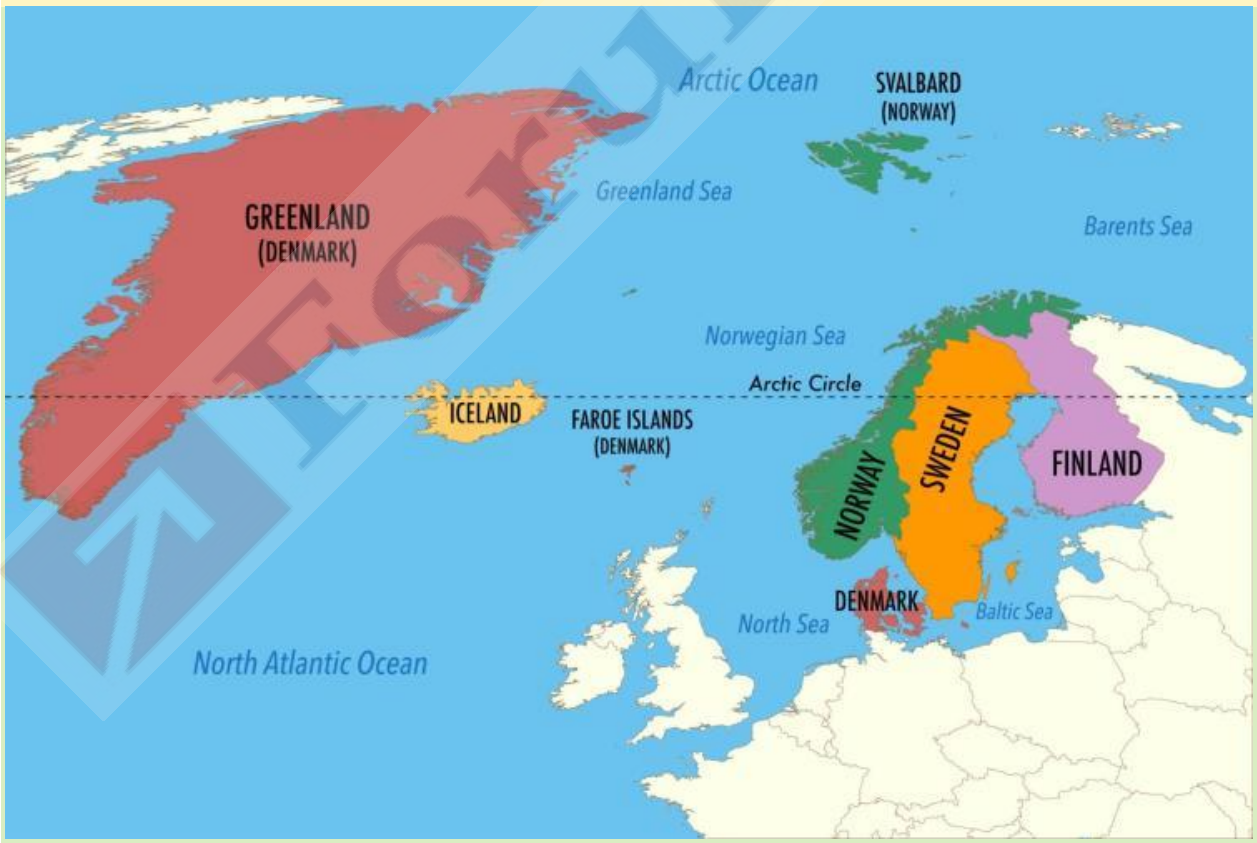
- Encourage firms with foreign-currency liabilities to **prudently hedge** and improve disclosure, limiting balance-sheet stress from sharp currency moves.
- Use **targeted support** (e.g., fuel tax calibration, transport and fertilizer support, food security buffers) to protect poorer households from imported-inflation spikes without large, open-ended subsidies.

6. **Long-term Solution:** Continue structural reforms (land, labour, financial inclusion, digital public infrastructure) that raise **productivity and long-term growth**, making India more attractive to capital and easing pressure on the rupee over time.

UPSC GS-3: Indian Economy
Read More: The Indian Express

India-Nordic Relations – Explained Pointwise

Recently, PM Narendra Modi attended the 3rd India-Nordic Summit at Oslo. The relationship between India and the **Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden)** has undergone a profound transformation. What once was a quiet, development-assistance-oriented connection has evolved into a future-focused, high-tech, and **Green Strategic Partnership.**



Evolution of India-Nordic Countries Relations:

Post-Independence Period	• After India's independence, Nordic countries established cordial diplomatic ties with India based on shared values such as **democracy, peace, multilateralism, and welfare-oriented governance**. • Nordic nations supported India's developmental efforts through technical assistance, education, healthcare, and humanitarian cooperation. • Relations during the **Cold War** remained relatively modest, as Nordic countries were more integrated with Western Europe while India followed a **policy of non-alignment**.
Expansion of Economic and Development Cooperation (1990s)	• India's economic liberalization in 1991 opened new avenues for trade and investment with Nordic economies. • Nordic companies increased their presence in India in sectors such as **telecommunications, engineering, shipping, renewable energy, and pharmaceuticals**. • Cooperation expanded in **clean technologies, environmental protection, and sustainable development** due to shared interest in green growth.
Strategic and Innovation-Oriented Partnership (2000s)	• India began engaging Nordic countries as innovation-driven economies with expertise in **digital technology, smart cities, clean energy, maritime sectors, and advanced manufacturing**. • Collaboration in **education, research, startups, and skill development** gained momentum.
Emergence of the India–Nordic Framework (2018 Onwards)	• A major turning point came with the first **India–Nordic Summit** in **2018** held in Stockholm, which institutionalized cooperation between India and the Nordic region. • India and Nordic countries now cooperate on global challenges such as climate change, resilient supply chains, energy transition, and sustainable urbanization.

What are the various initiatives undertaken to strengthen the India–Nordic relationship?

1. **India-Nordic Summits:** The introduction of the plurilateral **India-Nordic Summit format** completely institutionalized the India-Nordic relationship, shifting the dialogue from bilateral pleasantries to a structured regional framework:
    - **1st India-Nordic Summit (Stockholm, 2018):** Focused on global security, economic growth, and innovation.
    - **2nd India-Nordic Summit (Copenhagen, 2022):** Emphasized post-pandemic economic recovery, climate action, and maritime cooperation.

- **3rd India-Nordic Summit (Oslo, May 2026):** Marked a historic peak, formally upgrading ties to a comprehensive **Green Technology and Innovation Strategic Partnership.**

2. **EFTA TEPA Agreement:** The signing and activation of the Trade and Economic Partnership Agreement (TEPA) with the European Free Trade Association (which includes Norway and Iceland) has opened a pipeline for a targeted **$100 billion investment into India**, aiming to generate one million direct jobs.
   India-EU FTA: Negotiations with EU-member Nordic states (Denmark, Sweden, Finland) are moving concurrently to further diversify supply chains and lower trade barriers.
3. **Green Strategic Partnership (Norway)**: India and Norway elevated their ties to this level, focusing on **carbon capture, utilization, and storage (CCUS)** , offshore wind, and green shipping. This includes establishing **"Green Shipping Corridors"** to decarbonize maritime routes.
4. **Circular Economy**: India and Finland are jointly hosting the **World Circular Economic Forum** in Gujarat, highlighting shared initiatives in waste management and bioeconomy.
5. **Next-Gen Telecom:** Finland and Sweden are heavily integrated into India's 5G/6G rollout. Joint research initiatives have been launched specifically targeting **6G technologies**, AI, and quantum computing.
6. **Defense & Space:** Sweden's advanced manufacturing and defense capabilities have aligned with India's "Make in India" defense push. Nordic defense firms are increasingly looking at India's defense industrial corridors, leveraging provisions like 100% FDI.
7. **Maritime Cooperation:** India & Nordic countries are collaborating on green shipping corridors, sustainable fisheries management, and smart port logistics.
8. **Arctic Research:** India has expanded its scientific footprint in the Arctic region (India's '**Himadri**' research station in Svalbard, Norway). Through institutionalized polar research collaborations, Indian and Nordic scientists are jointly studying climate change, glacier melting, and cryosphere dynamics.
9. **Multilateral Reform:** The Nordic countries have consistently vocalized their support for India's permanent membership in a reformed **UN Security Council (UNSC)** and its bid for the Nuclear Suppliers Group (NSG).
10. **Indo-Pacific & Connectivity:** Both regions are actively working to link Nordic economies to the Indo-Pacific through corridors like the **India-Middle East-Europe Economic Corridor (IMEC)**, ensuring secure and resilient supply chains.

What is the significance of India-Nordic Relationship?

1. **Strategic & Diplomatic Significance**: The Nordic countries, despite their small size, exert greater influence in global governance, multilateralism, and international institutions — areas where India, as a rising power, seeks wider partnerships. Both sides share commitments to a rules-based international order, democratic values, and multilateral frameworks like the UN.
2. **Economic & Trade**: Nordic countries are home to globally competitive companies in sectors like shipping (Denmark's Maersk), telecom (Nokia, Ericsson), energy, and life sciences. For India, Nordic firms are important sources of technology, investment, and innovation.
3. **Climate & Clean Energy**: The Nordics are world leaders in green technology — wind energy, hydropower, carbon capture, and sustainable urban planning. India, with its massive climate commitments under the Paris Agreement and its National Solar Mission, sees the Nordics as critical partners in its clean energy transition.
4. **Technology & Innovation**: Nordic nations consistently rank among the world's most innovative. Collaboration in digital infrastructure, fintech, AI, cybersecurity, and the startup ecosystem is growing. India's large and skilled tech workforce complements Nordic technological leadership.

5. **Arctic & Maritime**: Norway and Iceland give the relationship an Arctic dimension. As India develops its **Arctic Policy** (released in 2022), Nordic expertise in polar research, sustainable Arctic development, and maritime governance becomes increasingly relevant.
6. **People-to-People & Education**: There is a growing Indian diaspora in Nordic countries, and academic exchanges, research partnerships, and cultural ties are strengthening the foundation of the relationship.

What are the challenges in India-Nordic relationship?

1. **Trade Asymmetry and Barriers**: India's trade with Nordic nations collectively stood at $19 billion in 2024, which, while growing, remains well below the relationship's potential. The target to double bilateral trade by 2030 is ambitious but may be difficult to achieve given persistent trade barriers, particularly for Indian exports in textiles and pharmaceuticals.
2. **India's Relationship with Russia**: India's relationship with Russia is a key stumbling block. India's foreign policy is often misunderstood in Nordic countries. The Nordic countries, now deeply embedded in NATO and the EU's security architecture, are particularly sensitive to India's continued defence and energy engagements with Russia amid the Ukraine war.
3. **Human Rights and Democratic Values Friction**: EU and Nordic concerns over India's internet restrictions, freedom of expression, and human rights create periodic friction in diplomatic engagements. The Nordics, which consistently rank at the top of global democracy and press freedom indices, sometimes vocalize concerns about democratic backsliding that India views as interference in internal affairs.
4. **India Lagging Behind China as an Economic Partner**: While India is emerging as a key economic and technological partner for the Nordics, it still lags behind China in terms of overall economic engagement, making it harder to displace China-centric supply chains and business ties despite the political will on both sides.
5. **Arctic Complexity**: Since 2022, the Arctic region has faced rising tensions due to Russia's war in Ukraine and its growing military presence near Nordic countries. At the same time, China is expanding its role in the Arctic through the "**Polar Silk Road**" initiative to access new trade routes and natural resources. Balancing relations with both Russia and China makes Arctic cooperation between India and Nordic countries more challenging.
6. **Visa and Mobility Barriers**: Strict visa policies remain a challenge for Indian workers and professionals seeking to work in Nordic countries, even as Indian professionals are increasingly in demand in Nordic tech and healthcare sectors.
7. **Scale vs. Niche:** Nordic companies are typically smaller, highly specialized niche players (in fields like green hydrogen, carbon mineralization, or biotech). Scaling these technologies to fit the sheer volume of the Indian market often overwhelms Nordic corporate structures, which are unaccustomed to navigating the complex, multi-tiered Indian bureaucratic and regulatory landscape.

What should be the way forward?

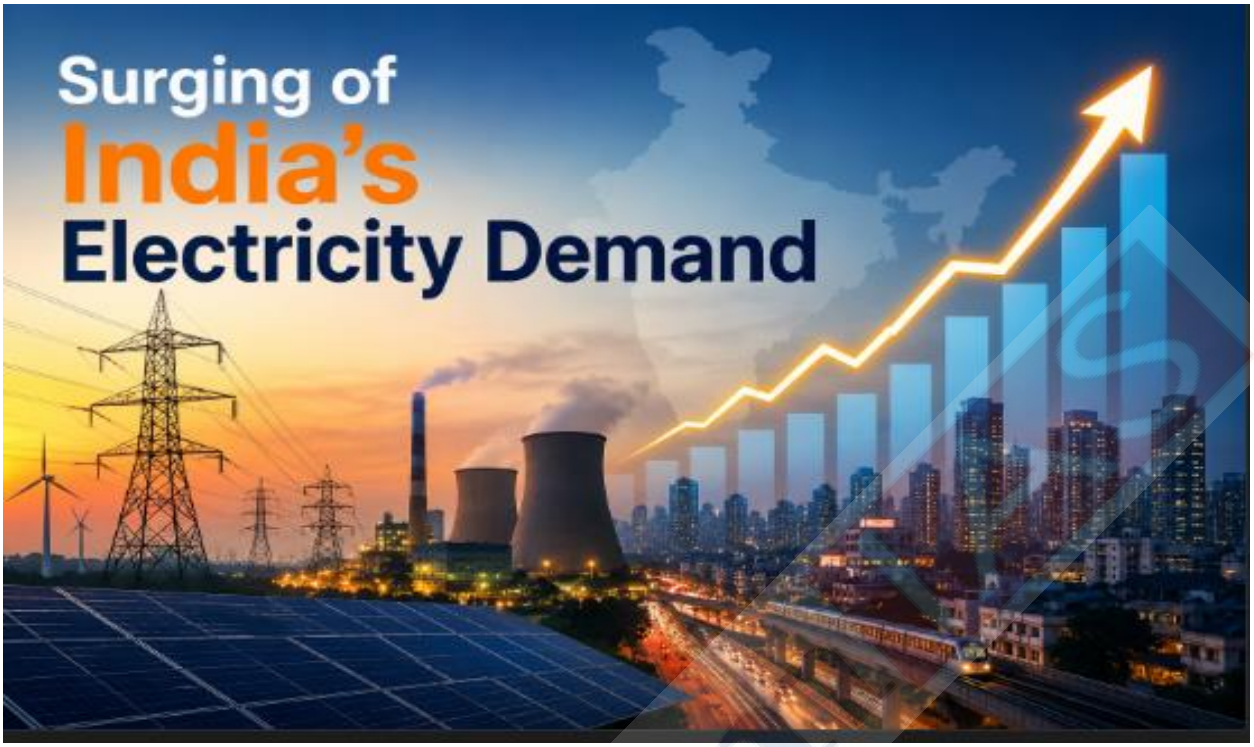
1. **Institutionalizing the Partnership**: Establish a **Permanent Secretariat** to ensure continuity between summits, monitor MoU implementation, drive agenda-setting year-round, and to take the relationship beyond the periodic summits.
2. **Leveraging the India-EFTA TEPA & India-EU FTA:** The Trade and Economic Partnership Agreement with Norway and Iceland must be operationalized effectively, with both sides actively reducing non-tariff barriers and facilitating investment flows toward the $100 billion target. Since Denmark, Finland, and Sweden are EU members, the India-EU FTA should be used to unlock deeper market access.

3. **Green Technology and Climate as the Anchor**: The elevation to a **Green Technology and Innovation Strategic Partnership** is the relationship's most promising pillar. To leverage it fully, India & Nordic countries should focus on initiatives like joint green hydrogen projects, technology transfer framework, carbon market cooperation, triangular development cooperation (Nordic countries and India can co-fund clean energy projects in the Global South).
4. **Managing India-Russia Relationship Diplomatically**: India should proactively communicate its strategic autonomy doctrine to Nordic partners, framing it as a stabilizing rather than destabilizing posture. Track-II dialogues between Indian and Nordic think tanks can help bridge the perception gap on India's Russia policy.
5. **Building a Structured Defence and Security Architecture**: India should actively engage Nordic countries — especially Sweden (Saab), Norway (naval technology), and Finland (surveillance) — in its Defence Industrial Corridors under the 100% FDI framework. Cybersecurity cooperation, where Nordic nations are world leaders, should be elevated to a dedicated bilateral track.
6. **Arctic Engagement**: India should build on its Arctic Policy (2022) and engage Nordic nations as primary partners in Arctic science, shipping route development, and environmental monitoring. Jointly countering China's Polar Silk Road ambitions through transparent, rules-based Arctic governance frameworks would align India and Nordic interests.
7. **Streamlined Visa Regimes:** A dedicated **Nordic-India Mobility Partnership**, similar to what India has with some EU states, would facilitate easier movement of students, professionals, and researchers. The Nordic nations should introduce streamlined, fast-track visa categories specifically for Indian STEM professionals, researchers, and academic exchange students involved in joint green-tech and digital projects.

UPSC GS-2: International Relations
Read More: The Hindu

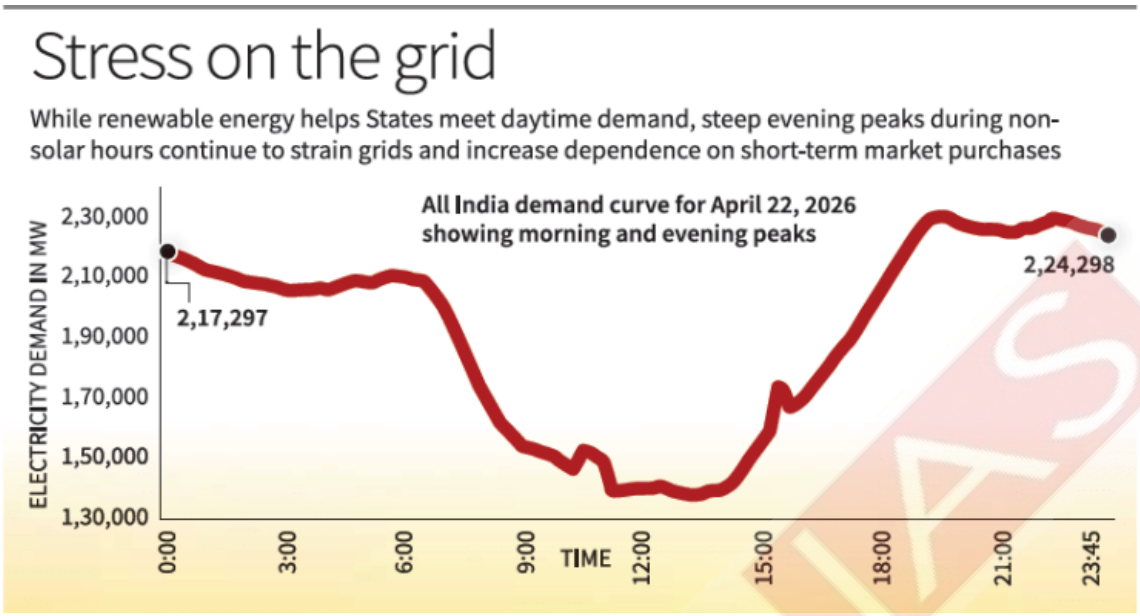
Surging of India's Electricity Demand – Explained Pointwise

India's electricity demand has reached a peak of 256 GW, touching an all-time high. This year, the peak demand surged much earlier than expected. Nearly one-third of this peak demand was met through renewable energy sources.



What is Peak Demand?

- **Peak Demand** (also called **Peak Load** or **Electricity Peak**) refers to the single highest moment of electricity usage on the electrical grid within a specific time period (typically a 15-minute interval).
- It represents the maximum amount of electricity consumers require simultaneously from the grid.
- Peak demand generally rises during:
    - Summer heatwaves due to heavy air-conditioner and cooler usage.
    - Industrial expansion and economic growth.
    - Increased urbanization and electrification.
- Entire power sector infrastructure (generation, transmission, distribution) needs to be planned to deal with the peak demand. If enough capacity is built to meet the peak demand, it will remain underutilized during off-peak hours, on the other hand, if enough capacity is not available to meet the peak demand, then the system will face issues like load shedding & grid instability.
- In last 5 years, the peak demand in India has risen by 37%. This surge has made it tougher for States to fulfill electricity requirements.



Source: The Hindu

How do States manage peak demand?

1. **Contractual Supply & Power Exchange Purchases**: Contractual supply comprises the long-term power purchase agreements (PPAs) that State DISCOMs sign with power supply over several years. Almost 85-90% of the demand in India is being met through contractual supply between the DISCOMs & generators. In times when contractual supply falls short due to spike in demand – DISCOMs turn to second mechanism – buying power from power exchanges. States buy short-term power from the **Indian Energy Exchange (IEX)** and **Power Exchange India Ltd (PXIL)** during peak hours.
2. **Demand-Side Management (DSM)**:
    - **Time-of-Day (ToD) Tariffs:** Higher electricity prices during peak hours (typically 6–10 PM) to discourage non-essential consumption.
    - **Energy Efficiency Programs:** Promotion of LED bulbs, star-rated appliances (BEE ratings), and efficient irrigation pumps (e.g. the KUSUM scheme for solar pumps).
    - **Load Limiting:** Industrial consumers are contracted with maximum demand limits; exceeding them attracts penalty charges.
3. **Load Shedding & Roster-Based Cuts**: Planned, rotational power cuts in specific zones or feeders when supply falls short. Agricultural feeders are often separated from domestic/industrial ones to allow targeted cuts without affecting critical consumers.
4. **Interconnection & Grid Balancing:**
    - The **National Grid (One Nation One Grid)** allows power-surplus states (e.g., Himachal Pradesh, Sikkim) to sell to deficit states.
    - **Regional Load Despatch Centres (RLDCs)** and **State Load Despatch Centres (SLDCs)** coordinate real-time balancing.
5. **Battery Energy Storage Systems (BESS)**: Increasingly deployed at grid scale (e.g., Andhra Pradesh, Rajasthan pilots) to store solar energy and discharge during evening peaks.

What are some challenges faced by the States due to rising demand?

1. **Expensive Emergency Power**: DISCOMs rely on long-term agreements for ~85-90% of their power, which is relatively cheap. When demand spikes, they are forced to buy extra power from short-term exchanges, where prices can skyrocket. Prices have repeatedly hit the **regulatory ceiling of ₹10 per kilowatt-hour** during recent peaks, making it incredibly costly to meet demand.
2. **Inadequacy of Distribution Network**: Even when power is available, the last-mile network often fails. The distribution infrastructure has not kept pace with generation growth. According to a recent assessment by CEA, nearly **13 lakh distribution transformers (DTs) fail annually** across India, leading to local blackouts. While states like Kerala have a failure rate of less than **2%**, some northern states see rates as high as **20%.** Overloading of transformers & feeders, ageing equipment, and inadequate maintenance continue to compromise the last-mile power delivery.
3. **States with Low Fiscal Space:** The challenge posed by demand surges becomes acute for financially stressed States because they are neither able to procure costly short-term power nor invest in distribution network upgrades. States like UP & Bihar continue to grapple with high losses, ageing distribution infrastructure, and overloaded transformers.
4. **Financial Stress on DISCOMs:** Many DISCOMs are already in a precarious financial state, with cumulative losses estimated around **₹1 lakh crore**. They are forced to sell power to agricultural and domestic users at highly subsidised rates, which are often below their own cost of supply. This makes it very difficult to recover the high costs of peak power purchases.
5. **Inadequate Transmission Capacity**: Inter-state transmission corridors are congested, preventing power-surplus states from selling to deficit ones efficiently. Intra-state networks in rapidly urbanising states (UP, Rajasthan, MP) lag behind load growth.

How does renewable energy help meet peak electricity demand?

1. **Solar Energy Contribution**: States with high solar energy generation capacity, such as Gujarat & Karnataka, are able to meet daytime peak comfortably as the solar power generation align reasonably well with daytime commercial & agricultural demand. But these States face steep evening peaks after sunset, for which they need to increasingly depend on energy storage technologies such as pumped hydro storage (PHS) & battery energy storage system (BESS).
2. **Wind Energy Contribution**: Wind generation in India is often **complementary to solar** — wind tends to blow more during evenings and monsoons when solar is weak. Coastal states like **Tamil Nadu, Gujarat, and Andhra Pradesh** benefit from strong evening sea breezes.

What needs to be done?

1. **Energy Storage Technologies**: Despite its growing contribution, RE cannot help in ensuring reliable round-the-clock power supply because of its intermittent nature & also because electricity demand & RE power generation do not always align – e.g. Solar power generation falls sharply after sunset, Wind generation is seasonal & highly dependent on monsoon conditions. This is where energy storage technologies become critical for India's power system:
    a. **Battery Storage (BESS):** The government has set ambitious targets, with plans to integrate around 47 GW of Battery Energy Storage Systems (BESS) by 2032**.**
    b. **Pumped Storage Hydro (PSH):** PHS is another key technology, with over 13,000 MW already under construction. Long-term transmission plans have been identified to support achieving 100 GW of PSP capacity; environmental clearances and funding need to be streamlined.
2. **Strengthen Distribution Networks**: Investment is needed to upgrade and modernize last-mile infrastructure to prevent local outages during peak periods. Government schemes like the **Revamped Distribution Sector Scheme (RDSS)** are designed to fund these upgrades, but they are linked to DISCOMs meeting specific performance targets, such as reducing AT&C losses.

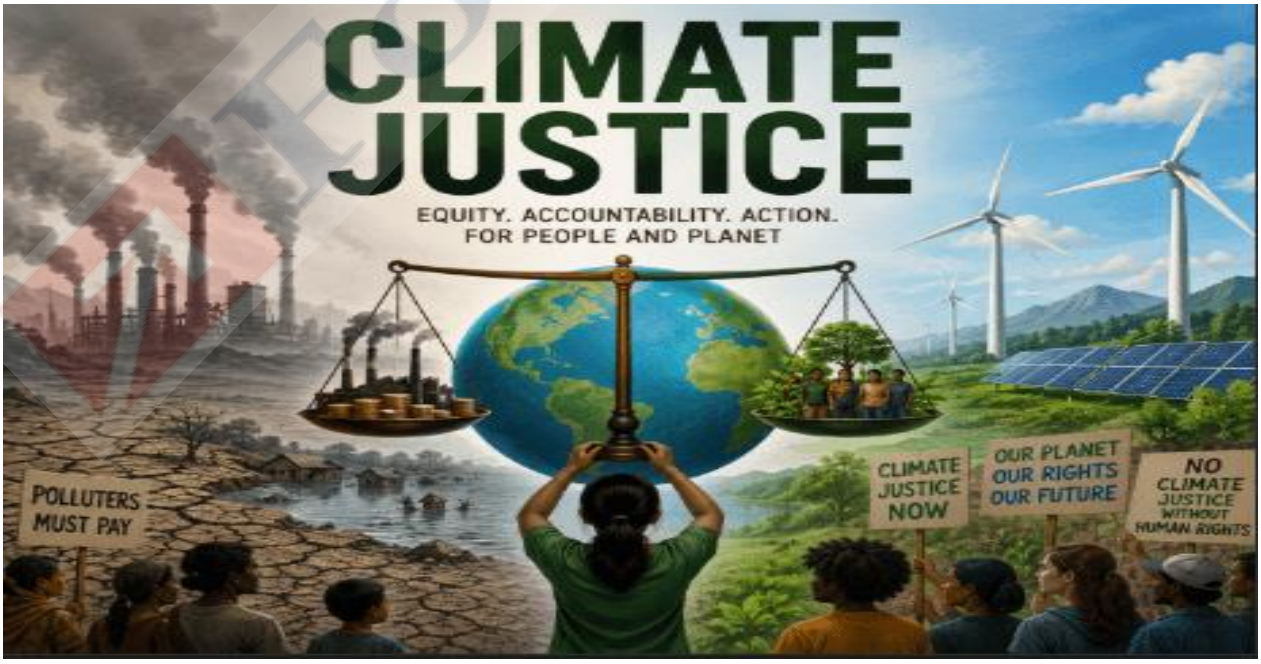
3. **Implement Tariff Reforms**: DISCOMs need to move towards **cost-reflective tariffs** to bridge the gap between their average cost of supply and revenue realized. The Draft National Electricity Policy (NEP) 2026 proposes automatic annual tariff revisions if state regulators fail to act, ensuring timely adjustments.
4. **Expand Time-of-Day (ToD) Tariffs**: ToD tariffs charge less for electricity during solar hours and more during peak evening hours. This incentivizes consumers to shift heavy appliance use (like running a water heater or dishwasher) to the daytime. States like Maharashtra, Gujarat, and Rajasthan have already introduced such tariffs.
5. **Leverage Smart Meters**: Smart meters are the technological enabler for ToD tariffs and other demand-response programs. They provide real-time data, allowing consumers to make informed choices and utilities to manage grid stress better. The RDSS has a major focus on implementing prepaid smart metering.

UPSC GS-3: Energy Infrastructure

Read More: The Hindu

Climate Justice: Meaning, Challenges and Way Forward – Explained Pointwise

Recently, the United Nations General Assembly (UNGA) formally adopted a Resolution on Climate Justice, which has been regarded as a historic milestone for climate accountability and climate justice. This resolution functions as the political and institutional mechanism to operationalize the landmark July 2025 Advisory Opinion from the **International Court of Justice (ICJ)**, shifting the conversation from climate action as a voluntary political choice to an explicit **legal duty under international law**. The resolution was passed with an overwhelming global majority, receiving 141 votes in favour, 8 against, while 28 countries – including India – abstained from voting.



What is the meaning of Climate Justice?

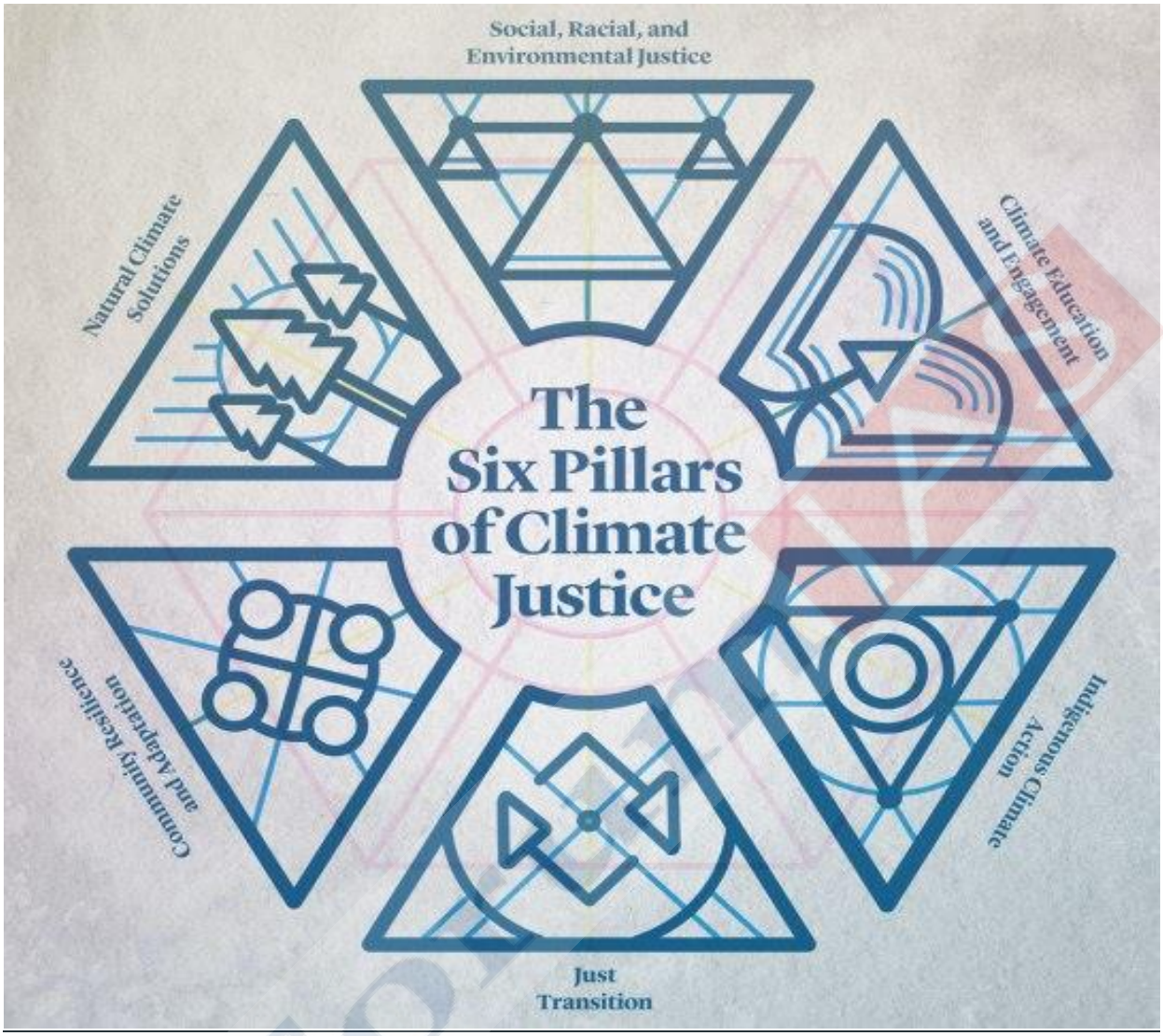
- Climate justice is a term used for **framing global warming as an ethical and political issue**, rather than one that is purely environmental or physical in nature.
- **'Climate Justice'** acknowledges climate change can have differing social, economic, public health, and other adverse impacts on underprivileged populations. The **impacts of climate change are not borne equally or fairly**, between rich and poor, women and men, and older and younger generations. From extreme weather to rising sea levels, the effects of climate change often have disproportionate effects on historically marginalized or underserved communities.
- Pursuing climate justice means addressing **social**, **gender**, **economic**, **intergenerational** and **environmental injustice**. All the dimensions of injustice are interconnected with each other and must be acknowledged in order to address them holistically e.g., some climate projects inadvertently create climate injustices when local communities are displaced for a conservation or renewable energy initiative. Advocates for climate justice are striving to have these inequities addressed through long-term mitigation and adaptation strategies.

What are the various dimensions of Climate Justice?

Climate Justice can be summarized under **Four types of Justice**:

1. **Procedural Climate Justice**: It is associated with **fair, accountable, and clear ways to make decisions about the effects of climate change** and how to deal with them. It is imperative to have fair procedures in place to make sure that goods are distributed fairly and in a way that is open and accountable. This can be ensured by due process, public participation, and representative justice. This can include **access to information**, **access to and meaningful participation in decision-making**, **lack of bias on the part of decision-makers**. It includes ideas like "transparency", "fair representation", "impartiality", and "objectivity".
2. **Distributive Climate Justice**: This aspect of justice deals with **how costs and benefits of climate change are shared**. There are three main aspects of distribution:
    a. Identifying the goods that are being distributed (e.g. food, clothing, water, power, wealth, or respect).
    b. Identifying the entities between which they are to be distributed (e.g. members of certain communities or stakeholders, certain generations, all of humankind).
    c. Identifying the most appropriate **mode of distribution** (e.g. status, need, merit, rights, or ascriptive and social identities).
3. **Recognitional Climate Justice**: It is focused on recognition of difference. It means **identifying vulnerable people** whose vulnerability may be worsened as a result of a process such as a low-carbon transition. Recognitional Climate Justice places emphasis on **understanding differences** alongside **protecting equal rights for all**, especially given uneven capacity to defend rights.
4. **Intergenerational Climate Justice**: It was recognized in the **Brundtland Report 'Our Common Future'** (1987) which conceived of sustainable development as being about the **ability of current generations to meet their needs without compromising the ability of future generations to meet their own needs**.

What are the main pillars of Climate Justice?



Source: Center for Climate Justice

The Center for Climate Justice (University of California) has identified **6 Pillars of Climate Justice**:

1. **Just Transition**: A just transition represents the transition of fossil fuel-based economies to equitable, regenerative, renewable energy-based systems.
2. **Social Racial and Environmental Justice**: It recognizes the disproportionate impacts of climate change on low-income and poor communities around the world, the people and places least responsible for the problem.
3. **Indigenous Climate Action**: Indigenous communities around the world are facing some of the most severe climate impacts. Indigenous communities are deeply reliant on their surrounding ecosystems for their lives and livelihoods. Indigenous peoples are leading efforts in climate change mitigation and adaptation across the globe **Climate Action should acknowledge their knowledge and role**.

4. **Community Resilience and Adaptation**: Community resilience and adaptation must be viewed from a perspective of social justice and equity. This would inspire models such as **food sovereignty**, **common property forest management**, and **energy democracy**. It would support local communities in **developing their own solutions** and allow them to benefit directly from local climate action.
5. **Natural Climate Solutions**: From a climate justice perspective, natural climate solutions take a systems approach and include regenerative farming, agroforestry, permaculture, urban gardens, and forest restoration.
6. **Climate Education and Engagement**: Widespread climate education and engagement is fundamental to addressing the root causes of climate change. A populace better educated about climate justice will fully understand why viewing climate change from a social justice and equity perspective is the best hope for solving the climate crisis.

What are the challenges in ensuring Climate Justice?

1. **Gradual Dilution of Common but Differentiated Responsibilities (CBDR)**: Article 3 of the UNFCCC recognizes the principle of CBDR based on differences between developed and developing countries in terms of their **current circumstances and historical contributions**. However, developed countries keep on pushing for higher commitments by developing countries e.g. Western nations pushed for 'phase-out' of coal at Glasgow 2021 (before agreeing for 'phase-down'). Coal is a cheap source and phasing-out of coal imposes big costs on developing countries.
2. **Economic and development trade-offs**: Poorer regions may prioritize immediate poverty alleviation and industrial growth over emissions reductions. Requiring them to adopt costly green technologies without external support can perpetuate economic inequality.
3. **Vulnerability and adaptation gaps**: The most climate-vulnerable communities (e.g., low-lying island states, Indigenous groups, agricultural dependents) often lack the resources, infrastructure, and political power to adapt. Adaptation funding consistently falls short of needs.
4. **Avoidance of Binding Targets**: The Nationally Determined Contributions (NDCs) under the Paris Agreement are voluntary in nature. They are not binding and legally enforceable. Kyoto Protocol had binding targets for developed countries but it has been non-functional. Developed countries, by avoiding binding targets, have reneged on their responsibility arising from their historical contributions.
5. **Shortfall in Climate Finance**: Despite their pledge, the developed countries have failed to provide US$ 100 billion per year for Climate Finance. Climate experts contend that US$ 100 billion per year is minuscule to address Climate Change. IPCC estimates that US$ 1.6–3.8 trillion is required annually to avoid warming exceeding 1.5°C.
6. **Definitional and Measurement Challenges**: There is no universal consensus on what climate justice requires — distributive fairness, procedural inclusion, recognition of harm, or restorative obligations? Attributing specific disasters or losses directly to climate change remains scientifically complex, complicating claims for compensation.

Read More: Climate Finance: Meaning, Need and Challenges – Explained, pointwise

Why did India abstain from voting on the resolution?

1. **Undermining the UNFCCC Process**: India's chief objection was that the resolution bypasses and **undermines the established UNFCCC** and the Paris Agreement. The Paris Agreement operates on a "bottom-up" structure where individual countries voluntarily set their own climate targets based on national capacity (known as Nationally Determined Contributions, or NDCs). India argued that the

UNGA resolution attempts to impose top-down, externally mandated benchmarks and specific mitigation pathways.

1. **Quasi-Binding Status**: By its very nature, an International Court of Justice (ICJ) Advisory Opinion is non-binding. However, India expressed serious concern that the UNGA resolution explicitly tries to elevate the ICJ's opinion into a **"binding or quasi-binding status."**
2. **Omission of 'Climate Finance'**: India has long maintained that developing nations cannot transition away from fossil fuels without significant financial assistance, technology transfers, and capacity building from developed nations. However, this resolution dictates strict obligations to cut emissions while entirely leaving out the means of implementation (money and technology) required to achieve them.
3. **Violation of CBDR Principle**: The foundational pillar of India's climate foreign policy is the principle of **Common But Differentiated Responsibilities (CBDR)**. India abstained because the resolution did not adequately reinforce that developed nations must shoulder the heaviest burden of global mitigation efforts.

India's abstention should not be seen as a vote against the concerns of the small island states. Indian initiatives such as SAGAR, and projects like International Solar Alliance, have been sensitive to the anxieties of countries most threatened by the rising seas.

How can Climate Justice be ensured?

1. **Operationalizing International Law & Accountability**: Now that UNGA Resolution and the International Court of Justice (ICJ) Advisory Opinion have established that climate inaction is a violation of international law, the next step is enforcement, which can be done by:
    a. **Climate Litigation:** Vulnerable nations and grassroots organizations must continue using domestic and international courts to sue major corporate polluters and negligent governments, establishing a legal precedent where environmental damage requires mandatory reparations.
    b. **Codifying Ecocide:** Formally recognizing "ecocide" (the widespread destruction of ecosystems) as an international crime under the Rome Statute would provide a powerful mechanism to hold individuals and corporate executives criminally liable for severe environmental neglect.
2. **Fulfilling and Expanding Climate Finance:** Developed nations must not only meet their historical $100 billion annual pledge but scale it up to meet the actual trillion-dollar needs of the Global South. This money should be provided as **grants, not loans**, so vulnerable nations aren't forced into further debt.
3. **Implementing a Globally "Just Transition"**: Shifting away from fossil fuels must be done in a way that protects workers, respects local communities, and prevents economic collapse. Transition pathways must be customized. Developed nations must phase out fossil fuels rapidly, while developing nations like India or African states are given the "policy space" and financial backing to transition gradually.
4. **Technology Transfer**: Technology transfer to developing nations must be accelerated, with intellectual property barriers reduced or waived for clean energy technologies. For e.g. similar to waivers created for life-saving medicines, certain patents on critical green technologies (like advanced solar cells, battery storage, and green hydrogen) should be waived or subsidized for developing nations.

5. **South-South Cooperation:** Expanding initiatives where emerging economies share regional expertise and scalable, cost-effective technologies with smaller, climate-vulnerable neighbors (similar to India's Infrastructure for Resilient Island States initiative).

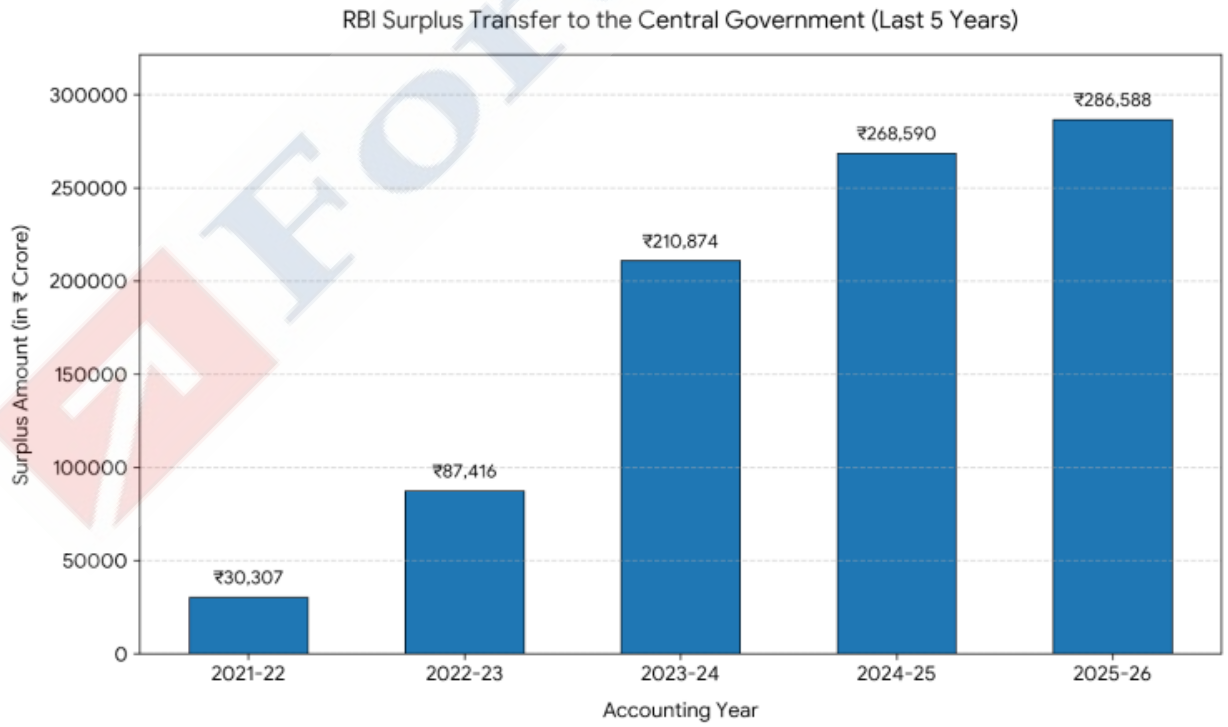
Conclusion:

Ensuring climate justice is anchored on a simple, foundational principle: **Common But Differentiated Responsibilities (CBDR)**. It is achieved when wealthy nations drastically cut their own emissions while financing the adaptation, survival, and clean energy transition of the rest of the world.

Read More: Indian Express
UPSC GS-3: Environment

RBI Surplus Transfer to Government – Explained Pointwise

Recently, the Central Board of the Reserve Bank of India (RBI) approved a **Rs. 2.86 lakh crore surplus** or dividend transfer to the Central Government for the accounting year 2025-26. The dividend payout is approximately **6.7% higher** than Rs 2.68 lakh crore transferred by RBI in 2024-25, marking the highest-ever surplus transfer by the central bank. At the same time, the RBI raised the **contingency risk buffer (CRB)** to Rs 10 lakh crore to create a safeguard in case geopolitical tensions escalate or crude oil prices worsen.



What is the source of RBI surplus? What is the mechanism for transfer of surplus by RBI?

The RBI has a unique operational nature, which stands apart from typical banks or financial entities.

Sources of Earnings of RBI	Expenditures of RBI
1. Profits derived from foreign currency assets like bonds, treasury bills and central bank deposits. 2. Earnings from local, rupee-based government securities. 3. Short-term based lending 4. Borrowing management for both central and state governments 5. Regulation of banks and non-banking financial bodies. 6. Commission from overseeing government transactions and specific underwriting endeavours.	1. Operating Expenses 2. Currency Printing 3. Staff remunerations 4. Transaction commissions for Banks 5. Dealer Compensations 6. Interest Paid on Deposits and Borrowings

- **Surplus:** Net income derived from the total income (sources of income) minus total expenditure (expenses). Out of the Surplus of RBI, risk provisioning is made for monetary and financial stability risks, and credit and operational Risks.
- **Transfer of Surplus:** RBI transfers its surplus to the government as per Section 47 of the Reserve Bank of India Act, 1934.
- The surplus calculation is based on the **Economic Capital Framework** (ECF) recommended by the Bimal Jalan committee. The committee, advised the RBI to maintain a Contingent Risk Buffer (CRB) between 5.5% and 6.5% of its balance sheet.

Read More- Economic Capital Framework

What are the reasons behind Increase in RBI surplus?

1. **Significant Foreign Exchange Trading Gains:** The single largest driver was the RBI's heavy intervention in the foreign exchange market. Amid persistent depreciation pressures on the Indian Rupee exacerbated by the West Asia conflict and global market volatility, the RBI engaged in large-scale sales of US dollars. Because these dollars were bought historically at much lower accumulation rates, selling them at current elevated rates allowed the central bank to book massive trading and revaluation gains.
2. **High Yields on Foreign Currency Assets**: Global interest rates across major advanced economies (like the US and Europe) remained elevated throughout the year. As a result, the RBI earned substantially higher returns and yields on its overseas investments, foreign currency assets, and sovereign securities held abroad.
3. **Increase in Gold Prices:** The RBI has progressively increased the share of gold in its foreign exchange reserves (rising to 16.7% in 2025–26). A massive rally in global gold prices—which surged by roughly

60% over the year—drastically inflated the value of the RBI's gold holdings, dramatically strengthening its accounting profitability and asset base.

4. **Robust Expansion of the Balance Sheet**: The RBI's overall balance sheet expanded by **20.61%**, crossing the ₹91 lakh crore mark. This growth was propelled by liquidity management operations, including the central bank buying domestic government securities (bonds) to inject liquidity into the banking system, which in turn increased its interest-earning asset portfolio.

What is the significance of the record RBI Surplus transfer to the Government?

1. **Absorbing the "Geopolitical War Shock"**: The ongoing US-Iran conflict has pushed up global energy, commodity, and fertilizer prices. Because India imports over 80% of its crude oil, these spiking prices severely inflate the government's import bill and threaten to balloon its subsidy obligations. This massive inflow of **non-tax revenue** essentially acts as an economic shield. It directly provides the cash buffer needed to cover higher-than-expected outlays for **food, fertilizer, and petroleum subsidies** without forcing the government to cut spending elsewhere.
2. **Increased Capital Expenditure (CAPEX):** The surplus transfer provides much needed fiscal stimulus to the government to increase its allocations to roads, railways, and defence projects.
3. **Managing Fiscal Deficit:** This substantial non-tax revenue helps the government in its efforts to contain the **fiscal deficit**. However, it may not be enough to fully meet the ambitious target of **4.3% of GDP** for FY27, with estimates suggesting the deficit could slip to around **4.7%**.
4. **Offsetting Revenue Losses**: It serves as a buffer against potential shortfalls from other sources, such as lower tax collections and reduced dividends from public sector companies like oil marketing companies, which are also impacted by the global crisis.
5. **Signaling Central Bank Autonomy and Resilience**: The RBI managed to transfer a record dividend while simultaneously injecting a massive **₹1.09 lakh crore into its own Contingent Risk Buffer (CRB)**—nearly triple what it provisioned last year. This sends a powerful signal to international rating agencies and global investors that the RBI can aggressively support the sovereign balance sheet while retaining immense financial firepower to defend the rupee and intervene in volatile markets.

What Should be the Way Forward?

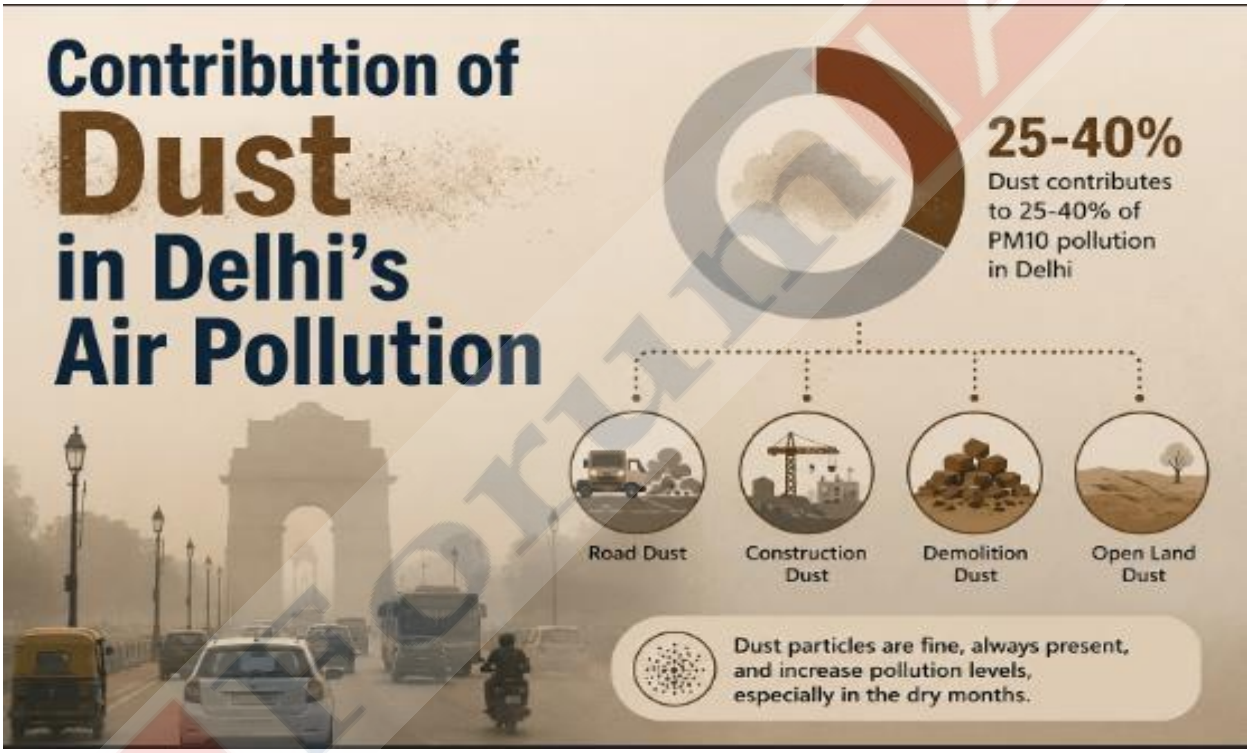
1. **Absorbing Global Energy and Commodity Shocks**: The immediate priority must be managing the fallout from the ongoing conflict in West Asia and the resulting surge in crude oil prices. The government should deploy a significant portion of this surplus to absorb the inevitable spikes in the **food, fertilizer, and petroleum subsidy bills**.
2. **Maintaining Infrastructure Targets:** The Union Budget set a massive public capex target of **₹12.2 lakh crore** (up from ₹11.2 lakh crore). The surplus must be funneled into key asset-creating sectors like transportation, green energy, urban development, and public logistics.
3. **Fiscal Deficit Consolidation:** The extra revenue should be strictly managed to hit the **4.3% fiscal deficit target** for the financial year.
4. **Increasing Govt tax-GDP Ratio:** The government must not constantly depend upon transfers from the central bank or dividend from public-sector enterprises. Proper fiscal management must be undertaken to increase the government's tax-to-GDP ratio.
5. **Avoid RBI-Reliant Fiscal Planning:** Refrain from budgeting for optimistic RBI surplus figures. Treat any transfer above a conservative baseline as a windfall for deficit reduction. This breaks the cycle of dependence and forces more disciplined fiscal management from the outset.
6. **Adhere Strictly to the ECF:** RBI should continue to determine the surplus transfer based on the rules of the Economic Capital Framework (ECF), which prioritizes building a strong risk buffer. The ECF

provides an objective, rule-based methodology. Following it closely shields the RBI from political pressure to maximize dividends.

Read More: The Indian Express
UPSC Syllabus- GS 3: Indian Economy

Contribution of Dust in Delhi's Air Pollution – Explained Pointwise

A January 2026 report by a panel of top experts constituted by the Commission for Air Quality Management (CAQM) identified road dust as a major pollution source in Delhi because it acts as both – a primary emission & a persistent source.



What is meant by road dust?

- **Road dust** refers to the fine, solid particles that accumulate on road surfaces and are kicked up into the air by passing vehicles, wind, or traffic.
- It is a major contributor to **particulate matter (PM)** air pollution, particularly in urban areas and near unpaved roads.
- Road dust broadly include airborne dust from roads & shoulders, vehicle movement, dry soil, and road wear. Poor road surfaces, potholes, broken edges, unpaved stretches, road-tyre-brake wear, and debris falling from the transport of construction & demolition material all contribute to the dust load.

What is Road Dust Made Of?

1. **Mechanical Wear:** Tiny particles worn off from vehicle brake pads, clutches, tires, and the road surface itself (asphalt or concrete).
2. **Crustal Material:** Natural dirt, soil, and rock dust blown onto the road from nearby fields or unpaved shoulders.
3. **Vehicle Emissions:** Leftover soot and exhaust particles that settled onto the ground and get re-suspended.
4. **Seasonal Debris:** Winter road salt, sand used for traction, and dried organic matter like leaves.

Why is road dust difficult to control, and why does it persist?

1. **The Re-suspension Loop:** When a vehicle drives over a road, its tires create a vacuum and turbulent airflow that lifts settled dust back into the air. Once lifted, it stays airborne for hours before settling again, only for the next car to repeat the cycle.
2. **"Non-Point Source" Pollutant Source**: Road dust is scientifically a very different kind of pollutant source as compared to construction & demolition (C&D) dust. It is a line source (spread along a corridor), unlike C&D dust, which is a point source. The non-point source nature of road dust makes it difficult to control as it requires routine removal & surface management.
3. **Arid Geography and Climate of Delhi**:
    - Delhi sits on the edge of the semi-arid Thar Desert and experiences extreme weather. The scorching summer heat bakes the soil, stripping it of all moisture. Without moisture to hold the dirt together, it easily turns into loose, powdery dust.
    - Strong winds regularly carry massive amounts of natural crustal dust from Rajasthan and neighboring dry states straight into the NCR, constantly replenishing the city's dust supply. Degradation of Aravalli range has weakened a natural dust barrier around Delhi, allowing more wind-blown dust to enter the city.
4. **Intense Construction Activity**: Delhi-NCR is a perpetual construction zone. Massive infrastructure projects (Metro expansions, flyovers, high-rises) alongside endless digging by civic agencies for internet cables, water pipes, and sewage lines leave behind heaps of loose soil.
5. **Operational Gaps in Clean-Up**: While the Delhi government heavily prioritizes a "dust-free roads" initiative – logistical gaps persist. Investigation data shows that Delhi's mechanical sweeping fleet is significantly under-scaled (80% shortage) for its thousands of kilometers of motorable roads, with active machines often concentrated heavily on a few select VIP or industrial hotspot routes, leaving large portions of peripheral roads unaddressed.

• DELHI'S ROADS CARRY A HIDDEN LOAD

145 KG Approx. amount of loose dust a 1-km road stretch in Delhi can hold

KEY POINTS FROM VARIOUS STUDIES

2016 IIT KANPUR:

- Road dust PM10 emissions in Delhi estimated at 79,626 kg/day
- Road dust PM2.5 emissions estimated at 22,165 kg/day
- North, north-east, and parts of north-west Delhi strong hotspots for road-dust resuspension-induced PM10
- These same areas overlap with low mechanical sweeping zones such as Narela, Shahdara North and Civil Lines
- Areas with relatively higher sweeping coverage, Shahdara South, Rohini and Keshavpuram, had much lower levels of road dust, as per the spatial mapping

2023 IIT KANPUR, IIT DELHI, TERI REPORT:

- Road silt load in Delhi ranged from 2 to 12.5 g/m². Reducing it below 2 g/m² recommended, with regular vacuum sweeping

2023 IIT DELHI:

- Average Delhi road silt load was around 14.47 g/m²
- This means a 1-km × 10-metre road stretch can hold ~144.7 kg road dust

2020 IIT MADRAS:

- Delhi road silt load near construction sites reaching about 40 g/m², considered high for urban roads in India

Aravalli degradation has weakened a natural dust barrier around Delhi.

Why dust pollution is a cause of worry?

1. **Air Pollution (PM10 & PM2.5):** When vehicles drive over dry roads, they create turbulence that lifts these fine particles into the air. For cities like Delhi, **road dust resuspension** is a major source of harmful particulate matter, second only to exhaust emissions in some cases.
2. **Respiratory Damage:** Inhaling fine dust causes immediate irritation to the airways, leading to coughing, wheezing, and shortness of breath. Over time, it severely aggravates chronic conditions like **asthma, bronchitis, and Chronic Obstructive Pulmonary Disease (COPD)**.
3. **Toxic Chemical Payload:** Dust is not just soil. Urban and industrial dust carries a toxic cocktail of heavy metals (like lead and copper from brake pads), microplastics, pesticides, and polycyclic aromatic hydrocarbons (PAHs) from vehicle exhaust, increasing the long-term risk of cancer. Nationwide, exposure to road dust is linked to more than 10,207 premature deaths annually.
4. **Suffocating Plant Life:** When heavy dust settles on leaves, it blocks sunlight and clogs stomata (the pores plants use to breathe). This disrupts **photosynthesis**, stunting plant growth and reducing agricultural crop yields.
5. **Water Contamination:** Toxic dust is washed by rain into lakes, rivers, and oceans. This introduces heavy metals and excess nutrients into aquatic ecosystems, leading to water pollution and harming marine life.

What is the Delhi government doing to control dust pollution?

1. **Mechanical Road Sweepers (MRSMs):** A growing fleet of vacuum-based sweeping trucks operates across key transit corridors to physically lift silt load off the streets.
2. **Mist-Spray Systems & Anti-Smog Guns:** Over 340 permanent mist-spray systems are installed on central verges to continuously dampen airborne dust. Furthermore, the city has deployed zero-emission, **EV-mounted anti-smog guns** that move through heavy-traffic and high-pollution corridors.
3. **Monitoring Construction & Demolition (C&D) Waste**: All construction projects covering more than 500 square meters must register on a centralized portal. The government uses artificial intelligence, geo-tagging, and remote video monitoring to track dust emissions from these sites in real time.
4. **Filterless Purifiers (STR-101):** The city has installed filterless, self-cleaning air purification units on electricity poles along heavy-traffic central verges. These systems suck in polluted air, isolate dust, smoke, and PM2.5 particles, and release cleaner air.
5. **Roadside Dust Catchers:** Devices like the **PAWAN III** are placed on roadside dividers to trap vehicular and dust emissions directly at the bumper level before they spread into the atmosphere.

What more needs to be done?

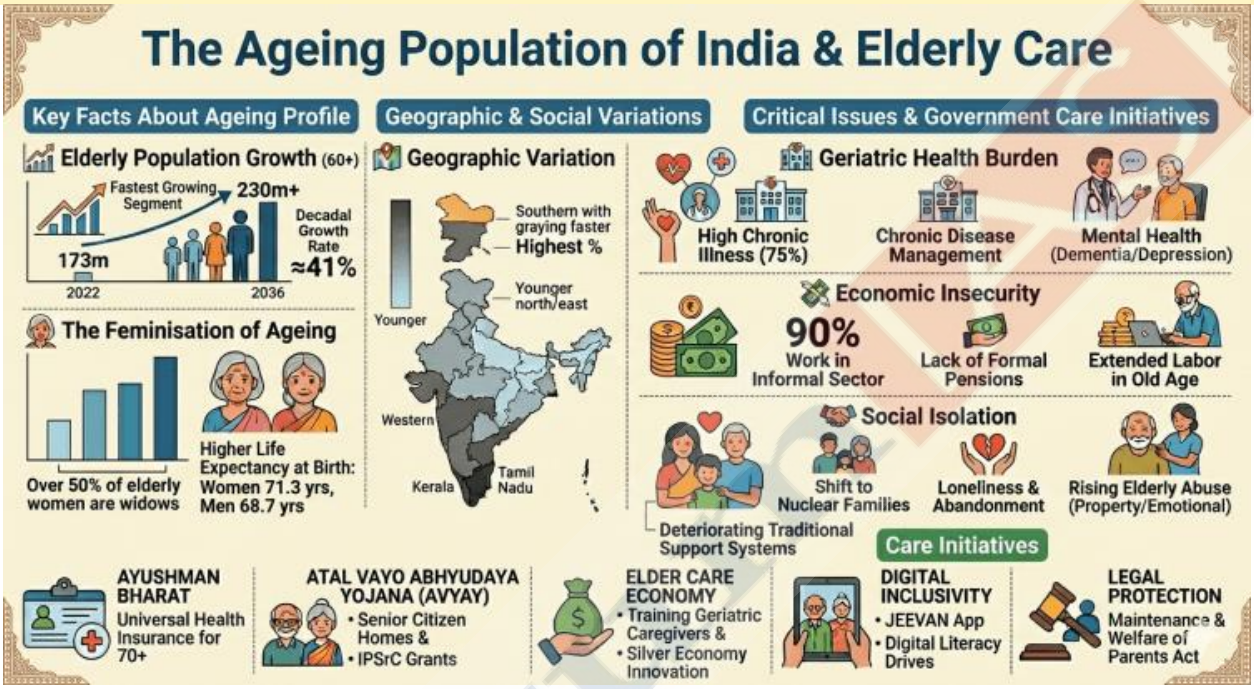
1. **Scale and Optimize Mechanical Sweeping**: Sprinkling water or sweeping with manual brooms just moves dust around. The city needs a massive upgrade to its **Mechanical Road Sweeping Machine (MRSM)** infrastructure. Sweeping routes must be mapped using GIS data to focus on high-silt commercial and industrial zones (like Anand Vihar or Narela), rather than prioritizing low-pollution VIP zones.
2. **Mandatory "Greening" of Open Pockets and Central Verges**: Paving alone won't work if open soil is constantly blown onto the tarmac. Every inch of unpaved road shoulder (*kutcha* edge) must be covered with interlocking concrete blocks or grass. Instead of cosmetic flowers, dividers and roadsides need dense, multi-layered canopy plants and grass. Planting dense, drought-resistant shrubs along road margins can trap dust and stabilize soil, preventing it from becoming airborne.
3. **Eliminating Potholes:** Broken pavement and potholes accumulate silt. When heavy vehicles drive over them, they crush this trapped silt into extremely fine, toxic PM2.5 particles. Maintaining smooth, pothole-free roads is a direct way to reduce dust suspension. Potholes and cracks must be repaired within 72 hours of identification to prevent them from grinding into fine dust.
4. **Transition to Regional, Multi-Agency Governance**: Dust does not respect political borders. A significant amount of dust is blown into Delhi from the arid plains of Rajasthan and unpaved roads in neighboring NCR cities like Gurugram, Noida, and Faridabad. **CAQM** needs to enforce a synchronized, legally binding dust-management protocol across the entire NCR. If Delhi sweeps its roads but neighboring cities don't, the wind will simply blow the dust back in.
5. **Dust suppressants**: While water evaporates quickly, the government could test longer-lasting, eco-friendly chemical suppressants (like calcium magnesium acetate) on high-traffic corridors, though these must be carefully vetted to avoid groundwater contamination.

UPSC GS-3: Environment
Read More: Indian Express

The Ageing Population of India & Elderly Care – Explained Pointwise

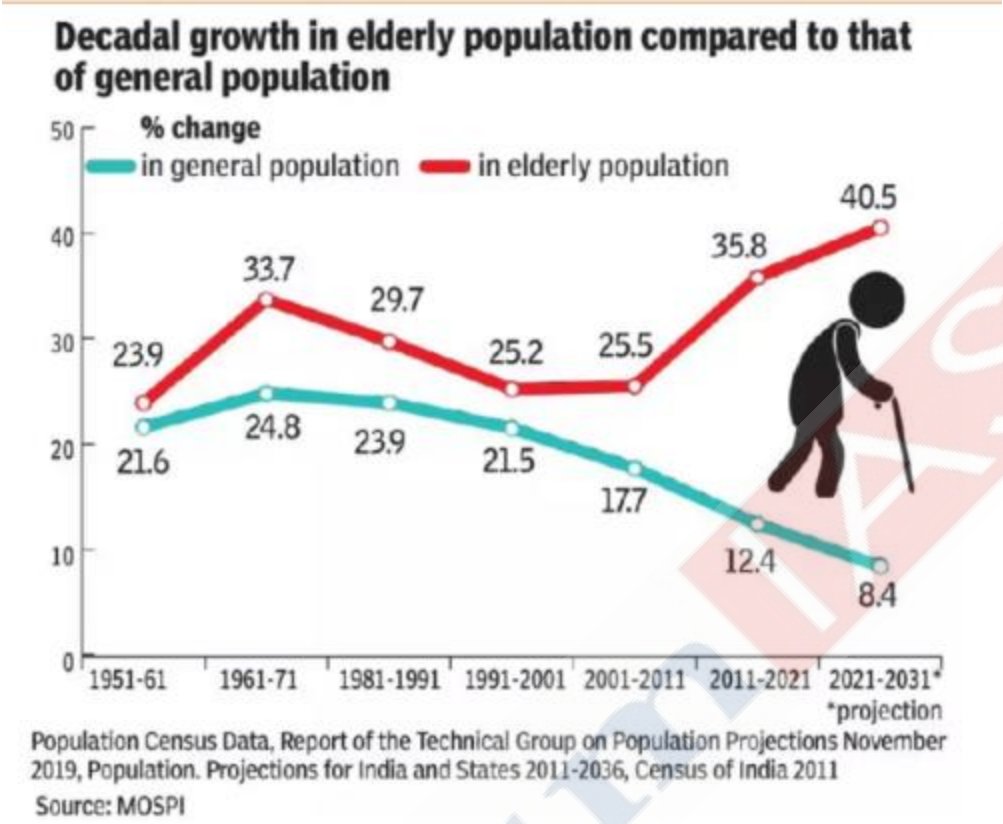
India is undergoing a profound demographic transition. While the country has long celebrated its "demographic dividend" of a young workforce, its population is graying at an unprecedented pace. According to the latest SRS

data, India's birth rate fell from 21 in 2014 to 18.3 in 2024; while death rate marginally went down from 6.7 to 6.4 – which shows that the country is well on its way from population 'explosion' to one of ageing population. Recently, Kerala – India's most rapidly ageing state – announced the formation of a department for the welfare of elderly people.



What is the Status of Elderly Population in India?

- According to the Government of India and the United Nations, India currently has **more than 150 million** elderly people (about **10%** of total population), making it the **second-largest elderly population globally**.
- The number of elderlies (persons above 60 years) is set to increase from 100 million in 2011 to **230 million** in 2036 (about **15%** of the population). By 2050, the elderly population is expected to constitute nearly **one-fifth** of the total population, that is around 350 million.
- The population aged 80 years and above is expected to expand by a massive **279%** between 2022 and 2050, triggering an urgent demand for long-term palliative care.
- **Old Age-Dependence Ratio:**
    - The old age-dependence ratio denotes the number of persons aged 60-plus per 100 persons in the age group of 15-59 years.
    - According to the Ministry of Statistics and Programme Implementation's (MOSPI) 'Elderly in India 2021' report, the old-age dependency ratio is increasing in India. The old age-dependence ratio has increased from 10.9% in 1961 to 14.2% in 2011, to 15.7% in 2021 and is projected to increase to 20.1% in 2031 respectively.



Source- MOSPI

- **Inter-State Variation:**
    - The demographic transition happening in India is not even across the States. According to the RBI report, **Kerala & TN** will be "**ageing States**" by 2036 because their elderly populations will exceed 22% & 20% respectively.
    - On the other hand, the **working age populations** of **Bihar, UP, Jharkhand** will continue to rise beyond 2031, **Karnataka & Maharashtra** occupy the middle ground – balancing growth with the onset of ageing pressure.

What is the need for taking care of the Elderly Population in India?

1. **Unlocking the "Silver Dividend"**: Healthy, well-supported seniors possess a lifetime of institutional knowledge, professional skills, and cultural wisdom. By keeping them healthy and integrated into society, India can leverage their potential for mentorship, community leadership, and part-time economic contributions—turning a perceived challenge into a national asset.
2. **Generational Link:** The elderly citizens provide a vital generational link for the upcoming generation, such as providing support and stability to families and society at large. **For ex-** Grandparents in joint families provide a crucial link for transferring values and morals to the younger generation.
3. **Social Harmony:** The deep cultural impressions and social experiences of the elderly population in India provide the necessary buffer against intolerance, violence and hate crimes.

4. **Relieving Pressure on the Working-Age Workforce:** Without formal elder care infrastructure (like day-care centers, trained caregivers, and assisted living), the burden of full-time care falls on working-age children. This often forces women out of the workforce or reduces overall economic productivity as families struggle to balance work and caregiving.
5. **Moral and ethical responsibility:** It is the moral and ethical responsibility of the society to care for its people beyond their prime. This helps in reciprocating their lifetime of physical, social, emotional, and economic investment in the society.
6. **Constitutional Mandate: Article 41** of the Constitution of India directs the State to secure the right to work, education, and public assistance in cases of old age, sickness, and disablement. Taking care of seniors is a fulfillment of this constitutional directive.

What are the Challenges Faced by Elderly Population in India?

Social Challenges	1. **Social Neglect:** Elderlies are increasingly being neglected by the younger generation due to various social reasons such as western education, globalisation, nuclear family structure. 2. **Abuse of the elderly population:** Elderlies in India face various forms of abuse such as physical, sexual, psychological or financial. They suffer from emotional harm that emerges from verbal or emotional abuse. 3. **Inter-section of Caste and Elderly:** The lower caste elderly have to keep on working for livelihood even at old age due to financial issues. While for the upper caste elderlies, good jobs become less available and they hesitate to take menial jobs which creates a feeling of 'worthlessness' amongst them. 4. **Feminisation of ageing:** Ageing in India is increasingly female-centric. **Over 54% of elderly women are widows**, making them highly vulnerable to economic dependency, lack of property rights, and social isolation. The life of elderly widows is riddled with stringent moral codes of the society. Social bias against elderly women results in unjust allocation of resources, neglect, abuse, exploitation, gender-based violence, lack of access to basic services and prevention of ownership of assets.
Economic and Financial Challenges	1. **Lack of Social Security Protection:** Approximately **90% of India's workforce is in the informal sector** (agriculture, daily wage labor, domestic work). Consequently, an overwhelming majority of seniors do not have access to formal, employer-matched pensions or retirement benefits. 2. **Inadequate Government Safety Nets:** India spends only about 1% of its gross domestic product on pensions. While government pension schemes like the Indira Gandhi National Old Age Pension Scheme (IGNOAPS) exist, the monthly payouts are heavily critiqued as being too low to cover basic nutritional and survival needs. 3. **Lack of housing and other basic amenities:** The housing available to a majority of the senior citizens are sometimes inappropriate and unsuitable to their requirement.

Health Issues and Challenges	1. **High Burden of Chronic Diseases:** Data from the Longitudinal Ageing Study in India (LASI) reveals that nearly **75% of senior citizens suffer from at least one chronic illness** (such as diabetes, hypertension, cardiovascular diseases, or severe arthritis). Multi-morbidity (suffering from two or more chronic conditions simultaneously) affects over half of the elderly population. 2. **Crippling Out-of-Pocket Expenditure:** India has a remarkably low penetration of health insurance tailored for senior citizens. High premium rates and exclusions for pre-existing conditions mean that families must pay for treatments entirely out-of-pocket, frequently driving vulnerable families into poverty. 3. **Mental Health and Cognitive Decline:** Issues like depression, severe anxiety, and cognitive impairments (such as Alzheimer's and dementia) affect roughly 20% to 25% of the elderly. Mental health stigma, combined with a severe shortage of trained geriatric psychologists, leaves these conditions largely undiagnosed and untreated. 4. **Rural-Urban Healthcare Divide:** While 71% of India's elderly reside in rural villages, specialized tertiary healthcare facilities and doctors are heavily concentrated in urban centers, making access a geographic nightmare for frail seniors.

What are the Government initiatives for elderly care in India?

Atal Vayo Abhyuday Yojana (AVYAY)	It is an umbrella scheme that consolidates various efforts under a single, strategic framework aimed at improving the quality of life for senior citizens. The scheme has five key components that address different needs: 1. **Integrated Programme for Senior Citizens (IPSrC):** To provide institutional care. 2. **Rashtriya Vayoshri Yojana (RVY):** To provide Physical Aids and Assisted-living Devices for Senior citizens belonging to the BPL category. 3. **Seniorcare Ageing Growth Engine (SAGE):** Aims to create Silver Economy. 4. **Senior Citizen Opportunities for Productive Engagement (SCOPE):** Portal that aims to utilize the experience, time and energy of the elderly population which can be used by the business enterprises looking for stable employees with experience. 5. **State Action Plan for Senior Citizens (SAPSrC):** Empowers states to develop and implement their own action plans for elderly welfare.

National Policy for Older Persons 2011	The policy aims to encourage individuals to make provisions for their own and their spouse during old age, to bring non-governmental organizations for caring for older persons and to provide healthcare facilities to the elderly.
The Maintenance and Welfare of Parents and Senior Citizens Act, 2007	The Act provides a legal framework for the care of the elderly. It makes it a legal obligation for children and heirs to provide maintenance to their parents/senior citizens, a provision that is increasingly important as family structures change. The Act also provides for the establishment of old age homes and the protection of life and property of seniors.
National Social Assistance Programme (NSAP)	This is a social security program that provides a monthly pension to seniors living below the poverty line. Under the **Indira Gandhi National Old Age Pension Scheme (IGNOAPS)**, eligible individuals between 60-79 years receive **₹200 per month**, while those aged 80 and above receive **₹500 per month**.
Pradhan Mantri Vaya Vandana Yojana	The scheme aims to provide social security during old age. It also protects elderly persons aged 60 and above against a future fall in their interest income due to uncertain market conditions.
Senior care Ageing Growth Engine (SAGE) Initiative and SAGE portal	This initiative aims to create a **"Silver Economy"** by identifying, evaluating, and supporting start-ups that develop innovative, age-friendly products and solutions to help seniors lead more independent lives.
Ayushman Bharat (AB-PMJAY) Expansion	Every senior citizen in India **aged 70 years and above is eligible for a ₹5 lakh annual free health insurance cover**, entirely irrespective of their socio-economic or income status. For families already covered under PMJAY, seniors over 70 get an exclusive, unshared ₹5 lakh top-up.
National Programme for the Health Care of the Elderly (NPHCE)	This program provides dedicated healthcare delivery systems for seniors down to the grassroots level. It sets up 10-bed geriatric wards in district hospitals, runs weekly clinics at Primary Health Centers (PHCs), and establishes specialized **National Centres of Ageing (NCAs)** at premier medical colleges like AIIMS New Delhi for tertiary research and palliative care.

Elderline (14567)	A national, toll-free helpline number specifically operationalized to support senior citizens. It offers immediate real-time support across India for grief counseling, guidance against elder abuse, clarity on pension schemes, and emergency rescue operations for abandoned citizens.

What should be the Way Forward?

1. **Formalization of caregiving economy:**
    - According to a NITI Aayog report, healthcare offered at home can replace up to 65% of unnecessary hospital visits and reduce hospital costs by 20%.
    - Well-trained caregivers possessing empathetic outlook towards elderly need to be provided formal and better work place conditions.
    - Recognition of "home" as a place for providing care and as a "place of work" for caregivers will be the first step towards elderly care.
2. **Reforming the National Pension System:** The current monthly payouts under the Indira Gandhi National Old Age Pension Scheme (IGNOAPS) need to be systematically revised and pegged to inflation indices to ensure they cover basic living and nutritional costs.
3. **Strengthen Geriatric Healthcare Infrastructure**: India must **establish geriatric departments in all medical colleges** and increase the number of specialist physicians. States like Tamil Nadu have already recommended creating geriatric units in every medical college as a model to follow.
4. **Replication of Switzerland's TIME BANK initiative:** Under this initiative, the younger generation start to save 'time' by taking care of senior citizens. Later, they can use the saved 'time' when they get old, sick, or in need of someone to take care of them. This initiative must be applied to Indian setup.
5. **Incentivizing the "Silver Economy":** The government should offer tax incentives, subsidies, and grants to startups and private enterprises developing senior-friendly technologies, assistive devices, universal design infrastructure, and specialized senior living communities.
6. **Public-Private Partnerships (PPP):** Private healthcare providers should be incentivized to establish specialized geriatric wings and day-care centers in semi-urban and rural areas, backed by state viability gap funding.
7. **Address the Feminisation of Ageing**: Since over 50% of elderly women are widows facing social exclusion, targeted policy must ensure **property rights, survivor pensions, access to healthcare, and legal protections** for elderly women — especially in rural areas where vulnerability is highest.
8. **Rationalisation of subsidies:** The RBI report recommends the ageing States to rationalize their subsidies to afford rising pension costs & youthful States to invest heavily in human capital.

Conclusion: India has a small window of opportunity to act. Unlike many developed nations that aged after becoming wealthy, India is ageing while still building its public health and social protection systems. Thus, India needs to shift from a **reactive, welfare-based model** to a **proactive, rights-based, and opportunity-driven approach** — one that invests in geriatric healthcare, financial inclusion, technology, age-friendly infrastructure, and social empowerment

Read More: The Hindu
UPSC Syllabus- GS 2- Govt policies for vulnerable section

Critical Infrastructure – Significance & Threats – Explained Pointwise

Critical infrastructure and essential services are often taken for granted. Over the past few decades, these services have expanded significantly due to digital transformation driven by automation, the Internet of Things (IoT), and AI. However, the same connectivity that enhances efficiency has also widened the spectrum of risks and vulnerabilities.

What is meant by critical infrastructure?

- **Critical infrastructure** refers to the physical and cyber systems, assets, and networks that are so vital to a nation that their incapacitation or destruction would have a debilitating effect on physical security, economic security, public health, or safety.
- **The key characteristics** that define something as critical infrastructure are that it is interconnected with other systems (so failures cascade), it serves large populations, it is difficult to quickly replace or repair, and its failure would cause widespread harm.
- The **National Critical Information Infrastructure Protection Centre (NCIIPC)** (the nodal national agency created in 2014 under the National Technical Research Organisation (NTRO)) has officially identified **six core sectors** as critical to India:
    1. **Power & Energy**
    2. **Banking, Financial Services & Insurance (BFSI)**
    3. **Telecommunications**
    4. **Transportation**
    5. **Healthcare**
    6. **Government & Strategic Public Enterprises**

What is the significance of critical infrastructure?

Economic Significance	• **Facilitates High Growth:** India targets 8-10% GDP growth to become a developed nation (Viksit Bharat). This is impossible without reliable power, modern transport (railways, highways, ports), and high-speed digital connectivity. • **Enables "Make in India" & Supply Chains:** Global companies shifting supply chains away from China need reliable infrastructure. A power cut or a failed logistics route in a manufacturing hub like Tamil Nadu or Gujarat directly loses contracts and investments for India. • **Drives Digital Economy:** With UPI processing billions of transactions monthly, India's fintech infrastructure is critical. A 2-hour outage of the banking network (which is designated as critical) would freeze e-commerce, salaries, and emergency aid transfers.
National Security Significance	• **Military Readiness:** All military bases, nuclear command centers, and border surveillance systems depend on a resilient power and communications grid. Disabling these via a cyber or physical attack would cripple India's defensive and offensive capabilities before a single shot is fired. • **Protecting Strategic Assets:** India's nuclear power plants (e.g., Kudankulam), space assets (ISRO), and defense R&D centers are prime terror targets. Their protection is directly linked to strategic stability in South Asia.
Social Significance	• **Public Health & Safety:** Hospitals require uninterrupted power for ICUs. Water treatment plants need power to pump clean water. A multi-day blackout in a city like Delhi or Mumbai could lead to dehydration, heatstroke, sewage overflows, and a public health crisis. • **Disaster Management:** India is prone to cyclones, floods, and earthquakes. Communication towers, early warning systems, and emergency services (police, fire, ambulances) are all critical. If these fail during a disaster, the death toll multiplies. • **Food Security:** India's Public Distribution System (PDS) and food supply chains rely on cold storage (refrigeration) and rail transport. Disrupting these leads to spoilage of grains and vegetables, directly impacting hunger and inflation for the poor.

What are the various threats and challenges faced by critical infrastructure?

Cyberthreats	• **State-Sponsored Cyber Warfare**: Critical infrastructure is a prime target for advanced persistent threat (APT) groups, with over **1.5 million cyberattacks** attributed to just seven such groups. Intelligence reports highlight that a vast majority of targeted attacks on Indian networks originate from the **China-**

	Pakistan axis & targeting India's power grids, telecom networks, and defense systems for leverage during geopolitical standoffs. • **Ransomware**: The energy sector is particularly vulnerable, with **67% of global energy, oil/gas, and utilities organizations** hit by ransomware in 2024. High-profile incidents—like the crippling attack on AIIMS Delhi and massive data breaches at healthcare insurers—demonstrate that hackers are actively targeting the operational lifelines of public safety, demanding massive payouts to release frozen operational systems.
Physical & Hybrid Threats	• **Terrorism attacks:** Cross-border terrorism remains a persistent threat, especially in Jammu & Kashmir. Pipelines, railway networks, power stations, and dams have historically been targets of terrorist groups. • **Left-Wing Extremism (Naxalism):** Maoist groups (Naxalites) have repeatedly targeted railway lines, power infrastructure, and communication towers in central and eastern India. This disrupts development in already vulnerable tribal and rural regions. • **Geopolitical Conflict**: Energy infrastructure, such as the **Jamnagar Refinery** and **Mundra Port**, is located close to the international border with Pakistan, making them strategic targets. The 2025 **Operation Sindoor** saw security agencies intercept over 600 drones and missiles, **40% of which targeted Gujarat and Rajasthan**, indicating a clear and present danger. • **Drone Warfare**: Recent global conflicts have shown how drones can precisely target oil depots, refineries, and gas fields, causing economic shockwaves. India is actively working to counter this threat, which traditional air defenses are not fully equipped to handle.
Technical & Systemic Challenges	• **Legacy Systems:** Many of India's physical infrastructures (like older power sub-stations, water pumping stations, and railways) run on outdated **Operational Technology (OT)**. These legacy systems were originally designed to be isolated from the internet. When they are retrofitted with modern internet-of-things (IoT) sensors to integrate with smart grids, they become highly vulnerable because they lack built-in, modern encryption and authentication protocols. • **Hardware Vulnerabilities**: India relies heavily on imported electronic hardware, microchips, and telecommunications equipment. This creates a severe **supply chain risk**, where foreign adversaries can embed malicious firmware at the manufacturing stage. If triggered remotely, these backdoors could compromise entire telecom or energy grids. • **Regulatory and Governance Gaps**: India currently lacks an overarching **Critical Infrastructure Protection Act** and a single nodal agency to oversee all aspects of security.

Environmental, Climate change & Natural disaster related Challenges	• **Extreme Weather Events:** Climate change poses a direct physical threat to India's infrastructure. Cyclones on the eastern and western coasts routinely tear down telecom towers and flood power stations. Intense heatwaves strain the electrical grid to its absolute limits, while flash floods and landslides in northern regions can physically wipe out transport corridors and hydro-dams. • **Earthquakes**: Large parts of northern and northeastern India lie in high seismic zones, putting dams, bridges, and urban infrastructure at risk.

What are the various government initiatives aimed at protecting critical infrastructure?

1. **Institutional Frameworks**:
    - **NCIIPC (National Critical Information Infrastructure Protection Centre):** Created under Section 70A of the IT Act, this is the nodal national agency responsible for safeguarding the designated 6 critical sectors (Power, BFSI, Telecom, Transport, Strategic/Defense, and Government). It issues real-time threat intelligence and coordinates national security protocols.
    - **CERT-In (Indian Computer Emergency Response Team):** Operating as the premier incident response agency, CERT-In handles broader cybersecurity threats and coordinates rapid response and forensics whenever a network breach or ransomware attempt is flagged.
    - **I4C (Indian Cyber Crime Coordination Centre):** Established under the Ministry of Home Affairs (MHA), this center enhances coordination between law enforcement agencies to intercept cross-border cybercrimes targeting critical digital assets.
    - **National Disaster Management Authority (NDMA)**: Apex body for disaster management under the Disaster Management Act, 2005. Develops national policies and plans for protecting infrastructure against natural disasters.
    - **CISF:** The Central Industrial Security Force provides dedicated physical security for over 350 vital industrial and public installations, including nuclear plants, airports, and space stations.
2. **Digital Personal Data Protection (DPDP) Act:** The DPDP Act introduces heavy statutory financial penalties (up to **₹250 crore per incident**) for any enterprise or government body failing to implement adequate security safeguards, legally forcing critical entities to heavily prioritize security investments.
3. **Silicon Sovereignty & Hardware Security:** To mitigate supply chain weaponization (such as hidden backdoors in imported hardware), India enforces strict screening and security testing for power grid components and telecom gear. The push for indigenous semiconductor manufacturing via the **India Semiconductor Mission (ISM)** aims to decouple critical national infrastructure from volatile foreign supply chains.
4. **Cyber Swachhta Kendra (Botnet Cleaning Centre):** Run by CERT-In, this initiative tracks and neutralizes botnet infections across the country, preventing attackers from using networks of compromised local devices to launch crippling Distributed Denial of Service (DDoS) attacks against national servers.
5. **CSPAI (Certified Security Professional in Artificial Intelligence):** Launched by the government to bridge the critical technical skill deficit, this specialized training track equips elite defensive engineers with the skills required to protect critical infrastructure from AI-generated threats, data poisoning, and automated network intrusions.

6. **National Cyclone Risk Mitigation Project (NCRMP):** Implemented in eight coastal states, this project has built **multi-purpose cyclone shelters, evacuation roads, and saline embankments** and has facilitated underground cabling for power.

What should be the way forward?

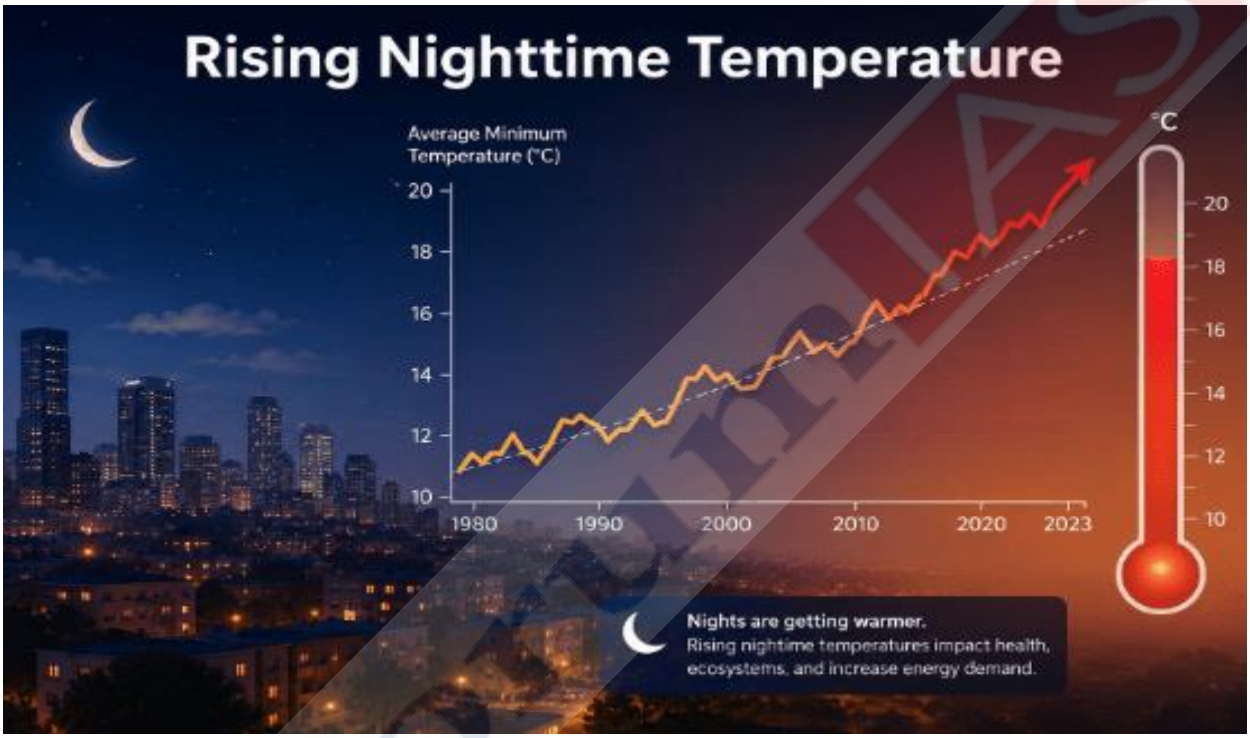
1. **Enact a Comprehensive Legal Framework:** India currently lacks an overarching **Critical Infrastructure Protection Act.** The Act should:
    - **Codify a Unified Definition:** Establish a clear, legally binding classification of "critical infrastructure" across all sectors to eliminate ambiguity.
    - **Mandate "Digital Twins":** Require every physical asset to be supported by a functional digital twin for real-time structural health monitoring and predictive maintenance .
    - **Establish Criminal Liability:** Impose clear accountability on designers, contractors, and operators for failures resulting from gross negligence, addressing the current diffusion of responsibility.
2. **Establish a Unified Governance Mechanism:** Create a **Supply Chain Technical Office (SCTO)** under the National Cyber Security Coordinator to provide technical expertise and move hardware security from subjective assessments to **quantifiable risk calculations.**
3. **Mandate Resilience Cost-Benefit Analysis (RCBA):** Use the RCBA tool developed by the **Coalition for Disaster Resilient Infrastructure (CDRI)** to demonstrate the economic returns of resilience investments. For example, flood protection on a road in Assam returned **eight rupees for every rupee spent.**
4. **Achieve Full Hardware & Silicon Sovereignty**: To mitigate the risk of embedded foreign spyware, India must aggressively accelerate its trusted source procurement policies. Through the India Semiconductor Mission, India must mandate that all microchips, routers, and supervisory systems used in strategic sectors (Defense, Telecom, Power) are either manufactured domestically or rigorously vetted through deep, cryptographic hardware audits.
5. **Create Sector-Specific CERTs**: While the NCIIPC provides macro-level oversight, India needs hyper-specialized, deeply embedded sector-specific response teams (e.g., **Fin-CERT** for finance, **Power-CERT** for energy, and **Trans-CERT** for logistics). Sector-specific engineers understand the unique operational nuances of their respective fields far better than general cybersecurity practitioners.
6. **Climate and Physical Resilience**: As extreme weather events become more frequent, India must legally mandate climate stress-testing for all physical infrastructure projects. New bridges, highways, data centers, and power lines must be engineered using predictive climate modeling to ensure they can withstand 50-year flood levels, severe heatwaves, and category-5 cyclones.
7. **Create a Dedicated "Cyber Defense Corps"**: To bridge the acute cyber-talent deficit, the government should establish a dedicated technical wing within the armed or paramilitary forces. Grooming and retaining elite ethical hackers, AI engineers, and industrial security experts within public service is vital to maintaining India's digital sovereignty.

Conclusion: As India moves toward becoming a major global economy & digitally empowered nation, the safety of critical infrastructure cannot be treated merely as a technical issue. It is a matter of sovereignty, resilience & economic security. The need of the hour is stricter policy enforcement, rigorous certification, preference for trusted indigenous technologies & continuous vigilance across government & industry.

Read More: The Hindu
UPSC GS-3: Infrastructure

Rising Nighttime Temperature – Reasons & Consequences – Explained Pointwise

India is witnessing a steady rise in nighttime temperatures due to climate change, rapid urbanisation, and changing land-use patterns. Unlike daytime heat, rising night temperatures prevent the atmosphere from cooling adequately after sunset, leading to prolonged heat stress for humans, agriculture, and ecosystems. This trend has become more pronounced in recent years, especially in urban areas affected by the urban heat island effect. Increasing nighttime temperatures not only worsen heatwaves but also impact public health, energy demand, crop productivity, and overall climate resilience in India.



What is meant by nighttime temperature?

- Nighttime temperature refers to the atmospheric temperature recorded during the night, usually after sunset and before sunrise. It generally represents the minimum temperature experienced in a day.
- Global mean temperatures have risen by more than 1.3°C since 1850, with nighttime temperatures increasing even more rapidly than daytime temperatures.
- Rising nighttime lows are often a clearer signal of global warming than rising daytime highs, as warmer nights can increase heat stress on humans and crops.

What are the reasons behind rising nighttime temperature?

1. **Changes in the Planetary Boundary Layer**: The planetary boundary layer is the lowest part of the atmosphere – the air directly influenced by the Earth's surface. This layer changes shape between day and night, which accelerates nighttime warming:
    - **The Daytime Layer:** During the day, solar heating causes the air to mix vigorously, expanding this boundary layer up to several kilometers high. The heat is distributed through a massive volume of air.

- **The Nighttime Layer:** At night, the ground cools and the boundary layer shrinks, becoming very thin and stable – often just a few hundred meters thick.
- When that trapped heat is compressed into a much shallower nighttime layer, the same amount of warming energy causes a **greater temperature increase** than during the day.

2. **Greenhouse Gas Emissions**: CO_2, methane, and other greenhouse gases trap heat in the atmosphere around the clock. While the sun drives daytime warming, these gases prevent heat from escaping at night — making nights warm faster than days.
3. **Increased Atmospheric Moisture (Water Vapor)**: As the planet warms, evaporation increases, and the atmosphere can hold more moisture (about 7% more moisture for every **1°C** of warming). Humid air holds onto heat far better than dry air. When nighttime humidity is high, it prevents the air temperature from dropping significantly, resulting in persistently hot nights.
4. **The Urban Heat Island Effect**: Cities are significantly hotter than surrounding rural areas at night due to:
   - **Concrete and asphalt:** Absorb heat during the day and release it slowly at night.
   - **Dark surfaces:** Low albedo (reflectivity) means more solar energy is absorbed.
   - **Lack of vegetation:** Fewer trees means less evaporative cooling
   - **Waste Heat:** Air conditioners, vehicles, and industrial machinery run around the clock in cities, pumping literal "waste heat" directly into the nighttime environment.
5. **Deforestation**: Trees provide shade and release moisture through transpiration, cooling the air at night. Clearing forests removes this natural cooling mechanism, leading to warmer nights in affected regions.
6. **Cloud Cover Changes**: Clouds trap heat beneath them at night (similar to greenhouse gases). Changes in cloud patterns due to climate change are contributing to warmer nights in many regions.
7. **Land Use Changes**: Converting forests and wetlands into farmland or urban areas reduces natural cooling. Irrigated farmland can increase humidity, which in turn traps more heat at night.

What are the impacts of rising nighttime temperatures?

1. **Impact on Human Health:** During heatwaves, high nighttime temperatures are actually more dangerous than daytime peaks. If the temperature doesn't drop enough at night, the human body can't cool down and recover from the daytime heat stress. For vulnerable groups (such as the elderly, infants, outdoor workers, and people with heart or kidney disease) this lack of nighttime relief drastically increases the risk of heatstroke and cardiovascular failure.
2. **Impact on Agriculture:**
   - Many crops and plants require a period of cooler nighttime temperatures to rest and regulate their metabolism.
   - High nighttime temperatures have been directly linked to lower yields in major global staples like rice, corn, and wheat. For example, research shows that for **every 1°C increase** in nighttime minimum temperatures, rice yields can **drop by roughly 10%**.
   - Like humans, dairy cows, pigs, and poultry rely on cool nights to shed daytime heat. Persistent nighttime heat causes severe heat stress in animals, leading to lower milk production, reduced fertility, and higher mortality rates.
3. **Economic Costs**:
   - Demand for air conditioning surges through the night, straining power grids and increasing electricity costs. This relentless demand deprives power grids and transformers of the cool night hours they need to cool down mechanically, leading to a higher frequency of brownouts, blackouts, and equipment failures.

- Buildings, roads, and bridges experience more thermal stress as they get less nighttime cooling, accelerating wear and tear.
- Urban infrastructure designed for historical temperature ranges becomes increasingly inadequate.

4. **Intensified Wildfires**: As nights warm, the relative humidity stays low, preventing the nighttime moisture recovery that used to naturally dampen fires. Wildfires now remain aggressively active through the night, making them much more unpredictable and dangerous to combat.
5. **Ecosystem Imbalance**: Many nocturnal animals, insects, and pollinators are adapted to specific nighttime temperature ranges. Warmer nights alter their hunting patterns, reproductive cycles, and geographical ranges, throwing entire local food webs out of sync.
6. **Aggravated Air Pollution**: Rising nighttime temperatures can trap pollutants close to the ground. When the night stays warm, it alters the stability of the lower atmosphere, preventing the dispersion of ground-level ozone and particulate matter (PM 2.5). This creates stagnant, toxic air in the urban areas.

What needs to be done?

1. **Emission Reduction**: To permanently slow down the rise of nighttime temperatures, global society must rapidly transition away from fossil fuels and toward renewable energy, halting the accumulation of carbon dioxide and methane that traps infrared heat at night.
2. **Redesign Cities to Combat the Heat Island Effect**:
   - **Cool Pavements and Roofs:** Replacing traditional dark asphalt and roofing with highly reflective materials (cool roofs and cool pavements) prevents surfaces from absorbing solar radiation during the day.
   - **Massive Urban Greening:** Planting trees, creating pocket parks, and installing green roofs. Plants naturally cool the air through evapotranspiration and provide shade that prevents the ground from heating up in the first place.
   - **Wind Corridors:** Designing city layouts with building heights and spacings that encourage natural wind flow. This helps flush trapped heat out of urban centers after sunset.
3. **Revising Heatwave Definitions:** Weather bureaus must issue heat warnings based on minimum nighttime temperatures, not just daytime peaks. A day that hits 38°C followed by a 28°C night is far more dangerous than one followed by a 20°C night.
4. **Smart Grid Management:** Power companies must fortify the electrical grid to handle 24/7 peak demand, incorporating large-scale battery storage to handle the relentless overnight air conditioning load without blackouts.
5. **Agriculture Adaptations:**
   - Develop and promote heat-tolerant crop varieties that can withstand warmer nights.
   - Use night-time irrigation techniques to cool soil and crops during warm nights.
   - Shift planting schedules to align with changing temperature patterns.
   - Install automated misting systems and fans in barns that trigger specifically at night to help dairy cows and livestock shed daytime heat stress.
6. **Cooling Shelters & Infrastructure:** Cities need to provide **24-hour cooling shelters** for those without AC at home, as well as **cool bus stops** and public **water kiosks** where people can access relief at any hour.

UPSC GS-1: Geography
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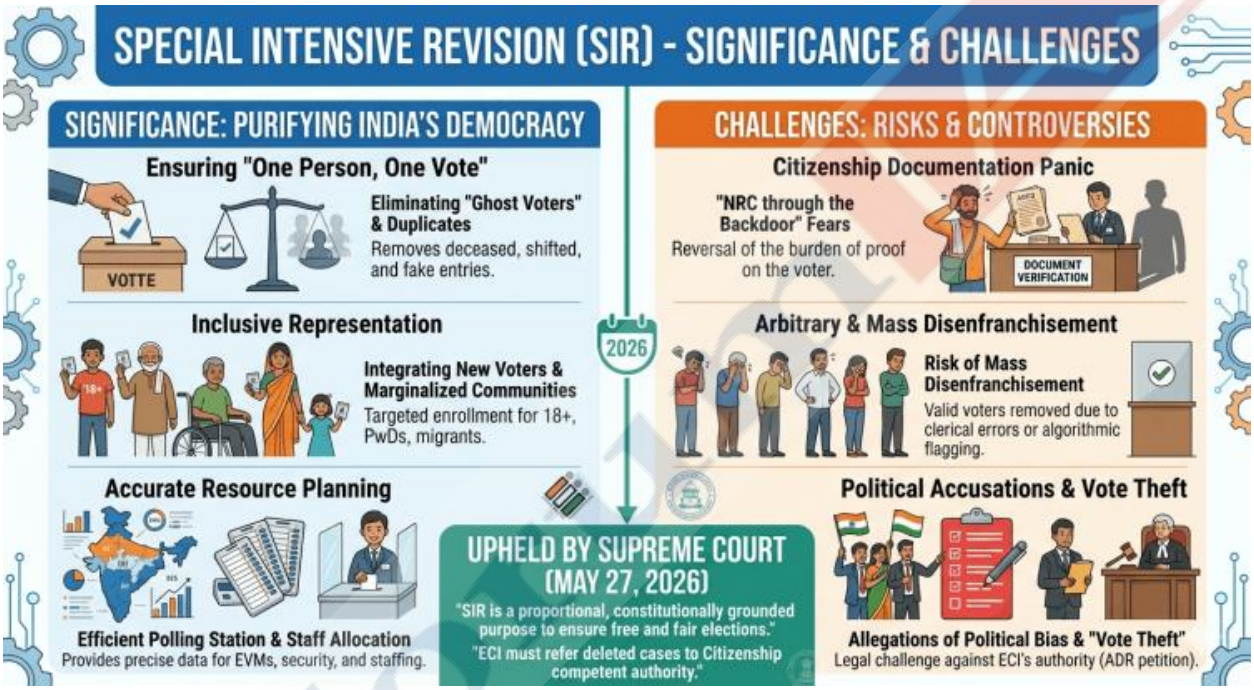
Special Intensive Revision (SIR) of Electoral Rolls – Significance & Challenges – Explained Pointwise

Recently, the Supreme Court completely upheld the legal and constitutional validity of the Election Commission of India's (ECI) Special Intensive Revision (SIR) exercise & also upheld the procedure followed by the EC. ECI, using its discretionary powers under **Section 21(3)** of **Representation of People Act, 1950**, conducted the Special Intensive Revision (SIR) of electoral rolls for the entire country, starting first from Bihar. It was first such exercise in more than 2 decades (last took place in 2004). However, the exercise has also triggered several controversies with opposition political parties questioning the exercise. Thus, it is important to understand Why & by what process ECI carry out revision of electoral rolls & its significance along with the limitations that it has.



What is Special Intensive Revision?

- A **Special Intensive Revision (SIR)** is a focused, time-bound exercise conducted by the Election Commission of India (ECI) to update and verify the accuracy of electoral rolls.
- Electoral revisions are of 3 types:
    - **Summary Revision:** Annual revision of electoral rolls for routine maintenance + No door-to-door verification.
    - **Intensive Revision:** Major overhaul of electoral rolls + Includes door-to-door verification.
    - **Special Revision:** Undertaken in exceptional cases such as missed areas, large-scale errors, legal or political exigencies etc.
- Unlike routine summary revisions, which are annual and involve only minor updates, an intensive revision involves full, fresh preparation of electoral rolls through **house-to-house verification** by Booth Level Officers (BLOs) to ensure that:
    - All eligible citizens are included in the electoral rolls.
    - Ineligible or duplicate entries are removed.
    - The voter list is accurate, inclusive, and transparent.

- For the latest SIR, ECI has adopted a hybrid approach – combining the characteristics of **intensive revision** as well as **summary revision**. It has also introduced a new step – the requirement of documentary proof at the enumeration stage itself – which is a departure from past practice. The '**special**' in this intensive revision in effect signals its methodological flexibility.
- Intensive revisions have been undertaken earlier **13 times** in **1952-56, 1957, 1961, 1965, 1966, 1983-84, 1987-89, 1992, 1993, 1995, 2002, 2003 & 2004.**

What are the Key Features of SIR?

- **Constitutional Mandate:** The exercise is backed by **Article 324** of the Indian Constitution, which grants the ECI total superintendence and control over elections.
- **Statutory Power:** It is formally conducted under **Section 21(3) of the Representation of the People Act, 1950**, allowing the Commission discretionary powers to comprehensively overhaul and refine rolls when ordinary revisions fall short.
- **Hybrid Approach:** The SIR combines features of both intensive and summary revisions. It includes door-to-door field verification (like intensive revision) and also uses existing rolls for distributing enumeration forms (like summary revision).
- **Documentary Proof:** For the first time, even existing electors (enrolled after 2003) must provide documentary proof of date and/or place of birth during enumeration.
- **Approved Documentation:** Electors are required to furnish strict proof of residence and identity. Following a pivotal Supreme Court ruling, widely accepted documents like **Aadhaar, Voter ID, and ration cards** are seamlessly utilized to prevent genuine eligible citizens from facing procedural exclusion.
- **House-to-House Enumeration:** Booth Level Officers (BLOs) visit every house in the assigned polling booth area and distribute pre-filled "Enumeration Forms" to existing electors and new eligible persons.
- **Duplicate & Invalid Entry Removal:** SIR systematically removes entries of deceased persons, those who have relocated, and duplicates — ensuring every registered voter entry is verified, genuine, and currently valid.
- **Special Focus on Vulnerable Groups:** There is special emphasis on migrants, youth, and excluded electorates to ensure no eligible voter is left out.
- **Draft Publication & Grievance Redressal:** A draft roll is published, objections are entertained, and a grievance redressal mechanism is applied before finalizing the rolls.
- **Final Roll & Freeze:** The final roll is constituted and frozen ahead of elections, with additions and deletions after that restricted to special cases only.

Why do we need the revision of electoral rolls?

1. **Foundation of Free and Fair Elections**: As the Supreme Court observed, "Free and fair elections do not rest merely upon the mechanics of polling. They fundamentally depend upon the integrity, accuracy and credibility of the electoral rolls, which form the foundation of the democratic process."
2. **Ensuring Electoral Roll Purity and Accuracy:** SIR is the most effective method for identifying and deleting names of deceased persons, duplicate entries, and individuals who have permanently shifted residence from the electoral roll. This prevents fraudulent voting and ensures that only eligible citizens vote. It provides an opportunity to correct errors in names, addresses, age, and other details, leading to a more accurate and reliable voter list.

3. **Preventing Inclusion of Ineligible/Foreign Persons**: The inclusion of foreign illegal immigrants has been cited as one of the key reasons necessitating an intensive revision of electoral rolls, to ensure that only genuine Indian citizens participate in elections.
4. **Identifies Unenrolled Voters:** Through house-to-house enumeration, BLOs can identify eligible citizens who have turned 18, or who were previously missed, and assist them in registering. This is crucial for expanding the democratic franchise and ensuring universal adult suffrage.
5. **Addresses Demographic Shifts:** Given India's rapid urbanization and internal migration, SIR helps in updating the rolls to reflect demographic changes, ensuring that migrant populations are correctly enrolled in their new places of residence.
6. **Strengthening Public Trust in Elections:** A transparent and rigorously updated electoral roll builds confidence among voters, political parties, and the general public in the fairness and legitimacy of the election process. When the voter list is perceived as pure, it enhances trust in election results.
7. **Addressing Concerns from Political Parties:** Political parties often raise concerns about the integrity of electoral rolls, especially regarding the inclusion of illegal voters or exclusion of genuine ones. SIR is the ECI's most robust tool to address such concerns and ensure a level playing field.
8. **Legal and Constitutional Mandate:** The ECI's power to conduct such revisions is enshrined in the Constitution and the Representation of the People Act, 1950. Conducting SIR fulfills the ECI's constitutional mandate to ensure free and fair elections.

What are the challenges and controversies associated with SIR?

1. **Risk of Disenfranchisement of Genuine Voters:** This is by far the biggest challenge and source of controversy. SIRs often demand specific, sometimes old, documents to prove citizenship, date of birth, and ordinary residence (e.g., pre-1987 documents, parental birth certificates). Many vulnerable groups, including:
    a. **Marginalized Communities:** Such as Scheduled Castes (SCs), Scheduled Tribes (STs), and minorities (e.g., Muslims), who may historically lack formal birth records or land deeds.
    b. **Migrant Workers:** Who frequently move for work and may not have stable residence proof or be present at their native village during the verification period.
    c. **Poor and Illiterate Individuals:** Who may not understand the process or have the resources to obtain complex documents.
    d. **Women:** Especially those who have migrated after marriage, who may face difficulties in producing parental documents or documents from their place of birth.
2. **Burden of Proof Shifted to Citizen:** Instead of the state being primarily responsible for ensuring all eligible voters are on the roll, the onus often shifts to the individual to prove their eligibility, which can be an overwhelming task for many.
3. **Scale of Deletions:** The sheer volume of names purged has caused intense friction. For instance, during the initial phases of the rollout, millions of voters were removed from the rolls across states like Bihar and West Bengal.
4. **Timing of the Exercise**: Opposition parties alleged that the timing of the SIR — close to important electoral events — creates unnecessary confusion and administrative overload, potentially disadvantaging certain voter groups.
5. **Logistical and Administrative Burden:**
    a. **Massive Scale:** India's electorate is enormous. Conducting house-to-house surveys for millions of households is a monumental logistical task, requiring a vast number of Booth Level Officers (BLOs) and supervisory staff.

   b. **Short Timelines:** SIRs are often conducted within relatively short, strict deadlines (e.g. 30 days for enumeration), which can be impractical, especially in large, densely populated, or remote areas, or during adverse weather conditions (like monsoon season in Bihar). This hurried process can lead to errors and omissions.

6. **Scope of ECI's Powers:** The debate often centers on whether the ECI, in the name of "purifying" rolls, oversteps its mandate by essentially conducting a de facto citizenship verification, which is primarily the domain of the Ministry of Home Affairs (MHA) under the Citizenship Act.
7. **Public Perception and Trust Deficit:** When the process is seen as exclusionary or politically motivated, it can erode public trust in the ECI's impartiality and the fairness of the electoral system itself.
8. **The "NRC through the Backdoor" Fear:** A major political flashpoint—particularly in states like West Bengal and Assam—is the fear that SIR is a covert step toward implementing a National Register of Citizens (NRC). Critics and opposition parties note that the intense scrutiny caused widespread panic among migrant workers and marginalized communities.
9. **Uneven Implementation Across Constituencies**: Critics point to uneven implementation across constituencies, with procedural shortcomings varying significantly from region to region, raising concerns about fairness and consistency of the exercise.

What are the issues raised by ADR and other petitioners in their challenge to the SIR before the Supreme Court?

1. **Lack of Statutory Backing**: The main objection was that the SIR effectively turned the Election Commission into a body deciding citizenship issues without clear legal authority. Petitioners argued that the ECI does not have the power to carry out large-scale citizenship checks in the name of cleaning up electoral rolls.
2. **Violation of Constitutional Rights**: The petitioners argued that the SIR exercise violated fundamental rights guaranteed under the Constitution, including:
   - **Articles 14, 19, and 21:** They claimed the process was arbitrary, lacked transparency, and violated the right to life and personal liberty by failing to follow principles of natural justice.
   - **Articles 325 and 326:** They argued that the manner of the revision threatened the universality of adult suffrage.
3. **Ultra Vires of Section 21(3) RP Act**: The ECI based its notification on Section 21(3) of the Representation of the People Act, 1950, which allows "special revisions" of electoral rolls. However, the this provision was originally meant only for limited or exceptional corrections in specific constituencies. Using it for a large-scale, fresh revision of voter rolls across an entire state or the country went beyond the law's original purpose.
4. **Reversal of the Burden of Proof**: The petitioners argued that the SIR reversed a well-settled legal presumption established by the Supreme Court in **Lal Babu Hussein vs. Electoral Registration Officer (1995)**, which dictates that a person whose name is already on the voter list is presumed to be an Indian citizen unless the State proves otherwise. The SIR required voters whose names were not in the 2002/2003 "legacy rolls" to **prove their citizenship** by furnishing specific documents.
5. **Discriminatory Documentation Barriers**: The stringent document requirements heavily penalized economically weaker sections, illiterate populations, and internal migrant laborers. Because these groups are less likely to possess pristine ancestral legacy records.

What did the Supreme Court rule?

1. **ECI Has the Power to Conduct SIR**: The Court ruled that the ECI did not overstep its bounds. It held that the exercise is entirely justified under **Article 324 of the Constitution** (which gives the ECI

absolute control over elections) read with **Section 21(3) of the Representation of the People Act, 1950**.

2. **Scale of SIR**: SC rejected the argument that "special revisions" can only be done in isolated constituencies, ruling that the ECI can scale the exercise statewide or nationwide if systemic inaccuracies (like massive migration or duplication) require it.
3. **Citizenship Claim**:
    - The Court ruled that under Section 16 of the RP Act, the ECI is undoubtedly empowered to check citizenship for the **limited purpose** of deciding who gets included or excluded from a voter list.
    - The Court clarified that deleting someone's name on citizenship grounds **does not** mean the ECI has legally declared them a non-citizen. It simply means the ECI was "unable to be satisfied" for electoral purposes. Final adjudication rests with competent authorities under the **Citizenship Act.**
4. **Document Requirements & Inclusions**: The Court rejected claims that the ECI's strict document checklist was arbitrary. It ruled that any massive verification drive requires a structured, reliable framework. However, the Court noted that the process was made constitutionally compliant because of safeguards added during the hearings—most notably, the **inclusion of the Aadhaar card** as a valid document to ease the burden on ordinary citizens.
5. **Grievance Redressal & Safeguards**: The Court noted that decisions taken during the SIR are **subject to judicial review**. It also ordered the ECI to refer all persons deleted on citizenship grounds to the competent authority within four weeks, with orders for restoration of voting rights if they are found to be citizens.
6. **Procedural Integrity**: The Supreme Court ruled that the measures adopted in electoral roll revision "bear a reasonable nexus to the objectives sought to be achieved, are not manifestly excessive and are accompanied by sufficient procedural safeguards to prevent arbitrary exclusion."

Read More: The Hindu
UPSC GS-2: Representation of People's Act

India-Myanmar Relations – Significance & Challenges – Explained Pointwise

Myanmar President U Min Aung Hlaing is currently on an official visit to India. It is his first foreign visit after assuming the presidency and reflects Myanmar's efforts to enhance regional diplomatic engagement. During the visit, discussions are expected to focus on border security, connectivity projects, trade, economic cooperation, and cultural ties.

The India-Myanmar relationship is one of India's most strategically important but geopolitically complex partnerships. The relationship is currently dominated by India's competing needs for **border security** and its commitment to the **Act East Policy**, all while navigating the unstable political environment created by the 2021 military coup.

Map of major regions in Myanmar and India's northeastern states.

Historical Background of India-Myanmar Relationship:

India and Myanmar have a long history of cultural, religious, and trade links that date back to ancient times. As the land of Lord Buddha, India is a country of pilgrimage for the people of Myanmar.

Spread of Buddhism	Theravada Buddhism traveled from India to Myanmar through both land and maritime routes. Emperor Ashoka's missionaries (Sona and Uttara) are traditionally credited with bringing the faith to **Suvarnabhumi** (the Golden Land, encompassing parts of Lower Burma).

British Era	Both India and Myanmar were part of British India during colonial rule until 1935. **The Anglo-Burmese Wars:** Through three successive wars (1824–26, 1852, and 1885), the British East India Company and the British Raj systematically annexed Burmese territories. The **Treaty of Yandabo (1826)** concluded the First Anglo-Burmese War, forcing Burma to cede Assam, Manipur, Arakan, and Tenasserim, fundamentally restructuring the borderlands. **The Indian Diaspora & Demographics:** Under British rule, large numbers of Indians—including civil servants, merchants, laborers, and moneylenders (such as the Chettiars)—migrated to Burma.
Post Independence	After independence, India and Myanmar established diplomatic relations and maintained close ties. India and Myanmar signed a **Treaty of Friendship** in **1951**. Prime Minister Nehru and Prime Minister U Nu stood together as founding members of the **Non-Aligned Movement (NAM)** at the Bandung Conference in 1955. Ties hit a historic low during the **8888 Uprising (1988)**. India strongly condemned the military's brutal crackdown on pro-democracy protestors and openly championed Daw Aung San Suu Kyi, even granting her the Jawaharlal Nehru Award for International Understanding in 1992.
2002	The Indian Consulate in Mandalay was reopened, and the Consulate of Myanmar was set up in Kolkata.
2014	Myanmar became part of India's "**Neighbourhood First" policy** and its "**Act East" policy**.

What is the Significance of Myanmar for India?

1. **Geo-strategic:** Myanmar is India's gateway to South-East Asia and development of North-Eastern India. Myanmar is an important pillar of India's "Neighborhood First" policy and "Act East" Policy. **For e.g.** Development of India-Myanmar-Thailand (IMT) trilateral highway, Kaladan Multi-Modal Transit Transport (KMMTT) corridor relies on Myanmar.
2. **Counter-Insurgency Operations:** For decades, insurgent groups operating in India's Northeast (such as the NSCN, ULFA, and various Manipuri outfits) have utilized the dense, forested terrain of Myanmar's Sagaing Region and Chin State to set up safe havens. India relies heavily on the cooperation of the Myanmar military (*Tatmadaw*) to conduct coordinated border operations (like *Operation Sunrise*) to dismantle these camps.
3. **Border Management and Stability:** The border region is deeply interconnected by shared ethnicity, causing internal conflicts in Myanmar (such as the post-2021 civil strife) to directly spill over into India. Managing the influx of refugees, smuggling, and cross-border ethnic tensions requires continuous institutional engagement with Myanmar.

4. **Balancing China's Influence:** China has deep economic and strategic footprints in Myanmar, notably through the **China-Myanmar Economic Corridor (CMEC)**. This includes pipelines and a deep-sea port at **Kyaukphyu**, which gives Beijing direct access to the Indian Ocean—effectively bypassing the Malacca Strait. India's proactive diplomatic, economic, and defense engagement with Myanmar is crucial to prevent New Delhi from being strategically encircled along its eastern maritime flank.
5. **Energy Security:** Myanmar possesses significant offshore natural gas reserves (such as the Shwe gas project). Indian public sector undertakings (like ONGC Videsh and GAIL) have invested heavily in these fields, helping diversify India's energy import basket.
6. **Reduction of illegal migration in India:** A stable Myanmar is necessary to reduce the illegal Rohingya and Chin migration in India.
7. **Cultural Soft Power:** The shared heritage of Theravada Buddhism creates an enduring cultural bond. India utilizes "Buddhist Circuit" tourism and the restoration of historical sites in Myanmar (such as the Ananda Temple in Bagan) to strengthen bilateral people-to-people ties.

What are the Major Areas of Cooperation Between India and Myanmar:

1. **Bilateral Trade Dynamics:** Trade between the two countries reaches roughly **$2.1 billion annually**. India's imports from Myanmar are heavily dominated by agricultural commodities (beans, pulses, and timber products account for nearly 90%), while India primarily exports pharmaceuticals, semi-finished steel, and heavy machinery. Indian companies such as Essar, GAIL, and ONGC Videsh Ltd. have invested in Myanmar's energy sector.
2. **Infrastructure and Connectivity:** India-Myanmar relations has been bolstered by the key connectivity projects. India has invested deeply in the infrastructure projects in Myanmar:
    - India and Myanmar inaugurated the 250-kilometer **Tamu-Kalewa-Kalemyo highway**, popularly called the Indo-Myanmar Friendship Road, in 2001.
    - India is building the **Kaladan Multi-Modal Transit Transport** to link Kolkata to Sittwe in Myanmar and then from Myanmar's Kaladan river to India's North-East.

    - India, Myanmar, and Thailand are building the **Asian Trilateral Highway**, which will connect India to ASEAN.

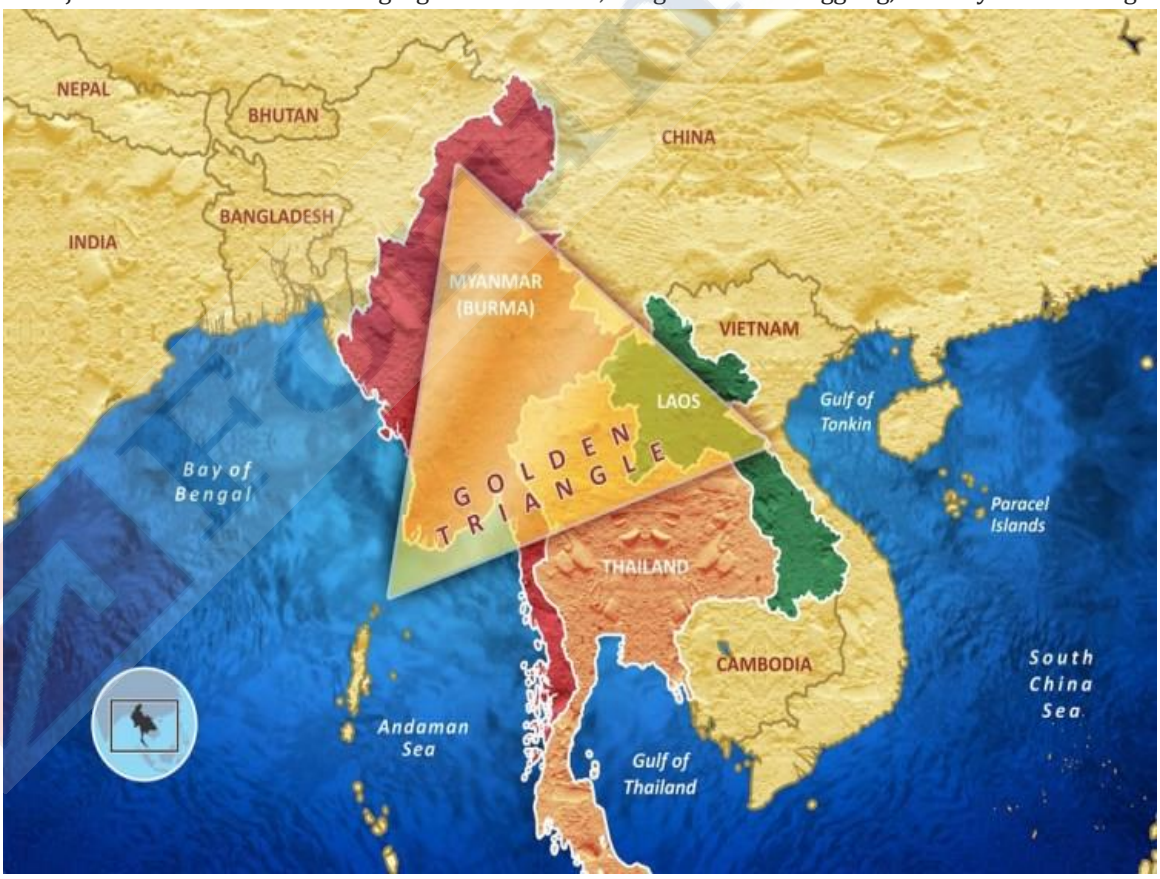
3. **Free Movement Regime (FMR):** The border is governed by an FMR, which allows people residing within 16 km on either side to cross without a visa. This facilitates local tribal links (especially the Kuki-Chin-Mizo communities) but is a major security challenge, especially during conflicts.
4. **Defence cooperation:**
    - India and Myanmar conduct a joint military exercise, called **India – Myanmar Bilateral Military Exercise (IMBEX)**.
    - **Operation Sunrise** between India-Myanmar armies jointly target the militant groups that operate in the border states.
5. **Multilateral partnership:** Myanmar is also a key component of India's strategy to bridge South and South-East Asia through ASEAN, BIMSTEC, and Mekong Ganga Cooperation (MGC).
6. **The Rakhine State Development Programme:** India provides targeted financial grants to build prefabricated houses, schools, and local infrastructure in conflict-prone areas to encourage socio-economic stability.
7. **Education and research:** India has developed Myanmar Institute of Information and Technology and Advanced Center for Agricultural Research and Education (ACARE) for conducting research on pulses and oilseeds.
8. **Humanitarian Aid and Disaster Relief:** India has provided humanitarian aid and disaster relief in natural calamities in Myanmar like Cyclone Mora (2017), Komen (2015), earthquake in Shan State (2010) and COVID-19.

What are the Challenges in India-Myanmar Relations?

1. **Political Unrest in Myanmar:**
    - **Military Coup in 2021:** Aung San Suu Kyi's National League for Democracy (NLD) landslide victory in the 2020 elections sparked concern among the military. The military (Tatmadaw) alleged electoral fraud and staged a coup in February 2021. Aung San Suu Kyi and other leaders were detained, sparking widespread protests and a violent military crackdown.

- **Anti-Junta Armed Struggle:** Various Ethnic Armed Organizations (EAOs) and People's Defence Forces (PDFs) intensified their resistance against the military regime, resulting in escalating conflicts across the country.

2. **India's Policy Paradox with respect to Myanmar Coup:** India faces a dilemma in the form of its commitment to democracy vs. its internal security concerns. On one hand, India has been engaging with the military junta to control insurgent groups operating along the India Myanmar border. On the other hand, India also favours the establishment of federal democracy in Myanmar.
3. **Massive Influx of Refugees in India:** The ongoing armed struggle between the military Junta and the People's Defence forces in the Chin region, Sagaing region have led to massive influx of refugees in India, especially in Mizoram and Manipur. This influx of refugees in India has emerged as a major bone of contention between India and Myanmar, as these have been linked to violent ethnic clashes, drug trafficking and smuggling.
4. **Misuse of Free movement regime:** The Free Movement Regime between India and Myanmar is being exploited by militants and cross-border criminals for the illegal transportation of weapons, contraband goods, and counterfeit Indian currency.
5. **Safe Havens for Indian Insurgents:** Indian insurgent groups (such as ULFA, NSCN, and Manipuri outfits) continue to exploit ungoverned spaces in Myanmar's Sagaing Region to maintain training camps, launch cross-border attacks, and slip back into sanctuary.
6. **The "Golden Triangle" Nexus:** Proximity to the notorious Golden Triangle makes the porous border a major transit corridor for high-grade narcotics, illegal arms smuggling, and synthetic drugs.



7. **Massive Footprint of China**: Through the **China-Myanmar Economic Corridor (CMEC)**, Beijing provides the cash-strapped junta with massive investments, veto protection at the UN, and strategic infrastructure like the Kyaukphyu deep-sea port. China's access to the Bay of Bengal directly bypasses

the Malacca Strait bottleneck, posing a long-term maritime challenge to India's security umbrella in the Indian Ocean. India finds it incredibly difficult to match China's financial muscle and rapid project execution speeds.

8. **Delays in regional connectivity Projects:** The inordinate delays in the implementation of the connectivity projects like the Kaladan Multimodal Connectivity project have widened the trust deficit between India and Myanmar.
9. **Cyber Scam Centers:** A major emerging threat is the rapid proliferation of sophisticated cyber scam syndicates and human trafficking networks operating out of lawless border zones in Myanmar, trapping thousands of foreign nationals—including hundreds of Indian citizens—in forced cyber slavery.

What should be the Way Forward?

1. **Support for democracy and human rights:** The United Nations Special Rapporteur has reported an increase in India's arms supply to the military since the coup. Arming the Tatmadaw (Myanmar Military) undermines India's position on restoring democracy. India should continue to advocate for the restoration of democracy and respect for human rights in Myanmar like the release of political prisoners and ending the military junta's crackdown on dissent.
2. **Engagement with all stakeholders:** India should use its influence to open channels of dialogue with and between the junta and the opposition, including armed ethnic groups.
3. **Use of Regional Organisations for enhanced cooperation:** India should collaborate closely with the ASEAN nations for a peace plan for Myanmar.
4. **Enhanced Economic Engagement:** India should continue to engage with Myanmar economically to promote sustainable development for the benefit of the people of Myanmar. The delayed connectivity projects like the Kaladan and Asian Trilateral Highways must be expedited at the earliest.
5. **Closer Security Cooperation:** India must closely collaborate with Myanmar in intelligence sharing and coordinated efforts to combat insurgencies and drug trafficking.
6. **Grassroots Development Grants:** Focus developmental funding on high-impact local programs, such as providing medical supplies, constructing mobile health clinics, and funding local primary education infrastructure through initiatives like the Rakhine State Development Programme.
7. **Leverage Spiritual Diplomacy:** Deepen ties through the common ground of Theravada Buddhism. Streamlining and subsidizing travel on the **"Buddhist Circuit"** for Myanmar nationals wishing to visit Bodh Gaya and Sarnath acts as an enduring bridge for people-to-people relations.
8. **Targeting Cyber Scam Syndicates:** India must prioritize high-level intelligence sharing and joint police operations with regional authorities to locate, dismantle, and rescue Indian nationals trapped in forced labor within cyber scam factories operating out of Myanmar's lawless pockets.

Conclusion: India-Myanmar relations remain vital for India's eastern strategy, Northeast integration, regional stability, and for managing China's expanding influence—necessitating patient engagement, rapid implementation of projects, and balanced diplomatic outreach.

UPSC GS-2: International Relations
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