



Whats new in Green IT?

St**A**irway to Heaven or **A**lhighway to Hell?

John Booth BSc (Hons) Tech (Open), CDCAP, CDCSP, MBCS (aka Grim Reaper)
MD Carbon3IT Ltd

BCS Green IT SG AGM 2024

BCS London
31st October 2024



“Don't fear the Reaper”





John Booth

MD - Carbon3IT Ltd

Technical Director – National **Data Centre** Academy

Vice Chair British Computer Society - Green IT SG

BSI TCT7/3 Committee Chair – ISO/IEC 30134/22237 & EN 50600 **Data Centre** Standards

EU Code of Conduct for **Data Centres (Energy Efficiency) Joint Author/Reviewer/Committee Member**

Data Centre Alliance – Chair SIG **Data Centre Energy Efficiency & Committee Member Sustainability**

DCD CEEDA (Certified **Energy Efficient Data Centre** Award) Global Lead Assessor

ISO 50001 **Energy Management** Systems Lead Auditor/ISO 22301 Business Continuity Management Systems Lead Auditor

Energy Saving Opportunities Scheme (ESOS) Lead Assessor – Energy Management Association

Certified **Data Centre Audit** Professional (CDCAP™) & Certified **Data Centre Sustainability** Professional (CDCSP™)

TechUK Data Centre Council Member, ESG and Skills Working Groups

Advisory Board - **Sustainable Digital Infrastructure** Alliance

iMasons – Sustainability Committee - Leadership



StAIrway to Heaven ?





Or...AI way to Hell?





AI – Heaven or Hell?

The “Promise” of AI

Energy

Supply Chain

Cost (Financial and Environmental)

AI’s Possible Future

Whats new in Green IT?



What is AI?

Artificial intelligence (AI), in its broadest sense, is intelligence exhibited by machines, particularly computer systems.

It is a field of research in computer science that develops and studies methods and software that enable machines to perceive their environment and use learning and intelligence to take actions that maximize their chances of achieving defined goals.

Such machines may be called AIs.

The “Promise” of AI



The “Promise” of AI

TOP 10 Advantages of Artificial Intelligence



1. Impact on the Job Market
2. Healthcare and Medicine
3. Banking and Finance Industry
4. Transportation Industry
5. Improved Efficiency and Productivity
6. Better Decision-Making Capabilities
7. Enhancing Customer Experience
8. Manufacturing Industry
9. Customer Service Industry
10. Entertainment Industry

The Ides of March



Beware the Ai'ds of March (The Ides of March)

Beware the AI'ds of March (The Ides of March)

By John Booth, DCA Energy Efficiency SIG & MD Carbon3IT



THE IDES IS THE DAY on the Roman calendar to indicate roughly the midpoint of the month it is usually the 15th, the Ides of March became famous as the date of Julius Caesar was assassinated in 44BC. According to Plutarch, a seer had warned that harm would come to Caesar on the Ides of March. Enroute to the Senate, Caesar has passed the seer and joked "well, the Ides of March are come", implying that the prophecy had not been fulfilled, to which the seer relied, "Aye, they are come, but they are not yet gone"

"Julius Caesar was assassinated by a group of senators on the Ides of March (15 March) of 44 BC during a meeting of the Senate at the Curia of Pompey of the Theatre of Pompey in Rome where the senators stabbed Caesar 23 times. They claimed to be acting over fears that Caesar's unprecedented concentration of power during his dictatorship was undermining the Roman Republic. At least 60 to 70 senators were party to the conspiracy, led by Marcus Junius Brutus, Gaius Cassius Longinus, and Decimus Junius Brutus Albinus."

Source: Wikipedia, accessed 7th May 2024 https://en.wikipedia.org/wiki/Assassination_of_Julius_Caesar

You may wonder where I am going with this, but AI and its impact on the data centre sector appears to me to be "an unprecedented concentration of power" it, AI, is taking over all rational thought and perhaps we should all take a deep breath, and consider what we are doing...

The dominant topic at the recent data centres events that I've attended is AI.



It is top of a list compiled by Simmons and Simmons <https://www.simmons-simmons.com/en/publications/cluuzex800hyatcw3kkq0xs/top-10-issues-in-data-centres> published on the 11th April 2024, the

"The Impact of AI on Data Centres" and has links to number 3 on the list "Balancing Net Zero with human need" and 4 Critical Infrastructures for powering data centres, as well as 8 "Supply chain challenges" and 9 "Lack of Skilled labour in the industry".

But, are we sure about AI?

Personally, I'm not convinced that AI will turn out to be the pancea that some are saying, yes, its good for healthcare and for analysis of geo-data which can be used to determine where and what we should consider for adaptation and mitigation of climate change, I'll even go so far as to say that it can eliminate errors and optimise production lines, but you could do that with sigma six and kaizen methods. The darker side of AI is fake news, outright disinformation and deep fakes, and I am not convinced that enough is being done from a legislative or self-regulatory point of view to address these issues.

From a data centre perspective, it appears to be "technology for technology's sake", AI chips use more power and thus require more cooling, a recent conversation revealed that one of the major players in the space have advised a power/cooling global manufacturer to prepare for 500kw racks.

Its clear that legacy data centres will not and cannot provide the infrastructure to support this path, meaning that AI will have to be located in "state of the art" data centres, which will take at least 3 years to build, even if we had a design ready to go, which we dont, so perhaps longer. Add to that the lack of power in the traditional data centre hubs and the question really is, where are we going to put them, and thats to assume that we'll be able to obtain the vast amounts of power required. One area could be the Nordics, to take advantage of renewable energy and a suitable climate, but if we were to deploy at



An unprecedented...

*“You may wonder where I am going with this, but AI and its impact on the data centre sector appears to me to be “an **unprecedented concentration of power**” it, **AI**, is taking over **all rational thought** and perhaps we should all take a deep breath, and consider what we are doing...”*



“But are we sure about AI?”

*“Personally, I’m not convinced that **AI** will turn out to be the **panacea** that some are saying, yes, its good for **healthcare** and for analysis of **geo-data** which can be used to determine where and what we should consider for adaptation and mitigation of climate change, I’ll even go so far as to say that it can **eliminate errors** and **optimise production lines**, but you could do that with sigma six and kaizen methods.*

*The darker side of **AI** is **fake news**, **outright disinformation** and **deep fakes**, and I am not convinced that enough is being done from a **legislative** or **self-regulatory** point of view to **address these issues.**”*

AI – Sheesh!

AI crossing to be installed near football ground



SHROPSHIRE COUNCIL/GOOGLE

A new Toucan crossing which uses AI detection will be installed on Oteley Road in Shrewsbury

Shehnaz Khan

BBC News, West Midlands



AI – Heaven or Hell?

The “Promise” of AI

Energy

Supply Chain

Cost (Financial and Environmental)

AI’s Possible Future



Energy - Here be "Dragons"

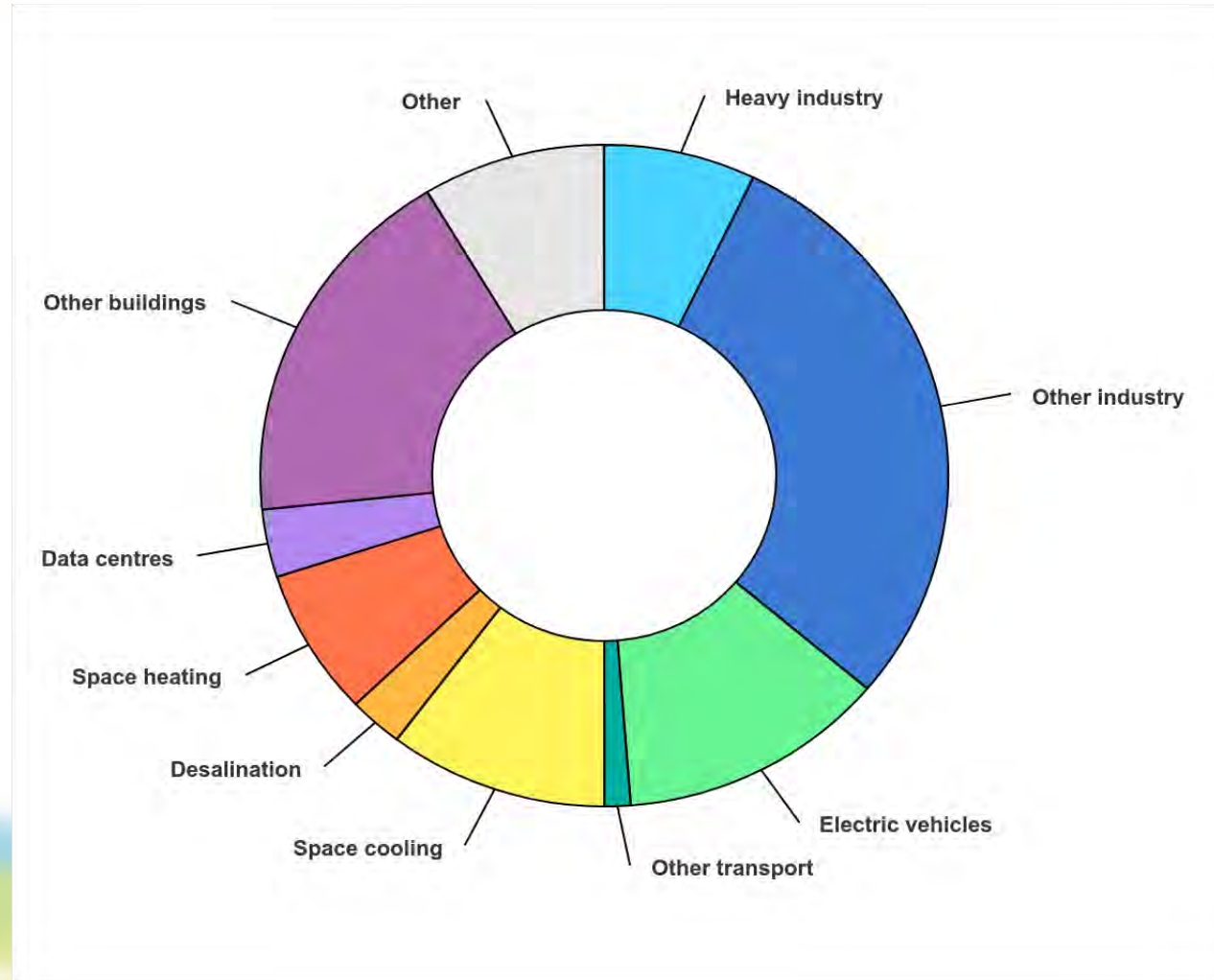




IEA 18 Oct 2024

In part because of expectations for **AI**, the next few years will see a **substantial rise** in the **number and size** of **data centres**. This growth will be partially mitigated by continued **efficiency** improvements at both the **hardware** and **software** level. Nonetheless, electricity demand from data centres is set to **grow strongly** to 2030 under today's policies settings and trends.

However, when considered in a **broader context** of **total electricity consumption growth globally**, the contribution of data centres is **modest**. Global aggregate electricity demand grows by **6 750 terawatt-hours (TWh)** by **2030** in our Stated Policies Scenario, **equivalent** to more than the **combined demand** from the **United States** and **European Union** today.





Carbon³IT Q- Data Centre Energy Demands - Global

How much energy is consumed by data centres globally ?

STILL,

NO ONE KNOWS!

But...



A- Data Centre Energy Demands - Global

International Energy Agency (Sept 22)

Global data centre electricity use in 2021 was 220-320 TWh, or around **0.9-1.3%** of global final electricity demand.

<https://www.iea.org/reports/data-centres-and-data-transmission-networks>

Electricity 2024 Update



A- Data Centre Energy Demands - EU

The energy consumption of data centres in the EU 28 increased from **53.9 TWh/a** to **76.8 TWh/a** between 2010 and 2018 . This means that in 2018, data centres accounted for **2.7%** of the electricity demand in the EU 28.

Compared to 2018, the energy consumption of data centres is expected to increase by **21%** to **92.6 TWh/a** by 2025.





EU-JRC Report - 2024



<https://publications.jrc.ec.europa.eu/repository/handle/JRC135926>



EU-JRC Report - 2024

Data centres in the EU used an estimated 45–65 TWh of electricity in **2022**, equivalent to **1.8–2.6%** of total regional electricity consumption.

The top four data centre markets – Germany, France, the Netherlands, and Ireland – accounted for nearly **two-thirds** of the region's data centre energy use, despite having less than **40%** of the population.

Data centres represent over **2%** of national electricity use in **Ireland** (18%), the **Netherlands** (5.2%), **Luxembourg** (4.8%), **Denmark** (4.5%), and **Germany** (3%), **Sweden** (2.3%), and **France** (2.2%).

Telecommunication networks used an estimated 25–30 TWh of electricity, equivalent to **1–1.2%** of total EU electricity use.

The four largest Member States by population and GDP (Germany, France, Italy, and Spain) were also the four largest users of energy for telecommunication networks, accounting for **65%** of the total.

Network energy use as a share of national electricity use was both lower and more uniform compared with data centres, ranging from 0.5% to 1.5%. In contrast, data centres as a share of national electricity use range from as low as 0.4% in some countries to as high as 18% in Ireland.



EU-JRC Report - 2024

The **combined energy use of data centres and telecommunication networks** in the EU was **70–95 TWh** in **2022**, equivalent to **2.8–3.8%** of total regional electricity use.

The four largest Member States – Germany, France, Italy, and Spain – accounted for about **60%** of total digital infrastructure energy use in the region.

Digital infrastructure accounts for more than **5%** of national electricity use in **four** countries, each with major data centre markets: **Ireland (19%)**, **the Netherlands (6%)**, **Luxembourg (5.5%)**, and **Denmark (5%)**.



Q- Data Centre Energy Demands - UK

How much energy was consumed by **UK** data centres between 2021-2023 (TP 5)?



Global Data Centre Energy Forecast?





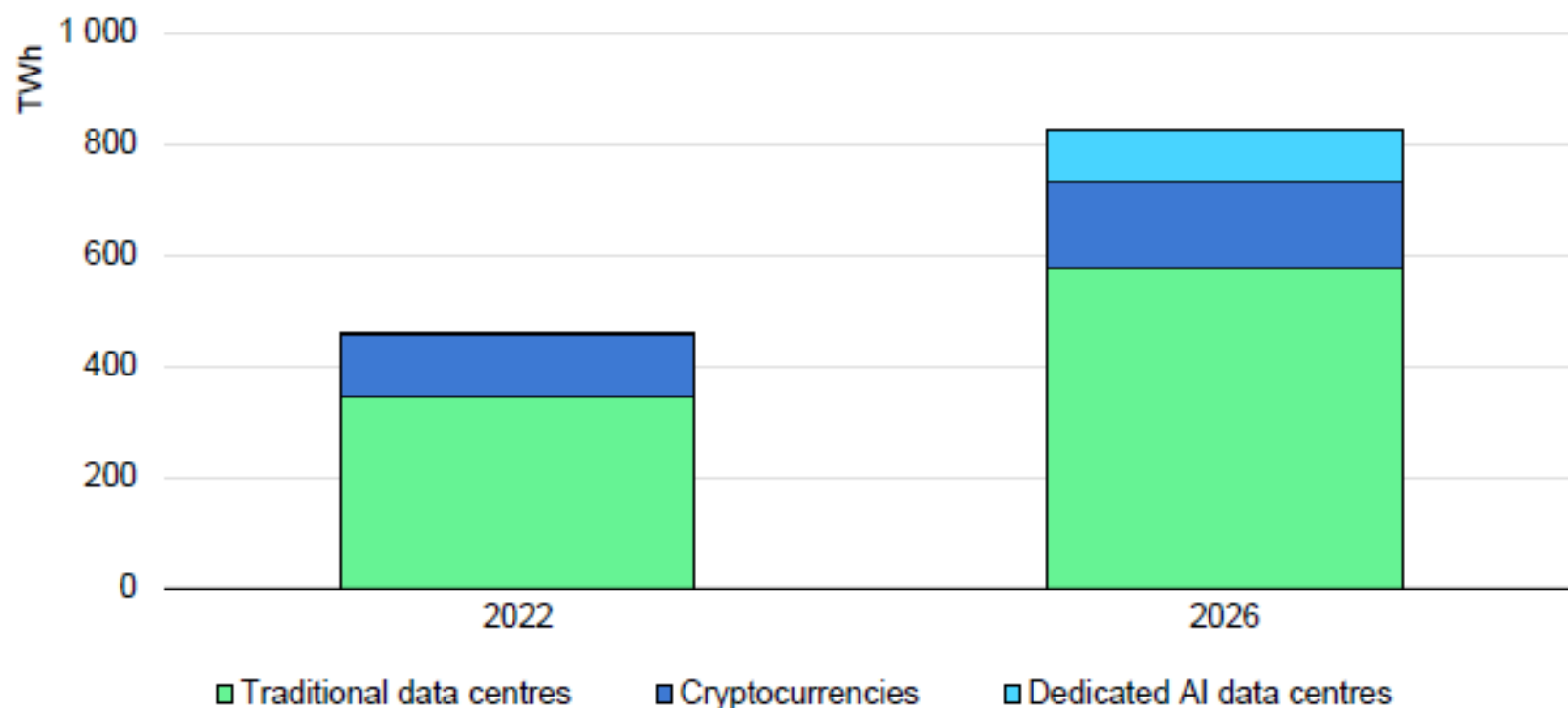
Global Data Centre Energy Forecast?

Global electricity demand from data centres could double towards **2026**

We estimate that data centres, cryptocurrencies, and artificial intelligence (AI) consumed about 460 TWh of electricity worldwide in **2022**, almost 2% of total global electricity demand.



Estimated electricity demand from traditional data centres, dedicated AI data centres and cryptocurrencies, 2022 and 2026, base case



IEA. CC BY 4.0.

Note: Data centre electricity demand excludes consumption from data network centres.

Sources: IEA forecast based on data and projections from [Data Centres and Data Transmission Networks](#); Joule (2023), Alex de Vries, [The growing energy footprint of artificial intelligence](#); Crypto Carbon Ratings Institute, [Indices](#); Ireland Central Statistics Office, [Data Centres Metered Electricity Consumption 2022](#); and Danish Energy Agency, [Denmark's Energy and Climate Outlook 2018](#).





Data Centre Energy Numbers - Global





Data Centre Energy Demands - UK

We don't really know!

What we do know is that the **commercial** data centre sector, i.e. Colocation in the CCA 5th Period

January 1, 2021 to December 31, 2022 was...

9.65 TWh



CCA 5th Period

Average PUE UK (CCA) = 1.70

Global Average (Uptime Inst) = 1.55

65 Organisations in the Scheme

30 did NOT meet their Target!



UK DC – New Projects

Havering	600 MW
LB Tower Hamlets	72 MW *
LB Newham (Tate & Lyle)	210 MW *
Culham (Old JET Fusion Reactor)	141/575 MW *
Lincoln (Humber Tech Park)	386 MW
British Volt	1100 MW *
South Mimms	300 MW
Basildon	??? MW

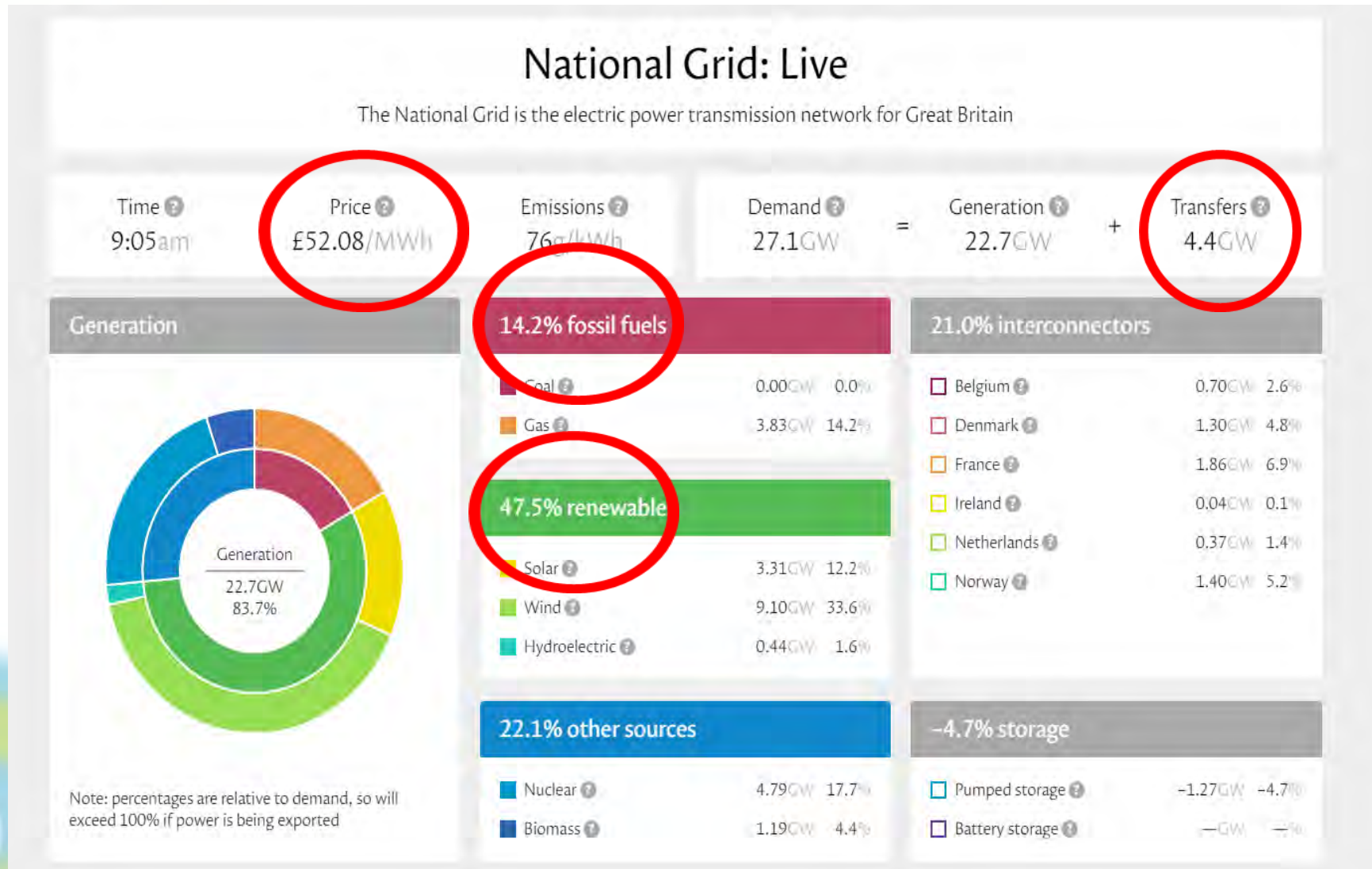
Total

2.9 GW

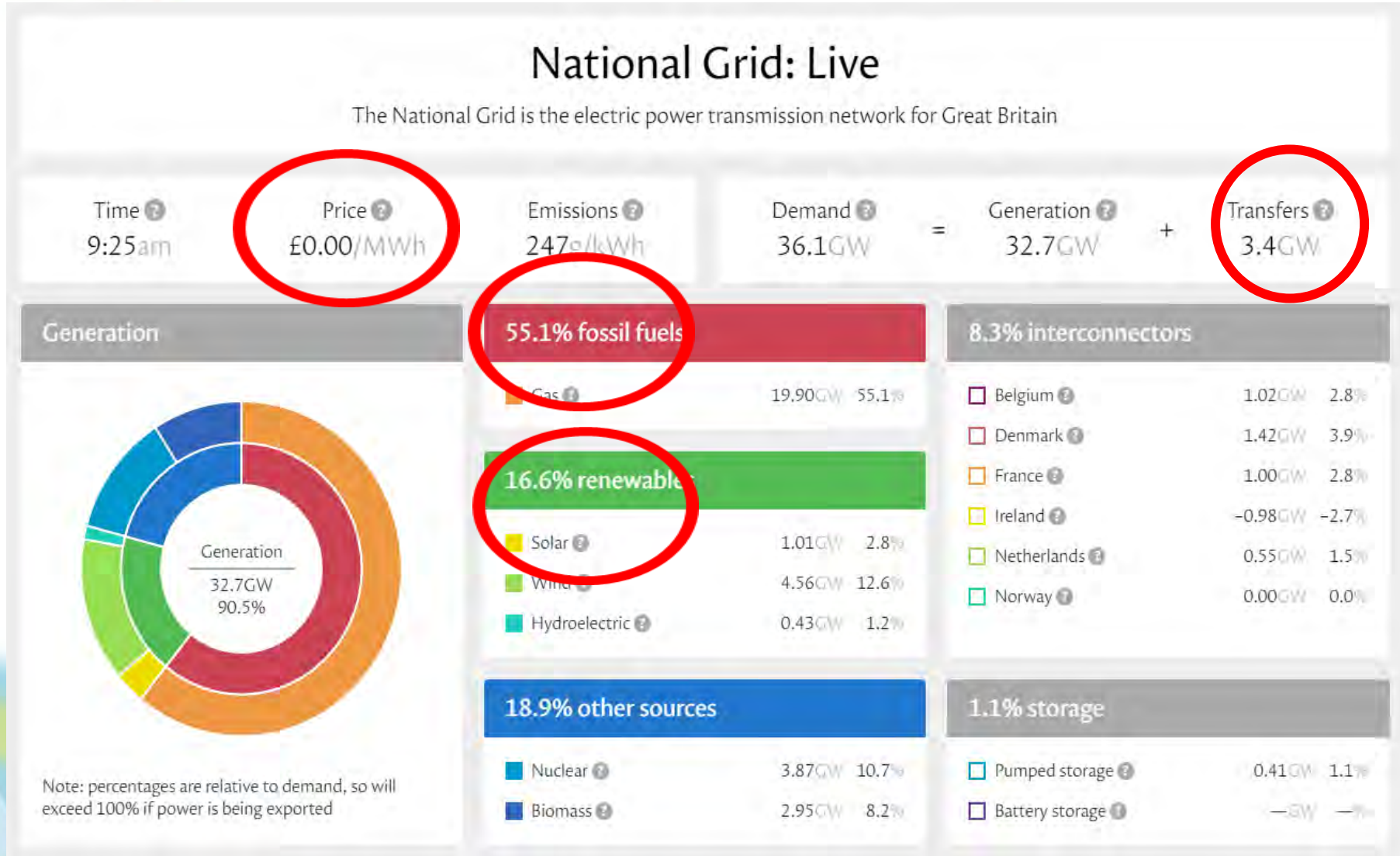
The “Elephant”



UK Energy - Debt



UK Energy - Debt



National Grid - CEO

Data centre power use 'to surge six-fold in 10 years'

🕒 26 March · 💬 275 Comments



The boom in artificial intelligence (AI) and quantum computing will drive a spike in energy use, the National Grid has predicted.

Both rely on data centres - warehouses full of computer systems.

Chief executive John Pettigrew said the power those data centres use would increase six-fold in the next decade.

He said the grid was becoming "constrained" and "bold action" was needed to create a network able to cope with "dramatically" growing demand.

"Future growth in foundational technologies like artificial intelligence and quantum computing will mean larger scale, energy-intensive computing infrastructure," Mr Pettigrew said.



Sunday Telegraph 13th October 2024

The age of energy rationing is looming for Britain

UK warned of blackout risk as nuclear power shrivels and Ed Miliband races towards net zero



UNSUSTAINABLE!

1. "not able to be maintained at the **current rate or level.**"

"macroeconomic instability led to an unsustainable boom"

Ecology

upsetting the ecological balance by **depleting natural resources.**

"unsustainable fishing practices"

2. not able to be upheld or defended.

"both remarks are unsustainable"



EU Legislation

Taxonomy Climate Delegated Act (TCDA)
2025

Taxonomy Climate Delegated Act (TCDA)

Energy Efficiency Directive (EED)

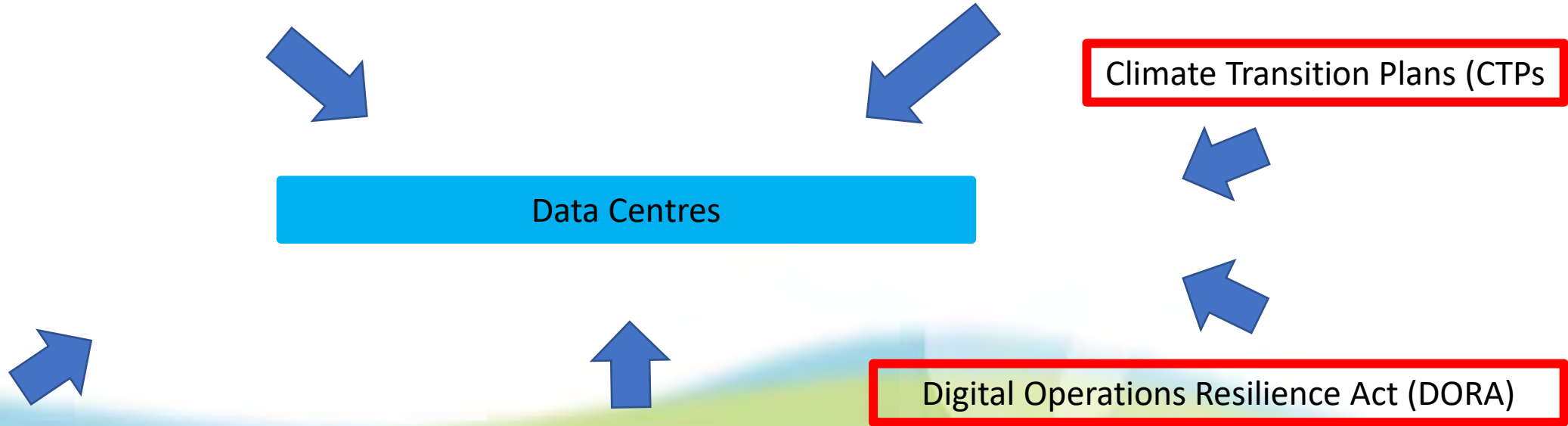
Climate Transition Plans (CTPs)

Data Centres

Digital Operations Resilience Act (DORA)

Corporate Sustainability Due Diligence
Directive (CSDDD)

Corporate Sustainability Reporting Directive
(CSRD)





UK-DCs

Critical National Infrastructure!

[HOME](#) > [NEWS](#) > [THE MANAGEMENT & OPERATIONS CHANNEL](#)

UK government designates data centers as Critical National Infrastructure

Means operators can call on more support in emergencies

September 12, 2024 By: Matthew Gooding [Have your say](#)



UK-DCs

Critical National Infrastructure!

Data centres powering the economy will be *designated* as *Critical National Infrastructure (CNI)* alongside energy and water systems.

<https://www.gov.uk/government/news/data-centres-to-be-given-massive-boost-and-protections-from-cyber-criminals-and-it-blackouts>



So,

Energy Infrastructure

Data Centre Regulations (Energy Efficiency/Sustainability?)

New Power Stations?

Hinkley Point C - Operational **2036!**

Sizewell C – Environmental Permits - **March 23**

New Nuclear – Jan 24 **?**

Grid Upgrades - ?

Disruption/Environmental Issues & Cost?



Options

Abandon UK net zero ambitions

Accelerate new energy plants

SMR's (GBN Investment Decision)

Fusion

Wind/Solar

✓

2029

2040?

✓

Abandon AI

?



The AI “Gold Rush” Supply Chain

The people who really made money on the **California Gold Rush** were **merchants**. Take Levi Strauss. When he heard news of the California Gold Rush, he headed to San Francisco where he established his wholesale dry goods business in 1853. Then in 1872, Strauss partnered with one of his customers, a Reno, Nevada, tailor named Jacob Davis, who was designing heavy cotton work pants hammered with rivets in the pocket corners to make them more durable. The company, "Levi Strauss & Co." couldn't sell enough of their "waist high overalls" to the miners, lumberjacks and farmers. And, well, you know the rest of the story.

And remember Sam Brannan from the beginning of our story — the one who basically kicked off the gold rush by paraded around with that vial of precious metal? Rather than staking a claim on the gold, Brannan bought up all the equipment that prospectors would need; then, when the rush began, re-sold the merchandise at a steep markup. His store made enormous profits, selling as much as \$5,000 (about \$155,000 in 2020 dollars) in goods per day to miners. He became California's first millionaire, perfectly illustrating the old maxim, "**during a gold rush, sell shovels.**"





Capital Plant





Construction Costs

Tender prices for data centre construction projects are expected to rise at a constant rate in the coming years.

58 percent of respondents to our survey reported rises of **5 to 15** percent over the past 12 months, with a further 21 percent reporting more than a 15 percent increase. The majority expect tender prices to continue rising at the **5 to 15** percent rate over the next 12 months, but about a third of respondents anticipate rises might slow to around a 5 percent increase.

Globally, the overall average year-on-year cost increase across the 2024 index is nine percent, compared to six percent in 2023. Our 2024 index considers the current average cost per watt to build in 50 key data centre locations globally.

<https://reports.turnerandtownsend.com/dcci-2024/data-centre-cost-trends>



Construction Costs

Tokyo	US\$ 14.30/W
London	US\$ 11.20/W
North Virginia	US\$ 11.50/W
Phoenix	US\$ 9.40/W

“Global demand is consistently outstripping the capability of supply chains and regions to deliver, pushing up prices, especially in markets with limited labour and contractor pools. Several core markets currently have 50 MW+ facilities under construction and, as construction activity has intensified, so have costs.”

<https://reports.turnerandtownsend.com/dcci-2024/data-centre-cost-trends>



Capital Items – Lead times

Generators – 8 Months – 2 years

Substation Transformers – 26-30 Mths

LV/MV Pods – 52-56 weeks

Chillers, - 6 Mths

CRACs – 6 Mths

UPS – 6 Mths

Batteries – 6 Mths

RMUs – 6 Mths

CDUs – 6 Mths

Construction Plant





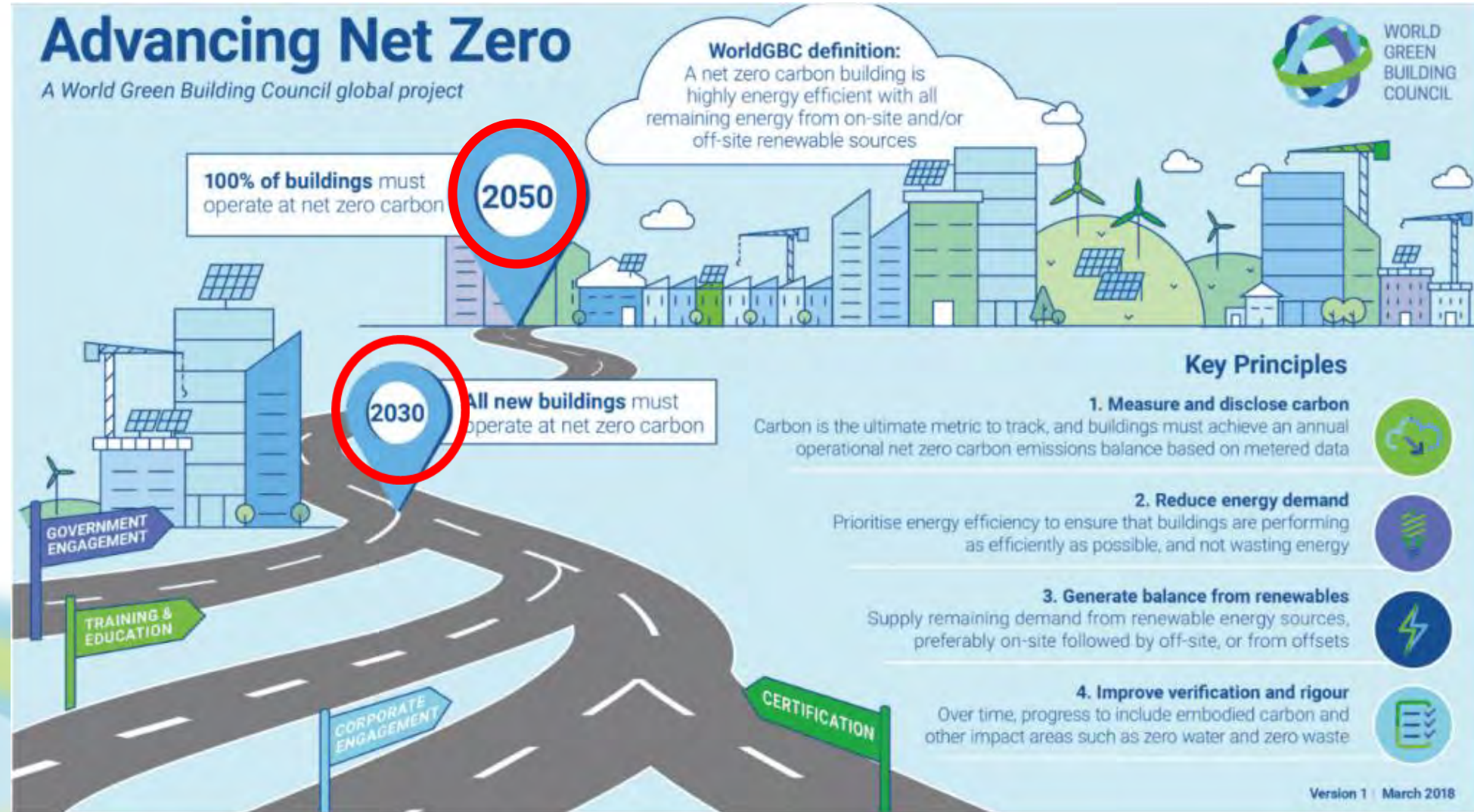
Construction Plant -

The broader economic recovery in the UK has had a profound impact on the construction sector. With the easing of COVID-19 restrictions and a rebound in business activity, there has been a resurgence in construction projects across the country. Key economic indicators, such as GDP growth and employment rates, have shown positive trends, further fuelling confidence in the market.

*However, the industry also faces challenges, including potential supply chain disruptions and regulatory changes. **The increasing focus on sustainability and reducing carbon footprints may lead to stricter regulations, impacting the production and usage of construction machinery.** Additionally, the global nature of the supply chain means that any international disruptions could have a **ripple effect** on the UK market.*

Source: <https://ccemagazine.com/news/uk-construction-equipment-sales-surge-amid-economic-recovery/>

Net Zero - Buildings



Advancing Net Zero

A World Green Building Council global project

WorldGBC definition:
A net zero carbon building is highly energy efficient with all remaining energy from on-site and/or off-site renewable sources

100% of buildings must operate at net zero carbon **2050**

All new buildings must operate at net zero carbon **2030**

Key Principles

- 1. Measure and disclose carbon**
Carbon is the ultimate metric to track, and buildings must achieve an annual operational net zero carbon emissions balance based on metered data
- 2. Reduce energy demand**
Prioritise energy efficiency to ensure that buildings are performing as efficiently as possible, and not wasting energy
- 3. Generate balance from renewables**
Supply remaining demand from renewable energy sources, preferably on-site followed by off-site, or from offsets
- 4. Improve verification and rigour**
Over time, progress to include embodied carbon and other impact areas such as zero water and zero waste

Government Engagement
Training & Education
Corporate Engagement
Certification

WORLD GREEN BUILDING COUNCIL

Version 1 | March 2018



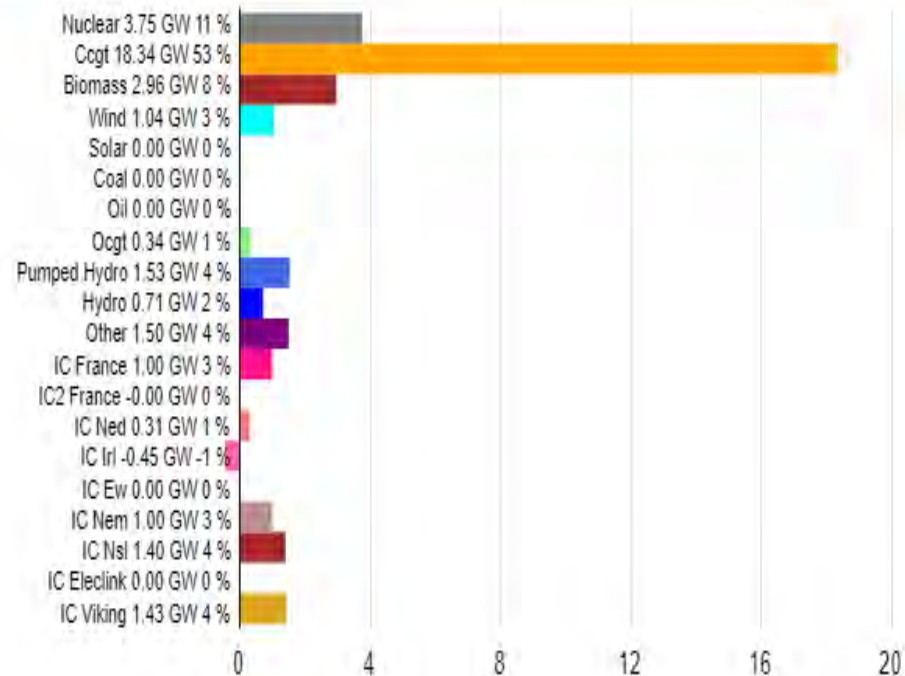
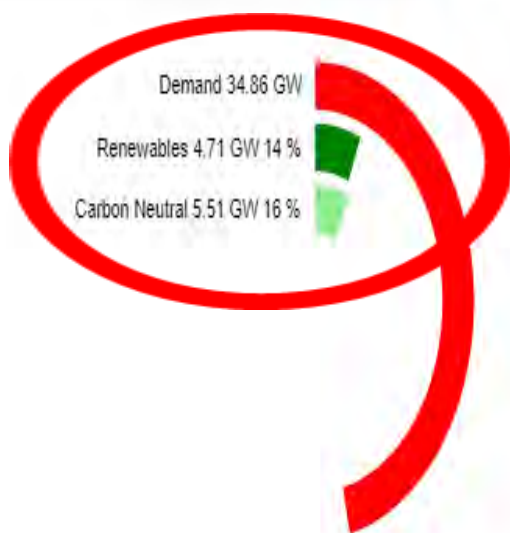
Decarbonised Grid



GB Fuel type power generation production

last update 2024-10-13 17:35:00 GMT

Bars **Meters**





Decarbonised Grid

The UK government has committed to fully decarbonizing its electricity grid by **2035** as part of its net zero by 2050 plans. This will require **significant investment, planning, and coordination** across the **government** and **private sector**.

Here are some of the challenges and opportunities associated with decarbonizing the UK's electricity grid:

Demand

Electricity consumption is expected to double by 2050. The Climate Change Committee anticipates that UK energy demand will be **50% higher** than pre-Covid levels by **2035** and **100% higher** by **2050**.

Infrastructure

New infrastructure is needed to connect renewable energy sources, such as offshore wind farms and solar, to homes and businesses. Building **new grid infrastructure** takes a **long time**.

Technologies

The UK will need to transition away from **fossil fuels** and **adopt new technologies**, such as **electric vehicles** and **heat pumps**.

Public support

The government will need to build and maintain public support for the transition.



Decarbonised Grid

Some say that decarbonizing the grid by 2030 is possible with **rapid reforms**. Others say that the UK's goal is **ambitious** and that it may **not be achievable** by **2035**.



Data Centre of the Future

Sustainable Buildings?

Decarbonised Grid?

Rethink our AI ambitions?

Legislation will force...

A Radical Rethink?



Data Centre of the Future

Sustainable Buildings?

Decarbonised Grid?

Rethink our AI ambitions?

Legislation will force...

A Radical Rethink?



Legislation

In a legal context, **regulations** are a type of **secondary legislation**: law made by a person or body other than parliament within the framework of an enabling Act of Parliament.

Regulations specify **detailed requirements** or **standards** developed to implement the principles and objectives set out in **primary legislation**.

More broadly defined, **regulation** is the **use of rules, incentives and penalties** to **change** the **behaviour** of individuals or **organisations**. While rules may be set out in law, this is not always the case.

Regulation involves not only setting standards but **monitoring performance** against them and **enforcing compliance**.

<https://www.instituteforgovernment.org.uk/explainer/regulation>



Data Centre of the Future

Sustainable Buildings?

Decarbonised Grid?

Rethink our AI ambitions?

Legislation will force...

A Radical Rethink?



Energy Efficiency

"At the IEA, we call energy efficiency 'the first fuel' – which shows its significance."

Fatih Birol
Executive Director, IEA

International
Energy Agency



EU Code of Conduct for Data Centres (Energy Efficiency)





EU Legislation

Taxonomy Climate Delegated Act (TCDA)
2025

Taxonomy Climate Delegated Act (TCDA)

Energy Efficiency Directive (EED)

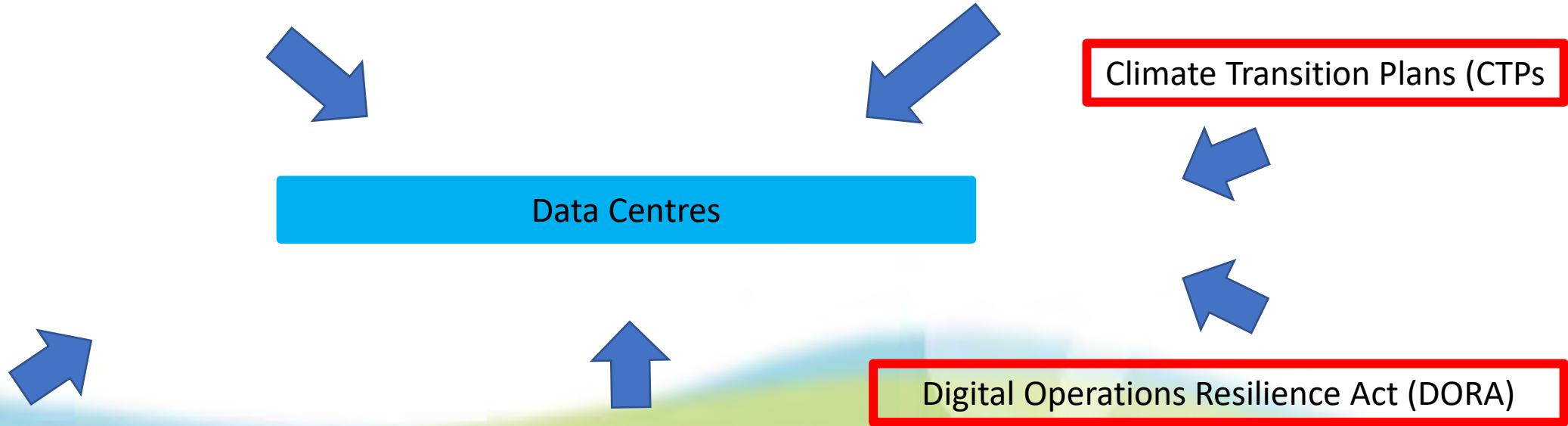
Climate Transition Plans (CTPs)

Data Centres

Digital Operations Resilience Act (DORA)

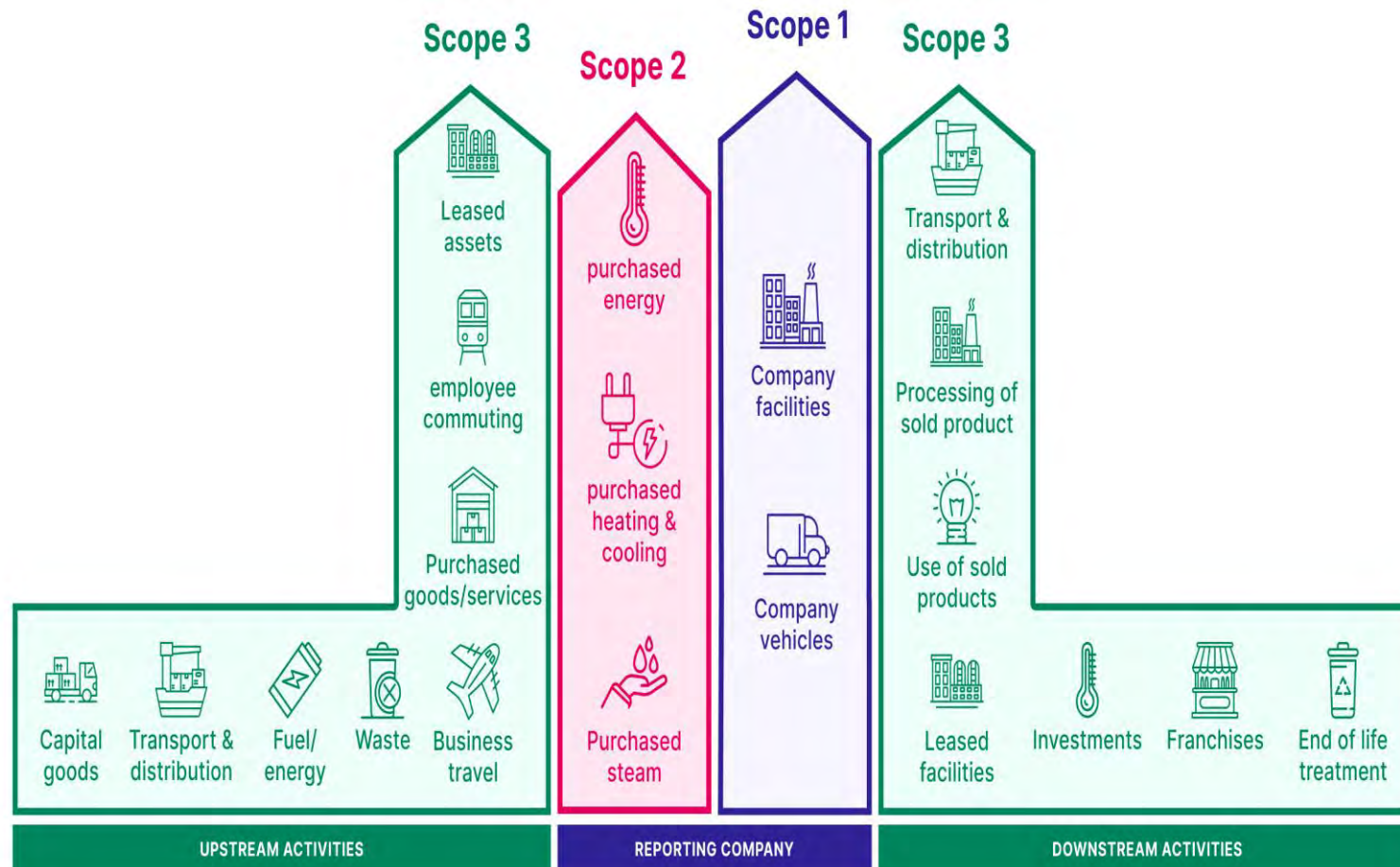
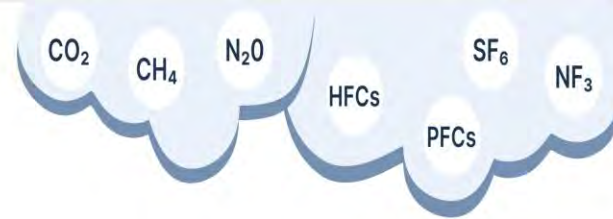
Corporate Sustainability Due Diligence
Directive (CSDDD)

Corporate Sustainability Reporting Directive
(CSRD)



GHG Scopes

The GHG Protocol





AI

Energy efficiency in chip design is important for reducing environmental impact, lowering operating costs, and extending battery life. Here are some ways to improve chip design energy efficiency:

Use energy-efficient materials: Use materials like **silicon carbide**

Use energy-efficient technologies: Use technologies like **silicon photonics**

Use energy-efficient transistor devices: Use transistor devices like FinFETs

Use strategies to reduce power consumption: Use strategies like voltage scaling, clock gating, and **dynamic power management**

Use low-power IP: Use IP that offers maximum energy efficiency while maintaining high performance

Use a lower voltage architecture: Use a lower voltage architecture, like **1.2 V**, to reduce battery size and extend battery life

Reduce the time it takes to design a chip: Use technology to reduce the time it takes to design a chip

Locate **data centers** near **renewable energy sources**: Locate data centers near solar and wind energy sources



AI

Here are some ways to improve the energy efficiency of a data center:

Use evaluation metrics

Assess your data center's **energy efficiency** using **metrics** to reduce **energy consumption** and **carbon emissions**.

Control **temperature and humidity**

Use **IoT** sensors to monitor **temperature** and **humidity** and protect equipment from overheating.

Consolidate lightly used servers

Reduce the amount of power needed to run the data center by consolidating servers that are not used often.

Use environmental sensors

Install an environmental monitoring system with sensors that can report data and alarms.

Enclose server racks

Contain server racks to prevent warm and cold air from mixing, which can reduce the need for powerful cooling.

Use energy-efficient technologies

Invest in technologies that are more energy-efficient, such as UPS systems that can automatically adapt to load demand.

Optimize variable efficiency

Use UPS technology that can minimize efficiency losses to less than 3%.



Data Centre of the Future

Sustainable Buildings?

Decarbonised Grid?

Rethink our AI ambitions?

Legislation will force...

A Radical Rethink?



Whats new in Green IT?

Green Software Foundation – SCI Metric (ISO/IEC 21031:2024)

UK Data Centres – Critical National Infrastructure



BCS Green IT Courses (Next Slide)

National Data Centre Academy

New Government!



Whats new in Green IT?

BCS Green IT Courses e Learning £30 each

3 Modules

Take approx. 1 hr to complete

Online learning & testing with immediate results

Cost £30 (+vat) each

Interactive learning including video

<https://campaign.bcs.org/greenit>

Mod 1 – Discovering Green IT

Mod 2 - Driving Sustainability

Mod 3 – Avoid Greenwashing



National Data Centre Academy

3 Training Rooms (12)

Semi Permanent Passive Exhibition/Events Space

3 Technical Areas

- Data Centre Energy Efficiency Room

- Power Systems

- Active Showcase

2 Breakout/Management/Strategy/Sales Training Rooms (6)

VR/AR WIP



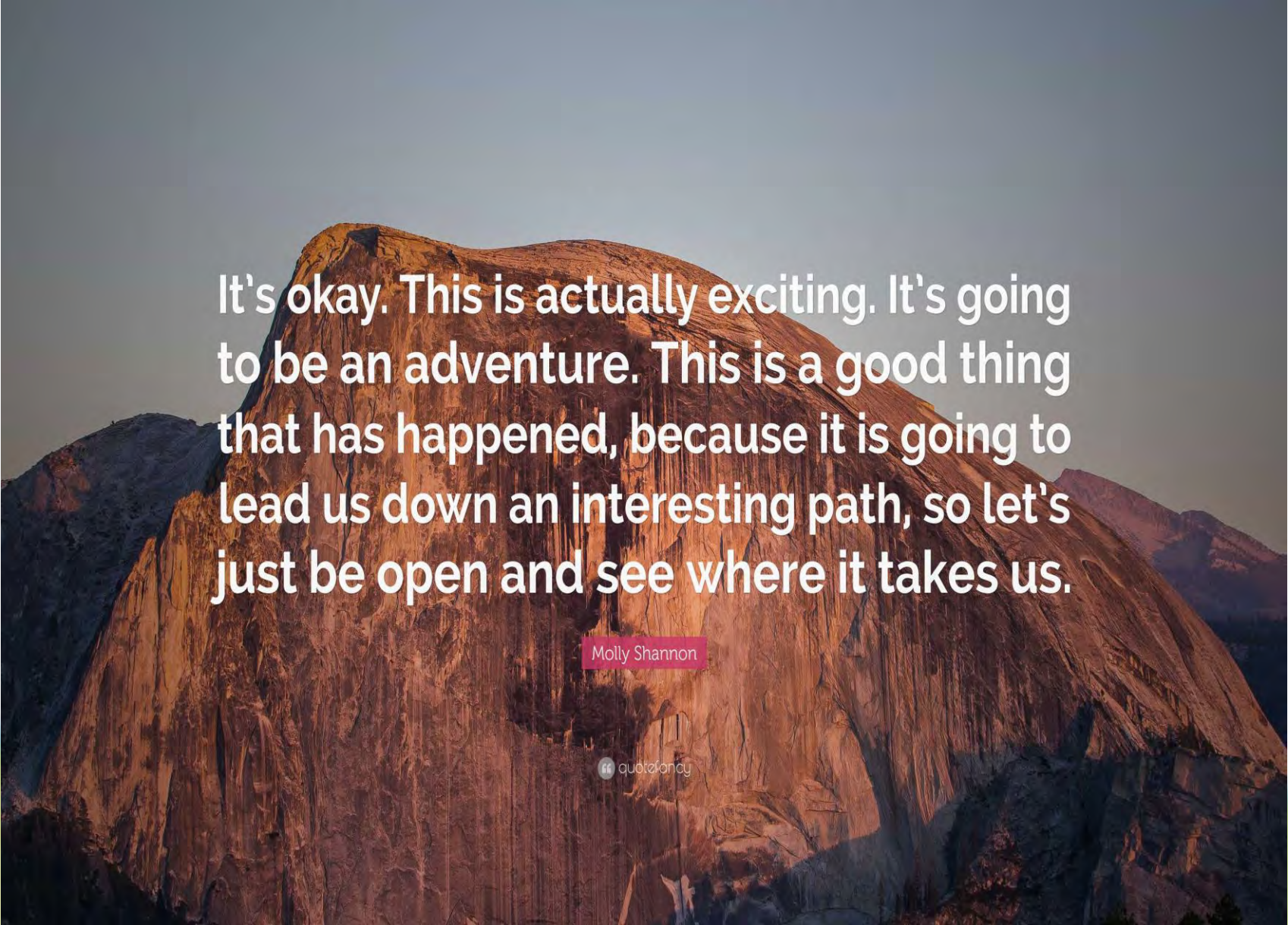
NDCA Leamington Spa -



Old/New Government







It's okay. This is actually exciting. It's going to be an adventure. This is a good thing that has happened, because it is going to lead us down an interesting path, so let's just be open and see where it takes us.

Molly Shannon

quoteofancy



national data centre academy

NDCA Data Centre of the Future event 22nd Jan 2025

Tickets *EventBrite*

<https://nationaldatacentre.academy/>



Thank You



Q&A's





Thank You



JOHN.BOOOTH@CARBON3IT.COM

WWW.CARBON3IT.COM

@CARBON3IT Twitter/Skype