CORNWALL INSIGHT

CREATING CLARITY

Co-op:

Renewable Energy and REGOs

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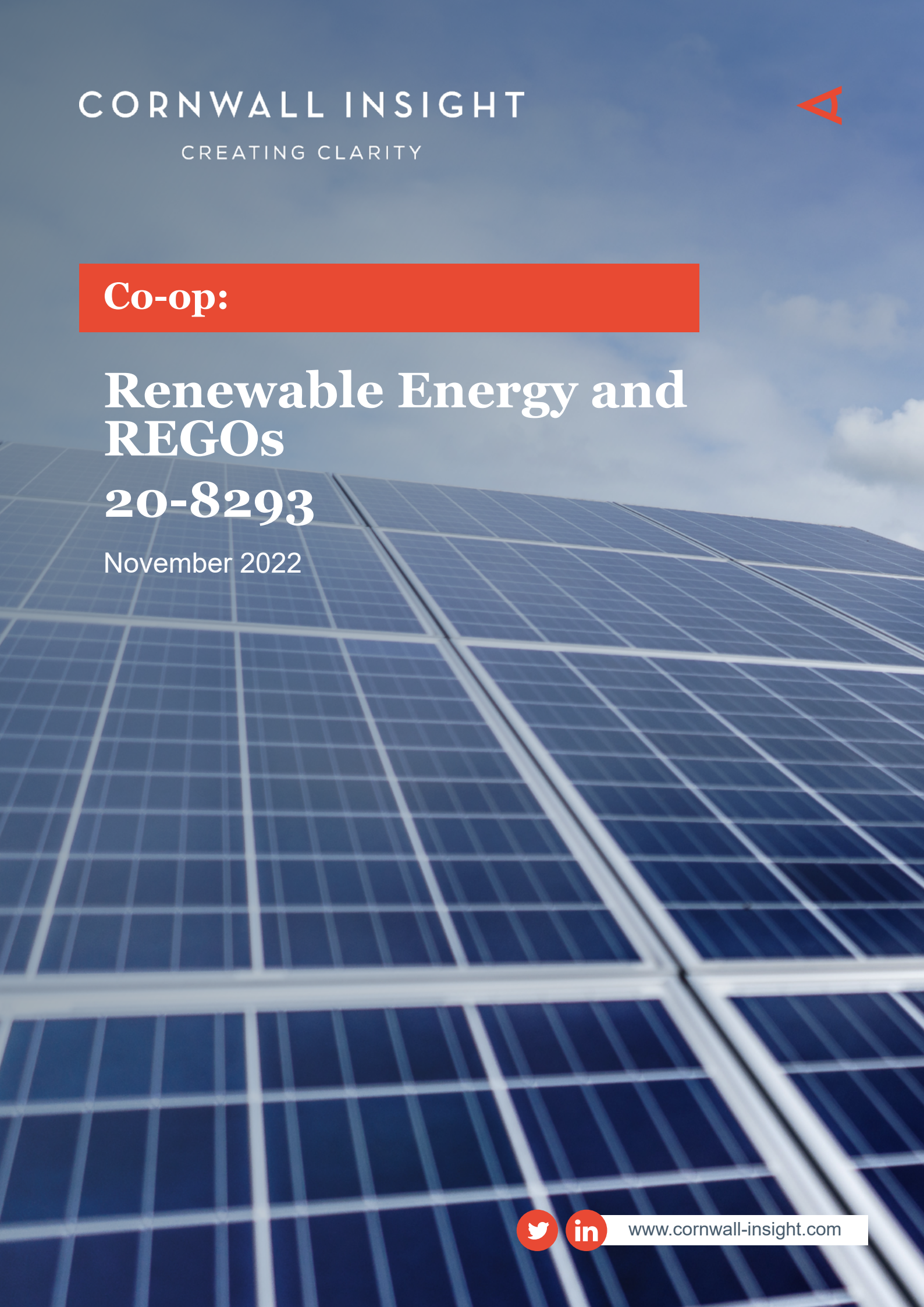

www.cornwall-insight.com

About Cornwall Insight

Getting to grips with the intricacies embedded in energy and water markets can be a daunting task.

There is a wealth of information to help you keep up-to-date with the latest developments, but finding what you are looking for and understanding the impact for your business can be tough. That's where Cornwall Insight comes in, providing independent and objective expertise.

You can ensure your business stays ahead of the game by taking advantage of our:

- Publications – Covering the full breadth of the GB energy industry, our reports and publications will help you keep pace with the fast moving, complex and multi-faceted markets by collating all the "must-know" developments and breaking-down complex topics
- Market research and insight – Providing you with comprehensive appraisals of the energy landscape helping you track, understand and respond to industry developments; effectively budget for fluctuating costs and charges; and understand the best route to market for your power
- Training, events and forums – From new starters to industry veterans, our training courses will ensure your team has the right knowledge and skills to support your business growth ambitions
- Consultancy – Energy market knowledge and expertise utilised to provide you with a deep insight to help you prove your business strategies are viable

For more information about us and our services contact us at enquiries@cornwall-insight.com or 01603 604400.

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1. Executive Summary

Co-op is a longstanding leader in renewable energy, seeking lower carbon options for energy in their own properties and when acting as an advisor to third party businesses. Co-op is supportive of energy policy that will deliver energy security, create economic growth, and help the transition to net zero.

Cornwall Insight ("we", "us", "our") is an independent market leading specialist energy consultancy based in the UK. We provide research, insight and intelligence to stakeholders across the energy value chain.

Co-op have commissioned Cornwall Insight to compile an independent report on the current energy market in Great Britain (GB), and the opportunities and challenges around achieving decarbonisation. This state of the market report is intended to promote better understanding of the key issues linked to net zero for businesses and the energy industry, making debate on this critical policy debate accessible to all.

The UK Government links up to

440,000 jobs

with the net zero transition by 2030[1].

The switch to low carbon power from fossil fuel reliance offers a range of potential benefits. A decarbonised energy system could result in lower bills, improve domestic energy security and create jobs. However, there are a number of challenges that could block or delay the transition.

Russia's invasion of Ukraine and post-pandemic commodity price and supply chain challenges have combined to cause a global energy crisis. British households and businesses are facing difficult years ahead, with energy prices driving inflation in an environment of macroeconomic uncertainty. An economic downturn and limits on available government directed resource means that energy policy must be carefully considered if it is to have maximum impact, and for net zero to remain achievable.

An effective mass rollout of homegrown renewable generation could offer protection from volatile fossil fuel prices. As well as being used for heating and industrial purposes, gas is a fuel used to generate electricity. Therefore, when gas prices are high and volatile, electricity prices can also be high and volatile. Very high energy prices seen since 2021 have been driven largely by high natural gas prices.

The UK Government, via the Department for Business, Energy and Industrial Strategy (BEIS), set out key future system challenges via the Review of Electricity Market Arrangements (REMA). A consultation[2] that closed in October 2022 provided

1 BEIS Net Zero Strategy, Build Back Greener
2 BEIS Review of Electricity Market Arrangements consultation

83%

of people report being concern about climate change

stakeholders across the energy value chain an opportunity to provide feedback on a range of options for market reform, and which market incentives might support mass rollout of low carbon generation. Existing policy tools alone - such as the use of renewable certificates or the Contracts for Difference scheme - are not expected to be able to deliver the scale of renewable power generation deployment required to meet net zero targets. There is a high degree of uncertainty about the development of the electricity system, including the pace of innovation, demand levels, the technical feasibility of some technologies, and investment in supporting infrastructure.

The importance of energy efficiency, decarbonisation of transport, and minimising supply chain emissions have risen up the agenda in recent years. BEIS' Public Attitudes tracker from Summer 2022 shows 83% of people reported being "fairly" or "very" concerned about climate change[3]. Households and Public and Private sector organisations are seeking opportunities to reduce emissions and manage costs. The current market arrangements might not be providing the right market signals to allow effective action to be taken.

According to our research the pipeline for electricity renewables generation is the highest it has ever been. Our Renewables Pipeline Tracker in September 2022 identified a viable pipeline of 196.7GW of renewable assets in different stages of planning and delivery. Not all of these projects will ultimately prove viable, with planning concerns, supply chain challenges, skills shortages, component costs, and investor confidence, all presenting potential obstacles for delivery. Approximately 36.4 GW (18.5%) of the pipeline is assessed to be highly likely to complete, with the remaining pipeline less likely or unlikely to deliver in their current format.

Only 18.5%

of planned renewable generation is assessed as Highly Likely to develop as planned

3 BEIS Public Attitudes Tracker Summer 2022 UK

2. The net zero energy transition

2.1 Why decarbonise energy?

The energy sector has been a focus for decarbonisation over the past decade due to its high contribution of greenhouse gas emissions from fossil fuels. Emissions must be brought down to help minimise a global temperature rise and the impacts of climate change. So, the energy transition has concentrated on using renewable technologies to generate electricity and reducing reliance on fossil fuels for that purpose. However, the energy system in Great Britain (GB) and globally is extremely complex. Nations have taken a trial and error approach to manage the transition in a way that minimises the risk of disruption to supply of energy to businesses and households.

Decarbonisation of the electricity system has reached a crucial point. Renewable generation has seen huge cost reductions and increases in efficiency over the last decade. Due to the cost reductions in offshore wind and solar, Government projections assume these technologies will make up a majority of renewable electricity generation during the transition. The need for secure, UK generated energy has been highlighted by the decision of Russia to halt gas supplies to Europe. Moving away from fossil fuels-based electricity generation and attracting investment in renewable generation in the UK will help to meet the government's objectives of energy security, affordability and decarbonisation.

As well as improving security of supply, low carbon power brings opportunity to create green jobs and invest in local economies. Green Alliance[4] assess that under the government's energy security strategy, decarbonisation by 2035 would lead to 15,500 jobs in operation and maintenance of solar generation alone, of which 13,500 would be highly skilled. Further upskilling of workers would be required to as the Green Alliance[5] believe that renewable generation has the potential to produce more UK jobs per MW than fossil fuel power generation does at present.

The electricity generation mix in GB has been rapidly decarbonising over the last 15 years. This has been supported by a range of support mechanisms such as the Renewables Obligation (RO), Feed in Tariff (FiT) and Contracts for Difference (CfD), and some precursor schemes that introduced low carbon generation at scale into the energy mix.

Currently, approximately 40% of GB's generation mix is low carbon with this primarily consisting of wind and solar. Carbon intensity varies period to period, and can be dependent on the kind of weather in GB and Europe. Average carbon intensity across the month of February 2022 was 127gCO2/kWh, compared to an average of 293gCO2/kWh in February 2018[6].

The targets for decarbonising the remaining generation mix are very ambitious, facing a range of challenges that could inhibit net zero being reached by 2035.

4 Green Alliance – Powering the labour market
5 Green Alliance – Powering the labour market
6 Nation Grid carbon intensity reporting

2.2 UK Government decarbonisation targets

The Climate Change Act passed into UK law in November 2008. The Act targeted an 80% reduction in emissions on 1990 levels by 2050, which was as part of a global effort deemed sufficient to keep average temperature rises below 2°C. However, an Intergovernmental Panel on Climate Change (IPCC) special report in 2018 showed forecasts of the global impacts of 1.5°C of warming globally were profound. In response, the UK government sought advice on setting a date to achieve net zero emissions from what is now named the Climate Change Committee (CCC), an independent statutory body. The CCC suggested that the UK should adopt a target to reach net zero greenhouse gas emissions by 2050.

The UK Government committed to the 100% net zero target in 2019 through an amendment to the 2008 Act. The target is legally binding, and represented a significant step-up in ambition. Reaching this target will require the decarbonisation or carbon offsetting of even the most challenging sectors to decarbonise – also referred to as being "hard to abate". The goal will require changes to national infrastructure, electrification of heat and transport, and introduction of carbon capture and storage at scale, all alongside behavioural change from consumers.

The government have committed to decarbonising electricity generation by 2035 to support the wider net zero goal. To achieve this, the Climate Change Committee[7] has suggested that renewables will need to make up over 70% of generation. The share of renewable generation in quarter 2 2022 was closer to 39% according to BEIS statistics[8], meaning over the next decade this gap will need to be closed, with low carbon generation reaching 55% for the same period.

With these targets in mind, in 2020, the government released the Ten Point Plan[9] for a Green Industrial Revolution and the Energy White Paper[10] to set the direction of the energy sector towards net zero. The main focus of these releases was outlining support for the following areas:

- Large-scale offshore wind and innovative wind technologies such as floating offshore wind
- Low carbon hydrogen for heat and transport
- Nuclear power

Subsequent policy papers have reconfirmed this approach, and boosted some targets that will accelerate the transition.

2.3 Businesses and renewable energy

From April 2022, it is mandatory for over 1,300 of the largest UK-registered businesses to disclose climate-related financial information. Whether the action is mandatory or

7 Climate Change Committee Net Zero Electricity Market Design
8 BEIS Energy Trends
9 Ten Point Plan for a Green Industrial Revolution
10 Energy White Paper – Powering our Net Zero Future

otherwise motivated, organisations are using decarbonising their energy supply to demonstrate leadership. Sustainability Disclosure Requirements (SDR) can baseline within scope emissions, and also be used to measure improvements. Investing in clean, secure, low-cost energy demonstrates an organisation's commitment to its values to both investors and customers alike.

Approaches businesses are choosing to decarbonise include investing in on-site renewable generation, on-site storage such as battery systems, private wire arrangements to nearby renewable generation, and Corporate Power Purchase Agreements (CPPAs) with remote renewable generators. Many businesses are using high energy prices as an opportunity to revisit decisions to invest in energy efficiency measures, as the time to see a return on investment may be substantially reduced.

However, despite the appetite for decarbonisation in industry and the changes that have already been made, there is lack of consistent support for small to medium sized enterprises (SMEs) and microbusinesses to meet net zero targets. The British Business Bank estimate that SMEs contribute around 36% of total UK emissions[11]. The Energy Saving Trust[12] has suggested that policy changes need to be made to support SMEs with decarbonisation to ensure that net zero targets are met. These suggestions have included joined-up and cross-departmental policy making, better coordination of funding for SMEs, a clear regulatory timetable, and a support framework so that SMEs can access information and support to help them decarbonise.

11 British Business Bank – small businesses and the transition to net zero
12 Energy Saving Trust – How can policy better support SMEs in the pathway to net zero

3. The electricity generation mix

3.1 Types of electricity generation

Electricity is generated using a wide range of methods. The most common technologies used in GB are listed below and can be grouped by themes.

- **Fossil fuel & thermal generation is typically available on demand, subject to the availability of fuel**
  - CCGT - Closed Cycle Gas Turbine may be used for baseload (continuous) generation
  - OCGT - Open Cycle Gas Turbine, typically used for short bursts at peak (high demand) times
  - Coal - had been declining in use due to carbon price and other disincentives, although the lifetime is being extended for security of supply reasons in 2022-23
  - CHP - Combined Heat and Power see electricity generated and useful thermal power captured at the same time
  - Reciprocating Engines - uses pistons rather than a turbine to create electricity from fuel, typically gas, at peak times

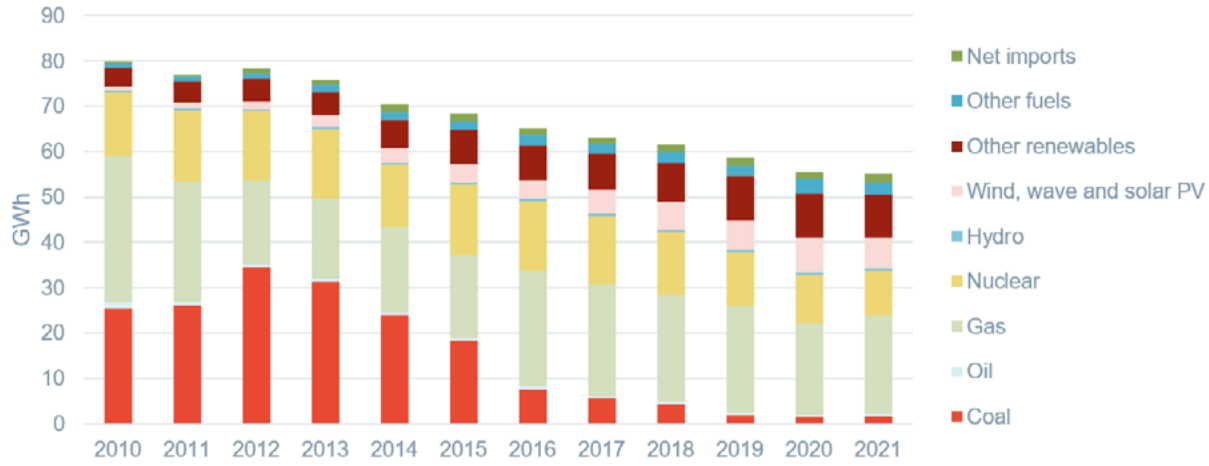
- **Availability of intermittent renewables is uncontrollably variable**
  - Onshore Wind - wind turbines on land
  - Offshore Wind - wind turbines in the sea, most commonly attached in a fixed position to the seabed, but floating turbines are being developed
  - Solar PV - Photovoltaic Solar panels
  - Hydro - energy captured from the flow of water, from rivers, streams or reservoirs, with the exception of stored/pumped, hydro is dependent on water levels and rainfall and is therefore intermittent and can be impacted by climate change

- **Other technologies sit outside these categories**
  - Nuclear - large scale generation that runs continuously day and night
  - Battery Storage – typically runs in 2 hour cycles, but installed systems vary between 1 and 4 hours
  - Pumped Storage – hydro based storage, can be used to store excess generation from nuclear
  - CCUS (Carbon Capture, Use and Storage) – technology to reduce the carbon impact of fossil fuel technology
  - Energy from Waste – may see waste products burned for heat, or generate electricity via Anaerobic Digestion (AD)
  - ACT (Advanced Conversion Technology) – uses pyrolysis or gasification
  - Biofuel – biomass and biogas sees a range of source products turned into fuel

3.2 Historical generation mix

The make-up of the GB electricity generation fleet has changed significantly over the past decades with ageing large-scale fossil-fuelled sites closing and being replaced with large and small-scale renewables, battery storage and smaller-scale fossil-fuelled peaking generators.

Figure 1: Historical GB generation mix, GWh (2010-2021)



Source: BEIS, DUKES 2022

Seen in Figure 1, the GB generation mix in 2010 was dominated by fossil fuels, with coal and gas contributing 32% and 41% respectively to the total power market[13]. In the past decade, rising carbon costs and more restrictive emission limits have made it increasingly difficult for fossil-fuelled generation to operate in the market, leading to retirements and making them less attractive investment opportunities. This financial unattractiveness paired with the increasing market penetration of low carbon technologies has led to a shift in the GB generation mix, with fossil fuels only making up ~40% combined in 2021. This decline in fossil fuel generation is largely seen from the phase out of coal, whilst the power generation share from gas has remained similar throughout the decade.

3.3 Subsidy schemes and incentives

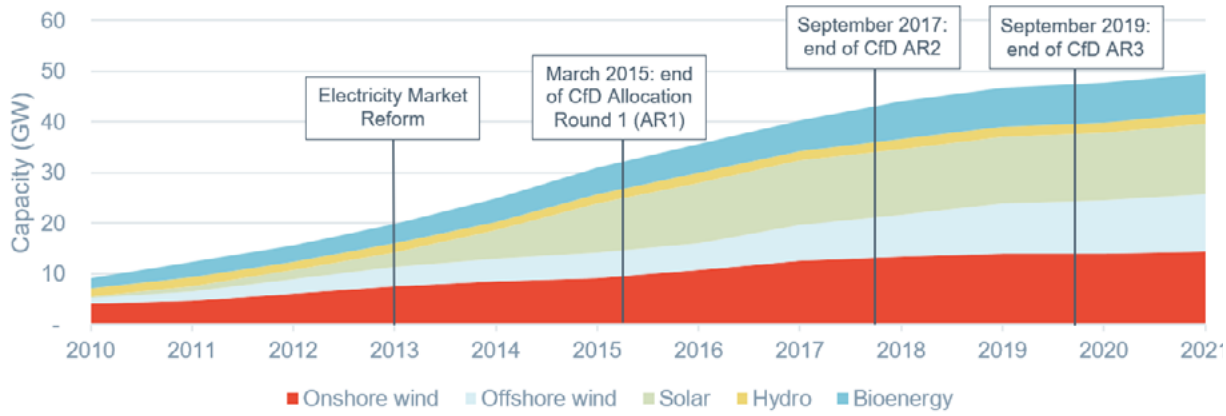
As fossil fuel generation has declined, the contribution from renewables and low carbon technology has increased rapidly in the past 10 years in response to government-led subsidy schemes, namely Feed-in Tariff (FiT), Renewable Obligation (RO), and most recently the Contract for Difference (CfD) schemes. These all operate differently, but in essence they provide a guaranteed level of revenue, or a guaranteed 'top-up' for renewable generators. These subsidy schemes, in particular the CfD, have made eligible projects particularly attractive to investors, which has resulted in the rapid growth in projects, both in terms of numbers and size. Figure 2 shows when the Electricity Market Reform (EMR) took place and the end of the CfD allocation rounds in relation to the growth of renewable capacity. The EMR considered ways to encourage investment in renewables on the electricity system, resulting in the CfD being introduced - along with other schemes such as the Capacity Market (CM). The CfD Allocation Rounds (AR) originally occurred every two years. AR4 concluded in 2022 and AR5 will open in March 2023 as the CfD rounds will now be run annually.

Shown in Figure 2, this rapid growth between the years of 2010 and 2021 has seen the capacity of wind assets increased by nearly four-fold to 25.7GW, and solar PV capacity rise dramatically from 0.1GW to 14.0GW. In the most recent reports from National

13 Digest of United Kingdom Energy Statistics (DUKES) 2022: Table 5.3

Grid ESO[14], September 2022 saw zero-carbon sources provide 44% of generation, peaking at a height of 78%, with wind and nuclear providing the bulk of the low carbon electricity.

Figure 2: GB renewable capacity, GW (2010-2021)



Source: BEIS, DUKES 2022[15]

Battery storage capacity has also been increasing in the past 5-10 years. Battery assets operate predominantly on a merchant risk basis – e.g. their capacity is sold via an exchange - as they are ineligible for direct subsidy schemes available to other low carbon technologies. The rise in intermittent renewable generation has supported the growth in battery capacity, as it is well suited to managing fluctuations in renewable output. Storage is useful for managing the intermittency of renewable output for short periods of time (hours). The technology for long-duration storage is not yet developed enough to manage long periods of reduced renewable output, seeing reliance on thermal fossil fuel generation in extended periods of low wind and sun.

3.4 Future renewable mix

Looking ahead, the GB generation fleet is expected to more than double in size in the next decade. This is being largely driven by increases in offshore wind, solar, OCGTs, reciprocating engines and battery storage. These trends are heavily interlinked, and also run alongside the increased need for energy security given the current international context of the war in Ukraine.

In a supportive policy environment, more intermittent renewables will come online, resulting in a corresponding increase in volatility between periods of high and low renewable output.

The Electricity System Operator (ESO) – National Grid – is responsible for balancing the national Transmission network, ensuring there is enough electricity on a second-by-second basis. One way the ESO manages the network is via frequency services. If demand is greater than generation, the frequency falls. If generation is greater than demand, frequency rises. The ESO contracts with flexible generation and demand assets to ensure the electricity system frequency can be maintained at 50 Hz +/-1%.

14 National Grid ESO – September 2022 Electricity Statistics
15 Digest of United Kingdom Energy Statistics (DUKES) 2022: Table 6.2

The increase in volatility, combined with the need for associated frequency and other reserve services, will incentivise the deployment of battery storage assets, and see efficient gas-fired sites operating as peaking assets (run at the highest demand times) rather than in their traditional baseload role.

A recent cross industry Net Zero Electricity Market Design Expert Group[16] considered the biggest challenges to the energy transition. They identified that the 2020s will need huge investment mobilised in low carbon generation, storage and networks. In the 2030s the biggest challenges will be the efficient operation of the low carbon electricity system, with much more dynamic demand once electric vehicles and heat pumps are more widespread.

3.4.1 Near-term renewable generation pipeline

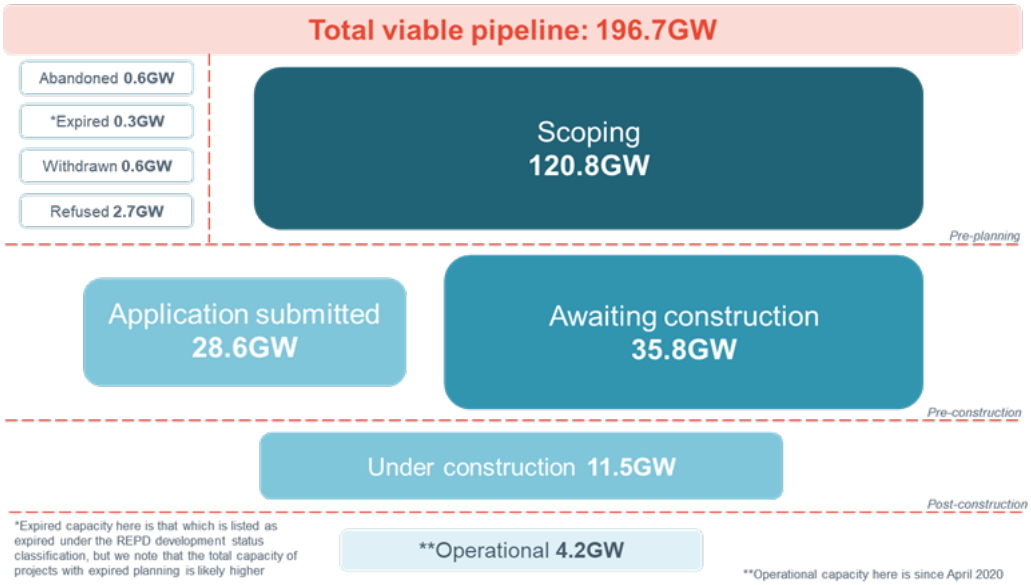
GB has a significant pipeline for new renewable generation capacity which in various stages of planning. A major part of the pipeline, currently totalling 120.8GW (Figure 3), is classified as having a development status of "scoping". These sites are yet to submit a planning application but have a grid connection option confirmed through the Transmission Entry Capacity (TEC) Register.

It could take time to deliver on this pipeline and not all of the scoped generation will be online by the 2035 grid decarbonisation targets. Projects may prove to be unviable, or be indefinitely suspended before completion. This scoped generation still faces barriers that may slow or even halt progress such as the high upfront costs of developing renewables, local planning opposition, and the lack of up-skilled workers in a local area to deliver these projects. Approximately 36.4 GW (18.5%) of the pipeline is assessed to be highly likely to complete, with the remaining pipeline less likely or unlikely to deliver in their current format.

Pipeline capacity is dominated by Offshore Wind, Onshore Wind (excluding Remote Island Wind (RIW)), Solar PV and Battery (predominantly Lithium Ion) technologies. These technologies account for 94% of capacity. Offshore Wind projects dominate scoping capacity at 82GW. The latest offshore leasing rounds delivered by Crown Estate and Crown Estate Scotland have shown there is no shortage of interest from developers looking to expand offshore wind capacity in the UK. The ScotWind clearing process provided three new projects[17] (expected capacity of 2.8GW) with seabed agreements in August. With the release of the National Grid's Holistic Network Design for Offshore Wind[18] and a 50GW offshore wind target by 2030 set by government in its Energy Security Strategy[19] earlier this year, interest in further developments seems likely to grow.

16 Climate Change Committee Net Zero Electricity Market Design
17 Crown Estate Scotland – Three Shetland ScotWind projects announced
18 National Grid ESO – A Holistic Network Design for Offshore Wind
19 BEIS – British Energy Security Strategy

Figure 3: GB renewable pipeline



Source: various, compiled by Cornwall Insight

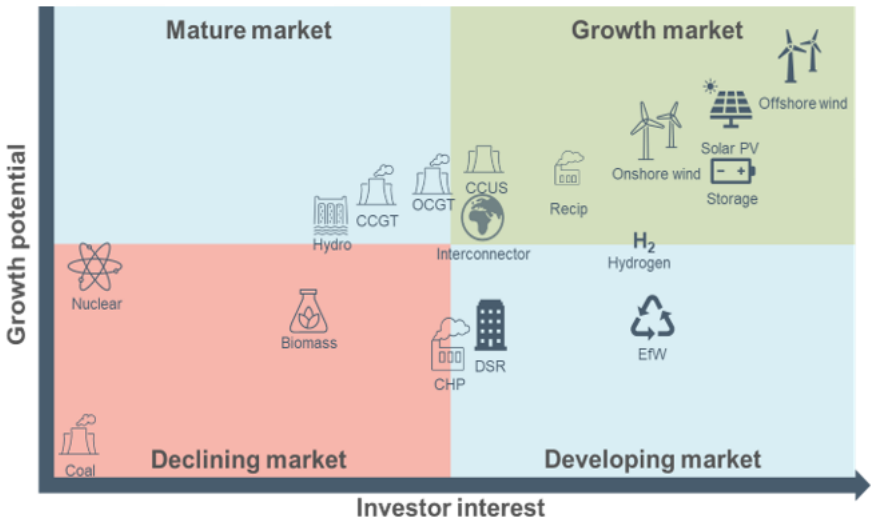
As for the rest of the pipeline, a further 28.6GW of pipeline capacity is currently classified as "application submitted" and awaiting planning approval. Capacity classified as "awaiting construction" and with planning approval totals 35.8GW and capacity classified as "under constriction" stands at 11.5GW. Since June, a total of 4.6GW of capacity has moved from awaiting construction to under construction development status. This movement is chiefly in offshore wind (3.6GW) under the Dogger Bank wind farms, alongside 0.4GW of remote island wind capacity from the Viking Wind Farm and 0.5GW of battery capacity.

July this year saw the Allocation Round Four (AR4) of the Contracts for Difference (CfD) scheme conclude. 93 projects, totalling 10.8GW of capacity, were successful in winning contracts, with Delivery Years ranging between 2023-24 and 2026-27. 7.0GW of offshore wind capacity was successful in the auction and will be added to an already operational or contracted capacity of 19.6GW across the Renewables Obligation (RO) and CfD schemes combined. However, this all-in total of 26.6GW is still notably shy of the 50GW offshore wind ambition for 2030[20], which would result in high expectations on the scope and success of AR5, 6 and 7 if the targets are to be met.

As these projects progress through different phases of development they will have varying levels of interest from different investors (Figure 4). This means that as projects move from scoping through to operation there is likely to be a number of financial transactions in relation to them. Given the size of the current pipeline we would expect there to be a significant financial market associated with them over the coming 5-10 years.

20 BEIS - Major acceleration of homegrown power in Britain's plan for greater energy independence

Figure 4: Generation opportunities, 2020-2030

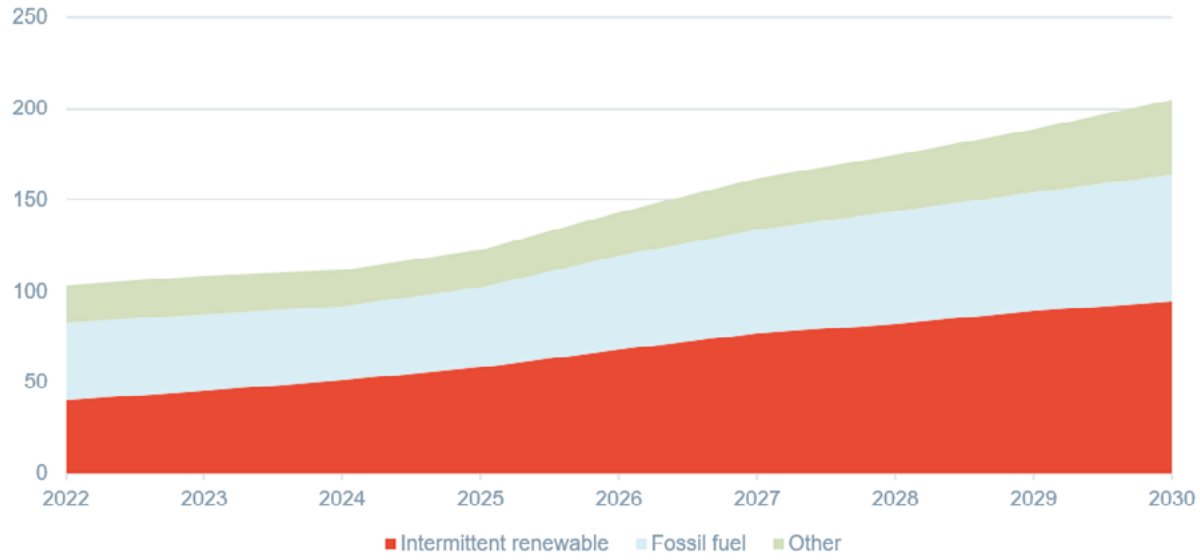


Source: Cornwall Insight

3.4.2 Longer-term forecast of the generation mix

Shown in Figure 5, over the coming decade we forecast renewables to take on a larger share of the GB generation mix, rising to 58% by 2030, whilst fossil fuel sources fall to 21%. Of this increase in renewable generation, offshore wind capacity makes up most of the rise, with the capacity more than tripling, from under 13GW in 2022 to over 58GW by 2030. As previously mentioned, this is largely driven by CfD supported capacity, which aims to help meet the government's 50GW offshore wind capacity target. This forecast includes ~2.5GW of floating offshore wind. These forecasts are also driven by our assumptions of increased efficiency of turbines and decreasing costs of installation. We also expect a material growth in solar capacity, rising from 14GW to over 29GW.

Figure 5: Forecast of the future GB energy mix by technology total capacity (GW)



Source: Cornwall Insight, various

While we expect onshore wind capacity growth to continue, the rate is slower than that seen for offshore wind or solar, rising from under 14GW in 2022 to over 30GW by 2037. Whilst we assume onshore wind is one of the cheapest forms of electricity on an Levelised Cost of Energy (LCOE) basis, the unsupportive planning environment partially restricts the growth in capacity. This is exacerbated by government policies favouring other low carbon technologies, namely offshore wind, nuclear and carbon capture and storage. Biofuels, hydro and pumped hydro sites are expected to retain their existing small share of the generation mix.

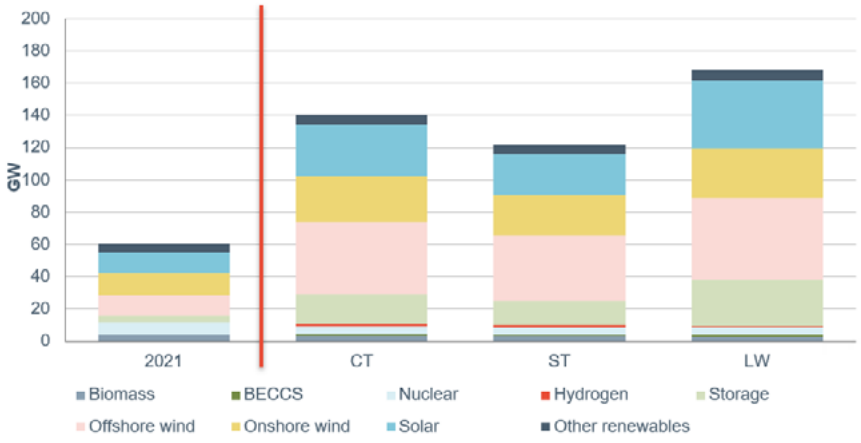
Meanwhile, capacity from fossil fuel assets is expected to continue to decline over the next 10 years as the economic attractiveness of these assets diminish due to rising carbon prices. In line with government targets, all coal capacity is assumed to close by April 2024. Gas assets are expected to decrease overtime, but to remain on the system, acting as more of a flexibility service rather than baseload energy. Capacity of batteries (part of the "Other" category), including longer duration batteries, and OCGTs will increase, offering flexibility and balancing services. They will be relied upon during periods when low carbon power is unavailable, i.e., low wind speeds or overnight.

3.5 National Grid's Future Energy Scenarios

According to the National Grid ESO Future Energy Scenarios (FES)[21], there should be between 40-50GW of offshore wind online by 2030 and around 100GW of capacity by 2050 to meet net zero targets. The FES set out credible ways that the UK can achieve net zero by 2050, as well as the UK Government's commitment to a decarbonised electricity system by 2035. Based on extensive stakeholder engagement, research and modelling, each scenario considers how much energy might be needed, where it could come from, and how to maintain a reliable system.

As shown in Figure 6, to meet net zero the scenarios suggest a need for between 60GW and 110GW of low carbon generation added to the generation mix by 2030.

Figure 6: National Grid Future Energy Scenarios. Renewable generation mix in 2030 for three scenarios that would meet net zero compared to 2021 capacity.



BECCS is Bioenergy Carbon Capture and Storage
Source: National Grid Future Energy Scenarios

21 National Grid's 2022 Future Energy Scenarios

3.6 Investment headwinds

While GB has a significant pipeline for new renewable generation capacity, the majority has not yet reached the final investment decision stage. Alternative opportunities for investors and macroeconomic volatility could see increased global competition to attract the necessary capital and technological expertise to meet the role out of renewable generation at scale. For example, US energy policy linked to the Inflation Reduction Act has seen renewed interest in some North American investment.

If the expected risk associated with an investment is high, then a high expected return is needed to compensate the provider of capital for such risk. A study of 23 EU Member states and GB found that most countries identified the risks caused by policy design to have been the most important in setting the Weighted Average Cost of Capital, a key driver of renewable generation costs.[22] At the time of this report's publication the UK government are considering introducing an effective cap on renewable generation revenues[23], which combined with some significant policy decisions pending, is resulting in uncertainty for investors in the GB energy system.

22 The impact of risks in renewable energy investments and the role of smart policies
23 Reuters – Britain plans 'de-facto windfall tax' on low-carbon energy producers

4. Wholesale prices

The 2010's saw a relatively stable GB energy market with wholesale power prices coverage. However, from the start of this decade price fluctuations have seen higher prices and increased volatility. Covid lockdowns and more recent geo-political events including the war in Ukraine have created uncertainty on the supply and demand sides.

Figure 7 below sets out the historic baseload power prices seen over the previous decade, with the price hovering around £50/MWh for most of the period. These stable prices were a result of relatively flat fossil fuel prices and a generation mix that was dominated by gas CCGTs and coal plants.

Figure 7: Historic monthly day-ahead wholesale power prices, £/MWh (2010-2022)

Source: Ofgem, complied by Cornwall Insight

Globally, economies resumed activities after Covid restrictions were lifted, leading to a considerable increase in gas demand and corresponding increase in wholesale market prices. Rates have risen to around five times their pre-lockdown levels to all-time highs of ~£500/MWh (Figure 8). These events, combined with retirements of dispatchable generators on the system, increasing carbon costs and tightened gas supply are expected to continue to support higher wholesale prices in the short-medium term.

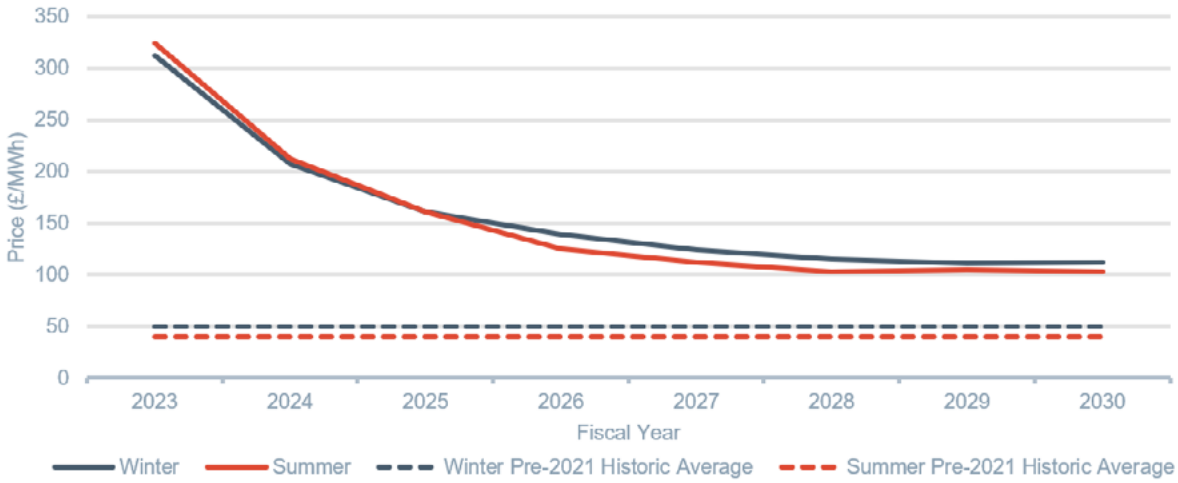
Figure 8: Day-ahead gas and baseload power prices, (Jan-2020 to Sep-2022)

Source: various, complied by Cornwall Insight

Looking forward, we expect power prices for winter 2022 to be consistently high as Russian gas supply uncertainty in the EU adds significant risk premiums to the gas forward curve. This is further exacerbated by prolonged outages of French nuclear capacity and low rainfall levels affecting Norwegian hydro.

Shown below in Figure 9, we forecast that prices drop in the 2020s as higher marginal cost coal fired plants retire and new offshore turbines are built to meet the government's 2030 wind generation target. The low marginal cost of wind turbines means that when they are generating, prices tend to fall. As we approach 2030, the deployment of low marginal cost generators is met by demand growth from electrification of the economy, increasing production of green hydrogen and increased power exports to Europe resulting in the levelling of prices above pre-pandemic levels.

Figure 9: Seasonal power price forecasts - average price per fiscal year, £/MWh (2023-2030)



Source: Cornwall Insight

4.1 De-linking gas and renewable generation prices

As well as being used for heating and industrial purposes, gas is a fuel used to generate electricity. Therefore, when gas prices are high and volatile, electricity prices can also be high and volatile. Recent very high electricity prices have been driven largely by high gas prices.

Various policy options have been tabled across Europe seeking to split the gas price from the price paid for renewable electricity generation. Windfall taxes, inframarginal revenue caps and even fixing the gas cost for marginal generators have been suggested. One idea that has captured the imagination of many industry players in the UK, including BEIS, is the possible extension of the Contract for Difference (CfD) to existing renewables and nuclear generators.

The most cohesive and well-developed proposal was published in April 2022 by the UK Energy Research Council (UKERC) in a paper titled Can existing renewables and nuclear help keep prices down next winter[24]? This developed the case for a new

24 UKERC, Can renewables and nuclear help keep bills down this winter?

'Pot Zero' CfD auction for existing low carbon generators that would cap wholesale revenues via a "strike price". UKERC argued that this would allow consumer bills to be lowered by returning payments through bills at times when wholesale prices were above the strike price.

The government issued its Energy Prices Bill on 12 October[25]. The bill will put in law a number of the already-announced mechanisms that will be used to support households and businesses this winter including the Energy Price Guarantee and the Energy Bill Relief Scheme. Also announced was the government's intention to consult on a Cost-Plus-Revenue Limit which will put a cap on all "excess" revenues renewable generators are receiving. The cap would still allow generators to cover their costs and receive an appropriate revenue that reflects their operational output, investment commitment and risk profile, and is expected to be in place from the beginning of 2023. The government does not consider this intervention to be a windfall tax noting that it will be applied to excess revenues generators are receiving, as opposed to applying to all profits. A costs plus revenues model would also allow fuelled generators such as biomass to take account of cost of fuel if they were within scope of the scheme.

25 UK Government press release

5. REGOs

5.1 The introduction of REGOs

The Renewable Energy Guarantees of Origin (REGOs) scheme was introduced in 2003 to provide generators with a way of accrediting renewable generation. One REGO certificate is issued per MWh of renewable energy generated. However, many stakeholders have raised concerns about the credibility of the current scheme and its fitness for the future.

The use of REGOs as a measure of environmental performance is constrained by declining carbon intensity in the electricity system. A growing share of renewable energy on the grid results in REGOs being unable to indicate additionality, rather reflecting prior investment in renewable assets.

Uncertainty around the application of the scheme is compounded by potential reform of labelling of renewable energy tariffs due to concerns of "greenwashing". In the 2020 Energy White Paper, the government stated that it would consult "on how to ensure consumers receive transparent information when choosing an energy product, for example quantifying the additional environmental benefits of a tariff marketed as 'green'." Similar commitments were made by Ofgem as part of its February 2020 Decarbonisation Programme Action Plan[26], with the regulator stating that suppliers must be transparent about any environmental benefits associated with their tariffs.

BEIS held its call for evidence Designing a Framework for Transparency of Carbon Content in Energy Products[27] 16 August to 6 December 2021. The consultation did not include proposals, but questions considered how a new framework could drive additional investment in low carbon generation, what adaptations could increase transparency and how innovation could accommodate flexibility.

5.2 The intention of the REGO scheme

There is a general perception that the REGO mechanism is in some way designed to support the build of additional renewable generation – effectively acting as an additional subsidy for renewable generators. However, a review of the legislation does not support this view. The REGO scheme was instituted as a result of Article 5 of Directive 2001/77/EC of the European Parliament and of the Council. This explains that:

"Member States shall, not later than 27 October 2003, ensure that the origin of electricity produced from renewable energy sources can be guaranteed as such within the meaning of this Directive according to objective, transparent and non-discriminatory criteria laid down by each Member State. They shall ensure that a guarantee of origin is issued to this effect in response to a request."

The Article goes on to set out the requirements for Guarantees of Origin, but does not specify that these are to be regarded as an income stream or support mechanism.

26 Decarbonisation Programme Action Plan
27 Designing a Framework for Transparency of Carbon Content in Energy Products

They are specifically separated from Article 4 of the same document, which does discuss support schemes. Neither the UK's original REGO legislation, issued to ensure compliance with this Directive, nor the 2010 update, include any intention for REGOs to provide revenue to support new generation buildout.

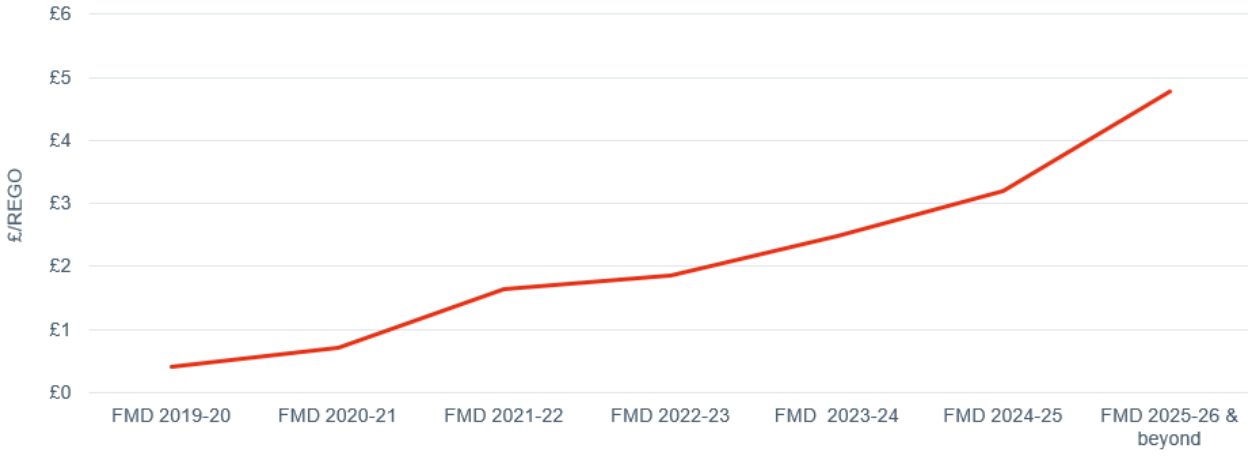
While is it not required for legislation to explain the purpose of the rules being out into place, the legislation indicates that the scheme is intended to track and monitor the transfer of electricity across the industry and to the customer, rather than to support the development of new generation. The REGO scheme is therefore, from a certain point of view, doing exactly what it was originally intended to do.

5.3 REGO Prices

We have conducted a quarterly REGO pricing survey since December 2019. Prior to this, REGOs are believed to have had a value around £0.20/REGO, although some contracts ascribed an effective value of £0.00 to REGOs where they were provided as part of a wider transaction without additional cost. The surveys gathered information on pricing that stakeholders had experienced for each Fuel Mix Disclosure (FMD) year. The FMD is a requirement that electricity suppliers disclose the mix of fuels used to generate the electricity supplied annually to their customers. There is no official, clear-cut record of the pricing of REGOs so this data represents an overview of prices seen by certificate holders. The results of the surveys are set out in Figure 10 below, and show a steady trend of increasing prices to date (see the red trend line). The prices shown for future years are based on forward trades that have been conducted already for that year.

Key drivers for changes in prices appear to be availability of renewable generation, and therefore availability of certificates (supply versus demand), the amount of time to the end of the FMD year (1 April – 31 March), and the technology which has produced the REGO. The first two of these points are linked, with prices tending to rise or fall sharply towards the end of an FMD year, depending on whether the volumes of certificates available to meet demand are sufficient or not.

Figure 10: Average REGO prices, from CI pricing surveys, December 2019 to July 2022



Future FMD prices are based on forward trades that have been conducted ahead of the FMD and is not a price forecast.
Source: Cornwall Insight

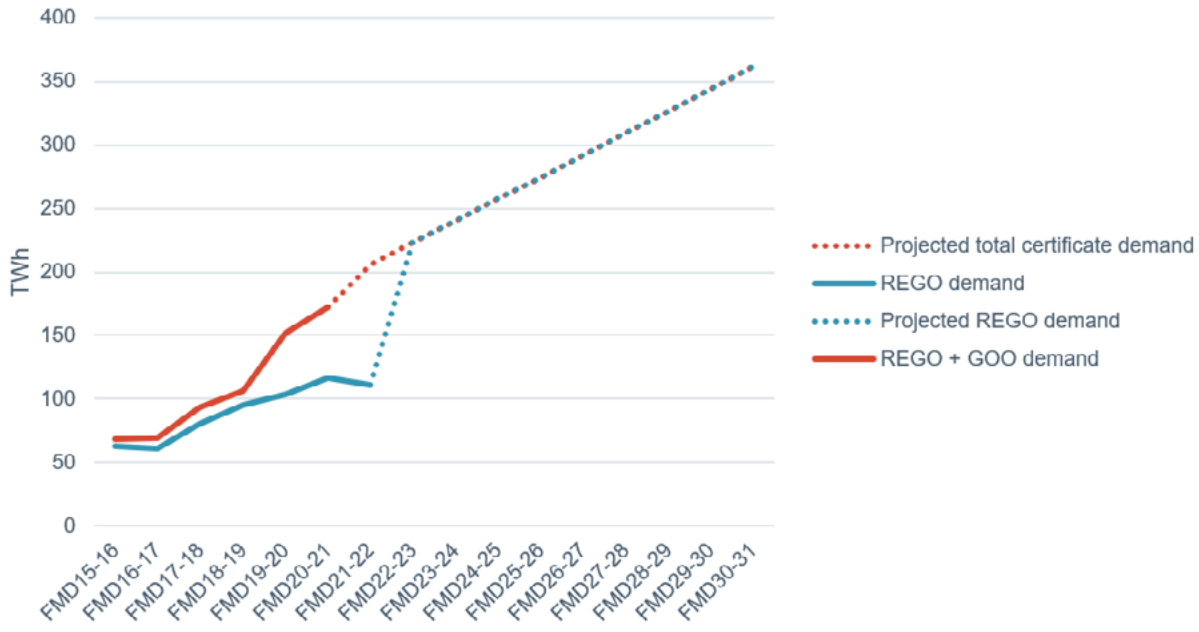
The trend is for unfuelled technologies such as solar, wind and hydro to see higher values – up to 66% higher, though more commonly around 25-33% higher – than fuelled technologies such as biomass, energy from waste and landfill gas.

The market sentiment appears to be for prices for each FMD year, to continue at the currently traded levels. Demand for REGOs remains strong, despite high energy costs and market exit of some suppliers which were purchasing volumes of REGOs.

The supply of Guarantee of Origin certificates[28] is a European-wide certification that was used by some UK suppliers. These certificates were cut off by BEIS in September 2022, as no reciprocity agreements were reached with the EU allowing GB REGOs to be traded into Europe following Brexit. Import will be banned from April 2023. This is expected to leave the GB REGO market very tight for the remainder of the decade, as shown in Figure 11. Most traders expect this to deliver REGO pricing at current levels for the foreseeable future.

Looking ahead, the REGO market participants gave reasons for the price rises over time as variously, low liquidity in forward compliance years and the impending removal of EU Guarantee of Origin recognition for UK FMD purposes. These concerns endure despite increasing renewable energy capacity being connected to the grid year on year.

Figure 11: Historic and future REGO supply and demand



Source: Cornwall Insight, from CI and BEIS data

28 The Guarantees of Origin of Electricity Produced from Renewable Energy Sources and High-efficiency Cogeneration (Amendment) (EU Exit) Regulations 2022

6. Policy landscape

The GB regulatory framework requires participants to adhere to complex industry codes. These set out responsibilities and requirements to ensure the effective operation of the electricity system and functioning of the market. Parties involved in the energy market will also usually need to be licensed, with the supply licence in particular intended to protect customers and ensure they are treated in a fair manner.

While the GB energy regulator Ofgem can take action to amend the supply licence to deliver better outcomes for consumers, there has been a growing level of intervention from government on pricing such as the introduction of the domestic energy price cap and more recently the energy price guarantee. While programmes to support the energy transition that will impact on pricing are already in train, the government has also taken action to address volatility in the market. These have taken the form of short-term interventions to tackle prices this winter, as well as more fundamental reforms of the market in the longer term. While the short-term interventions reduce costs and provide more certainty for both domestic and non-domestic energy users during the winter, the impact of longer-term reforms is more uncertain, and depends on the exact approaches taken, the implementation timescales, and the success of the changes.

6.1 Contracts for Difference

The current mechanism for subsidy support of renewable generation in GB is the Feed-in Tariff Contracts for Difference (CfD) mechanism. This is an auction system, with auctions held roughly bi-annually since 2016. Auctions are cleared on a “pay-as-clear” basis by technology, which means that all successful sites in a technology are awarded the same strike price.

In auctions, pre-accredited in-development renewable generation sites compete to set a “strike price” for power. This strike price will then be the price which the generator earns, per MWh of electricity generated. The generator is awarded a subsidy equal to the difference between the “reference price” and this strike price, multiplied by the number of units exported. 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. Generators are expected to contract in the market to sell the power they generate, though there is no requirement to do so. Strike prices are agreed for 15 years, increase annually with inflation, and are also adjusted to protect generators from changes to industry charges including Balancing charges and Transmission charges.

When implemented as intended, these elements result in a very stable income for the generator, as almost all risk to an ongoing project is mitigated. This has enabled a large capacity of generation to be built under the CfD – around 5.5GW was awarded across AR1 and AR2, with around the same again in AR3 and nearly 10.8GW under AR4 for a total of 22GW of generation capacity. Allocation rounds will now be held yearly, up from a previous bi-annual plan. AR4 of the CfD saw the return of onshore wind and solar generation to the mechanism, and these technologies, along with offshore wind, have won most of the capacity awarded.

The CfD has been recognised for its success in delivering large volumes of new generation capacity to the market, and in creating competitive pressures which succeeded in driving down the strike prices awarded to successful applicants.

6.2 REMA

In July 2022, the Department for Business Energy and Industrial Strategy (BEIS) launched a consultation on the Review of Electricity Market Arrangements (REMA)[29]. This represents a significant review of wholesale market arrangements in GB to ensure they are fit for purpose to deliver GB's net zero goals. The UK Government, via BEIS, set out five key future system challenges out to 2035, which are: investment; flexibility; location and networks; operability; and whole system flexibility.

One of the challenges REMA hopes to resolve is the perceived lack of investment signals for low carbon flexibility, with limited access to revenues from the market itself for flexible assets and prices currently set by the most expensive generators, which has typically been gas.

Price cannibalisation, whereby market design results in the zero marginal cost nature of renewable electricity plants displacing high-cost generation in the merit order[30], results in a depressive impact on wholesale markets. This in turn results in the wholesale market revenues alone not being sufficient to deliver the unprecedented volumes of investment required to scale up renewables.

The consultation sets out a range of options for reform for all (non-retail) electricity markets, including the wholesale market. These include:

- Splitting the market into separate markets for variable and firm power, which is primarily proposed as a solution to price cannibalisation, and the resulting price volatility.

- Introducing locational pricing - either zonal or nodal. This would see wholesale prices vary depending on location, with a broad expectation that higher prices would be seen in areas of relatively high demand and relatively low generation.

- Reorienting the wholesale market around local, distributional level markets, either through new local market structures or locational imbalance pricing.

- Moving to pay-as-bid rather than existing pay-as-clear pricing, where participants would receive the price of their bids/offers rather than the bid of the highest priced supplier selected to provide supply.

- Maintaining the fundamentals of the status quo, with incremental reforms of parameters, such as changes to dispatch arrangements from self-dispatch to central dispatch, changes to settlement periods and gate closure to increase

29 https://www.gov.uk/government/news/uk-launches-biggest-electricity-market-reform-in-a-generation
30 Merit order refers to the sequence in which power stations are prioritised in setting prices in the power market, with the cheapest offer made by the power station with the smallest running costs setting the starting point.

temporal granularity in the market, and changes to the Balancing Mechanism.

Reforms to the wholesale market could have major implications for energy procurement. Moves towards more locational pricing would add significant complexity, while separating the power market between firm and variable generation could help to deliver price reductions.

BEIS envisage solutions being delivered at least cost to consumers, presenting ongoing incentives to keep costs low and drive innovation - through competition where appropriate.

Looking ahead, BEIS expect to start sharing views from the consultation in Winter 2022/23.

6.3 Longer term changes

In addition to energy bill support announced on 8 September[31], a number of other energy measures have been set out in Parliament. A "review of the UK energy regulation" from government will lead to "fundamental reforms to the structure and regulation of [the] energy market". It is unclear what the scope of this review will be, and how it interacts with the wider REMA. MP Chris Skidmore is leading a review of the UK's climate goals in order to assess whether the Net Zero target is placing "undue burdens" on the economy[32]. A new Energy Supply Taskforce will negotiate "long term energy contracts" with domestic and international suppliers for wholesale gas. The Taskforce and BEIS will also negotiate with renewable generators to reduce prices. Notwithstanding the fluctuations in the UK government makeup, conclusions are expected to start around the end of 2022.

6.4 Rebalancing of policy costs

The government announced an effective temporary suspension of green levies, while a consideration of how policy costs are recovered has been discussed for a number of years. The government has previously indicated that it would consider whether the recovery of policy costs through the electricity bill was appropriate. As set out in the 2021 Heat and Buildings Strategy[33], the government said that it would look at options to shift or rebalance energy levies and obligations from electricity and gas. Such a move would be intended to increase the incentive for customers to make electrification choices such as switching from gas boilers to electric heat pumps. A call for evidence and decision was expected in 2022, but no publications have been made to date.

6.5 Carbon Offset markets

Carbon offsets are certificates which accredit a reduction in carbon emissions, usually expressed in tonnes of CO2 equivalent. There are a wide range of schemes, based all over the world, and little consensus on what the best schemes are. Some which

31 Hansard UK Energy Costs
32 UK Net zero review: terms of reference
33 UK Heat and buildings strategy

are considered “good quality” include: the Voluntary Gold Standard, Verified Carbon Standard, UK Woodland Carbon Code, UK Peatland Code, and Clean Development Mechanism.

Pricing is very opaque; however, in our regular REGO survey, discussed in section 6.3, we also ask about carbon offsets. Respondents reported that prices ranged between £2.50/tCO2e and over £20.00/tCO2e. In GB, some suppliers use carbon offset certificates as part of their green gas strategies. As the green gas market is very short and green gas certificates are not readily available, suppliers will use a share of green gas, alongside a share of carbon offset, to provide gas labelled as carbon neutral. One example is British Gas, which offers a green gas tariff with 10% green gas, plus 90% carbon offset certificates. We note that there is currently no official state-sponsored green gas certificate, no legislative requirement to publish a gas mix disclosure, and no plans to put these in place.

This means that suppliers can be more flexible in how they provide information to customers on their gas mix, compared to the information which they are required to publish for their electricity mix. Some Greenhouse Gas Protocol guidance suggests that corporations are permitted to use carbon offsets to mitigate their Scope 2 emissions. However, this is intended as a secondary measure, to deal with remaining emissions following reduction of consumption and purchase of renewable energy – which, in GB, means certified by REGOs.

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