



This whitepaper from Kao Data, in collaboration with Dallington Energy, provides insight into the winter energy outlook 2023/2024 and shares key information for data centre operators and end-users.

# The winter outlook for the GB electricity market 2023/24 and its implications for the data centre sector.

## Introduction

Ahead of the winter, Kao Data is publishing a new whitepaper to help data centre operators and end-users understand the current climate in the energy market and to provide readers with an outlook for the winter ahead.

We believe it is essential to reassure all businesses of the stability of the national electricity infrastructure and the contingency measures in place to keep British business dependent on data centre infrastructure, powered and connected.

National Grid Electricity System Operator (NGESO) has very recently published its important [Winter Outlook for the 2023-2024 winter period](#). The winter outlook details how the system operator will ensure the electricity transmission network remains balanced through the winter and how they will keep the lights on for homes and businesses.



## This year

**This year wholesale electricity prices have remained volatile following Russia's invasion of Ukraine and the subsequent cessation of gas flows from Russia to Europe.**

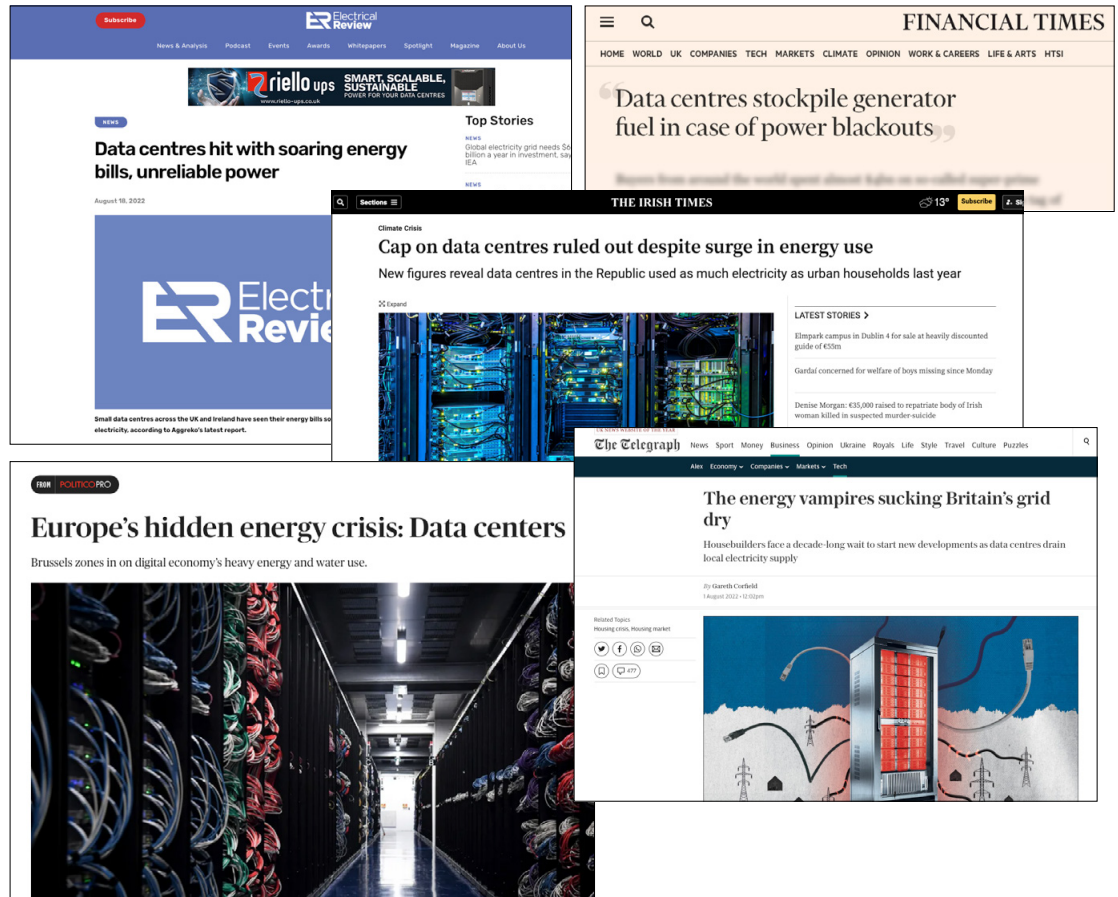
As gas is a major source of fuel for electricity generation, wholesale gas and electricity prices are linked. As the gas price moves, so does the electricity price. While the markets have adjusted to this 'new normal' and energy prices have come down to more reasonable levels, they remain high and prone to volatility.

## Last winter

**Last winter there was extensive media speculation about the potential for electricity blackouts in spite of NGENSO publishing a robust winter outlook, which detailed exactly how they planned to keep the network whole across the winter period.**

In hindsight, there were no blackouts, as predicted by those knowledgeable within the energy industry. This winter we aim to avoid similar speculation and instead, plan to provide information and reassurance that day-to-day business won't be interrupted.





In October 2022 there was a flurry of media activity predicting blackouts in *“those deepest, darkest evenings in January and February”*, which were in fact the words of National Grid Chief Executive John Pettigrew.

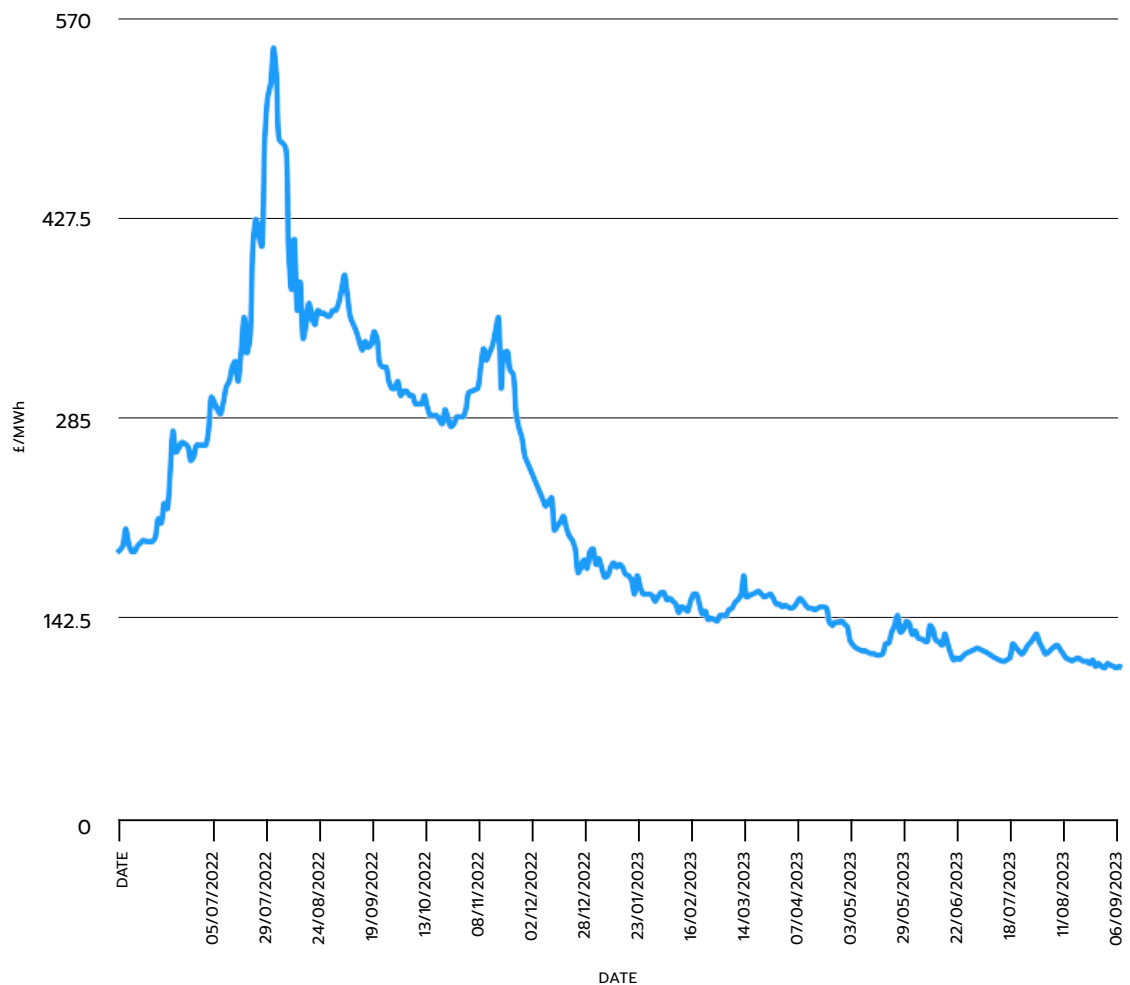
The comment was, unsurprisingly, taken out of context, and John Pettigrew was describing what might happen in the very worst-case scenario - if wholesale energy supply worsened and demand remained high at peak times in the coldest months.

Data centre operators also faced accusations of stockpiling diesel in readiness for last winter, with the subtext being that data centres were depriving other users of essential supplies of diesel for back-up power generation.

This of course is not true, data centre operators always maintain fuel for back-up power, often for between a few hours and a few days of generation, and some operators confirmed they would increase their reserves to allow them to generate on back-up for a week. This is all perfectly routine, and data centre operators always ensure they can operate if there's a power outage, which often includes provision of diesel, or as in Kao Data's case **100%** sustainable HVO fuel.

There is no doubt that last year energy prices were staggeringly high and unmanageably volatile, which created uncertainty and worry for the winter period when GB demand is at its highest. Before the Russian invasion of Ukraine and the subsequent energy crisis, typical winter electricity prices were considerably less than £100/MWh. In August 2022 the winter electricity price reached £545/MWh.

### GB wholesale electricity price development - Winter '23



If the media had taken a look at NGENSO's Winter Outlook for 2022/23 they would have seen that in spite of the challenging market conditions, the plan for winter was extremely robust. The energy market can be challenging to penetrate at times but the winter outlook is well-documented and well-explained.

We urge the media to present a more balanced view in future years as opposed to offering up sensationalist articles focusing on the worst case scenario.

Despite the media predictions, the reality last winter was that there were no blackouts. NGENSO's rigorous planning and preparation meant that they barely had to dip into their 'enhanced actions' to keep the system whole.

**NGESO has three levels of intervention they make to balance the system;**

1. **Everyday actions** - the routine activities NGENSO does behind the scenes, everyday, to ensure the system is balanced and whole.
2. **Enhanced actions** - a further set of actions that are called upon if the everyday actions are insufficient.
3. **Emergency actions** - only called upon in the most extreme of circumstances and if the enhanced actions are insufficient.

There are two key enhanced actions that NGENSO can call upon; the **Demand Flexibility Service**, a scheme where domestic energy users and businesses can **reduce electricity consumption** in specific periods and receive payments for doing so; and **Winter Contingency Units**, electricity generating capacity that is held in reserve, and paid to do so, and is called to generate only if required.

The National Grid Demand Flexibility Service (DFS) was tested and called upon as an enhanced action last winter, and as a new service being tested for the first winter, it was a success. 1.6m businesses and households participated in 22 events across the winter reducing their demand in specific peak times, as instructed by NGENSO, successfully saving over **3,300MWh** of electricity.



*"1.6m businesses and households participated in The National Grid Demand Flexibility Service (DFS) last winter, reducing their demand to save over 3,300MWh of electricity."*

In preparation for the winter period, five coal generating units at three power stations were contracted to be available. This measure held power generation capabilities in reserve as an enhanced action to minimise the risk of blackouts.

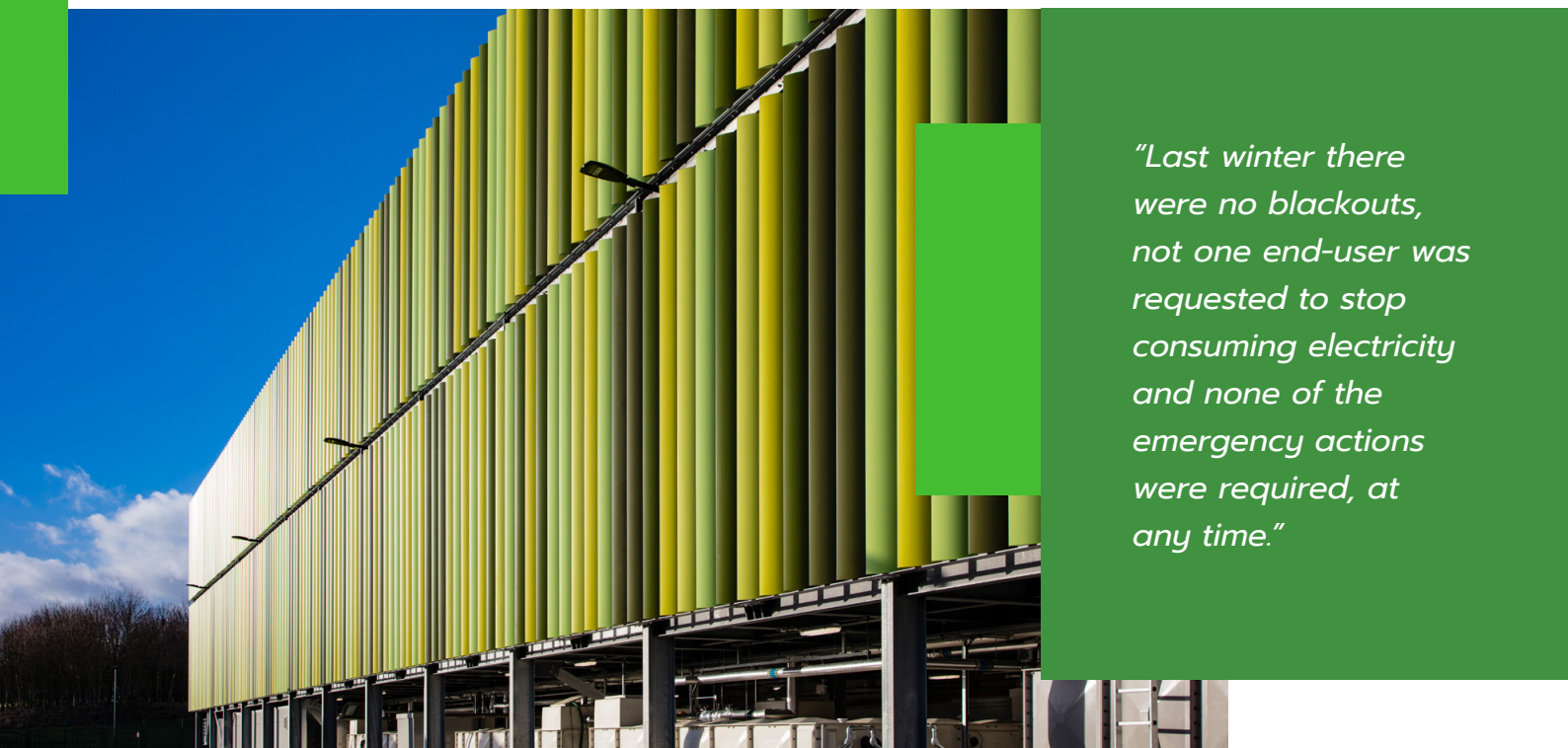
Coal contingency plant was requested to “warm” i.e. prepare to generate, on two occasions but was not in fact required to run.

NGESO also has available to them an action called an Electricity Margin Notice (EMN). An EMN can be issued at any time, but usually a day ahead, and indicates to the market that NGESO is looking for more generation or reduced demand due to system tightness. During winter 2022/23 there was only one EMN issued, on Tuesday 7 March, which was ultimately cancelled ahead of time.

NGESO is physically linked to other European electricity networks via interconnectors and maintains reciprocal arrangements across those market interconnections, with electricity flowing in both directions as and when required. Last winter, as ever, those interconnections were used throughout the winter to keep our system whole and to keep the systems whole of our nearest neighbours.

In conclusion, we must be very clear, last winter there were no blackouts. No end-user was requested to stop consuming electricity. NGESO carried out completely normal operations to keep the system whole. None of their emergency actions were required, at any time.

Reports of the potential for blackouts were unnecessarily alarming. The media got it wrong, and primarily because they chose not to examine the publicly available evidence that described exactly how the system would be kept whole.



*“Last winter there were no blackouts, not one end-user was requested to stop consuming electricity and none of the emergency actions were required, at any time.”*



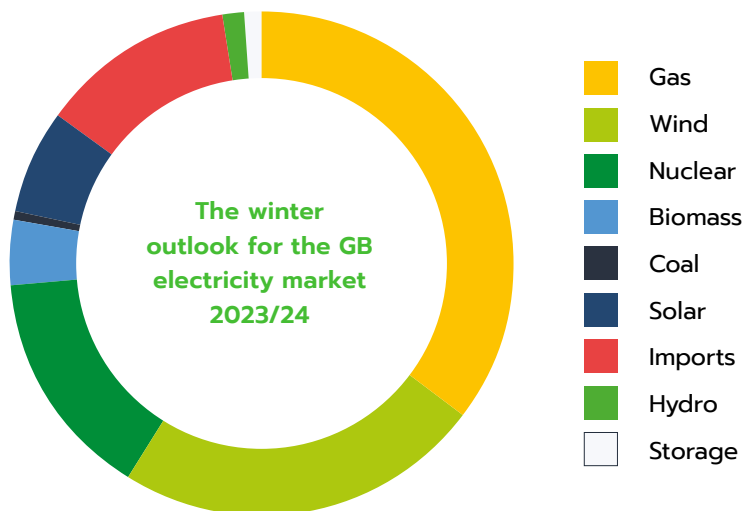


## Electricity generation in Great Britain

Great Britain's electricity is increasingly being generated from renewable or low carbon sources.

According to NGENSO in September 2023, **49%** of electricity came from zero-carbon sources, peaking at **86%** on 24 September at 1pm. During the month we also saw the lowest ever carbon intensity in the electricity system, **27gCO<sub>2</sub>/kWh**. In context, to reach our net zero goals we must be below **100gCO<sub>2</sub>/kWh** by 2030 and below **50gCO<sub>2</sub>/kWh** by 2050.

As the chart below shows, while we generate most of our own electricity, we still rely upon our nearest neighbours to import a small proportion of our electricity via interconnectors.



For the forthcoming winter season, NGENSO has forecast an electricity system margin – the amount by which electricity generation exceeds peak demand, of **4.4 GW (7.4%)** throughout the winter, which is similar to levels in recent years, but slightly higher than last year (**6.3%**). This is of course a forecast and a view, NGENSO will almost certainly use some of their enhanced actions e.g. the Demand Flexibility Service, on days of high demand at peak times.

## The market outlook for winter 2023/24

Electricity prices have come down considerably since this time last year, over **£350/MWh** then, versus **£110/MWh** today, as we have adapted to the reduced gas supply from Russia and are now importing Liquefied Natural Gas (LNG) from further afield.

In addition, French nuclear generating capacity is looking much better this winter, whereas there were a high number of outages last winter. The increased availability of French nuclear generation supplies on the continent has also created additional volume which can be sourced for the UK, should we need it.

Gas prices have softened to such an extent across the summer and autumn that we've been able to inject gas into storage bringing UK gas storage levels up to **c.99%** full and the EU up to **98%** full. On top of that, the UK now has increased storage capacity as Centrica increased the capacity of their Rough storage facility in the North Sea.

As gas demand is currently low, and as the weather has remained mild, there is a steady stream of LNG tankers at sea, off European coastlines, waiting to unload when the price is right. This is another positive sign that there is wholesale energy available to us.

Early weather data shows a milder and wetter winter than average, which will suppress peak demand and reduce the requirement to withdraw gas from our storage facilities. The longer gas storage remains available to us, the longer prices will remain softer.

While much of the market news is positive, there is some uncertainty in the market about supplies of LNG from Australia, which supplies around **10%** of global LNG. Workers at LNG facilities are embroiled in a dispute about pay and conditions and have already carried out strike action. At the time of writing this whitepaper the dispute is ongoing with no clear sign of resolution.

We have recently seen exactly how geopolitical events can impact energy prices, with GB electricity spot prices jumping **c.45%** in just a few days following the escalating conflict in Israel and Gaza. While neither are significant energy producers the market sees the potential for wider disruption in energy supplies in the Mediterranean and Middle East. The outlook has been somewhat moderated by the Saudi Arabian pledge to help stabilise the region and markets through diplomacy and oil production but GB whole power prices remain around **20%** higher than prior to the escalation of the conflict.

Overall, however, the wholesale energy supply and storage outlook looks positive, and prices are at a more manageable level, so the winter outlook in that regard is good and is better than last year.

Two notes of caution; (i) we have no coal contingency units this winter (ii) the Brent crude oil price has increased by **25%** since spring, now sitting at over **\$90/bbl**, and this could generate some wider energy market price increases and volatility.

*"Overall, however, the wholesale energy supply and storage outlook looks positive, and prices are at a more manageable level, so the winter outlook in that regard is good and is better than last year."*



# The NGENSO Winter Outlook 2023/24

## Margins

This winter NGENSO is forecasting a margin of **4.4GW (7.4%)** on an average cold spell peak demand.

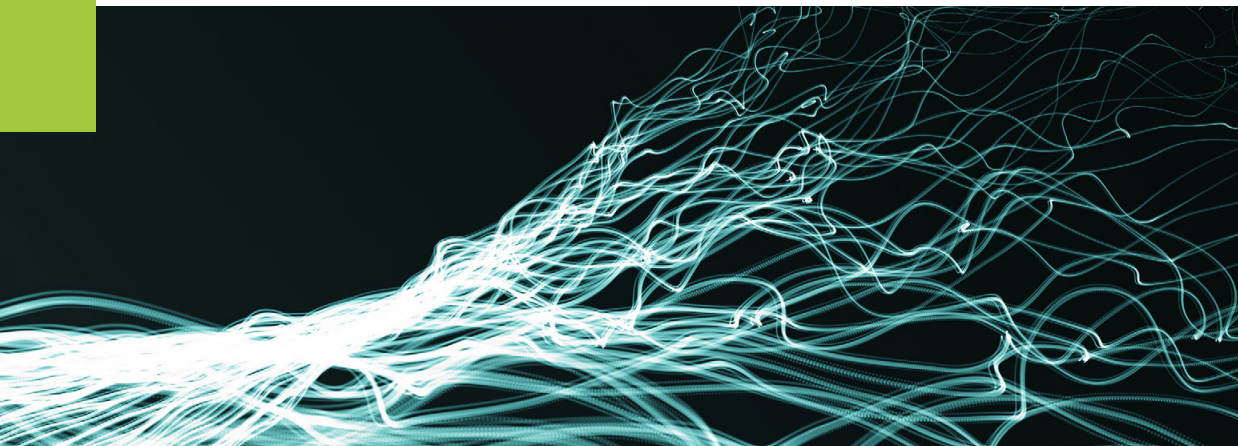
This is a slightly higher margin than last year (**6.3%**) due to;

- Availability of more generation than last winter due to more generation from gas units, one of last winter's coal contingency units has returned to full market operation rather than contingency, and a small increase due to newly installed wind capacity.
- Increased supply from battery storage and operation of demand side response.

There are, however, some forecast reductions in volumes flowing through interconnectors and an increase in peak demand.

The margin forecast is based on NGENSO's base case which assumes all generators, storage, interconnectors and DSR providers all perform as per their obligations and that there is no disruption to gas supplies.

On top of this base case, NGENSO expects to use some of the standard operational tools available to them e.g. Demand Flexibility Service (DFS) and Electricity Margin Notices (EMNs). NGENSO expects to have sufficient operational surplus throughout the coming winter in the base case scenario even when variations in demand, wind generation, and plant outages are taken into account.



## Scenario planning

While the base case scenario looks very positive, NGENSO also plans for less likely scenarios.

This is particularly important now as the gas supply demand balance is more delicate due to the cessation of gas flows from Russia into Europe.

Last year two credible scenarios were developed;

- (i) reduced electricity imports from Europe.
- (ii) reduced electricity imports from Europe and insufficient gas supply in GB.

In the latter scenario we now have very high gas stocks compared to last year and National Gas Transmission, who have developed their own winter outlook, say that *"it would take a combination of events"* to cause significant issues in GB this winter and as such they *"consider this to be an unlikely scenario"*. We must also bear in mind that these scenarios are mitigated by the increased generation from French nuclear plant.

NGESO has developed a scenario where we experience materially reduced electricity supplies of around **4GW** but is confident that supplies can be maintained by using the Demand Flexibility Service (DFS). If in the unlikely event this was still not enough, then NGENSO has further emergency measures it can call upon.





## Emergency scenarios

Under their most extreme scenario for maintaining the operation of the electricity network NGENSO may call upon a process called the Electricity Supply Emergency Code (ESEC), legislation that grants them “exceptional powers for controlling the sources and availability of energy.”

The ESEC is a well-established process and in the event of an emergency there are three levels of activity, in this order;

1. UK Government appeals to the nation for voluntary restraint in electricity consumption;
2. Directions to restrict the consumption of electricity by industry and commerce;
3. Directions requiring rota disconnections and associated restrictions.

In these extreme scenarios important national infrastructure will be protected from being required to stop using electricity, and crucially that includes data centres.

Even if there were an extreme energy event that required Kao Data to stop consumption of electricity, like all modern, Uptime Institute Tier 3 equivalent, concurrently maintainable data centres, we have robust back-up generation capabilities available to us, with priority service contracts to deliver additional fuel to run said back-up generation as required.

For example, Kao Data customers can be assured the highest levels of resiliency and uptime in the highly unlikely event of electricity supply issues owing to the fact that we operate back-up generators that can run for 48 hours concurrently on **100%** sustainable hydrotreated vegetable oil (HVO).

Long-before that even becomes a consideration, however, our customers can have confidence that the national energy system will be balanced and maintained through winter 2023/24 by NGENSO - just as it was last winter, and countless winters before that.

*“Data centres are now classified as national critical infrastructure, and protected from measures that require them to disconnect from the grid, or power-down.”*





## Summary

**The GB electricity system is well-managed and robust. Last winter, when the situation was more precarious, the system was kept whole using some of the enhanced actions available to NGESO.**

Some of the enhanced actions were called upon e.g. Demand Flexibility Service, and others were not e.g. coal contingency units. Yet in hindsight, what's clear is that none of the emergency actions were required.

Looking forward to the winter 2023, the market is far more stable, gas stocks are high, and we have LNG waiting offshore, French nuclear plant has returned to service, interconnections are all operational, and prices are more moderate.

*"We have seen that the energy markets performed as expected over the last year and there is currently no reason to doubt this won't be the case for this winter."*

National Grid Electricity System Operator (NGESO)

## Frequently asked questions

### 1. How does Kao Data ensure energy efficiency for customers?

At Kao Data, all our data centres have been precision-engineered for energy efficiency and we continue to provide customers with an SLA-backed PUE reaching as low as **1.2**, even at partial loads.

To achieve this, all of our high performance facilities have been rigorously modelled and tested under various operating conditions using digital twins software, allowing us to fine tune our designs to ensure the highest levels of efficiency. We also utilise a highly efficient, hybrid cooling system to minimise energy consumption.

Finally, we monitor all power consumed directly at the rack level, allowing us to be transparent with our customers and report their energy consumption directly back to them.

### 2. What types of energy or back-up power does Kao Data utilise?

At Kao Data, all our data centres are powered by **100%** certified renewable energy, and we continue to work with our energy provider and the Little Cheyne Court wind farm in Kent to ensure that every electron of energy we consume is matched by an equivalent new capacity generated at this specific UK energy asset.

This, we believe, is key to going beyond the Renewable Energy Guarantees of Origin (REGO) system, ensuring our energy provision is as green as possible, while pushing the boundaries of what's possible in terms of UK energy procurement.

Additionally, we were the first operator in Europe to transition all our back-up power generators to **100%** renewable hydrotreated vegetable oil (HVO), allowing us to reduce **90%** of net CO<sub>2</sub> emissions and minimise the use of fossil fuels across our platform.

### 3. What steps does Kao Data take to maintain 100% uptime in the event of a blackout or outage?

Should we experience a grid outage at Kao Data, we have several mechanisms in place to ensure uptime for our customers' critical workloads. They include robust uninterruptible power supplies (UPS) and back-up power generators.

Each one of our generators is tested for two hours each month, ensuring they're in good working condition and ready to become our primary source of power should the National Grid experience an outage.

Today we have a proven track record for **100%** uptime, and our customers can be assured that resiliency of their critical applications is our number one priority.

### 4. Are data centres deemed critical and protected infrastructure?

Yes, during the early stages of the Covid 19 pandemic, data centres were named critical infrastructure by the UK government and are now deemed as important as utilities such as energy and water.

This also means an enhanced level of security is needed to ensure data centre assets are secure and protected, in the same way that utilities are prioritised.



## About the author

Wayne Mitchell has over 25 years of energy sector experience, most recently as an independent consultant, advising major energy users, and prior to that spending 20 years in industrial and commercial energy retail with E.ON and npower.

He has worked with some of the most high profile energy consumers helping them navigate the most volatile energy market conditions. In his most recent corporate role as the Director of Corporate & Strategic at E.ON, Wayne was also a member of the senior leadership team of the £5bn revenue industrial and commercial division where he was responsible for all major energy clients across electricity, gas, export, and metering.

Today Wayne has a reputation for creativity, commercial rigour, and generating new revenues, and has led successful teams in pricing, sales, operations, marketing, energy services, and origination. He has written a series of blogs for Kao Data during and following the energy crisis and has now written this whitepaper to help data centre operators and end-users understand the outlook for the winter ahead.

**For further information about Kao Data, [Visit the website.](#)**





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