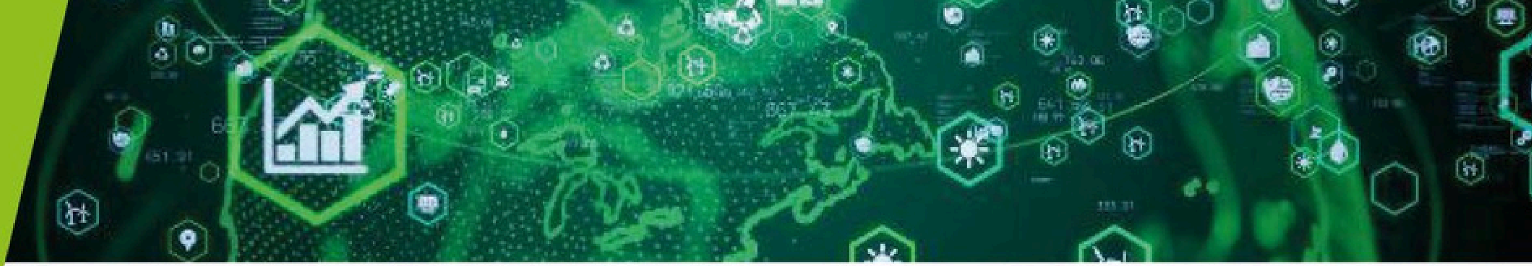

European Data Centre Association's
Technical Committee

Microgrids, Flexibility, and the Future of Energy Systems

EUDCA Viewpoint

EUROPEAN DATA CENTRE ASSOCIATION

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Microgrids, Flexibility, and the Future of Energy Systems

EUDCA Viewpoint

The data centre industry faces many challenges, with access to energy being chief among them. Can the industry play an active part in the evolving energy transformation becoming more than just consumers?

The data centre industry, as with many others, is facing a number of challenges. A key challenge is the evolving issue of energy in terms of supply and management. Energy grids locally, nationally, and internationally are struggling to meet demand, while at the same time undergoing digitalisation and development, as such their relationships with their energy consumers are changing. The strong likelihood is that in the near future, data centres will no longer be only consumers, but more active and supportive elements of a larger energy landscape.

Energy constraints

One of the key challenges faced by the data centre industry in relation to energy is supply constraint. With recent technological trends moving towards compute intensive workloads, including artificial intelligence (AI) and Generative AI (GenAI) in particular, this issue has come under intense scrutiny.

The EUDCA State of European Data Centres report 2025 has found that more than three quarters (76%) of data centre owners and operators say that access to power is going to be their greatest organisational challenge over the next three years.

The IEA reports that electricity consumption by data centres, AI and cryptocurrency processing could double by 2026. In the larger economies such as China, the US, and EU, data centres account for around 2-4% of total electricity consumption, while estimates are that in Ireland this figure proportion could be more than 20%.

The data centre industry has increased compute capacity manifold in the last 10-15 years, and yet, through a relentless focus on efficiency, has managed to keep overall energy consumption to less than 2% globally.

Despite this efficiency focus, locations such as Dublin, London and Amsterdam, all face energy constraints that have seen either slow, or no new connections for data centres. While new development areas are being seen around cities such as Madrid and Milan, the issue of energy constraints is forcing data centre owners and operators to look at other ways of reducing grid reliance, but also supporting grid development both in terms of digitalisation and energy balance for an increasing share of Renewable Energy Sources (RES) in the energy mix.

All of this is taking place amid regulatory changes for data centre owners and operators, such as the Energy Efficiency Directive (EED) reporting obligations that have come into effect, but also as more digital infrastructure falls under regulations such as the Digital Operational Resilience Act (DORA) or the NIS 2 Directive.

Location

One strategy that has been employed by some owner and operators is to select sites for large data centre facilities either in proximity to, or with, energy generation capacity. Microsoft with its project near the Three Mile Island nuclear energy facility, and Amazon with its Pennsylvania-based project typify this approach in sourcing low/no carbon energy sources. In other instances, operators are siting close to sources of hydroelectric power, as seen in Norway.

Availability of RES, not just energy capacity, is becoming a major factor in the planning decision for data centres generally, as the energy mix available of fossil fuel, low/no carbon energy, and renewables moves higher up the agenda.

There are also major investments in recently in wind farms and solar photovoltaic by data centres operators using Purchase Power Agreements (PPA), and more recently in on-site generation for data centres and data campuses, with geothermal and small modular reactors (SMR) all being actively investigated, implemented and combined. This has become more formalised in some instances such as in Dublin where the Commission for Regulation of Utilities has proposed strict new rules for energy generation, where new facilities connecting to the grid will be required to provide generation and/or storage capacity to match requested demand.

Microgrid approach

The implications for data centres are that, by combining energy sources — battery energy storage systems (BESS), on-site RES (e.g. Fuel Cells), and core generation, like gas turbine or potential future SMRs — owners and operators can confidently predict load shed or shave, or disconnect completely from the grid for extended periods, operating as microgrids — self-contained energy networks.

This can be a hugely beneficial support for those geographies where grid development may be lagging as well as experiencing demand issues. Furthermore, with data centres and campuses designed to handle increasingly larger proportions of RES, they can provide essential variability balancing services back to the grid to facilitate the grid's increasing mix of renewables too, potentially resulting in significant savings for grid operators by building out such capacity. In addition, as grids everywhere see digitalisation as a key development to becoming more efficient and resilient, they will be able to work with large energy consumers that have significant generation capability to take the surplus energy generated, especially, from RES, and feed it back to the grid.

Design considerations and wider implications

All of these operational models for data centres and campuses would have distinct design, infrastructure, and operational impacts that would need to be explored, weighing up the pros and cons. There would be significant investments in distribution, storage, and power trains. Data centres are increasingly likely to be active participants in energy systems, such as interconnected national grids. Therefore, their political, economic, and societal impacts will also become more pronounced and must be better explored and understood. The potential for data centre facilities to support developing grids must be examined beyond just the technical considerations. For example, the experience of EUDCA owners, operators, and vendors can be brought to bear regarding the political and economic aspects of developing national grids. This could range from the experiences and insights gained from supplying district heating schemes from waste heat to informing best practice on grid interconnects between regions, nations and continents, such as the proposed Celtic Interconnector initiative.

Service level agreements

Another area of consideration in this rapidly evolving landscape would be the impact on service level agreements (SLAs) with energy providers. With increasing levels of self-reliance, new parameters would have to be defined for supply as two-way flows from energy providers and the now prosumer data centre owners and operators would need to be accommodated, as well as for renewables variability balancing.

These energy developments represent a significant change for data centre owners and operators, as designs, equipment, technologies, services and supports would all have to be adapted to accommodate the shift towards contributing as energy producers, representing significant investment in money, resources, personnel and training. However, the potential benefits are also obvious in addressing energy constraints to meet demand, developing greater self-reliance, resilience, and meeting energy efficiency goals as well as broader sustainability ambitions.

Future energy sector

The data centre industry needs to adjust its mindset from being a consumer and service provider to being an active part of the solution to a decarbonised energy sector, working closely with governments, societies, and utilities to help power a liveable future.

Other works from the EUDCA on this and similar topics include:

- The Road to Zero Operational Emissions for Backup Power Generation
- Battery Technology Opportunities for Data Centres
- Is the microgrid the ideal solution for adaptive and reliable energy delivered as "software defined power for next generation data centres?"