06-07th January 2026: DSC

What does the SHANTI Bill change?

Why is it in News?

Parliament has enacted the **Sustainable Harnessing and Advancement of Nuclear Energy in India (SHANTI) Bill**.
The legislation dismantles the long-standing exclusive State control over nuclear power generation that has existed since 1956, by permitting private and foreign participation in the sector.

Opposition parties pressed for the Bill to be referred to a Select Committee, raising concerns related to:

- dilution of liability provisions
- potential safety and transparency compromises
- weakening of RTI applicability and labour protections

The Union government has defended the law as a critical reform to secure energy security, ensure reliable baseload electricity, support clean-energy transitions, and accelerate nuclear capacity expansion.

Relevance

GS-2 | Polity & Governance

- Public-sector restructuring and regulatory accountability
- Parliamentary oversight, transparency, RTI applicability, labour safeguards
- Recalibration of State versus market roles in strategic sectors

GS-3 | Economy / Infrastructure / Energy

- Nuclear power policy and investment frameworks
- Public–Private Partnerships in strategic infrastructure
- Energy security, baseload reliability, Net-Zero commitments
- Technology collaboration and FDI policy constraints

The Basics — Nuclear Governance Before SHANTI

Before the enactment of SHANTI, India's nuclear sector was governed by:

- the **Atomic Energy Act, 1962**
- the **Civil Liability for Nuclear Damage (CLND) Act, 2010**

Operational control over nuclear power rested entirely with **NPCIL (Nuclear Power Corporation of India Limited)**.

Private and foreign participation remained limited because of:

- stringent supplier-liability provisions
- high legal and financial exposure risks

The outcome was persistent capital constraints, slow capacity augmentation, and stalled international nuclear partnerships.

What the SHANTI Bill Does? — Core Provisions

The Bill permits private Indian entities to obtain licences to **own, construct, and operate nuclear power plants**.
It also allows **foreign supplier involvement indirectly**, primarily through joint ventures and nuclear supply chains.

The Union government retains **51% control** over sensitive and strategic domains, including:

- nuclear fuel cycle operations and reprocessing
- heavy-water production and enrichment
- management of radioactive waste and spent fuel
- radiation safety, emergency preparedness systems
- overarching regulatory supervision

NPCIL's monopoly is formally dismantled, introducing a **PPP-style nuclear model**.

Private-sector participation is enabled in:

- equipment manufacturing and fuel fabrication
- reactor construction and operational management
- research and development of advanced nuclear technologies

The framework supports deployment of:

- **Small Modular Reactors (SMRs)**
- **Advanced Pressurised Water Reactors**
- **Indigenous reactor designs**

Policy linkage: a **₹20,000 crore allocation** has been announced for SMRs and advanced reactors under the **Nuclear Energy Mission**.

Regulatory Architecture — Role of AERB

The **Atomic Energy Regulatory Board (AERB)** has been granted statutory status.
It is now accountable to **Parliament**, rather than functioning solely under executive authority.

Its mandate covers:

- nuclear and radiation safety

- licensing and inspections
- emergency preparedness
- industrial and quality-safety compliance, including linkages with the Factories Act

Critics have flagged concerns over excessive concentration of regulatory power within a single body, renewing demands for an **independent nuclear safety commission**.

What Has Changed on Liability?

Earlier Regime (CLND Act, 2010)

Operators could seek recourse from suppliers for:

- defective equipment
- design-related flaws
- wilful acts

This supplier liability framework significantly discouraged foreign participation.

Under SHANTI — Predictable, Capped Liability

Plant Type	Capacity	Operator Liability Cap
Large plants	~3600 MW	₹3,000 crore
Medium plants	1500–3600 MW	₹1,500 crore
SMRs	~150 MW	₹100 crore
Penalty for violations	—	₹1 crore (cap)

Any compensation beyond the liability cap will be borne by the **Union Government**, supported by a newly created **Nuclear Liability Fund**.

Supplier liability has been removed entirely.

Government rationale:
Predictable liability ceilings reduce investment risk and facilitate technology inflows.

Opposition view:
The reform transfers risk to the State and society, weakening the **polluter-pays principle**.

Comparative data point:
Estimated damages from the Fukushima disaster were nearly **700 times higher** than SHANTI's proposed liability cap — highlighting concerns of catastrophic-risk underestimation.

Safeguards Retained

- No automatic FDI approval; investment routes remain case-specific and regulated

- Mandatory AERB authorisation for:
    - possession, production, and disposal of nuclear materials
    - establishment and operation of nuclear facilities

The government continues to retain control over:

- fuel reprocessing and enrichment
- heavy-water production
- high-level radioactive waste management

A **Nuclear Liability Fund** has been instituted to ensure accident compensation.

Transparency, Labour & Safety — Contested Clauses

Concerns Raised

- **Section 39** overrides RTI Act review and appeal mechanisms, limiting public access to safety and operational information
- **Section 42** exempts nuclear workers from general labour safety laws, described by unions as "draconian"

The Bill lacks statutory mandates for:

- public hearings
- Environmental Impact Assessment disclosures
- community consent mechanisms
- periodic safety reporting or parliamentary review

Government's Position — Rationale & Benefits

The government argues the law will:

- strengthen energy security and baseload capacity
- reduce reliance on coal and fossil-fuel imports
- diversify nuclear partnerships beyond single-country dependence
- support **Net-Zero 2070** commitments
- revive stalled agreements with the U.S., France, and Japan
- attract investment and technological diversity

Why Nuclear Energy Matters for India?

Given renewable intermittency and high storage costs, India remains heavily coal-dependent.
Nuclear energy offers:

- uninterrupted 24×7 baseload power
- very low lifecycle carbon emissions
- long-term cost predictability

Current nuclear profile:

- 25 reactors across 7 plants
- 21 PHWRs and 4 LWRs
- Installed capacity ≈ 7 GW (about 3% of electricity mix)

India's long-term strategy centres on the **thorium fuel cycle** and **fast breeder reactors**.

Opposition's Key Criticisms

- Accountability diluted; profits privatised while risks socialised
- Liability caps deemed insufficient; suppliers fully insulated
- RTI dilution weakens democratic oversight
- Labour protections eroded
- Preference for vendor-driven solutions over indigenous thorium pathways
- Absence of safety-democracy tools such as consultations and transparent EIAs

Global comparator:
France retains nuclear power under complete State control.

The Bill has been labelled:
pro-corporate, **pro-oligarch**, and potentially hazardous to public safety and the environment.

Strategic & Governance Implications

The SHANTI Bill signals a paradigm shift from **State monopoly to regulated PPP governance**.
It may accelerate capacity creation, financing, and international technology partnerships.

However, it raises foundational questions:

- Are the liability caps socially optimal?
- Is nuclear safety regulation sufficiently independent?
- Can transparency coexist with national-security constraints?

Takeaways

The SHANTI Bill represents nuclear-sector liberalisation through:

- capped operator liability
- elimination of supplier liability
- PPP-led expansion under continued State oversight

The central trade-off remains:
energy security and clean baseload power versus liability adequacy, transparency, labour rights, and safety accountability.

What remote-sensing reveals about plants, forests, and minerals from space

Why is it in News?

Remote-sensing technologies — including satellites, drones, hyperspectral sensors, SAR radars, and gravity-mapping missions — are increasingly employed for:

- mineral, groundwater, and hydrocarbon mapping
- forest health assessment and biomass estimation
- flood analysis and water monitoring
- climate-change research and environmental protection

Their relevance is rising due to India's focus on climate resilience, water security, precision agriculture, and mineral exploration, alongside the expansion of **ISRO-led Earth Observation missions**, **NISAR**, **Bhuwan**, and **NRSC programmes**.

Remote-sensing has evolved from visual surface mapping to detecting subsurface and underwater features using physics-based signals.

07th January 2026: Daily MCQs

Q1. With reference to the SHANTI Bill, consider the following statements:

1. The Bill completely removes the Union Government from nuclear power generation activities.
2. Supplier liability for nuclear accidents has been entirely eliminated under the new framework.
3. Operator liability beyond a specified cap will be borne by a dedicated government-backed fund.
4. Atomic Energy Regulatory Board (AERB) is now directly accountable to Parliament.

Which of the statements given above are correct?

(a) 2, 3 and 4 only
(b) 1, 2 and 3 only
(c) 2 and 4 only
(d) 1, 3 and 4 only

Answer: (a)

Explanation:

- Statement 1 ✗: Government retains 51% control over strategic functions.
- Statement 2 ✓: Supplier liability is fully removed.
- Statement 3 ✓: Beyond the cap, compensation is paid by the State-backed Nuclear Liability Fund.
- Statement 4 ✓: AERB is given statutory status and parliamentary accountability.

Q2. Consider the following pairs regarding remote-sensing indices:

Index	Primary Application
1. NDVI	Crop health and biomass
2. NDWI	Flood and surface water mapping
3. MNDWI	Mineral exploration
4. SAR imagery	Cloud-independent flood detection

Which of the pairs given above are correctly matched?

(a) 1, 2 and 4 only
(b) 1 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

Answer: (a)

Explanation:

- NDVI → vegetation health ✓
- NDWI → water mapping ✓
- MNDWI improves water detection in urban areas, **not minerals** ✗
- SAR penetrates clouds and darkness → flood mapping ✓

Q3. With reference to satellite-based mineral and hydrocarbon exploration, consider the following statements:

1. Hyperspectral sensors identify minerals by analysing narrow-band spectral signatures.
2. Satellites can directly confirm the presence of oil reserves beneath the Earth's surface.
3. Gravity anomalies over oceans can indicate subsurface geological structures.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2 and 3

Answer: (b)

Explanation:

- Statement 1 ✅: Core principle of hyperspectral remote sensing.
- Statement 2 ❌: Satellites indicate *structures*, not direct oil presence.
- Statement 3 ✅: Gravity mapping reveals subsurface mass variations.

Q4. Consider the following statements regarding social-media monitoring by State police:

1. Social-media monitoring cells evolved primarily from cyber-crime police stations.
2. The growth of monitoring cells has coincided with a reduction in police manpower shortages.
3. These cells are used for both law-and-order intelligence and cyber-crime detection.

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

Answer: (c)

Explanation:

- Statement 1 ✅: They evolved from cyber-crime units.
- Statement 2 ❌: Expansion happened **despite massive vacancies**.
- Statement 3 ✅: Used for misinformation, riots, cyber-fraud, hate speech.

Q5. With reference to privacy and policing, which of the following principles is most directly implicated by large-scale social-media monitoring without clear statutory backing?

(a) Doctrine of Pleasure
(b) Proportionality
(c) Basic Structure
(d) Federal Supremacy

Answer: (b)

Explanation:
UPSC repeatedly links surveillance with **Article 21** and the **doctrine of proportionality** (necessity, suitability, minimal intrusion).

Q6. With reference to Popocatépetl volcano, consider the following statements:

1. It is located in the Pacific Ring of Fire.
2. It is classified as a stratovolcano.
3. The latest study reveals a single, unified magma chamber beneath the crater.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 only
(c) 1, 2 and 3
(d) 2 and 3 only

Answer: (a)

Explanation:

- Statement 1 ✅: Part of the Trans-Mexican Volcanic Belt (Ring of Fire).
- Statement 2 ✅: Classic stratovolcano.
- Statement 3 ❌: Imaging shows **multiple magma reservoirs**, not one.

Q7. The primary advantage of repeated 3-D subsurface imaging of active volcanoes lies in:

(a) predicting earthquake magnitudes
(b) mapping lava mineral composition
(c) tracking magma migration over time
(d) preventing volcanic eruptions entirely

Answer: (c)

Explanation:
Repeated imaging allows **change detection**, tracking magma movement before eruptions.

Q8. Consider the following countries and their unique geographic characteristics:

1. Colombia — coastlines on both Pacific Ocean and Caribbean Sea
2. Mexico — located entirely within the Tropic of Cancer
3. Greenland — autonomous territory with Arctic strategic relevance
4. Cuba — part of the Greater Antilles

Which of the statements given above are correct?

(a) 1, 3 and 4 only
(b) 1 and 2 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

Answer: (a)

Explanation:

- Colombia ✅ dual coastlines
- Mexico ❌ extends beyond the Tropic of Cancer
- Greenland ✅ Arctic strategic hub
- Cuba ✅ Greater Antilles

Q9. Which of the following best explains why Synthetic Aperture Radar (SAR) is preferred during floods and cyclones?

(a) It detects reflected visible light with higher resolution
(b) It uses gravity anomalies to map water depth
(c) It can operate independent of sunlight and cloud cover
(d) It measures water temperature variations

Answer: (c)

Explanation:
SAR is an **active microwave sensor** that works through clouds and at night.

Q10. In the context of the SHANTI Bill, which one of the following represents the most significant shift from earlier nuclear governance?

(a) Introduction of thorium-based reactors
(b) Parliamentary approval for nuclear projects
(c) Transition from State monopoly to regulated PPP model
(d) Replacement of nuclear power with renewables

Answer: (c)

Explanation:
The core structural reform is the **end of NPCIL monopoly** and the move to a **PPP-driven nuclear sector** under regulation.

Mains: Highlight the geographical significance of Colombia, Mexico, Cuba, and Greenland in contemporary geopolitics. *(10 marks)*