Energy Footprint of AI

> Mains Syllabus: GS III - Science and Technology- developments and their applications; Infrastructure - Energy, Environmental pollution and degradation.

Why in the News?

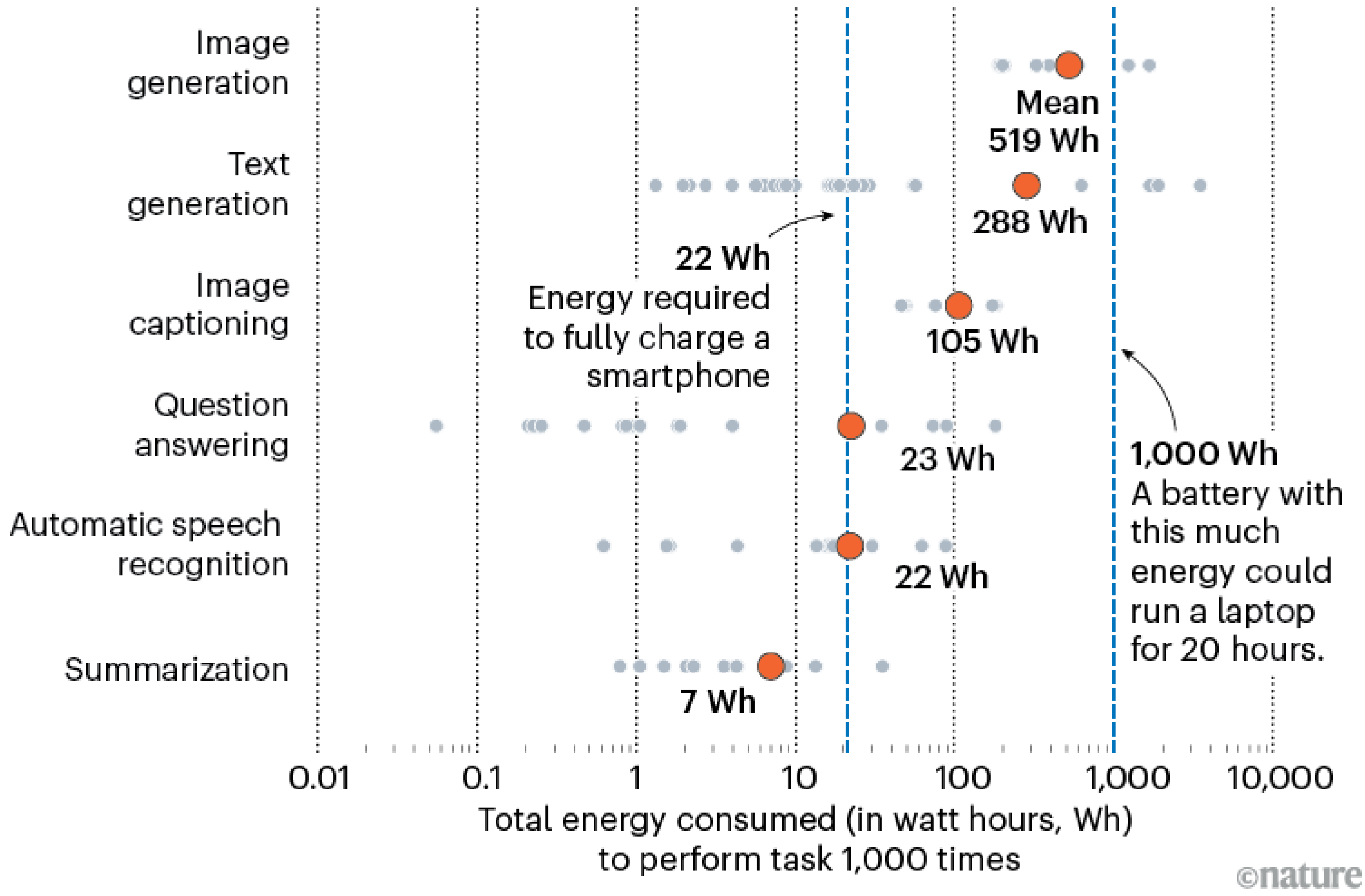
Recently, OpenAI’s CEO Sam Altman said that the courtesy phrases like thank you to AI , are increasing OpenAI's operating costs by tens of millions of dollars a year.

What is the energy cost of AI?

- **Generative Artificial Intelligence (AI)** – It is a type of AI that can create new content, including text, images, music, and videos, based on learned patterns from data.
- Unlike traditional AI that might focus on prediction or classification, GenAI can generate entirely new content that didn't previously exist.
- **High computation demand** - Training and running large AI models requires powerful hardware (GPUs, TPUs) operating at peak loads which come with a heavy environmental footprint.
- **Energy consumption** - Every time one uses ChatGPT or any other AI tool, somewhere in the world, there is a data centre chugging electricity, much of which is generated from fossil fuels.
- The power required for “inference” — when models process real-time queries — can account for up to 60% of AI’s total energy consumption.
- This resource consumption is staggering, and it is becoming more unsustainable as AI adoption grows.

HOW MUCH ENERGY DOES AI USE?

The AI Energy Score project tested dozens of artificial-intelligence models to estimate how much energy they consume when performing various tasks. Plotting the energy required to perform a task 1,000 times shows that energy use varies greatly depending on the task and the model.



- **CO2 emission** – Fossil fuel that is used to training an AI model, whether it is a conversational tool such as ChatGPT or an image-generator tool such as Midjourney, can generate the same amount of CO2 as five cars running continuously across their life.
- Recent research shows that training GPT-3 consumed approximately 1,287 megawatt-hours (MWh) of electricity, emitting 502 metric tons of CO_2, which is roughly equivalent to the emissions of 112 gasoline-powered cars over a year.
- **Growing demand** - As AI models grow in complexity, the energy required to train and deploy them skyrockets, raising concerns about the environmental footprint of AI-driven technologies.
- Projections indicate that AI data centres could account for 10% of the world's total electricity usage by 2030.

What are the advantages of using Small Modular Reactors (SMR) for AI energy needs?

Small Modular Reactors (SMR) - These are advanced nuclear reactors that have a power capacity of up to 300 MW(e) per unit, which is about one-third of the generating capacity of traditional nuclear power reactors.

To Know more about it , Click here.

- SMR is a powerful potential solution to the energy demands created by AI and other emerging technologies.
- **Supports existing energy infrastructure** - The AI boom is happening fast, and the current energy infrastructure will just not be able to keep up.
- SMRs present a transformative opportunity for the global energy landscape to support booming AI and data infrastructure.
- **Less resource requirement** - Unlike traditional large-scale nuclear power plants that demand extensive land, water, and infrastructure, SMRs are designed to be compact and scalable.
- **Location flexibility –** The flexibility of SMR allows them to be deployed closer to high-energy-demand facilities, such as data centres, which require consistent and reliable power to manage vast amounts of computational workloads.
- **Faster deployment** - Their modular construction reduces construction time and costs when compared to conventional nuclear plants, enabling faster deployment to meet the rapidly growing demands of AI and data-driven industries.
- **Better safety** - SMRs offer enhanced safety features, with passive safety systems that rely on natural phenomena to cool the reactor core and safely shut down, reducing the risk of accidents.
- **Better acceptability** – Enhanced safety features make SMR more acceptable and easier to integrate into regions where large-scale nuclear facilities would face opposition.
- **Better efficiency** - The ability of SMR to operate in diverse environments, from urban areas to remote locations, also supports the decentralisation of energy production, reducing transmission losses and enhancing grid resilience.
- **Viable alternative to renewables** - Their ability to provide 24X7, zero-carbon, baseload electricity makes them an ideal alternative to renewable sources such as solar and wind by ensuring a stable energy supply regardless of weather conditions.

What are the challenges in adopting SMR?

- **Regulatory challenges** - Significant policy shifts will be required to create a robust regulatory framework that addresses safety, waste management and public perception.
- **High investment** - There is also the matter of substantial upfront investment, as the technology is still maturing and may face issues of cost competitiveness when compared to established energy sources.
- **Balancing with renewables** - coordinating SMR deployment with existing renewable energy initiatives will require careful planning to maximise synergies while minimising redundancy.

What can be done to make AI energy sustainable?

- AI companies need to be transparent about their energy consumption and environmental impact.

- Data on amount of energy consumption, sources of energy and the purpose of AI use would provide further insights on where energy is being used the most and encourage research and development to create a more sustainable model of AI development.
- A public-private partnership model presents a realistic solution to the challenges of sustainable AI development.
- By leveraging the strengths of both sectors, this model can facilitate the efficient development of SMRs alongside other forms of renewable energy to support advancements in AI.

Reference

The Hindu | Redrawing the not-so-pretty energy footprint of AI