DAILY CURRENT AFFAIRS ANALYSIS

07 MAY 2024

1 – About the Energy Efficiency Bureau:

GS III

Environment related issues

- **The State Energy Efficiency Index (SEEI) 2023 is what?**

- This is the index's fifth edition, which was created in collaboration with the Alliance for an Energy-Efficient Economy (AEEE) and the Bureau of Energy Efficiency (BEE), a statutory organisation under the Ministry of Power.
- Using 65 indicators—qualitative, quantitative, and outcome-based measurements—it assesses the performance of 36 states and UTs in seven demand areas.
- The SEEI 2023 assigns total scores to states and UTs, which determine their classification as 'Front runner' (>=60), 'Achiever' (50-59.75), 'Contender' (30-49.75), and 'Aspirant' (<30).
- States and UTs are also classified into four groups based on their total final energy consumption (TFEC) for peer-to-peer performance comparison: Group 1 (>15 million tonnes of oil equivalent (MTOE)), Group 2 (5-15 MTOE), Group 3 (1-5 MTOE), and Group 4 (<1 MTOE).
- The top-performing states in each group are Karnataka (Group 1), Andhra Pradesh (Group 2), Assam (Group 3), and Chandigarh (Group 4).

- **Principal Results of SEEI 2023:**

- **Top finisher (>=60):**

- Seven states in 'Front runner' category in SEEI 2023: Karnataka (score 86.5), Andhra Pradesh (83.25), Haryana, Kerala, Maharashtra, Punjab, and Telangana.

- **Achiever (50-59.75):**

- Two states, Assam and Uttar Pradesh are in the ‘Achiever’ category,

- **Contender (30-49.75):**

- Three states, Goa, Jharkhand, and Tamil Nadu, are in the ‘Contender’ category.

- **Aspirant (<30):**

- Maharashtra and Haryana most improved states, with score increases of 18.5 and 17 points, respectively.
- 15 states have improved their scores compared to SEEI 2021- 22.

- Substantial decline in score observed in Rajasthan, primarily attributed to lack of reported data.

Source → The Hindu

2 – Details of the Artificial Intelligence's Carbon Footprint:

GS III

Environment related issues

- **What is Lifelong Learning and Spiking Neural Networks?**

- **Neural networks with spikes (SNNs):**

- SNNs are a kind of artificial neural network (ANN) that draws inspiration from the neural architecture of the human brain.
- Standard artificial neural networks (ANNs) analyse data using continuous numerical values; in contrast, SNNs function on discrete activity spikes or pulses.
- Similar to how neurons in the brain communicate through electrical impulses called spikes, SNNs process and send information using patterns or timings of spikes, just as Morse code employs particular sequences of dots and dashes to express messages.
- Because spikes are binary, all-or-none, SNNs are more energy-efficient than ANNs because they only use energy when a spike happens, as opposed to artificial neurons in ANNs that are continually active.
- SNNs are energy-efficient because they consume very little energy when there are no spikes in the data.
- Its event-driven processing and sparse activity have demonstrated that SNNs can be up to 280 times more energy-efficient than ANNs.
- Due to its energy-efficient characteristics, SNNs are well suited for a number of low-energy applications, such as self-driving automobiles, defensive systems, and space exploration.
- Research is still being done to further improve SNNs and create learning algorithms that will allow their energy efficiency to be used in a variety of real-world scenarios.

- Continuous learning is a component of the machine learning paradigm known as Lifelong Learning (L2) or Lifelong Machine Learning (LML). It entails gaining knowledge from completed tasks and applying it to aid in learning and problem-solving in the future.
- L2 is a tactic to reduce the total energy consumption of ANNs over the course of their lifetime.
- When ANNs are trained successively on new tasks, they lose track of their prior knowledge and have to be retrained when the operating environment changes. This increases the emissions associated with artificial intelligence.

- L2 is a group of methods that allow AI models to be sequentially trained on several tasks with low forgetting.
- This method promotes lifelong learning by using prior knowledge to adjust to novel situations without requiring significant retraining.

- **What is the reason for artificial intelligence's high carbon footprint?**

- **Increasing Energy Use:**

- The quantity of greenhouse gas emissions produced during the development, training, and use of AI systems is known as the artificial intelligence carbon footprint.
- The world's energy consumption is rising dramatically as a result of the development of data centres brought on by the growing need for artificial intelligence.
- According to estimates, the IT sector might account for up to 20% of worldwide electricity production and 5.5% of global carbon emissions by 2025, thanks to advances in artificial intelligence.

- **AI Training Emissions:**

- Large AI models, like GPT-3 and GPT-4, require a lot of energy to train and produce a lot of carbon dioxide (CO2).
- According to research, during the course of training, a single AI model can produce as much CO2 as multiple cars.
- 8.4 tonnes of CO2 are emitted annually by GPT-3. The energy needs of AI systems known as big language models—the kind of technology that powers ChatGPT—have increased by a factor of 300,000 since the beginning of the AI boom in the early 2010s.

- **Hardware Usage:**

- The computational demands of AI mostly depend on specialised processors, such as GPUs made available by firms like Nvidia, which have high power consumption.
- These processors continue to be powerful energy consumers even with improvements in energy efficiency.
- **Efficiency of Cloud Computing:**

- Prominent cloud providers, crucial for the implementation of AI, make assurances about energy efficiency and carbon neutrality.
- Despite a notable increase in computer workloads, attempts to enhance energy efficiency in data centres have yielded encouraging results, with only a slight increase in energy usage.

- **Environmental Issues:**

- Even with AI's bright future, scientists continue to raise concerns about the technology's potential environmental effects and call for more attention to be paid to the carbon footprint of AI implementation.
- The necessity for a balanced approach to sustainability in AI development and deployment is highlighted by the possibility that the race to progress AI would overwhelm current environmental problems.

- **AI's Water Footprint:**

- The amount of water required in data centres that run AI models for cooling and electricity generation determines the water footprint of AI.
- The direct water consumption from cooling processes and the indirect water consumption from producing energy make up the water footprint.
- The kind and size of AI models, the location and effectiveness of data centres, and the sources of energy generation all have an impact on the water footprint.
- Up to 700,000 litres of fresh water are needed to train a large AI model like GPT-3, which is the same as 370 BMW cars or 320 Tesla electric vehicles.
- During 20–50 Q&A sessions, interacting with AI chatbots such as ChatGPT can use up to 500 cc of water.
- Due to data availability, it is difficult to determine exact quantities, however GPT-4 is expected to increase water usage due to its bigger model size.
- Because of the heat produced, data centres require water-intensive cooling systems, which require freshwater for both cooling and electricity generation.

- **What Role Can AI Play in Combating Climate Change?**

- Improved Climate Modelling: AI can examine enormous volumes of climate data to enhance climate models and produce more precise forecasts, which can help prepare for and respond to disruptions brought on by climate change.
- Developments in Material Science: AI-driven research can create stronger, lighter materials for aircraft and wind turbines, which will save energy.
- Sustainability initiatives are aided by the design of materials with lower resource consumption, better battery storage, and increased carbon capture capabilities.
- Efficient Energy Management: AI systems monitor energy consumption, optimise the use of renewable energy sources, and spot chances for efficiency in industry, power plants, and smart grids.
- Monitoring of the Environment: State-of-the-art AI systems with training can instantly identify and forecast changes in the environment, such as flooding, deforestation, and illicit fishing.
- uses image analysis to find crop nutrition, pest, or disease problems, hence supporting sustainable agriculture.

- Remote Data Collection: Research and monitoring in inaccessible regions are made possible by AI-powered robots that collect data in harsh conditions like the Arctic and oceans.
- Data Centre Energy Efficiency: AI-driven technologies optimise data centre operations to cut energy use while upholding safety regulations.
- As an illustration, Google has developed artificial intelligence that reduces the quantity of electricity required to run its data centres. By utilising machine learning techniques created by DeepMind, the company's AI research division, it was feasible to achieve a remarkable 40% reduction in the energy consumption for cooling the facilities.

- **How Can AI Be Maintained?**

- **Openness in Energy Consumption:**

- Accurate evaluation of electricity consumption and carbon emissions is made possible for developers by standardising measurements of AI carbon footprints.
- AI's environmental impact can be tracked and compared thanks to programmes like Microsoft's Emissions Impact Dashboard and Stanford's energy tracker.

- **Model Selection and Optimisation by Algorithms:**

- Energy and computational resources are conserved when simpler tasks are assigned to smaller, more specialised AI models.
- Energy usage is decreased when the most effective algorithms are used for particular jobs.
- Utilising algorithms that put energy efficiency ahead of computational correctness reduces the amount of electricity used.

- **Developments in Quantum Information:**

- Artificial Neural Networks (ANNs) and Spiking Neural Networks (SNNs) may find their training and inference duties accelerated by the extraordinary processing capacity of quantum systems.
- Better processing powers provided by quantum computing may make it easier to find energy-efficient AI solutions on a much wider scale.
- The efficiency and scalability of AI systems could be revolutionised by utilising the capabilities of quantum computing, which would also help to develop sustainable AI technology.

- **Adoption of Renewable Energy:**

- Leading cloud providers ought to pledge to run their data centres entirely on renewable energy.
- Progress in Hardware Design:
- The Tensor Processing Units (TPUs) from Google are an example of specialised hardware that improves the speed and energy efficiency of AI systems.
- Sustainability initiatives are aided by the development of more energy-efficient hardware designed specifically for AI applications.

- **Novel Cooling Technologies:**

- Underwater data centres and liquid immersion cooling provide energy-efficient substitutes for conventional cooling techniques.
- Investigating cooling options that reduce environmental effect and use renewable energy sources, such as undersea and space-based data centres.
- Support from the government and regulations:
- establishing rules for the open reporting of sustainability and carbon emissions from AI.
- Offering tax breaks to encourage the use of sustainable techniques and renewable energy in the construction of AI infrastructure.

Source → The Hindu

3 – About the Plan and Policy for Coal Logistics:

GS III

Economy related issues

- **What is the policy and plan for coal logistics?**

- Background: In India, coal logistics have long been a problem, especially in the summer when power plants struggle with a scarcity of coal due to increased demand for electricity.
- Coal transportation has often presented difficulties, necessitating the implementation of special procedures by railways to avoid supply disruptions.
- About: The goal of the Coal Logistics Plan and Policy is to improve coal logistics through cost-effectiveness, environmental friendliness, and efficiency.
- It includes a number of activities, including the loading, unloading, and storing of coal as well as its transportation to cement, steel, power, and washery plants.
- It suggests a strategy change in First Mile Connectivity (FMC) projects to a railway-based system, with an annual cost-saving of Rs 21,000 Crore and a 14% reduction in rail logistic expenses.
- Anticipated Results: It is anticipated to decrease air pollution, ease traffic jams, and cut carbon emissions by about 100,000 tonnes annually.
- Furthermore, a 10% reduction in the nation's average waggon turnaround time is anticipated.

- **What is the Indian coal sector's current state?**

- Coal is a naturally occurring, combustible sedimentary rock that is mainly made of hydrocarbons and carbon.

- It develops over millions of years as a result of the buildup and breakdown of plant material. This organic stuff transforms chemically and physically under heat and pressure, becoming coal.
- India's coal reserves are primarily located in the eastern and central regions of the nation.
- At 75% of India's domestic raw coal dispatches, the three main coal-producing states are Odisha, Chhattisgarh, and Jharkhand, as well as some sections of Madhya Pradesh.

- **India's coal and cluster types:**

- Anthracite: Occurs in small amounts, mostly in Jammu and Kashmir, and has a carbon concentration of 80% to 95%.
- Bituminous coal: Mostly found in states like Jharkhand, West Bengal, Odisha, Chhattisgarh, and Madhya Pradesh, it has a carbon content of 60% to 80%.
- Lignite: Known for its high moisture content and 40% to 55% carbon content, it is mostly found in Tamil Nadu, Puducherry, Gujarat, Rajasthan, and Jammu & Kashmir.
- Peat: The first stage of the conversion of organic materials, such wood, into coal is represented by this material, which has less than 40% carbon.
- Importance of Coal to India: In India, coal is the most abundant and significant fossil fuel. It supplies 55% of the nation's energy requirements.
- The nation's industrial legacy was founded on its own coal. At the moment, thermal power plants, which are mostly fuelled by coal, provide 70% of India's electricity needs.
- India's commercial primary energy consumption has increased by almost 700% in the last forty years.
- The current annual per capita use of oil equivalent is about 350 kg, which is still less than that of rich nations.
- India's import policy currently permits the unlimited import of coal under an Open General Licence.
- Depending on their business needs, consumers—such as the steel, electricity, and cement industries—as well as coal dealers, can import coal.
- Coking coal is mostly imported by the steel industry in order to increase domestic supply and enhance quality.
- Non-coking coal is imported by coal dealers and other industries like power and cement to suit their different needs.

- **What are India's Coal-Related Challenges?**

- Environmental Impact: Deforestation, greenhouse gas emissions, water and air pollution, and habitat damage are all caused by the mining and burning of coal. It is very difficult to address these environmental effects while maintaining energy security.
- Health Risks: Communities living close to coal mines and power plants are at risk for respiratory illnesses and other health problems due to exposure to coal dust, particulate matter, and toxic emissions from coal-fired power plants.
- Land Acquisition and Rehabilitation: Relocating communities and upsetting livelihoods are frequent consequences of acquiring land for coal mining projects.

- It is still difficult to properly rehabilitate and resettle affected populations, as many of these towns struggle with social and economic issues.
- Technological Restrictions: Although clean coal technologies, such carbon capture and storage (CCS), have advanced, their general acceptance in India is still restricted by their high cost and difficult application.
- Transition to Renewable Energy: India's coal industry faces difficulties in light of the nation's resolve to switch to renewable energy sources and cut greenhouse gas emissions.
- A major challenge is striking a balance between achieving climate change mitigation goals and guaranteeing energy security.
- India argued at COP28 for a "phase down" of coal use rather than a total "phase out."

- **Why Does India Support Reducing Coal Instead of Reducing Its Use?**

- Energy Security: As a major source of electricity generation in India, coal presently plays a vital part in the country's energy security.
- A sudden phase-out of coal consumption might cause interruptions in the energy supply, which would affect homes, companies, and industries.
- Economic Aspects: Millions of employment are supported by the coal mining industry, which also makes a substantial economic contribution to India.
- In regions that rely heavily on coal, a quick move away from it might mean job losses and unstable economies.
- Furthermore, coal is now more affordable than renewable energy sources like wind and solar power.
- India has invested a significant amount of money on coal-based infrastructure, such as power plants and related infrastructures.
- Early coal phase-out would result in stranded assets and squandered investments, which would be bad for the economy.

- **The Way Ahead:**

- Enhancing Energy Efficiency: Energy consumption and environmental effect can be decreased by improving energy efficiency throughout the coal value chain, from mining and transportation to power generation and consumption.
- Additionally, while improving energy efficiency, high-efficiency, low-emission (HELE) technology can be used in coal-fired power plants to drastically cut emissions throughout the coal value chain.
- Energy Source Diversification: Increasing investments in renewable energy sources including solar, wind, hydro, and biomass would help India prioritise diversifying its energy mix.
- By diversifying, the energy system will become less dependent on coal and become more resilient and sustainable.
- Transition to Clean Coal Technologies: The environmental effects of coal-based power generation can be lessened by funding the study, creation, and use of clean coal technologies, such as carbon capture, utilisation, and storage.

- Encouraging Sustainable Mining Practices: Reclamation of land, conservation of water, and preservation of biodiversity are a few examples of environmentally sustainable mining techniques that can be used to reduce the environmental impact of coal mining operations.
- To guarantee that environmental requirements are followed, laws and enforcement systems must be strengthened.

Source → The Hindu

4 - About the Complete Progress Record:

GS II

Education related issues

- **Context:**

- The National Council for Educational and Research Training (NCERT) recently unveiled the "Holistic Progress Card" (HPC), a tool that will assess a student's growth in interpersonal relationships, self-reflection, creativity, and emotional application in the classroom in addition to academic performance.

- In accordance with recommendations made by the National Education Policy (NEP) 2020, the HPCs for the foundational stage (Classes 1 and 2), preparatory stage (Classes 3 to 5), and middle stage (Classes 6 to 8) have been developed by Performance Assessment, Review, and Analysis of Knowledge for Holistic Development (PARAKH), a standard-setting body under the NCERT.

- **A Holistic Progress Card (HPC): What is it?**

- A new method of assessing student performance in the classroom called the HPC does away with the conventional use of grades or marks.
- Rather, it uses a thorough 360-degree assessment method that considers many facets of a student's growth and educational journey.

- **Qualities:**

- Students actively participate in class activities under the HPC model, where they are urged to apply a variety of skills and abilities to show that they comprehend the material.
- The procedure of assessment also takes into account the degree of difficulty that students experience when completing assignments.

- In order to evaluate students' strengths and shortcomings in a variety of areas, including cooperation, creativity, empathy, attention, and readiness, teachers are essential.
- This enables educators to pinpoint areas in which pupils might require more help or direction.
- Involving students in the evaluation process is one of the HPC's unique features.
- In order to gain insight into their educational experiences and the classroom environment, students are encouraged to evaluate both their own and their classmates' performance.
- Additionally, the HPC incorporates parents into the evaluation process by asking for their opinions on a range of learning-related topics, such as finishing homework, participating in class, and striking a balance between screen time and extracurricular activities at home.

- Rather than emphasising memorization as in the past, the HPC places more focus on evaluating students' higher-order skills, such as analysis, critical thinking, and conceptual clarity.
- In 2023, the National Curriculum Framework for School Education (NCF-SE) was unveiled in compliance with the guidelines of the NEP. It promoted a change in the method of evaluating student advancement to the methodical gathering of data.
- Furthermore, the NCF SE encourages students to monitor their own learning journeys by providing tools for peer and self-assessment.
- The NCF SE advises using a variety of classroom assessment techniques, including projects, discussions, presentations, experiments, investigations, and role plays, to obtain a thorough grasp of students' key abilities. These suggestions are in line with HPC's concept.

- **What is the PARAKH?**

- As part of the execution of the National Education Policy (NEP), 2020, PARAKH was introduced. This policy called for the establishment of a standard-setting organisation to provide school boards with guidance on new assessment practices and current research, as well as to encourage cooperation between them.
- It will function as an NCERT component unit.
- In addition, it will be responsible for conducting recurring learning outcome assessments such as State Achievement Surveys and the National Achievement Survey (NAS).
- Large-scale assessments, school-based assessments, and examination changes are the three main areas of assessment that it will focus on.

- **Goal:**

- Set uniform standards, procedures, and norms for student assessment and evaluation throughout all Indian educational boards that are acknowledged.
- Enhance Assessment Pattern: School boards will be encouraged and assisted in changing their assessment practices to better align with the 21st century's skill requirements.
- Diminish assessment Disparity: It will create consistency between state and central boards, which now adhere to various assessment criteria that cause significant differences in test results.
- Benchmark Assessment: In line with the National Education Policy (NEP) 2020, the benchmark assessment framework aims to eliminate the focus on rote learning.

- **NCF for School Education: What Is It?**

- The goal of NEP 2020 is the foundation for the development of the National Curriculum Framework for School Education (NCF-SE), which was created to facilitate its execution.
- The NCERT will be in charge of creating NCF-SE. The NCFSE document will now be reviewed and revised based on the frontline curriculum once every five to ten years.

- **Goals:**

- India uses the NCF-SE as a guide when creating curricula, textbooks, and instructional strategies.
- Its goals are to move away from rote learning—memorization by repetition—to more flexible assessments, real-world application, and curriculum enrichment beyond textbooks.
- Along with promoting democratic ideals, the NCFSE also seeks to make learning engaging, child-centered, and independent. It is required for all age groups and offers guidelines for counselling secondary school pupils.

- **What are the Indian Constitutional and Legal Provisions Regarding Education?**

- **Lawful Requirements:**

- For primary school students (6–14 years old), the government has adopted the Sarva Shiksha Abhiyan (SSA) as part of the Right to Education (RTE) Act.
- With the Rashtriya Madhyamik Shiksha Abhiyan, the government has expanded the SSA to secondary education at the secondary level (age group 14–18).
- In order to meet the requirements of higher education, the government addresses higher education at the undergraduate (UG), postgraduate (PG), and MPhil/PhD levels through the Rashtriya Uchhattar Shiksha Abhiyan (RUSA).
- The Samagra Shiksha Abhiyan plan now encompasses all of these initiatives.

- **Articles of the Constitution:**

- Within ten years following the Constitution's adoption, the government was required under Article 45 of the Directive Principles of State Policy (DPSP) to guarantee free and compulsory education for all children up to the age of fourteen.
- In addition, a change to Article 45 expanded its scope to cover early childhood education and care for kids younger than six.
- The 86th Constitutional Amendment Act of 2002 created Article 21A, raising basic education from the position of a directive concept to a fundamental right, in response to the goal's non-fulfillment.

Source → The Hindu