

Domestic Electricity: will the cost of electricity fall or rise?

Introduction

As these cold winter months slowly turn into spring and our household electricity consumption begins to fall my thoughts often turn to the question of why electricity is so expensive and, more especially, why Ofgem's domestic gas price cap is around one quarter of the price cap for domestic electricity.

For example, in January 2025 the electricity price cap rose to 24.86p/kWh along with a standing charge of 60.99p/day against 6.34p/kWh for gas and a 31.65p/day standing charge. Furthermore, in April 2025 these caps will rise to 27.03p/kWh for electricity against 6.99p/kWh for gas.

How can this be? Why should a unit of electricity cost almost four times that of gas? And it seems I'm not alone in asking this question because reports from the both the BBC and Apple News have recently appeared in the media citing several reasons for this anomaly: ranging from high wholesale gas prices, the cost of subsidies paid to renewable generators to the cost of improving the transmission and distribution system to accommodate renewable generation.

Of course the stock answer given by Government, Ofgem and trade bodies with links to renewable industry is simply because of high wholesale gas prices and that when gas generation is displaced by renewables then prices will fall.

So that's the carrot - eliminate gas and combined cycle gas turbines (CCGT's) from the transmission network and electricity bills will automatically fall! Simple as that. When electricity generation no longer requires gas as a primary fuel we eliminate high wholesale gas prices as the primary driver for the high cost of electricity.

Indeed, so confident is Government on this point it is claimed that electricity bills will fall by up to £300 a year by 2030.

In my mind, therefore, the real question is this. If the marginal cost of a unit of electricity generation is simply and wholly determined by the high wholesale price of gas, why don't we also see this high wholesale gas price translated into much higher domestic gas prices? In other words, why is a unit of domestic gas so much cheaper than a unit of electricity if both are derived from the same wholesale gas price?

In this essay I would like to explore this subject and invite your thoughts and feedback. My conclusion, my hypothesis – based on the economics of marginal

production, is simply that electricity prices will continue to increase, not fall, because in the absence of suitable and longer-term (days not hours) energy storage technology, dispatchable CCGT generation will continue to be needed on the network to balance supply with demand in a world where demand is increasing and supply from renewables is intermittent, and to a degree unpredictable, and where security of supply is paramount.

Discussion

Let me expand but first let me look at the historical change in GB fuel mix for electricity generation over the past decade and a half as it helps focus the argument.

In 2010 the fuel mix comprised, to the nearest integer: Gas 47%, Coal 30%, Nuclear 19%, Renewables 3% and Other 1% while the maximum demand (MD) reached 57.5GW on 8 January at 5pm and the annual electrical energy demand was 335TWh's.

By comparison, in 2024 the equivalent metrics were: Gas 33%, Coal 15%, Nuclear 11%, Renewables 37%, Other 4%. Maximum demand fell to 45GW on the 15 January at 5pm, down some 20% from 2010, while the annual electrical energy demand also fell to 320TWh's, down around 5% from 2010.

From this simple analysis we can see that generation from CCGT plants reduced by 14% over this period - similar to coal (which in 2025 will be zero). Nuclear too, fell by almost 50% as older plant has been deemed no longer safe to operate while renewables has risen by 34%.

Interestingly, MD has fallen by almost 20% over this period and while the detail is not known it is possible this is due to the move to energy efficient appliances in homes and offices as well as the steady closure of electricity hungry industry - such as steel and iron, which is now largely imported as a manufactured product. Whatever the reason, in future MD is set to increase due to the adoption of electric vehicles, heat pumps and other electrical energy-hungry technology.

Now, getting back to the dilemma. Let's imagine, for instance, that we operate a CCGT plant – a much simplified and hypothetical situation to help tease out the arguments. It's 2010 and we, as the owners, have a 1, 2 or 5 year contract with the powers that be to supply the grid with x amount of energy. At the end of any of these periods we can simply choose not to renew the contract and close our station - no comeback, it's a free market!

So, in 2010 we crunch the numbers based on the expectation that our output will be needed (along with those of other CCGT stations) to supply 47% of the annual 335TWh's demand. In crunching the numbers we consider the capital cost of our investment and the return we expect. Let's say it's 10% or more, for instance.

We have an expectation for how long we will run in the year and therefore how much we will generate and our resulting revenue. We can also calculate the fuel cost (m³ gas) along with other costs we will need to create the product – the electrical energy we generate, such as the cost of operating staff, so that we can work out the gross margin - maybe 25% or 30%, say.

From this we can deduct the fixed costs needed to operate our enterprise to give the net margin – let's say it's 15% or more on which we have to pay various taxes and levy's to give an approximate overall return close to what we budgeted for.

This is all nice and predictable, and profitable for us. We, along with our coal and nuclear colleagues, operate what is called “dispatchable generation” in so far as we are simply requested to increase or decrease generation and the output follows some few minutes later - nuclear tends to be more stable due to longer response times. Life is under control and certain unless a generator trips or a transmission fault occurs, to which we, collectively, usually respond quickly.

However, some bright spark comes up with the idea of Net Zero in 2019 during the dying embers of the May government and the world, and more specifically the UK, turns on its head to significantly reduce the demand from our CCGT plant. But, come 2024, we still have all the infrastructure and employees in place even though our energy output has been forced down by almost 30%. Our revenue falls as does our gross margin, and true we don't buy in as much gas but we still have our fixed overheads to cover.

To put it simply, we end up in a potential loss-making situation - or do we? The downside of this unwanted – by us at least, renewable generation is that it is both intermittent and to a large degree unpredictable to the point where it keeps us awake at night wondering whether tomorrow we will need to generate more or less than today. And because renewable wind and solar is said to be the lowest cost marginal generation they get to be first in the pecking order to supply the demand and we pick up the crumbs - to make up the remainder when the wind doesn't blow and/or the sun doesn't shine.

True, we and other forms of generation, such as hydro along with battery storage, receive financial assistance. For example, the Capacity Market (CM) was introduced in 2014 along with Contracts for Difference (CfD) auctions for renewables as part of the Electricity Market Reform to enhance the security of supply by providing a reliable source of electrical capacity as a back up for intermittent renewables and inflexible low carbon generation, such as nuclear, to keep the lights on when supply is tight.

So, these annual CM payments are welcome and we, along with our other CCGT owner colleagues, have benefitted to the tune of some £12.5bn over the past decade - all paid for of course by the consumer to the tune of around £50 each, every year. And this is set to increase substantially for 2027-28 as the CM auction price will rise to £65 for each kW of capacity. And with our average 500MW CCGT station this higher auction price will bring in over £32m each year so long as we stay on line during the winter months when demand is high. It should be said that this payment is in addition to our, now depressed, revenue income stream that we receive for each unit of generation.

But where we can make supernormal profits is from the Balancing Mechanism. This is the 30 minute trading platform where, because of many factors, including the short-term intermittency associated with renewables, we may be requested to increase or decrease generation. In these instances we, along with our other CCGT generation colleagues and others, are invited to bid to increase or reduce our output (the short-term marginal generation) depending on the particular circumstances at the time.

We don't have to bid if we have given prior notice. And as it's a market we can hold back if we wish - it's an auction after all. But this is where we can make a killing, so to speak. This is where we can turn a profit. In fact, this is where we like to be and if wind was not intermittent and to a degree, unpredictable, then we would be in a much more difficult financial position.

And the strange thing about this Balancing Mechanism is that the marginal cost of generation - the short-term increase or decrease per unit cost of generation becomes the de facto price per MWh for all the other sources of generation during this half hour period. It sounds nuts I know, and it is nuts - it makes no sense, but that's the way the market works.

Of course, there are constraints, but not for us - although we don't want to attract too much attention from Ofgem. For instance, renewable generation is now covered by the Contracts for Difference mechanism that guarantees each form of generation a certain price per MWh - called the Strike Price. Onshore wind, for example, was £95/MWh when the first auction was held in 2016 and

has fallen to £55 by 2024. Meanwhile, solar was £120/MWh and has fallen to £60/MWh. So for these renewable generators if the marginal cost increases up to say £2000/MWh or more during one of these half hour periods the difference has to be paid back into a fund controlled by government and operated by the Low Carbon Contracts Company, and vice versa if the wholesale electricity price falls below the Strike Price.

In our case though, and having talked about staying under Ofgem's radar, it is worth mentioning that only recently, during a period when renewable generation reduced during low wind conditions and high demand led to an auction in which the marginal cost of electricity from one or more CCGT generators rose up to 100 times the rate compared to normal market prices. Not bad for a day's work - not so good for the consumer though!

So overall, we like this system as it allows us to continue to turn a profit on our investment. And why shouldn't we – it is a free market! But what happens as yet more renewable generation is added to the system that further adds to the level of variation of instantaneous power generation due to this intermittency?

Well, it means, on average, over the year, that our energy contribution to the network goes even further down. This in turn means that our long-run profitability, our net margin, falls as we still have to maintain a 24hr operation with reducing income. And this leaves us in the situation where we can only survive if, during these half-hour Balancing Mechanism periods we optimise the opportunities that present themselves to help cover our costs. It is the way we will return a profit and stay in business!

Conclusion

In summary, the driver of high domestic electricity prices is not simply the high wholesale cost of gas, although it is clearly a contributory factor - if it were the sole driver the cost of domestic gas would be far higher. And it is not the cost of re-wiring the transmission and distribution systems to cope with renewable generation joining the network as these costs form part of the daily standing charge – charges that have risen on average each year since January 2019 by almost 10%, way above the cost of inflation.

No, the hypothesis is that the real driver is the gradual displacement of gas and CCGT's - the main source of dispatchable generation, by increasing levels of intermittent renewable generation along with the current operation of the half-hour trading platform, the Balancing Mechanism that perhaps, with hindsight, unintentionally facilitates the marginal cost of production rising to inflated levels.

But there is more! Until such time as the Balancing Mechanism market is changed or the grid is supplied by 100% sustainable renewable generation and backed up by sufficient levels of some other, as yet unidentified, long-term energy storage mechanism capable of quickly responding to and riding through lengthy periods of intermittency that avoids these supernormal profit opportunities then domestic electricity prices must continue to increase as it is the only way to keep sufficient dispatchable generation on the network to maintain security of supply.

Put another way, intermittent wind together with periodic and variable solar is not the way to meet GB demand and provide security of supply, especially not without adequate, reliable back up. The current system, the only system we have available, is a recipe for disaster that can only lead to further domestic electricity price rises as yet more and more intermittent generation is added to the transmission network to meet demand.

And as CCGT's accounted for approximately 120TWh of generation in 2024 that equates roughly to the need for an additional 40GW of installed wind capacity in some on/offshore combination, along with solar. However, that is the steady state equivalent when the wind is blowing. But providing sufficient levels of energy storage to keep the lights on during periods of *Dunkelflaute* (dunkel – a German term for overcast skies, and flaute – low wind), and generally accepted as a period lasting more than 24 hours, is a more complex challenge as most current forms of energy storage, such as battery storage, is limited to a few hours. This is why we need CCGT back up. It is all we have to call upon that allows us to ride through such long outages.

Suffice to say here that one of the longest GB outage *Dunkelflaute*, if not the longest, occurred over an 11 day period between February-March 2021 during which the average capacity factor of the national wind fleet fell to around 11% along with solar at between 2-3%. Without CCGT generation as well as coal fired turbines power cuts would have been inevitable. And as coal has been phased out and biomass thermal generation has limited capacity gas provides our only security of supply, now and likely well into the future.

Against this background, falling domestic electricity prices is most unlikely. Indeed, we should brace ourselves for the opposite and not let politicians tell us otherwise.

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