The rise of the demand side

Global Energy Trends 2025 and Beyond

GridBeyond®

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Foreword

The world's demand for electricity is rising at its fastest rate in years, driven by robust economic growth, intense heatwaves, and increasing uptake of technologies that run on electricity such as electric vehicles (EVs) and heat pumps. At the same time, renewables continue their rapid ascent, with solar photovoltaic (PV) on course to set new records.

Traditionally, linear electricity value chains focused on managing the supply, ensuring there is enough demand, and adjusting production based on consumption. With the rise of intermittent renewables, however, electricity production is less flexible, as power must be harnessed when it is available. On top of this, the electrification of mobility and heating sectors is altering demand patterns. But power grids were not built for such heavy electrical loads, and grid capacity is limited. But with decentralisation and electrification comes significant opportunity for the demand side to play a greater role. Demand-side flexibility facilitates a more reliable, sustainable and efficient energy system reducing electricity demand when grid capacity is scarce. This also reduces costs and emissions, leading to increased customer satisfaction. Levelling out loads on the existing grid also reduces stress on power systems and makes them less susceptible to overloads.

In this 2025 edition of our Global Energy Trends series, we examine the multifaceted dynamics shaping the energy landscape. We delve into the pressing challenges and emerging opportunities as nations strive to balance energy security, economic growth, and environmental sustainability. This edition explores the latest developments in energy technologies, shifting global policies, and the critical role of energy flexibility in driving the energy transition.

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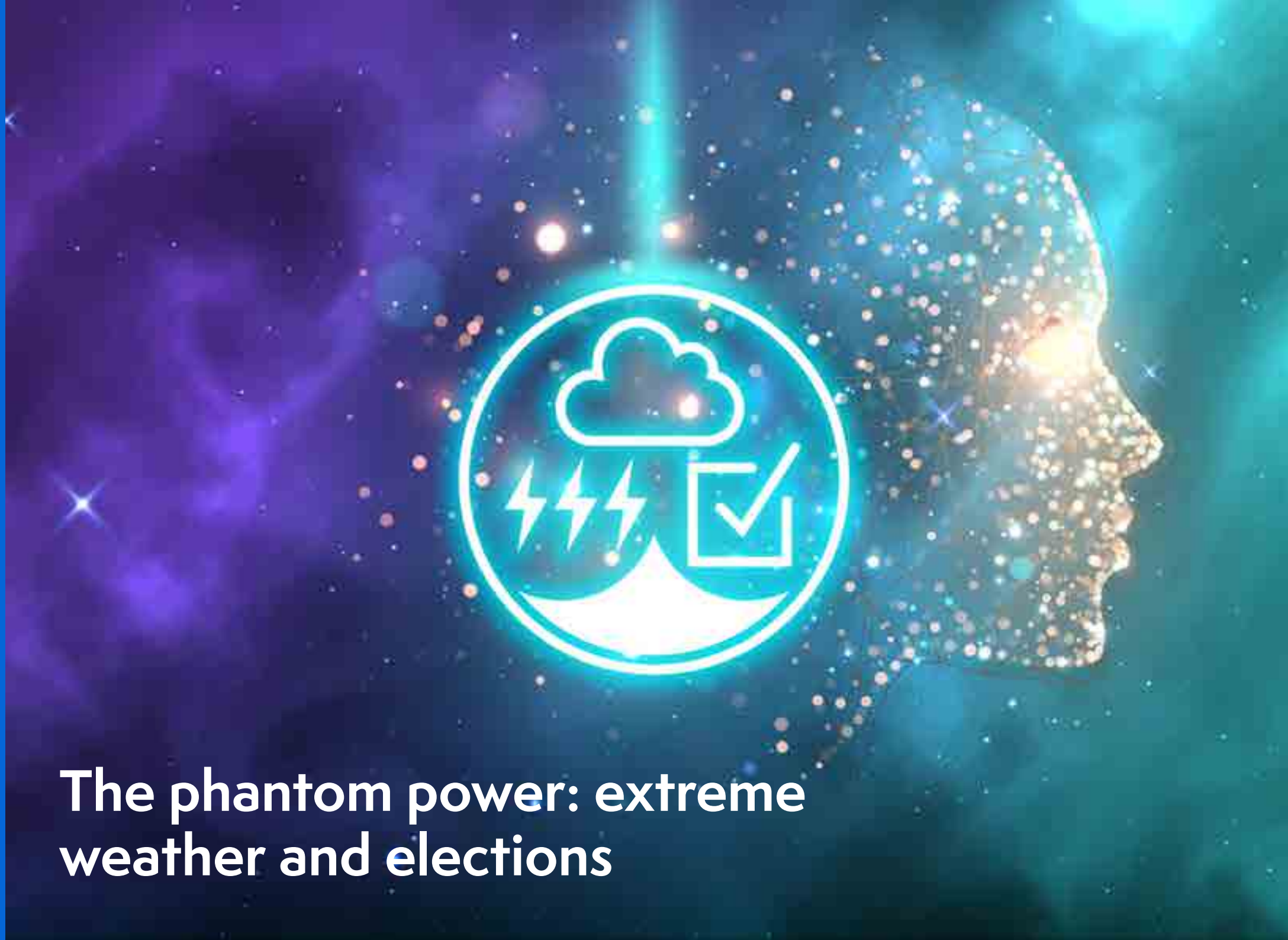
Executive summary

As the world confronts increasing energy demands alongside the challenges of climate change, this report offers an analysis of the driving forces, emerging trends, and policy frameworks influencing the future of energy systems.

We conclude that, while each country faces unique circumstances, global interconnected challenges and markets demand coordinated efforts to address supply chain vulnerabilities, policy alignment, and the need for flexibility to enable maximum integration of renewable technologies. But analysis across five key regions (UK, Ireland, USA, Australia and Japan) reveals shared challenges, including aging infrastructure, rising energy demand, and the need for innovation.

However, these challenges present equally transformative opportunities and flexibility is emerging as a critical factor in building resilient and adaptive energy systems. Technologies like virtual power plants (VPPs) and demand-side flexibility transforming how energy is distributed and consumed. It is becoming increasingly possible to leverage decentralised energy resources to enhance the wider grid while providing benefits to energy consumers through revenue generation and sustainable practices.

By embracing innovation, fostering collaboration, and implementing forward-thinking policies and practices, governments and businesses can navigate the complexities of the energy transition and secure a sustainable future for generations to come. What is clear is that the time to act is now. By embracing flexibility, investing in renewable energy, and committing to bold climate targets, we can build a sustainable energy system that meets the needs of today while planning for tomorrow.



The phantom power: extreme weather and elections

The phantom power: extreme weather and elections

As we step into the mid-2020s, the interplay between politics, economic growth, and the increasing frequency of extreme weather events is shaping the global energy landscape. Each of these factors influences the others, creating a complex web of challenges and opportunities.

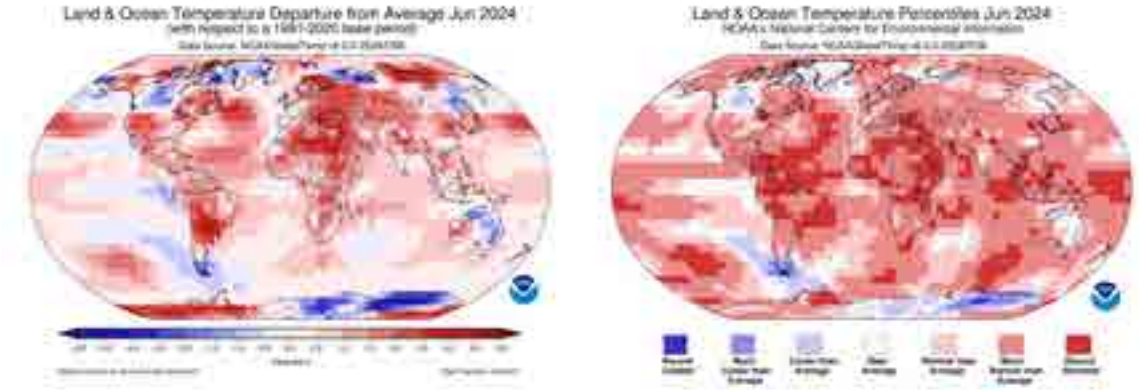
Extreme weather

Climate change has two aspects to it: the consequences of past actions, which are already tangible today and will increase towards 2030, and the far worse consequences of mistakes we must avoid now. This implies two outcomes: the tangible effects of rising temperatures will intensify, and we may reach an uncontrollable climate tipping point.

2023 shattered global heat records and the world witnessed the effects of rising temperatures in the form of devastating wildfires, severe flooding, extreme heatwaves and more. In 2024 we saw January–June global surface temperature ranked as the warmest in the 175-year record at 1.29°C (2.32°F) above the 1901-2000 average of 13.5°C (56.2°F).

According to NCEI's statistical analysis, there is a 59% chance that 2024 will rank as the warmest year on record and a 100% chance that it will rank in the top five. The Intergovernmental Panel on Climate Change (IPCC) reports that 2024 is expected to see a further rise in global temperatures, with more frequent heatwaves across Europe, North America, and Asia.

Northern Hemisphere land temperature and ocean temperature



Source: NOAA

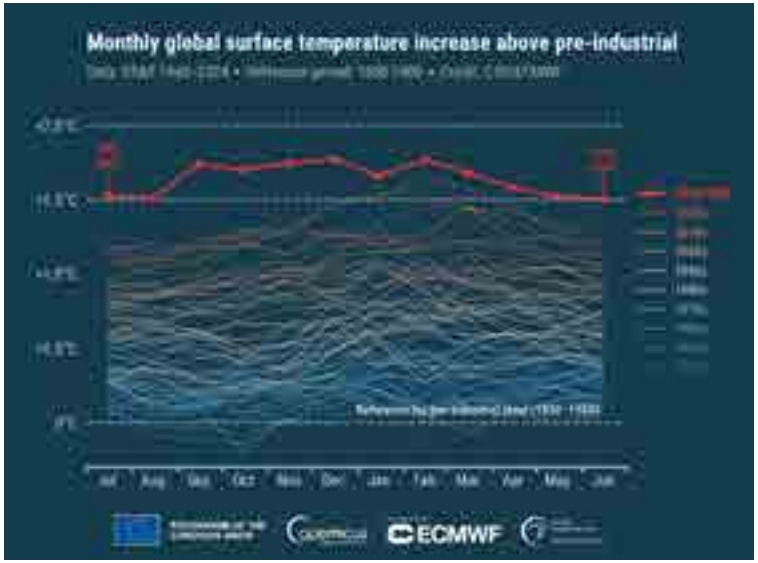
The phantom power: extreme weather and elections

According to ERA5 data, June 2024 was warmer globally than any previous June in the data record, with an average ERA5 surface air temperature of 16.66°C, 0.67°C above the 1991-2020 average for June and 0.14°C above the previous high set in June 2023. This is the thirteenth month in a row that is the warmest in the ERA5 data record for the respective month of the year. The global-average temperature for the past 12 months (July 2023 – June 2024) is the highest on record, at 0.76°C above the 1991-2020 average and 1.64°C above the 1850-1900 pre-industrial average. The average European temperature for June 2024 was 1.57°C above the 1991-2020 average for June, making the month the joint-second warmest June on record for Europe.

The Copernicus Climate Change Service as well as other global weather monitoring services declared 21 July 2024 as the hottest day on record. This was followed by even higher temperatures on July 22 and 23. September 2024 was the second-warmest September globally in the ERA5 dataset, after September 2023, with an average surface air temperature of 16.17°C––0.73°C above the 1991-2020 average for September.

Analysis by World Weather Attribution found that in the 12 months to May 2024, 6.3B people (about 78% of the global population) experienced at least 31 days of extreme heat (hotter than 90% of temperatures observed in their local area over the 1991-2020 period) that was made at least two times more likely due to human-caused climate change. It suggested that human-caused climate change added an average of 26 days of extreme heat (on average, across all places in the world) than there would have been without a warmed planet.

Monthly Global Surface Temperature Increase Above Pre-Industrial



Source:ERA5, Copernicus Climate Change Service /ECMWF

The phantom power: extreme weather and elections

Data from the National Oceanic and Atmospheric Administration (NOAA) indicates that the number of extreme heat days—when temperatures exceed the 90th percentile of historical data—has doubled since the 1980s and is projected to rise by another 30% by 2050 if current trends continue.

April was a historic month for climate action as the European Court of Human Rights (ECHR) recognised the climate crisis as an existential threat and confirmed that our leaders must act immediately to protect from accelerating harm. On 9 April the European Court of Human Rights (ECtHR) issued its first ever comprehensive decision in a climate litigation case. The judges found that Switzerland was in breach of its positive obligations to protect the health, well-being and quality of life of its citizens from the impacts of climate change. This violation was attributed to the Swiss government's failure to implement the robust regulatory framework necessary for fulfilling its commitment to reduce emissions as set out in the Paris Agreement.

Globally, energy-related greenhouse gas emissions rose by 1.1%, setting a new record at 37.5B tonnes of carbon dioxide (CO_2), with coal emissions contributing nearly two-thirds of this rise. The growing evidence of a rapidly warming climate is focusing the minds of politicians, corporations, investors and consumers and bringing about a new sense of urgency to tackle climate change.

The phantom power: extreme weather and elections

Elections

2024 was an election year for over 50% of the world's population.

Billions of voters, including those in the United States, the EU and the UK, elected the leaders who will be making decisions for the future. Having leaders who can negotiate strong policies is just the first step, but fulfilling these promises requires strong policies that turn climate commitments into action.

European Parliament

Between 6 and 9 June 2024 the 2024 European Parliament election was held to elect 720 members of the Tenth European Parliament. The new European Parliament, the new Commission and member states must agree in the coming months on an emissions target for 2040, a stepping stone on the bloc's wider path to "climate neutrality" by 2050.

When the last European Parliament elections were held in 2019, the results were interpreted as a clear mandate to set ambitious, EU-wide climate targets and policies. As a result the EU approved a European Green Deal, that aimed to cut emissions by 55% from 1990 levels by 2030, and reach net zero by 2050. It also passed a package of policies to help member states achieve these goals.

The European People's Party (EPP), von der Leyen's party group and the largest in the European Parliament since the 2024 election, has reaffirmed Europe's leading role in global climate action. At the same time, it advocates for technological neutral approaches and distances itself from the Greens and Socialists, whose position the EPP calls "ideological" in their manifesto. It is expected that the incoming European Parliament, support for the landmark Green Deal package will be weakened.

European Parliament 204-2029

Constitutive Session

Source: European Commission

The phantom power: extreme weather and elections

UK: Labour seeks to make the UK "a clean energy superpower"

Following its success in the general election, the Labour Party has been handed the responsibility of tackling the continuing challenges faced by the UK's energy sector.

One of Labour's "five missions" set out in its manifesto for the 2024 general election was to make the UK "a clean energy superpower". Labour has committed to decarbonising the UK's electricity system by the end of the decade, a step which it said would bring the UK closer to achieving net zero greenhouse gas emissions by 2050. It also said its plans for the clean energy transition would lead to lower household energy bills, deliver energy security and create 650,000 jobs across the UK by 2030.

In a written statement on 8 July, Ed Miliband outlined his priorities for the department in a message to staff following his appointment as Secretary of State for Energy Security and Net Zero. These included:

- delivering our mission to boost energy independence and cutting bills through clean power by 2030
- taking back control of our energy with Great British Energy
- upgrading Britain's homes and cutting fuel poverty through our Warm Homes Plan
- standing up for consumers by reforming our energy system
- creating good jobs in Britain's industrial heartlands, including a just transition for the industries based in the North Sea
- leading on international climate action, based on our domestic achievements

The phantom power: extreme weather and elections

At the state opening of parliament on 17 July a package of more than 35 bills was announced to "unlock growth and improve living standards" and based upon the principles of "security, fairness and opportunity for all". For the energy sector, it was announced that the government is committed to a "clean energy transition". To facilitate this, it was announced that:

- a bill to establish a publicly owned power company, Great British Energy, headquartered in Scotland, will be introduced
- legislation will be brought forward to help the country achieve energy independence
- introduction of an English Devolution Bill that will "give new powers" to metro mayors and combined authorities to help "support local growth plans"
- ministers "will get Britain building" as they work to "accelerate" the delivery of "high-quality infrastructure"
- ministers will also pursue "sustainable growth […] by encouraging investment in industry, skills and new technologies"

The phantom power: extreme weather and elections

USA: Trump to "unleash American energy"

Donald Trump's victory in the US presidential election has left investors and business leaders across the globe trying to assess what his return to the White House will mean. Previously Trump has promised protectionist trade measures, relaxed regulation and cheaper energy for consumers, but what is likely to be on the cards for the upcoming presidency?

To achieve a "rapid reduction in energy costs, I will declare a national emergency to allow us to dramatically increase energy production, generation and supply", Trump said at an August rally in Michigan. The win positions Trump to deliver on his campaign pledges to cut climate policies he's dubbed the "green new scam" while reorienting the federal government toward increasing domestic oil and gas production and building more power plants.

Trump has previously promised to hand Americans the "lowest cost of energy of any industrial country anywhere on Earth". His plan includes getting as much oil and gas from the US as possible by removing red tape and opening up federal land for new fracking projects. Trump has said he has plans to "unleash American energy" and "free up the vast stores of liquid gold on America's public land for energy development." A Biden administration moratorium on new permits to widely export liquefied natural gas is likely to be revoked, with Trump promising to end that permitting pause his "very first day back."

The phantom power: extreme weather and elections

The president-elect has repeatedly vowed to "terminate" a suite of EPA rules that aim to reduce emissions from power plants and encourage the closure of units generating electricity from coal, arguing that surging demand from artificial intelligence and manufacturing means the US needs to be building more of the units, not shutting them down. The EPA also is expected to pause work on developing new emission limits for existing gas-fired power plants. Emergency authorities could also be used to accelerate the construction of new power plants and plans for keeping coal-fired electricity online that was developed during his first term could be revisited.

The installation of Trump as the 47th President of the United States raises questions over the future of the Biden administration's Inflation Reduction Act (IRA), its $400B in new spending and tax breaks that aim to boost clean energy, alongside the 2021 Bipartisan Infrastructure Deal, which committed over $65B for transmission and grid upgrades. Congress isn't likely to claw back all unspent funding or repeal all of the IRA's energy and manufacturing tax credits. But lawmakers could target some of the law's incentives for phase-downs and scale-backs. The Treasury Department is expected to rewrite rules governing which projects and companies are eligible for credits so they are harder to obtain.

For offshore wind, Trump has been critical of the potential impacts on wildlife, and he used a New Jersey rally earlier this year to vow "day one" action targeting the industry. That could take the form of ordering a pause on permitting new projects or selling new offshore wind leases.

The phantom power: extreme weather and elections

However, it is estimated that half of the growth in US renewable energy generation since the turn of the century can be linked to state-level renewable energy requirements. Individual US states have policies in place such as the renewable portfolio standard (RPS) or clean energy standard (CES) that mandate increased production from low-carbon sources. While the definitions of "renewable" and "clean energy" differ from state to state, more than half of US states have these in place – including 15 states setting a target for 100% clean or renewable portfolio requirements, with deadlines ranging between 2030 and 2050.

While President Biden's negotiators will be at next week's COP talks in Azerbaijan, nothing they agree to will be binding for the Trump administration. In 2017 Trump announced the US would pull out of the Paris climate agreement, the most important UN process to tackle climate change. But at that time the treaty's rules meant the US was not able to withdraw until November 2020, a few months before he left office. If Trump withdraws there will be a one year wait before the US can withdraw from the agreement.

Trump has repeatedly promised to end a suite of federal policies that encourage Electric Vehicle sales, and his victory creates an opening for changes. A top target is expected to be an Environmental Protection Agency regulation limiting tailpipe pollution from cars and light trucks, which has a mandate that compels automakers to sell far more electric and plug-in hybrid models over time. It is expected that an executive order directing the EPA to revisit the rule will be issued.

There could also be changes to limit which EVs qualify for tax credits as a "leasing loophole," which exempts leased EVs in commercial fleets from restrictions on where the cars are made, the source of their battery materials and how much money consumers make.

The phantom power: extreme weather and elections

2025 Japanese Presidential Election

According to Japanese law, general elections for the House of Representatives (Shūgiin), the lower house of Japan's National Diet, must be held at least every four years, and the last general election was in October 2021, so the next one must occur by October 2025.

We also are right in the middle of 2024 Liberal Democratic Party (LDP) presidential election (scheduled to take place on September 27, 2024) due to the ongoing political and leadership challenges within the Fumio Kishida government.

Liberal Democratic Party (LDP) 自由民主党 (Jiyū-Minshutō)	Constitutional Democratic Party of Japan (CDP) 立憲民主党 (Rikken-Minshutō)	Japan Innovation Party (Nippon Ishin no Kai) 日本維新の会 (Nippon Ishin no Kai	Komeito 公明党 (Kōmeitō)	Democratic Party for the People (DPP) 国民民主党 (Kokumin-Minshutō)	Japanese Communist Party (JCP) 日本共産党 (Nihon Kyōsantō)
Nuclear Power: The LDP supports the restart of nuclear power plants, viewing them as crucial for energy security and cost control. They have also discussed constructing new nuclear facilities or extending the life of existing ones to stabilize the energy supply and meet decarbonization goals. **Renewable Energy:** While the LDP supports expanding renewables, they stress the importance of balancing these sources with nuclear and thermal power to ensure a stable energy supply. **Energy Security:** The LDP emphasizes reducing Japan's reliance on imported fossil fuels by boosting domestic energy production, including nuclear and renewables	**Nuclear Power:** The CDP opposes the use of nuclear power and advocates for phasing it out entirely. They focus on promoting renewable energy sources like solar and wind to replace nuclear and fossil fuels. **Renewable Energy:** The party is committed to increasing Japan's use of renewable energy as part of a broader decarbonization strategy. They stress the need to develop energy storage solutions and smart grids to manage variability in renewable energy output. **Energy Efficiency:** The CDP also emphasizes energy efficiency measures across all sectors to reduce overall consumption(JAPAN Forward).	**Nuclear Power:** Nippon Ishin no Kai supports restarting nuclear plants but with strict safety standards. They view nuclear energy as necessary for energy security and achieving carbon neutrality. **Renewable Energy:** They advocate for a balanced approach that includes expanding renewables alongside nuclear power, focusing on innovations in energy storage and grid management. **Technological Innovation:** The party places a strong emphasis on technological innovation, including the adoption of smart grids and next-generation energy technologies (JAPAN Forward).	**Nuclear Power:** Komeito has a cautious stance on nuclear energy, supporting the restart of plants only after stringent safety checks. They are less aggressive in pushing for new nuclear construction compared to the LDP. **Renewable Energy:** They advocate for increasing the share of renewables in Japan's energy mix and emphasize community-based energy solutions. **Climate Change:** Komeito focuses on policies that align with Japan's commitments to reduce carbon emissions, including energy efficiency and support for EVs(S&P Global).	**Nuclear Power:** The DPP supports the use of nuclear energy but insists on high safety standards and a gradual reduction in dependence on nuclear power over time. **Renewable Energy:** They promote the expansion of renewable energy as part of Japan's energy mix, supporting a gradual shift away from nuclear and fossil fuels while ensuring energy security. **Technological Innovation:** The DPP emphasizes a balanced energy transition strategy that includes investments in both renewable energy and the modernization of existing energy infrastructure(JAPAN Forward)	**Nuclear Power:** The JCP is firmly opposed to the use of nuclear energy and advocates for the complete abolition of nuclear power plants. They call for the immediate decommissioning of all existing nuclear reactors, citing concerns over safety, particularly after the 2011 Fukushima disaster. They see nuclear energy as too risky and costly for Japan's future (Energy Tracker Asia) (Nippon.com | Your Doorway to Japan) **Renewable Energy:** The party promotes a rapid transition to renewable energy sources, such as solar, wind, and geothermal power. They argue for a future where renewable energy constitutes the majority of Japan's energy mix. This involves significant investments in renewable technologies and supporting local community-based energy projects. **Technological Innovation:** The JCP strongly supports policies that address climate change, emphasizing Japan's responsibility to cut greenhouse gas emissions. They propose ambitious targets for reducing emissions and achieving carbon neutrality well before 2050. The party advocates for stricter regulations on industries that produce high emissions and seeks to reduce Japan's reliance on coal and other fossil fuels(Energy Tracker Asia)(JapanGov - The Government of Japan)

The phantom power: extreme weather and elections

Cross-country developments

In September 2024, the inaugural Global Renewables Summit was held with the ambition to drive action to triple renewable power by 2030, - a pledge made at the 2023 United Nations Climate Change Conference (COP28) in Dubai when, for the first time, countries agreed on the need to "transition away from fossil fuels to renewables". Announcements at the Summit included:

- the International Energy Agency (IEA) unveiled a new report, From Taking Stock to Taking Action: How to Implement the COP28 Energy Goals. The report outlines steps to achieve COP28 energy targets, focusing on tripling renewable energy, expanding grid infrastructure, and increasing energy storage. The report offers guidance on integrating these goals into national targets under the Paris Agreement
- the International Renewable Energy Agency (IRENA) annual report highlighted that 81% of new renewable power in 2023 was more cost-effective than fossil fuels. Renewables have saved $409 billion in fuel costs since 2000, and their growing competitiveness is crucial for future climate targets

The phantom power: extreme weather and elections

- the 32 largest utility companies, as part of the Utilities for Net Zero Alliance (UNEZA), representing 327 million customers, announced a commitment to invest $116B annually in clean energy and grid modernisation. The alliance aims to expand renewable energy portfolios 2.6 times by 2030, with a focus on easing supply chain challenges
- a report by Climate Analytics and NewClimate Institute, Setting 1.5°C Compatible Wind and Solar Targets: Guidance for Key Countries calls for wind and solar capacity to increase five-fold by 2030 and eight-fold by 2035 in key countries to meet the 1.5°C global warming limit
- the Global Renewables Alliance published an open letter, Now Deliver Change, backed by over 100 international organisations and companies, urging world leaders to set bold renewable energy targets in their next climate commitments. The call emphasized the need to triple renewable energy capacity by 2030 to keep the 1.5°C goal achievable.

The phantom power: extreme weather and elections

When 193 countries signed on to the Paris Agreement, they committed to three goals: 1) reduce emissions enough to hold global temperature rise to "well below 2 degrees C (3.6 degrees F)" above pre-industrial levels, and ideally 1.5 degrees C; 2) build communities' resilience to the impacts of climate change; and 3) align the world's financial flows with low-carbon, climate-resilient development. They also agreed to assess their progress toward these goals every five years (beginning in 2023) and strengthen their action in response, a process known as the "Global Stocktake."

The UN's first Global Stocktake report showed us that, to hold warming to what scientists consider "safe" levels, we must reduce global greenhouse gas emissions by 43% by 2030. But countries' current climate action plans will reduce emissions by just 8%.

The phantom power: extreme weather and elections

COP29

The 2024 UN Climate Change Conference (UNFCCC) will convene from 11-22 November 2024 in Baku, Azerbaijan. This event will include the 29th session of the Conference of the Parties (COP29).

On 21 March 2024, the United Arab Emirates (UAE) COP28 Presidency, the Azerbaijani COP29 Presidency, and the Brazilian COP30 Presidency sent out a letter to parties, which outlines a "Roadmap to Mission 1.5°C", to "significantly enhance international co-operation and the international enabling environment to stimulate ambition in the next round of nationally determined contributions, with a view to enhancing action and implementation over this critical decade and keeping 1.5°C within reach".

Money will be the most important focus of the negotiations. Aa "new collective quantified goal" (NCQG) for climate finance from 2025 onwards is on the agenda and the COP29 presidency has already announced a new voluntary fund into which oil and gas extracting companies and countries will be asked to pay.

COP28 included a historic commitment to transition away from fossil fuels. The first formal acknowledgement in COP outcomes that the use of coal, oil and gas has to end. However, there is very little sign of movement on this and COP29 hosts have made little reference to it, beyond reiterating the commitment itself. But the negotiations themselves will be key in determining future progress.

As the physical risks from climate change intensify, we expect 2025 and beyond to bring a heightened focus on adaptation and resilience planning, and financing along with an increasing awareness side of the impacts of climate change.

A new demand: the awakening of global energy needs

A new demand: the awakening of global energy needs

Global electricity demand in 2024 and 2025 is set to grow at the fastest rate seen in the past two decades, as a result of driven by robust economic growth, severe heat waves and increasing adoption of technologies that run on electricity.

In response to climate change and the urgent need to reduce greenhouse gas emissions, the world is witnessing a rapid shift towards electrification. This transition encompasses a broad spectrum of activities, from the electrification of transport to the decarbonisation of industrial processes.

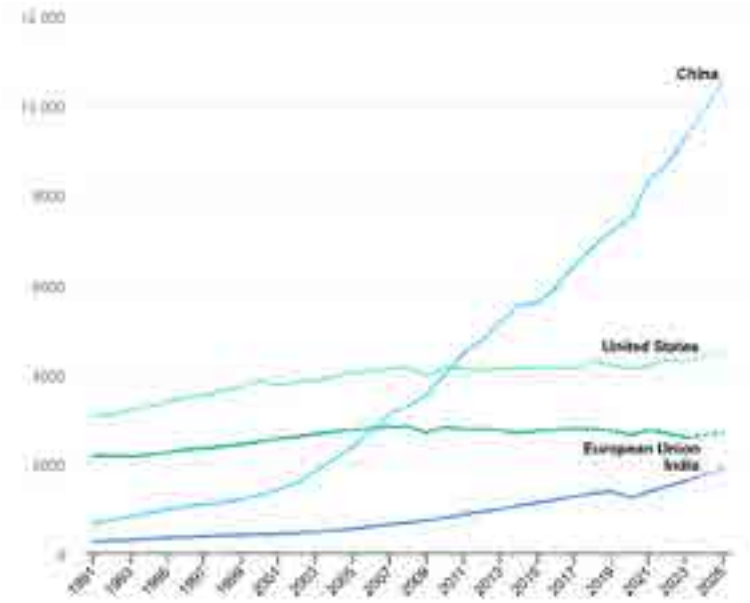
Global demand rising

In its report titled Electricity Mid-Year Update, published on 19 July 2024, the IEA claimed that global electricity demand will increase by 4% in 2024, up from 2.5% in 2023, representing the highest annual growth rate since 2007 (when factoring out the intense but short-term rebounds seen in the wake of the financial crisis and the Covid-19 pandemic).

The growth, which is expected to continue into 2025, also at a 4% increase, is driven by strong demand in multiple regions and countries, especially in the People's Republic of China, India and the United States.

The report notes that robust economic growth is the driving factor. Intense heatwaves and continued expansion of 5G networks and data centres as well as strong EV uptake are also contributing factors. In 2024 alone, EV sales are expected to surpass 20 million units globally, a significant increase from the 10 million units sold in 2020 .

Electricity demand in selected regions, 1991-2025



Source: IEA

A new demand: the awakening of global energy needs

A digital future

The power consumption from crypto mining has become a public concern in many countries. Bitcoin alone is estimated to consume around 100TWh a year. In the United States, cryptocurrency activity is estimated to emit from 25 to 50 million tons of CO2 each year, on par with the annual emissions from diesel fuel used by US railroads.

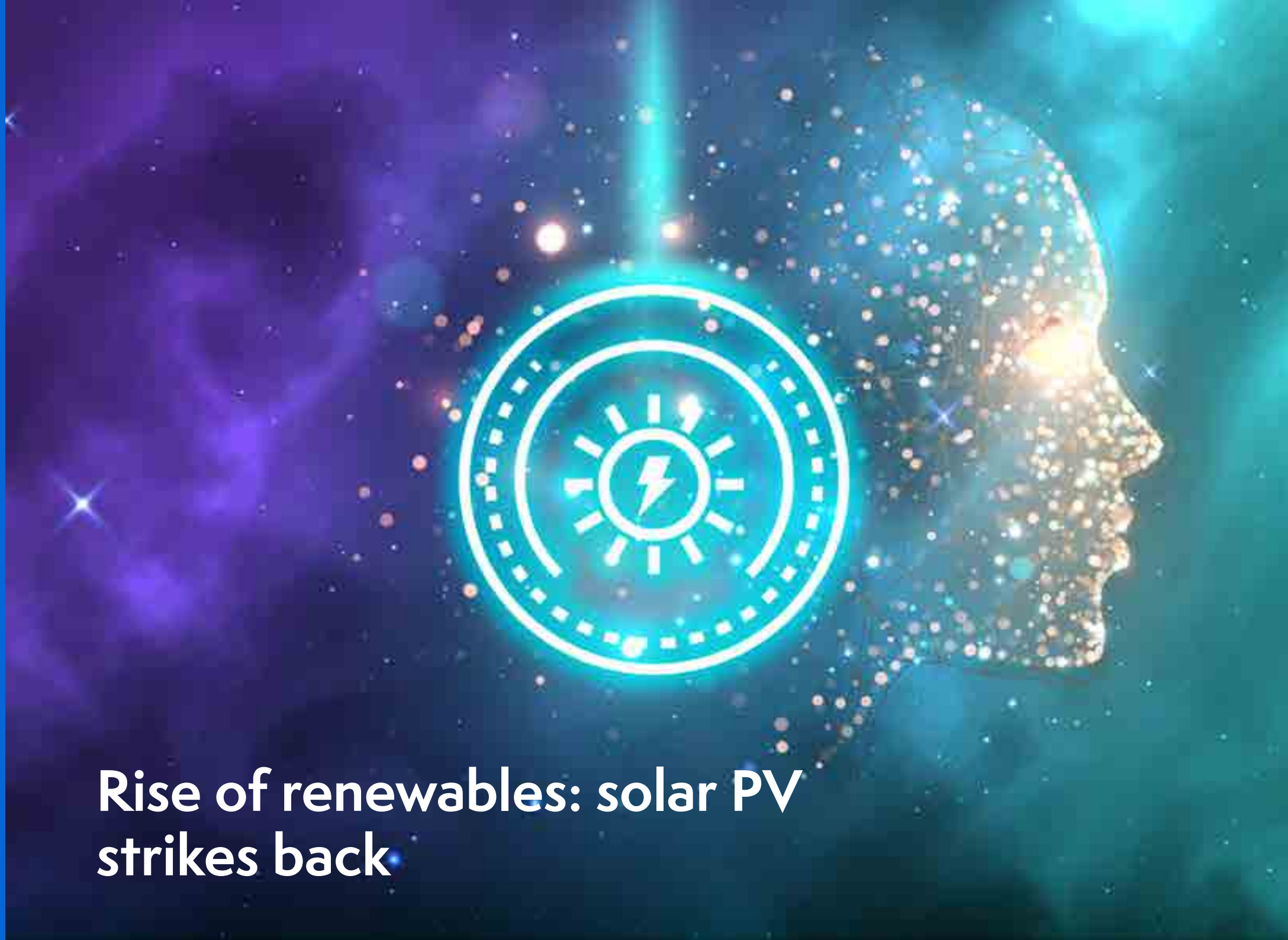
In addition, demand for digital services is growing rapidly. Since 2010, the number of internet users worldwide has more than doubled, while global internet traffic has expanded 20-fold. The data centres and data transmission networks that underpin digitalisation have led to rising energy use. Estimated global data centre electricity consumption in 2022 was 240-340 TWh, or around 1-1.3% of global final electricity demand. This excludes energy used for cryptocurrency mining.

According to the Office of Energy Efficiency and Renewable Energy, data centres are one the most energy-intensive building types, using 10 to 50 times the energy per floor space of a typical commercial office building. As a result, data centres are responsible for producing 2% of total greenhouse gas emissions globally.

A new demand: the awakening of global energy needs

Although data centre electricity consumption globally has grown only slightly, some smaller countries with expanding data centre markets are seeing rapid growth. The US contains 33% of the world's data centres accounting for approximately 2% of the total US electric use; however, in Ireland, data centres accounted for 18% of the country's total power consumed in 2022, which could increase to 32% by 2026. In 2022, the Irish state-owned energy company EirGrid placed a moratorium on new data centres in the Dublin area, which is set to last until 2028.

The convergence of economic growth, heatwaves, electrification and digitalisation presents both challenges and opportunities. On the one hand, rising temperatures and frequent heatwaves can strain energy systems, increase cooling demand, and disrupt economic activities. On the other hand, the push for electrification and renewable energy offers a pathway to mitigate these impacts. Digital technology and digitalisation are also key enablers of the transition to a low-carbon energy system and their potential transformative effects are massive.



Rise of renewables: solar PV strikes back

Rise of renewables: solar PV strikes back

In many countries, concerns about energy security have accelerated the transition to renewables and energy efficiency.

The renewable energy landscape in 2023 was shaped largely by policy decisions and targets adopted in previous years, particularly measures responding to the COVID-19 pandemic, Russia's invasion of Ukraine and the subsequent energy crisis.

Many countries have strengthened their commitment to renewables by setting targets. By the end of 2023, a total of 170 countries had a renewable energy target for electricity generation, and 90 countries had in place economy-wide targets for renewable energy, although only 7 had targets for 100% renewables. During the year, 3 countries announced new or updated renewable energy targets. Solar, wind and hydropower have dominated technology-specific targets.

Throughout 2024 developments in policies continued. The ambition and effectiveness of these policies helped stimulate large increases in renewable energy investment and in the number of projects announced and commissioned.

According to the latest Renewable Energy Statistics released by IRENA in July 2024, renewable energy sources were responsible for 29.1% of global electricity generation in 2022, amounting to 8,440TWh. The remaining 70.9% (20,591 TWh) came from fossil fuels, nuclear power, pumped storage, and other non-renewable sources, bringing the total global electricity generation to 29,031TWh in 2022.

Rise of renewables: solar PV strikes back

Since 2011, overall electricity generation has grown by an average of 2.4% annually. Renewable energy has increased at a rate of 6.1%, while non-renewable sources have grown by 1.3%. In 2022 alone, renewable electricity saw a 7.2% increase from 2021, though similar or higher growth rates have been recorded in previous years. Since 2010, solar and wind energy have been the main drivers of growth in renewable electricity, making up 11.7% of the global electricity mix in 2022, with an 18.2% rise from the previous year.

The range of renewable energy sources has become more diverse over time. While hydropower remains the largest contributor to renewable electricity generation, the share of variable renewables in the global electricity mix has grown significantly, rising from 1.1% of renewable generation in 2000 to 40.2% in 2022. In 2022, hydropower generated 4,330TWh, a 0.8% increase from 2021. Wind energy, the second-largest renewable source, produced 2,098TWh, reflecting a 14.0% increase compared to 2021.

Solar energy has experienced the most rapid growth among renewables in recent years, having generated 1,294TWh in 2022, marking a year-on-year increase of 25.6%. Bioenergy contributed 619TWh, growing by 1.5%, while geothermal energy provided 97TWh and marine energy was just under 1TWh.

According to the REN21 Renewables 2024 Global Status Report global renewable power capacity saw a significant increase in 2023, with an estimated 36% growth, reaching 473 GW—a record high for the 22nd year in a row. Solar PV was the main contributor to this expansion, representing three-quarters of all new renewable power capacity added that year.

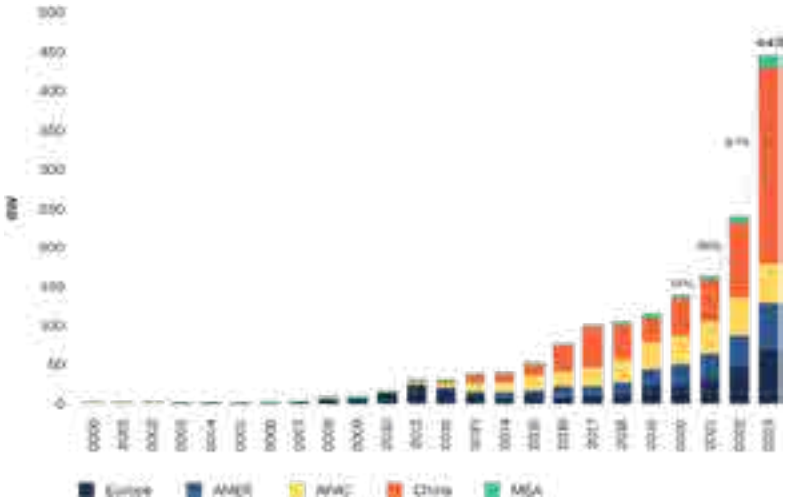
Rise of renewables: solar PV strikes back

While progress in renewable energy capacity was observed worldwide, regional differences and variations in technology were evident. In the United States, growth was attributed to solar PV, which saw its total installed capacity rise by over 50%, reaching nearly 33GW while wind power installations dropped to their lowest level since 2014. In the European Union, solar PV capacity additions grew from 41GW in 2022 to 56GW in 2023, while wind power additions increased slightly to 17GW.

Global investment in renewable energy increased by 8% in 2023, totalling $622.5B, up from $576B in 2022. However, the renewables sector, once driven by declining costs, low interest rates, and strong political backing, is now facing challenges such as supply chain disruptions and the impact of rising interest rates, which have driven up prices. As a result, some of the more expensive renewable energy projects have been postponed or cancelled.

In its Global Market Outlook for Solar Power 2024-28, Solar Power Europe noted that "for an established sector like solar, approaching double growth in one year was simply not part of any analyst's script. But it happened in 2023." In 2023, the world deployed 447GW of new solar PV capacity last year; an incredible 87% more than 2022 and achieving a growth rate not seen since 2010, when the global solar market was only 4% of today's size.

Annual solar PV installed capacity 2000-2023



Source: Global Market Outlook for Solar Power 2024-28, Solar Power Europe

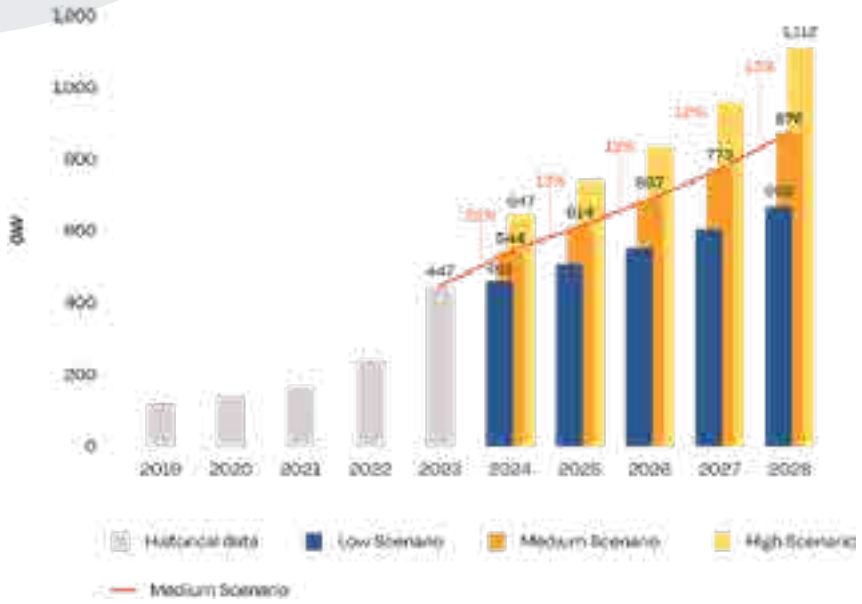
Rise of renewables: solar PV strikes back

For 2024, the medium scenario forecasts a global growth rate of 22% to a market size of 544GW, approximately 100GW more than in 2023. This rises to 45% annual growth to 647GW under the high scenario projection.

Looking ahead the report notes that annual global market installations reach 614GW in 2025 under the medium scenario, a 13% increase from 544GW in 2024, followed by a 12% increase to 687GW in 2026, 12% to 773GW in 2027, and 13% to 876GW in 2028.

After surpassing the 1.6TW level in 2023, the global solar power fleet is on track to exceed 2TW by 2024. The medium scenario estimates 2.2TW in 2024, 2.8TW in 2025, 3.5TW in 2026, 4.2TW in 2027, and 5.1TW in 2028.

Global annual solar PV market scenarios 2024-28



Source: Global Market Outlook for Solar Power 2024-28, Solar Power Europe

Rise of renewables: solar PV strikes back

Challenges with high shares of variable renewables in power systems are familiar. One of the main challenges is forecasting renewable energy generation accurately. Although forecasting technology has improved, it is not perfect, and unexpected drops in generation can cause grid imbalances. The solution to these challenges lies in enhancing flexibility in power systems—a crucial element that enables energy grids to cope with the unpredictability of renewable energy.

UK shuts off coal

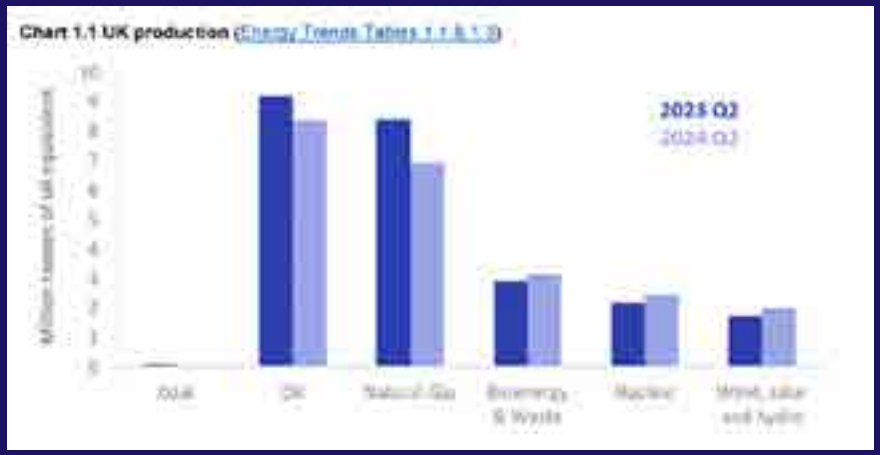
The UK has become the first G7 nation to completely phase out coal power.

With the closure of the Ratcliffe-on-Soar power station on 30 September the UK joins more than a third of OECD nations which have successfully phased out coal. Energy minister Michael Shanks heralded the closure of the plant as "the end of an era". "The era of coal might be ending, but a new age of good energy jobs for our country is just beginning", Shanks said.

Separately, the government's Department for Energy Security and Net Zero (DESNZ) has released its statistics on energy trends in the UK for the second quarter (April to June this year). It found that UK energy production was down 7% on the same period last year and at a near record low. Natural gas production dropped by 18% and petroleum production by 9%, marking a record low. Fossil fuels' share of the electricity mix was just 26.6%. Coal production was down 84% on the second quarter of 2023.Output from wind and hydro increased on last year as did nuclear.

Renewable electricity generation increased 19% on the same period in 2023 with the share of generation from renewable sources reaching a record high at 51.6% of total generation, the third consecutive quarter where renewable generation has exceeded 50%.

UK Production



Source: DESNEZ

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Learn more here

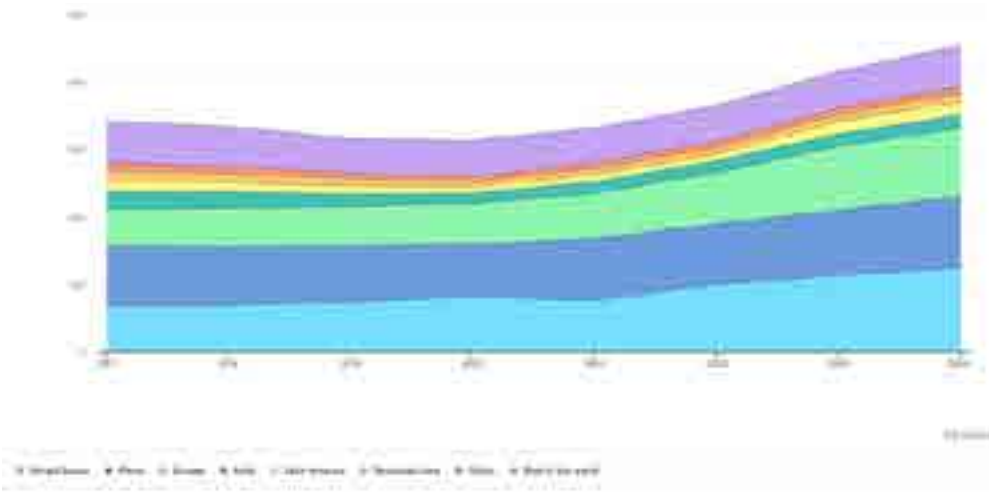
The demand-side menace: electrification and grid challenges

The demand-side menace: electrification and grid challenges

Over the past decade, global energy systems have shifted and as a result, there have been calls for increased investment in grid networks. While investment in renewables especially has increased significantly (roughly tripled according to Bloomberg NEF) without being connected to the grid the impact of these assets on the energy transition is limited. However, some progress is being made. As electricity grids take central stage in the delivery of the transition to a net zero system, transmission and distribution operators across the globe are seeing some common challenges.

The IEA latest World Energy Investment report, published in June 2024, notes that the integration of renewables and upgrades to existing infrastructure have sparked a recovery in spending on grids and storage. After stagnating around $300B per year since 2015, spending is expected to hit $400B in 2024, driven by new policies and funding in Europe, the United States, China, and parts of Latin America.

Investment in power grids and storage by region 2017-2024



Source: IEA

The demand-side menace: electrification and grid challenges

Waitlists

In the UK, demand for electricity is expected to increase from 120GW to 300GW by 2035. The Climate Change Committee's Balanced Pathway scenario for delivery of net zero by 2050, which has informed the Government's plan for delivering the Sixth Carbon Budget, projects annual electricity demand to be around 50% higher than pre-Covid levels in 2035 and 100% higher by 2050. But a report published by the Environmental Audit Committee in May 2024, concluded that many planned renewable energy projects are being hampered by persistent problems accessing the electricity grid. These include slow connections, limited capacity, inappropriate planning regulations and market uncertainty.

Demand to access the grid is high; the current queue to connect contains more than twice the amount of generation required to meet the Government's target of decarbonising the energy system by 2035. But projects being unable to access the grid could make that target harder to achieve. The energy regulator Ofgem and the Electricity System Operator (ESO) have attempted to speed up the system by requiring projects to meet key "milestones" like securing planning permission. Businesses that fail to meet such milestones could lose their place in the queue. However, the Committee's report finds that early evidence suggests these changes have not yet reduced the length of the connection queue.

The demand-side menace: electrification and grid challenges

According to Ofgem, over half of generation customers in the transmission queue today (i.e. holding connection agreements) have a connection offer date at least 5 years in the future, with over 10% due to wait 10 years or more. This trend is continuing, with 70% of recent applicants (offered in the last 12 months) receiving connection dates that are 5 or more years away and over a quarter receiving connection dates beyond 2032 – some beyond 2037. Many of these are large, complex projects with long lead times, but the wait is still too long.

The Environmental Audit Committee recommended that the Government and Ofgem actively monitor and streamline initiatives designed to deliver grid connections faster. In particular, it recommends that Ofgem review its milestone queue reforms, with a focus on advancing projects that are demonstrably ready to the front of the queue. The report also found that the planning system risks being a "bottleneck" to the rollout of energy infrastructure, as local authorities often lack the resources or in-house knowledge to accelerate clean energy projects. It recommends the Government develop a plan to ensure local authorities have the personnel and expertise they need to reach planning decisions quickly while engaging with local communities.

The demand-side menace: electrification and grid challenges

Across the USA, the waitlists for large projects to connect to the grid have also expanded significantly, with over 1,400GW of wind and solar power awaiting connection. PJM came in last out of seven regions, with a grade of D-, in the Generation Interconnection Scorecard report prepared for Advanced Energy United.

The report, published in February 2024, found that in a nation with "agonisingly slow" grid connection processes, the PJM process of studying and green-lighting new requests to connect to the grid was the slowest, with the most unpredictable timelines.

ERCOT and CAISO processes score the best, each receiving a B. ERCOT received high scores for the quantity of resources that completed its interconnection process at a reasonable cost, but the lack of proactive regional transmission planning to upgrade its transmission system is a major impediment to development of new generation resources. CAISO was awarded high marks for its proactive upgrades to its transmission system, but is rated lower than ERCOT for its overall interconnection process results due to recent delays in completing interconnection studies and agreements and constructing the necessary grid facilities.

Generator Interconnection Scorecard Grades

TABLE 1 | Generator Interconnection Scorecard Grades

	CAISO	ERCOT	ISO-NE	MISO	NYISO	PJM	SPP
Interconnection Process Results	B	A	C-	C	B	B	C+
Pre-queue Information	C+	C	B	C+	C	C	C+
Interconnection Study Process Design	B	A-	C+	D+	B-	F	B
Study Assumptions, Criteria, Replicability	A	A+	D+	D-	C+	F	C
Usefulness of Interconnection Alternatives	B+	B	D	B-	D	D	B
Using Regional Transmission Planning	A	D	D	B	C+	D+	C+
Overall grade	B	B-	D+	C-	C	D	C-

Source: Advanced Energy United

The demand-side menace: electrification and grid challenges

Action Plans

One of those new policies is the EU's Action Plan for Grids, which forms the Commission's response to the challenges facing the upgrading and expansion of the region's grids to meet climate targets and net zero in 2050.

Electricity consumption is expected to increase by around 60% between now and 2030. For the EU to reach its renewable energy target, wind and solar power generation capacity must increase from 400GW in 2022 to at least 1,000GW by 2030, including a large build-up of offshore renewables up to 317 GW by 2050.

As part of the European Green Deal, the Commission has put in place a framework for the rollout of electricity grids across Europe with the revised TEN-E regulation , the revised Renewable Energy Directive and proposals for a Net-Zero Industry Act and a reformed electricity market design. But to achieve an accelerate transition is so significant that "dedicated policy attention is required to ensure that grids are an enabler and not a bottleneck of the transition".

Specifically, the plan, released in November 2023, set out a series of "easy-to-implement actions to make sure a difference is made in time for the 2030 climate and energy objectives", based around seven challenges.

The demand-side menace: electrification and grid challenges

Grid Action Plan: key themes

The plan aims to join up the dots on a number of pan-EU grid issues, with an emphasis on removing policy or financial obstacles. For example, on network planning it aims to get cross-border collaboration on allocation of costs to invest ahead of the curve on grid projects that anticipate future needs of two or more states. It also aims to influence ways in which system operators can improve grid connection, moving away from the first come first serve model, to prioritise areas that most need clean power or technologies that would most benefit the transition agenda. Other actions in the plan include improved network tariffs for innovative technologies, exploring new ways of financing the scale of investment needs and seeking harmonised of grid code specifications, to help supply chain manufacturers scale up for faster, large-scale deployment.

The Grid Action Plan follows an institutional approach with:

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Grid capacity and planning

- Distribution Network Development Plans
- Overview of grid hosting capacity

Grid smartening

- Promotion of smart grid uptake
- Promotion of PCIs for smart grids
- Streamlining of grid connection procedures

Grid investment and financing

- Regulatory framework
- Anticipatory investments
- Access to funds (PCIs)

Grid permitting and the public

- Pact for Engagement (stakeholder, permitting)
- Faster processes and streamlining of permitting

Grid Supply Chains

- More visibility of grid project pipelines
- Development of common technology specifications (standardisation)

The demand-side menace: electrification and grid challenges

UK launches National Energy System Operator

On 1 October the UK launched the new National Energy System Operator (NESO), a publicly owned organisation tasked with overseeing the planning and operation of the UK's electricity and gas networks. The NESO's role also includes network planning, market development, security of supply and providing insights on achieving net zero energy goals. It comes in addition to the launch of Great British Energy, lifting England's onshore wind ban, approving four major solar farms and launching the Clean Energy Mission Control Centre.

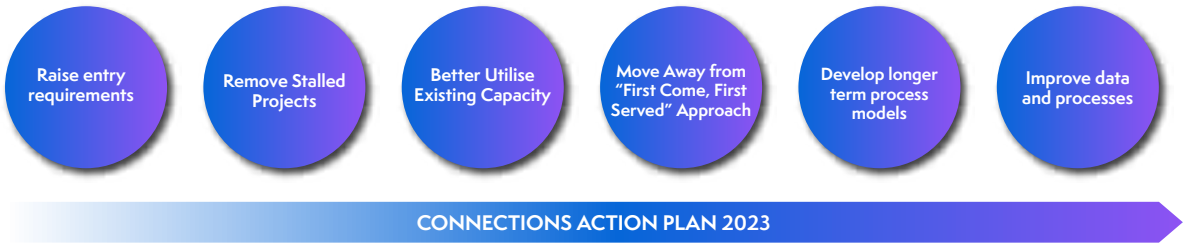
The key aims are to:

- Support clean energy and lower bills: NESO aims to play a key role in the UK's shift to clean energy. By co-ordinating electricity and gas network planning, it will help connect new renewable energy projects to the grid, supporting the government's goal of delivering clean power by 2030
- Provide a unified approach: a single organisation will oversee the planning and design of the UK's entire energy network. This integrated approach aims to reduce inefficiencies, accelerate the transition to renewable energy, and make it easier for new projects to fit into the broader energy plan
- Public ownership: by being publicly owned, NESO should work independently and in the best interests of consumers. It will provide expert advice on how to build a resilient, cost-effective energy system that meets our future needs
- Improving infrastructure and reducing costs: NESO will create strategic plans to optimise the placement of energy projects across the UK, which will help reduce grid connection times and minimise the costs of transporting energy, ultimately aiming to reduce bills
- Future planning: over the coming years, NESO will publish important reports, such as the Strategic Spatial Energy Plan and the Future Energy Pathways report. These documents will guide the development of the UK's energy infrastructure to meet net zero goals, enhance energy security, and support local job creation

The demand-side menace: electrification and grid challenges

In the UK, the Electricity System Operator, regulator (Ofgem) and the government have renewed their focus on grid connection delays. Primary amongst these is the Connections Action Plan, announced in November 2023. Key actions are set out under the plan include:

- Raise entry requirements to increase the quality of projects applying for transmission connections and deter speculative connection applications. Subject to Ofgem's approval, the ESO will start requiring a landowner Letter of Authority to evidence permission from a landowner for a transmission network connection application to be accepted.
- Remove stalled projects to release capacity for more viable projects - Require milestones in transmission connection contracts which a connection customer must meet or face termination of their connection contract – termination would see the affected customer lose their position in the queue. We will review and improve enforcement of existing connection milestones at distribution level.
- Better utilise existing network capacity to reduce connection timelines. We will change how the impact of connections is assessed by the ESO and network companies, beyond existing actions, and enhance use of flexibility, including non-firm/ flexible connections.
- Better allocate available network capacity moving away from the first come, first served approach to one that connects projects that are readier to progress and are able to quickly make use of capacity. Ensure the most strategically important projects receive the strongest possible support to explore timely connection solutions.
- Improve data and processes and sharpen obligations and incentives on the ESO and network companies. Ofgem will undertake an end-to-end review of connections incentives, obligations and requirements on the ESO and networks companies.
- Develop longer term connections process models aligned with strategic planning and market reform to ensure they are integrated to deliver strategic outcomes for a timely and efficient transition to a net zero energy system.



The demand-side menace: electrification and grid challenges

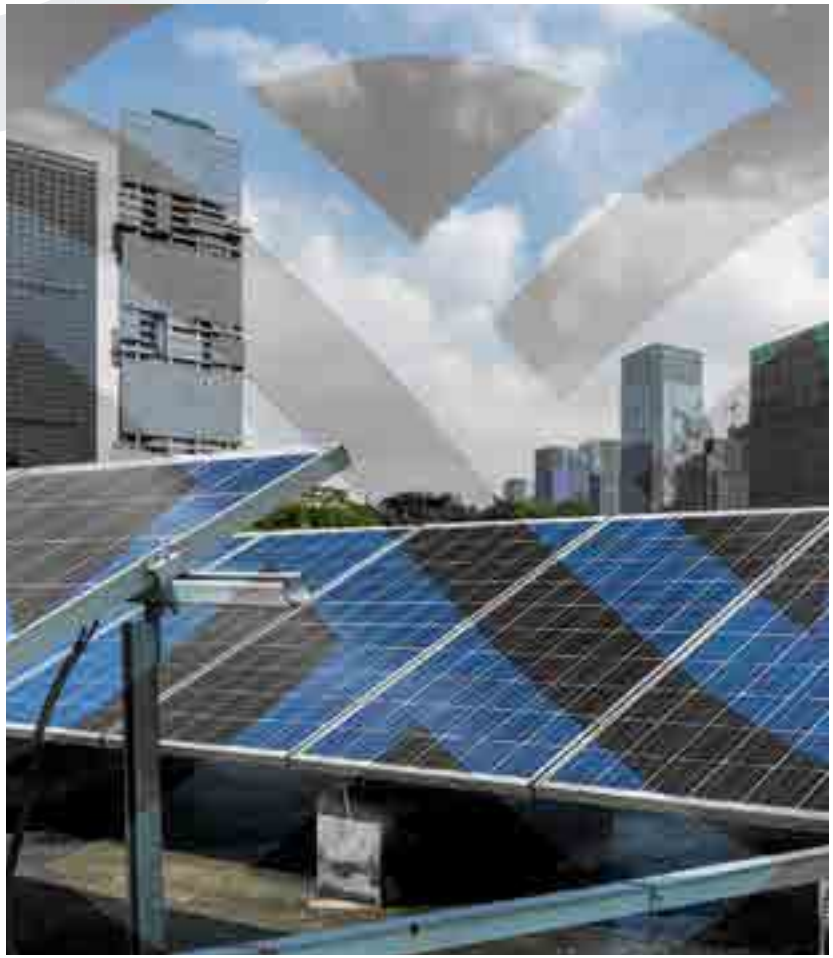
On 16 September Ofgem published a letter signalling further changes to the proposed new regime for transmission-related connections. In addition to the connection criteria already proposed – relating to projects having land secured and having a date for submitting a planning application – there will be new criteria relating to "strategic need" for the project, including by reference to the project's location and technology type, the "TMO4+" process will need to deliver a technology and location mix that is aligned with both the forthcoming 2023 Clean Power ("2030CP") policy to be produced by the new Labour Government and the Strategic Spatial Energy Plan ("SSEP") to be produced by the NESO. To allow for this, the timetable for implementing a revised TMO4+ has therefore been extended from January 2025 to "Q2 2025".

To accelerate the process through which new generation resources connect to the grid, in Summer 2023, in the USA, PJM began implementing landmark interconnection process reform, which was approved by the Federal Energy Regulatory Commission in 2022.

The demand-side menace: electrification and grid challenges

PJM's reformed interconnection process is expected to clear about 300 new generation projects totalling 26,000MW in 2024, marking significant progress in the integration of renewables and other generations in the nation's largest electric grid. PJM also identified another 46,000MW of nameplate generation capacity in projects that should clear PJM's study process and be ready for construction by mid-2025, for a total of 72,000MW of projects, mostly renewable and battery resources, expected to complete the process by that time. An additional 100,000MW of projects is expected to be cleared by the end of 2026.

While significant progress is being made in renewable energy investment, the ability to connect these resources to electricity grids remains a major challenge. Addressing these bottlenecks is crucial to achieving global climate goals and transitioning to a net-zero energy system. Co-ordinated policies, streamlined processes, and infrastructure improvements are essential to accelerate grid connections, enabling clean energy projects to meet growing electricity demand. Continued focus on reforming grid access, fostering collaboration, and removing financial and regulatory barriers will be key to ensuring a smoother and faster energy transition. Policymakers, industry leaders, and consumers must collaborate to accelerate this transition and achieve a sustainable energy future.



The force of flexibility: shaping the future of energy systems

The force of flexibility: shaping the future of energy systems

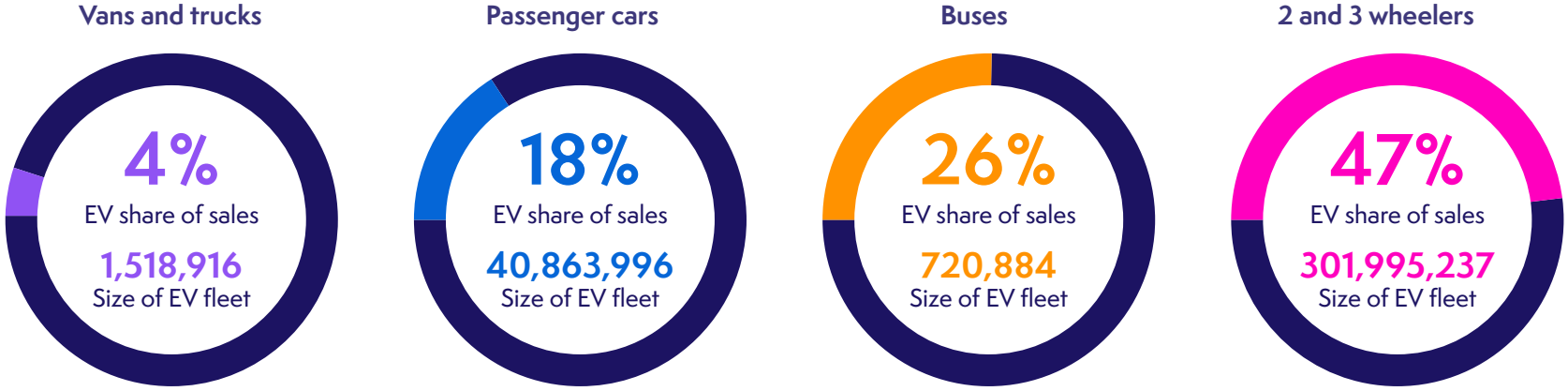
Flexibility in power systems refers to the ability to respond to changes in demand and supply effectively, without compromising the stability of the grid. To counterbalance these fluctuations, the power system needs to be flexible enough to adjust to these variations—quickly ramping up or down other energy sources to match the renewable output or finding ways to store excess energy for later use. Flexibility can be found in various aspects of power systems, from technological advancements to market design and regulatory frameworks.

Transport

The transport sector has made significant strides towards electrification in the last 12 months. With increasing consumer demand, a greater availability of electric models, and ambitious policy targets, the number of electric cars is growing rapidly.

BloombergNEF's (BNEF) Long-Term Electric Vehicle Outlook, published in June, noted that as technology for electrification continues to improve, and battery prices fall, adoption moves from being policy-driven to being driven by consumer demand across all markets.

BNEF also found that electrification is now spreading quickly to all sectors of road transport. The decarbonisation of the commercial vehicle sector, including vans, trucks and buses, is accelerating an unprecedented market opportunity. It forecasts that the cumulative value of EV sales across all segments could hit $9T dollars by 2030 and $63T by 2050.



Source: BNEF

The force of flexibility: shaping the future of energy systems

According to ZapMap, as of the end of August 2024, there are over 1,200,000 fully electric cars in the UK––around 3.5% of the ~34 million cars on UK roads are fully electric. There has been 213,544 new fully electric cars sold, which is 17.2% market share of all new cars registered this year.

Meanwhile the Society of Motor Manufacturers and Traders (SMMT) reported in August that, year to date, the battery electric vehicle (BEV) market share has increased up to 17.2% and is expected to rise to 18.5% by the end of 2024, with some 364,000 BEVs registrations forecast for the year. But it notes that despite this growth, this will still be lower than the Zero Emission Vehicle Mandate, which became law in January 2024.

EIU forecasts that Asia will account for 63% of the 115m new EVs sold worldwide over the next five years, with EVs accounting for 39% of new-car sales in the region by 2028. In an outlook published in January the EIU said that Japan remains the world's third-largest vehicle market and producer, behind China and the US, but it also noted that Japan's policymakers and automakers have focused not on battery technology but on hybrids and hydrogen fuel cells, leaving companies struggling to catch up on battery EVs.

ZEV Mandate: UK

In November 2020, then Prime Minister Boris Johnson announced that the sale of new fully petrol and diesel cars and vans would be phased out by 2030, and that all new cars and vans would be zero emission by 2035. In 2023 then Prime Minister Rishi Sunak changed this phase-out date to 2035.

The mandate specifies the minimum proportion of car manufacturers' sales that must be zero-emission vehicles. This will increase from 22% in 2024 to 80% by 2030, and 100% in 2035.

The 2024 Labour party manifesto pledged to restore the phase-out date of 2030 "for new cars with internal combustion engines".

The force of flexibility: shaping the future of energy systems

For Australia the government is targeting emissions from cars and light commercial vehicles as part of its efforts to combat climate change. These vehicles alone account for over 10% of Australia's greenhouse gas emissions, and transport is forecast to be Australia's largest source of emissions by 2030. The government has also set a target of 75% of its own new passenger vehicle fleet orders to be low emission vehicles (LEV), such as battery electric, hydrogen fuel cell or plug-in hybrid, by 2025. Although some states have been more ambitious for government vehicle targets: the Western Australian Government has a minimum 25% electric vehicle target for its passenger fleet by 2025, the Queensland Government has committed to 100% of eligible government fleet passenger vehicles being zero emission vehicles by 2026, and the Tasmanian Government has set a target to transition its fleet to 100% electric by 2030.

Figures from the Federal Chamber of Automotive Industries released in July showed that EVs accounted for 8% of new vehicle sales in the first half of 2024. The 50,219 EV registrations were 16.5% ahead of the first six months of 2023, and put the zero emission vehicles on course to exceed 100,000 annual sales for the first time. EV sales more than doubled in 2023, compared to 2022, maintaining a growth trend that has seen the new EV market double year-on-year, every year since 2020, according to the Electric Vehicle Council.

Private sector fleets in Australia will also start to notice the emphasis on lower emission vehicles with the introduction of the New Vehicle Efficiency Standard on 1 January, 2025, which sets maximum average CO2 thresholds for manufacturers' nationwide sales. Vehicle manufacturers will still be free to sell any type of vehicle, but will have to offset any less efficient models with greater sales of more fuel-efficient models.

EV implementation and optimisation smart solutions for fleets

At GridBeyond, we offer a comprehensive solution for EV fleet owners, supporting them in the installation, operation, and intelligent management of their energy chain. Our award-winning platform also integrates batteries and renewables to provide a complete turnkey solution for EV fleets.

In addition to providing charging infrastructure, GridBeyond also offers the integration of batteries and renewables. This enables EV fleet owners to optimise their energy usage, reducing costs and maximising revenue.

GridBeyond can offer your business a range of finance agreements so you can buy renewable energy equipment for your growing business. Working with a leading investment fund, GridBeyond has access to an asset financing facility that can help fleet operators implement projects that help them save money on their energy bill or take advantage of additional income by selling the energy.

The force of flexibility: shaping the future of energy systems

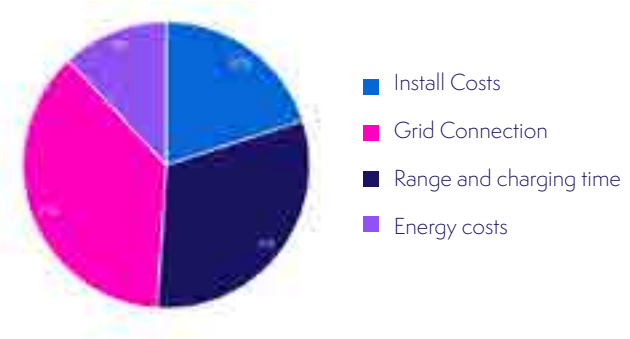
Despite the progress in the EV sector globally, in its report BNEF notes that global road transport is still not on course for a net-zero trajectory. While BNEF's net zero scenario calls for 100% of the road car fleet to be electrified by 2050, the base case only achieves 69% in the same year. This shows that current techno-economic trends alone are not enough to get the transport sector on track for global climate goals, and that continued strong regulatory support is still very much needed.

In our recent poll, nearly half of respondents highlighted charge point connection and high energy costs as a key challenge for the roll out of EVs. While electric cars are often much cheaper to run than similar-sized petrol or diesel vehicles, they are also generally more expensive to buy.

The cost of charging an electric vehicle depends on where, when and how it's done. EV fleet owners with charging facilities on site can take advantage of cheaper electricity rates, especially during off-peak hours. Costs increase significantly when drivers use public chargers. But there are opportunities for EV fleet owners to use their fleets to earn revenues from grid programmes.

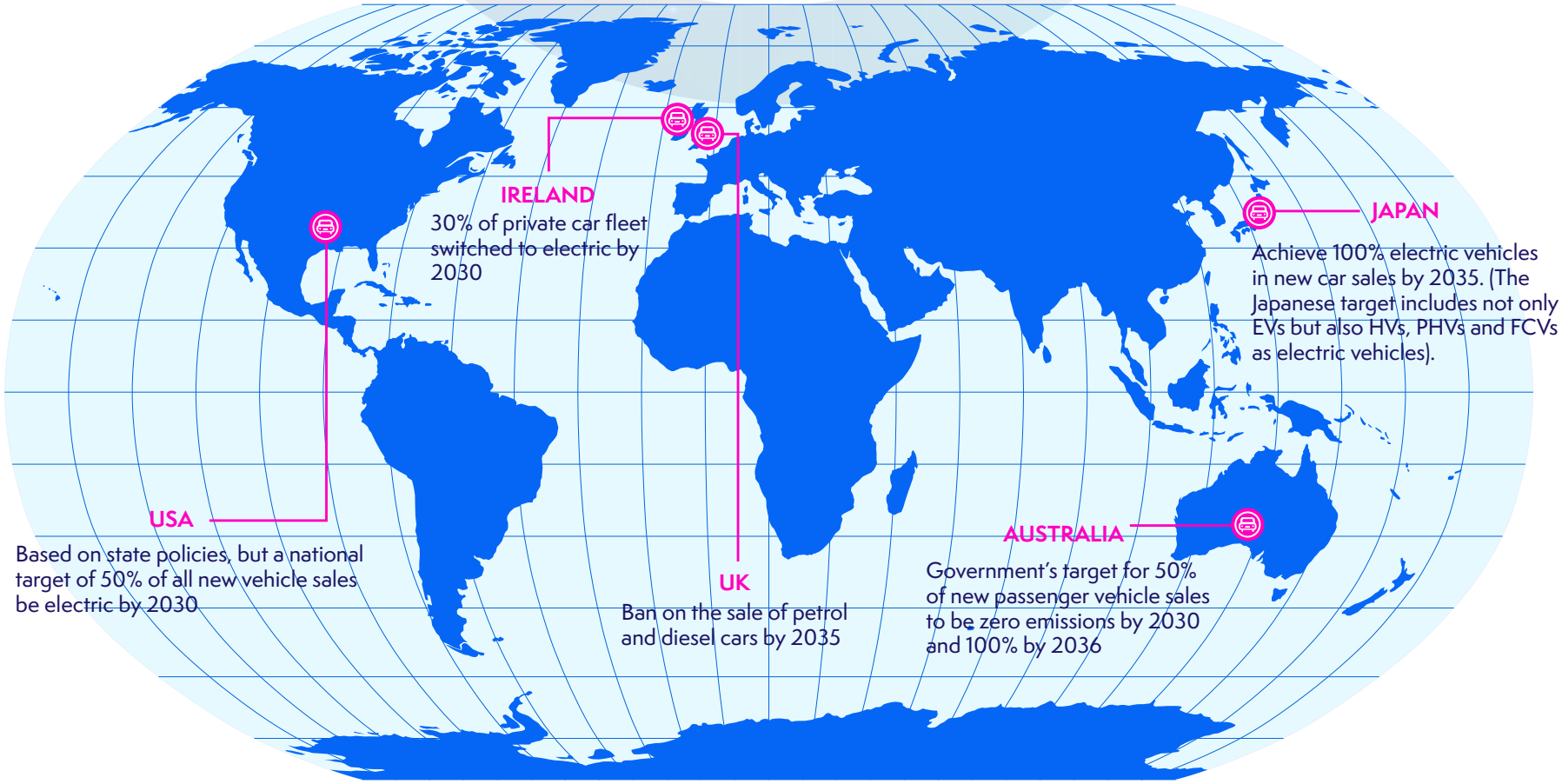
In all sectors, the cost of going electric translates into high initial investment costs. Governments can provide clear pathways for grid operators to allow investments to be made in a timely manner. Currently, targets exist for EVs, heat pump installations, and renewable energy capacity, but governments will need to translate these targets into concrete geographical capacity that can meet future needs.

Vehicle electrification is growing but what are the biggest challenges for the mass roll-out of EV fleets?



Source: Global energy trends 2025 poll questions

The force of flexibility: shaping the future of energy systems



The force of flexibility: shaping the future of energy systems

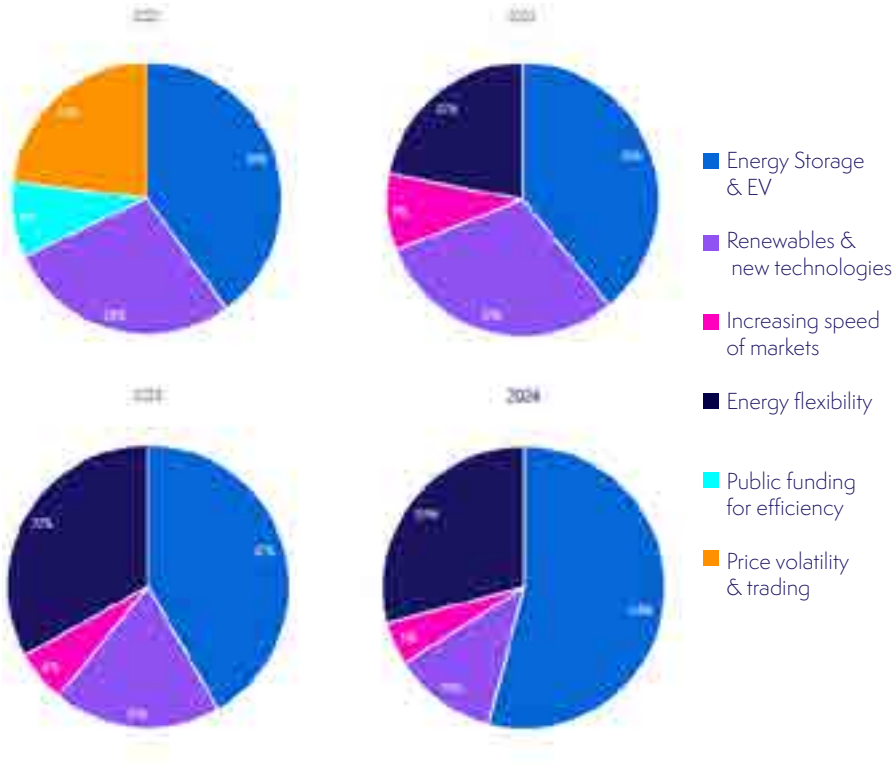
In our recent research over 29% of survey respondents saw energy flexibility as being the biggest trend impacting the energy markets of the future. When combined with enabling flexible technologies such as energy storage and electric vehicles this percentage was over 80% of respondents. This is a sharp shift from 2022 levels, when just 22% saw energy flexibility as a key trend for the future (60% when again combined with enabling technologies).

Battery storage

Batteries energy storage systems (BESS) are a key player in providing flexibility. They can store surplus energy when renewable generation exceeds demand and discharge it when supply falls short. Other forms of storage, such as pumped hydro and thermal storage, are also playing significant roles.

Battery costs have dropped by more than 90% in the last 15 years, the IEA has said. It's one of the fastest declines ever seen among clean energy technologies, and provides hope that batteries can carry the world to its renewable energy goals. To triple global renewable energy capacity by 2030, the IEA calculates that 1,500 GW of energy storage, of which 1,200GW from batteries, will be required.

What technologies and trends do you think will have the biggest impact on energy markets of the future?



Source: Global energy trends 2025 poll questions

The force of flexibility: shaping the future of energy systems

In April 2024, the Environment, Energy and Climate G7 meeting concluded in Turin with leaders committing to "promote stationary battery storage development and deployment to increase storage efficiency and reduce storage costs, increase coordination and supportive policies, and technologies to include storage in grid planning and operations".

As renewable capacity is added to the grid, the need to store and flexibly manage electricity grows with it. This is where the crucial role of battery energy storage systems (BESS) come into play, storing and releasing energy for when it's needed most. It is expected that the global energy storage market will reach 159GW/358GWh by the end of 2024. This will be the first time the global energy storage market adds more than 100GWh of capacity in a year.

According to Solar Media Market Research in the UK the energy storage market is experiencing substantial growth, with the total operational capacity for projects in the UK at 4.6GW. This is projected to increase to 7.4GW by the end of the year. The data also suggests a shift towards larger projects, with the average size increasing to 80MW. A decade ago the average project size was just 2MW.

The force of flexibility: shaping the future of energy systems

Co-location of BESS is also becoming more mainstream. These are projects where the renewable generation and the battery storage are combined at the same grid connection point. For example, a new solar farm might be co-located with batteries to store electricity generation. This can be more efficient from a grid connection point of view as the two technologies often complement each other well. During the wholesale electricity peak at the start or end of the day, there can be lower solar generation (depending on time of year) and this is when the battery comes in. Developing a co-located project can also be cheaper than standalone BESS. But there are various barriers and complexities with market, grid and planning as well as technical challenges around metering. Dealing with these issues would enable more co-located projects and with it increased flexibility and optimisation of renewables.

The force of flexibility: shaping the future of energy systems

Facilitating flexibility

UK

In 2023 Ofgem issued its decision on BSC P415 modification Facilitating Access to Wholesale Electricity Markets for Flexibility Dispatched by Virtual Lead Partners (VLPs). This change benefits aggregators of distributed energy resources (DERs) like battery storage, demand response, and renewable generators.

Previously, VLPs could only participate through energy suppliers, limiting their market role. The P415 change, effective November 2024, removes the need for a costly supply license, enabling VLPs to compete on equal terms. This will increase competition, lower prices for consumers, and offer new revenue opportunities for smaller energy players.

The reform also enhances grid flexibility by allowing VLPs to aggregate and dispatch DERs based on price signals. This helps consumers adjust energy use, supports demand-side response, and strengthens the grid's resilience. Additionally, it aids the UK's net-zero goals by facilitating the integration of renewable energy.

In the UK, distribution network operators (DNOs) are also increasingly turning to flexibility programmes as a key tool to manage the evolving energy grid.

The force of flexibility: shaping the future of energy systems

The six Distribution Service Operators (DSOs) in GB have published overviews of DSO flexibility services and how they intend to implement these:

- Electricity North West (ENW) – "Distribution Flexibility Services Procurement Statement"
- UK Power Networks (UKPN) – "Flexibility Services Procurement Statement"
- Northern Powergrid (NPG) – "Distribution Flexibility Services Procurement Statement: 2024-25"
- National Grid Electricity Distribution (NGED) – "Distribution Flexibility Services Procurement Statement: 2024-25"
- Scottish and Southern Electricity Networks (SSEN) – "Distribution Flexibility Services Procurement Statement: 2024-25"
- Scottish Power Energy Networks (SPEN) – "Procurement Statement for SP Distribution PLC and SP Manweb PLC"

Standardisation efforts have been made to the types of flexibility products that DSOs are seeking to procure, so that there is consistency across them all. These are peak generation, scheduled utilisation, operational utilisation, operational utilisation + scheduled availability, and operational utilisation + variable availability.

	Purpose	Payment for	Key delivery requirements	Product variants	DSOs
Peak reduction	Manage peaks in demand	Utilisation only (£/MWh)	Minimum utilisation time: 30 mins	N/A	ENW, UKPN
Scheduled Utilisation	Manage seasonal peak demands and defer network reinforcement	Utilisation achieved only (£/MWh)	Continuous, stable reduction over delivery period (≥30 mins)	Two variants with different a Utilisation Period: 'Settlement Periods' or 'Specific Periods'	UKPN, NGED, NPG, SPEN, SSEN
Operational Utilisation	Restore network supplies following an unplanned outage/ fault	Utilisation only (£/MWh)	Continuous delivery, either real-time response or week- ahead, minimum utilisation 30 mins	Three variants with different response times: ≤ 2 mins, ≤15 mins, anc week-ahead	SSEN, ENW, NGED, SPEN
Scheduled Availability + Operational Utilisation	Planning for flexibility based upon short-medium range forecasting of network constraints	Availability (£/MW/h) & Utilisation (£/MWh)	Response time ≤ 2 mins or day-ahead; ≥30 mins continuous delivery minimum. Ensure availability for contracted windows	Two variants with different response times: ≤ 2 mins and day- ahead	UKPN, NGED, SSEN
Variable Availability + Operational Utilisation	Planning for sufficient flexibility based upon long range forecasting of network constraints.	Availability (£/MW/h) & Utilisation (£/MWh)	Minimum utilisation time: 30 mins	Three variants with different response times: ≤ 2 mins, ≤15 mins, day-ahead and week-ahead	ENW, SSEN

The force of flexibility: shaping the future of energy systems

USA

Demand Response (DR) aggregation is a key element of the USA energy strategy, helping improve grid stability and energy efficiency by coordinating energy use across consumers. DR aggregation pools electricity consumers, allowing even smaller users to benefit from demand response programs, reducing individual risks. Participants can earn financial incentives by lowering or shifting their energy use during peak periods, receiving payments from grid operators and saving on energy bills.

DERs, including DR, are more accessible due to lower costs, supportive policies, and utility programs. However, barriers have limited participation in wholesale markets. The Federal Energy Regulatory Commission (FERC) has issued orders allowing DERs to compete in wholesale markets, boosting efficiency and cutting costs. Regional transmission organizations (RTOs) and independent system operators (ISOs) also provide markets for DR services, enabling aggregators to offer load reductions and gain revenue.

FERC's 2008 Order 719 instructed RTOs and ISOs to reduce barriers to DR participation. While some states opted out of allowing aggregators to bid DR services in wholesale markets, several states, such as Illinois, Kansas, and Oklahoma, now allow partial participation. States like Missouri, Michigan, and Wisconsin have also recently lifted or amended restrictions on DR aggregation for commercial and industrial customers.

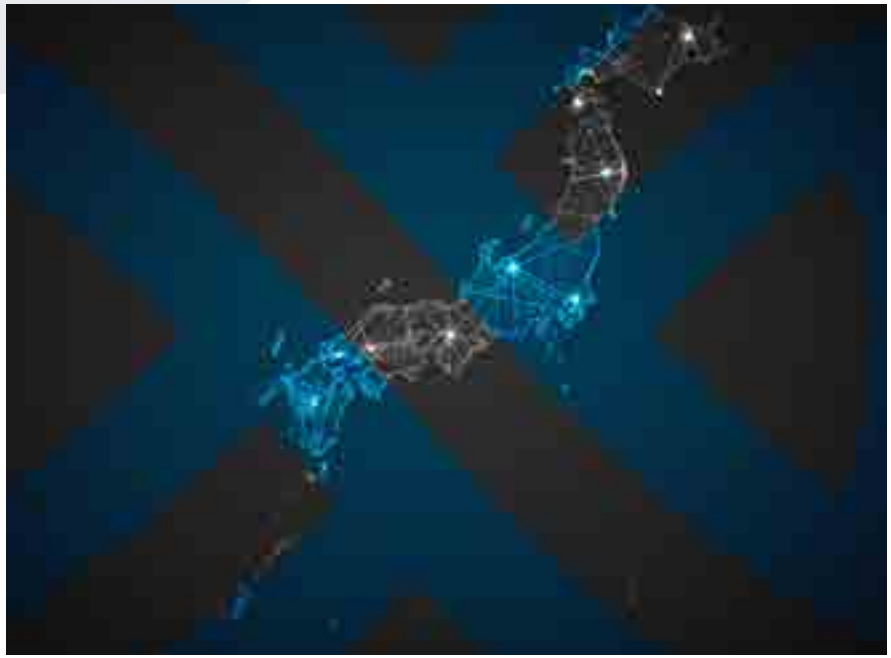
The force of flexibility: shaping the future of energy systems

Japan

In Japan, aggregated demand response is increasingly gaining traction as part of the country's energy transition strategy.

The government has implemented the Capacity Market and Balancing Market reforms, allowing demand-side resources to participate. The FIP (Feed-In Premium) scheme, launched in 2022, supports renewable energy integration, while new rules under the Energy Conservation Act and Electricity Business Act are aimed at promoting DR and flexibility from DERs like solar and battery storage.

However, unlike the UK's P415 or the USA's FERC Order 719, Japan's market reforms are more centralised, focusing on enhancing the role of utilities and grid operators.

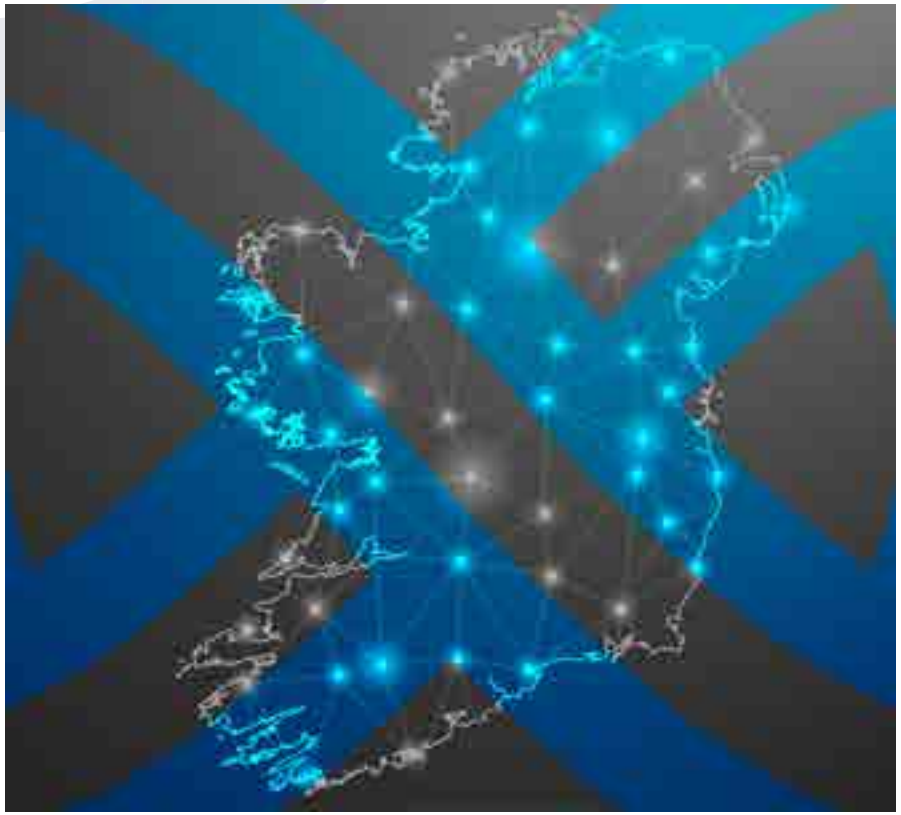


The force of flexibility: shaping the future of energy systems

Ireland

In Ireland, demand response and flexibility services are promoted through EirGrid's Delivering a Secure Sustainable Electricity System (DS3) program, which allows demand-side units to provide balancing services. Aggregators can participate in these services, including Fast Frequency Response and Primary Operating Reserve.

The Integrated Single Electricity Market (I-SEM), which connects Ireland's electricity market with Northern Ireland, also allows demand-side participation. However, while aggregators play a role, Ireland does not yet have an equivalent to the UK's P415, where independent Virtual Lead Parties (VLPs) are fully integrated into the wholesale market without needing to partner with suppliers.



The force of flexibility: shaping the future of energy systems

Australia

Australia has a growing focus on demand response aggregation, especially through the Wholesale Demand Response Mechanism (WDRM), which was introduced by the Australian Energy Market Operator (AEMO) in 2021. Under the WDRM, large electricity users and aggregators can offer demand reductions in the wholesale market, similar to the USA's DR aggregation programs. This opens up the market for third-party aggregators to directly participate without needing a retail license, making it closer to the UK's P415. Additionally, the National Electricity Market (NEM) is undergoing reforms to further integrate DERs and enhance grid flexibility.

While Japan, Ireland, and Australia all have frameworks promoting DR and DER participation, Australia's WDRM is the most similar to the UK's BSC P415 and the USA's FERC Order 719 in terms of enabling direct participation of aggregators in the wholesale market.

GridBeyond®

Process Optimizer

Our AI-powered forecasting, automated control solutions, and smart energy management platform are designed to optimise operations and reduce energy costs. Experience seamless integration that ensures production schedules are met without compromising on quality.

Enhance Efficiency and Maximise Savings

Learn more here

The power unleashed: Flexibility in action

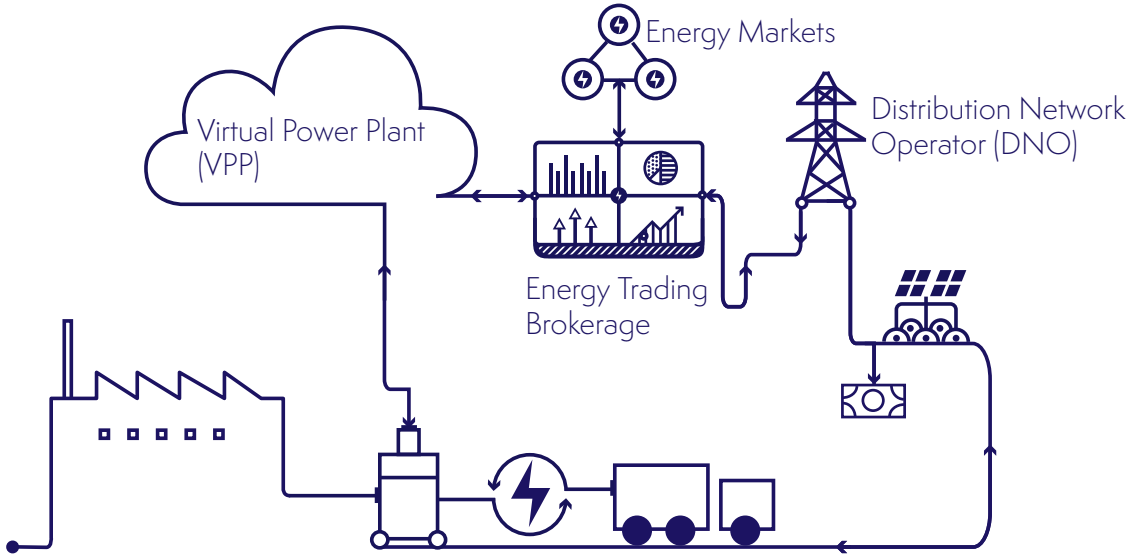
The power unleashed: Flexibility in action

For more than a century, the prevalent image of power plants has been characterised by towering smokestacks, endless coal trains, and loud spinning turbines. But the assets powering our future and keeping the grid in balance will look radically different. By orchestrating EVs, batteries, and smart home devices, consumers of all types and with all types of assets can help make the grid cleaner and more efficient.

Virtual power plants

Virtual power plants as a term have been reframed as any aggregation of available distributed energy resources (DERs) including solar, battery energy storage systems, electric vehicles and chargers, and smart home devices like thermostats or water heaters. Currently, the DER market is expected to more than double by 2027, creating an opportunity for grid operators to tap into the increasing number of assets found at the grid edge.

By intelligently managing and aggregating electricity generation, storage and consumption, while also trading profitably on the electricity market hundreds of thousands of batteries, EVs and heat pumps are poised to connect into a vast, decentralised network – offering capacity akin to several nuclear power plants, but with unparalleled flexibility.. The smart integration of DERs into the energy market also paves the way for transitioning away from subsidies and ensuring that the value of assets is fully realised.



The power unleashed: Flexibility in action

In the USA, the Department of Energy estimates VPP capacity at around 30GW to 60GW. This represents about 4% to 8% of peak electricity demand nationwide, a minor fraction within the overall system. However, some states and utility companies are moving quickly to add more VPPs to their grids. The Department of Energy currently aims to expand national VPP capacity to 80 to 160 GW by 2030.

As we explored in a previous chapter, the capacity of distributed energy sources is expanding rapidly and connecting these to VPP systems enhances the grid's ability to balance electricity demand and supply in real time. Better AI can also help VPPs become more adept at coordinating diverse assets. But flexibility doesn't only come from the supply side. Consumers of electricity can also adjust their demand to align with renewable generation. Through demand-side management techniques, industries, commercial entities, and even residential customers can shift their electricity consumption to periods when renewable generation is high, reducing the strain on the grid during low generation periods.

The power unleashed: Flexibility in action

Demand flexibility

In the UK the Demand Flexibility Service (DFS), which was introduced in Winter 2022 to help the UK cope with tight energy supplies, provided valuable support to the grid during periods of heightened strain. In its Future Energy Scenarios 2024 report, National Grid ESO noted that more than 2.4M households signed up for Winter 23-24 DFS, compared to 1.6M in Winter 22-23, demonstrating a positive increase in consumer engagement.

The increasing selection of time of use tariffs and enabling technologies, such as electric vehicles, further encourage longer-term engagement by offering consumers the opportunity to save money by shifting demand. As a result, residential and commercial demand side response in Holistic Transition achieves 10GW peak demand reduction in 2050.

The introduction of the Market-wide Half-Hourly Settlement (MHHS), planned for delivery in December 2026, will make the settlement process more accurate by capturing consumers' usage on a more regular basis. This can benefit consumers indirectly through flexible charging tariffs, and act as a driver for the adoption of more flexibility services alongside the increased use of electricity aggregators.

The power unleashed: Flexibility in action

Meanwhile in Ireland the Commission for the Regulation of Utilities (CRU) published its decision in September on dynamic price tariffs. A dynamic price tariff is one where the price for electricity varies throughout the day and where the price changes reflect the wholesale market price. As identified in the National Energy Demand Strategy (NEDS), there are many potential benefits of dynamic price tariffs to both the individual customer and also in providing flexibility to the power system. The CRU has required five suppliers to offer a Standard Dynamic Price Contract to electricity customers by 1 October 2025. This is a new more advanced type of time of use tariff which will track prices in the wholesale electricity market every half-hour. Whilst not suitable for everybody, engaged domestic and business customers who choose this tariff and actively manage the timing of their energy consumption will have an opportunity to make cost savings on their electricity bills.

Flexibility is the linchpin in the transformation of modern power systems dominated by renewable energy. By integrating energy storage, demand-side management, flexible generation technologies, and enhancing grid interconnections, power systems can mitigate the challenges posed by the variability of renewables. The power unleashed through this flexibility will not only stabilize energy grids but also accelerate the global transition to a renewable energy economy.

The power unleashed: Flexibility in action

Process optimisation

Businesses are increasingly looking for ways to reduce their energy consumption and costs. One approach is to adopt energy-oriented production planning, which involves considering energy consumption and prices when making production decisions.

When it comes to energy, value is determined by three key factors: price and quantity and time. When and how you use energy is just as important as the price you pay for it and how much you use. Ultimately, the ability to be flexible about when you use energy represents both a value and a cost. This means that some types of industries are able to schedule production to align with periods of lower energy prices and to optimise their production processes to reduce emissions and even gain revenues.

The power unleashed: Flexibility in action

Manufacturing processes typically consume significant amounts of energy, impacting both operational costs and environmental footprint. Traditional production planning approaches have often assumed that energy prices are constant. This means many production planning methodologies prioritise factors like output maximisation or lead time minimisation, without considering energy consumption. Integrating energy use into production schedules is crucial for achieving sustainable and cost-effective operations.

In many markets, energy prices vary significantly over time, depending on factors such as supply and demand, time of day, and day of the week. Failing to account for these time-dependent prices can lead to production decisions that result in higher energy costs. The emergence of dynamic energy pricing models further intensifies the need for energy-aware production planning. These models introduce significant price fluctuations based on grid conditions, creating opportunities to shift production activities to coincide with lower energy cost periods. But efficiently adapting production schedules to these dynamic prices while satisfying other operational constraints can present a complex optimisation problem.

The power unleashed: Flexibility in action

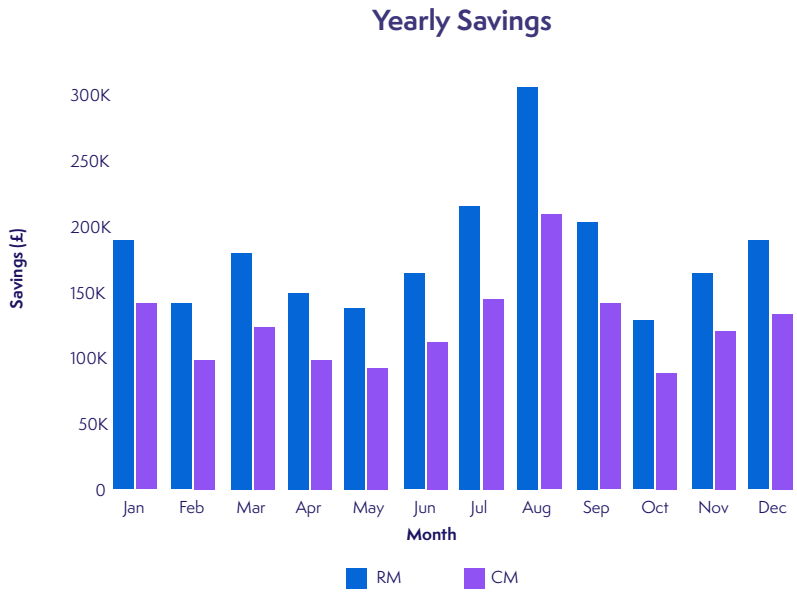
Benefits: Cement plant optimisation

Harnessing the power of big data and site-specific information from an extensive network of sensors and controllers, GridBeyond's optimisation model successfully reduced energy consumption in industrial production without affecting quality or production targets, saving our client (a cement manufacturing facility in Great Britain) £3,694,827 per year in energy costs while ensuring its production schedules were met.

Challenge: The site was using power to operate throughout the day, despite the cost of power fluctuating across settlement periods. Energy flexibility was found in the silo assets without impacting overall product quality or operations – providing an opportunity to make cost savings on electricity and generate revenue for the business.

Solution: By reducing production when at or near maximum capacity, the three silos on site and using Robotic Trading, energy flexibility was traded in the highest revenue markets. This meant the site earned revenue from flexibility offered in grid programmes in addition to avoiding the peak price power periods and reducing overall production costs. Production from the kiln and further downstream in the operational process was not impacted.

Results: By forecasting market prices, shifting load, and trading, GridBeyond's solution saved £3,694,827 annually, accompanied by a substantial reduction of Scope two emissions per year.



Source: Cement Case Study

The power unleashed: Flexibility in action

The model incorporates the following key elements:

- Decision variables: Binary variables are used to represent whether each job is processed in each time period. Integer variables indicate the quantity of each product produced in each period.
- Objective function: Minimises the total energy cost, calculated by multiplying the energy consumption of each activity by the corresponding time-dependent energy price and production quantity.
- Constraints: Operational constraints, such as job precedence relationships, machine capacities, and production deadlines, are incorporated.
- Energy consumption: The model utilises energy consumption profiles specific to each activity and machine.

The model provides a systematic approach to find the most cost-efficient production schedule under time-dependent energy prices. It allows for incorporating various operational constraints and optimisation priorities and the model can be adapted to accommodate complex production systems with diverse equipment and product types.

Production scheduling with time-dependent energy prices is an important tool for businesses that want to reduce their energy consumption and costs. While there are challenges associated with this approach, there are also a number of solutions available.

The power unleashed: Flexibility in action

CPPA and procurement

While reducing energy consumption or utilising flexibility is often the most obvious way to reduce impact where it's crucial for assets or processes to maintain continuous operation (inflexible assets and operations) this may not be possible. As a result, many companies are procuring energy from renewable generation sources as part of their net zero plans. But renewable electricity strategies vary from investing directly in a generation asset, or purchasing the power from a third party's project to pure purchasing of renewables certificates.

There are a range of revenues which investors will consider when assessing the viability of a green generation project. These include wholesale market revenues, subsidy schemes, balancing services revenues, offtake agreements and other elements such as Renewable certificates.

As noted in a previous chapter, the contribution from renewables to generation mixes across the world has increased rapidly over the last 10 years, largely in response to government-led subsidy schemes and policy incentives. While these operate differently, they typically provided a guaranteed level of revenue or "top-up" for renewable generators.

In the UK for example Contract-for-Difference (CfD) is an auction process, where renewable generation projects compete in an auction to set a strike price for the sale of power by technology type. The generator earns the strike price per MWh of electricity exported and is awarded a subsidy equal to the difference between the "reference price" and the strike price, multiplied by the number of units exported. This means when the reference price is below the strike price, the generator receives money; when the reference price is above the strike price, the generator pays back money.

The power unleashed: Flexibility in action

Renewables certificates

Renewable certificates, referred to as Renewable Energy Guarantees of Origin (REGOs) in the UK and Guarantees of Origin (GOOs) in Ireland (and similar names across the globe), serve to ensure transparency regarding the source of electricity generated from renewable resources. These certificates trace the transfer of renewable electricity credentials from the producer to the end user, with one certificate issued for each unit of electricity produced.

Certificates are then used by corporates to report lower emissions from electricity consumption allowing them to show progress against emissions reductions targets or zero-carbon electricity consumption. But as electricity grids continue to decarbonise, concerns have been raised that they don't accurately represent renewable energy usage or better drive investment in clean energy.

The main problem with renewables certificates is that they can provide a misleading picture of how "green" the electricity actually is:

- Double counting: certificates can be sold separately from the physical electricity, meaning that a company can claim to use renewable energy simply by purchasing REGOs, even if the electricity they use comes from non-renewable sources.
- Lack of additionality: Purchasing certificates doesn't directly contribute to new renewable energy generation. Companies can claim to be using renewable energy without necessarily encouraging the development of new renewable projects.
- Complex Tracking: As the market for certificates has grown, it has become more complicated to track the certificates accurately across borders and systems, leading to potential inconsistencies.

The power unleashed: Flexibility in action

PPAs

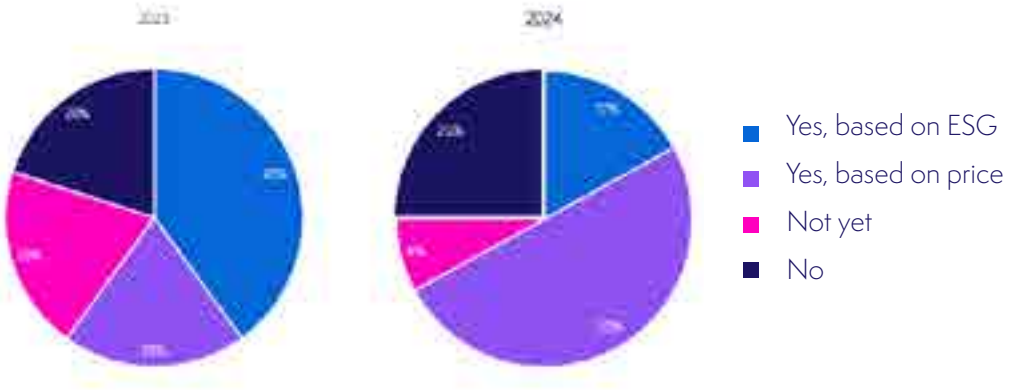
One method increasingly being utilised is Corporate Power Purchase Agreement (PPAs). CPPA is a contract between two parties, one which generates electricity (the generator) and one which is looking to purchase electricity (the buyer).

In the case of CPPAs, the latter party is specifically a large end-user as opposed to an energy supplier, although PPAs between generators and suppliers are also common. The CPPA defines all of the commercial terms for the sale of electricity between the two parties, including when the project will begin commercial operation, the schedule for delivery of electricity, any penalties for under or over delivery, the payment terms and termination rights. These bi-lateral contracts typically bundle in the REGO, to be used in emissions reports.

While 67% of businesses (according to GridBeyond's research) have made changes to either how they procure energy (often shifting to flexible contracts) or taking action to limit energy use, large energy buyers play an important role in the clean energy transition and some could go further and expand their approaches to clean energy procurement and demand flexibility.

According to GridBeyond's research some 36% of businesses will be looking to source a new CCPA in the next 12 months.

The way businesses are procuring energy is changing, has your business made changes to its energy strategy?



Source: Global energy trends 2025 poll questions

The power unleashed: Flexibility in action

For some businesses there is an opportunity to take this further. Renewable procurement or power matching is the practice of purchasing clean energy that aligns with an individual buyer's load on an hourly basis and in the local grid. But there are various levels of sophistication.

- Load shifting: Where buyers reshape load profiles, often using thermal or battery storage, to align demand with clean energy availability.
- Time-based matching: where buyers establish a target to meet a fraction or all of their load with clean energy sources on an hourly basis. The most ambitious form of time-coincident procurement is 24/7 matching, where clean energy portfolios are matched to buyer load every hour of the year.
- Firm, dispatchable clean energy or storage: Buyers can achieve time coincidence by buying more output from firm clean energy resources whose generation profiles align with buyer load profiles or use energy storage to save and dispatch energy when needed.
- Market-based instruments and verification: Buyers can achieve time coincidence by participating in emerging market-based programs that can help verify time-based transactions.
- Time-coincident procurement may involve additional costs, particularly at higher matching percentages, that may need to be weighed against other strategies considering grid needs.

When are you looking to source your next CPPA?

Source: Global energy trends 2025 poll questions

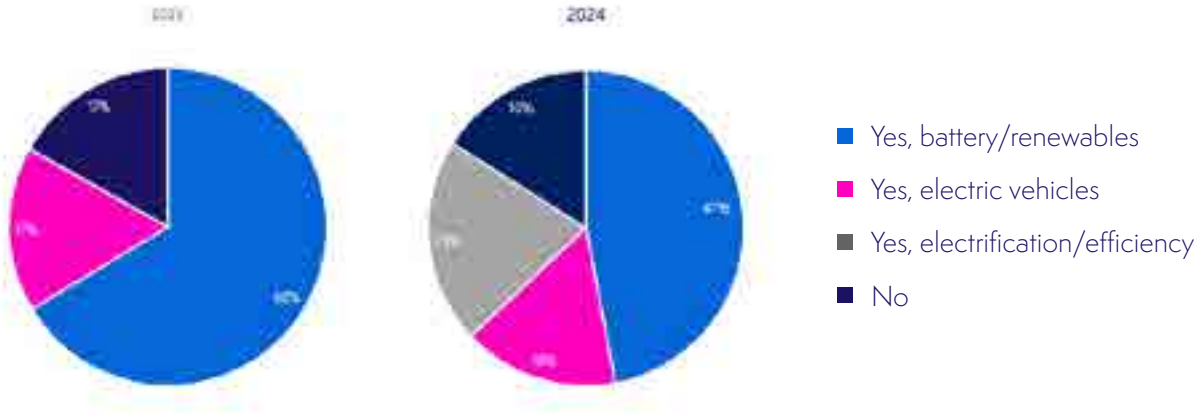
The power unleashed: Flexibility in action

By combining battery storage with any on-site generation or load assets you can further reduce your carbon footprint and help increase the volume of renewables in the energy mix. If your onsite generation exceeds your needs, batteries allow you to store surplus energy or export electricity to the grid. However, the cost of equipment can be significant. Despite this many businesses have already made or are planning to make investments in energy assets.

According to GridBeyond's research 47% of respondents have or are planning to make investments in battery storage and/or renewables technology and a further 16% in fleet electrification. When compared to 2023 there has been a refocus on the benefits of electrification and efficiency (21% of respondents in 2024) over investments in other types of technology.

To enable transformative clean energy procurement practices, the right incentive and reward structures must be present to encourage buyers to undertake advanced procurement measures, particularly given that they can be more complex than common forms of procurement today. In designing new products and services, the incentives offered to the customers providing these services should reflect the value of any grid benefits and increased resiliency that can accrue to utilities, grid operators, or other market participants.

Has your business made, or is planning to make investments in energy assets?



Source: Global energy trends 2025 poll questions

Conclusion

Conclusion

The energy sector stands on the brink of its next evolution. The global energy landscape will change more in the next 10 years than in the previous hundred. As the world's energy sector moves away from fossil fuels toward renewable energy sources, industrial companies are challenged with addressing this transition in transformative ways. Innovators are leading the way into a fresh era characterised by a strong emphasis on sustainability and efficiency, which are now considered essential rather than optional.

The energy transition, at the pace and scale required, is no simple matter. It will take innovation, collaboration, and cooperation at an unprecedented level. It will require physical changes in how we generate, transport, and consume energy. It will mobilise capital and investments in nascent energy sources and assets. It will affect how we think about land use and the importance of energy density. It will change how companies, including competitors, work together to achieve the progress required.

But this change offers opportunities that will enable companies to:

- Unlock new business models focused on energy balancing
- Manage risk and create critical new revenue streams associated with carbon management
- Drive new levels of operational efficiency and generate additional profitability outcomes
- Digitise to decarbonise

Conclusion

This crucial juncture presents an opportunity for both established and aspiring companies to move away from the conventional volume-based, commodity sales approach and adopt the following strategies:

- Prioritise participation: Embrace an unwavering dedication to empowering customers. This involves understanding their needs, preferences, and concerns, and providing them with the tools and information to make informed choices.
- Implement advanced risk management solutions: To build trust and assurance among customers, it is essential to integrate sophisticated risk management solutions. By offering robust protection measures, customers can feel confident and secure in their dealings with the business.
- Introduce transformative energy services: In the downstream sector, focus on developing innovative energy services that can lead to transformative changes. These services should go beyond traditional offerings and present new and sustainable solutions for energy consumption.

Fundamentally, achieving net zero targets – particularly the near-term goal of a 2030 net zero electricity sector – will require a smarter and more flexible energy system. It may therefore serve to reevaluate the frameworks introduced 20 years ago to ensure they remain relevant in today's market and can support the short-term transition to decarbonised electricity sector. Improved clarity, granularity and reporting will have near term benefits for early adopters, and long-term benefits for the whole system and all end users

Energy transition will never be a straight path but by adopting forward-thinking approaches, businesses can thrive in the evolving landscape. As we navigate the complexities of 2024 and beyond, it is important to realise that the feasibility of meeting energy, renewables and net zero targets depends on the availability of sustainable and cost-effective solutions and crucially how these can work together to secure a clean and stable grid fit for a decentralised future.

GridBeyond solutions

DSR

Unlock additional revenue streams with Robotic Trading. Let AI handle the complexities of providing ancillary services, optimising your participation and generating extra income effortlessly.

Trading as a Service

Asset optimisation solutions to help you earn the most revenue possible from your participation in energy markets. By optimising your assets, you can take advantage of market conditions and increase revenues.

Forecaster

Harness AI models to forecast price, demand, renewable power generation, and other time series data using Forecaster to ensure that all revenue streams are maximised.

Peak Management

With AI-driven Peak Management, you can efficiently manage peak demand periods, ensuring minimal expenses and maximising your overall savings.

Bid Optimizer

AI-powered optimisation and Robotic Trading to drive profitability to new heights by ensuring optimal bids that maximise gross margin or P&L across all forward trading periods.

SaaS

A suite of software to maximise profitability of your investments in the energy sector - from planning to optimisation, powered by AI.

Designer

A powerful tool to assist asset and project developers in planning, designing, and analysing prospective revenues from investments in the energy sector.

CapEx free battery

Asset optimisation solutions to help you earn the most revenue possible from your participation in energy markets. By optimising your assets, you can take advantage of market conditions and increase revenues.

Baseline

Deliver cost and carbon savings with unparalleled reliability and efficiency, while simultaneously addressing the commercial aspects of your portfolio, as you accelerate the mission to end global dependence on fossil fuels.

GridBeyond®

The rise of the demand side

Global Energy Trends 2025 and Beyond

A GridBeyond Academy Resource

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