UK Election 2024: How can the UK achieve a net zero power sector?

Part one: Overview

Foreword

With the recent announcement for a general election on 4th July 2024, the UK's decarbonisation pathway has come under focus. The energy transition has been a salient topic for both main parties, the Conservatives and Labour. In 2021, the current government committed to a net zero power sector by 2035. This was seen as a landmark decision that was designed to boost domestic growth in the sector. This was put to the test during the Russian invasion of Ukraine which prompted the energy crisis and the subsequent cost of living crisis. These events signalled the need for an accelerated energy transition and have led to the future of energy taking centre-stage in the upcoming elections. The opposition Labour party have sought to build upon the incumbent's targets by pledging a decarbonised power system by 2030. The Labour party have explicitly cited an accelerated decarbonisation pathway as being imperative to increasing energy security and affordability. Here the incumbent diverges, as the Conservatives have raised concerns over an accelerated pathway costing the tax-payer too much and leaving the UK's energy supply chains at risk of international volatility. In this report, we analyse the party stances towards decarbonisation and why both of their targets remain at risk.

Spurred by the parties' ambitious targets to decarbonise the power system, we will be releasing a series of pieces following on from this introductory note which will explore four key challenges to reaching a net zero power sector.

1. The first issue will be centred around the challenge of deploying a sufficient volume of renewables.
2. The second will take a step back and assess the ability of the existing and proposed grid infrastructure to efficiently deliver power for a net zero system.
3. The third will discuss the implications of retiring thermal plants and what this requires in system services.
4. The fourth, and final challenge, will explore the importance of low-carbon dispatchable technologies and their required deployment for a net zero system to cover the periods when renewable generation is low.

Each issue will analyse one of the challenges across five lenses: finance, technical, supply chain, policy, and social cost and affordability. In doing so, we seek to highlight the importance of a thorough and holistic decarbonisation plan in order to come within reach of a net zero power system within the next decade.

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Beyond the energy trilemma: Diverging party views

The main parties have expressed the importance of achieving affordable energy prices and energy security as top priorities. Although the Conservatives have listed decarbonisation as a component of their energy policy, they have warned against an accelerated pathway compromising their first two objectives. The Labour party, however, have maintained the need for an accelerated transition to enable the first two shared objectives. Central to this, is the belief that the forecasted reduced cost of low-carbon technologies relative to traditional fossil fuels signals the end of the trade-off between affordability and decarbonisation (see figure below).

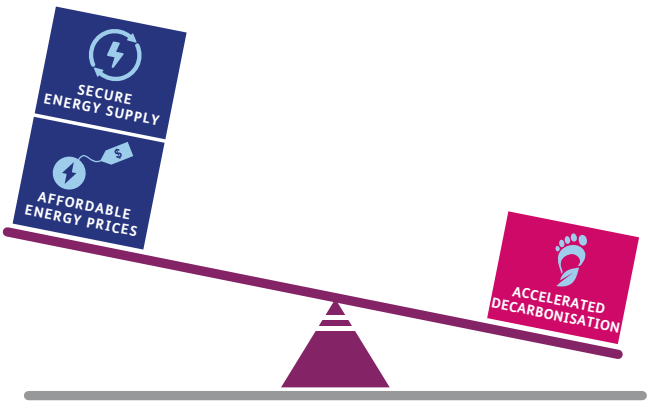
Conservatives

Key Objectives:

- Priority 1: Energy security and affordability
- Priority 2: Decarbonisation

"We've prioritised energy security and your families' finances, over environmental dogma, in our approach to net zero"
Rishi Sunak

Accelerated decarbonisation considered a **trade-off** to achieving key objectives due to high expenses and potential for reliance on high-risk sources of supply.



Labour

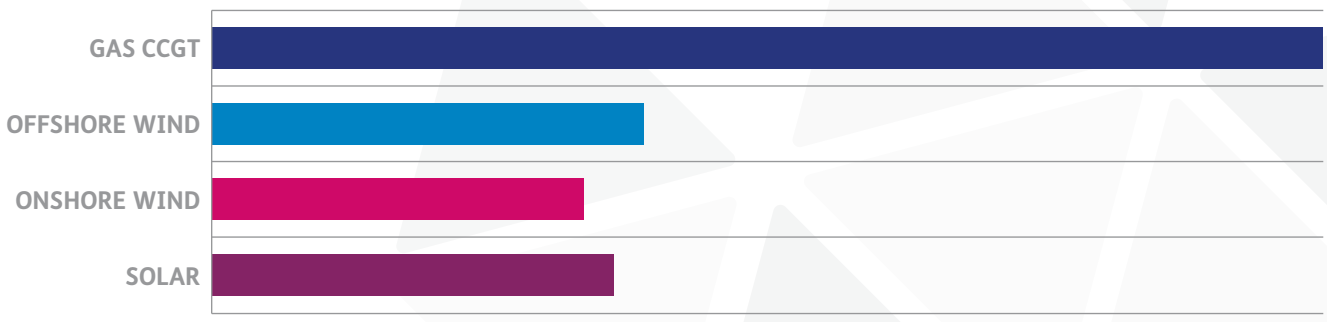
Key Objectives:

- Priority 1: Energy security, affordability and accelerated decarbonisation

"Labour will lead a global Clean Power Alliance to deliver lower energy bills while accelerating the energy transition"
Keir Starmer

Accelerated decarbonisation considered an **enabler** to achieve key objectives as it incentivises development of domestic supply chains and reduces exposure to volatile power prices.

DESNZ levelised cost of electricity estimate for projects commissioned in 2025, £/MWh (real 2021 prices)



The Labour party intends to accelerate decarbonisation vs Conservatives existing targets

The governing Conservative party have pledged decarbonisation efforts across the economy over the course of their administration. However, in recent months, they have rolled back on key targets including delaying the ICE vehicle ban and the production incentives to increase heat pump sales under the Clean Heat Market Mechanism policy. The Labour party have conversely set out an accelerated decarbonisation roadmap with key milestones being brought forward in the power sector and in electrification of other sectors. It is the pace of decarbonisation which therefore sets the main parties apart, not the ambition to decarbonise in and of itself.

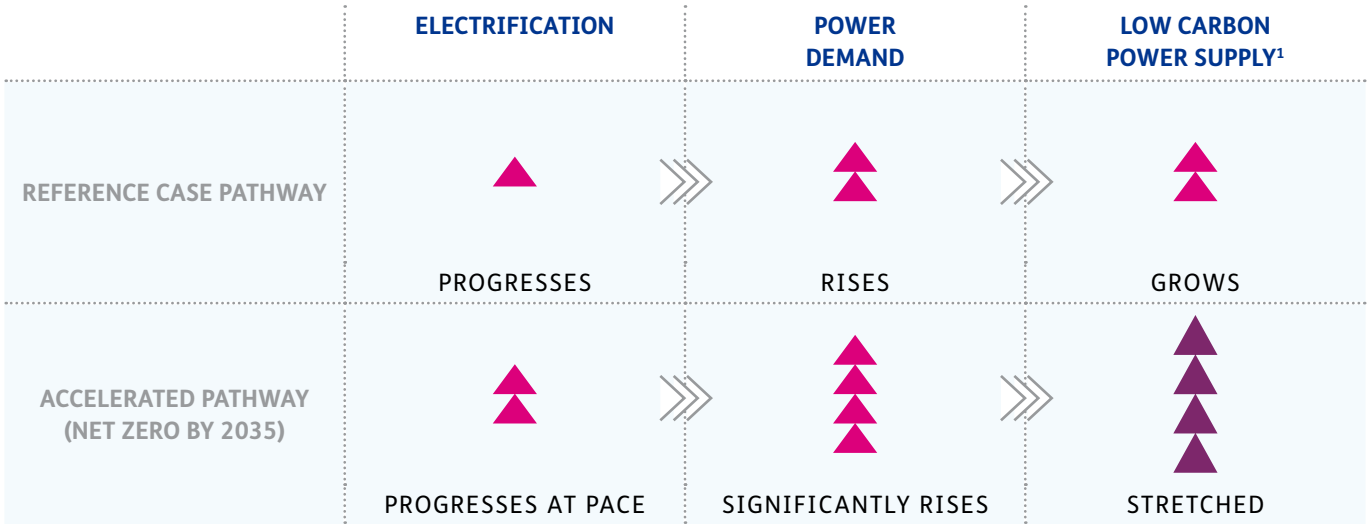
	Conservatives	Labour
DECARBONISATION OF POWER	Target for a net zero system by 2035.	Target for a net zero system by 2030 and will maintain strategic reserves of gas for non-windy periods. Primary goal to establish public entity and clean generation company, GB Energy.
HOMES	**Consumer incentives:** Boiler Upgrade Scheme offers £7,500 grant for heat pump installation. **Producer incentives:** Clean Heat Market Mechanism issues financial penalties on manufacturers if they don't develop heat pumps (delayed until Q2 2025).	In addition to maintaining the current government's Clean Heat Market Mechanism, the party will establish the Warm Homes Plan to upgrade all homes below an EPC B and C rating.
TRANSPORT	Ban on ICE vehicles by 2035 (delayed from original 2030 target).	Alluded to working towards the 2030 ICE ban target, however, have not made this an explicit pledge.
PLANNING AND PERMITTING	September 2023 announced an end to the ban on new onshore wind but there have been no developments since.	Committed to reducing barriers to entry and overturning the effective ban on onshore wind.
OIL AND GAS	New policy to mandate oil and gas license grants in new resources in the North Sea.	Pledged to cease granting new oil and gas exploration licenses in the North Sea. Also seek to increase the windfall tax from 25% to 28% and extend it out until 2029, using the revenue to fund the new public entity GB Energy.

Source: Conservative party website, Labour party website

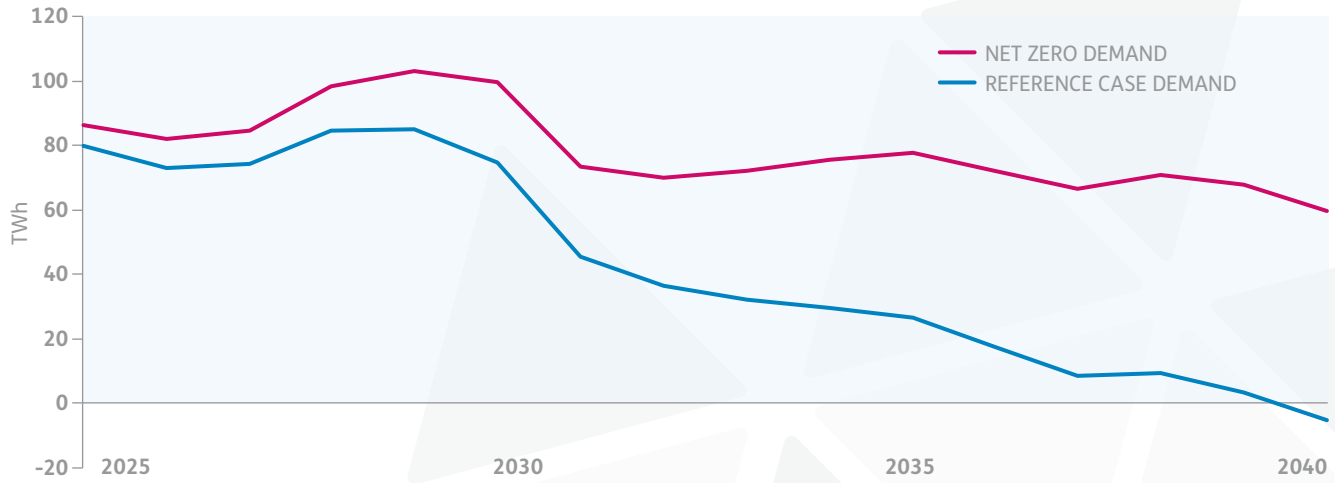
Electrification is necessary for economy-wide decarbonisation, but will place pressure on low-carbon supply and the push for a net zero system

Decarbonisation targets to electrify demand-side sectors, for example replacing ICE cars with EVs, substantially increase overall power demand, requiring more low-carbon supply to achieve net zero emissions. Transport and residential buildings alone are projected to increase their power demand almost 6-fold between 2025-35 in a net zero scenario. For example, although low-carbon supply doubles between 2025-40 under Baringa's central Reference Case scenario, this would fall well short of the supply needed under a net zero demand growth trajectory.

To give a sense of scale, under net zero demand levels with higher electrification, the low-carbon supply gap peaks at around 100 TWh in 2029, remaining high until 2040. If much more low-carbon supply cannot be sourced, continued reliance on fossil fuels puts emissions targets at risk.



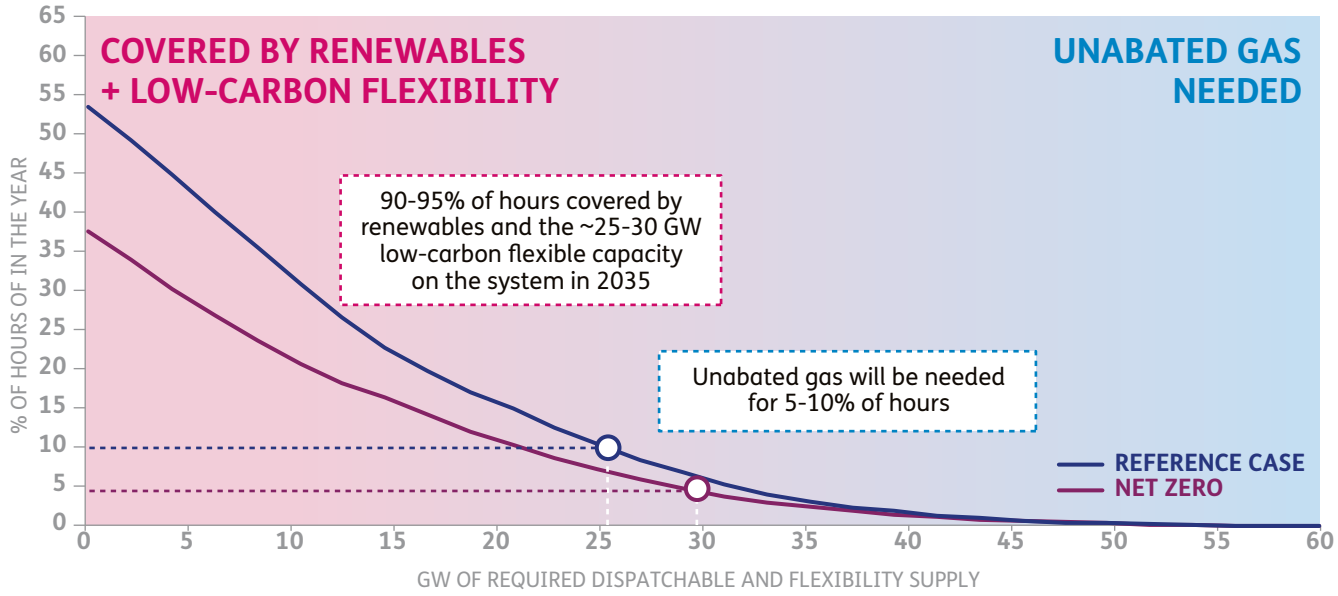
Annual additional generation needed to meet entirely low-carbon supply for reference case and net zero demand 2025-40 (TWh)



1. Based on Baringa Reference Case. Low-carbon supply includes: wind, solar, hydro, nuclear and other renewables and carbon capture technologies (BECCS, gas power CCUS)
Source: Baringa Ref Case analysis

Even with high renewable deployment to reach net zero, the power sector may still need unabated gas-fired plants in 2035

% of hours of generation in 2035 covered by renewable and nuclear capacity vs dispatchable and flexibility



	APPROXIMATE % OF HOURS REQUIRING UNABATED GAS SUPPLY TO MEET POWER DEMAND	
REFERENCE CASE	▲	c.10%
NET ZERO	▲	c.5%

In some hours of the year intermittent renewables such as wind and solar will not generate enough power to cover demand. In these hours, dispatchable technologies, such as low-carbon flexibility, interconnectors and gas are needed. In 2035, 40-55% of hours will require some form of dispatchable generation.

Sources of low-carbon flexibility include storage, interconnectors and abated gas. With around 25-30 GW of low-carbon flexibility projected to be on the grid by 2035, these will meet most of the demand not met by renewables. However, in around 10% of hours in our Reference Case and 5% under a net zero scenario, demand cannot be met by low-carbon technologies. These "difficult" hours tend to combine high winter demand, extended periods of low wind / solar output, and depleted storage – often affecting neighbouring markets too.

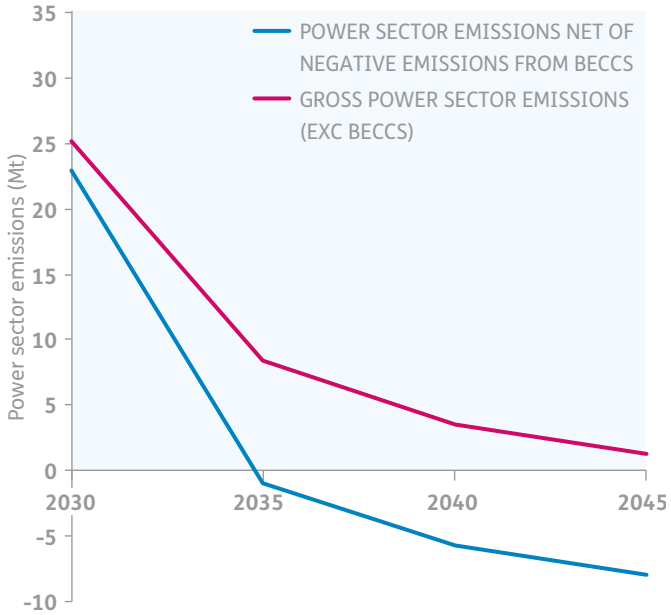
It may not be economically viable to construct additional low-carbon flexibility to cover these 5-10% of hours in time to meet decarbonisation targets. Unabated gas would be the default option to provide the necessary security of supply in such conditions until enough low-carbon capacity (long duration storage and low-carbon thermal) is available. Residual emissions from this unabated gas usage could be offset by negative emissions technologies such as BECCS, if they can be economically deployed at scale – providing a possible route to a net zero power system.

1. Residual load is defined as fixed electricity demand – variable renewable and nuclear generation (2017 weather year)
2. Low-carbon dispatchable technology and flexibility includes: short and long duration storage, interconnectors, and abated gas; other dispatchable technology and flexibility refers to unabated gas

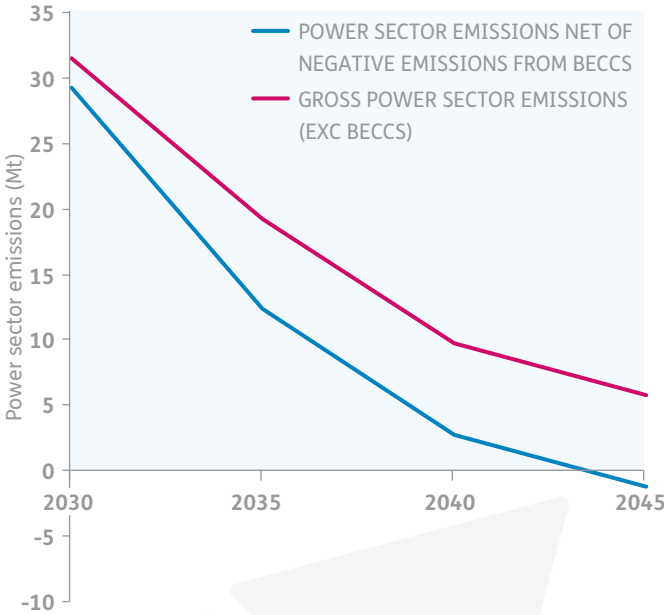
If BECCS negative emissions are treated as within the power sector, this could offset residual emissions from unabated gas

Using unabated gas to meet demand during “difficult” hours where low-carbon generation is low leads to emissions which could put net zero targets at risk. BECCS (Bio-Energy with Carbon Capture and Storage) is a negative emissions technology, because the fuel (eg wood) contains biologically sequestered carbon whose emissions when burnt can be captured and stored. BECCS can therefore counterbalance emissions, enabling a net zero power sector whilst meeting power demands from a generation mix that includes fossil fuels if BECCS negative emissions are accounted to the power sector. Under a net zero scenario, this allows for negative power sector emissions as early as 2035, compared to emissions remaining positive till 2045 without the use of BECCS. Under a Reference Case scenario, including BECCS allows for negative emissions by 2045, compared to emissions remaining positive beyond 2045 without it.

Net zero scenario



Reference case scenario



...Therefore leaving three potential outcomes for emissions across the power and demand sectors

Given the likely role of fossil fuels, there are three potential outcomes for emissions targets based on the decarbonisation of the power and demand sectors:

OUTCOME 1:
Reference case power demand and reference case low-carbon supply

With the current expected rollout of Heat Pumps and Electric Vehicles, power demand is lower than in an accelerated economy-wide decarbonisation case. With low-carbon power supply on the reference case pathway, there is a continued need for fossil fuels, producing significant emissions that outstrip the negative emissions from BECCS.

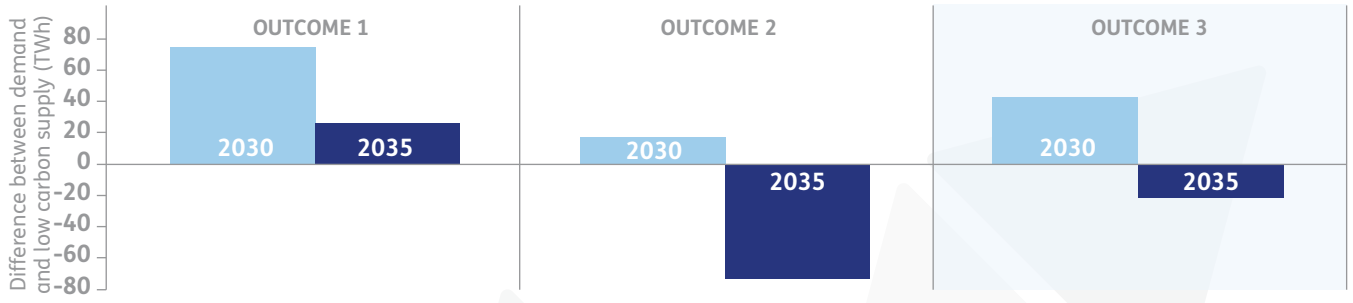
OUTCOME 2:
Reference case power demand and increased low-carbon power supply

With the current expected pathway of power demand but an increased low-carbon supply, demand is almost entirely met without fossil fuels by 2035 but would still use some unabated gas in "difficult" hours. This would result in reduced power sector emissions but would miss key targets to reduce emissions in homes and transport, thereby increasing emissions from these sectors.

OUTCOME 3:
Increase demand to a net zero pathway and increase low-carbon power supply

Progressing with a high economy-wide power demand pathway (due to electrification of other sectors) and high deployment of low-carbon generation enables sufficient low-carbon supply to meet demand on an annual basis by 2035, but would still use low amounts of unabated gas in certain periods due to renewable intermittency. This results in lower power sector emissions -power sector net zero in 2035 if BECCS negative emissions are counted against unabated gas emissions- as it allows for low amounts of fossil fuels to remain in the mix whilst BECCS contributes negative emissions. Regardless of treatment of BECCS, it is the best of the three outcomes for overall decarbonisation, allowing emissions reductions in both power and other sectors, due to the electrification of sectors such as transport and homes.

Difference between demand and low carbon supply under demand/supply outcomes, 2030 and 2035



	OUTCOME 1 EMISSIONS	OUTCOME 2 EMISSIONS	OUTCOME 3 EMISSIONS
POWER SECTOR	▲ TARGETS MISSED	▼ TARGETS MET	▼ TARGETS MET
ECONOMY-WIDE	▲▲ TARGETS MISSED	▲▲ TARGETS MISSED	▲ TARGETS WITHIN REACH
NET	▲▲	▲	▼ BEST SCENARIO
SCALE OF CHANGE	▲ *MODERATE*	▲ *LARGE*	▲▲ *SIGNIFICANT*

*Even though low carbon supply meets demand for outcomes 2 and 3 by 2035, this is in annual potential volume terms, not hourly terms, therefore unabated gas will still be necessary to cover for the periods when low carbon supply is unable to do so.

...However, achieving a net zero scenario of increased demand and increased low-carbon supply carries four key challenges which we will explore over the next few weeks

There are four big challenges to be addressed to facilitate an outcome 3. The interconnected nature of these challenges requires that they be approached simultaneously. Over the upcoming weeks we will analyse each of them using these five lenses:

FINANCE	TECHNICAL	SUPPLY CHAINS	POLICY	SOCIAL COST AND AFFORDABILITY

CHALLENGE	DESCRIPTION	SME
01. INSUFFICIENT DEPLOYMENT OF RENEWABLES	To meet the net zero emissions pathway, a lot of low-carbon technologies must be deployed. However, there are big challenges in delivering the planned pipeline of projects. Solving these is crucial to achieving sufficient low-carbon capacity for a net zero power sector.	 Sanjay Rathod  Manon Derelle
02. INSUFFICIENT GRID CONNECTION FOR A DECARBONISED POWER GRID	The existing grid infrastructure is unable to deliver the amount of energy necessary to keep up with the demands of a net zero power system and electrification of other sectors (transport and homes). Increased grid reinforcement in a timely manner is therefore necessary to ensure a reliable and stable supply.	 Chris Collins  Katherine Kerr
03. INSUFFICIENT SYSTEM SERVICES FOR A DECARBONISED GRID	Decarbonisation targets will lead to the early retirement of traditional thermal power plants. These thermal plants have historically provided system services like inertia, dynamic voltage regulation and short circuit current. With inverter-based wind and solar technologies being limited in their provision of these services, there will be an increased need for technologies like synchronous condensers to provide these services.	 Osamudiame Evbuomwan  Amber Madden-Nadeau
04. INSUFFICIENT LOW-CARBON DISPATCHABLE CAPACITY	With reduced reliance on gas in a net zero power system, there is an increased need for low-carbon dispatchable energy due to intermittency from renewable energy sources such as solar and wind. Increased deployment of low carbon dispatchable capacity is therefore necessary to reduce emissions and maintain reliable and stable supply.	 Samuel Ebohon  Sumit Joshi

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