INSIGHT 11

AI COULD DELAY THE GREEN TRANSITION

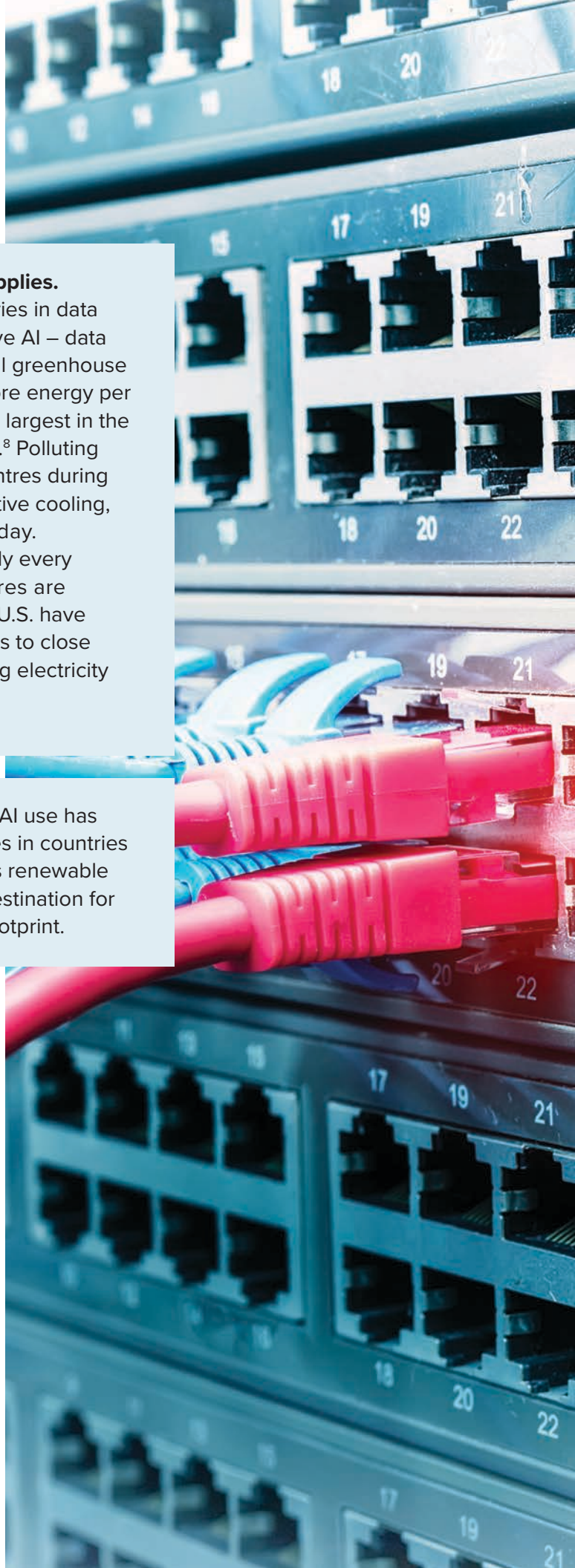
AI uptake is driving up demand for energy and water globally. This could potentially delay the green transition, though Canada could benefit from an increased demand for greener data centres.

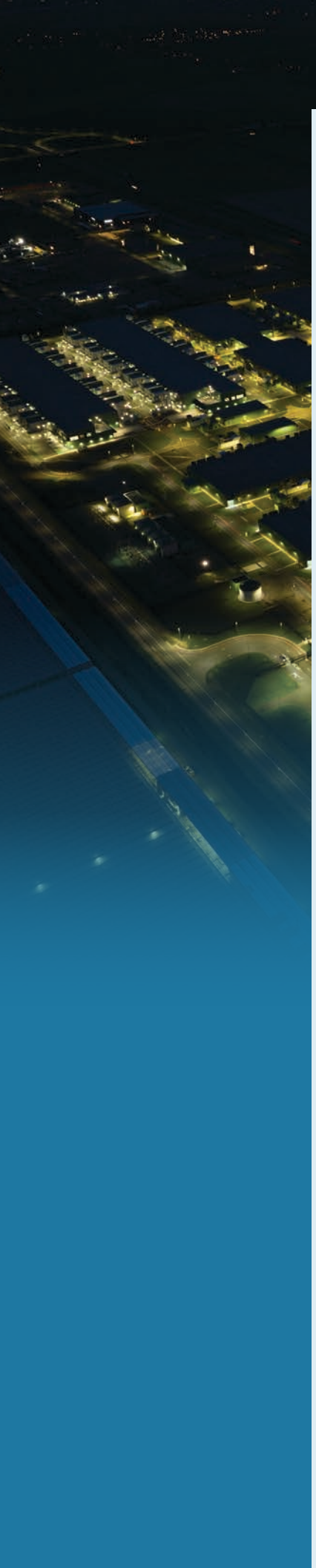
TODAY

AI has climate impacts, though accurately measuring its carbon footprint is a challenge. Generative AI is a particularly energy- and water-intensive technology.[1] Training a new model consumes energy, as does the use of a model once trained. Google's greenhouse gas emissions were 48% higher in 2023 than in 2019, due largely to the energy required by AI.[2] However, as AI companies are not all fully transparent about their energy use or environmental impacts from the development and disposal of hardware, it is hard to be sure about the carbon footprint of AI.[3] Smaller models that run on devices, rather than in the cloud, could have fewer climate impacts (See Insight AI could become "lighter" and run on commonly held devices).

Data centres are already straining energy and water supplies. Machine learning models like ChatGPT process user queries in data centres.[4, 5] Even in 2020 – before the take-off in generative AI – data centres and transmission networks produced 0.6% of total greenhouse gas emissions.[6] Data centres consume 10 to 50 times more energy per floor space than a typical commercial office building.[7] The largest in the world can use as much energy as 80,000 US households.[8] Polluting diesel generators provide backup power to most data centres during power outages.[9] Data centres also use water for evaporative cooling, and in warmer climates can use millions of gallons per day. With the computational power used by AI doubling roughly every 100 days,[10] demands on water and energy by data centres are increasing. Data centres in water-stressed regions of the U.S. have come under fire from local residents.[11] In some areas, plans to close coal-fired power plants have been delayed due to growing electricity demand from data centres.[12]

Canada is an attractive destination for data centres. As AI use has grown, tech companies have sought to locate data centres in countries with cooler climates and clean and cheap power.[13] With its renewable hydroelectric power, Canada has become an attractive destination for tech companies looking to advertise a reduced carbon footprint.





FUTURES

Increased AI uptake could hinder the transition toward global climate commitments. As AI is integrated into more devices and processes, its energy and water use could rise steeply. For example, if every online search used ChatGPT, electricity demand would increase by an amount equivalent to adding 1.5 million residents to the European Union.[14] By 2026, AI could be using more power than the country of Iceland did in 2021.[15] The International Energy Agency has estimated that data centres' electricity consumption could double between 2024 and 2026.[16] The market for GPUs (graphics processing units) used in data centres is projected to grow tenfold from 2022 to 2032.[17] IT seems poised to increase its carbon footprint in the coming decade, just as other industries are moving in the opposite direction.[18]

Innovations in AI hardware and software could reduce energy use. Nvidia's upcoming Blackwell GPUs for data centres, for example, promise to be much more efficient – offering up to 30 times the performance while consuming 1/25th of the energy of current chips.[19] There could also be a shift towards smaller, "lighter", less energy-intensive computational models[20] (See Insight AI could become "lighter" and run on commonly held devices).

Canada could face challenges meeting AI's demand for cheap, clean hydropower. Canadian utilities might find it challenging to meet the rapid growth in energy demand due to AI. Hydro Quebec anticipates that by 2032, data centres will contribute to an increase of about two percent of the total amount of electricity produced in Quebec in 2022.[21] Energy shortfalls are being projected in Quebec as early as 2027 and could be made worse by drought and other climate events.[22] Data centre providers could increasingly be asked to generate their own power and build their own energy infrastructure.[23]

New ways to mitigate the energy demands and impacts of AI could scale up. Some AI companies, including Amazon, Microsoft, and Google, have announced plans to use nuclear energy to reduce their emissions.[24] In September 2024, Microsoft acquired Pennsylvania's Three Mile Island nuclear plant, closed since 2019. Microsoft plans to reopen the plant and purchase its entire electric generating capacity over the next twenty years.[25] Google is expected to have small modular nuclear reactors operational by 2030.[26] Waste heat from data centres could increasingly be captured and put to other uses, such as to warm adjacent greenhouses.[27] In the consumer domain, the AI Energy Star project, inspired by similar ratings for home appliances, aims to monitor AI carbon emissions and give the public information that will enable them to choose the least energy intensive AI model for a given task.[28] Despite these efforts, in a scenario with exponential growth of AI infrastructure it is unclear whether they would be sufficient to mitigate the environmental costs.

IMPLICATIONS

- **Use of energy and water by the information technology sector could increase more than is currently being forecast.**
  - Even if AI becomes more energy efficient, its **total resource consumption could increase** if this lowers costs and leads to AI being embedded in many more devices.
- Economic pressure to expand data centres may **compete with efforts to transition to green energy.**
- **Public utilities could face increased challenges meeting the growing demand for clean energy.** Considerations on **the types of projects that are offered clean energy access may shift.**
- If AI companies increasingly turn to nuclear or other forms of energy to privately fuel the AI boom, this could **create new pressures for organizations responsible for regulatory oversight.**[29]
- Data centres could become increasingly controversial as they put **pressure on land, water, and power supplies.**
  - Inequities could emerge as those most impacted by the physical infrastructure of AI may not be the ones who most benefit.
  - Calls for stricter environmental regulation could grow if an increase in data centres causes more emissions and e-waste.[30]
- **Demand for strategic metals and minerals could grow,** as data centres compete with green tech such as solar panels and electric batteries.
- Platforms that **automatically select AI models for a given task** based on their performan and energy intensity could become common.
- Tech companies may move towards **deploying AI locally in their products** to reduce use of data centres.

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