

Written Evidence Submitted by Tokamak Energy Ltd (FUS001)

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Tokamak Energy, founded in 2009 and based near Oxford, employs nearly 200 people in pursuit of commercial fusion energy and has raised over £120m of private investment. Earlier this year we were able to achieve 100 million degrees, the temperature threshold necessary for commercial fusion energy, in our prototype ST40 spherical tokamak. This was a world first achievement for both a spherical tokamak and a privately funded one. The ST40 is 30 times smaller than other devices which have reached this temperature and it paves the way for rapid development and deployment of commercial fusion energy.

We welcome the timely interest of the Science and Technology Committee in Fusion Energy. The debate at your oral evidence session on 25 May centred around the issue of whether fusion could contribute to 2050 carbon targets. It seems that private companies such as Tokamak Energy, Commonwealth Fusion Systems, Helion, TAE Technologies, General Fusion and First Light Fusion think it can, while publicly funded projects such as UKAEA/STEP and ITER suggest a more relaxed timescale.

Last week I participated in a US Dept of Energy Workshop on Fusion Energy Development via Public-Private Partnerships, in Washington, DC. This workshop represents the first major step from US DOE following the White House Summit (March 17, 2022) on Developing a Bold Decadal Vision for Commercial Fusion Energy. We are aware that the US usually leads the way in commercialisation of bold new technologies with world-changing potential and we want to learn from the approach they are taking. Ideally, we will develop strong partnership with US organisations and attract more US investment, while keeping the majority of our rapidly growing workforce in the UK.

We think that the Science and Technology Committee should investigate the opportunity to accelerate development of fusion energy in the UK in greater detail with the aim of:

- securing the UK as *the* world leader in the commercial fusion energy sector;
- creating permanent and abundant UK based employment opportunities, both within the sector, but also across a world class supply chain;
- ensuring the sector is structured in an optimal way to underpin an efficient allocation of both public and private capital, minimising the potential “crowding out” of private investment; and,
- encouraging international equity investors to invest in the UK private fusion sector as it strives towards commercial success with fusion as source of safe and sustainable clean energy for the long term.

BEIS and UKAEA have worked hard to achieve a world-leading position in fusion energy science for the UK – the challenge now is to turn that scientific progress into commercial, industrial and economic success for the UK.

Clarification of the STEP project

We support the Government’s desire to encourage significant collaboration between private and public ventures whilst ensuring that taxpayer funds are spent as efficiently as possible. However, we

believe the Government should require more rigour in the clarification of the objectives, timeline and associated funding earmarked for the STEP programme. At present, ambiguity regarding the STEP program contributes to private investor confusion and consequently, an adverse impact on investor perception of the wider UK fusion sector

The present governance, commercial, legal and contractual basis for STEP is not necessarily sustainable and does not follow any well-established model of government funding of civil R&D. To ensure the UK is able to take advantage of its current world-leading position, the Government needs to assess if the current structure is the best route forward to further incentivise private fusion ventures, and to succeed in its own ambitions.

Some examples where we would welcome greater collaboration and clarification are:

Applied Research & Supporting Technologies: It should be possible for Tokamak Energy to attract more private investment to support the aims of STEP and to develop superconducting magnet technology suitable for STEP, but this is not the case at the moment. We would welcome the opportunity to jointly explore solutions to ensure that private investment can be attracted and that the work we want to undertake can support the STEP project.

Contractual: The current procurement process does not allow for active dialogue with the private sector on scope or approach. In addition, the intellectual property clauses in the STEP procurement contracts prove challenging for a private fusion developer such as Tokamak Energy, which has significant IP assets, and this creates some barriers to participation.

Commercial: There are many examples where greater public/private collaboration could succeed for mutual benefit. We are currently looking at site options for our next device, the ST-HTS, which will be the world's first spherical tokamak to demonstrate the full potential of high temperature superconducting magnets and is due to be commissioned in the mid-2020s. This device will demonstrate multiple advanced technologies required for fusion energy and inform the design of our fusion pilot plant, to be commissioned in the early 2030s. Our preferred site would be on space available at Culham which would also enable a stronger partnership with the UKAEA in terms of site facilities, expert talent and knowledge.

Learning lessons from US policy

As noted above, the US has set out a Bold Decadal Vision for development of fusion energy and expects development of a Fusion Pilot Plant to be led by the private sector. We note the following US initiatives which all help to accelerate development of commercial fusion energy.

1. Tokamak Energy has participated in a series of ARPA-E workshops on fusion energy since 2017 at the invitation of the US Department of Energy. These workshops are valuable because they bring together innovators, entrepreneurs and investors interested in tackling the same challenge in different ways. ARPA-E has several programs that can support fusion energy development with a total budget of some \$110m so far, just for commercially viable fusion energy.
2. The UK can learn from other examples of programmes that work well in the US. For example, the US Department of Energy has a program known as [the Innovation Network for Fusion Energy, or INFUSE](#), to encourage private-public research partnerships to tackle challenges in fusion energy development. Tokamak Energy Inc, a wholly owned subsidiary for Tokamak Energy Ltd, has won 5 grants under the INFUSE program. They are valuable because they give access to unique knowledge and technology. The UK Government could use a programme like INFUSE to

allow UK companies better access to Government Laboratories in fusion and related areas needing radical technology development. The programme could be extended to University-business collaboration.

3. The US DOE has also held a formal consultation on a [“cost share” program for fusion power prototype devices](#). Funding for the start of this program has very recently been approved by Congress. This is particularly timely as it resembles the NASA COTS program that helped finance the early years of Space-X and resulted in major US successes with commercial space launchers.
4. US Government Agencies recently held a fusion summit at the White House to announce a [“bold decadal vision for delivery of commercial fusion energy”](#). The summit heralded a major change of approach by the US Dept of Energy, to adopt a much more active role in supporting private fusion ventures. It was followed last week by a US Dept of Energy Workshop on Fusion Energy Development via Public-Private Partnerships, in Washington, DC. International collaboration was discussed at this Workshop and is an attractive option to help accelerate development of fusion energy.

We would appreciate the opportunity to meet with you, or to provide more evidence to the Science and Technology Committee at a later date to outline what more we think the Government could do to help support the private fusion industry in the UK as it continues its progress.

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