Energy&Climate
INTELLIGENCE UNIT

PAYING BACK

UK's investment in renewables is being rewarded by lower bills

March 2022

About

The Energy & Climate Intelligence Unit (ECIU) is a non-profit organisation supporting informed debate on energy and climate change issues in the UK. Britain faces important choices on energy and on responding to climate change, and we believe it is vital that debates on these issues are underpinned by evidence and set in their proper context.

Citation

Energy and Climate Intelligence Unit (2022): Paying back: UK's investment in renewables is being rewarded by lower bills

Contents

Executive summary

The UK's investment in renewable electricity generation is providing increasing amounts of homegrown, low-carbon power – with rapidly falling costs.

The support for early renewables was designed to grow the UK industry in order to achieve the low costs offered by the net zero transition through learning, innovation and economies of scale.

But some of the early wind farms are providing an additional benefit by returning part of the wholesale price that has been driven to record levels by the gas crisis.

Wind farms supported via 'Contracts for Difference' (CfDs) paid back £157million in Q4 2021 as gas quadrupled the wholesale power price.

And these wind farms are forecast to pay almost £390million in 2022, and £660million over the course of 18 months from the start of the gas crisis in Q4 2021 through to Q1 2023. With the Russian invasion of the Ukraine likely to make the gas crisis deeper and more prolonged, repayments from wind farms are expected to be higher than these estimates.

With wind generators set to continue making payments into early 2023, the CfD 'green levy' on bills has been set to effectively zero, so that customers will pay nothing for CfDs under the next price control – a saving of £35 from the previous year.

Currently, the CfD levy cannot be set to a negative value, but once through this immediate crisis, the Government could consider changing the legislation so that households can essentially receive payments from cheap wind farms.

Cost savings from wind farms will become more frequent in coming years even if wholesale prices fall, with new wind farms coming online over the next few years whose strike prices (at less than £50 per MWh in 2021 prices) are lower than likely scenarios for gas-fired power plants that usually set the price received by all generators.

If another gas crisis was to occur five years in the future with wholesale prices of £200 per megawatt-hour for a year, wind farms with CfDs could provide a cost saving of £5.7–6.7billion in a year, equivalent to £70–85 a year for each household.

If that crisis was repeated in ten years' time, by which point the Government aims to have 40GW of offshore wind as part of the move to net zero, CfDs for wind power could save £23–26billion in a year, equivalent to £290–330 per home.

Introduction

Contracts for Difference (CfDs) is the mechanism used to support most renewable electricity projects commissioned in the UK since 2017. CfDs were introduced as a way of lowering the cost of finance and so ensuring that consumers see the benefits of the falling cost of renewable electricity generation.

Recent data from the Low Carbon Contracts Company (LCCC) shows that wind farms operating under CfDs paid back £157million in Q4 2021 out of payments they had received on the wholesale market during the gas crisis. With further payments from generators expected throughout 2022 and into early 2023, the LCCC has reduced the levy on customers' bills to the lowest level permitted (essentially zero).

This report explores these developments and how more renewables coming online will impact bills, including in potential future gas crises. But first of all, it starts with some background on CfDs and the UK's wholesale electricity market.

This report focuses on wind power, both offshore and onshore. It does not consider CfDs for biomass power plants or for the Hinkley C nuclear power plant.

Background

Wholesale electricity market price is set by gas

The international gas crisis is impacting electricity prices. Gas is used to generate about 40% of the UK's electricity. However, the design of the UK's wholesale electricity market (in common with those in the EU, the US and other jurisdictions) means that gas has an impact on the price of more than 40% of the UK's electricity.

Each of these markets (UK, EU and US) uses a system called 'marginal pricing' or 'pay as you clear'. For each half-hour 'balancing period' during the day, generators place bids stating the amount of energy they can provide (the volume) and the price per unit of energy.

These bids are arranged in order ('stacked') from cheapest to most expensive, and are accepted up to the level that is needed to balance the volume of generation with the volume of expected demand (hence the term 'balancing period'). The last generator needed to meet total demand is the 'marginal generator', and its bid price is the 'marginal cost'.

Next comes the important bit: every generator receives the same price for their energy, namely the price of the marginal generator's bid, which is by definition the most expensive generator needed during that half-hour slot. This is often a gas-powered generator.

There is some variation in costs between different gas power plants, as a result of differences in technical efficiency and their gas purchase contracts, but the present gas crisis means that all gas generators are currently significantly more expensive than all other power plants.

This raises the obvious question of why we allow the most expensive generators to set the price that's paid to all.

As liberalised electricity markets have developed over the past 30 years, one of the main objectives has been to ensure that generators could not set the prices artificially high, but only enough to cover their costs (and a reasonable profit to encourage investment).

Marginal pricing gives generators an incentive to not bid higher than they need to – bidding higher risks not making the cut-off in the stack and hence not being able to make any income for that balancing period.

Marginal pricing gives generators confidence to submit bids that accurately reflect their costs, safe in the knowledge that they will have those costs covered if they are accepted and have to generate. This 'price transparency' comes at the price of consumers paying more than the actual costs of generation – except in the case of CfDs, as discussed below.

Economists and policy makers took the view that marginal pricing gave lower costs for consumers than if generators felt free to bid high prices without any consequences – there could be 'unspoken collusion' to keep prices high.

The UK was amongst the first countries in Europe to liberalise its energy sector, and developed various market designs before settling on the marginal pricing model. The UK played a leading role in the adoption of this approach for the EU's internal power market, and retained the design upon leaving the EU in 2021.

That said, some experts are now asking whether this logic should still dictate the market structure, and whether the new paradigm of cheap renewables merits a change to a market in which they set the price and more expensive power stations are contracted for any excess that is required.

Contracts for Difference were chosen to cut costs for consumers

With gas currently so expensive, wholesale costs only drop in those periods of time when gas isn't needed at all – when demand is met by a range of renewables supported by nuclear. At present there are many occasions when gas does set the marginal price; and that's when CfDs have been providing significant savings for customers.

CfDs are an established financial instrument[1], commonly applied in a range of trading situations; they were considered as an option for Government lending to energy suppliers during the gas crisis.

A CfD is a two-way agreement whereby one party (e.g. an electricity generator) is guaranteed a constant price for their product (e.g. from energy suppliers). As the market price varies, the producer either receives top-up payments to reach their guaranteed price or gives back excess income.

The application of CfDs to the UK power sector is the latest stage in the evolution of the UK's support for renewables, building on the Renewables Obligation (RO) that set renewable electricity purchasing targets for suppliers and the Feed-in Tariffs (FiTs) that provide top-up funding for projects (including small-scale generation in homes and communities).

Whist applying CfDs as an energy policy instrument is an innovative move by the UK, it was carefully chosen to enable the UK to pursue decarbonisation on a par with other European countries but at lower costs.

[1]A CfD mechanism has been proposed as a means of alleviating the impacts of the gas crisis more broadly. The suggestion is that suppliers could enter into CfDs with a lender (a bank or the Government). Suppliers would receive funds when the wholesale price of gas (or electricity) exceeded an agreed level, and hence not have to increase bills as much to cover the costs; and suppliers would pay back funds when the wholesale price fell below the agreed level. This mechanism would allow supplier to smooth the impacts on bills. But customers would still be paying the high prices, just over a longer period of time, plus whatever interest was charged by the lender. In the end, the Government opted for a loan to be repaid at a fixed speed over five years.

That is, the UK wishes to use renewables to achieve low wholesale prices (e.g. like Denmark has using offshore wind) but with lower support costs on retail bills. Perhaps one an indication that the UK's move is seen as a success is that the EU is considering adopting a CfD for carbon pricing.

UK renewables CfDs have been predominantly issued for offshore wind, but also onshore wind, solar and biomass, with small amounts of emerging technologies such as tidal energy – and Hinkley C nuclear power station. Most of the contracts last for 15 years. The contracts are made between generators and the Low Carbon Contracts Company (LCCC, a government-owned company) that sets the levy rate that suppliers use on consumers' bills.

CfD funds flow between electricity suppliers and generators via the LCCC, to ensure that there are sufficient funds to pay generators, and the LCCC settles accounts with suppliers within the next financial quarter. CfD prices are often stated in 2012 prices (for ease of comparability between projects of different ages), and are then uprated using Consumer Price Index (CPI) inflation.[2]

Renewables CfDs are awarded in 'rounds'. Details of wind farm CfD deployments are summarised in Table 1 (terms are explained in the following paragraphs). The initial CfDs were called 'Investment Contracts' (IC) and were awarded to developers whose plans were advanced at the time when the Government was closing the Renewables Obligation (RO) to new projects.

Table 1 – Summary of wind deployment in CfD rounds

	Operational by	Total wind capacity (GW)	Wind Technology	Capacity (GW)	Strike prices (£/MW/h, 2021 prices)
Investment Contracts	2017-21	3.1	Offshore	3.1	169.83
Allocation Round 1	2017-23	1.8	Offshore	1.2	139.15
			Onshore	0.6	96.48
Allocation Round 2	2021-24	3.2	Offshore	3.2	73.94
Allocation Round 3	2024-27	5.7	Offshore	5.5	48.38
			Remote island	0.3	47.34
Allocation Round 4	2023-29	Up to 12.5	Onshore	Up to 5.0	TBC 45-50
			Offshore	Est. 5.8-7.5	TBC 45-50

Sources: CFD Register (LCCC, updated on 9 December 2021), and analysis based on data from Allocation Round 4: Allocation Framework, 2021 (BEIS, November 2021) and Contracts for Difference (CfD): Budget Notice for the fourth Allocation Round, 2021 (BEIS, November 2021). Some figures do not sum exactly due to rounding.

[2] In this analysis, prices are presented on a 2021 basis, which are available in the LCCC's CfD Register.

[3] Wind generators' strike prices are compared to the 'intermittent market reference price' (IMRP), which is the day-ahead wholesale price. The actual average price paid to wind generators is the 'generation weighted average IMRP', that reflects wind generators' ability to enter the market at some times but not others. These two measures were essentially the same under lower wholesale prices, but the generation weighted average IMRP has been up to 10% lower than the IMRP under the high prices of the gas crisis (see data from the LCCC Historical Dashboard). As more wind generation is added over a larger area, there will be more times when at least part of the wind fleet can enter the market, and so the generation weighted average IMRP could become closer to the IMRP. So, forecasts in this report use both prices to give a range of possible cost savings.

Thereafter, CfDs have been awarded through an auction process in 'Allocation Rounds' (AR). AR1, AR2 and AR3 have been decided, with AR1 projects fully operational, AR2 mostly there, and AR3 commencing operation over the coming few years.

AR4 bids are currently being considered, with decisions due by the middle of 2022. The Government has just announced its intention to speed up CfD auctions running them every year rather than every two years.

Renewables CfDs achieve cost reductions for consumers in a number of ways.

1. **By providing generators with a consistent price for their electricity (the 'strike price') even when the wholesale price (the 'reference price') varies,** CfDs reduce generators' financial risks and hence the financing costs for wind farm construction – generating a saving that benefits consumers through generators being able to bid into auctions with a lower strike price (lower cost for generating electricity).

2. **CfDs require generators to pay to the LCCC any part of the reference price that exceeds their strike price,** offsetting payments made to the generators by the LCCC that are funded by a levy on consumer bills. The LCCC uses forecasts of wholesale prices to set the levy at a level that will cover the net costs of payments to generators in the next quarter, so lower strike prices will (under any given wholesale price forecast) reduce costs for consumers.

CfDs were developed in the expectation that wholesale prices being a few tens of pounds per megawatt-hour (£/MWh) and rising during this decade. The wholesale price had typically been around £50/MWh over the past few years, but has fluctuated around £200/MWh during the gas crisis.

The UK's CfDs system has also helped to cut other costs for renewables – again to the benefit of consumers. By reducing the financing costs of each project, CfDs have allowed more capacity to be built for a set amount of money (limited by the Treasury's Levy Control Framework), helping to expand the industry and create employment (including in coastal communities in need of levelling-up), and cut costs through innovation and economies of scale. And the auction process for allocating CfDs has ensured that developers include all of these savings in their bids, to avoid being undercut and losing out on contracts.

As a result, CfDs have played a role in the dramatic reductions in not just financing costs but also the other two cost categories of any major project.

Capital investment to build the renewables projects are falling dramatically through economies of scale. And operational costs, which are much lower anyway for technologies such as wind that use no fuel, are falling further due to innovations in maintenance.

The UK's strategy has been very effective. Earlier projects with smaller capacity and higher strike prices grew the industry and created jobs and allowed the sector to find savings through innovation and economies of scale that are dramatically reducing the costs of newer projects, whose larger size and higher efficiency will outweigh the earlier costs.

In particular, CfDs have contributed to the dramatic fall in the costs of offshore wind since 2012. And the auction process ensures that these benefits can be locked into the 15 year contracts. Overall, the strike prices of offshore CfD wind farms have fallen (all prices in 2021 values) from an average of £170/MWh for the early Investment Contracts to £47–49/MWh for projects in AR3 coming online from 2024 onwards.

Looking ahead, after a renewables CfD expires the generator's income will vary with the wholesale price. This shouldn't matter for the generator, because they should have paid off the capital investment and financing costs, and would have only operational expenses to cover from their income.

It would mean that they would no longer provide the same payback when wholesale prices are high. But on the other hand, the higher amount of wind capacity would mean that there would be more periods when other power sources weren't needed and wind could sometimes set the marginal price – at very low prices indeed.

Analysis

CfDs show their worth in the gas crisis

When the CfD scheme was established, policy makers didn't foresee a gas crisis the likes of which we're currently experiencing, that would trigger such large repayments from early renewables projects.

For the reasons set out above, suppliers are paying the high price of gas-powered generation for almost all of the electricity that they buy and then sell to consumers – even power from sources that have lower costs.

The exception is renewables with CfDs: uniquely amongst all electricity generation, these projects are paying back at this time of high wholesale prices.

In Q4 of 2021, wholesale power prices rose dramatically and moved above wind's strike prices. Wind farms with CfDs returned £157million to the LCCC, 16% of what they had been paid in wholesale prices.

By contrast, other generators will have kept the entirety of any profit they made on the high prices (albeit that gas power stations will have used some of the income to cover the high costs of wholesale gas, with the amount depending upon their operational efficiency and hedging strategies for gas purchases).

Breaking down the total CfD payments for Q4, offshore wind farms returned £117million, and onshore wind farms returned £40million. Although onshore wind is cheaper than offshore wind, it was only allowed to enter the CfD system once before the Government's decision in 2015 to stop further onshore wind development in England and the subsequent exclusion from CfDs in 2016. This position was reversed in 2020, and onshore wind was allowed to bid into AR4 in 2021 (with contract awards due in 2022).

Wholesale gas prices over the winter were four times their pre-crisis levels, keeping wholesale electricity prices at a similarly inflated level, such that CfD wind farms are continuing to make payments to the LCCC. The Russian invasion of Ukraine has increased gas prices even futher.

The initial forecast for Q1 2022 based on wholesale prices around £250/MWh was that wind generators would pay £580million, equivalent to 40% of the wholesale price costs they were paid. Wholesale prices have fallen since then to around £180/MWh – but CfDs are still forecast to pay a net amount of £144million in Q1 2022. (This includes any payments to or from biomass generators – the separate figures aren't provided for that particular forecast.)

The LCCC forcast that wind farms will pay almost £390million in total in 2022, and £660million over the course of 18 months from the start of the gas crisis in Q4 2021 through to Q1 2023. The Russian invasion means that payments will likely be higher.

Savings cut customers' bills

The recently announced price cap rise for April 2022 is driven overwhelmingly by gas costs, but includes a sliver of good news in the form of savings due to CfDs.

Based on the forecasts of high wholesale prices this year, the LCCC has set the levy

to essentially zero – that is, apart from an average of 29p per year per home, to cover administrative costs, customers will pay nothing for CfDs for as long as wholesale prices are forecast to remain high.

This saving will come into effect in the price cap from April 2022, giving a saving of £35 compared to the April 2021 price cap – a 99% reduction in costs, in a year in which wholesale gas costs quadrupled and drove gas bills up by 97% and dual fuel bills up by 73%.[4]

At the other end of the CfD process, the payments that the LCCC receives from renewable generators are being included by the quarterly reconciliations with suppliers.[5] These reconciliations usually involve only adjustments to the 'reserve fund'. This pot exists in case the LCCC has to make larger payments to generators than forecast, and is funded by suppliers above and beyond the levy on bills.

This fund exposes suppliers to a certain level of risk, and some suppliers attempt to hedge against the uncertainty in CfD payments. Effective hedging of any risk should reduce costs and should feed through Ofgem's price cap assessment to give lower consumer bills.

There is currently no automatic mechanism for these CfD payments to be returned to customers, and suppliers can decide what to do with their share. Some suppliers use any such income as part of their hedge against the risk of higher CfD payments that they fund via the reserve fund, and Ofgem takes this into account when setting the price caps.

---

[4] Ofgem's price caps cover 22million households as of late 2021, up from about 16million before the gas crisis (11million on the default tariff price cap, and 5million on the prepayment price cap). The increase is due partly to suppliers going bust and their customers being transferred to default tariffs with other suppliers, and partly due to fixed deals ending and options for new deals being limited and/or uncertain.

The April price cap for average household consumption is £1,917, a rise of £833 (73%) in a year. Using Ofgem's model (and making an adjustment for the fact that it uses the older value of 3.1MWh for average electricity consumption), this dual fuel bill can be broken down as follows (rounding means the sum is out by £1): £983 for gas, a rise of £485 (97%) in a year; and £987 for electricity, a rise of £347 (54%) in a year.

The fall in the CfD levy is seen in the Annex 4 spreadsheet of the model, on Sheet 2a, Table 3, Rows 75-88 (single rate metering, the most common type). This gives the annual levy per MWh for each of the 14 DNOs, from which an average can be calculated (albeit not weighted by customers numbers in each DNOs' area). This rate is then multiplied by 2.9MWh (Ofgem's value for average annual household consumption) to get the average annual levy.

[5] Usually, these quarterly reconciliations are used only to adjust the 'reserve fund' that the LCCC holds in case it has to make higher payments than expected. For example, the reserve fund was set lower for Q1 2022 than for Q4 2021, and so the LCCC is paying the difference back to suppliers. The LCCC is also including in the reconciliations the net payments received from generators.

At present, any money from wind farms that suppliers receive is helping to shore up suppliers' finances that are under strain due to the gas crisis (unlike gas producers, which are making large profits).

This is of benefit to customers, in that the funds reduce the risk of further suppliers going into administration. Customers are already set to pay on average £68 a year under the April 2022 price cap to cover the costs of 28 supplier failures since last August – plus the costs to taxpayers of special administration for Bulb Energy.

However, Ofgem believes that there is money in the CfD system that could benefit consumers, and plans to review how this is treated in the October 2022 price cap – possibly through an 'offset', essentially a 'claw back' of savings produced by generators.

As discussed below, there is the prospect of generators' payments to the LCCC being larger and more common in future, including in circumstances in which gas prices are lower and suppliers are under less financial pressure. Once through the current crisis, the Government could consider whether it is appropriate to amend the legislation to allow the LCCC to set a 'negative levy' that would automatically pass CfD funds back to consumers via suppliers.[6]

Future savings

Whereas existing CfD wind farms have helped at a time of unexpectedly high prices, future wind farms with lower strike prices will also be competitive at lower wholesale prices. As such, they are expected to make net payments to the LCCC over the projects' lifetimes, no-matter where the gas price goes. Indeed, for many of these projects the CfDs will be less of a price support mechanism and more of a price stabilisation mechanism.

With the ongoing gas crisis likely to keep wholesale power costs above their pre-crisis levels for several years to come, there are likely to be larger savings from new wind farms and also some further savings from the earlier projects that have paid back during the gas crisis so far.

However, savings from wind generators will sometimes simply be recycled by the LCCC to pay the CfD for Hinkley C nuclear power station – due to come online in mid-2026 with a strike

[6] In addition, under circumstances in future with lower average strike prices, there would be less scope for payments to generators to be larger than forecast, and therefore suppliers would face less risk via the reserve fund. This changing balance for suppliers (between the risk from the reserve fund under lower wholesale prices and the rewards from renewables under higher wholesale prices) would be relevant in any decision about allowing negative levies to be paid back to consumers.

price of £106 (in 2021 prices).

Table 2 provides details of some of the major wind farms contracted to come online over the next few years under AR2 and AR3, along with an estimate of the potential cost savings via their CfDs under different wholesale prices.

These savings are expressed in terms of savings for a household with average electricity consumption – this approach deliberately omits the complexities of how tariffs are set, but is illustrative of the scale and potential average impact.[7] As discussed above, these savings would not be seen directly on bills unless the legislation was amended to permit negative levies (or Ofgem implemented an offset).

Table 2 – Potential savings from upcoming offshore wind farms in AR2 and AR3

	Capacity (MW)	Completion date (estimated)	Strike price (£/MWh, 2021 prices)	Cost (+) or saving (-) equated to amount per household (£ per year) at wholesale price (£/MWh) of:			
				50	100	150	200
Moray East	950	Apr 22	68.55	0.92	-1.56	-4.04	-6.52
Triton Knoll	860	Apr 23	88.59	1.73	-0.51	-2.76	-5.00
Hornsea Project 2	1,386	Apr 24	68.55	1.34	-2.28	-5.90	-9.52
Dogger Bank	3,600	Jul 24 -Jul 26	47.2 - 49.47	-0.30	-11.81	-23.32	-34.83
Seagreen	454	Mar 26 - Mar 28	49.47	-0.02	-1.47	-2.92	-4.37
Sofia	1,400	Jul 25 - May 26	47.20	-0.25	-4.73	-9.20	-13.68
Total	**8,650**			**3.43**	**-22.35**	**-48.14**	**-73.92**

Source: ECIU analysis based on CFD Register (LCCC, updated on 9 December 2021). These results using wholesale prices correspond to the upper end of the range of savings discussed in the main text (see explanation in footnote 3). Annual savings have been equated to an amount per home (as discussed in the main text). Some projects are being built in phases, with a range of completion dates.

[7] This analysis includes the following assumptions, taken from data published by BEIS and the LCCC. It assumes the following load factors for offshore wind (the output per year as a percentage of the output if operating at full power for all 8760hours of the year): 48% for AR2 and 58% for AR3. Also included in AR3 will be a smaller amount of 'remote island wind', which performs somewhere between onshore and offshore wind.

The increasing load factors are because of taller wind turbines (that can access the higher wind speeds experienced at higher altitudes) and wider distribution of wind farms (so that they will cover a wider variety of weather at any one time, and more wind turbines generate more energy more of the time). Total savings are split between businesses (65%) and households (35%). The 35% figure for homes is the approximate level for recent years prior to the pandemic; it rose to 39% in 2020, but that was due to the pandemic simultaneously increasing electricity demand from homes and reducing it from businesses. Finally, the household share is split equally amongst 28mllion homes to give the equivalent value per household on average.

For example, once the enormous 3.6GW Dogger Bank wind farm comes fully onstream in 2026, it would give each household a saving even if wholesale prices returned to pre-crisis levels of £50/MWh. But if wholesale prices were around £100/MWh, Dogger Bank wind farm would save £ 850 – 940million per year, an equivalent of £11-12 per year per household.

Were another gas crisis to hit, with wholesale prices around £200/MWh, Dogger Bank would save £ 2.5 – 2.8billion per year, equivalent to £31 - 35 a year for each home.

The overall impact of projects in AR2 and AR3 coming online will be to increase the UK's offshore wind capacity to almost 20GW (over 6GW deployed under the Renewables Obligation, and around 13GW via CfDs), in addition to onshore wind capacity.

This renewable resource is so significant that National Grid expects to see periods of time from 2025 onwards when the UK is powered solely by wind and other low-carbon sources, and is preparing its control systems to be ready for this new way of working.

Insurance against another gas crisis

With Government forecasting even before the gas crisis that gas prices would rise over this decade (most likely by a quarter, but potentially doubling) largely due to increasing global demand, it is likely that any 'new normal' for gas prices will be between £50 and £100 per MWh, in which case these new windfarms would always be providing net savings for customers. This is a cheap insurance policy against the risk of another gas crisis.

Were the gas crisis to be repeated in five years' time (by which point almost all of the AR2 and AR3 offshore wind will be operational) and wholesale prices were around £200/MWh for a year, these new wind farms would take the total savings to £5.7–6.7billion in a year, equivalent to £70–£85 per household.

Looking further ahead, the Government is currently considering bids submitted for AR4, with decisions expected in the middle of this year and deployment in 2025/26 to 2028/29. The exact outcome will depend on the details of the bids, but experts have used the 'Framework' document (with or without some simplifying assumptions) to deduce that there could be 5.8–7.5GW of offshore wind depending on the strike price.

The maximum 7.5GW would be accepted if the strike price was £45/MWh (in 2021 prices),

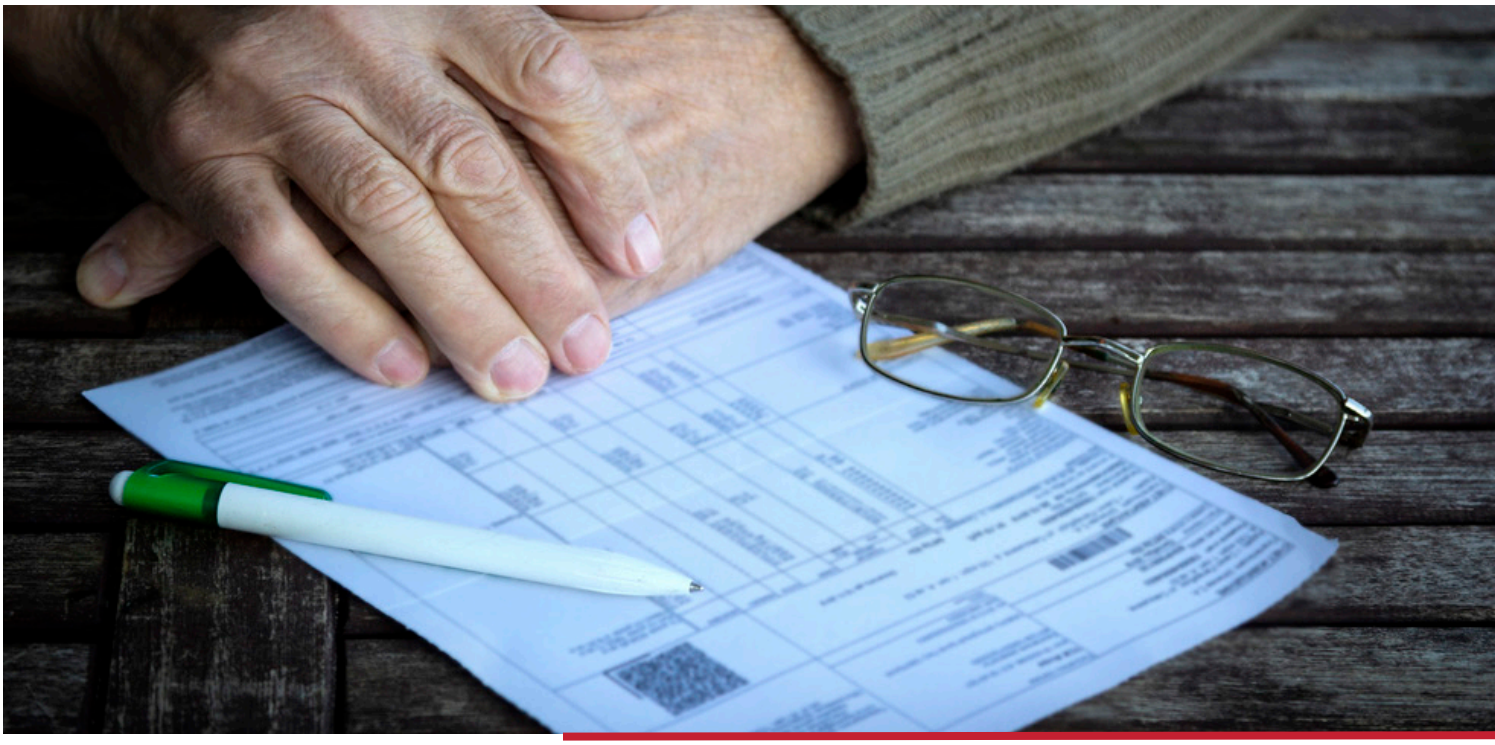
taking CfD offshore wind to just over 20GW. There will be up to 5GW of onshore wind (a cap shared with solar), likely at a strike price of around £48/MWh, taking CfD onshore wind to 5.6GW.

These objectives for AR4 are definitely deliverable, with plenty of offshore wind farms in development,[8] and onshore wind waiting to re-enter the CfD auctions after being banned in England from 2016 to 2020.

As above, onshore wind looks likely to deliver on price: it was already one-third cheaper than offshore wind in AR1. And it enjoys strong public support: the latest Government survey results show 80% support for onshore wind, almost as high as 84% for offshore wind.

Whatever the outcome of AR4, those wind farms would make payments to the LCCC under most plausible future wholesale prices. And with the total offshore capacity then standing at over 27GW, the Government would need to add around 13GW to reach its goal of 40GW of offshore wind by 2030. There might also be more onshore wind by then, but there is no specific target.

It is sobering to consider what might happen if today's gas crisis was repeated in ten years' time, with 40GW of CfD offshore wind resource and (at least) 5.6GW of CfD onshore wind. The wind generation would be displacing more of the gas generation, but gas would still usually set the marginal price as at present.



[8] The renewables project pipeline (see spreadsheet or this map) lists six major offshore wind farms (7.3GW of capacity) that have planning permission, and three more (2.1GW) awaiting planning decisions.

In the event of a repeat gas crisis ten years from now, CfDs for wind power would save £23–26billion per year, equivalent to £290–330 per home.[9]

This assumes that all of the electricity can be used or stored for later, which will be more likely with smarter control systems, demand-side response, and with demand from electric vehicles and heat pumps. Even if other effects in the complex market were to reduce that saving a bit, it is clear that renewables' CfDs would be highly beneficial for customers.

Furthermore, by the mid-2030s, contracts will expire for the earlier CfD projects. Firstly, they should have paid off all of their capital costs by that time, and could therefore offer wholesale prices at much lower levels to cover only their operational costs. Secondly, the remaining CfD wind farms would be the cheapest, pulling the average strike even lower, into the range £40-50/MWh and increasing all of the benefits discussed throughout this analysis.

[9] For each CfD round (IC and AR1–4), the load factor and capacity are used to find the annual energy output. The weighted average strike price for each round is compared to the IMPR (to give the upper end of the savings range) and the generation weighted average IMRP (to give the lower end of the savings range) to find the CfD payment per unit.

The CfD payment per unit is multiplied by the annual output to find the annual CfD payments (to or from generators). This is repeated for the extra c.13GW of offshore wind needed to reach the 40GW target, assuming that it would have the same properties as for AR4 i.e. load factor 63%, giving annual output of 108TWh, at a strike price £45 (in 2021 money).

All of these totals are then added together. The total generation was calculated to be 185TWh per year; for comparison, this is 57% of the total generation of 324TWh in 2019 (the latest pre-pandemic year of data), although demand will be higher in future years due to electric vehicles and heat pumps. At a price of £200/MWh, this wind resource would have earned £37billion, so the £26billion returned under CfDs would be a 70% reduction in wind costs. Floating wind turbines with higher load factors will feature to some extent in AR4, and the Government aims for 1GW within the 40GW target, but this detail would not make a large difference and has not been included in this analysis.

There are various complexities in the electricity system and market that are omitted from this simple model, but they do not change the broad conclusions that CfDs would pay back significant amounts of money, as per their design.

Conclusions

CfD auctions are being effective in bringing online large volumes of ever-cheaper renewables. This is providing the UK with a growing portfolio of power generation that is secure from the vagaries of international gas markets.

Indeed, as we are seeing in the current gas crisis, these renewable power plants are actually helping to reduce the costs in a crisis.

With ever-larger and ever-cheaper wind farms coming online, and with the Government targeting a huge expansion in offshore wind by 2030, the benefits of this homegrown energy resource will only grow.

Each new project has the potential to pay back more and more, insulating the UK from future gas price volatility.