RWE

RWE Reflections

Filling in the Gaps

Sarah Standen
Head of UK Commercial
Asset Optimisation

What is the role of gas and other thermal technologies in the UK electricity market?

As RWE's Head of UK Commercial Asset Optimisation, Sarah Standen is responsible for the operation and dispatch of RWE's UK fleet. She explains the value of thermal generation in meeting demand and ensuring security of supply, and how we expect this to change over time as the UK moves towards a clean power system by 2030.

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What flexible thermal technologies does RWE operate?

In the UK, RWE operates over 7,000 MW of thermal power generation, principally fuelled by natural gas, and producing enough electricity to power over 8.5 million typical UK homes per year.

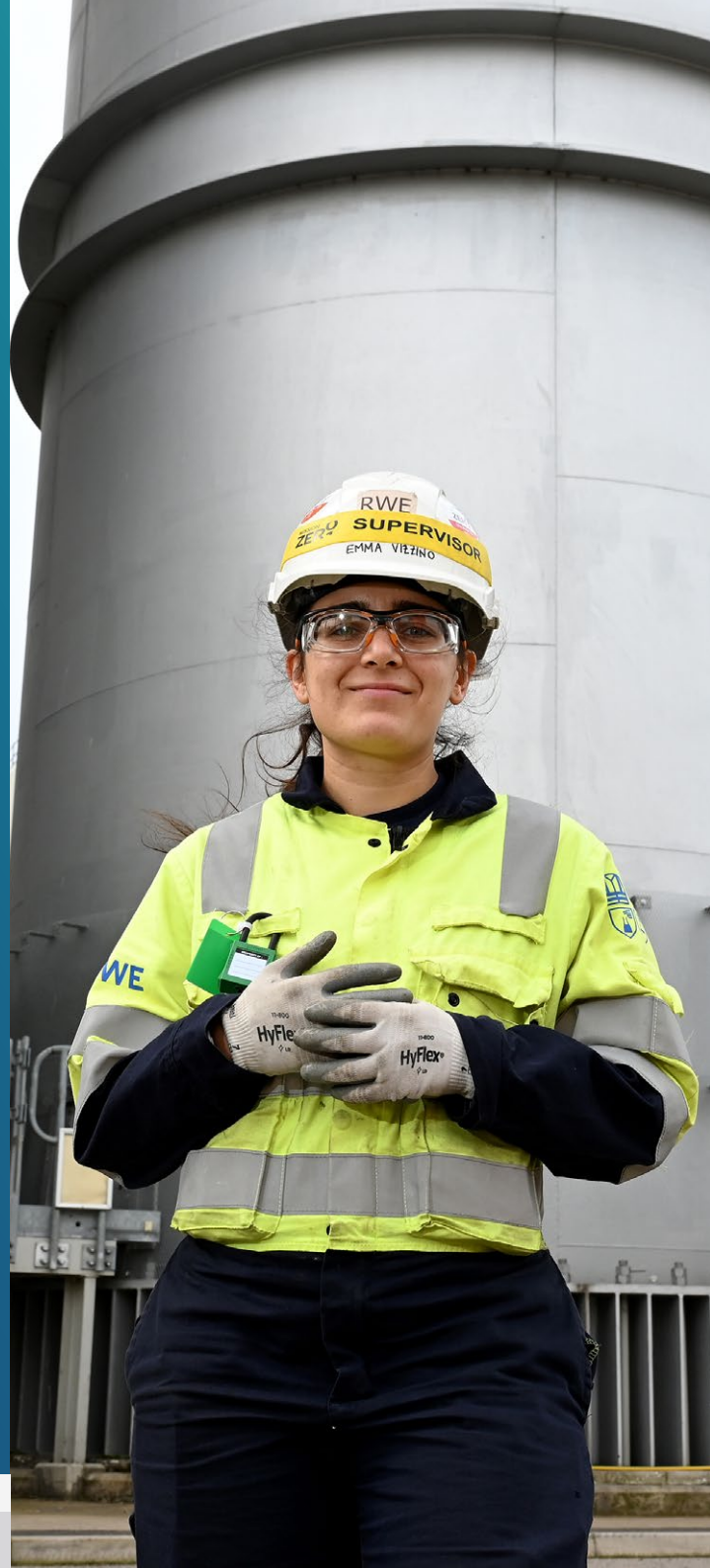
The fleet comprises a range of technology types, each designed to provide unique benefits in terms of generation and system security:

Our Combined Cycle Gas Turbines (CCGTs) were designed and built to run throughout the year as baseload. They are considered relatively high efficiency due to harnessing the heat output from a gas turbine to raise steam, which is then used to generate additional power in a steam turbine. RWE operates six CCGTs in the UK, of which the largest and most efficient is the 2,200 MW Pembroke Power Station in Wales, which commenced operation in 2012.

Our Open Cycle Gas Turbines (OCGTs), such as our 140 MW Cowes power station, run on either gas or liquid fuel. These types of engines are typically much smaller than CCGTs and, whilst less efficient than CCGTs, can be started very quickly in response to unexpected events such as a power station trip or sudden loss of imports from an interconnector. For our liquid fuel stations, the fuel is stored on-site and can therefore provide some diversification in the event of shortages or disruptions to the supply of gas.

Gas Reciprocating Engines are particularly suited to running at times of peak demand in order to ensure that there is sufficient generation at times of greatest need. New gas engines can be significantly more efficient than older OCGTs but are typically smaller – for example our gas engines in Grimsby and Cheshire are 20 MW each.

RWE's thermal sites complement our large, growing renewable portfolio, providing firm and flexible power when renewable resources are scarce



What value do these technologies bring?

Thermal power generation, including gas, is an important source of flexibility and security because it is fully dispatchable i.e. you can ramp it up and down.

In addition, it is a valuable source of 'inertia', a characteristic of rotating plant that is synchronised with the grid. This effectively stores energy that is available instantaneously to smooth small fluctuations in supply and demand, stabilising the system and making it more resilient to disturbances that could otherwise cause system collapse.

The other services that are provided by dispatchable and flexible technologies such as gas include:

Frequency Response

The ability to match real-time variations in demand in order to keep the system frequency at the target of 50Hz. Many technologies can provide this service but in order to maximise the output from renewable sources, it can be sensible to vary the output from gas plant rather than wind or solar.

Reactive Power

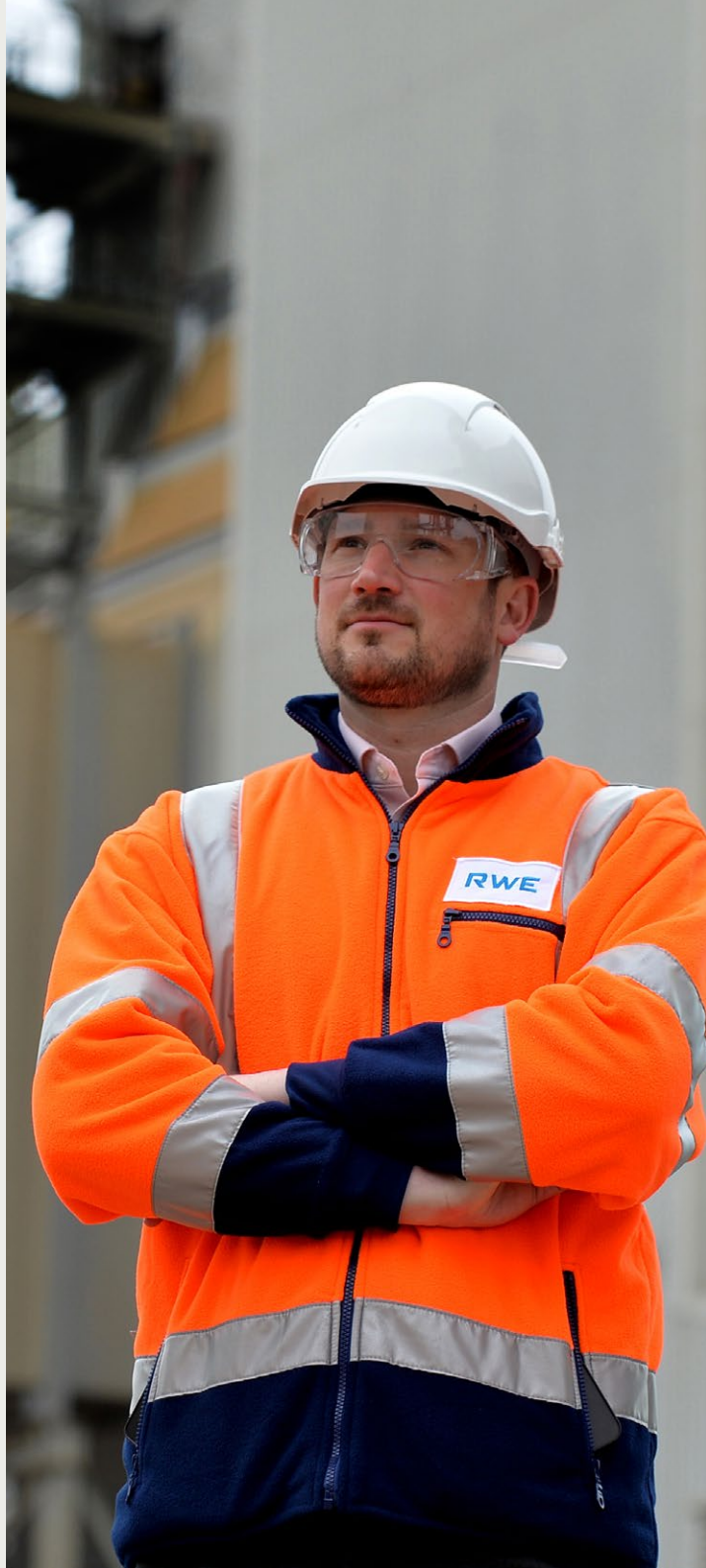
Supporting system voltage in different locations in order to facilitate the flow of power from areas of high generation to parts of the system where it is needed. CCGTs can provide significant amounts of reactive power but as their load-factors reduce, the system will be increasingly reliant on alternative sources from renewables, batteries and dedicated equipment such as synchronous condensers[1].

Reserve services

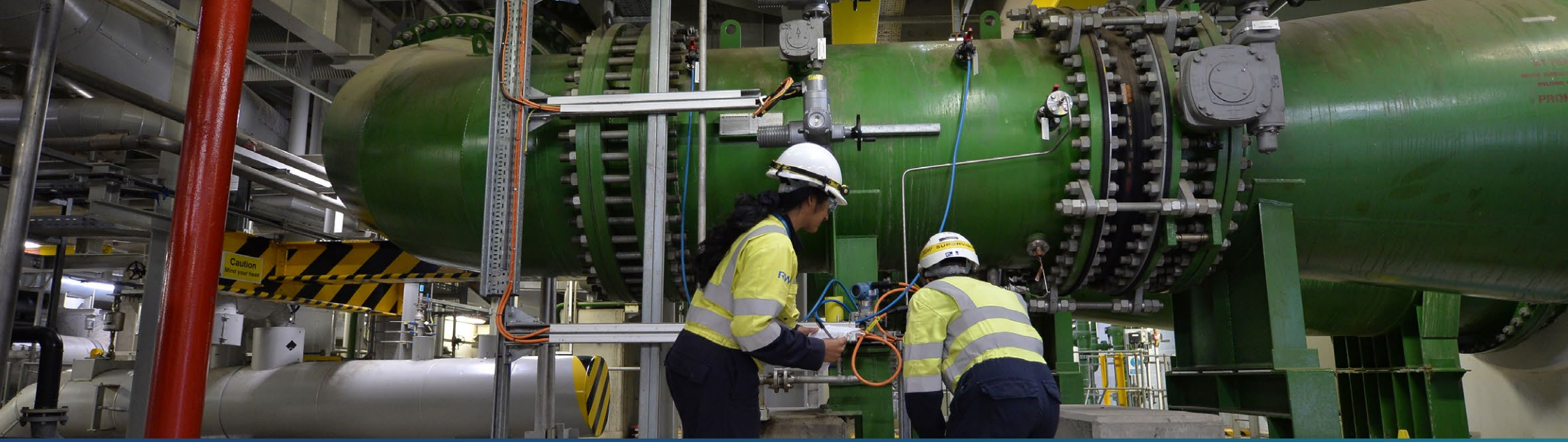
These services allow the National Energy System Operator (NESO) to access increases or decreases in generation at short notice in order to, for example, fill in any gaps arising from the variability of renewable generation. The flexibility of CCGTs make them a particularly useful complement to renewable generation.

Restoration Services

OCGTs and CCGTs that can be started without external power supplies can be contracted by NESO to provide the ability to restart the power system in the event of total or partial system failure. Increasingly, NESO is seeking alternative sources of restoration from smaller, distributed generators, including renewables, but CCGTs remain a very useful large source.



[1] Synchronous condensers are essentially electric motors (to which no load is connected) that produce or absorb reactive power. They are controlled by a voltage regulator as needed to adjust the grid's voltage. This process helps to meet reactive power needs, boost system inertia and short-circuit strength.



What role will these technologies play in the future?

RWE's gas fleet has already adapted to a changing power system, evolving with the market over many years. Increasing amounts of generation from renewables such as wind and solar has driven a reduction in running hours for our plant.

For example, it has been some time since the gas fleet has run baseload throughout the day and night - our gas CCGTs are now frequently 'two shifting'.

'Two shifting' means they are turning off at times of day when renewable resources are plentiful, and turning back on to generate when the system needs additional generation i.e. during peak periods.

The role of gas is set to change even further on the path to clean power. In 2023, natural gas comprised around one-third of electricity generation. According to the recent NESO advice to Government, this could reduce to less than 5% by 2030, primarily running as 'backup' during periods of low wind or sun and/or high demand, such as during the peak winter period.

Also in their report, NESO acknowledged the continued, critical need for gas technology in all scenarios. They also note there will be challenges in operating and maintaining an ageing gas fleet that is running infrequently. It is however reassuring that their gas network analysis shows that the gas transmission network can absorb the impact of the gas fleet's start-up behaviour in a clean power system. This is especially important given that gas infrastructure will also be central to delivering the Government's carbon capture and hydrogen ambitions.

How do we ensure the continued, safe operation of flexible thermal generation?

For RWE's thermal fleet, reliability, availability, and flexibility are more important now than ever. It's critical to ensure the right signals are in place to facilitate the continued, safe operation of the fleet to support a clean power system in 2030. RWE think this is best achieved via evolution of the existing Capacity Market.

At the same time as ensuring its existing thermal fleet can support a clean power system, RWE is investing in low-carbon technologies such as Carbon Capture and Storage (CCS) and/or hydrogen combustion as a source of low-carbon, flexible thermal generation. By investing in such technologies, RWE will ensure its fleet will continue to contribute to energy security while supporting the UK's transition to low-carbon power.

Further information on RWE's decarbonisation projects is available on our website:

uk.rwe.com/rwe-generation-uk/rwes-carbon-capture-projects

A reformed Capacity Market can ensure the safe, continued operation of gas in 2030 and beyond

The Capacity Market

The Capacity Market (CM) was introduced as part of the Electricity Market Reforms in 2013, recognising that in parallel with increased renewable generation, revenue support would be required for plant providing security of supply alongside intermittent renewables.

How does it work?

Each year the National Energy System Operator (NESO) organises an auction on behalf of government to procure sufficient capacity, to meet the security of supply requirements approximately four years ahead. Sources of both generation (including storage) and demand reduction can participate. In return for fixed payments at a rate set by the auction process, providers commit to being available and providing generation or demand reduction at times of system stress.

Since its introduction, the CM has ensured the continued operation of existing generators, supported investment in new generation and flexible storage, and contributed to the growth of demand-side response. This has been achieved through competitive auctions ensuring value for consumers.

How should the CM evolve on the path the 2030 and beyond?

In order to ensure that the CM is capable of providing security of supply in a rapidly decarbonising system, the Government have recently put forward a number of proposals including facilitating investment in improvements to existing plant by offering three-year agreements for qualifying projects.

Further development of CM rules is required to ensure that the GB system has sufficient flexible, dispatchable plant capable of running for prolonged periods of low wind and solar output. For example, a minimum target within the CM for plant meeting certain criteria for prolonged generation would ensure the availability of the right kind of plant, running only rarely and at the time of greatest need.