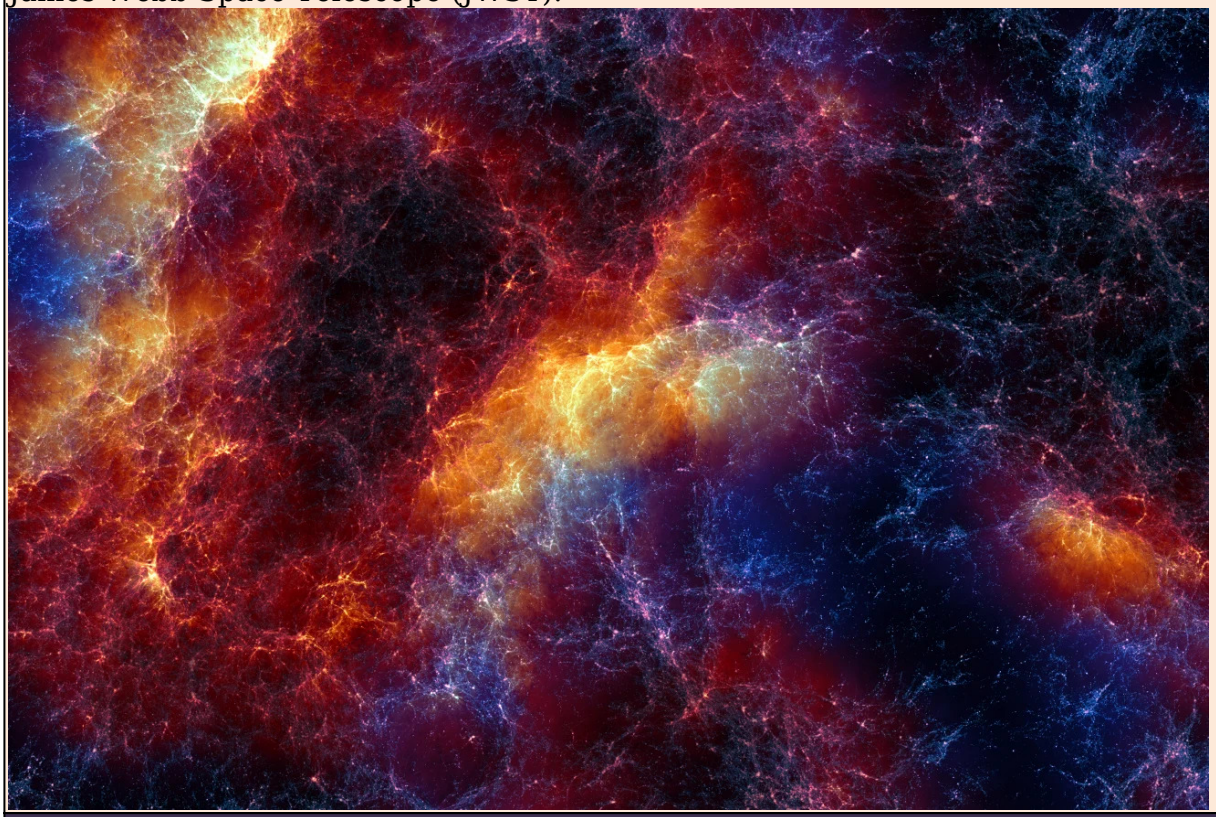
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Geography

Lumina Simulation – Early Universe Evolution

• Recently, International researchers developed Lumina, one of the largest and most detailed cosmological simulations, to study the first 2 billion years of the universe.
• **Published in –** Monthly Notices of the Royal Astronomical Society.
• **Objective –** To understand the formation of the 1st stars, galaxies and black holes and their role in cosmic evolution.
• **Key Features**
  - Covers a region approximately 1.5 billion light-years across in each direction.
  - Covers over 100 times more space than earlier comparable simulations.
  - Models the evolution of hydrogen and helium in the early universe.
  - Enables simultaneous study of large-scale cosmic structures and individual galaxies.
• **Computational Infrastructure**
  - Used over 15,000 GPUs.
  - Run on the Frontier supercomputer, Oak Ridge National Laboratory, USA.
  - Took nearly 3 years to complete.
• **Reionization –** Early stars and black holes emitted ultraviolet radiation, ionising neutral hydrogen by removing electrons and enabling light to travel more freely.
• **Significance –** It helps to understand galaxy formation, dark matter, ordinary matter and the evolution of the early universe; findings can be compared with observations from the James Webb Space Telescope (JWST).



International Relations and Issues

Bahamas Joins International Solar Alliance (ISA)

• Recently, Bahamas became the 116th member of the International Solar Alliance (ISA).
• **Accession –** Bahamas handed over the Instrument of Accession to the ISA Framework Agreement during the *9th ISA Assembly in New Delhi.*

Commonwealth of the Bahamas



• **Geographical Features**
  - Consists of approximately 700 islands and cays.
  - Located southeast of Florida (USA) and north of Cuba.
  - Does not share a land boundary with any country.

International Solar Alliance (ISA)

• It is a joint initiative of India and France, launched at COP21 (Paris, 2015).
• **Headquarters –** Gurugram, Haryana, India.
• **Aim –** To promote solar energy deployment, particularly in solar-rich countries.
• **Focus –** Energy access, energy security and clean energy transition.

Economy

NDC Transport Initiative for Asia – Phase II (NDC-TIA II)

• Recently, *NITI Aayog and GIZ India* signed an Implementation Agreement to accelerate road freight decarbonisation in India.
• It is a regional initiative supported by Germany's International Climate Initiative (IKI) *to decarbonise road freight transport and commercial vehicles.*
• **Countries covered** – China, India and Vietnam.
• **Implementing organisation –** Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.
• **Political Partners**
  - India – NITI Aayog.
  - China – Ministry of Ecology and Environment.
  - Vietnam – Ministry of Construction.
• **Implementing Partners**
  - World Resources Institute (WRI),
  - International Council on Clean Transportation (ICCT),
  - Agora Transport Transformation,
  - SLOCAT and REN21.
• **Funding –** €4.9 million under Germany's IKI.
• **Duration –** November 2024 - September 2028.
• **Major Objectives**
  - Promote electrification of medium- and heavy-duty freight vehicles.
  - Develop charging infrastructure, innovative financing and enabling regulatory frameworks.
  - Promote renewable energy use in transport.
  - Facilitate cooperation among governments, civil society and private sector.
• **Significance –** It supports India's Nationally Determined Contribution (NDC) targets and transition towards low-carbon, energy-efficient transport.

Agriculture

Pioxaniliprole – India's First Indigenously Discovered Insecticide

• Recently, PI Industries Ltd's **Pioxaniliprole**, India's first indigenously discovered insecticide molecule, received CIB&RC approval for use on rice, chilli, tomato and chickpea (chana).
• **Trade Name –** Pioxazon (planned launch in the Rabi season).
• **Chemical Class –** Anthranilic diamide; registered as a 20% w/v Suspension Concentrate (SC).
• **Mechanism of Action**
  - Targets *Ryanodine Receptors (RyRs)* in insect muscle cells.
  - Causes uncontrolled release of calcium ions.
  - Leads to feeding cessation, muscle paralysis and eventually death.
• **Target Pests –** Yellow stem borer, leaf folder, fall armyworm, tobacco cutworm, fruit borer and pod borer.

Insecticide Regulation in India

• **Insecticides Act, 1968 –** It regulates import, manufacture, sale, transport, distribution and use of insecticides to protect humans and animals.
• **Insecticides Rules, 1971 –** It prescribe packaging, labelling, storage, transport, licensing, safety standards and residue limits.

Central Insecticides Board and Registration Committee (CIB&RC)

• **Headquarters –** Faridabad, Haryana.
• **Functions under –** Department of Agriculture and Farmers Welfare, Ministry of Agriculture.
• **Central Insecticides Board (CIB) –** It advises Central and State Governments on technical matters, toxicity, safety and residue limits.
• **Registration Committee (RC)** – It registers insecticides after examining their composition, efficacy and safety.
• **Directorate of Plant Protection, Quarantine & Storage (DPPQ&S) –** It coordinates Integrated Pest Management (IPM), plant quarantine, pesticide regulation and locust control.
• **Significance –** It promotes indigenous agrochemical innovation, agricultural productivity and reduced dependence on foreign-developed crop-protection technologies.

Environment

India's Space Debris Removal Initiative – Vision 2030

Recently, Union Minister announced India's vision of achieving debris-free space by 2030 during the inauguration of Cosmoserve Space's Base 1 facility in Hyderabad.

• **Cosmoserve Space –** Indian space startup working on Active Debris Removal (ADR) and in-orbit satellite servicing.

Base 1 Facility

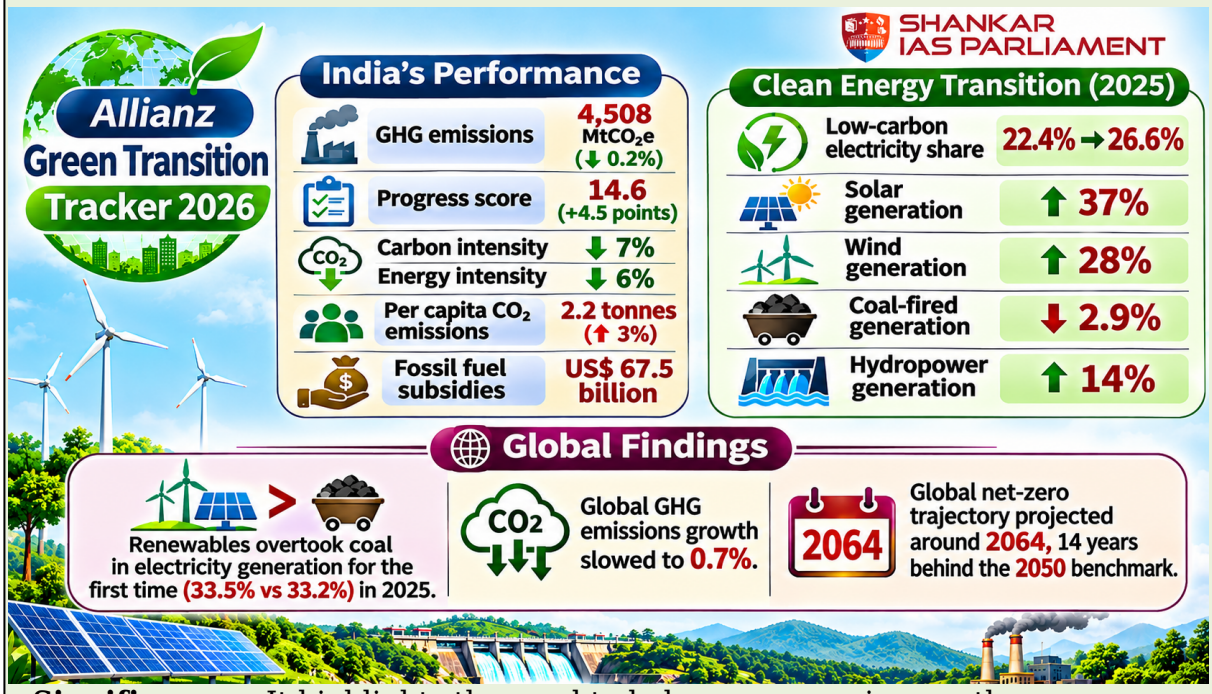
• **Location –** VSD Tech Park, Gachibowli, Hyderabad.
• **Area –** Approximately 14,800 sq. ft.
• **Facilities** – Space robotics labs, orbital rendezvous and capture labs, microgravity simulation platforms and satellite integration clean rooms.
• **Mission EMBRACE –** Tested soft robotic petals in space in July 2026.
• **Collaborations –** Pixxel (satellite systems), Dhruv Aerospace Netherlands (propulsion) and Skyroot Aerospace (launch services).

India's Space Economy

• **Current value –** Nearly US$9 billion.
• **Target –** US$40–45 billion in the coming decade.
• **Space startups –** Increased from single digits to nearly 450.
• **Key Institutions –** ISRO, IN-SPACe and NewSpace India Limited (NSIL).
• **Significance –** It promotes space sustainability, technological self-reliance and India's global leadership in space technology.

Allianz Green Transition Tracker 2026

• Recently, India climbed 5 places to 45th rank in the Allianz Green Transition Tracker 2026, despite a 0.2% decline in GHG emissions in 2025 alongside 7.6% economic growth.
• **Report Coverage –** Assessed 65 economies accounting for 81% of global GHG emissions; released on 5 November 2026 ahead of COP31.



• **Significance –** It highlights the need to balance economic growth, energy security and climate commitments through renewable energy expansion and reduced fossil fuel dependence.

Security

Next Generation Offshore Patrol Vessel (NGOPV) – Srishti

• Recently, *Yard 1283, named Srishti, a Next Generation Offshore Patrol Vessel (NGOPV)*, was launched on 27 October 2026.
• **Etymology –** Srishti means 'Creation' in Sanskrit.
• **Shipyard –** Goa Shipyard Limited (GSL), Goa.
• **Construction** – NGOPVs are being built at two shipyards:
  - Goa Shipyard Limited (GSL) – Goa.
  - Garden Reach Shipbuilders & Engineers (GRSE) – Kolkata.
• **Major Roles**
  - Maritime surveillance and search & rescue (SAR).
  - Protection of offshore assets.
  - Humanitarian Assistance and Disaster Relief (HADR).
  - Anti-piracy and multidomain operations.
• **Significance** – Indigenous shipbuilding initiative supporting Aatmanirbhar Bharat and Make in India.

Science

IndiaAI Mission: Indigenous Foundation Models

• Recently, IndiaAI Mission released indigenous AI foundation models under the IndiaAI Innovation Centre (Foundation Models) pillar.
• **Developers –** EKA-1 – Soket Labs; Dhīr 2B & Dhīr 5B – ZenteiQ AiTech Innovations.

EKA-1

• 26.3 billion parameters; trained on approximately 7.5 trillion tokens.
• Supports all 22 Scheduled Indian Languages + English.
• Open, sparse hybrid language model for mathematics, coding, reasoning and agentic applications.

Dhīr 2B & Dhīr 5B

• Open-source multilingual AI models supporting English + 10 Indian languages.
• Enable secure, on-premise, offline-capable deployment, including on mobile devices.
• **Applications –** Defence, governance, industry and education.
• **Significance –** It strengthens India's AI self-reliance, data privacy, technological sovereignty and indigenous innovation.

IndiaAI Mission

• **Approved by –** Union Cabinet on 7 March 2024.
• **Ministry –** MeitY.
• **Guided by –** The vision of "Making AI in India and Making AI Work for India
• **7 pillars –** Compute Capacity, Innovation Centre, AIKosh (Datasets Platform), Application Development, FutureSkills, Startup Financing and Safe & Trusted AI.

ESA's Hera Mission – Dimorphos Asteroid

• Recently, ESA's Hera spacecraft captured its first image clearly distinguishing Dimorphos from its parent asteroid Didymos (18 October).
• **Mission –** Hera is a planetary defence mission of the European Space Agency (ESA), launched in October 2024 aboard SpaceX Falcon 9.
• **Target –** Didymos–Dimorphos binary asteroid system.

DART Mission (NASA)

• 1st demonstration of asteroid deflection through human intervention.
• **DART –** Double Asteroid Redirection Test (September 2022).
• Deliberately impacted Dimorphos and successfully changed its orbital period.
• **Hera's Objectives**
  - Assess the impact crater and damage caused by DART.
  - Study the physical properties of both asteroids.
  - Improve understanding of asteroid deflection for planetary defence.
• **Key Features –** It carries 12 scientific payloads and two CubeSats for close-up observations and potential landing on Dimorphos.
• **Significance –** It advances global planetary defence against potentially hazardous asteroids.

Species

Begonia siangensis – New Wild Flower Species



• **Discovered in –** Siang Valley of Arunachal Pradesh.
• **Discoverer –** Researchers from Thackeray Wildlife Foundation, Mumbai (discovery made in 2024).
• **Location –** Upper Siang District, between Bomdo and Jengging, along the Siang River basin.
• **Altitude –** Approximately 600 metres above sea level.
• **Key Features**
  - Pale-pink flowers and creeping stems.
  - Dark-green, non-variegated leaves with blister-like bumps underneath.
  - Belongs to the genus Begonia, section Platycentrum.
  - Closely resembles Begonia iridescens.
• **Nomenclature –** Named after the Siang River Valley, Arunachal Pradesh.
• **IUCN Status** – Provisionally classified as Data Deficient (DD) due to insufficient information on its population and distribution.
• **Significance –** It highlights the rich, unexplored floral biodiversity of the Eastern Himalayas, a global biodiversity hotspot.

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