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Daily News Analysis

The Hindu Important News Articles & Editorial For UPSC CSE

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India and Bahrain, two long-standing partners in the Gulf region, held high-level talks in New Delhi aimed at strengthening their defence, trade, and diplomatic cooperation. The meeting between External Affairs Minister S. Jaishankar and Bahrain's Foreign Minister Abdullatif bin Rashid Alzayani took place during the session of the High Joint Commission, marking a new phase in bilateral relations between the two countries.

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External Affairs Minister S. Jaishankar with Bahrain Foreign Affairs Minister Abdullatif bin Rashid Alzayani in New Delhi. PTI

India, Bahrain hold talks on boosting defence, trade ties

Kallol Bhattacherjee
NEW DELHI

India on Monday reiterated that the Gaza peace plan of U.S. President Donald Trump will lead to a "lasting" solution to the West Asian conflict.

Welcoming Bahrain's Foreign Minister Abdullatif bin Rashid Alzayani, External Affairs Minister S. Jaishankar said there are "unprecedented" changes in the West Asian region as well as in the world.

"So I take the opportunity to reiterate our support for the Gaza Peace Plan which we hope will lead to a lasting and durable solution," said Mr. Jaishankar in his opening remarks.

A joint statement issued after the meeting of the High Joint Commission headed by Mr. Jaishankar and Mr. Alzayani said that India and Bahrain expressed optimism for "enhancing future collaboration in the areas of defence and security". The joint statement also mentioned unequivocal condemnation of "terrorism, in all its forms and manifestations and reaffirmed strong commitment to combat terrorism, including cross border terrorism."

The two sides highlighted that India is among the top five trading partners of the Kingdom of Bahrain.

Both sides agreed to develop a common understanding to commence Double Taxation Avoidance Agreement (DTAA) negotiations, which will help eliminate double taxation, provide tax certainty and promote trade and investment.

Key Highlights of the Meeting

1. **Defence and Security Cooperation**
   - Both nations expressed optimism about deepening collaboration in defence and security.
   - The joint statement strongly condemned terrorism in all forms, reaffirming a shared commitment to counter cross-border terrorism.
   - This aligns with India's broader strategic objective of enhancing maritime and regional security in the Gulf and Indian Ocean Region.
2. **Trade and Economic Ties**
   - India is among the top five trading partners of Bahrain.
   - The two sides agreed to initiate negotiations for a Double Taxation Avoidance Agreement (DTAA) to provide tax certainty and promote trade and investment.
   - Strengthening trade relations supports India's energy security and access to West Asian markets.
3. **Regional and Global Issues**
   - External Affairs Minister Jaishankar reiterated India's support for the Gaza Peace Plan proposed by U.S. President Donald Trump, hoping for a lasting and durable solution to the West Asian conflict.
   - This reflects India's balanced approach—maintaining relations with both Arab countries and Israel while advocating peace in the region.
4. **Context: Changing Geopolitics in West Asia**
   - The meeting took place amid "unprecedented changes" in West Asia, including shifting alliances post-Abraham Accords, normalization of ties between Arab nations and Israel, and evolving regional security dynamics.
   - For India, engagement with Gulf nations like Bahrain is vital due to the presence of a large Indian diaspora and the region's significance for energy imports and remittances.

Key Analysis

- Strategic Importance: Bahrain hosts the U.S. Navy's Fifth Fleet, making it a key security player in the Persian Gulf. Strengthening defence ties with Bahrain enhances India's strategic footprint in the region.

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- Economic Cooperation: With Bahrain's open economy and India's expanding market, the proposed DTAA could boost two-way investments, especially in sectors like finance, infrastructure, and technology.
- Diplomatic Balance: India's reiteration of support for the Gaza Peace Plan highlights its effort to maintain neutrality while engaging constructively with both Israel and Arab nations.

Conclusion

The India–Bahrain dialogue marks a step forward in deepening strategic and economic relations amid changing geopolitical realities in West Asia. By focusing on defence cooperation, counterterrorism, and trade facilitation, India continues to consolidate its position as a reliable partner in the Gulf region. This partnership not only strengthens India's "Look West" policy but also contributes to its broader vision of regional stability and economic integration.

UPSC Prelims Practice Question

Ques: With reference to India–Bahrain relations, consider the following statements:

1. India and Bahrain have agreed to begin negotiations for a Double Taxation Avoidance Agreement (DTAA).

2. Bahrain is among India's top five trading partners in the Gulf region.

3. Both countries have condemned terrorism in all its forms and reaffirmed cooperation in defence and security.

Which of the statements given above are correct?

(A) 1 and 2 only

(B) 2 and 3 only

(C) 1 and 3 only

(D) 1, 2 and 3

Ans: d)

UPSC Mains Practice Question

Ques: Strengthening ties with Bahrain reinforces India's strategic engagement in the Gulf region. Discuss in light of the recent India–Bahrain High Joint Commission meeting. **(150 Words)**

Daily News Analysis

Page 07 : GS 3 : Environment / Prelims

A recent study by Bharathidasan University, Tiruchirappalli, published in *Environmental Earth Sciences (August 2024)*, has revealed alarming levels of heavy metals—particularly cadmium, lead, chromium, copper, and zinc—in the Cauvery River and its fish species. The findings highlight significant ecological and health concerns arising from industrial effluents, agricultural runoff, and urban waste discharge.

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Heavy metals found in Cauvery fish; study advises reducing consumption

While occasional fish consumption may not pose immediate threats, prolonged exposure could lead to non-carcinogenic and carcinogenic risks, particularly from cadmium and lead; the risk depends on both the amount consumed, the frequency of intake, and the age of the individual

T.V. Padma

Heavy metals are polluting the Cauvery River and its fish, researchers from Tamil Nadu have reported. They have also cautioned against consuming "regular" or "excessive" amounts of fish from here.

The study was conducted by a team at Bharathidasan University in Tiruchirappalli and was published in the journal *Environmental Earth Sciences* in August.

Scientists from the university studied the spatial distribution of and ecological risks due to heavy metals in sediments from 18 sites along the river and fish from 10 sites, from August 2023 to February 2024.

They focused their analysis on chromium, cadmium, copper, lead and zinc.

They found that the accumulation of heavy metals in fish tissues varied significantly across species, with several exceeding the threshold values for non-carcinogenic (non-cancer causing) and carcinogenic health risks, especially for cadmium and lead, they found.

Human v. natural sources

Rajaram Rajendran, in the marine science department at Bharathidasan University and one of the authors of the report, said his team's study holds significant ecological, environmental, and public health relevance because it provides a comprehensive assessment of heavy metal contamination in the Cauvery river basin.

"It highlights the pressing impacts of urbanisation, industrial effluents, and agricultural runoff on sediment and freshwater fish quality," he said.

The team also found what it described as a notable variation in metal concentrations across the various sites.

"The detection of cadmium and lead as primary contaminants of concern, with levels exceeding threshold limits in some fish species, underscores the potential risks to both ecosystem health and human consumers," Dr. Rajendran said.

The scientists used several pollution indices, each index being a number that evaluates the pollution levels of soils and sediments, calculated using the concentration of specific elements relative to their background levels.

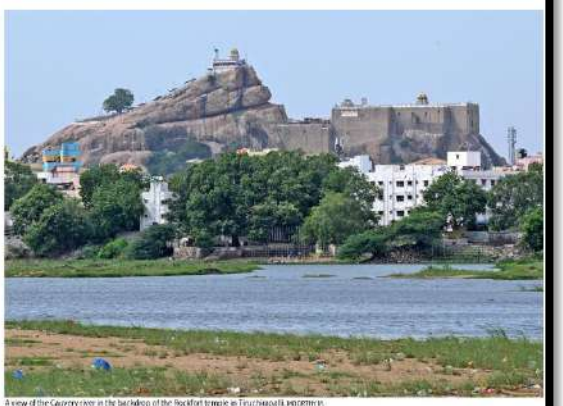
They included I_{geo}, or the geoaccumulation index, to determine heavy metal pollution in sediments; contamination factor; the contamination degree; the pollution load index; and the potential ecological risk.

Dr. Rajendran said that by integrating I_{geo} and the potential ecological risk indices with multivariate statistical analyses, the study was able to "effectively" distinguish between anthropogenic, or human origin, and natural sources vis-à-vis heavy metals.

"This approach provides valuable insights into the dynamics of metal bioaccumulation and pollution pathways in a tropical river system under rapid industrial and urban development," Dr. Rajendran said.

The study "provides valuable, updated insight into the scale and risks of heavy metal pollution in freshwater fish populations of the Cauvery river," Nikita Gupta, a researcher at the Vellore Institute of Technology, who, along with her colleague, School of Biosciences and Technology assistant professor Sathiavelu Arunachalam, has studied heavy metal pollution in tilapia fish in the Cauvery.

She added that the new paper highlighted the presence as well as the distribution of key toxic metals in multiple local fish species – "a critical concern given the river's importance for drinking water, fisheries, and agriculture in Southern India."



A view of the Cauvery river in the backdrop of the Rockfort temple in Tiruchirapalli, yesterday.

Fish consumption

The findings have direct implications for public health: while occasional fish consumption may not pose immediate threats, prolonged exposure could lead to cumulative (non-carcinogenic and carcinogenic) risks, particularly from cadmium and lead.

The risk depends on both the amount consumed, the frequency of intake, and the age of the individual, Dr. Rajendran said.

"Based on various risk assessment indices from this study, consuming fish twice a week, with a portion size of 250 g per serving, is considered safe," he estimated.

Earlier, Ms. Gupta and Dr. Arunachalam had estimated the health risk posed by heavy metals in tilapia fish using atomic absorption spectroscopy. In November 2024, they reported in *Frontiers Public Health* that the hazard quotient for cadmium, cobalt, lead, and chromium in the fish's liver, cobalt and chromium in the gills, and the cobalt in muscle "showed a significant health risk from the combined effects of these metals".

The potential health risk to humans is mainly due to exposure to cadmium and chromium, they added.

Like the new study, the researchers advised moderate fish consumption to limit the bioaccumulation of heavy metals in the body.

Researchers found that the target hazard quotient for several metals exceeded 1, which is the threshold for concern, in the liver, gills, and sometimes even muscles

"Our study is among the first to provide a thorough, multi-organ and multi-metal health risk assessment for tilapia consumers in the Cauvery basin, delivering actionable data for consumers, regulators, and health authorities," Ms. Gupta said.

The new study took these findings further.

"In our publication, we focused on one fish species whose samples we could acquire," Ms. Gupta said. "However, in this new publication, we learn that the same phenomenon of heavy metal accumulation in fish is observed in multiple regional fish species. This broadens the claim that indeed the heavy metal pollution in the Cauvery is a fact."

"Evidence that some metals, particularly cadmium and lead, pose carcinogenic and non-carcinogenic risks, including through biomagnification up the food chain," she added. "This result agrees with the findings of our study."

Using US Environment Protection Agency guidelines, the Vellore Institute of Technology researchers found that the target hazard quotient for several metals exceeded 1, which is the threshold for concern, in the liver, gills, and sometimes even muscles, "indicating real human health risks from regular exposure," Ms. Gupta said.

Scientific basis

Dr. Rajendran said his study "exposes gaps in current environmental management practices and emphasises the need for continuous monitoring of sediments, water, and aquatic organisms, stricter pollution control and regulatory enforcement, policy interventions to manage industrial emissions and unsustainable land-use practices, and enhanced public awareness to mitigate health risks."

There is an urgent call for systematic, longitudinal monitoring of riverine contamination and more stringent regulation of effluent discharge into the Cauvery, Ms. Gupta added.

The new study is especially significant for providing a contemporary, region-specific health-risk assessment and thus a much-needed scientific basis for local authorities to design regulatory and public health interventions, she added.

Industrial effluents, from textile and electroplating units operating near Erode stretch, are major contributors to heavy metal contamination. Other sources include agricultural runoff, from fertilizers and pesticides, and untreated urban wastewater.

There is some natural contribution, even if at lower levels, due to the presence of mineralised zones upstream of the river; they are important sources of iron in particular. "However, the elevated and variable levels of cadmium, chromium, and lead are highly indicative of human-driven contamination," Ms. Gupta said.

There have been similar reports from other rivers in Tamil Nadu. Researchers from the SRM Institute of Science and Technology in Kattankulathur, for example, studied heavy metal contamination on surface waters in the Noyyal river basin in western Tamil Nadu and reported that industrial activity was an important contributor of contaminants.

(T.V. Padma is a science journalist in New Delhi. tvpadma.30@yahoo.co.in)

Key Findings

1. **Extent of Contamination**
   - Sediment samples were collected from 18 sites and fish samples from 10 sites along the river (Aug 2023–Feb 2024).
   - Heavy metal accumulation varied across fish species, with cadmium and lead exceeding safe thresholds.

- Pollution indices such as Igeo (Geoaccumulation Index), Contamination Factor, and Potential Ecological Risk Index confirmed moderate to high ecological risk in several sites.

2. **Human Health Risks**
   - Cadmium and lead pose both carcinogenic and non-carcinogenic health risks through prolonged fish consumption.
   - Researchers advised limiting consumption to two servings per week (≈250 g each) to remain within safe exposure limits.
   - Risk depends on frequency, quantity consumed, and age of individuals.
3. **Anthropogenic vs. Natural Sources**
   - Major pollution sources: industrial effluents (textile, electroplating units near Erode), agricultural runoff, and urban wastewater.
   - Minor natural contributions from mineralized zones upstream (notably iron).
   - Statistical analyses confirmed a dominant human-driven contamination pattern.
4. **Comparative Studies**
   - A related study by Vellore Institute of Technology (2024) on tilapia fish in the Cauvery reported similar findings, with target hazard quotient (THQ) > 1, indicating genuine human health risks.
   - Both studies reinforce the bioaccumulation and biomagnification of metals through the food chain.

Key Analysis

- **Environmental Significance:** The findings underscore the deteriorating water and sediment quality of one of South India's most vital rivers, crucial for drinking water, irrigation, and fisheries.
- **Public Health Concern:** Chronic exposure to cadmium and lead can lead to kidney dysfunction, neurological disorders, and developmental issues.
- **Regulatory Gap:** The study exposes weaknesses in effluent regulation, wastewater treatment, and continuous river monitoring in industrial regions of Tamil Nadu.
- **Policy Relevance:** Provides a scientific evidence base for local governments to frame pollution control measures, strengthen environmental surveillance, and conduct community awareness campaigns.

Conclusion

The Cauvery river study serves as a critical environmental wake-up call, revealing how unchecked industrialization and poor waste management are endangering aquatic ecosystems and human health. Urgent policy actions—such as stricter enforcement of effluent norms, continuous biomonitoring, and sustainable land-use practices—are essential to mitigate contamination. The findings reaffirm the need to integrate environmental management with public health policy, ensuring the long-term sustainability of India's riverine ecosystems.

Daily News Analysis

UPSC Prelims Practice Question

Ques: With reference to the recent study on heavy metal contamination in the Cauvery River, consider the following statements:

1. The study found high levels of cadmium and lead in fish species exceeding safe limits.

2. Heavy metal pollution in the Cauvery is mainly of natural origin due to mineralized zones in the upper basin.

3. The study used indices like Igeo and the Potential Ecological Risk Index to assess contamination levels.

Which of the statements given above is/are correct?

(A) 1 and 3 only

(B) 2 and 3 only

(C) 1 only

(D) 1, 2 and 3

Ans: a)

UPSC Mains Practice Question

Ques: Recent studies on the Cauvery River have revealed bioaccumulation of toxic metals in fish species. Explain the concept of bioaccumulation and biomagnification, and analyze their implications for ecosystem and human health. **(150 Words)**

Daily News Analysis

Page 10 : GS 3 : Environment / Prelims

In October 2025, Delhi conducted two cloud seeding trials in collaboration with the Indian Institute of Technology Kanpur (IITK)—its first such attempt in nearly 50 years. The primary goal was to induce artificial rainfall to settle smog and reduce particulate matter (PM) concentration during the capital's severe pollution phase.

However, while the initiative drew national attention, it yielded disappointing results, raising important questions about the scientific feasibility and climatic suitability of cloud seeding in North India's post-monsoon atmosphere.

Daily News Analysis

Has cloud seeding been effective?

How does the process work? How does it aim to settle the build of smog and particulate matter in the air? When did India first experiment with cloud seeding? What was the Cloud Aerosol Interaction and Precipitation Enhancement Experiment? Have the recent trials in Delhi been successful?

EXPLAINER

Jacob Koshy

The story so far:
For the first time in nearly 50 years, Delhi conducted two cloud seeding trials with the Indian Institute of Technology Kanpur (IITK) last week. The aim was to induce rain over Delhi to settle the build of smog and particulate matter that had deteriorated the air quality.

What is cloud seeding?
Cloud seeding involves spraying a salt mixture into clouds. The science is that such seeding, which is done by aircraft fitted with flares that fire the salt mixture into clouds, can induce ice or water vapour within the clouds to form water droplets. When lots of such droplets coalesce, they can pour down as rain.

What has been its history?
Cloud seeding has been around for at least three quarters of a century with mixed success. Beginning in the 1940s, General Electric scientists William Schaefer and Bernard Vonnegut chanced upon the principle of using dry ice to form ice crystals in their lab freezer. They then decided to experiment on real clouds. It was reported that they successfully made it snow over Pittsfield in Massachusetts, U.S. This got the U.S. government excited and a formal programme called Project Cirrus was born. While creating rain was certainly on the back of their minds, the big excitement was the prospect of taming hurricanes, which did not pan out well. In the 1950s and 60s, the use of cloud seeding as a weather modification tool became popular. The Soviets seeded clouds over Leningrad to protect May Day parades – years before China used cloud seeding for clear skies ahead of the inaugural ceremony of the Olympics in 2008. The U.S. launched Project Skywater, dumping silver iodide from planes over the Rockies.

For a better sky: A view of the aircraft after the second trial of cloud seeding in Delhi, on October 28. ANI

What has India's experience been?
Nearly coincident with Project Cirrus, S.K. Banerji, the first Indian Director General of the India Meteorological Department (IMD), oversaw the first cloud seeding experiments in Kolkata by releasing salt and silver iodide in hydrogen balloons in 1952. Most of these were administered as rockets that were fired from the ground. And while these experiments seemed to suggest that on the days when seeding was done, there was more rain compared to days when there was no seeding, it wasn't verifiable if the rain was due to natural sources or from the seeding. There was even an attempt to conduct such seeding in Delhi in 1962 but it failed.

It's only from the 1970s that researchers properly started to use planes and fly to the top of the clouds to spray salt solutions. They also studied cloud physics, condensation, what kind of clouds gave rain, which ones didn't, and so on. Several States, when grappling with drought, have experimented with cloud seeding. The results have been sporadic and there was never any systematic way to tell how much rain could reasonably be expected if a certain amount of salt mixture was scattered. There was also less clarity on where exactly one could expect rain. The cost-benefit also was not clear, given that hiring aircraft, pilots, technical personnel and making salt mixtures was expensive.

What was the CAIPEEX?
Initiated by the Pune-based Indian Institute of Tropical Meteorology in 2009, Cloud Aerosol Interaction and Precipitation Enhancement Experiment (CAIPEEX) was a systematic scientific investigation to quantify if there were any benefits from cloud seeding. For that it actually studied the interior world of clouds, its physics, and water droplet formation for nearly a decade after which from 2017-2019 they physically identified, using radar and other instruments, clouds that were suitable for seeding.

This experiment was conducted over a drought prone region called Solapur, Maharashtra, and hence a natural test ground to measure enhancement (if there was any). Once the clouds were identified they flew aircraft and fired flares of calcium chloride (no silver iodide used) into some clouds and left others 'unseeded.' Their overall finding was that Solapur got an extra 867 million litres of water – which is considerable. In terms of rainfall measured on the ground: seeded clouds gave an average 46% more rain at the seeded locations relative to the unseeded ones.

Over a 100 square km area downwind, there was 18% more rain in the seed versus unseeded.

What happened in Delhi?
There were two flights on October 28 when IIT Kanpur flew its own plane and flared clouds. The results were disappointing with no rainfall triggered, though researchers at IITK said that some parts of Delhi reported a 'light drizzle' and a 'small improvement' in air quality. The drawback was the quality of clouds. The CAIPEEX demonstrated that only monsoon clouds which had a certain quantity of moisture could hope to yield sufficient water. Such clouds are absent in the post-monsoon over Delhi.

For seven years, there have been various proposals for seeding over Delhi that have been discouraged by scientists due to the winter atmospheric characteristics. IIT Kanpur has however said that it will continue 'trials' during this season.

THE GIST

- Cloud seeding has been around for at least three quarters of a century with mixed success.
- Cloud seeding involves spraying a salt mixture into clouds. The science is that such seeding, which is done by aircraft fitted with flares that fire the salt mixture into clouds, can induce ice or water vapour within the clouds to form water droplets.
- There were two flights on October 28 when IIT Kanpur flew its own plane and flared clouds. The results were disappointing with no rainfall triggered.

What is Cloud Seeding?

- Definition: Cloud seeding is a form of weather modification aimed at enhancing rainfall or snowfall by spraying certain chemical agents into clouds.
- Process:
    - Aircraft fitted with flares release salt mixtures such as silver iodide, sodium chloride, or calcium chloride into clouds.

  - These particles act as condensation nuclei, around which water vapour condenses to form larger droplets.
  - When droplets coalesce and grow heavy, they fall as rain.
- Purpose: Apart from increasing rainfall, it can be used to:
  - Reduce smog by washing out suspended pollutants,
  - Mitigate drought,
  - Suppress hailstorms or control snowfall in specific regions.

How Does Cloud Seeding Help Reduce Smog?

- Artificial rain helps settle airborne particulate matter (PM2.5 and PM10) by bringing them down to the surface.
- It can temporarily improve air quality, but effectiveness depends on:
  - Cloud type and moisture content,
  - Wind direction and temperature inversion,
  - Urban heat and aerosol concentration.
- In Delhi's winter, the dry and stable atmosphere with limited cloud moisture makes the process largely ineffective.

History of Cloud Seeding

Period	Region / Project	Objective & Outcome
1940s (U.S.)	Project Cirrus (GE scientists William Schaefer & Bernard Vonnegut)	First modern experiment using dry ice to form ice crystals; limited success.
1950s–60s	USSR & U.S.	Used for weather control and protection of parades/events.
2008 (China)	Ahead of Beijing Olympics	Used to clear skies—one of the largest modern operations.
1952 (India)	Kolkata — led by S.K. Banerji, first DG of IMD	Early trials using salt and silver iodide in hydrogen balloons; results uncertain.
1962 (Delhi)	Attempted seeding, failed due to poor cloud conditions.	
1970s–2000s	Various Indian States (esp. Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka)	Drought relief attempts with mixed and inconclusive outcomes.

The Cloud Aerosol Interaction and Precipitation Enhancement Experiment (CAIPEEX)

- Launched: 2009 by Indian Institute of Tropical Meteorology (IITM), Pune.
- Objective: To scientifically assess the efficacy of cloud seeding by understanding cloud microphysics and aerosol interactions.
- Method:
  - Conducted in Solapur, Maharashtra (drought-prone area).
  - Used calcium chloride flares to seed select clouds (2017–2019).
- Findings:
  - 46% more rainfall over seeded locations;
  - 18% increase over a 100 sq. km downwind area;
  - 867 million litres of extra water generated.
- Significance: Provided India's first scientific evidence of partial success in rain enhancement under suitable monsoon conditions.

Delhi Trials (October 2025)

- Conducted by: IIT Kanpur using its own aircraft.
- Objective: To induce rainfall and reduce smog.
- Result:
  - No measurable rainfall; only light drizzle in some localities.
  - Minor, short-term improvement in air quality reported.
- Reason for Failure:
  - Poor cloud quality — lack of sufficient moisture and vertical development in post-monsoon skies.
  - Unfavourable winter conditions—low humidity and temperature inversions trap pollutants instead of dispersing them.

Key Analysis

- Scientific Limitation: Cloud seeding is not a pollution control method but a weather-dependent rain enhancement technique. It can't work without suitable cloud systems.
- Policy Perspective:
  - While technologically feasible, it offers uncertain outcomes and high operational costs.
  - More reliable long-term solutions lie in emission reduction, green cover expansion, and industrial regulation.
- Global Experience: Even advanced nations like the U.S. and China report variable results depending on humidity, temperature, and cloud microstructure.

Conclusion

Daily News Analysis

The Delhi cloud seeding trials mark an innovative but scientifically challenging attempt to combat air pollution. Although CAIPEEX demonstrated success in monsoon conditions, replicating the same in dry winter atmospheres is unlikely to yield results.

For sustainable clean-air outcomes, India must focus on reducing emissions at the source, strengthening urban air quality management, and treating cloud seeding only as an experimental supplement, not a reliable mitigation measure.

UPSC Prelims Practice Question

Ques. Consider the following pairs:

Cloud Seeding Project	Country / Organisation	Objective
1 .Project Cirrus	United States	First experiment on artificial precipitation
2. Project Skywater	Soviet Union	To induce snow for crop irrigation
3. CAIPEEX	India	To study cloud-aerosol interactions and precipitation enhancement

Which of the pairs given above is/are correctly matched?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2, and 3

Ans : b)

UPSC Mains Practice Question

Ques What is cloud seeding? Discuss the scientific principles behind it and evaluate its effectiveness as a tool to mitigate air pollution in Indian cities like Delhi. **(250 Words)**

Daily News Analysis

Page : 10 : GS 2 : International Relations / Prelims

In September 2025, more than 60 countries ratified the High Seas Treaty, officially titled the Biodiversity Beyond National Jurisdiction (BBNJ) Agreement. It will come into force in January 2026, marking a landmark step toward protecting marine biodiversity in areas beyond national jurisdiction, which make up two-thirds of the ocean surface and 95% of its volume.

The treaty seeks to ensure sustainable use, equitable sharing of marine resources, and conservation in the high seas—areas that were largely unregulated under the UNCLOS (1982).

What are the challenges with the High Seas Treaty?

What does the principle of 'common heritage of humankind' mean? Is the treaty ambiguous?

Padmashree Anandhan

The story so far:

The High Seas Treaty was ratified by over 60 countries in September; it will now be enforced in January 2026. The treaty sets rules to preserve and use marine biodiversity sustainably and addresses threats from climate change, overfishing and pollution.

What is the treaty about?

The Biodiversity Beyond National Jurisdiction (BBNJ) agreement, as the High Seas treaty is formally referred to, creates an all-inclusive framework to govern and manage common marine biodiversity. It identifies Marine Genetic Resources (MGRs) as the common heritage of humankind, insisting on a fair and equitable sharing of benefits. Besides, the Area-Based Management Tools (ABMTs) include Marine Protected Areas (MPAs) that can be recognised to protect biodiversity. This will help in improving climate resilience and provide food security, combining science and indigenous knowledge. The treaty also entails Environmental Impact Assessments (EIAs) for events potentially affecting these areas, especially when cumulative and transboundary impacts are taken into account. The first steps for the treaty began two decades ago. In 2004, the UN General Assembly formed an ad-hoc working group to fix the gap in the UN Convention on the Law of the Sea (UNCLOS), 1982, which did not have clear guidelines on protecting BBNJ. By 2011, states had agreed to negotiate on four key issues, mainly MGRs, ABMTs, EIAs, and capacity building and technology transfer. Following this, four Intergovernmental Conference sessions were held between 2018 and 2023. The parties to these discussions finally reached an agreement in March 2023, which led to the adoption of the treaty in June 2023.

What are the major issues?

First is the uncertainty over the principles of "common heritage of humankind" and "freedom of the high seas." The "common heritage principle" supports equitable access and benefit-sharing of marine resources for all, while the "freedom on the high seas" stresses on unrestricted rights of states to carry out navigation, resource usage and research activities. However, the common heritage principle is only applicable partially, especially when it comes to MGRs. This shows a compromise instead of a resolution. It also creates ambiguity in exploration, research and benefit sharing. Second, is the use of MGRs. The governance of MGRs was earlier not defined, raising concerns over "biopiracy" and unfair exploitation by developed countries. Developing nations were concerned that they would be excluded from the profits of scientific discoveries from the high seas. The treaty now includes a framework on sharing monetary and non-monetary benefits, but with no clear details on how such benefits will be calculated or shared. Third is the reluctance of big powers to get engaged. The treaty is under threat due to non-participation from the U.S., China, and Russia, who are yet to ratify the treaty. Fourth, is interaction with multilateral institutions. The treaty must coexist and not ignore existing international institutions, such as the International Seabed Authority (ISA) and Regional Fisheries Management Organisations (RFMOs). The BBNJ agreement must also blend with existing international treaties to prevent legal conflicts and lead to more fragmentation of ocean governance.

What next?

The treaty provides more clarity to the UNCLOS provisions, focusing on science-based requirements for EIAs, ABMTs and benefit sharing. However, the ambiguous language in the MGRs and the common heritage of humankind principle challenge the execution of the treaty. There is a need for dynamic management of MPAs, and regular monitoring. To deliver the BBNJ, linking climate-biodiversity with the ocean will be crucial for resilient management.

Padmashree Anandhan is a project associate at NIAS, Bangalore.

THE GIST

- The Biodiversity Beyond National Jurisdiction (BBNJ) agreement, as the High Seas treaty is formally referred to, creates an all-inclusive framework to govern and manage common marine biodiversity.
- The "common heritage principle" supports equitable access and benefit-sharing of marine resources for all.
- Developing nations were concerned that they would be excluded from the profits of scientific discoveries from the high seas.

Key Provisions of the Treaty

Daily News Analysis

1. **Marine Genetic Resources (MGRs):**
    - Declared the common heritage of humankind.
    - Ensures fair and equitable sharing of benefits derived from biological resources in international waters (both monetary and non-monetary).
2. **Area-Based Management Tools (ABMTs):**
    - Creation of Marine Protected Areas (MPAs) to conserve biodiversity and enhance climate resilience.
3. **Environmental Impact Assessments (EIAs):**
    - Mandatory for any planned activity in high seas likely to affect marine ecosystems, considering cumulative and transboundary impacts.
4. **Capacity Building and Technology Transfer**:
    - Support for developing countries to enhance participation in research and sustainable exploitation of marine resources.

The Principle of 'Common Heritage of Humankind'

- This principle asserts that certain global commons—like the deep seabed, outer space, and now MGRs of the high seas—belong to all humanity collectively.
- No single nation can claim sovereignty over these resources; instead, benefits should be shared equitably among all nations, especially between developed and developing ones.
- It embodies equity, cooperation, and shared stewardship — balancing exploration rights with collective responsibility.

Challenges and Ambiguities

1. **Conflict Between Two Principles:**
    - The treaty struggles to reconcile "common heritage of humankind" with "freedom of the high seas."
    - The latter, enshrined in UNCLOS, gives states unrestricted rights for navigation and research.
    - Partial application of the common heritage principle creates ambiguity in access, benefit sharing, and governance of MGRs.
2. **Unclear Benefit-Sharing Mechanism:**
    - While the treaty mandates equitable sharing of benefits from MGRs, it lacks a clear formula for how profits or intellectual property from genetic discoveries will be distributed.
    - Raises fears of biopiracy and technological monopolization by developed countries.
3. **Reluctance of Major Powers:**
    - The U.S., China, and Russia have not ratified the treaty, undermining its global legitimacy and enforcement.
    - Without their participation, implementation and compliance mechanisms may remain weak.
4. **Institutional Overlap:**
    - The treaty must align with existing frameworks such as the International Seabed Authority (ISA) and Regional Fisheries Management Organisations (RFMOs).

- Overlaps risk creating legal fragmentation and bureaucratic conflict in ocean governance.

5. **Implementation and Monitoring:**
   - Establishing and managing Marine Protected Areas over vast, ungoverned waters requires technological capacity, data sharing, and consistent monitoring, which many developing states lack.

Is the Treaty Ambiguous?

- Yes — while it is a progressive step, its language on key issues like MGRs, benefit sharing, and the extent of "common heritage" remains vague and open to interpretation.
- This ambiguity may allow powerful states or corporations to exploit loopholes, undermining the treaty's equitable and conservation-focused intent.

Conclusion

The High Seas Treaty represents a historic move toward global ocean stewardship, bridging environmental protection with equity. However, conceptual ambiguities, institutional overlaps, and uneven political will pose significant challenges.

To realise its potential, states must work toward:

- Clarifying benefit-sharing mechanisms,
- Ensuring participation of major powers, and
- Integrating ocean governance with climate and biodiversity goals.

Ultimately, the treaty's success will depend on turning the ideal of the "common heritage of humankind" into practical, enforceable cooperation for a truly shared global ocean.

UPSC Prelims Practice Question

Ques : With reference to the High Seas Treaty (BBNJ Agreement), consider the following statements:

1. The treaty aims to conserve marine biodiversity in areas beyond national jurisdiction.

2. It establishes the concept of Marine Protected Areas (MPAs) in international waters.

3. The treaty is part of the United Nations Convention on Biological Diversity (CBD).

Which of the statements given above is/are correct?

(A) 1 and 2 only

(B) 2 and 3 only

(C) 1 and 3 only

(D) 1, 2 and 3

Ans: a)

UPSC Mains Practice Question

Ques: Discuss the significance of the High Seas Treaty (BBNJ Agreement) in strengthening global ocean governance. What are the key challenges in its implementation? **(150 Words)**

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India's energy security strategy is undergoing a realignment as crude oil imports from Russia dipped by nearly 29% in September 2025, according to The Hindu BusinessLine. The fall comes amid increased U.S. pressure and a 25% tariff on purchases of Russian oil. This marks a turning point in India's balancing act between economic pragmatism and geopolitical sensitivity.

Daily News Analysis

India trims Russian oil import by 29% in September

Sourashis Banerjee
CHENNAI

India's crude import patterns are undergoing a significant shift as the country diversifies away from Russian barrels under pressure from the U.S.

Petroleum crude imports from Russia dropped sharply by 28.9%, from $4,675 million in September 2024 to $3,322 million in September 2025.

This decline follows the additional 25% tariff imposed by the U.S. for purchasing Russian oil in August, which came into effect on August 27.

businessline's analysis of data from the Ministry of Commerce for September 2025 shows India's total crude imports fell by 6.66% in September 2025 compared with the same month last year, from $11,476 million in September 2024 to $10,712 million this year. Besides Russia, imports from Iraq slid 16%.

Slippery wicket: Dip in Russian oil imports follows the additional 25% tariff imposed by the U.S. for purchasing Russian oil. REUTERS

But India appears to be actively exploring imports from other countries to bridge the gap left by Russia. While purchases from Saudi Arabia, the UAE, the U.S., Angola and Colombia increased, it has added many other sources to its list.

Suppliers, who were not present in September 2024 but appeared on the crude oil import list in September 2025, include Nigeria, Turkiye, Libya and Egypt.

Crude from Saudi Arabia, the UAE, the U.S., Angola and Colombia rose, in an attempt to diversify

Changing market shares

The decline in imports has dragged Russia's dominance in India's oil imports down below one-third for the first time in almost two years. Russia's share in total crude oil imports slid by 9.72 percentage points, though it is the largest supplier from 40.74% share in September 2024 to 31.02 % share in September 2025.

While the UAE increased its share from 9.7% last year to 13.8%, the share of U.S. in India's crude imports increased to 6.3% from 5.3% a year ago.

The Gulf trio – Saudi Arabia, the UAE, and Kuwait – collectively increased share from 26.6% to 31.3%. The U.S. and African together account for over 10%, signalling a strategic broadening of supply lines. Canada's share fell from 1.39% to zero.

Costlier imports

India's crude oil imports are, however, becoming pricier. While Russian barrels were available at about $500 a tonne in September 2025, substitutes from the Middle East, Africa, and the U.S. are significantly costlier with crude from the UAE at $543, Saudi Arabia $560, the U.S. $549, and Libya $602 per tonne.

Even with a smaller overall import volume, this upward shift in unit costs could pressure India's refinery margins, trade deficit, and retail fuel inflation.

Tightening pragmatism

With total imports contracting and cheaper sources shrinking, India's balancing act between economic pragmatism and strategic alignment appears to be tightening. The data underline a crucial trade-off: less dependence on sanctioned oil, but higher import costs and reduced pricing flexibility.

(The writer is with The Hindu businessline)

Main Analysis

1. **Shift in Import Dynamics**
   - India's crude imports from Russia declined from $4.67 billion in September 2024 to $3.32 billion in September 2025 — a 28.9% fall.
   - Russia's share in India's crude basket dropped from 40.74% to 31.02%, its lowest in two years.
   - Imports from Iraq also slipped by 16%, while the UAE, Saudi Arabia, and the U.S. increased their shares significantly.
2. **Diversification of Supply**
   - India added new suppliers such as Nigeria, Turkiye, Libya, and Egypt, reflecting an active attempt to reduce overdependence on any single source.
   - The Gulf trio (Saudi Arabia, UAE, Kuwait) now accounts for over 31% of total crude imports, and the U.S. and African nations together contribute more than 10%.
   - This diversification strengthens supply security but may strain India's refining economics.
3. **Rising Import Costs**
   - Russian crude had been significantly cheaper (around $500 per tonne) compared to Middle Eastern and U.S. crude (ranging from $543 to $602 per tonne).
   - The shift toward costlier sources could increase India's trade deficit, refinery input costs, and retail fuel prices, potentially impacting inflation management.
4. **Strategic Implications**

- The reduction reflects India's cautious response to Western sanctions and tariff pressures, especially from the U.S.
- However, the move narrows India's strategic flexibility in securing energy at competitive prices.
- It also highlights the tension between India's economic interests (cheap Russian crude) and geopolitical alignments (closer ties with the U.S. and Europe).

Conclusion

India's cutback in Russian oil imports underscores the growing complexity of its energy diplomacy. While diversification enhances long-term energy security and international credibility, it comes at an economic cost. The coming months will test India's ability to balance strategic autonomy, economic prudence, and geopolitical alignment amid a volatile global oil market.

UPSC Mains Practice Question

Ques: Examine how India's diversification of crude oil imports impacts its energy security, trade balance, and inflation management. **(150 Words)**

NITIN SIR CLASSES

THE HINDU
INDIA'S NATIONAL NEWSPAPER SINCE 1878

Daily News Analysis

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The case for energy efficiency

India has doubled down on clean energy, yet the power you plug into today is dirtier than it was five years ago. This is a paradox that is at the heart of our energy transition.

As of June 2025, non-fossil fuel sources account for about 50% of India's total installed capacity. However, India's grid emission factor (GEF) – a measure of the carbon intensity of electricity – has increased from 0.703 tCO_2/MWh in 2020-21 to 0.727 tCO_2/MWh in 2023-24, according to the Central Electricity Authority. This is a striking reversal: more renewables should mean a cleaner grid. Why is India's grid getting dirtier instead?

The capacity-generation mismatch

The answer lies in the distinction between capacity and generation. While renewables now account for a large share of installed capacity, they deliver far less electricity over the year compared to coal or nuclear. Solar and wind plants typically run at 15-25% capacity utilisation, versus 65-90% for coal and nuclear.

In 2023-24, renewables (including hydro) supplied just 22% of total electricity; the rest was fossil fuel-powered. The gap between headline capacity and actual delivered energy is widening, and India's fast-growing demand is being met by the most carbon-intensive source in the system: coal.

India's electricity demand also peaks when renewables are least available. Solar floods the grid in the afternoon but fades by evening, just as peak loads from households surge. Fossil fuel plants, therefore, act as the system's shock absorbers – dispatched to meet night-time and peak demand – but they also lock in emissions.

This temporal mismatch highlights the limits of capacity expansion alone. To truly decarbonise, India needs flexibility along with more gigawatts.

Satish Kumar

President and Executive Director, Alliance for an Energy Efficient Economy

Ajay Mathur

Professor of Practice, IIT Delhi; Former Director General, International Solar Alliance and Bureau of Energy Efficiency

If India wants to actually decarbonise its grid, efficiency must become the first fuel – and flexibility, not fossil fuels, must power the future

While Round-the-Clock (RTC) renewable electricity, at less than ₹5 per kWh, costs less than new coal-based power stations, upscaling is slow. We need policies that enable more land, transmission lines, and investment.

The role of energy efficiency

Energy efficiency provides the opportunity. Often called the "first fuel", it reduces demand before supply even needs to be generated. By lowering the evening and night-time peaks, efficiency reduces reliance on coal when emissions are highest. Scaling up efficient appliances – fans, air conditioners, and motors – and embedding efficiency in buildings and industrial processes can reshape this curve.

The benefits extend beyond reduced coal consumption and enhanced opportunity for integrating renewables. Energy efficiency enhances flexibility by flattening demand peaks and allowing demand to align with renewable availability. It also prevents lock-in by replacing old, inefficient technologies early.

Energy efficiency is invisible by design – diffuse, distributed, and cumulative. Yet, without it, the energy transition cannot be achieved. Concrete evidence from the Bureau of Energy Efficiency shows that India saved about 200 Million Tonnes of Oil Equivalent of final energy, equivalent to around 1.29 GT of CO2eq, and close to ₹760,000 crore in savings, from FY2017-18 to FY2022-23.

India is not alone, but its pathway is unique. Countries such as France, Norway, and Sweden boast grid emission factors of just 0.1-0.2 tCO_2/MWh, largely thanks to large shares of hydro and nuclear electricity. India, at 0.727, starts from a coal-heavy base and faces relentless demand growth. This makes efficiency part of the core strategy, not just an option. Without it, renewables risk being stranded in the wrong hours.

What needs to be done

To unlock the full value of clean energy, India must urgently do the following. First, it must enable homes and offices to connect their batteries into virtual power plants, helping the grid glide over the peak demand. Second, it must accelerate appliance efficiency standards. It must move markets towards 4- and 5-star products and steadily raise benchmarks. Third, it must support small and medium enterprises to adopt efficient motors, pumps, and processes. Fourth, it must enable flexible pricing by adopting tariff structures that reward consumers for shifting demand to periods of high renewable availability. Fifth, it must introduce scrappage incentives for old, energy-guzzling equipment. Sixth, it must enable electricity distribution companies to procure "electricity services", such as green cooling, which allows for high-efficiency air conditioning powered by RTC clean power.

The Central Electricity Authority's National Electricity Plan projects a fall in India's GEF to 0.548 by 2026-27, and 0.430 by 2031-32. Achieving this requires more than just building solar and wind farms. It demands a flexible system approach - with efficiency at the centre.

India has grown its economy while cutting emissions intensity by 33% between 2005 and 2019, as noted in its Fourth Biennial Update Report to the UNFCCC. But the rising GEF calls for a balanced approach: accelerate supply-side investments in renewables, storage, and transmission, while embedding efficiency across households, industries, and cities. If India wants to actually decarbonise its grid, efficiency must become the first fuel – and flexibility, not fossil fuels, must power the future.

GS. Paper 3 Indian Economy

UPSC Mains Practice Question: Energy efficiency must become the 'first fuel' if India is to decarbonise its grid. Discuss the statement in the context of India's energy transition challenges and policy priorities. **(150 Words)**

Context :

Daily News Analysis

India's clean energy transition stands at a paradox. Despite non-fossil fuel sources now contributing around 50% of India's total installed power capacity (as of June 2025), the Grid Emission Factor (GEF) — the measure of carbon emitted per unit of electricity — has risen from 0.703 tCO_2/MWh in 2020–21 to 0.727 tCO_2/MWh in 2023–24. This paradox — "more renewables, yet a dirtier grid" — underscores a critical challenge: India's energy transition needs not just capacity expansion, but also efficiency, flexibility, and demand-side management.

Understanding the Paradox

1. **Capacity vs. Generation Mismatch**
    - Renewable energy (solar, wind, hydro) constitutes about half of India's installed capacity, but contributes only around 22% of total electricity generation.
    - This is because renewable plants operate at low capacity utilization (15–25%), compared to coal and nuclear (65–90%).
    - India's peak power demand occurs during evening hours — when solar output declines sharply — forcing coal-based plants to fill the gap.
2. **Rising Dependence on Coal**
    - India's fast-growing electricity demand is increasingly met by coal-fired power, the most carbon-intensive source.
    - Coal acts as a "shock absorber" for the grid — reliable during night and peak hours but environmentally costly.
    - The result is an increase in grid carbon intensity, even though renewable installations are rising.

Why Energy Efficiency Matters

Energy efficiency is often termed the "first fuel" — because it reduces demand before additional supply is needed. Rather than merely adding renewable capacity, efficiency reduces the volume and timing of demand, thus cutting dependence on fossil fuels when emissions are highest.

Key Benefits

1. Reduces Peak Load: Efficient appliances and processes lower electricity use during peak hours, reducing the need for coal back-up.
2. Improves Grid Flexibility: A flatter demand curve helps integrate variable renewable energy smoothly.
3. Saves Resources: Between 2017–18 and 2022–23, India saved 200 Million Tonnes of Oil Equivalent, avoiding 1.29 GT of CO_2 and saving around ₹7.6 lakh crore, according to the Bureau of Energy Efficiency (BEE).
4. Prevents Technological Lock-in: Replacing inefficient technologies early avoids locking into carbon-heavy infrastructure for decades.

Global Context

- Developed countries such as France, Norway, and Sweden have GEFs as low as 0.1–0.2 tCO_2/MWh, largely due to nuclear and hydro dominance.
- India, starting from a coal-heavy base (GEF: 0.727) and facing rapid demand growth, must carve a unique pathway.
- For India, efficiency isn't an optional add-on — it is the core pillar of sustainable energy transition.

Policy Recommendations and Way Forward

1. Virtual Power Plants (VPPs): Integrate distributed storage (like home or EV batteries) into the grid to manage peak loads effectively.
2. Tighter Appliance Efficiency Standards: Accelerate the transition toward 4- and 5-star rated appliances and raise baseline efficiency norms regularly.
3. Support for MSMEs: Provide fiscal and technical incentives to upgrade motors, pumps, and industrial processes to efficient alternatives.
4. Dynamic Tariff Structures: Introduce time-of-day pricing to encourage consumers to use electricity when renewable generation is high.
5. Scrappage Policy: Offer incentives for replacing old, inefficient appliances and equipment, similar to vehicle scrappage norms.
6. Energy Service Procurement by DISCOMs: Encourage power distribution companies to procure energy services (like efficient cooling) rather than just electricity.

Projected Outlook

The National Electricity Plan (2023) projects India's GEF to decline to:

- 0.548 by 2026–27, and
- 0.430 by 2031–32.

However, achieving this trajectory demands more than building renewable capacity; it requires a system-level transformation built on energy efficiency and grid flexibility.

Conclusion

India has achieved commendable progress by reducing emissions intensity by 33% (2005–2019), but rising grid emissions highlight an urgent gap. To decarbonise effectively, India must:

- Combine renewable expansion with efficiency-driven demand moderation,
- Build flexible storage and transmission networks, and
- Institutionalize energy efficiency as the first line of defence against emissions growth.

Daily News Analysis

Ultimately, energy efficiency is not just a side policy — it is the cornerstone of a resilient, affordable, and low-carbon energy future for India.