Why energy strategy is key to data centre growth

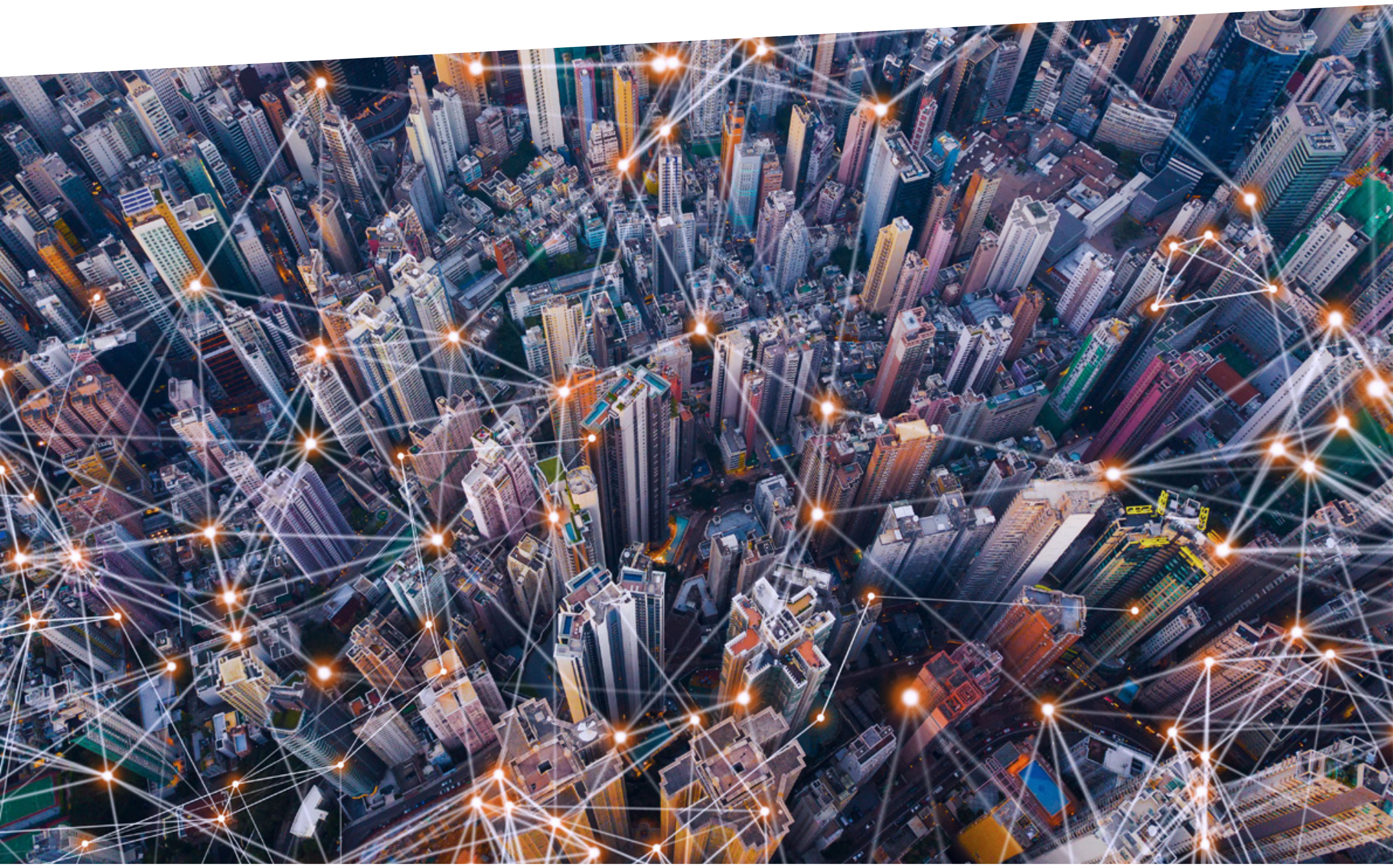
Data centres continue to cut emissions while enabling grid innovation

Introduction

The global pandemic and resulting lockdown have brought society's growing dependence on **data into sharp focus**. Whether due to remote working or home entertainment, the increase in video streaming alone caused a **40% surge in data** between February and April 2020[1].

Even before lockdown, our data consumption was on a well-established long-term growth trajectory. Gartner predicts that 30% of the workforce will be working from home by 2024. Data centre electricity use is likely to increase about fifteen-fold by 2030 to 8% of projected total global electricity demand[2].

To meet this increase in electricity use, and keep carbon emissions to a minimum, data centre operators need an **energy strategy** now more than ever.



1 Data Centres and Data Transmission Networks.
2 Nature: How to stop data centres from gobbling up the world's electricity.

Business drivers

Climate change. Without action, more data will lead to more emissions

When we think about industrial greenhouse gas emissions, we usually think of traditional carbon-intensive sectors like transport, agriculture or construction. But data centres and network communications companies are consuming ever-increasing amounts of energy. Data centres use an estimated **200 TWh each year**, creating CO_2 equivalent to **0.3%** of the world's carbon emissions. This may seem small, but the Information and Communication Technology (ICT) ecosystem as a whole (including personal digital devices, mobile-phone networks and televisions) accounts for more than 2% of global emissions. Meanwhile, ICT energy consumption is increasing by 9% every year[3].

How the major players are leading the net-zero journey

On a positive note, some of the really big players in the data centre world are already leading by example. **Microsoft**, which had previously set an interim goal of switching to **70% renewable energy by 2023**, now says it will meet its target of using 100% renewable energy for all of its data centres and buildings by 2025 – and will no longer use carbon offsetting to meet its goals. According to Microsoft, *"Purchasing renewable energy is consistent with our commitment to carbon neutrality. We are continually searching for ways to integrate more renewable power into our portfolio to lower our carbon footprint."*[4]

Within Europe, the Climate Neutral Data Centre Pact commits signatories to achieving targets for energy efficiency, procuring clean

[3] "Lean Ict: Towards Digital Sobriety": Our new Report on the Environmental Impact of Ict.
[4] Self-Regulatory Initiative.

energy, water use and other measures[5].

Google and **Apple** both claim to have already reached the **100% milestone**, with Google pledging to match renewable supply and demand hourly, 24/7 by 2030[6]. **Amazon** says it will run on 100% renewable energy by 2030. **Facebook** claims to have used 86% renewable energy for all its operations in 2019, and states: *"We're proud of how efficiently our data centres operate today, but we're always looking for new ways to increase that efficiency… with each new data centre we build, we add renewable energy to the local grid."*

The industry-wide efforts to reduce emissions are reflected in the overall statistics. Despite exponential growth in data and workloads, **energy demand from data centres has increased** only modestly over the past 10 years. Older data centres have been retired and repurposed. Improved energy efficiency measures have been widely adopted by small to mid-size data centres. Hyperscale data centres are functional and efficient, right down to the removal of video connectors and blinking lights from the machines that fill these huge data warehouses. However, as our demand for data grows, it will become harder to rely on further efficiency improvements to keep electricity demand down. There will come a point where electricity demand will start to climb; sourcing clean energy will be the only way to keep emissions down.

5 Self-Regulatory Initiative.
6 Google Pledges 24/7 Carbon-Free Energy by 2030.

The role of the circular economy

Many of the major players in the data centre sector have identified the **circular economy** – reuse and repair of servers, electrical equipment and recycling of server – **as a key sustainability metric**. Google released a case study paper[7] with **the Ellen MacArthur Foundation** in 2016 that announced the economic benefit of reuse, refurbishment and remanufacturing of servers and component parts. Circular economy is cited as one of the six levers towards climate neutral data centres by 2030 according to the Climate Neutral Data Centre Pact [8]. From a carbon standpoint, reducing the need for new materials by extending product life and developing recycling technologies reduces the need for mining, manufacture and transport of new goods. The emissions used to create these (known as Scope 3 emissions or "embodied carbon") are seen as an increasingly large piece of the puzzle as the sector transitions towards clean energy supply.

[7] Circular economy at work in Google data centers.
[8] Climate Neutral Data Centre Pact.

Managing grid capacity needs collaboration with major energy users

Awareness of public sentiment regarding carbon emissions has no doubt helped shape the energy reduction and zero-carbon policies of Facebook, Google et al. But there are practical considerations too, behind the drive to increase **energy efficiency** and reduce carbon emissions. The increasing and unpredictable demand that data centres are placing on the grid is prompting some governments to consider putting embargos on further data centre development. Another risk is that governments may put legislation in place to demand throttling mechanisms that place an upper limit on instantaneous energy use. This approach would require energy use capping mechanisms that turn off equipment or run servers more slowly – actions that are highly problematic for data centres. Either option would put unwanted constraints on tech corporations and limit their ability to meet the requirements and **Service Level Agreements (SLAs) of their customers**.

If data centre operators are to continue to expand their operations, they will need to work with energy companies to both reduce carbon emissions and increase grid stability. As large energy consumers, data centres are well placed to help improve grid stability in a variety of ways including through demand response mechanisms, for example. They are also able to guarantee long-term demand, thereby justifying investment in new sources of **renewable energy**. By improving grid stability and supporting the growth of renewable energy, data centres can help create a more secure energy future for everyone, while mitigating the risk of restrictions to their growth.

Building energy resilience is a two-way street

Grid stability is important to data centres, as they need a **constant**, **uninterrupted electricity** supply to operate. Large tech corporations, such as Facebook and Google, are expected to **deliver 100% uptime**. Similarly, enterprise customers expect 100% availability from their data centre providers. What's more, data centre outages are expensive. According to a recent study, the average cost of data centre downtime in 2020, across all industries, was approximately **$7,900 per minute**. On top of lost earnings from downtime, the financial penalties for even a few seconds loss of service can be severe.

Extreme weather events and natural disasters can also cause disruption to electricity supply. In 2021, the polar vortex that saw temperatures plummet in Texas, or the sudden flooding resulting from Hurricane Sandy in New York in 2012, put many data centres at risk and in some cases caused power outages. In the UK, a mobile operator's data centre in Leeds temporarily lost power due to flooding in 2015. And not all disasters are natural. In 2007, a truck drove into a transformer that was feeding power to a data centre in Dallas, Texas, disrupting power to the entire facility.

To protect against **power outages**, data centres typically operate a **back-up supply** capable of providing power within milliseconds of an outage occurring. This is in fact what happened with the data centre above; its emergency supply automatically kicked in and powered the servers and the chiller units. A back-up power supply will typically consist of **batteries**, to provide an instant response, and diesel or gas generators to cover any outage longer than a few seconds.

Data centre operators can (and in some cases do) use their back-up energy supplies to operate independently of the grid to support grid stability through capacity and ancillary market mechanisms. Understandably, some operators see this approach as a risk to their ability to meet their SLAs – but, in fact, such mechanisms can benefit both sides, as we shall see.

Dealing with the unpredictability of energy costs

As major electricity consumers, data centres need to be able to accurately **forecast costs** in order to plan their long-term growth strategies. However, predicting future electricity costs is a difficult task at the best of times and has been made even trickier by recent global events.

According to the **International Energy Agency**, COVID-19 caused a "staggering" fall in energy demand in 2020. Many suppliers have been put in a perilous position as wholesale electricity prices have slumped to their lowest in a decade. On top of that, suppliers are having to manage a surge in bad debts, as some customers struggle to make payments. With the uncertainties surrounding lockdown exit strategies, organisations have little idea when demand will return to normal, or indeed what normal looks like once lockdown is over.

The future of wholesale electricity prices is also affected by ongoing issues such as the fluctuating price of gas, the amount of renewable energy in the mix, unpredictability of demand and the cost of importing electricity from neighbouring countries. There is likely to be continued turbulence across the energy sector for some time, and for this reason, data centre operators need a **long-term energy strategy** in order to predict costs.

A grid in transition

Apart from accommodating an overall increase in electricity demand, grid operators have other less predictable challenges to manage. For example, in Poland, increased use of air conditioning is blurring the traditional lines between summer and winter demand. Energy pricing is increasingly volatile and prices have increased by 60% over the last three years.

As major energy consumers, data centres in Poland are increasingly motivated to participate in capacity market programmes to benefit from additional revenue streams, get early warning of potential grid problems and as a way of testing standby power systems under load.

Energy strategies

Lowering emissions, managing grid stability, maintaining resilience and coping with volatile electricity prices cannot be left to chance. To effectively tackle all of these issues, data centres need an energy strategy that encompasses every aspect of the organisation's energy use.

Energy and emissions visibility

The first step in creating a strategy is to get **full visibility of current energy use** and **emissions levels**. Getting a clear picture of a data centre's energy landscape helps to identify the specific needs, helps to optimise energy use, highlights inefficiencies, and enables benchmarking against similar organisations to assess performance.

Informed decision making requires accurate and easily accessible data. **Utility Bill**

Management (UBM) services provide visibility into how and when organisations use energy, establishing a baseline for further efficiency measures. Energy bills are rich in multiple layers of information, extending far beyond the utility company charges. Utility bill data can provide insights for budget forecasting and accruals, peer group analysis and carbon emission calculation as well as identifying opportunities for energy efficiency and optimisation.

To capture the environmental benefits of renewable programmes, carbon reporting is an integral part of UBM services. This allows organisations to track all data associated with the purchase, consumption and generation of renewable energy including its **impact on sustainability goals** and **environmental benefits** using market-based and location-based emission calculations.

Energy efficiency

Once an organisation has a clear picture of its energy landscape, the next step is to identify **opportunities for efficiency gains**. As mentioned earlier in this paper, many data centres have already moved towards using more efficient servers, and the big players have invested in highly efficient hyperscale data centres. As well as housing efficient, purpose-built servers, these huge data warehouses are also designed to **reduce the cost of cooling**. Google, for example, uses machine learning to automatically optimise cooling in its hyperscale data centres. Other organisations deliberately locate their data facilities in regions with colder climates, where outside air can simply be piped in to cool the servers. Microsoft is even testing underwater data centres to improve cooling efficiency.

Analysing hardware efficiency

For a long time, the data centre sector has focused on **Power Usage Effectiveness** (PUE) as an energy efficiency metric. There has been significant work done on the cooling side to address this, however commentators suggest that gains have flattened off over recent years[9]. A large proportion of a facility's energy draw comes from the IT hardware, servers in particular. With the slowdown in Moore's Law, the doubling of efficiency between successive generations is no longer as true as it was, meaning that there are opportunities to reduce operational energy and embodied energy simultaneously with the use of refurbished hardware and remanufactured machines[10]. Tools that calculate this and suggest optimum hardware solutions, have been developed to this end and deployed in mid-tier and smaller data centres as a means of reducing use phase emissions and furthering circular economy[11].

However, with hyperscale operators developing proprietary technology to cut costs and power, the divergence in data centre design and increase in bespoke solutions may render energy efficiency benchmarking standards less meaningful as like-for-like comparisons become harder to identify.

9 Uptime Institute: Beyond PUE: Tackling IT's Wasted Terawatts
10 Optimizing server refresh cycles: The case for circular economy with an aging Moore's Law (computer.org)
11 Interact: How to execute a 5-year strategy on server efficiency

Low-carbon energy

Efficiency measures can only go so far. Once efficiency has been maximised, the next step is to look at **sourcing green electricity for power**. The best way to do this is to make a long-term agreement with an energy company that can guarantee to deliver a supply of clean electricity sufficient to meet an organisation's growing needs.

Locating your data centre next to a solar or wind farm may compromise access to fibre communications, which in turn may adversely affect data latency. This is generally not a trade-off that operators are willing to make.

Increasingly, data centre operators are choosing to become off-takers using **power purchase agreements** (PPA). As well as guaranteeing supply, this approach allows them to reliably predict future costs.

However, negotiating PPAs can be technically complex. Some key PPA parameters include the term of the agreement; whether the PPA is a corporate arrangement, includes a private wire and/or storage; how risk is allocated between procurer and generator, including the volume risk. Optimising these parameters to deliver a bespoke agreement that suits both generator and off-taker requires depth of knowledge and experience.

Enel X and optical fibre infrastructure

To accommodate today's digital lifestyles, huge amounts of data is transmitted through fibre optic and copper cables. **Fibre optic cable** offers the fastest transmission speeds and is also a greener Internet solution. Fibre has a lower ecological impact than copper, reduces waste, consumes less energy and helps **decrease greenhouse gas** (GHG) **emissions**.

In 2018, Enel acquired 21% of Ufinet International, a fibre optic network operator in Latin America. UFINET, now part of the **Enel X Ultra Broadband Global Business Unit**, is a neutral optical fibre wholesale operator. It provides data connectivity and capacity services to operators and system integrators through fibre optic networks.

More than 70,000km of optical fibre has been deployed by Ufinet across 18 countries in LATAM connecting 64 data centres.

Case study

Leading multinational technology company accelerates renewable energy purchase through auctions

In 2018, a leading multinational technology company that specialises in internet-related services and products matched 100% of its **global electricity consumption with renewable energy** for the second year in a row. Looking to the future, they recognised that sustaining a 100% match would require thinking beyond its historical procurement methods. To continue meeting its users' needs in a sustainable way, it decided to streamline its renewables procurement process by running reverse auctions (where energy sellers bid for a buyer's business) for wind and solar projects. Their goal was to source, negotiate and sign a large wave of renewable energy deals in a single, global push.

Using Enel X's proprietary reverse auction technology, which is integrated in **Enel X Connect**, **10 agreements** comprising more than **1.2 GW of renewable energy** were successfully transacted. In addition to securing the renewable energy needed to maintain their industry-leading commitment to sustainability, running digital reverse auctions provided complete transparency, accelerated the procurement process and was instrumental in the achievement of cost optimisation goals.

Procurement

For a large electricity consumer, procuring clean electricity is not as simple as it is for domestic customer switching to a renewable energy supplier. Data centre operators can simplify their energy purchases through a holistic, **three-step process**:

1. Strategy

Understanding how different renewable energy resources and product options accomplish different objectives is the cornerstone of an effective renewable energy strategy. Data centre operators should prioritise their goals among reducing costs and emissions, budget stability, contractual complexity, speed to market and tenure.

The next step is to **select the best resources** e.g. wind, solar, biomass; the best products e.g. Power Purchase Agreements (PPAs), Virtual PPAs and Renewable Energy Credits (RECs); **the appropriate geographies**, and the types of production (new vs. existing projects) for tender.

2. Execution

Given the complexity of renewable energy contracts, **request for proposal** (RFP) definition is a critical step for apples-to-apples comparisons. RFPs should be structured to manage market, basis, counterparty, and contractual risks effectively. For example, commercial operation date (COD) guarantees, production guarantees, and REC deliveries should all be consistent across bidders so that organisations can evaluate deals on equal terms.

After qualifying renewable energy developers / suppliers, either sealed-bid or live renewable PPA auctions can be conducted to ensure bid transparency, exert maximum competitive pressure, and render the best possible price for renewable buyers.

The production of **physical** and **virtual PPAs** may then be integrated into your broader supply mix by optimising net meter aggregations, managing monthly market settlements, incorporating hedging and risk management strategies, arranging REC delivery, retirement, and arbitrage opportunities, and by providing scheduling and bid support for physical PPAs.

3. Support

To further maximise the economic benefits of renewable PPAs, revenue streams exist for renewable off-takers through managing and bidding renewable capacity into annual and seasonal capacity markets.

Your energy management partner should suggest **adjustment measures** and provide **administrative support for renewable energy reporting**. They should also assist with the management of RECs by ensuring received RECs are correct; by certifying, tracking, and retiring them with local registries, as well as validating invoices, incorporating renewable production into GHG emission reports and providing guidance in the development of **Carbon Disclosure Project** (CDP) reports and disclosures.

Demand response and resilience

Being available to respond in times of grid stress through **Demand Response (DR) mechanisms** has proven to be a successful flexibility strategy for data centres and grid operators for many years.

Demand response (DR) is a good fit for data centres but there are still questions around how participation works with some business models. For example, co-location data centres operate within strict customer SLAs, and operators are understandably cautious about adopting measures that are perceived as a threat to uptime.

Case study

Cork Internet Exchange (CIX), Ireland

CIX, is a 33,000 square foot co-location data centre with **4MVA of generative capacity**. It participates in the grid operator's demand response programme, guaranteeing **400kW of curtailed load** for up to 20 dispatches in a given year. In the rare event that the grid encounters difficulties, a demand response call is initiated. Enel X immediately relays that call to CIX, which already has a curtailment plan they can enact quickly. Rather than seeing DR as a threat to uptime, CIX uses **Enel X's dispatch intelligence** to mitigate power source interruption risk.

On the other side of the debate, some co-location data centre operators (and their customers) have actively embraced DR. The key reasons why data centres participate in DR programmes include:

1. DR participation is a better way to test backup systems

Most data centres still perform on-load testing of backup systems at pre-planned times, but grid outages don't occur at pre-planned times. Proving that you can respond correctly to DR events without advanced notice/planning is the most realistic way to test. And any problems that are revealed while doing this occur in a safer environment while the grid is still there, which is much less risky than finding a problem during a real grid event.

2. Responding to DR events can prevent an actual outage that would result in more grid downtime and longer time running on generators

This is an example of how the data centre can be a "good grid citizen" that helps everyone.

3. DR enables more renewables

Renewables like solar and wind are intermittent, so result in more disruptions to the supply/demand balance needed to maintain the grid frequency. Without large users like data centres participating on the demand side, more expensive frequency balancing capacity would have to be deployed from traditional generators. DR participants are improving grid sustainability by enabling more renewable generation, without increasing costs.

4. DR prepares you for potential future grid restrictions on maximum energy use

The same mechanisms put in place to respond to DR event triggers can be used to transfer some data centre load over to backup systems when a maximum demand threshold is reached.

As well as being a means to more robust resiliency measures, DR provides data centres with additional energy, capacity and ancillary payments simply for being on standby; valuable income to help offset energy costs.

Case study

DR in action – how Enel X created Australia's largest virtual power plant

One highly effective way that data centres can participate in DR programmes is through involvement in **virtual power plants** (VPPs). VPPs are a collection of distributed energy assets (such as backup generators and UPS battery systems) that work together to support the grid. For the exceptional times when the grid doesn't have enough volume of electricity or capacity in the network, a VPP can add capacity – creating a cheaper and greener alternative to building more generation capacity and adding network infrastructure.

In Australia, the transition to renewable power has increased grid frequency fluctuation and increased the cost of power. The **Australian Energy Market Operator** (AEMO) stated that to ensure system reliability and affordability, targeted actions must be taken to provide additional dispatchable capacity from the demand side (energy users). Enel X has responded to this need by creating **Australia's largest VPP**.

Data centres are a key sector of focus for Enel X's VPP programmes in Australia. They can participate without any capital expenditure or investment in additional equipment and can simply use existing assets to participate. The VPP participants alter their grid electricity consumption when needed simply by switching to onsite backup generation or UPS. Rather than exporting to the grid, data centres are paid to reduce consumption when the grid needs more supply. Enel X currently works work with several data centres in Australia, with **73 MW of data centre energy load under contract**.

This unique solution provides data centres with new revenue streams that can be reinvested in sustainability initiatives, while providing critical support to Australia's electricity grid. The grid support is only required under emergency conditions, typically for no more than 30 hours (~0.34%) per year. As data centres are important facilities where information security and facility stability are the top priority, they can be cautious about VPP participation. However, Enel X has proven to customers through actual applications that VPP participation is viable, safe, and can occur without interrupting regular operations.

Other examples of Enel X helping data centres to participate in DR programmes through VPPs include **South Korea**, where the data centre industry is growing at an extremely fast pace. Many global corporations – including AWS (operating at four locations including metropolitan areas and Busan), Microsoft (Seoul, Busan), Google, Oracle, SAP, have data centres there. Similarly, in Japan, where there are around 600 data centres run by commercial operators, Enel X is using its VPP technology to support **Japan's DR programmes**, by enabling data centre operators to automatically switch to backup generation.

Fast frequency response

Another way that data centres can work with grid operators for their mutual benefit is through **ancillary programmes** such as providing f**ast frequency response** (FFR). When grid operators have a large amount of renewable energy in the mix, there is less inertia and the system is more sensitive to sudden changes in frequency – threatening the balance of supply and demand and compromising the stability of the grid. FFR solves the problem by creating a sudden reduction in demand with response times less than one second in some markets.

Enel X has pioneered its own FFR technology and works with data centres and other businesses to support the evolution of the energy system. As with other DR mechanisms, **businesses are rewarded financially for their contribution**, and, thanks to Enel X's technology can participate without any capital investment.

Data centres have UPS systems onsite as part of their critical response setup. The latest generation of UPS systems are capable of maintaining a "floating" capacity in the battery, over and above that needed for critical load response, which can be enrolled in the flex markets through Enel X's technology platform. UPS systems are ideally placed to fulfil the need for fast responding assets to **help stabilise grid frequency**.

The technology can be seen in action in Ireland, which, according to Dr David Connolly, CEO of the **Irish Wind Energy Association**, "is number one in the world for the share of electricity demand met by onshore wind." As of 2020, Enel X manages over **400 MW of FFR capacity globally**. To participate in the FFR programme, clients must be able to respond very quickly when frequency drops, a process which can be automated using Enel X technology.

Holistic energy planning

Energy management initiatives extend beyond the matter of supplying power to the data centre itself. Increasingly, businesses are seeking **holistic approaches** to manage their energy needs.

Today, battery backup and diesel - or gas - powered generators are used extensively to support short - and longer - term business continuity in the event of power outages, but Microsoft has successfully tested **hydrogen fuel cells** to provide continuous standby power and help the company move away from fossil fuels[12]. In a similar move, Google has installed a large-scale battery plant at a Belgium data centre as backup power for 3 MW of computing load while also providing grid balancing services[13].

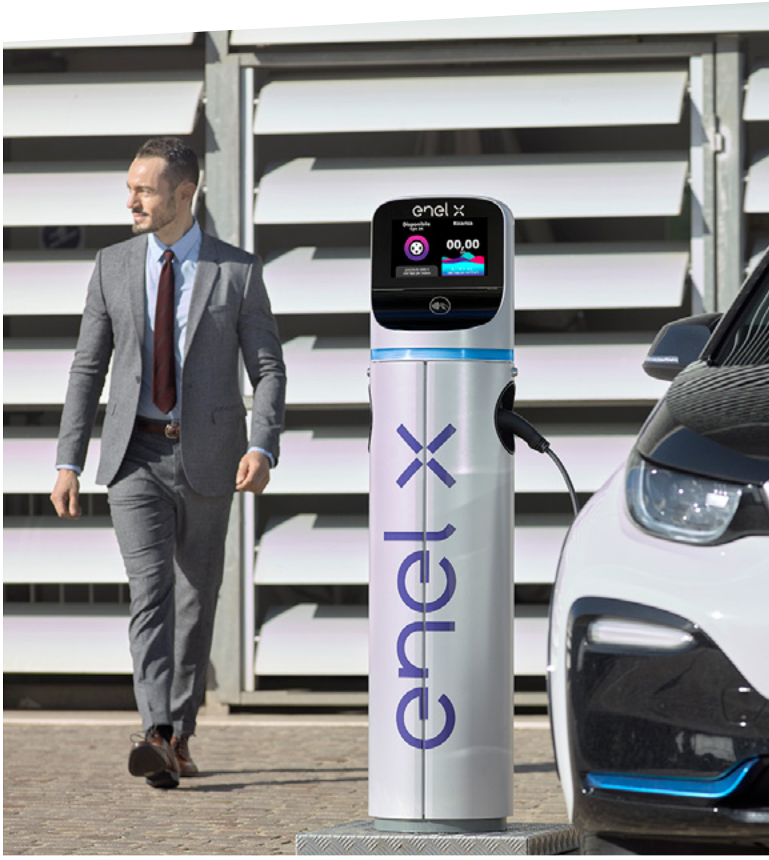
As the use of electric vehicles grows, workplaces are integrating charging infrastructure for employee and visitor use. **Smart EV charging** can play a role in grid balancing by integrating these more flexible, non-critical loads into an overall energy efficiency plan.

A holistic approach to managing energy typically incorporates efficiency measures, alongside other initiatives such as **Battery Energy Storage solutions**, **DR**, **PPAs**, **EV infrastructure** and **UBM**, which provides detailed insights into energy spend that can inform planning.

Funding energy efficiency

While major energy users see the benefits of planning a broad approach to energy strategy, finding capital to fund the measures can be a barrier to moving forward. A potential solution to address the funding barrier is to work with a specialist partner on an **'energy as-a-service' model**.

Energy-as-a-Service, or EaaS, helps to overcome the issue of having to find capital to fund improvements and forges a long-term relationship with a partner who can advise and deliver on PPAs, flexibility solutions, energy efficiency measures, UBM and other solutions. As well as monetising the flexibility of energy assets and reducing costs, EaaS enables **profitability**, improved **resiliency**, **sustainability** and **better risk management** – especially with respect to compliance and market exposure. Another key benefit of EaaS is increasing visibility into the overall impact of an organisations energy strategy – which is essential if data-centres are to meet emissions targets.



12 Microsoft tests hydrogen fuel cells for backup power at datacenters.
13 Google Thinks Data Centers, Armed with Batteries, Should 'Anchor' a Carbon-Free Grid.

Conclusion

Traditionally, the key challenge for grid suppliers was ensuring they had sufficient capacity to meet demand. Now, with the penetration of renewables they face additional challenges around system inertia. When data centres make their backup assets available to help balance the grid, they **improve grid stability** and also create a **return on investment** for these assets.

Without a comprehensive energy strategy, data centres will not be able to continue unchecked on their current trajectory of expansion. Operators will need to meet the challenges of **reducing carbon emissions**, managing the effect of their growth on **grid capacity**, **maintaining resilience** and **predicting future energy costs**. An effective strategy must include optimising energy efficiency, planning and implementing a procurement strategy, and exploring ways to co-operate with energy companies and grid operators. By committing to PPAs with clean energy suppliers and participating in grid balancing programmes, data centres can both help maintain the stability of the grid and find valuable new sources of income.

For most organisations however, energy in itself is not a core business competence and implementing an energy strategy that addresses all of these priorities takes knowledge and expertise and a current understanding of regulatory and compliance issues. Furthermore, putting the technology in place to support an energy strategy could present a significant capital challenge to data centre operators. For this reason, some data centre operators may see the EaaS model as an attractive option enabling them to deliver higher cost savings and lower long-term risk while addressing the growing complexity – and opportunities – of energy use.

The data centre industry has the resources and opportunity to play a partnership role as a platform for innovation in energy production, management and distribution at a scale that is unmatched by almost any other industry. Such a **partnership approach** could be the key to both **grid stability** and **data centre growth** over the next decade and beyond.

About Enel X

Enel X is Enel Group's global business line offering services that accelerate **innovation** and drive the **energy transition**. A global leader in the advanced energy solution sector, Enel X manages services such as demand response for around **6 GW** of total capacity at global level and **123 MW** of storage capacity installed worldwide, as well as around **186,000** electric vehicle charging points made available around the globe. Through its advanced solutions, including energy management, financial services and electric mobility, Enel X provides each partner with an intuitive, personalized **ecosystem** of tech platforms and consulting services, focusing on sustainability and circular economy principles in order to provide people, communities, institutions and companies with an alternative model that respects the environment and integrates technological innovation into daily life. Each solution has the power to turn **decarbonization**, **electrification** and **digitalization** goals into sustainable actions for everyone, in order to build a more sustainable and efficient world together.

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