



BEIS consultation: Business Models for Carbon Capture, Usage and Storage

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September 2019

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1. Have we identified the right parameters to guide the development of CCUS business models?

The parameters described are perfectly sensible.

There is a risk that there are too many of them and that they are highly subjective in some cases (one person's "appropriate" is another's disproportionate).

The Oxburgh report¹ for instance suggested a single primary goal of being lowest cost. This provides more focus.

Having said this, the obvious omission is the goal of setting standards and precedents for the rest of the world to follow.

It is also worth saying that it is impossible for CCS to ever be cheaper than emitting CO₂ to the atmosphere from the same hydrocarbon based source, and that therefore the aspiration to be "subsidy free" implies that any arrangement which provides a value to the societal good of avoiding emissions is not a subsidy. While this is a welcome approach it doesn't make defining "subsidy free" any easier.

2. Bearing in mind our emerging findings on CCUS business models, do you have any views at this stage on how the business models might be integrated?

The key here is that they must be integrated. CCS addresses some whole energy system problems but also needs a whole of energy system approach. As our comments will show in this document, the decisions on the approach to power, hydrogen and industry are interrelated and need to be co-ordinated by a delivery body of some form. The individual sectoral proposals in the consultation simply cannot work without that over-arching co-ordination.

3. Do you have proposals to mitigate CCUS-specific risks?

The key question about these risks, which are correctly identified, is whether they should be mitigated in a financial or technical sense. In essence much of the narrative on CCS business models to date has been about the government insuring certain risks because they are presented as unmanageable by the private sector. Hence the government should financially insure them rather than the private sector develop the capability to manage them.

The first question to answer is whether this is really true (that the risk is unmanageable) or whether it is simply that some companies would like to be involved in CCS but don't like some of the risks that come with it. We suspect the latter.

Secondly, the government should consider if these are really risks that are unprecedented in the private sector. They are not. Businesses take long-dated risks of unquantifiable cost all

¹ Oxburgh (2016): Lowest cost decarbonisation for the UK: The critical role of CCS. Report to the Secretary of State for Business, Energy and Industrial Strategy from the Parliamentary Advisory Group on Carbon Capture and Storage.

the time. The very existence of continued hydrocarbon exploration and production given the costs of accidents such as BP's in the Gulf of Mexico are perfectly obvious evidence of that.

Thirdly, the government should consider if, for an industry of enormous global application, the UK should set a precedent which is that these risks are simply offloaded onto the taxpayer or consumer via contract. It is surely incumbent on the UK to prove that such risks can both be understood and managed to a sufficient level of technical detail that the risks can be accepted by investors alongside all the other such risks that they take. This would set a global benchmark for CCS development.

One of the things that makes CCS different to, for instance, the Super Sewer, is that CCS is not a "one off" with one off risks that have to be allocated. It is an essential part of meeting our emissions reductions targets and has application across the world at large scale, as the consultation points out.

The UK should lead the development of the skills and techniques needed to understand and manage these risks, not wish them away in a contract.

4. Are there any other CCUS-specific risks that need to be considered? If so, what are your proposals for mitigating them?

No. Full chain risk and long-term storage liability are the key ones.

5. Have we identified the most important challenges in considering the development of CO₂ networks?

Yes. Most important amongst them is the source of any regulated revenue and whether it is independent of the delivery of the full chain CCS project. Much of the debate is silent on these two most important issues.

The Oxburgh Report took the view that the underwriter of the T&S network was the electricity consumer through the anchoring of each hub via a power station. This is one approach. If the anchor were a hydrogen producer then hydrogen consumers (gas consumers today) could perform a similar role. It is entirely unclear where the underwriter comes from in an industrial CCS led approach.

In advancing the debate on CCS business models it perhaps behoves us to use a more direct vocabulary and be explicit as to which group of people we are expecting to underwrite T&S. All the models rely on such an underwriter.

The other point is the full-chain point. The Oxburgh report recommended a separate T&SCo, but that would only become a stand-alone entity once it has proven its place in a full chain. Policy should be clear, are the underwriting group of people expected to perform that underwriting irrespective of whether the pipes and stores are ever used?

6. Do you agree that a T&S fee is an important consideration for any CO₂ T&S network? In your view, what is the optimal approach to setting the T&S fee?

Yes it is.

The T&S fee should be underwritten by an identified group of early users and then spread around further users as they are added. It should always be clear who is underwriting.

The T&S fees should be set by an economic regulator. The UK has a strong history in this field.

The T&S fees should reflect costs and so will most likely be largely fixed with perhaps a smaller “per tonne” element.

7. Of the models we have considered for CO₂ T&S, do you have a preference, and why?

Whether a model has a grant or not doesn't really change the model and so there are really two models: private and public.

If the private model is adopted from day one then the government will be forced by the private sector to take CCS specific risks in contract and limited expertise will be developed in these risks and a poor precedent will be set for a global industry.

If the public model is adopted then there is always a risk that these risks cannot be transferred to the private sector in the future, but at least there will be a vehicle for developing the skills needed for a safe and effective global industry.

This leads to a preference for the initial public model.

8. Are there any models that we have not considered in this consultation which you think should be taken forward for CO₂ T&S, and why?

No

9. Have we identified the most important challenges in considering the development of CCUS power projects?

Yes. The uncertainty of despatch is the key issue. A CCS power station will be among the generators with the highest avoidable cost on the UK power system in the future. It is a very easy to observe from the history of the power sector that new power stations that are paid by output measures are always intended to run at their maximum technical load factor when the investment decision is made.

Where this is not the case (i.e. for back-up capacity) financing is supported by fixed payment (such as those in the capacity mechanism or ancillary service arrangements for instance).

CCS power stations are large capital-intensive generators with very little certainty over their production profile.

There is another issue with respect to power which the consultation avoids by taking a laissez-faire 'power stations will happen if they happen' approach to this sector, and that is who the underwriter is of large scale (and hence cost effective) CCS infrastructure. If it is not the power sector, then it must be the hydrogen sector (industry is simply not an option) and that implies a swift ramp up in hydrogen roll-out. The power sector exists at scale and will continue to do so.

Hence while the consultation does identify the challenges of developing CCS power stations, it fails to address the challenges of developing CCS without power stations.

10. Of the models we have considered for power CCUS, do you have a preference, and why?

Yes. The regulated asset base (RAB) approach.

The CfD exists for power stations that expect to despatch at their maximum technical load factor. This is not the case here. The Despatchable CfD is a creditable attempt to match the wrong instrument to the problem, but it will collapse to a RAB in practice.

Power stations of uncertain despatch at point of investment need a cost reflective remuneration system which is trusted by investors but which can change over time as circumstances change. That is a RAB.

11. In your view, should any potential funding model(s) be applicable across all power CCUS technologies (including but not necessarily limited to CCGT with post-combustion capture, BECCS, and pre-combustion capture or hydrogen turbines)?

Yes. The form of power technology used does not change the model applied. The challenges are common across them.

12. Are there any models that we have not considered in this consultation which you think should be taken forward for power CCUS, and why?

As noted above, the dismissal of the role of power as an anchor directed by some government entity in pursuit of an efficient CCS system is unfortunate and leaves only one viable underwriter of a CCS network (the gas consumer) and hence ties CCS to hydrogen deployment at scale which adds to the challenge and doubles the policy bet.

13. Have we considered the most important challenges in considering the development of CCUS for industry?

When considering industrial CCS it is important to take a careful look at for instance the data on page 10 of the consultation (and exclude the power emissions which are dealt with

separately). The UK's two largest industrial CO₂ emitters are its two remaining steel production facilities at Scunthorpe and Port Talbot. While we wish the people who work there no ill-will, we have to observe that hardly a year goes by without the viability of one or both of these facilities coming into question (the Scunthorpe plant is currently in the hands of the official receiver). Hence developing a large capital-intensive infrastructure to deal with their emissions is a very tough ask commercially and financially. A large proportion of the rest of the industrial emissions comes from oil and gas which (except for CCS) must have a very much diminished role in a net-zero UK economy. Most cement production is inland and hence not easily connected to offshore storage.

Hence the main challenge of industrial CCS is actually whether there is much to do and whether what there is to do can possibly support a cost-effective CCS infrastructure. It cannot.

A key challenge not properly addressed in the consultation is the terms on which industrial emitters can access the T&S system in view of their often precarious future prospects. Only the Oxburgh report deals with this issue explicitly by proposing that a regulated T&SCo would be obliged to build excess capacity at each hub for potential use by industry. This would have a cost to the underwriting people (say electricity or gas consumers). Industrial emitters would have the ability to access the T&S system on a short-term basis, paying their dues when they did use it, but handing the liability back to the underwriting group when they did not need to store. We do not see another credible approach to industrial CCS access to T&S.

14. Of the models we have considered for industry CCUS, do you have a preference, and why?

The Cost-plus open book approach, which is the same in essence as the Industrial Capture Contract proposed by the BEIS Committee and originally by the Oxburgh report is obviously the answer.

It is flexible for application to different industries, it is as cost reflective as possible, it requires the minimum implementation, and it provides the potential to recover excess support provided by the taxpayer.

15. Are there any other models that we have not considered in this consultation which you think should be taken forward for industry CCUS, and why?

No, but the challenge of access terms to the T&S infrastructure (as noted above) is a missing element to this debate.

16. In your view, are there any models which best work across all industrial sectors where CCUS could have a role to play?

Yes. The "cost plus" or Industrial Capture Contract model embodies the flexibility needed to fit across sectors and to fit to the individual circumstances of individual facilities.

17. What actions should Government and industry take to help establish demand for low carbon industrial products?

While we fully endorse the aspiration of global markets which properly value the externality associated with emissions from high carbon products and the merits of low carbon alternatives, we do wonder if this is likely to be achieved for iron and steel, oil and gas, bulk chemicals and fertiliser in a reasonable time-frame.

There are clearly a range of trade-based mechanisms for giving preference to low carbon products (preferential procurement; border tax adjustments etc). Whether the complexity of such arrangements merits the prize of making industrial CCS happen in the UK is questionable.

18. Do you agree that a future business model should focus on hydrogen production costs? If not, what are the benefits of considering other parts of the hydrogen value chain in the next phase of our work?

While the incentive mechanism related to CCS from hydrogen production should indeed focus on production costs, to exclude the costs of the rest of the hydrogen value chain is wrong. The reason for this is volume not price.

As the consultation shows no appetite for power providing anchor CCS projects then it is more likely that hydrogen consumers will need to be the underwriter of CCS infrastructure. To be cost effective this requires scale and hence a ramp up in the use of hydrogen in the UK in certain sectors at least.

As such a ramp up is a prerequisite of a cost-effective hydrogen underwritten deployment of CCS, the costs and challenges of achieving that ramp-up cannot be out of scope.

19. Do you have views on whether the model should seek to support both CCUS-enabled hydrogen production and renewable production methods? If so, how might this work?

Yes. While we agree that it is unlikely that renewable sources will compete with hydrocarbons with CCS in the planning horizon of the consultation, there seems no reason to preclude a positive surprise in renewable hydrogen production.

20. Have we identified the most important challenges in considering the development of a business model for hydrogen production?

Yes. As noted a number of times above, a key challenge is getting new applications of hydrogen to the scale required for the CCS system to be cost effective.

21. What reflections do you have on the approaches we have identified to address the main challenges in designing the model?

22. Do you have views on which business models we should evaluate in the next phase of our work?

For applications in power please see comments above on power and CCS.

For applications in heating, fitting the hydrogen production into the currently regulated approach to incentives seems logical.

For industrial applications there are the same challenges as for industrial CCS. There is not a sufficient existing market for hydrogen to underwrite the industrial user of it, and in many cases the investment horizon might be quite short.

23. What capabilities are needed for the delivery of CCUS in the UK

A delivery body of some form is needed.

As noted above, for an industry of this importance to our decarbonisation goals, the specific risks should not be contracted away, but should instead be addressed by developing the capabilities to deal with those risks. It is clear from past attempts to develop CCS and from the continued lobbying from industry to contract away those risks that they have no appetite for developing them themselves to the extent needed. This is a large part of the case for a delivery body.

Secondly, the need to explicitly address who is underwriting what and how an optimal system is deployed will need guidance and oversight, it will not, in our opinion, emerge from the individual decisions of market players (who have made it very clear that they have little interest in related parts of the overall CCS chain).

In 2018 UKERC published an opinion piece of the [need for a Delivery Body](#)².

² UKERC (2018) CCS: New enthusiasm, old uncertainty, and the need for a Delivery Body