

Slaughter and May Podcast

UK Hydrogen: Key considerations for low carbon hydrogen production

<p>Oliver Moir</p>	<p>Hallo – my name is Oly Moir, I’m a partner the infrastructure, energy and natural resources team here at Slaughter and May.</p> <p>I’m here today with my colleague Kathryn Emmett, a PSL Counsel in the team, to discuss the opportunities for low carbon hydrogen in the UK. Our team are currently working on both green and blue hydrogen projects in the UK and internationally. However, today’s discussion is focused on new build hydrogen production in the UK and, specifically, what the government is doing to help make these projects investable.</p> <p>Kathryn - hydrogen is an extremely hot topic at the moment – it seems we’re constantly talking about hydrogen with so many of our clients. And I struggle to think of a client who isn’t interested to some degree in the future of the hydrogen economy,</p>
<p>Kathryn Emmett</p>	<p>Yes – what makes the topic so fascinating is its relevance to almost every sector of the economy.</p> <p>Activity in this space is driven by decarbonisation policy. But from a UK perspective, not only does low carbon hydrogen have the potential help meet the UK emission reduction goals, but also the hope is that it will assist the UK’s energy security objectives too.</p> <p>So the UK recently doubled its ambitions for low carbon hydrogen and is now aiming for 10 GW of low carbon hydrogen capacity by 2030. This was announced as part of its British Energy Security Strategy -in part this is a response to the conflict in Ukraine and also the recognition that we need to diversify our sources of energy as well as to decarbonise them.</p> <p>But also, since the Hydrogen Strategy was originally published in August 2021, there’s been this realisation of the contribution that electrolytic hydrogen might make to the UK energy mix. So at least half of this 10 GW target is expected to come from electrolytic hydrogen using surplus renewable power. In the short term, the aim is for 1 GW of electrolytic hydrogen to be in construction or operational by 2025.</p>
	<p>Yes, you mention electrolytic hydrogen, but we should emphasise that the UK plans to support a variety of hydrogen production methods including both blue hydrogen, produced from methane gas using carbon capture and storage, but perhaps also biomass gasification with CCS. An allocation process is already underway to provide support to hydrogen production with CCS – we’ll touch on that more later.</p> <p>This very notably contrasts with the approach in many EU member states where green hydrogen, produced by electrolysis using renewable electricity, is the main or sole focus</p>

<p>Oliver Moir</p>	<p>These range of production methods – often referred by reference to different colours of hydrogen – are all being supported provided these contribute to the UK's net zero target.</p> <p>But, because hydrogen molecules are fungible, the government needs to define the level of emissions associated with low carbon hydrogen production in order to distinguish it from existing 'grey' hydrogen production methods. In the UK, this is being done via the introduction of a Low Carbon Hydrogen standard.</p>
<p>Kathryn Emmett</p>	<p>Yes, that's right Oly. The UK standard will be a single 'low carbon label', applied at the point of production to all UK production methods that meet the required emissions threshold of 20gCO_{2e}/MegaJoule_(Lower Heating Value).</p> <p>Low carbon hydrogen projects and businesses seeking grants from the Net Zero Hydrogen Fund or revenue support under the hydrogen business model are required to comply with the standard in order to secure that support. And although the standard will be reviewed periodically, starting in 2023, the level of the standard will be grandfathered so any future changes wouldn't apply retrospectively to support that had already been awarded.</p> <p>Initially the Low Carbon Hydrogen Standard only applies to UK production but the government also intends the standard be developed into a certification or guarantee of origin scheme by 2025 meaning it may apply to imports and exports also in future.</p>
<p>Oliver Moir</p>	<p>And without getting too technical – it's worth pointing out that the variety of production methods inevitably means there are different requirements to measure emissions and so to determine whether the standard is met or not.</p> <p>For example, the standard places requirements on the renewable electricity used in green hydrogen production. These of course aren't applicable to blue hydrogen, which is produced from reformation of natural gas.</p> <p>Now - you may think that renewable electricity means the hydrogen will necessarily be low carbon. But it's not quite that straight forward. The wind's not always blowing and the sun's not always shining, but the guidance published recently says that there must be a temporal correlation between the renewable electricity and the hydrogen production.</p> <p>If an electrolytic hydrogen production plant uses electricity that is not produced on-site but is instead procured under a corporate power purchase agreement, it must, amongst other things, show a temporal correlation between the renewable energy generated and the hydrogen produced. And essentially, there needs to be metering data linking the low carbon generator and hydrogen production facility in every 30 minute settlement period. And if the link can't be established, the national grid average emissions intensity will be used. Which of course means that</p>

	<p>whether the electricity is low carbon depends on the electricity generation mix at that time.</p>
<p>Kathryn Emmett</p>	<p>Yes, I can see that this also adds operational complexity for the production plant. The intermittency of many renewable sources of electricity, as you say, like wind or solar, is likely to mean that some grid electricity or stored electricity may be needed to provide the required utilisation profile for the electrolyser.</p> <p>As I understand it, a similar debate is ongoing at in the EU as well – in particular in relation to the requirements of the recast Renewable Energy Directive for a renewable hydrogen standard.</p> <p>The key takeaway here is that compliance with the Low Carbon Hydrogen Standard is going to need to be considered on a project by project basis, particularly as meeting the standard for any volume of hydrogen is key to accessing the support in the UK on an ongoing basis.</p>
<p>Oliver Moir</p>	<p>Indeed. Let's turn now to the package of support for new build hydrogen production you mentioned. That includes grants and support from a hydrogen business model.</p> <p>I think it's fair to say the hydrogen business model has generated a lot of interest so we will focus there.</p> <p>But before we do, we should mention that there are numerous grant funding schemes available such as the Industrial Fuel Switching and the Industrial Energy Transformation Fund. And most recently the government has launched the £240 million Net Zero Hydrogen Fund which can provide devex and capex support for hydrogen production for both green and blue projects. We're actively working with clients seeking support for their early stage projects.</p> <p>The hydrogen business model on the other hand is essentially a form of revenue support for new build projects which it is hoped will make low carbon hydrogen production in the UK viable, investable and - that crucial word - bankable.</p>
<p>Kathryn Emmett</p>	<p>Yes, it is intended to provide investor certainty and to appeal to capital with a risk appetite to invest in early opportunities in the UK hydrogen market. I should also mention that if a project is a retrofit of an existing hydrogen production plant, it will be supported but under an industrial carbon capture contract – which is the subject of an entirely different podcast!</p> <p>What's proposed for new build plant is a contract for difference called a low carbon hydrogen agreement, based on the CfD for renewables. It is essentially a private contract, topping up the agreed sales price for hydrogen to a negotiated strike price for a period between 10 and 15 years (the duration of support is one of the things still under review). The CfD structure allows for the subsidy level to adjust as the market matures so that if the sales price (i.e. the reference price)</p>

	<p>were to rise above the strike price during the contract term, then the producer would make a payment to the contract counterparty.</p> <p>Hydrogen is already used and marketed in a number of sectors, but currently these sectors are using grey, carbon intensive hydrogen. The business model will help low carbon hydrogen compete with this higher emission hydrogen. It will also encourage fuel switching away from natural gas and in favour of low carbon hydrogen.</p> <p>At a competitive price with the counterfactual fuel, the expectation is demand will develop for low carbon hydrogen across a variety of end use applications, including heavy industry, heat, power and transport.</p>
<p>Oliver Moir</p>	<p>Yes and the hydrogen business model is particularly interesting – in my view – because of the decision the government has taken on the reference price.</p> <p>Now, the difficulty policy makers had in establishing the reference price is that, unlike for electricity with the renewables CfD, there’s no single market price for hydrogen as yet. There is no liquid, traded market and there will not be for some time. Until one develops, the government has decided that the reference price will be the ‘achieved sales price’ negotiated by the producer, with a floor of the natural gas price. And that floor price is intended to avoid producers gaming and agreeing an artificially low sales price, knowing that they will be able to recover the difference via this mechanic. The gas price has been selected as that floor because this will be the fuel that is, in most cases, being displaced by the low carbon hydrogen – i.e., the counterfactual fuel.</p>
<p>Kathryn Emmett</p>	<p>Yes, and another tool proposed to prevent gaming is a price discovery mechanism – this is to enable the true price of hydrogen to emerge over time. It is described – and I quote - as “an amount linked to the increment by which the reference price exceeds the price floor for each unit of hydrogen sold”. There’s not a lot of detail there, but, from what’s been published, this effectively looks like a bonus payment where the producer achieves a price higher than the natural gas floor price. The idea is that this will incentivise hydrogen producers to negotiate a higher sales price, reducing the difference payment and so minimising the subsidy.</p> <p>However, government don’t want to overpay and so they are also considering whether to cap this reward if the sales price exceeds a certain level to ensure hydrogen remains affordable for offtakers and to protect the government from over subsidy.</p>
<p>Oliver Moir</p>	<p>Also crucial, and particularly relevant in these times of high inflation, is that the strike price will be indexed. The indexation regime however varies depending on whether the facility is CCS-enabled (in part indexed to natural gas prices and CPI) or electrolytic (indexed to CPI, as with the renewables CfD).</p> <p>There are also proposals to help mitigate volume risk – it’s no good getting revenue support for what you sell if you can hardly sell any of what you’re</p>

	<p>producing. So the government will support volume risk by using a ‘sliding scale’ payment system, whereby it will pay a higher level of support in the event of low offtake volumes, with the level of price support tapering off as volumes increase. And this is particularly important because with hydrogen we are dealing with a commodity where there is currently neither meaningful supply nor wide-scale demand – the demand also needs to be stimulated and cannot be guaranteed. However, where offtake volumes fall to zero, no payments will be made. My reading of the government thinking on this is that they simply can’t justify a subsidy if no hydrogen is actually produced whatsoever – you can imagine the headlines. But this does of course pose a risk to projects. And again, we don’t have a lot of detail yet about how this will be operate in practice yet and it obviously raises a number of questions.</p> <p>So, I think the take-away is that although investors will be familiar with the CfD model, there are a number of elements – like the price discovery mechanism and the volume support - which are novel, so developers and investors will want to consider these carefully as and when more information is available.</p>
<p>Kathryn Emmett</p>	<p>Yes, absolutely. And from the discussions we’re having and the activity we’re seeing, there’s a lot of interest in the low carbon hydrogen agreement.</p> <p>As we’ve mentioned, the process is already underway to allocate support. But the process depends on the production method – so whether it involves CCS-enabled or electrolytic hydrogen production.</p> <p>For new build hydrogen production using CCS, initial projects have already applied for support under the CCUS cluster sequencing programme and a number of eligible projects have been identified to enter into negotiations. Contracts are expected to be awarded from Q2 2023.</p> <p>New build electrolytic hydrogen is following a different process. Annual allocation rounds are expected with the first round applications opening in July 2022 and contracts expected to be awarded by December 2023.</p> <p>Now the reason for this split process is two-fold:</p> <ul style="list-style-type: none"> • Firstly - CCS-enable hydrogen production needs to be integrated into the government’s CCUS programme, so that it can be coordinated with the development of carbon transport and storage networks; and • Secondly, the characteristics and costs of electrolytic and CCS-enabled hydrogen are very different so it wouldn’t be appropriate for them to compete with each other for support, particularly not at this stage of maturity.

	<p>And in the longer term the government will transition to competitive allocation by 2025, but even then it is likely to include different technology pots to recognise those different production methods.</p>
Oliver Moir	<p>Thanks Kathryn. A key issue with hydrogen projects of any colour will be 'project on project risks' or 'cross chain risks'. These are issues of co-dependency between related projects.</p> <p>So, for example, for blue hydrogen, using CCS, developers of the hydrogen production plant are of course reliant on the timely construction of the carbon transport and storage network and on its continued availability of once operational.</p> <p>Surprisingly there's still no decision been taken on how to manage carbon transport and storage network risks in the low carbon hydrogen agreement draft heads of terms.</p>
Kathryn Emmett	<p>Yes. In relation to delays to construction and commissioning of the carbon transport and storage network, I struggle to see how the government could justify a different approach compared to the proposals for other industrial carbon capture users. Under the CCUS business model for industrial carbon capture plant, there's a day for day extension of key dates such as the longstop date for commissioning of the carbon capture plant in the event of delays to the commissioning of the transport and storage network if these are not caused by the capture project.</p>
Oliver Moir	<p>And, once commissioned, importantly for the hydrogen producer, any unavailability of the carbon T&S network will also impact the quality of the hydrogen produced in that it will not meet the Low Carbon Hydrogen Standard. This means there will be no support payment payable under the low carbon hydrogen agreement. And I note that the government are also considering a termination event for off-spec hydrogen. On top of consequences under the government support contract, this may also result in a breach under the producer's offtake agreements for the low carbon hydrogen.</p> <p>Finally, if the carbon transport and storage network continues to be unavailable, the government is also considering including a termination right which would mean that the contract counterparty would have a right to terminate for prolonged, continuous unavailability of the carbon T&S network. But the period and consequences of termination are still to be determined.</p>
Kathryn Emmett	<p>It is interesting that under the industrial carbon capture plant contract terms, although compensation for certain unavoidable costs will be available when the carbon transport and storage suffers an unplanned outage, there won't be any compensation for the loss of value or marketability of any product from the industrial facility. It will be interesting to see whether the same approach will be taken in relation to hydrogen production as well.</p>

Oliver Moir	Indeed. These are key issues which developers and investors will need to understand in the context of their particular project, and more progress will need to be made on these issues.
Kathryn Emmett	And just picking up on the termination for off-spec hydrogen point Oly, it's worth highlighting that we've been talking about blue, but green hydrogen production faces a similar 'quality' risk if it fails to meet the Low Carbon Hydrogen Standard for any given period of time.
Oliver Moir	<p>Another aspect which clients are considering is the offtake. The hydrogen produced will need to be transported to market. Unlike for the carbon transport and storage networks, there's currently no plan for a centralised UK hydrogen network.</p> <p>The government has indicated that small scale transport and storage, like above ground tanks and pipelines linking a production project to a local offtaker are likely to be covered by the hydrogen business model support. But these costs are expected to be assessed on a case by case basis.</p> <p>In relation to larger scale networks, as part of the British Energy Security Strategy Kathryn mentioned earlier, the government has now committed to designing by 2025 a new business model to support hydrogen transport and storage infrastructure. This is however subject to the findings of a review of the UK's hydrogen transport and infrastructure requirements that is currently ongoing. And the current draft heads of terms simply don't factor this in – but this might be considered in a future draft.</p>
Kathryn Emmett	<p>Yes, offtake strategies will be a key consideration. Clearly an investable offtake strategy is essential for a hydrogen production plant but there are some restrictions in the low carbon hydrogen heads of terms in relation to offtake that will be important not to fall foul of.</p> <p>Firstly, the draft heads of terms specify that hydrogen sold for blending into the gas grid won't qualify for support – but that doesn't mean that the hydrogen can't be sold to those offtakers if it still makes economic sense, it simply won't qualify for the difference payment we discussed earlier.</p> <p>Secondly, hydrogen sold for export won't be supported either. But it's unclear in the heads of terms whether the hydrogen production plant will be required to verify that any offtaker that it sells its hydrogen to is then not on-selling this for export and how far the onward supply chain will be scrutinised.</p> <p>Finally, good news is that, at the moment, the government are permitting sales to producers or affiliates for self-consumption and also to feed-stock users (so where hydrogen is used to produce SAF, or green ammonia for example), but perhaps with some adjustments to make sure government is not over-paying.</p>

<p>Oliver Moir</p>	<p>And finally, a key question is always “where does the money come from” to make payments under the low carbon hydrogen agreement, particularly in the context of today’s high energy prices and pressure on consumers.</p> <p>The government’s position appears to be initially funding this from a specific tax revenue funding envelope. £100 million has been identified and earmarked for electrolytic hydrogen contracts in 2023 and a further funding envelope will be announced later in 2022 which will enable the award of the first CCS-enabled hydrogen projects, along with industrial carbon capture plant.</p> <p>In the longer term, the government’s intention is that all revenue support for hydrogen production will be funded from a consumer levy from 2025 at the latest. A levy is however expected to need primary legislation. The design of the levy will be subject to further consultation, and will need to be designed to ensure affordability of consumer energy bills. This is likely to form part of a wider conversation on supplier levies and the energy supply market more generally.</p>
<p>Oliver Moir</p>	<p>Thank you Kathryn – we have certainly covered a significant amount of ground albeit there is an awful lot more detail behind all of this. .</p>
<p>Kathryn Emmett</p>	<p>Yes, thanks to you too Oly.</p> <p>Please also checkout our CCUS focused podcast, available on the SM podcast series, on our website and wherever you get your podcasts.</p> <p>Thanks for listening.</p>