Climate Change Committee

The UK's independent adviser on tackling climate change

Environmental Information Regulations (EIR) Request
Received: 08/08/2023

Published: www.theccc.org.uk/about/transparency

Climate Change Committee
1 Victoria Street,
Westminster, London,
SW1H 0ET
w theccc.org.uk

Date: 06 September 2023
Ref: Sent by email from enquiries@theccc.org.uk

Your request:

Please provide all correspondence, and any relevant research data, between CCC staff and all other experts and stakeholders, including government departments (for example, DESNZ, DfT, DSIT and DLUHC), on the issue of small modular reactor (SMR) technology and deployment.

Our response:

Thank you for your request. We have handled your request under the Environmental Information Regulations (EIR) 2004. Please find our response below.

The information requested has been considered environmental information, given it covers measures (including administrative measures), such as policies, legislation, plans, programmes, environmental agreements, and activities affecting or likely to affect factors, such as substances, energy, noise, radiation or waste, including radioactive waste, emissions, discharges and other releases into the environment.

Under regulation 5(3), personal information from junior CCC staff and external contacts has been removed.

All relevant correspondence that refers to small modular reactor technology and deployment is set out in date order in annex A.

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Information disclosed in response to this FOIA request is releasable to the public. In keeping with the spirit and effect of the FOIA and the government's Transparency Agenda, this letter and the information disclosed to you may be placed on the CCC website, together with any related information that will provide a key to its wider context. No information identifying you will be placed on the CCC website.

If you are dissatisfied with the handling of your request, you have the right to ask for an internal review. If you are not content with the outcome of the review, you may apply directly to the Information Commissioner for a decision. In keeping with our transparency policy, the information released to you will be published on www.theccc.org.uk. Please note that this publication will not include your personal data.

Kind regards,
Climate Change Committee

Annex A – correspondence

Email Chain 1

From: [Name redacted] <[email redacted]>
Sent: 19 July 2022 11:27
To: [Chris Stark] <[email redacted]>
Cc: [Name redacted] <[email redacted]>
Subject: Last Energy - Follow up Materials

Hi Chris,

Thank you for your time speaking with [Name redacted] and me yesterday. We wanted to follow up with the information requested, in this hopes this will be useful or your team to better understand the impact (very) small modular reactors can have on achieving the UK's decarbonisation targets, and the associated policy and economic considerations.

First, here is a link to the deck we presented. If you want to see the underlying data in the graphs on slides 7 and 8, we likely would need to get an NDA in place with the CCC.

Second, Last Energy's CfD proposal (attached) shows how we think we would provide value for money, but ultimately we think the government should determine its willingness to pay for this kind of product.

Third, see our FNEF proposal (attached) if you're interested in our philosophy about how funding projects and developers with government money too early in the nuclear industry has misaligned incentives and hurt the industry.

Finally, a couple key points I would like to reiterate:

- We want to highlight that public policy's job is not to pick winners, but to model what the value to UK citizens is for carbon free energy, and specifically dispatchable carbon free energy. Figuring out how the market can make up for the difference between the cheapest possible source every 30 seconds vs long-term, stable, carbon-free, dispatchable energy is key.
- The main idea is that the cheapest option may not be the best, because the long term cumulative social costs of these cheap options are enormous. Picking individual technologies or companies exacerbates the market dislocation.

Thank you,

[Name redacted]

[Name redacted]

[Role redacted], Last Energy

[Tel redacted] | LinkedIn | @[personal social media account redacted]

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Email chain 2

From: [Name redacted] <[email redacted]>
Sent: 14 September 2022 10:50
To: [Name redacted] <[email redacted]>
Cc: [Name redacted] <[email redacted]>; [Name] <[email redacted]>; [Name redacted] <[email redacted]>; [Name redacted] <[email redacted]>
Subject: Visit of a delegation of members of the Belgian, Flemish and European Parliament (2-4 October)

Dear [Name redacted],

I've just confirmed availability for the 3rd. Monday morning (anytime from 10am) would work best for us, if that works?

We propose something like the following hour session:

1) A welcome from one of the CCC Senior Leadership – 5 mins

2) A presentation and Q&A on the CCC and International Network of Climate Councils (ICCN) – 30 mins

3) Findings on Nuclear and CCS - 25 mins

Grateful for your views on whether that suits the delegations needs? 😊

Very best,

[Name redacted]

[Role redacted]

Climate Change Committee

[Tel redacted]

theccc.org.uk | @theCCCuk

From: [Name redacted] <[email redacted]>
Sent: 09 September 2022 17:08
To: [Name redacted] <[email redacted]>
Cc: [Name redacted] <[email redacted]>; [Name] <[email redacted]>; [Name redacted] <[email redacted]>
Subject: Visit of a delegation of members of the Belgian, Flemish and European Parliament (2-4 October)

Dear [Name redacted]

Thank you for your message!

Might be helpful to give some more information on the rest of the draft program: The delegation will most likely (I am awaiting final confirmation at the moment) have a meeting with [Name redacted] of the UKCCS Research Centre the same morning. Main focus of that meeting will most likely be opportunities (new technologies) and challenges (legislation for instance) for Carbon Storage and wider use of carbon as a raw material. In the afternoon, we are scheduled to have a meeting with Hydrogen UK (2.00 – 3.00 pm). We are also trying to get a

meeting with Rolls Royce on their advances in the fields of electrification, hydrogen, alternative fuels and of course Small Modular Reactors (SMR). The next day (4th of October) the delegation will have a meeting with BEIS and will participate in a site-visite to Zenobe.

From the delegations point of view I think it would be very useful to learn about the CCC in general (what is your statute (independent, statutory body) and how do you operate), but also to get an overview of your latest findings/publications. This way, when the delegation return to their work in the Flemish/Belgian and European parliaments, they can take your findings with them in debating and preparing new regional/national and European legislation. The delegation is specifically interested in your stance/findings on the role of nuclear energy in the climate transition, as well as your findings in CCS and Hydrogen (these might be different or complimentary to those of the UK CCS RS and Hydrogen UK?).

Hope this extra information helps, please don't hesitate to contact me in case you would require some more information,

Best wishes,

[Name redacted]

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Email chain 3

From: [Name redacted] <[email redacted]>
Sent: 03 November 2022 10:56
To: [Name redacted] <[email redacted]>
Cc: [Name redacted] <[email redacted]>
Subject: Briefing from Rolls-Royce SMR

Dear Dr Joffe,

I hope you're well, I am getting in touch from Rolls-Royce SMR.

We listened to the BEIS Select Committee evidence session on Tuesday, and it was interesting to hear the views from yourself and the other panellists.

I wondered if it would be possible to set up a time over the next few weeks for some of our team to brief you and any colleagues you think would be interested on where we are with our plans to deploy our small modular reactors in the UK. It would be incredibly helpful for us too to hear a bit more on the CCC's views on the potential for the nuclear sector in the coming years, so please let me know if a meeting either in person or virtually would be possible.

As you can imagine, our plans have been progressing quickly since we were formally established a year ago, and it would be great to update you on the stages we are at to ensure we can have power on the grid as close to 2030 as possible.

Please let me know if this would be of interest and when could potentially work.
Many thanks, [Name redacted]

[Name redacted]

[Role redacted]

[Tel redacted]

[email redacted]

W www.rolls-royce-smr.com

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Email chain 4

From: Keith Bell <[email redacted]>
Sent: 10 February 2023 08:14

To: [Name redacted] <[email redacted]>; Piers Forster <[email redacted]>
Cc: [Name redacted] <[email redacted]>; [Name redacted] <[email redacted]>
Subject: RE: Salt SMRs

Hi all,

It seems to me that what EDF told you doesn't address the question of flexibility of the nuclear plant itself. It just says: "ah, we could connect other loads to it so that the net export to the grid can be flexed". (OK, so electrolysers need a supply of electricity and they shouldn't really care where it comes from).

Keith

From: [Name redacted] <[email redacted]>
Sent: 10 February 2023 08:09
To: Piers Forster <[email redacted]>; Keith Bell <[email redacted]>

Cc: [Name redacted] <[email redacted]>; [Name redacted] <[email redacted]>
Subject: RE: Salt SMRs

Thanks Piers, I hadn't come across that although [Name redacted] may have.

We've got a host of feedback from the stakeholder testing we'd been doing, among which was the following from EDF on nuclear flex:

- Nuclear is, of course, not generally regarded as a flexible technology. However, we are exploring the ways in which nuclear could provide a flexible supply of electricity to the grid by making use of some of its energy for other purposes, including as a source of heat (e.g. for industrial use) and as a low carbon power source for electrolysis. Indeed, solid oxide electrolysers could make use of nuclear heat to improve the efficiency of hydrogen production. Such developments have the potential to enable nuclear to play a significant role in the net zero transition beyond 2035. This could potentially include the use of nuclear hydrogen production as part of the solution to the concern you identified about the UK's ability to meet its electrolytic hydrogen needs even by 2050.

I think the point about a potential role for nuclear in electrolysis particularly is a valid one – [Name redacted] is planning to add a short section in the report on dedicated capacity build for green hydrogen production. I'm not sure whether we were planning to mention any specific technologies in relation to this but let us know if any views.

Thanks,

[Name redacted]

From: Piers Forster <[email redacted]>
Sent: 09 February 2023 17:16
To: Keith Bell <[email redacted]>; [Name redacted] <[email redacted]>

Cc: [Name redacted] <[email redacted]>; [Name redacted] <[email redacted]>
Subject: RE: Salt SMRs

This is PR but at least they are thinking about flex in nuclear – you probably know this already

https://www.world-nuclear-news.org/Articles/MoltexFLEX-launches-flexibly-operated-molten-salt

Professor Piers Forster

Director of the Priestley International Centre for Climate

Professor of Physical Climate

[personal social media account redacted], @PriestleyCentre; climate.leeds.ac.uk

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Email chain 5

From: [Name redacted] <[email redacted]>
Sent: 04 August 2023 11:34
To: [Name redacted] <[email redacted]>; [Name redacted] <[email redacted]>; [Name redacted] <[email redacted]>; Keith Bell <[email redacted]>
Cc: [Name redacted] <[email redacted]>; [Name redacted] <[email redacted]>; [Name redacted] <[email redacted]>; [Name redacted] <[email redacted]>; [Name redacted] <[email redacted]>
Subject: Follow up to our discussion

Hi [Name redacted],

Thanks for coming back to me. I believe we'll be speaking on an ENA call regarding leakage on Monday 8th, so looking forward to seeing you then, virtually at least. It would be great to get an opportunity to explore some of the analytical issues with you and your colleagues in-person. We have detailed spreadsheet models on many of the economic questions and it would be good to explore where you see gaps and challenges and compare assumptions and our basis for them. To reflect on some of your points:

Norway (Equinor) is actively exploring long-term contracting of gas into Europe – either as natural gas or as hydrogen. The UK is uniquely well-placed to import

supply through existing pipelines and has well-documented capacity for CCS. I have been involved in long-term contracting for gas supply from Norway in the past and I'd be confident that Norway would consider long-term supply to the UK as appealing – especially in comparison with building new hydrogen supply infrastructure into continental Europe where CCS potential is more limited than the UK. There are also a range of pricing models that would mitigate the wholesale price risk that has driven the current focus on security of future energy supply. This would need government engagement to be progressed as it is not an approach that fits the business model of 'the market' – gas traders, shippers or suppliers, but is one that would address a critical issue for the UK economy and consumers. My own view is that the government should be actively prioritising this but I suspect it's not on their radar as a possibility.

It would be good to understand your concerns around CCS scalability. CCS is often challenged based on capture rates, costs and maturity, there is a large body of evidence that demonstrates that these are all addressable. The IEA, BNEF and others have produced detailed analysis demonstrating the cost of CCS across a range of sectors and applications. Historically those costs have been high relative to the way that carbon markets have valued emissions; however, where UK ETS prices rose to >£100/tonne last year and abatement curves and existing policy support measures (for other technologies, e.g. biomethane production) are already at higher levels than that, then the economic case is credible. CCS project investment need greater certainty than volatile market prices can support (just like power stations, wind farms and gas storage) and so should be funded in the same way, and I believe will be, under the business models developed by DESNZ, assuming that funding is made available. In terms of maturity of the overall process, then enhanced oil recovery (EOR) demonstrates the practice of CCS works; there has been no economic incentive to maximise CO2 capture rates without a stable value of carbon abatement. With that changing, process innovation, notably the Allam-Fetvedt cycle, means that close to 100% capture rates are feasible based on the economics outlined here. If your concern is deployment timelines, then for me it comes back to funding and certainty of demand, and clearly a commitment to blue hydrogen at scale could underpin demand.

More generally, the point about scalability feels to me like one that could be applied equally to a whole range of mature and emerging technologies. Nuclear has taken an inordinate amount of time to develop in the UK and has experienced dramatic cost overruns in other countries. There was coverage recently by the former chairman of the US Nuclear Regulatory Commission, Allison Macfarlane, setting out her concerns on the potential from small modular reactors (SMRs) and her view that SMRs will not be commercialised in a timeframe reflective of net zero targets. Onshore wind is highly contentious in the UK. Hydrogen power plants would need large scale storage (without blue hydrogen production at scale) as would gas with CCS. Many of the other technologies seen as part of the mix are less mature than CCS where, at least in the UK, we have four decades of experience of pumping up to 4BCM of gas (methane) in and out of the Rough each year. It would be good to understand why you see the scalability of CCS as any more challenging than the other infrastructure needed to deliver a net zero energy system.

As noted above, there are well established mechanisms that can mitigate the price exposure of international commodity markets. In addition, a fundamental feature of financial risk management is that the cost of a mitigation should not exceed the cost implied by the risk. We've explored this analytically as it related to different energy systems in some detail and would welcome the opportunity

to share that analysis. Broadly our analysis, and that of others, tends to show gas price volatility as a second order cost risk.

I'd appreciate the opportunity to explore your thinking around the availability of green hydrogen. In terms of demand forecasts, load factors and efficiencies, we typically use DESNZ sources for power generation and hydrogen production (e.g. the 2020 generation cost report and the 2021 Hydrogen production cost dataset) and the ESO's FES data. I know the FES scenarios are at least in part designed to align with the CCC 6CB scenarios and I'd see both DESNZ and the ESO as good quality sources. If you see different and better sources it would be good to touch on that. I'm not sure what view you'd take on interconnectors – my own experience is that consultant models overstate the price/dispatch efficiency of interconnectors and storage - partly because they can't represent the vast complexities of interconnected markets and forward/spot price interactions across commodities. Intuitively, if electricity (or hydrogen) is available for export through interconnectors then there must be more than is needed to meet domestic demand and vice versa electricity is available for import when prices are low to produce hydrogen. There are a whole other set of questions if we were to consider hydrogen pipeline interconnection so I'll park that one. One question on interconnection – if it is correct that the CCC sees any exposure to international gas prices as a challenge to be avoided, it is fair to say that the same exposure to international electricity prices is not a concern if interconnection is seen as a key part of the generation capacity that delivers security of supply?

Given the CCC position that hydrogen for heat costs are similar to the alternative of full electrification (as [Name redacted] indicated in the ENA meeting) then the potential for cost-effective green hydrogen production seems critical, as such it would be valuable for us if we could take you through sources and assumptions and understand how you differ in your view by 40% of potential supply.

Would it be possible to meet with you and your colleagues step through some of our modelling?

Best regards,

[Name redacted]

[Name redacted]

[Role redacted]

Cadent

[Tel redacted]

[Email redacted]