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Daily News Analysis

The Hindu Important News Articles & Editorial For UPSC CSE

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India is preparing to submit its updated **Nationally Determined Contributions (NDCs)** at COP30 in Belém, Brazil (November 2025). NDCs are country-specific climate action goals under the **Paris Agreement (2015)**, aimed at limiting global warming to **below 2°C (preferably 1.5°C)** above pre-industrial levels. India is likely to raise its **energy efficiency targets**, signaling a stronger commitment to sustainable development while balancing the needs of economic growth and energy security.

India may increase energy efficiency target for COP30

Jacob Koshy
NEW DELHI

India will submit its updated Nationally Determined Contributions (NDCs) around the commencement of the UN Climate Change Conference COP30 in Brazil on November 10, likely with an increased target for energy efficiency improvement, sources in the Environment Ministry indicated to *The Hindu*.

The NDCs are renewable-energy adoption goals set by a country as part of being a signatory to the Paris Agreement - under which countries must regulate their fossil fuel consumption to keep the globe from heating 2 degrees Celsius , and as far as possible, 1.5 degrees Celsius above that in pre-industrial times.

As part of this, countries are required to update their NDCs every five years. India last updated its NDCs in 2022, when it committed to reduce the emissions intensity of its GDP by 45% of 2005 levels; source half of its electric power capacity from non-fossil fuel sources; and create a carbon sink of at least two billion tonnes by 2030.

Emissions intensity of the GDP refers to the amount of carbon emitted per unit of GDP and does not mean a reduction in net emissions. As of December 2023, India reported to the United Nations climate-governing body that the emissions intensity of its GDP had been reduced by 33% between 2005 and 2019. This June, India reported installing at least 50% of its power capacity from non-fossil fuel sources.

Planet getting warmer

The NDCs are of particular significance this year because Brazil, which assumes the COP presidency in Belém, has stressed that a major effort this year will be to assess what hindered countries from achieving their stated NDCs.

Clean energy: India has committed to source half of its electric power capacity from non-fossil fuel sources by 2030. REUTERS

All commitments by countries, even if achieved perfectly, cannot stop the globe from heating to an average of 3 degrees Celsius by the century - well short of the Paris Agreement goals.

Overall, the ambition to undertake significant emission cuts seems muted.

EU climate target looms

The European Union has yet to announce a 2035 target, though it has a long-term goal to be "net zero" by 2050.

The EU commission this July had proposed an amendment to the EU climate law enabling a 90% cut in emissions compared to 1990 by 2040.

Though they were to vote on a target for 2035 last week, France and Germany weighed in to postpone a vote on the matter.

The EU is expected to submit its NDCs ahead of COP30 with an indicative 2035 target in a range from 66.25% to 72.5%, compared with the 1990 levels. Australia this month updated its NDCs to say that it "aimed" to cut emissions to 62%-70% of 2005 levels by 2035.

The United States has exited the Paris Agreement and it remains to be seen if China will announce ambitious NDCs ahead of COP30.

Major reductions, sources in the Environment Ministry suggest, would likely result from bilateral agreements between countries where developed and developing countries jointly invested in clean energy projects and shared the resulting cut in emissions, as computed by an approved methodology, as carbon credits.

Indian initiatives

India has recently signed such an agreement called a JCM (Joint Crediting Mechanism) with Japan and is in talks with other countries. However it will be a few years before such projects practically kick in.

"Developed countries are not willing to part with the necessary finance to make good on ambitious goals and developing countries require fossil fuels for their development," an Environment Ministry official added.

India is also expected to operationalise the India Carbon Market by 2026 – under which 13 major sectors will be given mandatory emission-intensity targets – and can trade their resulting savings, if any, via emission reduction certificates.

Static Context

1. **Paris Agreement & NDCs**
   - Legally binding international treaty adopted at COP21 (2015).
   - Requires countries to submit and update NDCs every 5 years.
   - Focus on mitigation (emission cuts), adaptation, and climate finance.
2. **India's Current NDCs (Updated in 2022):**
   - Reduce **emissions intensity of GDP** by **45% of 2005 levels by 2030**.
   - Source **50% of electric power capacity** from **non-fossil fuel sources** by 2030.
   - Create a **carbon sink of 2.5–3 billion tonnes** through afforestation.
3. **Concept Check (Prelims):**

- Emissions Intensity = CO_2 emissions per unit of GDP (not absolute emission cuts).
- Carbon Sink = Absorption of carbon by forests, soil, oceans.
- Carbon Credits = Tradable certificates for emission reductions.

Current Context

- **India's Progress:**
  - Reduced emissions intensity by **33% (2005–2019)**.
  - Installed **>50% power capacity from non-fossil fuels (June 2024)**.
- **Expected Enhancements in NDCs (2025):**
  - Increased focus on **energy efficiency**.
  - Expansion of **India Carbon Market (2026)**: 13 sectors with mandatory emission targets, tradable via Emission Reduction Certificates.
  - Bilateral cooperation through **Joint Crediting Mechanism (JCM)** with Japan; similar pacts under discussion.
- **Global Scenario:**
  - **EU:** Proposed 90% emission cut (1990 baseline) by 2040; 2035 target yet to be finalized.
  - **Australia:** Updated target to cut emissions 62–70% (2005 baseline) by 2035.
  - **US:** Exited Paris Agreement under Trump; future stance uncertain.
  - **China:** Position on ambitious NDCs still unclear.
- **Challenges:**
  - Finance Gap: Developed nations reluctant to provide promised $100 billion annually.
  - Development vs. Decarbonisation: Developing countries (incl. India) still reliant on fossil fuels for growth.

Conclusion

India's decision to likely **raise its energy efficiency target** at COP30 demonstrates its proactive approach towards climate leadership while protecting developmental interests. However, achieving ambitious goals depends on **global climate finance, technology transfer, and effective carbon markets**. For the world to stay within the Paris Agreement temperature limits, both developed and developing countries must enhance ambition and cooperate through fair and transparent mechanisms.

India's path reflects the larger global dilemma: ensuring growth and poverty reduction while urgently addressing the climate crisis.

UPSC Prelims Practice Question

Ques: With reference to the Paris Agreement (2015), consider the following statements:

1. It is legally binding on all Parties to achieve net-zero emissions by 2050.

2. Under it, countries are required to submit and update their Nationally Determined Contributions (NDCs) every five years.

3. Its primary goal is to limit global warming well below 2°C, preferably to 1.5°C, compared to pre-industrial levels.

Which of the above statements are correct?

a) 1 and 2 only

b) 2 and 3 only

c) 1 and 3 only

d) 1, 2 and 3

Ans: b)

UPSC Mains Practice Question

Ques: India's climate commitments under the Paris Agreement highlight a balance between development imperatives and environmental sustainability." Discuss in light of India's likely enhanced energy efficiency targets at COP30. **(250 Words)**

Page 04 : GS 3 : DisasterManagement / Prelims

The Union government plans to introduce **new guidelines mandating slope stabilisation** before constructing highways in hilly and disaster-prone regions. This move comes after repeated incidents of road collapses in **Himachal Pradesh and Uttarakhand**, where cloudbursts and floods damaged stretches of the **Kiratpur–Manali Highway (NH-21)** and other National Highways. Strengthening highways against natural disasters is crucial for **disaster resilience, infrastructure safety, and sustainable development**.

Centre to issue new norms to curb highway collapse in disaster-prone areas

Jagriti Chandra
NEW DELHI

The Union government is "cognisant" of concerns after sections of highways were washed away following cloudbursts and floods in parts of Himachal Pradesh and Uttarakhand, and will frame new guidelines to focus on "slope stabilisation" to curb road collapse during natural disasters, a senior official of the Road Transport and Highways Ministry said.

"We will be issuing new guidelines mandating slope stabilisation prior to road construction, rather than as a post-construction measure, in hilly regions. Additionally, we will revise concessionaire agreements to incorporate these requirements for all future projects," V. Umashankar, Secretary, Road Transport and Highways Ministry, told *The Hindu*.

The official said that following the recent incidents of road collapses, including the 15 damaged sites along National Highway-21 (Kiratpur-Manali Highway), it was observed that the locations which underwent slope stabilisation measures withstood the impact of cloudbursts and floods. Slope stabilisation is an engineering process of strengthening an unstable slope to prevent landslides and erosion. It involves techniques that increase a slope's safety by controlling soil or rock movement, managing water drainage, and reinforcing the ground. Common methods include building retaining walls, soil nails, anchors, shotcrete, drainage systems, vegetation planting, and adjusting slope shape to improve stability.

The official said damage to National Highways was mostly observed in sections constructed along riverbanks, exacerbated by rising river levels. The damage was observed on the "valley side", or the side of the road that slopes down towards the river flowing through the valley below, he added.

Damage to National Highways was mostly observed in sections constructed along riverbanks, says Transport Ministry official. PTI

Static Context

1. **Importance of National Highways:**
   - Carry ~40% of road traffic despite being only ~2% of India's road network.
   - Critical for **economic growth, connectivity, disaster relief, and tourism**.
2. **Challenges in Hilly Terrain:**
   - Fragile geology, seismic activity, and **intense rainfall events** (cloudbursts, flash floods).
   - Unstable slopes, landslides, erosion, and riverbank cutting.
   - Increased risk due to **climate change and extreme weather events**.
3. **Slope Stabilisation Techniques (Prelims relevance):**
   - Retaining walls, soil nailing, anchors, shotcrete.
   - Vegetation planting (bio-engineering).
   - Surface drainage and subsurface water management.
   - Slope regrading and terracing.

Current Context

- **Key Decision:**
  - Slope stabilisation to be made **mandatory before road construction**, not after damage occurs.
  - Revised concessionaire agreements for all **future highway projects** in hilly regions.
- **Observations:**
  - Locations with slope stabilisation **survived floods and cloudbursts**, while unprotected stretches collapsed.
  - Damage most severe on **valley-side stretches along riverbanks** due to rising river levels.
- **Impact:**
  - Expected reduction in **road collapses, economic losses, and travel disruptions**.
  - Enhances safety for **tourists, locals, and freight movement** in Himalayan states.
  - Could serve as a model for **other climate-vulnerable geographies**.

Issues & Challenges

- High **cost of slope stabilisation** may raise project expenditure.
- Land acquisition and ecological concerns in fragile Himalayan ecosystems.
- Need for **continuous monitoring and maintenance**.
- Coordination with **disaster management authorities** for early warning and preparedness.

Conclusion

The move to mandate slope stabilisation in highway projects reflects a shift towards climate-resilient infrastructure planning. While it may raise initial costs, the long-term benefits in terms of safety, reduced economic losses, and disaster preparedness outweigh the expenses. For India, where road networks are the lifeline of the economy, integrating engineering solutions with environmental sensitivity is essential to achieve sustainable infrastructure development in the face of climate change.

UPSC Prelims Practice Question

Ques: With reference to slope stabilisation in road construction, consider the following statements:

1. It is a post-construction activity taken up only after road damage has occurred.

2. It involves controlling soil or rock movement, drainage, and reinforcement of the ground.

3. Slope stabilisation is particularly important in highway stretches built along riverbanks in Himalayan states.

Which of the above is/are correct?

(a) 1 only

(b) 2 and 3 only

(c) 1 and 2 only

(d) 1, 2 and 3

Ans: (b)

UPSC Mains Practice Question

Ques: Critically examine the challenges of highway construction in the Himalayan states of India. Suggest engineering and policy measures to ensure climate-resilient road infrastructure. **(150 Words)**

Page 06 : GS 1 : Social Issues/ Prelims

The **71st National Film Awards** ceremony (2023) highlighted the evolving role of Indian cinema in portraying **women-centric narratives, social issues, and national values**. President Droupadi Murmu, while presenting the **Dadasaheb Phalke Award** to veteran actor Mohanlal, underscored the importance of **cinema as a medium of social awareness**, calling for greater **women's representation in jury panels** and encouraging films that address issues of **patriarchy, gender equality, and youth sensitisation**.

President lauds women-centric films

At National Film Awards ceremony, Murmu notes recognition of films focusing on women; she calls for adequate representation of women on the jury panels, says films should spread social awareness; receiving Dadasaheb Phalke Award, actor Mohanlal says cinema is the 'heartbeat of his soul'

The Hindu Bureau
NEW DELHI

President Droupadi Murmu on Tuesday presented the prestigious Dadasaheb Phalke Award for 2023 to actor Mohanlal and gave away awards to the other winners at the 71st National Film Awards ceremony.

"Cinema is the heartbeat of my soul. Jai Hind," Mohanlal said after receiving the country's highest cinema honour.

Congratulating all the winners, Ms. Murmu spoke about Mohanlal's phenomenal contributions, stating that the accomplished actor effortlessly portrayed emotions ranging from the most gentle to the most intense.

She noted that good films focusing on women were being made and recognised. "We all see that women, at some level, struggle with patriarchy and prejudiced attitudes. Today, the award-winning films include stories of mothers shaping the moral character of their children, women uniting to challenge social norms..., the stories of courageous women who raise their voices against patriarchal structures," she said, praising such filmmakers.

Top performances: The President gives the Dada Saheb Phalke Award to Mohanlal, the best male actor award to Shah Rukh Khan for *Jawan* and Vikrant Massey for *12th Fail*; and best female actor award to Rani Mukerjee for *Mrs. Chatterjee vs Norway*. SUSHIL KUMAR VERMA

The President said there should be adequate representation of women on the central and regional panels of the jury.

Underscoring the importance of cinema in spreading awareness of, and sensitivity to, social issues, particularly among the youth, Ms. Murmu said cinema should not only be popular but also serve a larger public interest. The President commended everyone involved in the award ceremony for encouraging films that focus on children, especially girls. Six child actors won awards this year.

Notable awards

The best male actor award went to Shah Rukh Khan for *Jawan* and Vikrant Massey for *12th Fail*, which was also declared the best feature film. Rani Mukerji got the best female actor award for her role in *Mrs. Chatterjee vs Norway*. The best direction award was bagged by Sudipto Sen for *The Kerala Story* (Hindi), which also won in the best cinematography (Prasantanu Mohapatra) category. P.V.N.S. Rohit and Shilpa Rao were adjudged the best male and female singers for the song *Premisthunna* in *Baby* (Telugu), which also won for the best screenplay (Sai Rajesh Neelam) along with *Parking* (Tamil) and *Chaleya* in *Jawan* (Hindi). The best debut film award went to Ashish Bende for *Aatmapamphlet* (Marathi), and the best popular film providing wholesome entertainment to Karan Johar-directorial *Rocky Aur Rani Kii Prem Kahaani*. Meghna Gulzar's *Sam Bahadur* was the best feature film promoting national, social, and environmental values.

Sudhakar Reddy Yakanti-directed *Naal 2* (Marathi) was adjudged the best children's film and *Hanu-Man* (Telugu) the best film in the animation, visual effects, gaming and comic category.

The best male actor in a supporting role award was shared by Vijayaraghavan for *Pookkaalam* (Malayalam) and Muthupettai Somu Bhaskar for *Parking* (Tamil). Urvashi won the award for the best female actor in a supporting role for *Ullozhukku* (Malayalam) along with Janki Bodiwala for *Vash* (Gujarati).

The best child artiste award went to Sukriti Veni Bandreddi for *Gandhi Tatha Chettu* (Telugu), Kabir Khandare for *Gypsy* (Marathi), and Treesha Thosar, Shrinivas Pokale and Bhargav Jagtap for *Naal 2*.

The awards for music direction went to G.V. Prakash Kumar in *Vaathi* (Tamil) and Harshavardhan Rameshwar in *Animal* (Hindi); and for lyrics to Karsarla Shyam for the song *Ooru Palleturu* in *Balagam* (Telugu).

Deepak Kingrani won the award for the best dialogue writer for the Hindi film *Sirf Ek Bandaa Kaafi Hai*. *Rongatapu 1982* (Assamese), *Deep Fridge* (Bengali), *Parking* (Tamil), *Kandedelu* (Kannada), *Shamchi Aai* (Marathi), *Puskara* (Odia), *Godday Godday Chaa* (Punjabi), and *Bhagavanth Kesari* (Telugu) won in the language film categories.

Static Context

1. **National Film Awards:**

- Instituted in **1954**, administered by the Directorate of Film Festivals under the **Ministry of Information and Broadcasting**.
- Aim: To encourage **artistic expression, cultural preservation, and socially relevant storytelling**.
- Categories include feature films, non-feature films, and writing on cinema.

2. **Dadasaheb Phalke Award:**
   - Instituted in **1969**, India's **highest honour in cinema**.
   - Recognises lifetime contribution to Indian cinema.

Current Context (71st Awards Highlights)

- **Key Winners:**
  - Dadasaheb Phalke Award: Mohanlal.
  - Best Male Actor: Shah Rukh Khan (Jawan), Vikrant Massey (12th Fail).
  - Best Female Actor: Rani Mukerji (Mrs. Chatterjee vs Norway).
  - Best Feature Film: 12th Fail.
  - Best Direction: Sudipto Sen (The Kerala Story).
  - Best Popular Film: Rocky Aur Rani Kii Prem Kahaani.
  - Best Film Promoting National Values: Sam Bahadur.
  - Best Children's Film: Naal 2.
- **Women-Centric Recognition:**
  - Awards to films depicting **mothers shaping values, women uniting against patriarchy, and courageous female voices**.
  - Six child actors awarded, including girls, highlighting encouragement of **children's and women's roles in cinema**.
- **President's Remarks:**
  - Called for **adequate representation of women on jury panels**.
  - Urged cinema to **spread awareness on social issues** alongside entertainment.
  - Emphasised cinema's role in shaping **youth sensitivity** towards gender justice and equality.

Broader Analysis for UPSC Mains

1. **Cinema & Society:**
   - Reflects **social realities** (patriarchy, migration, inequality).
   - Can act as a **tool of social reform** (e.g., Taare Zameen Par on learning disabilities, Pink on women's consent).
2. **Women's Representation:**
   - Both on-screen (protagonists, narratives) and off-screen (jury, direction, production) still limited.
   - Representation in awards jury panels ensures **inclusive perspectives**.
3. **Soft Power & Nation-Building:**
   - Indian cinema as a **cultural ambassador** globally.
   - Awards encourage **regional films and linguistic diversity** (winners across Hindi, Tamil, Telugu, Malayalam, Assamese, Marathi, etc.).

Conclusion

The 71st National Film Awards reaffirm cinema's role as more than just entertainment—**a cultural instrument for social change, gender justice, and national unity**. President Murmu's emphasis on **women-centric films and women's representation in decision-making** reflects India's commitment to inclusive growth. Strengthening cinema's role in spreading **awareness on social issues, especially among youth**, can make it a powerful ally in India's pursuit of **equity, justice, and cultural vibrancy**.

UPSC Prelims Practice Question

Ques: Consider the following statements regarding the National Film Awards:

1. They were instituted in 1954 and are administered by the Directorate of Film Festivals under the Ministry of Information and Broadcasting.

2. The awards are presented by the President of India.

3. The Dadasaheb Phalke Award was instituted in 1969 as the highest honour in Indian cinema.

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: d)

UPSC Mains Practice Question

Ques: Examine the role of Indian cinema in promoting gender equality and social awareness. In your view, how can national recognition such as the National Film Awards strengthen this role? **(150 Words)**

Page : 07: GS 3 : Science and Tech/ Prelims

The Institute for Plasma Research (IPR), Gandhinagar, has released a roadmap for **India's first fusion electricity generator** — SST-Bharat, targeting commissioning by 2060. Fusion energy, which powers the sun, offers a **potentially limitless, clean, and low-waste energy source**, but remains technologically and economically challenging. The roadmap puts India on a long-term trajectory to integrate into global fusion research while balancing domestic energy security goals.

Daily News Analysis

IPR Gandhinagar proposes roadmap for India's fusion power plans

Controlled fusion can only happen in extreme conditions, the kind that exists inside stars; there are currently two popular ways to achieve this: inertial confinement and magnetic confinement. India is already invested in the magnetic confinement technique as a member of the ITER project, which is building a reactor in France

Unnati Ashar

Researchers at the Institute for Plasma Research (IPR) in Gandhinagar have laid out a roadmap for India to achieve fusion power.

They envisage developing India's first fusion electricity generator, called the Steady-state Superconducting Tokamak-Bharat (SST-Bharat), with a power output 5x the input. According to the team, it will be a fusion-fission hybrid reactor with 100 MW of the total 130 MW provided by fission. The estimated construction cost is ₹25,000 crore.

The team ultimately aims to commission a full-scale demonstration reactor by 2060 with an ambitious output-to-input power ratio of 20 and to generate 250 MW.

Fission to fusion

"Fusion is the process where two small, light atoms come together to form a bigger, heavier atom. When this happens, a huge amount of energy is released," Daniel Raju, Dean of academics and student affairs at IPR and lead author of the new study, said.

Nuclear fusion is the reason stars exist and produce heat and light.

For decades, fission reactors have provided the backbone for nuclear power. Fusion, however, is more attractive than fission because it produces less radioactive waste, eliminating many (but not all) of the costs and headaches of storing hazardous material.

Controlled fusion can only happen in extreme physical conditions, the kinds that exist in the belly of a star. There are currently two popular ways to achieve this: inertial confinement and magnetic confinement. Inertial confinement uses powerful lasers to blast a capsule with X-rays to initiate fusion. Magnetic confinement works by recreating some of the conditions inside stars.

India is already invested in magnetic confinement as a member of the International Thermonuclear Experimental Reactor (ITER) project, which is building a large reactor in France. In this method, scientists heat plasma to 100 million degrees C, then gently guide the nuclei with magnetic fields until they fuse. To compare, temperatures in the sun's core reach 15 million degrees C.

Maintaining the plasma

The ratio of the output power to the input, called the Q value, determines efficiency.

"We need Q to be much greater than 1, meaning the reactor gives us more energy than we use to run it. Right now, the best result has come from the Joint European Torus in the U.K., which got about 0.67, that is, 67% of the energy back," Raju said.

ITER aims to achieve a Q of 10. Future fusion power plants are expected to achieve a value of 20 to be commercially feasible.The doughnut-shaped reactor vessel in which fusion happens is called a tokamak. Its success is measured by how long it can hold the plasma together without dissipating.

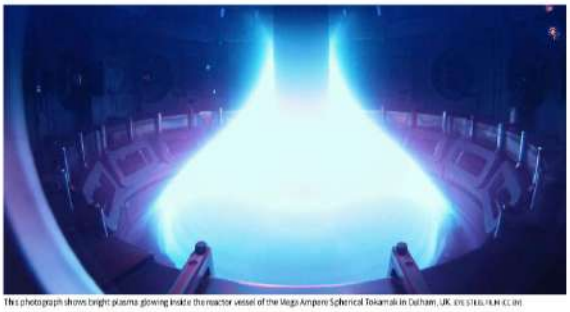
"The longer we can hold it, the closer we get to continuous and reliable fusion reactions," Raju said.

In February 2025, the WEST tokamak in France maintained plasma for a record 22 minutes. The current state-of-the-art facility in India is the SST-1 tokamak at IPR. According to Raju, "It has managed to produce plasma for about 680 milliseconds, and it is designed to go up to 16 minutes."

SST-1 is a research machine and not meant to generate electricity. SST-Bharat is presented as the next step beyond this experimental base.

Digital twinning

To strengthen the new roadmap, the researchers have proposed digital twins – virtual replicas of physical systems that mimic real-time conditions inside a tokamak. This would allow scientists to test new designs and troubleshoot before building them physically. They also suggest machine learning-assisted plasma confinement and programmes to develop radiation-resistant materials. These innovations are still at an early stage, but the roadmap argues they are critical to making progress.



This photograph shows bright plasma glowing inside the reactor vessel of the Mega Ampere Spherical Tokamak in Culham, UK. EPS STEG FILM (CC BY)

In February 2025, the WEST tokamak in France maintained plasma for a record 22 minutes

Globally, however, timelines remain uncertain. The U.K.'s STEP programme aims for a prototype fusion plant by 2040. Several U.S. private firms claim they will demonstrate grid-connected fusion as early as the 2030s. China's EAST tokamak has already set records for plasma duration. India's target of 2060 places it on a longer path – one that may be less competitive but more cautious.

Funding and policy are crucial. While the EU and U.S. are investing billions of dollars in fusion R&D and private start-ups, India's budgets remain modest and almost entirely public-sector driven. The absence of Indian private-sector engagement stands out when compared with the global boom in fusion start-ups. Within India's wider energy policy, fusion also competes with pressing commitments: net zero by 2070, major expansions in solar and wind, and a long-standing nuclear fission programme.

Rough terrain

M.V. Ramana, Simons Chair in Disarmament, Global and Human Security at the University of British Columbia, also struck a note of caution on the prospects for fusion.

"Timelines in nuclear fusion are realistic and often not achievable," Mr. Ramana emphasised.

He also pointed out that the economic viability of fusion power is unproven: "The unstated assumption is that electrical power from this process will be affordable at some future date. There is no reason to expect that to be the case."

Raju himself acknowledged the cost challenge: "The economic viability of fusion energy will certainly face a huge challenge while competing with fission and other energy sources due to costs in R&D, construction, and operations."

Even if commercial viability remains elusive, the researchers argued that fusion R&D will produce dividends in other areas, including radiation-hardened materials, superconducting magnets, plasma modelling, and high-temperature engineering. These capabilities have strategic value, potentially upgrading Indian industry and strengthening technological autonomy. Partnerships with ITER and global firms may also spark innovation and bring project management expertise into Indian labs.

"Since its [commercial viability hasn't been demonstrated so far], we are aware that it would be difficult to push it as a potential source of energy in the near future," Raju said. "Since a lot of private [entities], start-ups, and government bodies across the world are jumping into fusion energy, it makes sense for us to go with optimism and align our domestic fusion programmes with the world."

(Unnati Ashar is a freelance science journalist. unnati.a@gmail.com)

THE GIST

Fusion happens when two atoms fuse to form a bigger atom. A huge amount of energy is released as a result. Fusion reactors are more attractive than fission because they produce less radioactive waste, eliminating many costs associated with storing hazardous material

India participates in magnetic confinement research through the International Thermonuclear Experimental Reactor project in France. In this approach, scientists heat plasma to 100 million degrees Celsius and guide atomic nuclei to achieve fusion

Even if commercial viability remains elusive, researchers contend that fusion R&D will produce dividends in other areas, including radiation-hardened materials, superconducting magnets, plasma modelling, and high-temperature engineering

Static Context

1. **Nuclear Fission vs Fusion**
   - Fission: Splitting of heavy nuclei (uranium, plutonium); commercial use since 1950s.
   - Fusion: Combining light nuclei (hydrogen isotopes) into helium, releasing massive energy (basis of stars).
2. **Why Fusion is Attractive?**
   - Produces **less radioactive waste** than fission.
   - Abundant fuel (deuterium from seawater, lithium for tritium breeding).
   - Inherently safer (no runaway reaction like Chernobyl).
3. **Confinement Techniques**
   - Magnetic confinement: Tokamaks; plasma heated to ~100 million °C, contained via magnetic fields.
   - Inertial confinement: Lasers compress fuel pellet to trigger fusion.
4. **India's Current Fusion Work**

- Member of **ITER** (International Thermonuclear Experimental Reactor, France) — world's largest tokamak project, aiming for Q=10.
- Domestic machine: **SST-1 Tokamak** (IPR Gandhinagar) — research-focused, not power generation.

Current Context

- **SST-Bharat Proposal:**
  - Hybrid reactor: **100 MW from fission + 30 MW from fusion** (first stage).
  - Cost estimate: ₹25,000 crore.
  - Long-term target: **250 MW full-scale reactor by 2060** with Q=20 (commercially viable).
- **Technological Innovations Proposed:**
  - **Digital twins**: Virtual reactor models to test & troubleshoot.
  - **Machine learning**: Plasma confinement optimisation.
  - **Radiation-resistant materials**&**superconducting magnets**.
- **Global Scenario:**
  - UK STEP programme: prototype by 2040.
  - US private firms: promise grid-connected fusion by 2030s.
  - China's EAST tokamak: world record plasma durations.
  - India's timeline (2060) = more cautious, less competitive.
- **Challenges:**
  - Best experimental Q so far: **0.67 (Joint European Torus, UK)**.
  - ITER hopes for **Q=10**; commercial plants require **Q≈20**.
  - India's **funding modest**, almost entirely public-sector; little private participation.
  - Competes with **solar, wind, and fission** in India's 2070 net-zero pathway

Critical Analysis

- **Pros:**
  - Long-term strategic autonomy in advanced nuclear technologies.
  - Spin-offs: superconductors, radiation-hardened materials, AI-driven modelling.
  - Boost to India's scientific ecosystem and global standing.
- **Cons:**
  - Commercial viability uncertain; costs extremely high.
  - Long gestation (target 2060) risks irrelevance if solar + storage dominate earlier.
  - Lack of private sector involvement = innovation gap.

Conclusion

India's **fusion roadmap is aspirational and cautious**, reflecting both optimism and realism. While **commercial viability remains uncertain**, the R&D dividends — from materials science to plasma physics — could upgrade India's technological base. For now, fusion may not be a near-term energy solution, but sustained investment ensures India is not left behind in a future breakthrough. Aligning fusion R&D with **global collaborations, private investment, and national energy security goals** will be critical for its success.

Daily News Analysis

UPSC Prelims Practice Question

Ques : With reference to nuclear fusion, consider the following statements:

1. Fusion produces less radioactive waste compared to fission.

2. Magnetic confinement fusion requires plasma temperatures higher than those at the core of the Sun.

3. India is a member of the ITER project in France, which is based on inertial confinement.

Which of the above statements is/are correct?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

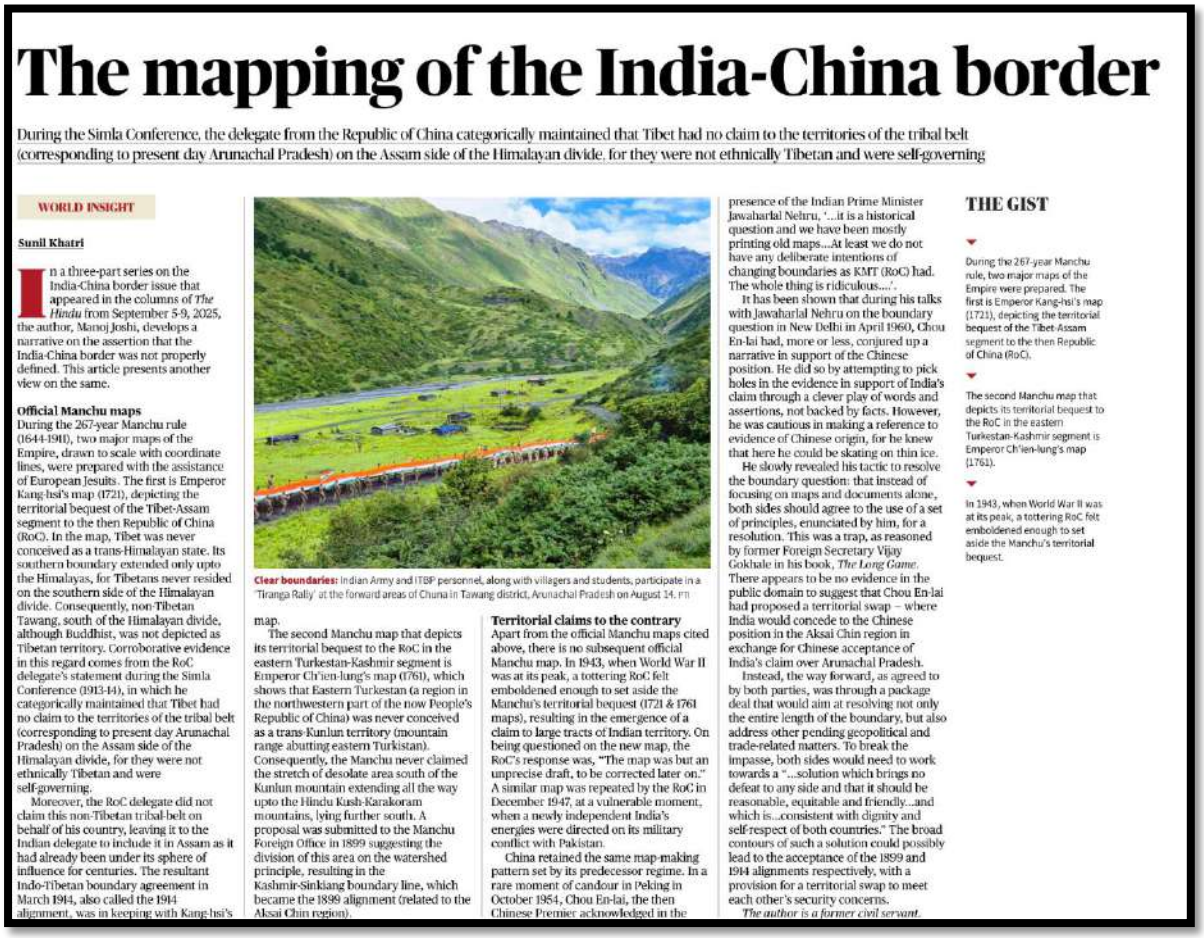
Ans: a)

UPSC Mains Practice Question

Ques: India's roadmap for nuclear fusion, including the proposed SST-Bharat project, reflects both scientific ambition and economic caution. Discuss the potential benefits, challenges, and strategic significance of India's fusion research programme in the global energy landscape.**(150 Words)**

Page 10 : GS 2: International Relations/ Prelims

The India-China border has been a subject of historical debate, with both sides asserting claims based on legacy maps, historical control, and strategic considerations. While the **1914 Simla Conference** and **Manchu-era maps** indicate clear historical boundaries, later claims by the Republic of China (RoC) and the People's Republic of China (PRC) have complicated the situation. Understanding the origins of these boundaries is critical for appreciating contemporary border disputes in Arunachal Pradesh and Aksai Chin.



The mapping of the India-China border

During the Simla Conference, the delegate from the Republic of China categorically maintained that Tibet had no claim to the territories of the tribal belt (corresponding to present day Arunachal Pradesh) on the Assam side of the Himalayan divide, for they were not ethnically Tibetan and were self-governing

WORLD INSIGHT

Sunil Khatri

In a three-part series on the India-China border issue that appeared in the columns of *The Hindu* from September 5-9, 2025, the author, Manoj Joshi, develops a narrative on the assertion that the India-China border was not properly defined. This article presents another view on the same.

Official Manchu maps

During the 267-year Manchu rule (1644-1911), two major maps of the Empire, drawn to scale with coordinate lines, were prepared with the assistance of European Jesuits. The first is Emperor Kang-hsi's map (1721), depicting the territorial bequest of the Tibet-Assam segment to the then Republic of China (RoC). In the map, Tibet was never conceived as a trans-Himalayan state. Its southern boundary extended only upto the Himalayas, for Tibetans never resided on the southern side of the Himalayan divide. Consequently, non-Tibetan Tawang, south of the Himalayan divide, although Buddhist, was not depicted as Tibetan territory. Corroborative evidence in this regard comes from the RoC delegate's statement during the Simla Conference (1913-14), in which he categorically maintained that Tibet had no claim to the territories of the tribal belt (corresponding to present day Arunachal Pradesh) on the Assam side of the Himalayan divide, for they were not ethnically Tibetan and were self-governing.

Moreover, the RoC delegate did not claim this non-Tibetan tribal-belt on behalf of his country, leaving it to the Indian delegate to include it in Assam as it had already been under its sphere of influence for centuries. The resultant Indo-Tibetan boundary agreement in March 1914, also called the 1914 alignment, was in keeping with Kang-hsi's map.

Clear boundaries: Indian Army and ITBP personnel, along with villagers and students, participate in a 'Tiranga Rally' at the forward areas of Chuna in Tawang district, Arunachal Pradesh on August 14. PTI

The second Manchu map that depicts its territorial bequest to the RoC in the eastern Turkestan-Kashmir segment is Emperor Ch'ien-lung's map (1761), which shows that Eastern Turkestan (a region in the northwestern part of the now People's Republic of China) was never conceived as a trans-Kunlun territory (mountain range abutting eastern Turkistan). Consequently, the Manchu never claimed the stretch of desolate area south of the Kunlun mountain extending all the way upto the Hindu Kush-Karakoram mountains, lying further south. A proposal was submitted to the Manchu Foreign Office in 1899 suggesting the division of this area on the watershed principle, resulting in the Kashmir-Sinkiang boundary line, which became the 1899 alignment (related to the Aksai Chin region).

Territorial claims to the contrary

Apart from the official Manchu maps cited above, there is no subsequent official Manchu map. In 1943, when World War II was at its peak, a tottering RoC felt emboldened enough to set aside the Manchu's territorial bequest (1721 & 1761 maps), resulting in the emergence of a claim to large tracts of Indian territory. On being questioned on the new map, the RoC's response was, "The map was but an unprecise draft, to be corrected later on." A similar map was repeated by the RoC in December 1947, at a vulnerable moment, when a newly independent India's energies were directed on its military conflict with Pakistan.

China retained the same map-making pattern set by its predecessor regime. In a rare moment of candour in Peking in October 1954, Chou En-lai, the then Chinese Premier acknowledged in the presence of the Indian Prime Minister Jawaharlal Nehru, '...it is a historical question and we have been mostly printing old maps....At least we do not have any deliberate intentions of changing boundaries as KMT (RoC) had. The whole thing is ridiculous....'.

It has been shown that during his talks with Jawaharlal Nehru on the boundary question in New Delhi in April 1960, Chou En-lai had, more or less, conjured up a narrative in support of the Chinese position. He did so by attempting to pick holes in the evidence in support of India's claim through a clever play of words and assertions, not backed by facts. However, he was cautious in making a reference to evidence of Chinese origin, for he knew that here he could be skating on thin ice.

He slowly revealed his tactic to resolve the boundary question: that instead of focusing on maps and documents alone, both sides should agree to the use of a set of principles, enunciated by him, for a resolution. This was a trap, as reasoned by former Foreign Secretary Vijay Gokhale in his book, *The Long Game*. There appears to be no evidence in the public domain to suggest that Chou En-lai had proposed a territorial swap – where India would concede to the Chinese position in the Aksai Chin region in exchange for Chinese acceptance of India's claim over Arunachal Pradesh.

Instead, the way forward, as agreed to by both parties, was through a package deal that would aim at resolving not only the entire length of the boundary, but also address other pending geopolitical and trade-related matters. To break the impasse, both sides would need to work towards a "...solution which brings no defeat to any side and that it should be reasonable, equitable and friendly...and which is...consistent with dignity and self-respect of both countries." The broad contours of such a solution could possibly lead to the acceptance of the 1899 and 1914 alignments respectively, with a provision for a territorial swap to meet each other's security concerns.

The author is a former civil servant.

THE GIST

During the 267-year Manchu rule, two major maps of the Empire were prepared. The first is Emperor Kang-hsi's map (1721), depicting the territorial bequest of the Tibet-Assam segment to the then Republic of China (RoC).

The second Manchu map that depicts its territorial bequest to the RoC in the eastern Turkestan-Kashmir segment is Emperor Ch'ien-lung's map (1761).

In 1943, when World War II was at its peak, a tottering RoC felt emboldened enough to set aside the Manchu's territorial bequest.

Static Context

1. **Historical Maps and Agreements:**
   - **Manchu Maps (1644–1911):**
     - **Kang-hsi (1721)**: Tibet's southern boundary up to the Himalayas; Tawang (south of the divide) not Tibetan.
     - **Ch'ien-lung (1761):** Eastern Turkestan-Kashmir segment; no claim south of the Kunlun range to Hindu Kush-Karakoram mountains.
   - **1914 Simla Conference:** RoC delegate acknowledged Tibet had **no claim over the Assam tribal belt** (present-day Arunachal Pradesh).
   - **1899 Alignment:** Proposed Kashmir-Sinkiang boundary based on watershed principle.

2. **Key Principles for Borders:**
    - Ethnic composition and self-governance of local populations.
    - Historical administrative control.
    - Watershed and topographical considerations.

Current Context

1. **Shift in Chinese Claims:**
    - Post-1943, RoC produced maps claiming **large tracts of Indian territory**, ignoring historical Manchu maps.
    - 1947: Similar maps issued amid India-Pakistan conflict.
    - PRC inherited this map tradition, occasionally admitting printing old maps without intent to alter boundaries (Chou En-lai, 1954).
2. **Diplomatic Maneuvers:**
    - Chou En-lai (1960 talks with Nehru) avoided reliance on Chinese-origin evidence, focusing instead on **principles for negotiated resolution**.
    - Emphasis on **equitable, dignified, and mutually acceptable solutions**, possibly incorporating:
        - Acceptance of 1899 (Aksai Chin) and 1914 (Arunachal Pradesh) alignments.
        - Provision for **territorial swaps** to address security concerns.
3. **Current Status:**
    - India maintains **historical claim over Arunachal Pradesh**, supported by maps and colonial-era agreements.
    - Aksai Chin is under **Chinese control**, forming part of the broader unresolved boundary issue.
    - Border disputes continue to affect **geopolitics, trade, and military deployment** in the Himalayas.

Conclusion

Historical evidence, including Manchu maps and Simla Conference proceedings, supports India's claim over Arunachal Pradesh, while the **1899 and 1914 alignments** provide a foundation for potential negotiated settlement. However, post-independence assertions by the RoC and PRC complicate the scenario. Moving forward, a **principled, equitable, and mutually respectful approach**—possibly incorporating territorial swaps and security assurances—remains the most viable path for resolving the India-China border dispute while maintaining **regional stability and bilateral relations**.

UPSC Prelims Practice Question

Ques:Which of the following statements about Manchu-era maps is correct?

1. Kang-hsi's 1721 map depicted Tibet's southern boundary up to the Himalayas.

2. Ch'ien-lung's 1761 map showed Aksai Chin south of the Kunlun mountains as part of Tibet.

3. Tawang (Arunachal Pradesh) was not considered Tibetan territory.

Options:

A) 1 and 2 only

B) 1 and 3 only

C) 2 and 3 only

D) All of the above

Ans: B)

UPSC Mains Practice Question

Ques: Discuss the historical basis and contemporary challenges of the India-China border dispute. Suggest ways forward for an equitable resolution. **(150 Words)**

Page : 08 Editorial Analysis

GS. Paper 02–International Relations

UPSC Mains Practice Question: Examine the recent Western recognition of Palestine and analyse its implications for India's foreign policy in West Asia. **(150 Words)**

Context :

Right to state

Recognition of Palestine is more than just symbolic

When the state of Israel was declared in Palestine on May 14, 1948, the U.S. recognised it in just 11 minutes. In the years since, most UN members extended recognition to the Jewish nation, which became a UN member in 1949. When the Palestine Liberation Organisation (PLO) declared a state of Palestine in 1988, much of the Global South recognised it, but powerful western nations stayed away with the position that recognition would come only as part of a negotiated two-state settlement. But this week, at the UN General Assembly, the U.K., France, Canada and Australia finally recognised Palestine, which shows their fraying ties with Israel and diminishing faith in a coercion-free diplomatic process leading to a final settlement. For Palestinians, the western recognition could be seen as a diplomatic respite but comes too late – Gaza has been devastated by Israeli forces; Jewish settlements and Israeli checkpoints have mushroomed in the West Bank; and settler violence has displaced thousands of Palestinians over the past two years. Israel's Prime Minister Benjamin Netanyahu openly declares that there will never be a Palestinian state, and Washington offers Israel unconditional support.

Recognition may not have an immediate impact on the ground. Israel's ruling coalition is incapable of even ending the slaughter in Gaza, let alone discuss a two-state solution. Yet, this wave of recognition is not just a symbolic act. It shows cracks in the post-1948 pro-Israel consensus in the West. The U.K. played a decisive role in the establishment of the state of Israel. France armed it in its early years and helped it build nuclear weapons. These powers bear historical responsibility to find a solution to the problem they were a party to from the beginning. And Palestinians have an internationally recognised right to have their own independent, sovereign state. If Israel does not stop the war in Gaza, which should be the first step, and continues with the settlements in the West Bank, Europe should impose an arms embargo on Tel Aviv. Israel should be warned against annexing the West Bank, which should be treated as a red line. Mr. Netanyahu and his extremist Ministers, though internationally isolated, will not be persuaded. But they will not rule forever. A future Israeli leader could abandon Mr. Netanyahu's militarism. This forever war and genocidal tag are not helping Israel's interests either, even though it allows Mr. Netanyahu to cling on to power. The recognition of today should serve as a stepping stone for a Palestinian state tomorrow. That is the best chance for peace for Palestinians, Israelis and West Asia.

The United Kingdom, France, Canada, and Australia recently **recognised the state of Palestine** at the UN General Assembly, marking a historic shift in Western diplomatic posture. While recognition may not immediately alter ground realities, it reflects **cracks in the post-1948 pro-Israel consensus** and underscores the **Palestinian right to self-determination**, a cornerstone of international law and the UN Charter.

Static Context

1. **Historical Background:**
   - **1948:** Israel declared; recognised swiftly by the U.S. and later by most UN members.
   - **1988:** Palestine Liberation Organisation (PLO) declared the State of Palestine; recognised by many Global South nations.
   - **Western Stance:** Recognition withheld, arguing that a Palestinian state should emerge via a **negotiated two-state solution**.
2. **International Law Basis:**
   - **Right to self-determination:** Enshrined in **UN Charter** (Article 1 & 55) and **ICCPR/ICESCR**.
   - Recognition is a political act but provides **legal and diplomatic legitimacy**.

Current Context

1. **Western Recognition:**
   - UK, France, Canada, Australia acknowledged Palestine, signalling:
     - Erosion of **unconditional pro-Israel consensus**.
     - Growing frustration with **stalemated peace negotiations**.
     - Indirect criticism of **Israeli policies in Gaza and West Bank settlements**.
2. **Ground Realities:**

- Gaza remains devastated by conflict.
- Israeli settlements and checkpoints expand in the West Bank.
- UN-recognised statehood does not translate immediately into sovereignty or territory control.

3. **Diplomatic Implications:**
   - Potential for **arms embargoes** or sanctions if Israel violates West Bank red lines.
   - Recognition strengthens **Palestinian claims in multilateral forums**.
   - May pressure future Israeli leadership to reconsider militaristic policies.

Critical Analysis

- **Pros:**
  - Provides **diplomatic legitimacy** to Palestine.
  - Signals weakening of **absolute Western support for Israel**, opening avenues for negotiation.
  - Historical responsibility of Western powers is acknowledged.
- **Cons / Limitations:**
  - No immediate relief on the ground in Gaza or West Bank.
  - Israeli political leadership (Netanyahu) unlikely to respond positively.
  - Recognition is **symbolic unless backed by enforceable measures** (arms embargo, sanctions).

Conclusion

Recognition of Palestine by major Western powers is more than symbolic—it is a **step toward international legitimisation** and a potential foundation for a **future two-state solution**. While immediate impact may be limited due to entrenched conflict, historical accountability, international law, and global diplomatic pressure provide avenues for **peaceful resolution**, benefiting Palestinians, Israelis, and the broader West Asian region.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