Press release
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AI boom won't spike nation-wide energy prices, but climate costs could reach $80bn a year, new HEC Paris research finds

New paper by HEC Paris finance professor Olivier Darmouni finds AI-driven data centre expansion will sharply increase emissions and regional energy costs, despite limited impact on national electricity prices.

New research by Olivier Darmouni, Associate Professor of Finance at HEC Paris and colleagues Clemens Lehner and Yuqi Zhang from Columbia Business School, reveals that the rapid growth of AI infrastructure will dramatically increase electricity demand without triggering large, price rises nationwide. Instead, the costs of data centre expansion are expected to massively inflate regional costs in heavily exposed locations such as Virigina, Texas, and the Carolinas. According to Prof. Darmouni, Europe, the world's second most dense data centre hub, will see similar effects. With more than fifty new sites planned in cities like London or Paris, these and other remote out towns such as Slough, electricity prices could rise by 20–40%.

In his new paper, *The Energy Cost of AI and Data Centers*, Prof. Olivier Darmouni, an expert in global finance and the energy transition, finds that if the additional electricity demand created by data centre expansion is met using fossil fuels, the resulting rise in carbon emissions could generate up to $80bn a year in climate and social costs, largely offsetting the projected increase in earnings for the fossil fuel sector.

In the next couple of years, the demand for energy is expected to increase due to the explosion of Artificial Intelligence (AI), with global data-centre power demand forecast to grow by roughly 50% by 2027 and AI's share of that demand nearly doubling. The findings of this new paper challenges the prevailing narrative that the most important impact of data centre expansion is an increase in energy prices, felt equally across countries and regions.

Analysing 420 US-based data centres projects for sites to be built by 2035, Prof. Darmouni projects that on the order of 100 GW of additional electricity capacity could be required over the next decade but that this would only increase nation-wide energy prices by a modest 2%.

The research also highlights that cost increases associated to data centre expansion will have a minor impact on the overall economy, with production output in "non-data-center sectors" like manufacturing, declining only 0.07% of US GDP. By contrast, the study finds that one of

the key economic risks identified relates to grid reliability and exposure to volatile fuel prices, especially acute in recent months due to geopolitical instability and the war in Iran.

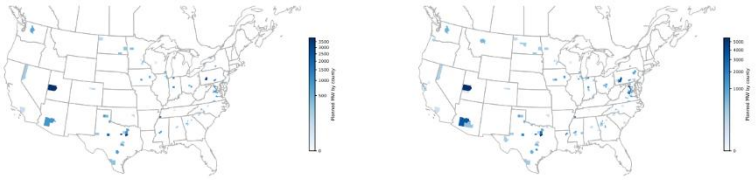
As Prof. Darmouni added: *"The US-Iran War has introduced price volatility and financial risk into the US electricity market. Renewables are appealing energy sources as they provide greater insulation from geopolitical tensions. Current instability could encourage greater levels of investment in renewables in the long-term, which would have a positive impact on the planet and, importantly, greater energy independence and security."*

Energy prices

The research uses a computer model to map and predict changes to local electricity markets in the US over the next decade. With nearly half of US data centres located in in states like Virgina, Texas, North Carolina and South Carolina, the paper highlights that US regional energy prices will skyrocket, with prices in these "regional clusters" surging between 20% and 40%.

However, nation-wide prices will only increase by a modest 2%, as the majority of US fossil-fuel-powered plants are currently operating between 60% and 70% of their full potential. In other words, there is enough spare capacity to absorb new energy demand without inflicting massive price increases nationally. This expansion could inflate fossil fuel profits by around $20B a year.

Figure 4: Geographic Distribution of Planned U.S. Data Center Capacity



(a) Planned capacity by 2028 (b) Planned capacity by 2035

Notes: County-level map of planned U.S. data center capacity measured in megawatts (MW). Darker shading indicates higher planned capacity aggregated across projects located in each county. Panel (a) shows projects expected by 2028 and panel (b) shows projects expected by 2035. Underlying project-level data are from Cleanview.

Climate and social costs

However, the research warns that if power plants do absorb the extra energy demand, a grave increase on emissions would inflict $80bn a year in social and climate costs (assuming $\$200/tCO_2$), coming from higher temperatures and extreme weather events.

By contrast, scaling renewables would materially cut emissions and reallocate value: profits for new renewable providers could rise at the expense of fossil fuel producers, and higher electricity prices would stimulate the investment required to expand green innovation across the sector.

Prof. Darmouni comments: *"Data centre expansion is a double-edged sword. On the one hand, plentiful existing fossil fuel capacity can scale up production to meet new demand, which will lead to a downward spiral of increasing carbon emissions and growing climate damage. On*

the other hand, renewable energy sector profits will rise to new levels that will drive mass innovation across the green sector."

Limited economic impact

Prof. Darmouni projects that data centre expansion will not have a big impact on the US economy and will reduce output in "non-data-center sectors" like manufacturing by only 0.07% of US GDP. The research argues that the most significant economic risk will come through external factors, such as geopolitical conflicts driving energy price instability, while also having a significant impact on reshaping the long-term energy mix of different countries and regions.

Prof. Darmouni comments: *"To offset the increasing volatility of fuel prices, energy providers will have to increase existing capacity levels, or governments will have to invest massively to scale renewables, which remain extremely cost-ineffective to develop at scale."*

The research goes further, explaining how data centre expansion will reduce the long-term appeal of gas as a reliable source of energy. It cites figures from the National Renewable Energy Laboratory (NREL) which show that the cost of building wind and solar power have risen by 42%, while gas has risen to an astonishing 65%.

"As electricity capacity begins to tighten", notes Prof. Darmouni, *"supply chain bottlenecks combined with inflationary pressures will make building new gas plants more expensive than ever."*

For more information, please find a link to the report here.

About Olivier Darmouni:
Olivier Darmouni is Associate Professor at HEC Paris and the holder of the school's Pierre Andurand Chair in sustainability. Olivier is a financial economist whose research interests span credit markets, the energy transition and monetary policy. He applies a variety of empirical methods to understand how frictions affect firms' financing and investment. Prior to joining HEC Paris, Olivier was Associate Professor at Columbia Business School in New York City. Olivier graduated with a PhD in Economics from Princeton University.

About HEC Paris:
Founded in 1881 by the Paris Chamber of Commerce, HEC Paris is a leading European business school with the ambition to make a positive impact on both business and society. Its mission is driven by a unique "Think, Teach, Act" approach, aimed at fostering a more inclusive, sustainable, and prosperous world.
With 167 research professors from around the globe, HEC Paris produces and shares cutting-edge knowledge with over 5,000 students from more than 130 countries. Its campus serves as a true laboratory of innovation and dialogue, fully engaged with the world's diversity and global challenges.
Guided by its five founding values — Excellence, Curiosity, Entrepreneurial Spirit, Diversity, and Responsibility — HEC Paris offers a comprehensive portfolio of programs designed for tomorrow's leaders: Bachelor's, Grande École, Specialized Masters, MSc, Summer School, MBA, Executive MBA, TRIUM Global Executive MBA, PhD, and a wide range of executive education programs for managers and senior leaders.

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