4. Environment & Ai- Science & Technology

India must focus on AI and its environmental impact The rapid adoption of Artificial Intelligence is driving economic growth but generating significant environmental costs through high energy consumption, water usage, and e-waste. To mitigate this, India has launched the "Planet Sutra" framework and "Green Compute" initiatives (like BharatGen) to promote energy-efficient, sustainable AI infrastructure and transparency.

1. Understanding Artificial Intelligence (AI)

Definition- A branch of Computer Science focused on creating systems capable of-

a. Reasoning- Using rules to reach conclusions.
b. Learning- Acquiring information and rules for using it.
c. Self-Correction**-** Improving performance over time.

Objectives

1. Drive economic growth, productivity, and national security.
2. Establish geopolitical power, economic competitiveness, and strategic autonomy.

Key Application Domains- Governance, healthcare, agriculture, defense, manufacturing, education, finance, climate action, and digital public infrastructure.

2. AI Market Dimensions

Global Market

Current Valuation- Estimated at ~USD 400–450 billion (2026).
Projection- Expected to cross USD 2–2.5 trillion by the early 2030s.
Growth Rate- High double-digit growth (≈26–30% CAGR).
Infrastructure Spend- Capital expenditure on data centers, chips, and cloud infrastructure expected to exceed USD 2 trillion by 2026.

Indian Market

Projection- Expected to reach ~USD 15–20 billion by 2027.
Growth Rate- Among the fastest globally, with an estimated 25–35% CAGR.

Talent Advantage

a. India holds ~16% of the global AI talent pool (ranking 2nd worldwide).
b. Workforce demand expected to approach 1 million professionals by end-2026.

3. AI's Role in Environmental Sustainability

AI technologies offer significant benefits for environmental governance and resource management.

Sector	Application & Benefits	Real-World Examples
Pollution Governance	Improves monitoring, compliance, and public access to data.	GreenMind AI (Maharashtra)- Assists regulators/citizens with compliance.
Sustainable Agriculture	Precision farming, disease detection, and optimized resource use (less water/chemicals).	IIIT Allahabad System- Real-time crop disease detection to reduce chemical inputs.
Smart Urban Management	Optimizes traffic flow and air quality monitoring to reduce stress.	Project Green Light (Google)- Optimizes traffic lights to reduce idling and emissions.
Waste Management	Image recognition for sorting materials, enhancing recycling and energy recovery.	Sorting facilities using AI for material identification.
Biodiversity Conservation	Real-time monitoring of deforestation, poaching, and ecosystem changes.	Kerala Forest Dept- India's first AI-enabled wildlife monitoring system.

Energy & Climate	Enhances smart grids, EV charging, building energy optimization, and disaster forecasting.	Weather prediction models and early warning systems.

4. Environmental Costs of AI

Despite its benefits, the rapid adoption of AI carries a heavy environmental price tag.

A. Energy Consumption

High Demand- Development of algorithms is energy-intensive (OECD).

Training Costs- Training large models (e.g., GPT-3) consume 256,000 kWh, equivalent to powering a home for over 20 years.

Inference Costs- The rise of Agentic AI (autonomous agents) has increased inference energy consumption by 300% in two years.

B. Carbon Footprint

ICT Contribution- The global ICT industry accounts for 1.8%–3.9% of global GHG emissions.

LLM Emissions- Training a single Large Language Model (LLM) can generate ~300,000 kg of CO_2, equivalent to the lifetime emissions of five cars.

Fossil Fuel Dependency- Operational footprints remain high if data centers are powered by fossil fuels.

C. Resource Depletion

Water Usage- AI data centers may consume 4.2–6.6 billion cubic meters of water by 2027 for cooling (UNEP).

Raw Materials- Hardware requires rare earth metals, lithium, cobalt, copper, and gold.

Mining Impact- Extraction leads to habitat destruction, water pollution, and high energy use.

D. E-Waste Generation

Obsolescence- Rapid innovation leads to frequent hardware replacement.

Volume- E-waste could reach 1.2–5.0 million metric tons by 2030 (approx. 1,000 times the 2023 levels).

5. Global Initiatives for Sustainable AI

UNESCO Recommendation (2021)- Adopted by ~190 countries; emphasizes mitigating environmental risks of AI.

Paris Action Summit Legacy (2025)- Officially incorporated AI Sustainability as a third pillar alongside Safety and Security.

G7 AI Hub for Sustainable Development (2025)- Endorsed by G7 and UNDP; integrates renewable energy with AI data centers in the Global South.

USA (Artificial Intelligence Environmental Impacts Act 2024)- Mandates transparency on carbon footprints and encourages sustainability standards.

European Union (Resolution on Harmonized AI Rules)- Integrates environmental impact assessments, promotes green AI, and standardizes metrics for energy/water.

6. India's Initiatives for Sustainable AI

Planet Sutra Framework (2026)

1. Introduced at the IndiaAI Impact Summit.
2. Positions India as a Global South leader.
3. Focuses on Mandatory Transparency, Sovereign Green Compute, and environmental accountability.

Green Compute Pillar (IndiaAI Mission)

Funding- A major portion of the ₹10,372 crore allocation goes to Green Data Centers.

Mandates

a. Use of Renewable Energy Certificates (RECs).
b. Power Usage Effectiveness (PUE) below 1.2.

BharatGen Model (2025)

Innovation- India's foundational AI model using Frugal Training.

Efficiency- Achieves high performance for Indic languages using 40% less compute power than global peers.

7. Challenges in Mitigation

Measurement Standards- Lack of a universal framework for AI carbon accounting leads to inconsistent data.
Scope 3 Blind Spots- Emissions from supply chains (GPU manufacturing, mining) are often unreported, unlike direct energy use (Scope 1 & 2).
Rebound Effect (Jevons Paradox)- Efficiency gains lower costs, driving up usage and net energy demand.
Discursive Bias- Public discourse focuses on AI as a solution, often neglecting its environmental costs.
Policy Gaps- Current guidelines (e.g., MeitY 2025) lack enforceable mandates like lifecycle reporting or efficiency targets.
Social Equity- Environmental burdens (e.g., water stress) disproportionately affect vulnerable communities in the Global South.

8. Way Forward

Green Data Centers- Enforce PUE < 1.2 and 100% renewable energy usage to set global benchmarks.
Small Language Models (SLMs)- Prioritize models like Yukti and Varta that run on edge devices, reducing data center reliance.
Circular Hardware Economy- Implement Hardware Passporting and strengthen E-Waste rules to recover minerals like Cobalt and Lithium.
Green-fication- Use AI to support the National Green Hydrogen Mission and Smart Grids to offset its own footprint.

a. Standardization- Develop sustainability metrics for GHG, energy, and water consumption.
b. Mandatory EIA- Extend the EIA Notification, 2006 to include high-compute AI projects.
c. Zoning**-** Restrict data centers in water-stressed regions; promote coastal/renewable-rich zones.

Conclusion

India's strategy balances technological growth with ecological protection, aligning with constitutional mandates under Article 48A (protection of environment) and Article 51A(g) (compassion for living creatures).
Source- https-//www.thehindu.com/opinion/op-ed/india-must-focus-on-ai-and-its-environmental-impact/article70506214.ece