NITIN SIR CLASSES

THE HINDU
INDIA'S NATIONAL NEWSPAPER SINCE 1878

Daily News Analysis

The Hindu Important News Articles & Editorial For UPSC CSE

Friday, 31 Oct, 2025

Edition : International Table of Contents

NITIN SIR CLASSES

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INDIA'S NATIONAL NEWSPAPER SINCE 1878

Daily News Analysis

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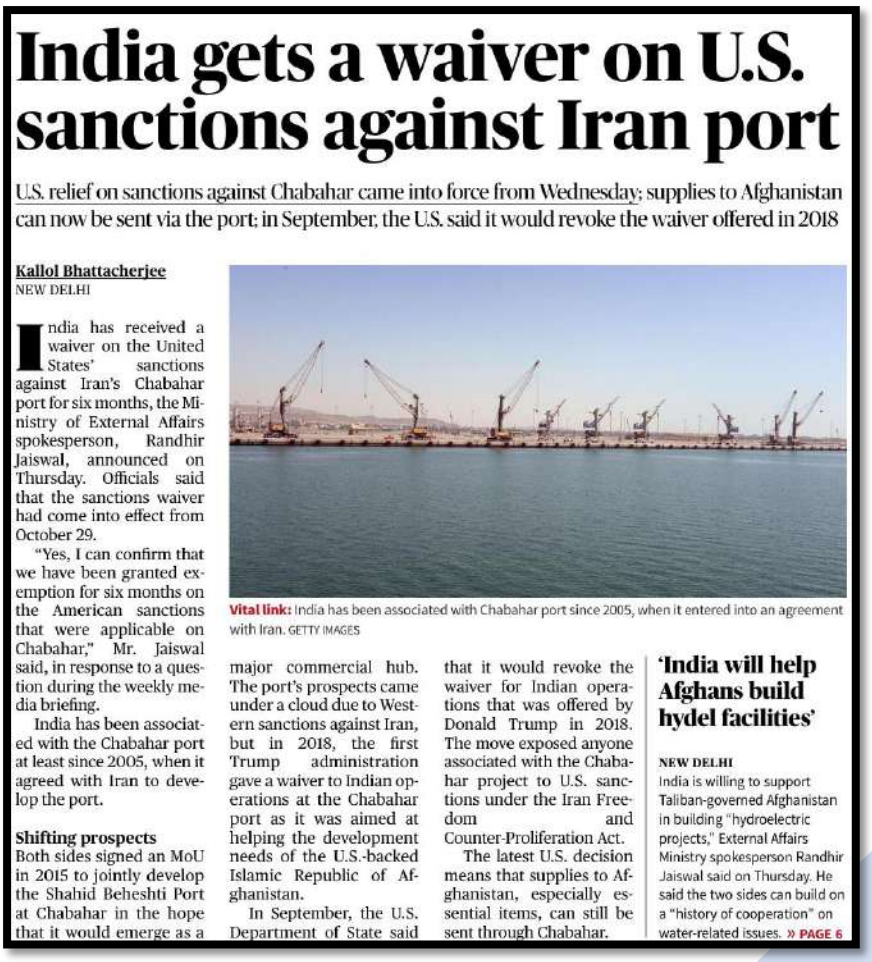
The United States has granted India a six-month waiver on sanctions related to Iran's Chabahar Port, allowing India to continue its developmental and logistical operations there. The waiver, effective from October 29, 2025, ensures that supplies, especially humanitarian and trade consignments to Afghanistan, can proceed uninterrupted through the Chabahar route. This move reflects the port's continued geopolitical relevance despite the larger U.S.-Iran tensions.

Background

- Chabahar Port, located in southeastern Iran on the Gulf of Oman, provides India a strategic alternative route to Afghanistan and Central Asia, bypassing Pakistan.
- India's involvement began in 2005, and a formal MoU was signed in 2015 to develop the Shahid Beheshti terminal.
- In 2018, during the Trump administration, a waiver was first issued allowing India's activities at Chabahar due to its importance for Afghanistan's reconstruction and trade.
- However, in September 2025, the U.S. indicated plans to revoke the waiver under the Iran Freedom and Counter-Proliferation Act, raising concerns about India's investments and supply chains.
- The current renewal of the waiver reinstates operational certainty and



India gets a waiver on U.S. sanctions against Iran port

U.S. relief on sanctions against Chabahar came into force from Wednesday; supplies to Afghanistan can now be sent via the port; in September, the U.S. said it would revoke the waiver offered in 2018

Kallol Bhattacherjee
NEW DELHI

India has received a waiver on the United States' sanctions against Iran's Chabahar port for six months, the Ministry of External Affairs spokesperson, Randhir Jaiswal, announced on Thursday. Officials said that the sanctions waiver had come into effect from October 29.

"Yes, I can confirm that we have been granted exemption for six months on the American sanctions that were applicable on Chabahar," Mr. Jaiswal said, in response to a question during the weekly media briefing.

India has been associated with the Chabahar port at least since 2005, when it agreed with Iran to develop the port.

Shifting prospects

Both sides signed an MoU in 2015 to jointly develop the Shahid Beheshti Port at Chabahar in the hope that it would emerge as a major commercial hub. The port's prospects came under a cloud due to Western sanctions against Iran, but in 2018, the first Trump administration gave a waiver to Indian operations at the Chabahar port as it was aimed at helping the development needs of the U.S.-backed Islamic Republic of Afghanistan.

In September, the U.S. Department of State said that it would revoke the waiver for Indian operations that was offered by Donald Trump in 2018. The move exposed anyone associated with the Chabahar project to U.S. sanctions under the Iran Freedom and Counter-Proliferation Act.

The latest U.S. decision means that supplies to Afghanistan, especially essential items, can still be sent through Chabahar.

Vital link: India has been associated with Chabahar port since 2005, when it entered into an agreement with Iran. GETTY IMAGES

'India will help Afghans build hydel facilities'

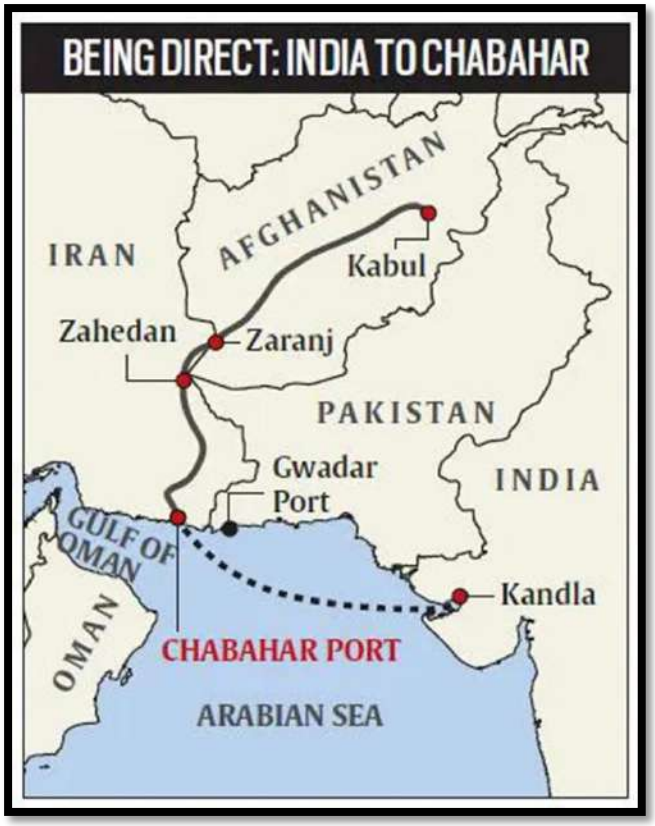
NEW DELHI

India is willing to support Taliban-governed Afghanistan in building "hydroelectric projects," External Affairs Ministry spokesperson Randhir Jaiswal said on Thursday. He said the two sides can build on a "history of cooperation" on water-related issues. » PAGE 6

revives India's strategic outreach in the region.

Strategic and Economic Significance

1. Gateway to Afghanistan and Central Asia: Chabahar facilitates access to Afghanistan and further into Central Asian markets, reducing India's dependence on Pakistan's land routes.
2. Part of the International North–South Transport Corridor (INSTC): It links India with Iran, Russia, and Europe, potentially reducing transport costs and time by up to 40%.
3. Energy and Trade Interests: The port provides a platform for India to expand its energy security, trade, and regional connectivity projects, crucial for long-term strategic balance.
4. Regional Stability and Humanitarian Role: The waiver allows uninterrupted humanitarian supplies to Afghanistan, aligning with both Indian and U.S. interests in promoting stability there.



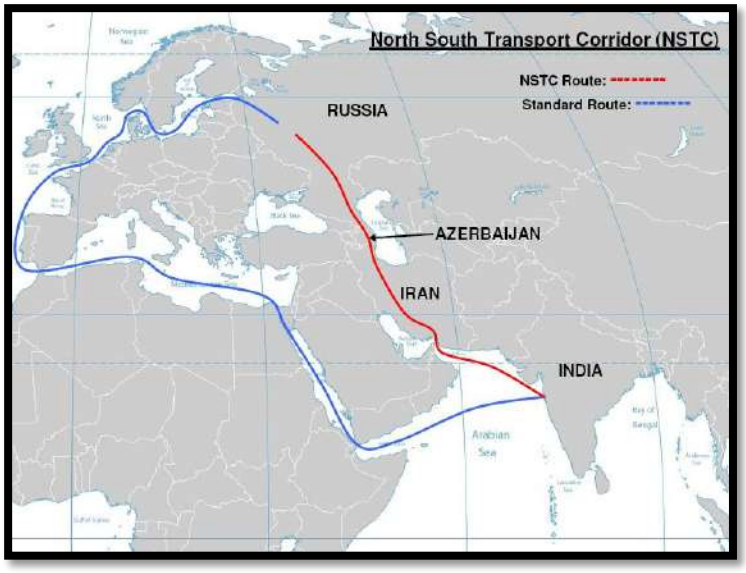
International North-South Transport Corridor

- It is a 7,200-kilometre multi-modal transport corridor that combines road, rail and maritime routes, connecting Saint Petersburg (Russia) to Mumbai.
- International North-South Transport Corridor offers a platform for India to collaborate with Russia, Iran, and the Central Asian Republics towards fostering a Eurasian Free Trade Area.
- Once fully operational, INSTC is expected to reduce freight costs by 30% and the journey time by 40% compared to the deep-sea route via the Suez Canal.

Geopolitical Implications

- India-U.S. Relations: The waiver signals U.S. recognition of India's legitimate strategic interests in the region despite differences over Iran.
- India-Iran Cooperation: It revives India's engagement with Iran amid a delicate regional balance shaped by U.S. sanctions and China's growing presence.
- Counterbalance to China's Gwadar Port (Pakistan): Chabahar serves as a strategic counterpoint to the China-backed Gwadar Port, enhancing India's maritime influence in the Indian Ocean region.

- Regional Connectivity Diplomacy: The move supports India's "Connect Central Asia" policy and its vision of regional multipolarity.



Challenges and Concerns

- Sanctions Uncertainty: The temporary six-month waiver creates planning difficulties for long-term investment and infrastructure development.
- Iran's Volatile Political Climate: Domestic and regional instability in Iran continues to pose risks.
- Competition from China: China's deepening footprint in Iran through the 25-year strategic partnership could dilute India's influence.
- Infrastructure Bottlenecks: Slow project execution and lack of dedicated shipping links reduce the port's full potential.

Conclusion

The renewal of the U.S. sanctions waiver for Chabahar underscores the strategic indispensability of the port for both India and regional stability in South-Central Asia. It highlights Washington's pragmatic approach in accommodating India's developmental role while balancing its hardline stance on Iran. For India, the decision offers a window of opportunity to accelerate work at Chabahar, deepen regional trade connectivity, and reinforce its image as a responsible regional power. Sustaining this momentum, however, will require deft diplomacy, faster project implementation, and a clear long-term strategy to navigate the shifting geopolitics of the region.

UPSC Prelims Practice Question

Ques: What is the importance of developing Chabahar Port by India? (PYQ : 2017)

(a) India's trade with African countries will enormously increase.

(b) India's relations with oil-producing Arab countries will be strengthened.

(c) India will not depend on Pakistan for access to Afghanistan and Central Asia.

(d) Pakistan will facilitate and protect the installation of a gas pipeline between Iraq and India.

Ans: (c)

UPSC Mains Practice Question

Ques: The question of India's Energy Security constitutes the most important part of India's economic progress. Analyse India's energy policy cooperation with West Asian countries. **(150 Words) (PYQ - 2017)**

Page 04 : Prelims

Justice Surya Kant has been appointed as the 53rd Chief Justice of India (CJI) and will assume office on November 24, 2025, succeeding Justice Bhushan R. Gavai. His tenure will continue till February 9, 2027, making it one of the relatively longer recent CJI tenures. This appointment marks another milestone in the functioning of India's higher judiciary and the collegium-based succession process under Article 124 of the Constitution.

Key Facts for UPSC Prelims

Aspect	Details
Name	Justice Surya Kant
Position	53rd Chief Justice of India
Date of Taking Office	November 24, 2025

Daily News Analysis

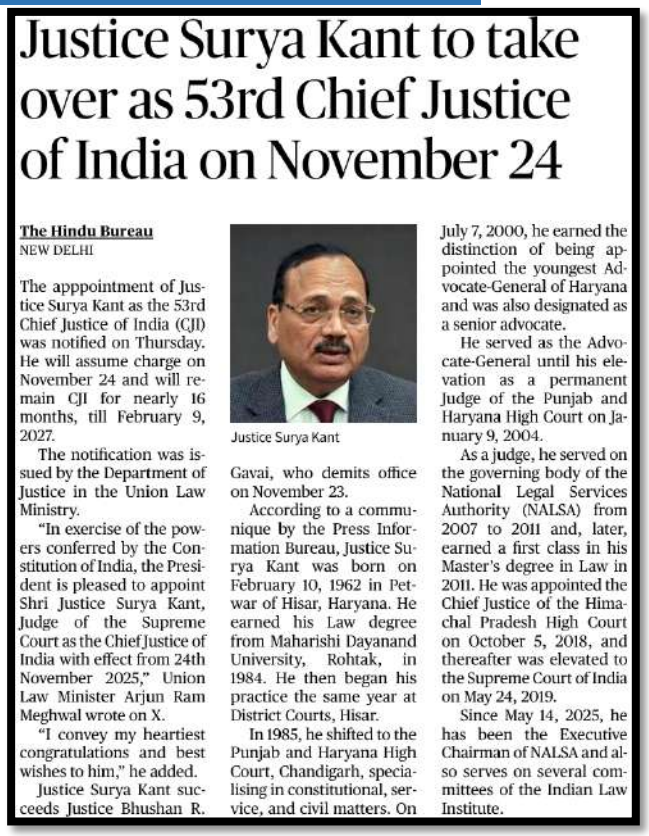
Aspect	Details
Retirement Date	February 9, 2027
Appointed By	President of India (under Article 124(2) of the Constitution)
Predecessor	Justice Bhushan R. Gavai
Birthplace	Petwar village, Hisar, Haryana
Educational Background	LL.B. from Maharishi Dayanand University, Rohtak (1984); LL.M. (First Class) in 2011
Professional Milestones	- Youngest Advocate-General of Haryana (2000)

About the Chief Justice of India (CJI)

- **Qualifications of CJI:** A person is eligible to be appointed as Chief Justice of India if they:
  - Are a citizen of India.
  - Have served as a Judge of a High Court for at least five years.
  - Have been an advocate in a High Court for at least ten years.
  - Are considered a distinguished jurist by the President of India.
- **Appointment of CJI**
  - The President appoints the CJI under Article 124(2) of the Constitution.
  - The outgoing CJI recommends their successor based on seniority.
  - The Union Law Minister forwards the recommendation to the Prime Minister, who then advises the President.

- As per the Second Judges Case (1993), the senior-most Supreme Court judge is appointed as the CJI.

- **Role and Powers of the CJI**
  - Master of the Roster: The CJI allocates cases to Supreme Court benches and decides the composition of benches.
  - Head of the Collegium System: The CJI leads the Supreme Court Collegium, responsible for appointing and transferring judges.
  - Administrative Authority: The CJI supervises court administration, staff appointments, and judicial proceedings management.
  - Judicial Leadership: The CJI is first among equals and does not hold superior judicial power over other judges.
- **Removal of CJI or Judges**
  - A Supreme Court judge, including the CJI, can be removed by the President after an address by Parliament supported by a special majority.
  - Grounds for removal (Article 124(4)):
    - Proven misbehavior
    - Incapacity



Justice Surya Kant to take over as 53rd Chief Justice of India on November 24

The Hindu Bureau
NEW DELHI

The apppointment of Justice Surya Kant as the 53rd Chief Justice of India (CJI) was notified on Thursday. He will assume charge on November 24 and will remain CJI for nearly 16 months, till February 9, 2027.

The notification was issued by the Department of Justice in the Union Law Ministry.

"In exercise of the powers conferred by the Constitution of India, the President is pleased to appoint Shri Justice Surya Kant, Judge of the Supreme Court as the Chief Justice of India with effect from 24th November 2025," Union Law Minister Arjun Ram Meghwal wrote on X.

"I convey my heartiest congratulations and best wishes to him," he added.

Justice Surya Kant succeeds Justice Bhushan R. Gavai, who demits office on November 23.

Justice Surya Kant

According to a communique by the Press Information Bureau, Justice Surya Kant was born on February 10, 1962 in Petwar of Hisar, Haryana. He earned his Law degree from Maharishi Dayanand University, Rohtak, in 1984. He then began his practice the same year at District Courts, Hisar.

In 1985, he shifted to the Punjab and Haryana High Court, Chandigarh, specialising in constitutional, service, and civil matters. On July 7, 2000, he earned the distinction of being appointed the youngest Advocate-General of Haryana and was also designated as a senior advocate.

He served as the Advocate-General until his elevation as a permanent Judge of the Punjab and Haryana High Court on January 9, 2004.

As a judge, he served on the governing body of the National Legal Services Authority (NALSA) from 2007 to 2011 and, later, earned a first class in his Master's degree in Law in 2011. He was appointed the Chief Justice of the Himachal Pradesh High Court on October 5, 2018, and thereafter was elevated to the Supreme Court of India on May 24, 2019.

Since May 14, 2025, he has been the Executive Chairman of NALSA and also serves on several committees of the Indian Law Institute.

- **What is the Collegium System?**
  - A mechanism for appointing and transferring judges in the Supreme Court and High Courts.
  - Not established by an Act of Parliament, but evolved through Supreme Court judgments (Judges Cases).
  - For SC Appointments: CJI + four senior-most judges.
  - For HC Appointments:
    - HC-level Collegium: Chief Justice of HC + two senior judges.
    - SC-level Collegium: CJI + two senior-most SC judges.

Conclusion

Daily News Analysis

Justice Surya Kant's elevation as the 53rd Chief Justice of India symbolizes the continuity of judicial tradition and independence. With his long experience across various judicial roles and leadership at NALSA, his tenure is expected to focus on access to justice, legal aid, and judicial efficiency.

UPSC Prelims Practice Question

Ques: Which of the following statements regarding the Chief Justice of India (CJI) is/are correct?

1. The CJI holds office until the age of 65 years.

2. The CJI can be removed by the President only after an impeachment process similar to that of the President of India.

3. The tenure of the CJI is fixed as five years in the Constitution.

Select the correct answer using the code below:

(A) 1 only

(B) 1 and 2 only

(C) 2 and 3 only

(D) 1, 2 and 3

Ans: b)

Daily News Analysis

Page 07 : GS 3 : Science and Tech / Prelims

India's healthcare system is witnessing a gradual shift in cancer treatment delivery, with a move from lengthy intravenous (IV) infusions to subcutaneous (SC) injections for certain breast cancer drugs like trastuzumab and pertuzumab. This innovation — backed by strong clinical evidence — represents how science, technology, and patient-centered care can converge to make treatment more efficient, accessible, and humane.

Daily News Analysis

Shorter, simpler breast cancer treatment: where evidence meets practice

Studies show that injection-based delivery of HER2 drugs matches IV infusions in safety and efficacy — while saving time for patients and hospitals alike; even as the benefits of subcutaneous therapy are well established in major hospitals, experts say that access remains uneven across India's mixed healthcare system

Amrikon Mukhopadhyay

When Vrinda Thakker was diagnosed with metastatic HER2-positive breast cancer in December 2021, her doctors postponed surgery and began targeted therapy the next month — an intravenous combination of trastuzumab and pertuzumab, the standard regimen for this form of disease. The drugs were delivered through a chemoport, a small device implanted under the skin to allow repeated infusions directly into a central vein.

"Each session took a couple of hours, including the time to flush the line so it wouldn't block," she said. The routine was repetitive and time-consuming, and even a single cycle meant hours at the hospital.

After several months, she discussed switching to a subcutaneous option with her oncologist. In which the same drugs are injected under the skin rather than through an intravenous line.

"A subcutaneous injection can be painful at first because about 10 millilitres of the drug are given under the skin of the thigh," said another patient, who also opted for the subcutaneous method, describing the difference between the two treatment modes. "But the whole process takes only two or three minutes. Once you're used to it, you walk in, take the injection, and leave." She added that the switch also eliminates risks linked to chemoports, such as infections or blood clots, and replaces a four-hour infusion with a five-minute injection.

These experiences reflect a broader shift in oncology: replacing long intravenous infusions with shorter subcutaneous delivery that maintains the same therapeutic outcomes while reducing time in hospital.

Science behind the switch

Trastuzumab, a monoclonal antibody that targets the HER2 receptor, has been a mainstay of treatment for HER2-positive breast cancer for more than two decades. Traditionally, it is given intravenously every three weeks, often with pertuzumab — a schedule that is effective but time-intensive for patients and oncology units.

A subcutaneous formulation of trastuzumab was developed using recombinant human hyaluronidase (rHuPH20), which temporarily breaks down hyaluronan in the tissue, allowing large molecules to be absorbed through the skin. Clinical studies such as the HannaH and FeDeriCa trials showed that fixed-dose subcutaneous trastuzumab, alone or combined with pertuzumab, matched intravenous infusion in safety, efficacy, and drug absorption.

A three-and-median substudy from the ADEPT trial found that subcutaneous dosing cut the time patients spent in the treatment chair by about an hour, and pharmacy preparation by a little over an hour.

The fixed-dose combination of pertuzumab and trastuzumab, marketed as PHESGO, delivers both antibodies together in a single subcutaneous injection.

In India, the first real-world report on PHESGO showed similar outcomes across early and metastatic disease. Most patients reported fewer hospital visits and preferred the subcutaneous route, citing comfort and convenience.

While these data establish the clinical equivalence of the two delivery routes, the practical difference becomes clearer when seen in how much time patients actually spend in hospital.

Why shorter treatments

The time needed for drug preparation and administration has long shaped the experience of breast cancer therapy. In the ADEPT study, the mean time in the treatment chair fell from about 85 minutes with intravenous administration to around 20 minutes with subcutaneous dosing. Total hospital time, including waiting and observation, was shorter by nearly 80 minutes.

Meenu Walia, a senior oncologist at Max Super Specialty Hospital, Patparganj, said the time factor affects patients and families in direct ways. "Between travel, waiting, and the procedure itself, it's almost a full-day commitment," she said. "Long hours at the hospital can be especially hard for daily-wage earners or elderly caregivers. Any approach that shortens that time makes a tangible difference."

Shoma Nag, a cancer specialist at Sahyadri Group of Hospitals, Pune, who led the Indian PHESGO study, said the time saving is especially meaningful for women balancing work or care giving responsibilities.

The hospital side

On the hospital side, shorter sessions are changing how oncology units schedule and staff treatment days.

Niti Raizada, principal director of medical oncology at Fortis Cancer Institute, Bengaluru, said that subcutaneous delivery had streamlined patient flow. "When procedures take less time, we can manage more cases efficiently without crowding our infusion units," she said. "Subcutaneous fixed-dose therapies require less loading and preparation time, saving time not only for patients, but for hospital staff too. It's one of the few innovations that improves efficiency without losing the human element of care."

For oncologists, shorter and simpler treatment modes are not just about efficiency — they change how patients experience care

Raja T., senior consultant at Apollo Hospitals, Chennai, noted that this trend fits into a wider evolution of cancer treatment toward minimally invasive, less intrusive approaches. "When it comes to medicines, we are looking at how we can avoid too much intravenous medication — whether we can treat patients with under-the-skin subcutaneous medicines and tablets — making the whole journey easy and comfortable so that they can go back home or to work as soon as possible," he said.

Uneven access

While the benefits of subcutaneous therapy are well established in major hospitals, experts say that access remains uneven across India's mixed healthcare system. Dr. Raja said that facilities and staff training vary widely. "In major cities, good hospitals and infrastructure are available. Then you move to Tier 2 towns and smaller areas where such high-touch care is not available," he added that patients from smaller towns often have to travel repeatedly to larger centres for months of therapy. "They have to stay near the hospital — that's a big challenge," he said. "Insurance and employer support have helped many, but not everyone benefits equally."

Dr. Raja also noted that public hospitals face high patient volumes, which can make it difficult to introduce newer delivery modes that need specific handling and training. "Government hospitals are doing an excellent job," he said, "but the sheer numbers they see make it difficult to provide that kind of care to everyone."

Experts said broader adoption in public hospitals would depend on drug availability, staff training, and inclusion in government oncology programmes.

More time for life

For oncologists, shorter and simpler treatment modes are not just about efficiency — they change how patients experience care.

Dr. Nag said the traditional infusion process can be physically and emotionally draining. "The long time they spend in the hospital — the indignity of being pricked several times, the discomfort of hours of hospitalisation, and the long wait after the infusion for observation — all interfere with their daily routine, especially if they have young children or are working women," she said. "When it is subcutaneous, they are in and out of hospital — no IV pricks — done very quickly." She added that being able to continue treatment outside hospitals helped during the pandemic. "During COVID, we were able to continue these subcutaneous sessions at the home of the patient so they could complete their treatment," she said.

Ms. Thakker is continuing her treatment. She encourages anyone who is starting or undergoing treatment to seek out the subcutaneous route, adding that it costs less than IV in her experience.

Other small measures also play a part. "When we offer treatment in sessions, hair loss is an issue. Here, we have things to protect the hair, such as scalp cooling devices. We also use precision surgery, radiation, and medications with fewer side effects," Dr. Raja said.

The ultimate goal is not just treating the disease, but making the process less intrusive and more comfortable for patients.

(amrikon.mukhopadhyay@thehindu.co.in)

Amrikon Mukhopadhyay is a journalist by training and science communicator from Delhi.

THE GIST

- Trastuzumab, a monoclonal antibody that targets the HER2 receptor, has been a mainstay of treatment for HER2-positive breast cancer for more than two decades. Traditionally, it is given intravenously every three weeks, often with pertuzumab.
- A three-and-median substudy from the ADEPT trial found that subcutaneous dosing cut the time patients spent in the treatment chair by about an hour, and pharmacy preparation by a little over an hour. The fixed-dose combination of pertuzumab and trastuzumab, marketed as PHESGO, delivers both antibodies together in a single subcutaneous injection.
- In India, the first real-world report on PHESGO showed similar outcomes across early and metastatic disease. Most patients reported fewer hospital visits and preferred the subcutaneous route, citing comfort and convenience.

Shining the spotlight: People taking part in a breast cancer awareness rally organised by a hospital in Tiruchirappalli. Tamil Nadu. Breast Cancer Awareness Month is observed annually in October. PTI

Background and Scientific Basis

- HER2-positive breast cancer accounts for about 20–25% of all breast cancers and is treated using targeted drugs such as trastuzumab and pertuzumab, which block the HER2 receptor.
- Traditionally, these drugs were delivered through IV infusion, requiring several hours at the hospital and increasing risks such as infection or clotting due to chemoports.
- New formulations, like PHESGO (a fixed-dose combination of trastuzumab and pertuzumab), can now be delivered subcutaneously in just 2–5 minutes with the same safety and efficacy.
- Global trials such as HannaH, FeDeriCa, and ADEPT have proven that subcutaneous administration is clinically equivalent to IV infusions while saving significant time for patients and hospitals.

Significance for Patients

1. Time and Convenience: SC injections reduce hospital time by over an hour per session, freeing patients from long infusion schedules.
2. Comfort and Dignity: Eliminates multiple IV pricks and reduces infection risk; particularly beneficial for working women or those balancing caregiving duties.
3. Continuity of Care: During COVID-19, SC delivery even allowed home-based treatments, ensuring uninterrupted therapy.
4. Cost and Accessibility: In some cases, the total cost of SC treatment (including hospital stay and staff time) is lower than IV therapy.

Impact on Healthcare System

- Efficiency Gains: Hospitals can treat more patients per day due to shorter sessions and simpler preparation.
- Staff Optimization: Reduced pharmacy and nursing time allows oncology units to handle higher patient volumes efficiently.
- Public Health Relevance: Promotes the vision of patient-centric and minimally invasive care, aligning with Ayushman Bharat's preventive and accessible healthcare goals.

Challenges in Implementation

1. Uneven Access: Advanced SC therapies are mainly available in urban tertiary hospitals, while rural and Tier-2 cities lag due to lack of infrastructure and trained staff.
2. Public Sector Limitations: Government hospitals face heavy patient loads and limited budgets, delaying the introduction of such innovations.
3. Awareness and Training: Both patients and healthcare providers need awareness of newer options and technical training for safe administration.
4. Policy Integration: Inclusion of SC therapies in government oncology schemes (like PMJAY or state cancer programmes) is essential for equitable access.

Ethical and Social Dimensions

- Gender Sensitivity: Simplifying breast cancer treatment has a social impact — it supports women's participation in the workforce and reduces the emotional toll of long hospital stays.
- Health Equity: The transition underscores India's need to bridge gaps between urban private hospitals and rural public health systems.

Conclusion

The shift from intravenous to subcutaneous delivery in HER2-positive breast cancer treatment demonstrates how scientific innovation can directly improve patient experience and healthcare efficiency. However, the benefits will be fully realised only when access becomes equitable across India's healthcare spectrum. Policymakers must therefore

ensure that such breakthroughs move beyond big hospitals and reach district-level cancer care centres, embodying the principle of "universal, dignified, and patient-friendly healthcare."

UPSC Prelims Practice Question

Ques. Which of the following statements about HER2-positive breast cancer is/are correct?

1. It is a type of breast cancer characterized by overexpression of the HER2 protein.

2. It can be treated effectively using monoclonal antibodies such as trastuzumab and pertuzumab.

3. It cannot be detected through laboratory or imaging tests.

Select the correct answer using the code below:

(A) 1 only

(B) 1 and 2 only

(C) 2 and 3 only

(D) 1, 2 and 3

Ans : b)

UPSC Mains Practice Question

Ques : Recent innovations in cancer treatment delivery highlight the intersection of science, policy, and equity in healthcare. Discuss the challenges and opportunities in implementing patient-centric cancer care in India. **(250 Words)**

Daily News Analysis

Page :10 : GS 3 : Science and Tech / Prelims

Artificial Intelligence (AI) has emerged as the defining technology of the 21st century — but its data centres, which train and operate massive AI models, are becoming some of the largest electricity consumers on the planet. The explosion in AI workloads, coupled with global digitalisation and the growth of electric vehicles and IoT, is reshaping global energy demand patterns. The result: a massive push toward low-carbon, high-reliability energy sources — including the renewed interest in Small Modular Reactors (SMRs) as potential game changers.

Daily News Analysis

What will power AI data centres?

How much energy and electricity do AI data centres use when compared to traditional enterprise servers? Why are such data centres being pushed towards low-carbon energy sources? Are Small Modular Reactors safe? What are its advantages?

EXPLAINER

Kalyan Mangalapalli

The story so far:

For the past two decades, India's electricity demand growth rates remained relatively flat at around 5%. While energy and electricity demands have been traditionally managed through forward planning, the rollout of data centres, Electric Vehicles (EVs), green hydrogen and 5G/Internet of Things (IoT) programmes are key drivers which will steadily increase electricity consumption.

Why does India need data centres?

The demand for data centres in India is being driven by the need for data storage given the government's Digital India and data localisation policies, increased data consumption, and 5G roll-out which is expected to enable adoption of data intensive technologies such as IoTs and Artificial Intelligence (AI). Although India boasts of 2x internet users than Europe, it lags on the data centre capacity front (0.4 GW versus 10GW). However, as data privacy rules come into effect and AI adoption grows, India's data centre capacity might grow by two to three times in the near term (2027) and over five-fold in the long term (2030), based on a low buildout and an aggressive buildout scenario, respectively (excluding large AI infrastructure).

How much power is required?

The energy consumption of AI data centres is monumental and presents a critical challenge. These facilities are not just large storage units; they are computational powerhouses utilising Graphic Processing Units (GPUs) with individual racks consuming 80-150 kW compared to 15-20 kW for traditional enterprise servers. This compute-driven intensity drives an insatiable demand for electricity, making AI the most significant driver of increased energy consumption within the data centre sector. Projections indicate that global electricity generation for data centres could surge from 460 terawatt hours (TWh) in 2024 to over 1,000 TWh by 2030, reaching 1,300 TWh in 2035. A good example would be China, which is witnessing a 20% year-on-year growth with respect to base load electricity due to Generative AI and Large Language Model (LLM) usage. China's data centres' power consumption could reach 400+ billion kWh in 2025 (~4% of total power consumption), with a compound annual growth rate (CAGR) of 18% in 2023-2030, much earlier than the original forecast of reaching 400 billion kWh only by 2030.

Another example is from the Dominion service territory in Virginia, U.S. which has total electricity demand and peak demand growth rates projected to exceed 25% within the next five years, due to the GW-scale data centres it hosts.

Where are data centres being built?

The U.S. leads with 5% of the global data centre capacity in Texas, Wisconsin, Northern Virginia, Illinois, Ohio and Pennsylvania. Other countries planning such AI infrastructure include China, Norway, the U.K., Germany, Egypt and Malaysia. In India, Visakhapatnam and Jamnagar have recently been chosen by Google and Reliance Industries respectively for their GW-scale AI data centre ambitions.

Companies such as Yotta, AdaniConneX, E2E and CtrlS are also planning AI data centres in Mumbai, Chennai, Bangalore, and Hyderabad. The Indian government's "IndiaAI mission" and substantial private investments are further accelerating this expansion, highlighting a national commitment to fostering a thriving AI ecosystem.

What are the power sources?

The push by AI data centres towards low-carbon energy sources is driven by corporate decarbonisation targets, soaring energy demands, and increasing pressure from regulators and investors. As AI workloads rapidly increase, major tech companies are investing in diverse renewable energy strategies and new technologies to meet climate goals.

Current power mixes rely on multiple sources – intermittent renewables with developing storage solutions, onsite green hydrogen and natural gas for grid reliability, and emerging alternatives like geothermal energy and nuclear fusion. Small Modular Reactors (SMRs) represent another source of low carbon that has caught the attention of Big Tech companies. SMRs provide crucial benefits such as flexible sizing in the range of 1 MW to 300+ MW, factory manufacturing capability for cost savings, passive safety enhancements, and 24/7 stable baseload power production. Around $15.4 billion has been invested in SMR development worldwide – $10 billion (public funding) and $5.4 billion from private investment.

While legacy challenges like safety, waste disposal and regulatory hurdles persist, the evolving public perception of SMRs is becoming more favourable, especially with technological advancements enhancing safety. Moreover, SMRs do not need expensive transmission infrastructure as it is positioned close to consumption hubs. AI data centres across the world are urgently looking to secure reliable baseload power for its own centres as utilities might not have the budget to create the necessary infrastructure by the 2030 timeframe.

How can India capitalise on SMRs?

India's 2025 budget initiated the Nuclear Energy Mission with a ₹20,000 crore ($2.4 billion) outlay with the aim to reach 100 GW of nuclear capacity by 2047, and putting at least five indigenously manufactured SMRs into operation by 2033. The current development includes Bhabha Atomic Research Centre's (BARC) 200 MW(e) pressurised heavy water reactor with slightly enriched uranium fuel and a variant of 55 MW for remote areas in isolated mode.

India's approach rests on complete reforms. The government is planning to introduce amendments to the Atomic Energy Act, 1962 and the Civil Liability for Nuclear Damage Act, 2010 to draw in around $26 billion worth of private investment and bring India in line with international legal provisions. India must leverage SMR technology transfer agreements with Holtec International (USA and other international partners to position its technology for domestic as well as international opportunities. State governments can assist with identifying and preapproving existing coal sites and green hydrogen hubs for nuclear projects; investing in demonstration projects; facilitating land acquisition; offering training for regulators; and helping to re-skill the coal workforce. Additionally, collaborations between nuclear SMR vendors, AI data centre players, and renewable energy companies could unlock large-scale opportunities.

How do SMRs enhance safety?

SMR designs incorporate advanced safety features aiming for performance comparable to or better than existing reactor designs. Modern SMRs rely heavily on inherent and passive safety systems requiring fewer external electricity sources and reduced human intervention. These passive systems ensure SMRs provide secure, reliable, and sustainable energy. The inherent design characteristics lead to reduced likelihood of core-damaging accidents, and reduced consequences, if accidents do occur, due to less radioactivity and thermal energy. The smaller size simplifies safety measures during emergencies.

SMR designs leverage several advantages: smaller reactor cores with smaller quantities of nuclear material, passive safety features like natural convection enabling automated shutdown; accident-tolerant fuels maintaining structural integrity at higher temperatures, longer event sequences (hours or days) providing extra time for mitigation; and the combination of lower nuclear material quantities and passive features leading to smaller offsite emergency planning zones.

What about SMR regulation?

The business case depends heavily on responsive regulatory environments, but regulators face challenges with licensing processes originally developed for larger light-water reactors. Existing regulations often don't apply to advanced technologies proposed for new SMRs, necessitating new regulations. However, such regulatory processes are typically time-consuming, expensive, and opaque. A specific concern is how regulatory bodies will handle design iteration after initial certification.

Global SMR regulatory reforms focus on six key areas – (1) technology-neutral frameworks replacing large reactor-specific rules; (2) streamlined licensing including fleet approvals and combined construction-operating licenses; (3) modular manufacturing accommodation with factory fabrication certification; (4) international harmonisation through International Atomic Energy Agency (IAEA) standards and mutual design recognition; (5) risk-informed requirements adjusting emergency planning zones and staffing proportional to smaller facility risks; and (6) accelerated deployment pathways for fulltop-on units. The U.S. ADVANCE Act (2024), Canada's Version Design Review, and the U.K.'s regulatory sandbox exemplify these reforms, with most jurisdictions targeting framework completion by 2026 and first commercial deployment by 2030.

Moreover, international cooperation is essential for timely deployment of safe and secure SMRs. The IAEA offers comprehensive support through its platform on Small Modular Reactors and their Applications. The Nuclear Harmonisation and Standardisation Initiative (NHSI) facilitates safe and secure development by promoting regulatory harmonisation. The IAEA hosts the SMR Regulators' Forum for sharing experiences and best practices among regulatory authorities worldwide. The Safeguards by Design Programme helps stakeholders make informed design choices incorporating international safeguards while optimising economic, operational, safety, and security factors.

What are the concerns related to transportation and waste of SMRs?

New regulatory approaches are needed for SMR transportation and waste streams. Since SMRs are factory-fabricated and transported, this creates security vulnerabilities and radiation leakage risks, especially for fuel-loaded systems. Regulations are needed to address liability in transportation accidents.

Advanced SMR designs using new fuel concepts (like HALEU) or coolants other than water may generate new forms of radioactive waste requiring new disposal and storage plans. SMR companies are developing plans to store spent nuclear fuel indefinitely in interim on-site storage facilities, as a clear national pathway for long-term disposal remains a concern.

The author is an Energy and Emerging Technologies expert.

THE GIST

- The demand for data centres in India is being driven by the need for data storage given the government's Digital India and data localisation policies, increased data consumption, and 5G roll-out which is expected to enable adoption of data intensive technologies such as IoTs and Artificial Intelligence (AI).
- Small Modular Reactors (SMRs) represent another source of low carbon that has caught the attention of Big Tech companies. SMRs provide crucial benefits such as flexible sizing in the range of 1 MW to 300+ MW, factory manufacturing capability for cost savings, passive safety enhancements, and 24/7 stable baseload power production.
- Advanced SMR designs using new fuel concepts or coolants other than water may generate new forms of radioactive waste requiring new disposal and storage plans.

Rising Power Demand from AI Data Centres

- AI vs Traditional Servers: Traditional enterprise servers consume 15–20 kW per rack, while AI-driven GPU racks consume 80–150 kW each — almost 8 times higher energy intensity.
- Global Power Estimates: Global electricity use for data centres may grow from 460 TWh (2024) to over 1,000 TWh by 2030, and 1,300 TWh by 2035 — equivalent to the entire electricity consumption of Japan today.
- Country Examples:
  - China: Data centre electricity use projected at 400+ billion kWh by 2025 (~4% of total).
  - U.S. (Virginia): Demand projected to grow 25% in five years due to data centre clusters.

- India's Context: Despite having twice Europe's internet users, India's data centre capacity (1.4 GW) lags far behind Europe's (10 GW). With the IndiaAI Mission and Digital India rollout, demand is expected to triple by 2027 and increase fivefold by 2030.

Why Low-Carbon Energy Sources Are Needed

1. Decarbonisation Pressure: Global tech giants (Google, Microsoft, Amazon) have pledged net-zero emissions, compelling them to power data centres with clean energy.
2. Energy Reliability: AI workloads are 24/7 — intermittent renewable sources (solar/wind) need stable baseload partners like nuclear, geothermal, or gas.
3. Investor & Regulatory Pressure: ESG mandates and carbon accounting are forcing firms to reduce fossil fuel dependence.
4. Grid Stress: Concentrated data centre clusters risk overloading existing grids, demanding localized clean generation near consumption hubs.

Small Modular Reactors (SMRs): The New Frontier

What are SMRs?

SMRs are compact nuclear reactors (1–300 MW capacity) built in factories and transported to sites. They are designed for scalable, modular deployment with enhanced safety and reduced cost.

Advantages

- Low Carbon, 24/7 Baseload Power: Continuous clean energy ideal for AI data centres.
- Modularity & Flexibility: Suitable for deployment close to consumption sites, reducing transmission losses.
- Passive Safety Systems: Require minimal external intervention — use natural convection for cooling.
- Cost Efficiency: Factory fabrication allows mass production and standardization.
- Reduced Risk Profile: Smaller core size and less radioactive material lower accident severity.

Safety Features

- Passive safety and accident-tolerant fuels reduce meltdown risk.
- Smaller emergency planning zones due to limited radioactive release potential.
- Natural circulation eliminates dependence on external power during shutdowns.

India's SMR Roadmap

- Nuclear Energy Mission (2025): ₹20,000 crore plan to reach 100 GW nuclear capacity by 2047, with at least five SMRs operational by 2033.
- BARC's BSMR-200: A 200 MW pressurised heavy water reactor under development; smaller 55 MW variants planned for remote areas.
- Reform and Collaboration: Amendments proposed to the Atomic Energy Act (1962) and Civil Liability for Nuclear Damage Act (2010) to attract ~$26 billion private investment.
- Global Partnerships: India is exploring technology transfer with Holtec International (USA) and others for indigenisation and export potential.
- State-Level Support: States can repurpose old coal sites, create pre-approved zones, and train local regulators and workers for SMR deployment.

Challenges

1. Regulatory Barriers: Current nuclear laws were designed for large reactors — need flexible, technology-neutral frameworks.
2. Safety & Waste Concerns: New fuels (like HALEU) create novel waste streams requiring fresh disposal mechanisms.
3. Transportation Risks: Factory-fabricated, fuel-loaded SMRs require secure logistics to prevent leakage or theft.
4. Public Perception: Despite advances, nuclear energy fears persist regarding accidents and waste management.

Global Policy Context

- U.S. ADVANCE Act (2024): Streamlines SMR licensing and supports modular manufacturing.
- IAEA SMR Platform & NHSI Initiative: Promote international harmonisation and safety standards.
- UK's Regulatory Sandbox: Encourages experimental SMR designs within safety oversight.

Way Forward for India

1. Fast-track SMR Regulatory Framework with IAEA guidance.
2. Public-Private Partnerships to link AI data centres with localized SMR grids.
3. Integrate SMRs in IndiaAI Mission and National Electricity Policy.
4. Public Outreach Campaigns to build trust in nuclear safety.
5. International Collaboration for technology transfer, R&D, and financing.

Conclusion

As the AI revolution accelerates, the world faces a new paradox — the smarter our machines become, the more power they demand. Balancing this need with climate commitments requires innovation in clean, reliable baseload

energy. Small Modular Reactors offer a pragmatic bridge between sustainability and scalability, enabling nations like India to power their digital growth without compromising on decarbonisation goals.

In the coming decade, the synergy between AI, renewable energy, and next-generation nuclear technologies could define not just the future of computing but the future of sustainable industrialisation itself.

UPSC Prelims Practice Question

Ques : Which of the following is the primary reason AI data centres consume more electricity than traditional enterprise servers?

(A) They use more air-conditioning systems.

(B) They use Graphic Processing Units (GPUs) which require higher power per rack.

(C) They are located in warmer climates.

(D) They operate only on renewable energy sources.

Ans: b)

UPSC Mains Practice Question

Ques: AI-driven digitalisation has created a new energy paradigm. Discuss the role of Small Modular Reactors (SMRs) in meeting the energy needs of data centres while ensuring sustainability and safety. **(150 Words)**

Daily News Analysis

Page 13 : GS 3 : Science and Tech & Environment / Prelims

Rare earth elements (REEs) — though not truly "rare" in abundance — are among the most strategically significant minerals in the 21st century. These 17 metallic elements (15 lanthanides + scandium + yttrium) form the backbone of modern technology — from smartphones and electric vehicles to defense systems and renewable energy infrastructure.
The recent U.S.–China agreement to maintain rare earth exports underscores their geopolitical importance and strategic vulnerability in global supply chains.

What Are Rare Earths?

- Rare earths are a group of **17 metallic elements**: Scandium, Yttrium, Lanthanum, Cerium, Praseodymium, Neodymium, Promethium, Samarium, Europium, Gadolinium, Terbium, Dysprosium, Holmium, Erbium, Thulium, Ytterbium, and Lutetium.

- They are not "rare" in terms of availability but are **dispersed thinly** in the Earth's crust, making extraction and refining complex and expensive.

What are rare earths, why are they so vital?

Eye of a storm: A sample of bastnaesite ore, a mineral used in the rare earth industry. REUTERS

FACTBOX

Reuters

U.S. President Donald Trump and his Chinese counterpart Xi Jinping have wrapped up a summit in South Korea with a deal to keep Chinese rare earth exports flowing.

Here are some basic facts about these obscure elements making headlines around the world:

What are they?

Rare earths are a group of 17 elements including 15 silvery-white metals called lanthanides, or lanthanoids, plusscandium and yttrium.

Used for?

Rare earths or the magnets which they are sometimes made into can be found in small but important quantities in everything from iPhones and washing machines to the F35 fighterjet.

They are also used in electric vehicles (EVs), medical equipment, oil refining, and other military applications such as missiles and radar systems. Without them, supply chains quickly grind to a halt. Automakers were forced to paused some production earlier this year after Chinese export controls caused shortages.

Are they rare? They are not rare in the sense that they are uncommon; some are more common than lead, for example. But they tend to be spread thin around the Earth's crust in small quantities and mixed together or with other minerals, so larger deposits are difficult to find and costly to extract.

Who produces the most?

While U.S. scientists helped develop a process to separate and refine rare earths in the 1950s, China since the 1980s has come to dominate the industry thanks to lower costs, laxer environmental standards and decades of government support. China accounts for about 60% of global mine production and 90% or more of refined production and rare earth magnet output. Projects are under way across the U.S., Europe, and Australia to build an alternative supply chain but it will take years to produce meaningful quantities.

In the meantime, China is restricting exports of an increasing number of the elements and the equipment needed to mine and refine them.

What are their names?

In their periodic table order, they are: scandium, yttrium,lanthanum, cerium, praseodymium, neodymium, promethium,samarium, europium, gadolinium, terbium, dysprosium, holmium,erbium, thulium, ytterbium, and lutetium.

Environmental impact

Processing rare earths often involves the use of solvents, which can produce toxic waste that pollutes the soil, water, and atmosphere. More environmentally-friendly technologies are being developed, but they are not yet widely used.

Certain types of rare earth ores also contain radioactive thorium or uranium, which is often removed using acid. For this reason, development of the sector faces health and environmental regulatory hurdles.

Uses and Economic Importance

Rare earths are **critical for high-tech, clean energy, and defense industries**:

- **Electronics**: Smartphones, computers, and display screens.
- **Green technologies**: Wind turbines, solar panels, EV motors.
- **Defense**: Missiles, radar systems, fighter jets (e.g., F-35).
- **Medical**: MRI machines and imaging devices.
- **Energy**: Used as catalysts in oil refining.

Their role in the transition to renewable and electric energy systems makes them a **cornerstone of future economic growth**.

Global Production and Geopolitical Concerns

- **China dominates** the global supply chain:
  - ~60% of mining output
  - ~90% of refining and magnet production
- The U.S., EU, and Australia are working to create **alternative supply chains**, but large-scale diversification will take years.
- **Export controls** by China have already caused production halts in Western automakers — highlighting the **strategic monopoly risk**.

Geopolitical Dimension:

- Rare earths are the new "oil" of the digital age.
- China's control provides it **leverage in global trade negotiations**, particularly against the U.S. and allies.
- Many countries are classifying REEs as "critical minerals" under national security and energy transition policies.

Environmental Concerns

- Extraction and processing involve **acid leaching and solvent use**, leading to:
  - Soil and water contamination
  - Toxic and radioactive waste (due to thorium/uranium presence)
- Cleaner extraction technologies are being developed but **remain costly and limited**.

Daily News Analysis

India, too, faces this dilemma — balancing strategic need with environmental sustainability.

India's Position

- India has **modest reserves** of monazite (a rare earth mineral) found in coastal sands of Kerala, Tamil Nadu, Odisha, and Andhra Pradesh.
- The Indian Rare Earths Limited (IREL), under DAE, plays a key role in exploration and processing.
- India is collaborating with Japan and Australia to reduce dependence on China and expand domestic refining capacity.

Critical Analysis

- The **monopolisation of REEs** by China represents a strategic vulnerability for the global technology sector.
- Developing **resilient and sustainable supply chains** will require:
    - Technological innovation in recycling and green extraction
    - Strategic reserves and stockpiling
    - International cooperation on resource sharing
- Environmental regulation must evolve to ensure that the "green transition" does not come at the cost of ecological degradation.

Conclusion

Rare earths are not just industrial commodities — they are strategic enablers of the 21st-century digital and green economies. As the world accelerates toward clean energy, electric mobility, and AI-driven infrastructure, **the demand for rare earths will soar**. For India, balancing self-reliance (Atmanirbharta) with sustainable mining practices and strategic international partnerships will be crucial to secure its place in the global rare earth value chain.

UPSC Prelims Practice Question

Ques : Which of the following statements about Rare Earth Elements (REEs) is/are correct?

1. They are truly rare in terms of global availability.

2. China accounts for the majority of global rare earth production and refining.

3. Rare earths are essential for manufacturing renewable energy technologies and defense systems.

Select the correct answer using the code below:

(A) 1 only

(B) 2 and 3 only

(C) 1 and 2 only

(D) 1, 2 and 3

Ans: a)

UPSC Mains Practice Question

Ques: India's rare earth potential remains underutilised due to regulatory, environmental, and technological barriers. Critically analyse. **(150 Words)**

Page : 08 Editorial Analysis

NITIN SIR CLASSES

THE HINDU
INDIA'S NATIONAL NEWSPAPER SINCE 1878

Daily News Analysis

AI's rewriting of the rules of education

India is gearing up to turn its education system on its head by introducing Artificial Intelligence (AI) to students as early as class three from the academic year in 2026-27. This is no small feat. The Ministry of Education, in synchrony with the National Education Policy 2020, is crafting a comprehensive framework to weave AI learning through the entire K-12 tapestry (kindergarten to class 12). The goal is to arm the future workforce with cutting-edge tech skills to thrive in a techno-driven economy.

Teacher training and pilot projects

But throwing AI into classrooms is not just plug-and-play. The real challenge lies in upskilling a mammoth teaching force of over one crore educators in India. The government is rolling out pilot initiatives allowing teachers to harness AI tools to design lesson plans and teaching resources. Over 10,000 teachers have already been trained since 2019 with help from technology giants Intel, IBM, and government institutes such as the National Institute of Electronics and Information Technology. The goal is to equip educators who can impart AI concepts confidently and practically. But how ready are India's teachers to morph into AI guides? What are the obstacles in this massive transition? How ready teachers are will dictate how successful the AI revolution becomes.

AI is not just about introducing new content. It promises a colossal shift away from "one-size-fits-all" education to personalisation. AI-powered platforms analyse student behaviour, learning speed, and comprehension to tailor lessons that meet individual needs. If a student struggles with algebra, the AI tutor offers extra practice and alternative explanations. If a student is good in biology, he can get ready for more advanced challenges, with AI. Such adaptive learning not only boosts engagement but also dismantles barriers for diverse student populations, including those with disabilities or regional language needs.

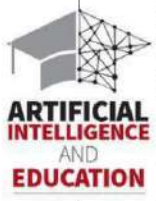
Sakshi Rewaria
is Faculty of Law, Indian Institute of Management, Rohtak, Haryana

India's bold initiative to introduce AI in early education is a transformative step, but there are challenges

Despite its transformative potential, AI is designed to augment, not replace, the human element in education. The focus is on enhancing human judgment, creativity and critical thinking through smart tools. AI automates repetitive tasks such as grading and attendance, freeing teachers to spend more time on meaningful engagement with students. It acts as a powerful assistant in personalised lesson planning and real-time feedback, amplifying the effectiveness of educators. So, while AI is shaking up the classroom, there is still no substitute for a passionate teacher who drives learning with empathy and insight.

Opportunity amid disruption

As AI reshapes education, it also signals seismic workforce changes. According to a recent NITI Aayog report, while AI could displace up to two million jobs in India's tech sector over the next five years, it is also projected to create four million new jobs by 2030, jobs that demand new skills and adaptability. This is a dual-edged sword that calls for the urgent preparation of today's learners.



By embedding AI in early education, India aims to create a workforce that is ready for a digital economy, and not left behind by rapid automation. But are students and educators prepared to embrace this whirlwind of change? The question is not just about job loss or creation but about shaping a resilient workforce that can ride the AI wave.

Generative AI technology, which creates new content based on patterns in data, is already gaining traction in Indian education. More than half of India's higher education institutes are incorporating generative AI to enhance teaching and learning. From AI chatbots that answer student queries 24X7 to platforms that create interactive quizzes and personalised study materials, generative AI is making education more engaging and tailored. This explosion of AI tools could narrow the learning gap significantly in India's vast and diverse education landscape. It is a frontier full of promise but also challenges that are related to access, quality and ethics.

Driving inclusivity and accessibility

Perhaps the most heartening impact of AI in education is its role in fostering inclusivity. AI-powered adaptive learning and language processing tools break down barriers for non-native speakers and learners with disabilities. The customisation of educational content can create equitable learning environments. In countries that are multicultural and multilingual like India, this AI-driven push for inclusiveness could rewrite the rules of who gets to learn and how. Could AI be the great equaliser that education systems worldwide have long sought? The signs are promising, but deliberate design and policy are critical.

India's bold initiative to weave AI into early education signals a massive transformation in how knowledge is imparted, how teachers teach, and how students engage with learning. The revolution comes with challenges: teacher training at scale, ensuring equitable access to AI tools, and preparing students for jobs that do not even exist.

Are Indian schools truly ready for this AI overhaul? Can the education system keep pace with rapid technological advancements without leaving disadvantaged communities behind? Only time will tell. But one thing is clear: the rules of education are being rewritten right before our eyes, and AI is the pen scripting this brave new world.

GS. Paper 2 **Social Justice**

Essay

UPSC Mains Essay Practice Question: Education in the Age of AI: Challenges and Opportunities. **(1200 Words)**

Context :

India's education system is on the verge of a historic transformation as the government prepares to integrate Artificial Intelligence (AI) education from Class 3 onwards beginning in the 2026–27 academic year. This initiative

aligns with the National Education Policy (NEP) 2020, which envisions a tech-integrated, competency-based, and future-ready education framework. The move signifies not just curriculum reform, but a systemic re-engineering of how India teaches, learns, and prepares its citizens for the AI-driven global economy.

The Vision: AI Across K–12 Education

The plan aims to embed AI learning throughout the K–12 continuum, turning digital literacy into a core skill much like reading and mathematics. The goals include:

- Early exposure to AI concepts and computational thinking.
- Integration of AI-based tools for adaptive and personalised learning.
- Cultivation of digital-age skills such as critical thinking, creativity, and problem-solving.

The Ministry of Education, along with NITI Aayog and tech companies (Intel, IBM, etc.), is developing curricula, teacher training modules, and pilot projects to build capacity and test scalable models.

Teacher Training and Readiness

The success of AI in classrooms depends on the teacher's ability to integrate technology effectively. India faces the enormous challenge of upskilling over 10 million teachers. Since 2019, around 10,000 teachers have been trained through partnerships with Intel, IBM, and NIELIT. However, the challenges include:

- Limited digital literacy among existing teachers.
- Infrastructure gaps in rural and government schools.
- Curriculum and pedagogical redesign to include AI-based learning without increasing rote dependency.

AI should serve as a teaching assistant, automating tasks like attendance and grading, thereby freeing educators to focus on higher-order engagement and mentorship.

Transformative Potential of AI in Learning

AI introduces personalised and adaptive learning — a shift from "one-size-fits-all" to individualised education.

- It can assess student progress in real-time and adjust lesson difficulty.
- Students with disabilities or language barriers can benefit through speech recognition, translation, and adaptive content.
- AI chatbots and content generators can enhance student engagement and self-paced learning.

Thus, AI is not a replacement for teachers but a tool to augment human teaching with precision and inclusivity.

Daily News Analysis

Economic and Workforce Implications

According to NITI Aayog, while AI could displace nearly 2 million jobs in India's tech sector by 2030, it may also create around 4 million new roles requiring advanced digital, analytical, and AI-management skills. Embedding AI in early education therefore ensures:

- A future-ready workforce aligned with the digital economy.
- Enhanced employability and innovation capacity among youth.
- Development of new industries in edtech, data science, and automation.

In this way, AI in education becomes not just a pedagogical reform, but an economic imperative.

Inclusivity and Accessibility

One of AI's greatest promises lies in bridging the learning divide:

- Multilingual AI tools can enable quality education for non-native speakers.
- Assistive AI technologies empower students with disabilities through speech-to-text, visual recognition, and adaptive content.
- Rural students can access AI-driven learning platforms even with minimal teacher presence.

If implemented thoughtfully, AI could be the "great equaliser" in Indian education — addressing inequities that have persisted for decades.

Challenges and Ethical Concerns

Despite the optimism, several roadblocks must be addressed:

1. Digital divide: Unequal access to internet, devices, and reliable power in rural areas.
2. Data privacy: Collection of sensitive student data by AI systems raises concerns over surveillance and misuse.
3. Algorithmic bias: AI trained on biased data could reinforce stereotypes and discrimination.
4. Teacher resistance: Fear of job displacement or unfamiliarity with technology may create reluctance.
5. Over-reliance on technology: Excessive dependence may undermine critical thinking, empathy, and creativity.

Hence, ethical AI frameworks, robust data governance, and equitable infrastructure are vital.

India's Strategic Context

- National Education Policy 2020 emphasises digital literacy, coding, and critical thinking from early grades.
- IndiaAI Mission (2024) seeks to develop indigenous AI technologies, data sets, and innovation hubs.
- Public-private partnerships are being encouraged to localise AI tools for regional languages and affordable access.

This multi-layered approach can transform India from a passive consumer to a global AI knowledge hub.

Critical Analysis

- The introduction of AI in early education marks a paradigm shift comparable to the industrial or information revolutions. However, technology alone cannot reform education — human capacity and institutional readiness remain decisive. Without adequate investment in teacher development, infrastructure, and digital ethics, AI could widen existing inequalities rather than bridge them.
- Moreover, the reform must maintain focus on the core purpose of education — nurturing empathy, values, and creativity — which no algorithm can replicate.

Conclusion

India's plan to mainstream AI in its school system represents a bold and futuristic reform, aligning education with the demands of an AI-driven world. It holds immense promise for personalised, inclusive, and skill-oriented learning, provided challenges of access, training, and ethics are addressed. The transformation must be guided by human values, policy foresight, and equitable design, ensuring that technology empowers rather than replaces educators and learners.