

COMMENTARY



Decarbonisation challenges of two contrasting growth sectors: Data centres and aviation

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The drive towards global net-zero emissions has put energy-intensive industries under increasing scrutiny, with data centres and aviation emerging as two pivotal sectors with substantial emission footprints and growing energy demands (see Figure 1). While their energy requirements differ, both sectors face a common challenge of securing vast quantities of low-carbon power as the primary lever to abate emissions.

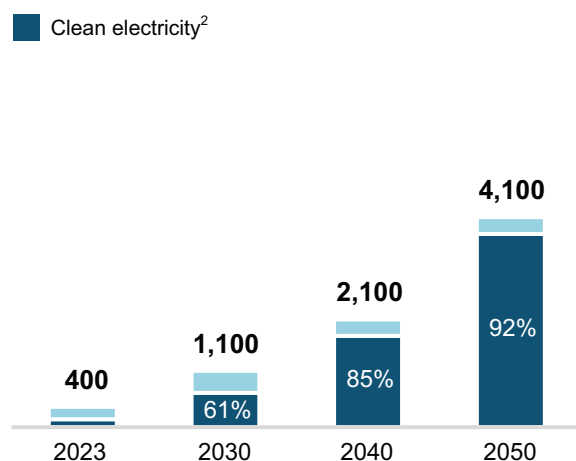
Data centres currently account for 1–2% of global electricity use, but their energy demand is surging due to the rapid expansion of artificial intelligence combined with plateauing efficiency improvements (or power usage effectiveness) in recent years. There is therefore increasing pressure to secure new supplies of low-carbon electricity. Few data centres, however, are in locations offering the ideal mix of abundant, clean, reliable and affordable energy. Furthermore, grid infrastructure is often stretched to capacity, with upgrades in some regions taking more than a decade. As a result, data centres are driving

fierce competition for low-carbon electricity offtake agreements from renewable and nuclear sources.

Aviation also faces significant decarbonisation hurdles. Long aircraft development life cycles inherently limit the rapid adoption of some emerging sustainable alternatives, such as hybrid-electric and hydrogen-powered systems, which for now are viable only on short- and medium-haul routes. This leaves long-haul operations, which account for the bulk of energy demand, reliant on liquid fuels for the foreseeable future. Scaling up the production of sustainable aviation fuel (SAF) is therefore critical.

First-generation SAF production is modest and relies on biogenic waste, which is available only in limited quantities. An inevitable shift will therefore be required towards next-generation solutions, including synthetic fuels (e-SAF) derived from renewable energy sources, which are more scalable. However, producing e-SAF from green hydrogen and sustainable carbon feedstock is significantly more

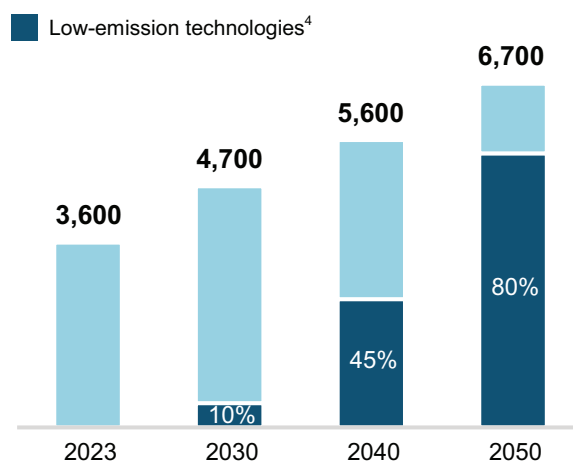
Data centre energy consumption¹ (TWh)



Share of global CO2 emissions



Aviation energy consumption³ (TWh)



Energy consumption forecast to 2050 is based on continued 7% growth rate trend 2023-2030; 2. Share of clean energy (including nuclear) is based on International Energy Agency's (IEA's) Announced Pledges scenario projection for global grid composition; 3. Aviation energy consumption is based on IEA's Stated Policies scenario that considers current global policies and private sector momentum; 4. Share of low-emission solutions under IEA's Net Zero scenario, including biofuels, e-fuels, hybrid-electric planes and hydrogen.

Source: Ener Outlook, Goldman Sachs, IEA

expensive and can consume twice the energy that the fuel ultimately provides. Replacing current fossil jet fuel demand would require energy inputs equivalent to the entire renewables capacity deployed across the EU. These challenges underscore the scale of technological advancements and project investments needed to achieve meaningful progress.

Recent developments highlight that airlines may need to collaborate more closely to aggregate SAF demand, as several major American carriers are quietly stepping back from earlier project commitments. In parallel, policy shifts in the US, including reduced tax credits for SAF, are also hindering investment. Overall, stronger and more consistent policy signals will be needed to accelerate further uptake of SAF.

On a broader level, decarbonisation will require advancements in three areas: energy efficiency, new technologies and low-carbon energy sources. Data

centres and aviation are already capitalising on opportunities to achieve energy efficiency gains, use alternative technologies (e.g., propulsion systems) and make operational improvements. However, the shift to low-carbon energy sources remains the most significant lever for progress. For data centres, this includes partnering with renewable and nuclear energy providers. For aviation, achieving scale in SAF production requires both technological advancement and accessing sufficient renewable energy to meet the growing demand for long-distance flights.

Operational challenges also complicate decarbonisation efforts. Aviation's reliance on globally coordinated refuelling infrastructure is slowing progress. Meanwhile, data centres typically face restrictions due to latency and national security concerns, which limits their ability to site operations in areas with abundant clean energy.

	Data centres	Aviation
Energy demand growth	H <i>Driven by rapid AI and cloud services expansion</i>	M <i>Aligned with steady industry growth</i>
Reliance on fossil fuels	L/M <i>Mostly powered by grid, but energy-mix dependent</i>	H <i>Heavily reliant on conventional liquid fuels</i>
Pace of clean technology adoption	M <i>Growing interest, hyperscalers more active</i>	M <i>SAF faces scale-up issues, hybrid systems still nascent</i>
Ability to colocate with renewables	L <i>Security, latency, and infrastructure limitations</i>	H <i>Flexible, as e-SAF can be easily transported</i>
Potential for efficiency gains	H <i>High innovation potential in software and cooling</i>	M <i>15%-25% engine efficiency gain potential over 20 years</i>
Regulatory and consumer pressure	M <i>Increasing; EU to impose reporting requirements</i>	H <i>SAF mandates already in place (e.g., UK, Europe)</i>
Availability of incentives	L <i>Mostly in the form of tax credits</i>	M <i>Rising number of grants and tax credits available</i>
Carbon offset use	M <i>Moderate use of Renewable Energy Certificates</i>	H <i>Established practice of carbon offsetting</i>
Net zero targets	H <i>Leaders announced 2050 net zero targets (or earlier)</i>	H <i>Leaders announced 2050 net zero targets (or earlier)</i>
Industrywide collaboration	L <i>Limited coordination across firms and jurisdictions</i>	H <i>Significant presence of alliances and joint efforts</i>

Key: **H** High **M** Medium **L** Low

Both sectors require significant infrastructure upgrades to meet their decarbonisation goals. Data centres are constrained by immediate grid limitations as energy demand outpaces current infrastructure growth. In some markets, notably the US, new gas-fired capacity is being deployed to meet rapid data centre demand, highlighting the risk of prolonged reliance on fossil generation. Aviation, on the other hand, must increase SAF production and distribution capabilities globally while addressing the extensive renewable energy requirements this entails in the long term. Enhancements to grids, pipelines and storage solutions are essential to enable these transitions.

In summary, to achieve significant emission reductions in these growth sectors, it will be necessary to overcome techno-economic and operational hurdles as well as foster innovation ecosystems that are conducive to progress. While mandates and targeted incentives are already pushing airlines to act, competitive advantages are also encouraging further innovation among data centre operators. Ultimately, a combination of supportive policy, technological advancement, infrastructure development and industry collaboration will be key to encouraging further clean technology investments and to ensuring sustained progress towards the decarbonisation goals of these industries.

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About Marakon

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We help clients achieve their ambitions for sustainable, profitable growth through:

- Stronger strategies and advantaged execution based on:
 - A better understanding of what drives client economics and value
 - Insight into changing industry dynamics and the context in which clients need to succeed
- A stronger management framework to generate better ideas and link decisions and actions to value
- A stronger organisation with a more focused top management agenda and well-aligned resources
- A more confident and effective leadership team that's focused, decisive and strategic

We have a joint team delivery approach where client ownership and engagement is paramount. Partners are highly engaged in the work product and supported by strong analytical and industry relevant capability. We work as advisers and catalysts in close, trust-based relationships with top management teams.

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