Ayca Tasli, S&P Global, University of Warwick (Msc), +44 7484942470, ayca.tasli@spglobal.com
Supervisor: Dr. Phil Lewis, University of Warwick, Phil.Lewis@warwick.ac.uk

ASSESSING THE INFLUENCE OF AI, CRYPTOCURRENCIES, AND ICT GROWTH ON DATACENTERS ENERGY CONSUMPTION AND CARBON EMISSIONS: EVALUATING THE ROLE OF TECHNOLOGY INDUSTRY INVESTMENTS IN RENEWABLE ENERGY IN CLOSING EMISSIONS GAP

Overview

The rapid advancement of artificial intelligence (AI), cryptocurrencies, and other information and communication technologies (ICT) is driving significant growth in the demand for data storage and processing capabilities. This, in turn, is leading to a significant increase in energy consumption by datacenters worldwide. As major technology companies continue to expand their digital infrastructures, the energy required to power these facilities is projected to increase, boosting carbon emissions if not matched by adequate investments in renewable energy (RE).

Datacenters are already responsible for a significant portion of global electricity consumption, and this trend is expected to accelerate by 2030 as projected by International Energy Agency (IEA). With projections indicating that energy demand from datacenters could double within the next decade, there is an urgent need to understand the environmental implications of this growth. Sustainable strategies should be developed to mitigate this projected demand gap, as public funds should not be responsible to compensate for this generated demand increase by technology companies. Technology companies should compensate for the demand increase that they are responsible for, by making private renewable investments and support renewable energy generation with additionality.

This research project explores if the increasing energy demands of datacenters can be compensated by private investments in renewable energy projects and mitigate contributing to global carbon emissions. Project aims to assess the current and projected investments in renewable energy by major technology companies, analyse and quantify the demand gap in terms of energy demand and its emission's impact, and the investment gap by 2030 and provide recommendations for bridging this gap.

Methods

The methodology of this research is structured around a multi-dimensional approach, incorporating both qualitative and quantitative techniques to assess the influence of AI, cryptocurrencies, and ICT growth on datacenter consumption and in measuring the impact of carbon emissions. The study initially considers a comprehensive literature review conducted over existing knowledge on the environmental impacts of datacenters, focusing on the role of technological advancements in driving electricity demand and the potential of renewable energy to mitigate these impacts at global and regional scale. Through this research, academic articles, sustainability focused industry reports and global forecasts are analysed to develop an outlook for electricity demand, the demand increase that belongs to AI advancements, and the renewable investment agendas of technology companies for 2025-2030.

An outlook considering the three pillars (electricity demand, the demand increase that belongs to AI advancements, and the renewable investment agendas) in identifying the emissions gap the AI advancements create, is developed with sensitivity scenarios, based on different adoption levels of renewable investments from technology companies. In demand outlook modelling, the global electricity demand estimation by International Energy Agency (IEA) as suggested under their 2024 review report

and their estimation on datacenter demand which is expected to be around 10% of the total increase in electricity demand by 2030 is considered as base assumptions. This increase dedicated to datacenter demand is modelled considering different CAGR scenarios using interpolation methods. Resulting datacenter demand scenarios then compared against the rate of adoption of Renewables, and the suggested rates are gathered from the sustainability reports of the largest datacenters globally. Their renewable energy adoption rate is analysed to calculate different sensitivity scenarios to identify a confidence interval considering the pace in adoption. The contribution of this study can be considered as identifying the difference between total datacenter demand and the adoption rate of renewables, measuring the emission impact of the identified gap and highlighting in the gap in investments, required in the future years to close the demand and the emissions gap.

With results, the study allows a comprehensive evaluation of whether green investments from technology companies are adequate to meet the anticipated energy demands of datacenters in short term (2025-2030) at global scale. Based on the findings, actionable recommendations are determined to assist technology companies in reducing the gap between energy demand and renewable energy supply, focusing on enhancing datacenter efficiency and promoting robust renewable energy investments (direct asset investments, Power Purchase Agreements, Renewable energy certificates etc.). A review of global best practices is also conducted to highlight the insights from successful implementations of sustainable practices in datacenters, which can inform strategies applicable across different regions and industries. Finally, this study results in a synthesis of key insights, emphasizing the critical need for addressing the energy and environmental challenges posed by datacenters and the implications for policymakers and the broader ICT sector.

Results

The research findings indicate a significant correlation between the growth of AI, cryptocurrencies, and ICT advancements and the increasing energy consumption of datacenters. The analysis considered the IEA projections as base assumptions such that global electricity demand from datacenters is assumed to increase approximately 6.750 TWh by 2030 as and the assumption suggests a total of 36,229 TWh electricity consumption by 2030, primarily driven by the surge in AI applications and cryptocurrency mining.

Preliminary results suggest that after considering the renewable adoptions from technology companies under different sensitivities, the averaged demand gap estimated to be in around 839 TWh and if we put the number into context, required energy demand is estimated to be above the annual electricity consumption of Brazil, which is between 600-700 TWh/year. As the estimation of the adoption rates are based on the sustainability conscious companies, it is fair to suggest that, by 2030, investment efforts may fall short to meet the anticipated energy requirements of their datacenters.

The study continues with final evaluations and conversions of the identified energy gap in terms of emissions. And once quantified, study is expected to also suggest the additional financial investments required (in dollar terms) over the next five years to effectively mitigate the emissions gap.

Conclusions

This study highlights and quantifies the energy impact of AI. The findings reveal a significant increase in energy demand, projected to reach approximately 6,750 TWh by 2030, calling the technology companies for urgent action to mitigate the associated carbon emissions resulted from the energy demand gap estimated. To bridge this gap, the study emphasizes the need for robust private investments in renewable energy and the adoption of best practices in datacenter efficiency, which is elaborated further in the study. By aligning corporate strategies with sustainable energy goals, technology companies can play a pivotal role in addressing the environmental challenges resulted by their R&D and operations. AI holds the power to be a great enabler in the future however, as the study suggests technology companies do have a public responsibility in the energy bill and the environmental consequences.

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