From: <redacted>
Sent: 06 September 2022 15:30
To: Minister for Business, Trade, Tourism & Enterprise <MinisterBTTE@gov.scot>; DG Economy <DGEconomy@gov.scot>
Cc: Cabinet Secretary for Net Zero, Energy and Transport <CabSecNetZET@gov.scot>; Deputy First Minister and Cabinet Secretary for Covid Recovery <DFMCSCR@gov.scot>; DG Net Zero <DGNetZero@gov.scot>; Berge K (Kersti) <Kersti.Berge@gov.scot>; Low R (Ragne) <Ragne.Low@gov.scot>; [redacted]< [redacted]@gov.scot>; McAvenue K (Karen) <Karen.McAvenue@gov.scot>; [redacted]< [redacted]@gov.scot>; [redacted]< [redacted]@gov.scot>; [redacted]< [redacted]@gov.scot>
Subject: ROUTINE - BRIEFING FOR MR MCKEE AND DG ECONOMY - Nuclear Fusion (STEP Ardeer)

Mr McKee, Minister for Business, Trade, Tourism and Enterprise
Louise MacDonald, DG Economy

Following on from [redacted] previous advice regarding handling of stakeholder engagement issues related to North Ayrshire's STEP bid, please find the additional requested briefing attached.

Please do not hesitate to let us know if there is any further information that would be helpful.

Kind regards,

[redacted] | 5 Atlantic Quay, 150 Broomielaw, Glasgow, G2 8LU | [redacted]

NUCLEAR FUSION – Minister for Business, Trade, Tourism and Enterprise

- Nuclear Fusion works in the opposite way to Nuclear Fission with two lighter atoms combining to form a heavier one, by which process energy is released.
- Proponents of the technology assert that it has the potential to be a low carbon, safe, continuous and effectively, an unlimited source of energy.
- While a number of research and development projects have managed to achieve Fusion (most recently in February of this year) the generation of electricity has been, thus far, short lived (a few seconds).
- In October 2021, UKG published "Towards Fusion energy: the UK Fusion strategy", which set out how they will seek to leverage scientific, commercial and international leadership to enable delivery of fusion energy.

How long will it take for Fusion to come to fruition and provide generation to our energy mix?

- BEIS anticipate that the first demonstration of a commercially viable Fusion energy would occur in early 2040s, with the possibility that ambitious private sector innovation could shorten timescales.
- However, it is acknowledged that Fusion is unlikely to make a significant net zero contribution pre-2050.

Will it be as expensive as Nuclear Fission?

- Proponents of Fusion argue that the cost of electricity generated from Fusion would be much lower than traditional Nuclear Fission. This is in part because the decommissioning and waste costs are much lower, as are the fuel costs.
- These arguments are, however, essentially theoretical at this point because the technology has not reached commercial (or even small) scale.

Would Fusion be treated the same way as Nuclear Fission from a regulatory perspective?

- In Autumn 2021, a consultation ran regarding proposals for a regulatory framework for the technology. The results of the consultation were published in June 2022 and confirmed:
    - Current UK regulators of Fusion R&D facilities retain responsibility for Fusion, instead of aligning to the approach used in Nuclear Fission.
    - The regulatory approach will apply to all planned Fusion prototype energy facilities in the UK to provide confidence to developers.
    - It will legislate to make clear in law the regulatory treatment of Fusion energy to provide certainty to industry.
    - The accompanying Energy bill has begun its passage through UK Parliament and is currently in the House of Lords.

Why is there such a big focus on Fusion right now?

- The UK Government, through the UK Atomic Energy Association is currently running a competition to identify a site for a prototype Fusion plant – a 'Spherical Tokamak for Energy Production' (STEP).
- The purpose of this is to create an anchor point for the Fusion industry in the UK.
- A site in North Ayrshire (Ardeer) has made the final shortlist and is the only Scottish site on the shortlist. It was one of five Scottish sites to initially bid for the project.
- The bid for the North Ayrshire site is being led by the Fusion Forward (Ardeer) consortium, which consists of the University of Glasgow, NPL Group, which owns the land, and North Ayrshire Council.
- The other sites currently under consideration are:
    - Moorside, Cumbria

- Goole, East Yorkshire
- West Burton, Nottinghamshire
- Severn Edge, Gloucestershire

- For context, the STEP project is expected to have a generation capacity of approximately 100MWe. This is relatively small when compared to the generation capability of Torness, which is approximately 1250MWe.

What are the economic development opportunities for the Fusion?

- North Ayrshire Council and University of Glasgow estimate that the project will generate around 3000 construction jobs, a further 1000 jobs for site operation and contribute to the development of an international innovation and research community around the location.
- This is based on the assumption of an initial investment by UK Government of £222m for the first phase. This will run until 2024 and includes the selection of a site concept design and all other early activity. Further phases would require billions of pounds of additional investment.
- Fusion would represent a considerable export opportunity, enabling UK technology to play central role in global decarbonisation of energy production. Related technologies include advanced remote handling, robotics and materials science.

When can we expect a decision to be made?

- We understand that the UKAEA has already made its recommendation (based on technical factors) and this was presented to the previous BEIS Secretary of State, Kwasi Kwarteng.
- The Ardeer team may not be aware of this. However, that decision is likely to have been held for the incoming Secretary of State.

How much waste would be created from the Fusion process and to what level of radioactivity?

- The radioactive waste implications of Fusion are considered and set out by the UK Government, the UK Atomic Energy Authority and independently by the Committee on Radioactive Waste Management in respective papers each published towards the end of 2021.
- Broadly these papers set out that, as Fusion is still a developing technology, the radioactive waste implications are not yet certain. Much will depend on choices made during the design and construction of a future site and further consideration will be necessary of how this waste can be disposed of once more is known.
- It is generally acknowledged that a Fusion reactor is not likely to produce any High Level Waste (HLW), as the fission process does.
- We understand though that there is the potential for a Fusion reactor to produce thousands of tonnes of both Low Level Radioactive Waste (LLW) and Intermediate Level Radioactive Waste (ILW) during its operation and decommissioning. Some of this waste, in particular the ILW, would be classed as Higher Activity Radioactive Waste.
- While much of this waste, in particular any LLW, is likely to be manageable within existing policies, we understand that some of this ILW could be longer lasting (ie it will remain ILW for over a thousand years) and may not be suitable for near surface disposal in accordance with Scottish policies. This is still likely to be less hazardous than the waste generated from the *fission* process and as such, it is presented positively by UKG.

Does Scotland have any divergent policies for the management of nuclear waste?

- Scotland has a highly complex and challenging nuclear and radioactive substances landscape. Nuclear Decommissioning and Radioactive Waste Management are devolved, but issues such as nuclear fuel, import/export and security are reserved.
- The Scottish Government has a clear policy for the management of Higher Activity Radioactive Wastes (which would apply to some wastes generated by a Fusion Site), which is that the long-

term management of higher-activity radioactive waste should be in near-surface facilities located as near as possible to the site where the waste was produced.
- This contrasts with UK Government policy for deep geological disposal of some of these types of waste.

[redacted]

[redacted]

From: [redacted]< [redacted]@gov.scot>
Sent: 13 September 2022 13:59
To: Minister for Business, Trade, Tourism & Enterprise <MinisterBTTE@gov.scot>
Cc: [redacted]< [redacted]@gov.scot>; [redacted]< [redacted]@gov.scot>; [redacted]< [redacted]@gov.scot>; [redacted]< [redacted]@gov.scot>; [redacted]< [redacted]@gov.scot>; [redacted]< [redacted]@gov.scot>; [redacted]< [redacted]@gov.scot>; [redacted]< [redacted]@gov.scot>; [redacted]< [redacted]@gov.scot>; Business Engagement <businessengagement@gov.scot>
Subject: Mr McKee quarterly meeting with SCDI - 8 September

PO

Please see below readout of the Minister's quarterly meeting with Sara Thiam and [redacted], SCDI on Thursday 8 September.

Regards
[redacted]

[out of scope]

Fusion energy

- SCDI keen for SG to support the North Ayrshire fusion energy bid. As this is an energy policy matter, this falls within the portfolio of the Cabinet Secretary for Net Zero, Energy and Transport. Ministers are content they have an extensive level of information on the project. If this should change officials will be in contact to arrange a discussion with SCDI.

[out of scope]

No specific actions recorded.

[redacted]|Strategic Business Engagement and Events Division| Economic Strategy Directorate | Scottish Government | [redacted]

From: [redacted]
Sent: 30 September 2022 11:04
To: Cabinet Secretary for Net Zero, Energy and Transport <CabSecNetZET@gov.scot>; [redacted] <[redacted]@gov.scot>
Cc: Deputy First Minister and Cabinet Secretary for Covid Recovery <DFMCSCR@gov.scot>; DG Net Zero <DGNetZero@gov.scot>; Director of Environment & Forestry <director.enfor@gov.scot>; Deputy Director Environmental Quality and Resilience <DDEQR@gov.scot>; [redacted]<[redacted]@gov.scot>; Low R (Ragne) <Ragne.Low@gov.scot>; Communications Net Zero & Rural Affairs <CommunicationsNetZero&RuralAffairs@gov.scot>; McFarlane J (John) (Special Adviser) <John.McFarlane@gov.scot>; Berge K (Kersti) <Kersti.Berge@gov.scot>; [redacted]<[redacted]@gov.scot>
Subject: Update on UKAEA - OffSen
Importance: High

Official Sensitive – do not disclose.

Cab Sec/PO

On a shortened copy list due the sensitivity of the information below.

We have had a call this morning with UK Government officials who have advised us, in confidence, that the results of the UK Atomic Energy Association's STEP competition will be released on Monday.

Ardeer in North Ayrshire, the only Scottish site in the 5 site shortlist, has not been successful in the competition. We do not know which site has been successful. The project team at Ardeer will be made aware by UKAEA this afternoon of the result of their bid. We have not been given specific information on why Ardeer was not successful although understand the decision was taken on which site was most 'technically' suitable.

Although the official announcement is not due to be made until Monday we will work with comms to prepare lines in the event of any media activity this weekend. We will look to clear these past SpAds and Cab Sec today if possible.

We will also ensure lines are part of this coming weeks FMQ briefing and will look to respond to any other communications in the coming weeks in the usual way.

Thanks and happy to discuss

[redacted]
Directorate of Energy and Climate Change | Scottish Government
Victoria Quay, Edinburgh, EH6 6QQ | [redacted]

Dear all,

On behalf of [redacted], thanks for the meeting last Friday. Attached is a factual Q&A about fusion and the STEP programme which I understand you asked for.

[redacted]and I can provide more information later this week regarding the siting process.

Kind regards,
[redacted]

-----Original Appointment-----
From: [redacted]< [redacted]@beis.gov.uk>
Sent: 27 September 2022 17:03
To: [redacted]; [redacted]; [redacted]; [redacted]; [redacted]; [redacted]; [redacted]
Subject: STEP Siting Update
When: 30 September 2022 09:45-10:15 (UTC+00:00) Dublin, Edinburgh, Lisbon, London.
Where: Microsoft Teams Meeting

Dear all,

[redacted]requested that this meeting be moved back slightly due to a clash.

Kind regards,
[redacted]

Dear all,

A short meeting to provide an update on the STEP siting process.

All the best,
[redacted]

STEP Programme and Fusion

Q: What is fusion?

- Fusion is the process that powers the sun and stars.
- Scientists around the world are developing technology to use this process to generate energy on earth.
- Fusion energy would be the ultimate solution in clean power production, delivering low-carbon, secure, inexhaustible baseload energy with no very long-lived radioactive waste on the scale of traditional nuclear.

Q: What is STEP?

- Spherical Tokamak for Energy Production (STEP) is a UK Atomic Energy Authority programme which aims to design, develop and build, by 2040, a prototype fusion power plant capable of delivering energy to the UK grid. This will demonstrate a path to commercial viability of fusion energy. The government has committed £220m towards the first five-year design phase of STEP.
- The 20-year project will create high-skilled jobs throughout its lifetime and has potential to create a brand-new industry located right here in the UK, to export UK fusion technology around the world in subsequent decades

Q: Why are we spending money on STEP when fusion is not yet proven?

- In the last year the UK-based JET facility made a breakthrough. JET set new fusion power records, producing 59 megajoules of energy over five seconds, more than double the previous fusion records achieved in 1997. These results show that sustained fusion power can be achieved.
- In view of the environmental and economic benefits, the Government wants the UK to lead the commercialisation of this transformative low carbon energy technology.

Q: Is fusion safe?

- Yes. The hazards of fusion are lower than with traditional nuclear (fission) power plants – fusion does not produce very long-lived, high-level radioactive waste and there is no risk of a runaway chain reaction. The product of the fusion process is helium, an inert gas. Fusion does not involve burning fossil fuels, so does not contribute to climate change by emitting carbon dioxide.
- The UK government's proposed regulatory framework for fusion has safety at its core and is based on a proportionate and evidence-driven approach founded on extensive work with technical safety experts.

Q: Will fusion help to meet Net Zero by 2050 and support energy security?

- Fusion is expected to play an important role in longer term decarbonisation of global energy production beyond 2040 and will enable UK industry to secure the economic benefits of the future low carbon industry
- Fusion could be the ultimate clean power solution, representing a low carbon, secure, continuous and sustainable source of energy. However, the timescales involved in realising large scale fusion energy mean that fusion is not currently expected to play a major role in delivering the UK's Net Zero by 2050 target.

Q: How will STEP/ fusion be regulated?

- Fusion energy facilities will continue to be regulated under the legal framework already in place for fusion research.
- Based on a public consultation carried out in 2021, the Government confirmed proposals to build a proportionate regulatory environment that encourages innovation and maintains human and environmental protections.

Q: Who is paying for STEP? How much will it cost?

- The STEP programme is designed to be a growing collaboration between Government and industry. The Government has already committed £222m for the early stages of the programme, which will cost £bns across its lifetime. As the programme progresses, the Government will focus increasingly on encouraging industrial collaboration and investment.