Debriefing note - Energy for AI and AI for Energy

Speaker - Siddharth Singh, International Energy Agency

The speaker is an energy sector expert with 14 years of experience across policy, investments, governance, finance, artificial intelligence, and clean energy. He is the author of The Great Smog of India.

What was the structure of the talk?

Mr. Singh began with the strategic context, post-2022 advances in AI and their energy-policy implications. He first framed the session around the dual relationship—how AI drives new electricity demand ("Energy for AI") and how it can optimize the energy system ("AI for Energy"). He then quantified generative-AI inference electricity use, distinguishing experimental results from optimised operations. The talk moved to siting and scale, showing data-centre clustering near urban grids and the shift from typical hyperscalers to multi-million-household equivalents.
Next came the demand outlook, data-centre electricity use more than doubling by 2030 and nearly tripling by 2035, led by AI-optimised servers. A Virginia case demonstrated system integration, with wind, solar and batteries meeting ~80% of hourly demand and the balance supplied by the grid. He surveyed AI applications across oil and gas, power, industry and cities, underscoring barriers, misaligned incentives, skills gaps and digital-infrastructure constraints.
He closed on the emissions ledger from data centres by 2035 potentially outweighed by larger AI-enabled reductions if rebound effects are managed, followed by Q&A.

What are the taken home messages?

The dual relationship between AI and energy demonstrates that they are becoming inseparable nowadays. He showed that data centres—the physical heart of the digital world—already consume enormous amounts of power, and their electricity demand could more than double by 2030 and nearly triple by 2035. What felt abstract suddenly became real when he mentioned that in an economy not that large such as Ireland, roughly 20 % of local electricity already goes to data centres.

Yet his tone was not alarmist. Efficiency in chips and cooling is improving, and hybrid portfolios of wind, solar, and batteries can now meet most of a centre's hourly demand at competitive cost. The challenge, he stressed, is not energy scarcity but planning and coordination between governments, utilities, and tech companies.

Turning the relationship around, Singh reminded us that AI can also help energy—optimizing grids, forecasting demand, and supporting industrial efficiency. With careful and wise deployment, AI has the potential to deliver greater emission savings than the emission created when utilizing or developing AI. But this will require incentives, digital skills, and clean power.

The lasting impression was one of cautious optimism: AI is neither a threat nor a saviour—it magnifies the systems we build. With clear policies and smart deployment, it could become a quiet engine of the global energy transition.

What were the chunky bits?

Mr. Singh presented benchmarks of LLMs' energy consumption that were developed by the IEA as the basis for their studies. He mentioned that AI companies do not usually provide such numbers to the public, so in order to validate their assumptions, the IEA utilized their own servers to measure the energy needed for text and video generation. Initially, the results from multi-billion parameter models showed an average consumption of 1-5 Wh for text generation and around 110 Wh for the production of an 8-second video. Upon questioning AI companies, the IEA was informed about AI-optimized servers, and under this new condition, the benchmarks showed that the consumption was 1-2.5 Wh for text and around 55 Wh for 8-second videos.

It was also mentioned that data centers, unlike conventional industrial facilities such as mines and steel plants, are heavily clustered, tending to be located around 10 km from urban areas. The reference number for factories is 50km and 75 km for steel plants. This reduces transmission losses but accounts for higher land prices.

The presenter mentioned that multiple data centers are delayed due to the lack of permitting, but the most surprising part of the future delays are related to supply chain bottlenecks on cables, and electromechanical material. Out of the 120 GW of planned datacenters, 30 GW are under this risky condition.

As per the topic of grid capacity, it was mentioned that new transmission lines and power plants need to be built to supply the demand of data centers. In the long term, new physical assets need to be built, but in the short term, Grid Enhancing Technologies such as Dynamic Line Rating have to be deployed to "unlock" transmission capacity on already existing overhead power lines. This "additional" power is achieved by considering live weather data that heat and cool down overhead cables, impacting on the ampacity.

On the benefits that AI can bring to the electricity system, Mr. Singh mentioned that if all current efforts and technologies available were completely scaled up, the energy savings AI could bring would represent the equivalent of Mexico's yearly demand. AI can be used in many sectors. From energy production to transmission and usage, e.g. oil and gas maintenance, electricity smart system, autonomous in transportation and industry. Many uncertainties are still not modeled, as mentioned by the presenter. On this matter, he mentioned that breakthrough discoveries in the electricity system, similarly to AlphaFold's ability of discovering new proteins for chemistry and biology, are expected but cannot be accounted for.

In addition, Mr. Singh discussed the emissions balance expected by 2035. According to the IEA's projections, electricity use in data centres could result in up to 500 million tonnes of CO_2 emissions by that year. However, AI applications across sectors—such as transport, industry, and energy efficiency—could enable emission reductions up to three times greater than those produced by data centres. The speaker also warned that these benefits are not guaranteed, as rebound effects may offset part of the gains. For instance, if AI makes certain products cheaper or more convenient, overall consumption could rise, leading to higher total emissions. This part of the presentation highlighted the importance of combining technological progress with careful modelling and policy design to ensure that AI's contribution remains genuinely sustainable.

What were the questions from the audience? Did they open a new perspective?

One question from the audience on which electricity market tools, such as the Frequency Containment Reserve, could boost BESS deployment for better integration of renewable energy to supply datacenters was directed to the presenter's colleagues specialists on electricity.

A question on the pre-allocation of computing power for off-peak hours was made to inquire about which tools can be used to properly manage demand. The presenter said that this was one of the main ideas to control energy usage from data centers, but many more should be thought of.

One question refers to how the rising electricity demand of data centres could be managed, the speaker pointed out that flexibility is key. Workloads can be shifted to off-peak hours or to regions with abundant renewable energy, easing pressure on local grids. In his view, the goal is for digital demand to adapt to the power system's rhythms—using energy when it's available, rather than intensifying strain on the grid.

One question was about whether data centers could be used as a source of district heating to cut carbon emissions. The speaker mentioned that some of the facilities already reuse waste heat for district heating, while others have not yet integrated such systems. He explained that while it sounds good in theory, in reality it would take a lot of coordination between different parties and end up being quite complicated.

Are you able to summarize and comment the conference to someone who didn't attend it

With the growth of AI, electricity consumption in data centers is becoming increasingly significant, and new facilities need to be built, putting additional pressure on energy demand all over the world. By 2035, data centers are expected to account for up to 500 Mt of CO_2 emissions. At the same time, AI can be applied across the energy sector — from resource extraction to end use — and can help accelerate energy innovation.With the right applications, AI could enable carbon reductions that exceed the emissions caused by its own energy use, resulting in a net decrease in overall carbon emissions. However, AI may also lead to additional carbon emissions in certain cases, which need to be carefully simulated and modeled to provide a realistic roadmap for addressing climate change.

The talk gave a balanced view of how artificial intelligence and the energy system are becoming increasingly connected. Mr. Singh explained that while AI is driving a sharp rise in electricity demand through the growth of data centres, it can also make energy systems more efficient and flexible. What I found most valuable was the sense of realism in his message: AI is neither a threat nor a solution on its own. Its true impact will depend on how governments, industries, and societies manage its integration into energy planning. The discussion made it clear that the future of AI and energy is not only about technology, but about coordination, responsibility, and the choices we make in balancing innovation with sustainability.

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