

Commissioning Letter

LONDON ECONOMICS LIMITED  
Somerset House,  
New Wing,  
Strand,  
London,  
WC2R 1LA

Tuesday, 02 April 2019

Dear [REDACTED]

**BEIS Research and Evaluation Framework Agreement – Lot 3  
An independent impact evaluation of nuclear fusion research  
at the Culham Centre for Fusion Energy  
CR19025**

Thank you for your response to the Specification for the above commission by the Department for Business, Energy and Industrial Strategy (BEIS) (the Customer) through the BIS Research and Evaluation Framework dated 2 January 2016 between (1) Secretary of State for Business, Innovation and Skills; and (2) London Economics Limited (the Framework Agreement).

Annexes:     A.     Tender dated 15<sup>th</sup> March 2019  
              B.     Specification for An independent impact evaluation of nuclear fusion research at the Culham Centre for Fusion Energy

The Department for Business, Energy and Industrial Strategy (BEIS) accepts your Tender (Annex A), submitted in response to our Specification (Annex B).

The Call-Off Terms and Conditions for this Contract are those set out in Schedule 5 to the Framework.

The agreed total charges for this assignment are **£ 49,137.50** exclusive of VAT which should be added at the prevailing rate, as detailed below;



OFFICIAL-SENSITIVE (COMMERCIAL)

The agreed invoice schedule is as follows:

- 30% on delivery of the interim report June 2019
- 30% on delivery of draft report Aug 2019
- 40% once the final report is completed Sept 2019



All invoices should be sent to should be sent to [finance@services.uksbs.co.uk](mailto:finance@services.uksbs.co.uk) or Billingham (UKSBS, Queensway House, West Precinct, Billingham, TS23 2NF) A copy of the invoice should be sent to [REDACTED]

You are reminded that any Customer Intellectual Property Rights provided in order to perform the Services will remain the property of the Customer. The following deliverables have been agreed:

**The Services Commencement Date is Wednesday, 3<sup>rd</sup> April 2019**

**The Completion date is Monday, 16<sup>th</sup> September 2019**

The Contract may be terminated for convenience by giving 30 days' notice in accordance with clause 38 of the Call-off Terms and Conditions.

Your invoice(s) for this work must include the following information:  
Commission number: CR19025

The Authorised Representative for this Commission will be [REDACTED] who can be contacted at [REDACTED]

Until the date of publication, findings from all Project outputs shall be treated as confidential. Findings shall not be released to the press or disseminated in any way or at any time prior to publication without approval of the Department.

This clause applies at all times prior to publication of the final report. Where the Contractor wishes to issue a Press Notice or other publicity material containing findings from the Project, notification of plans, including timing and drafts of planned releases shall be submitted by the Contractor to the Project Manager at least one week before the intended date of release and before any agreement is made with press or other external audiences, to allow the Department time to comment on factual accuracy. All Press Notices released by the Department or the Contractor shall state the full title of the research report, and include a hyperlink to the Department's research web pages, and any other web pages as relevant, to access the publication/s.

This clause applies at all times prior to publication of the final report and within one month from the date of publication. Where the Contractor wishes to present findings from the Project in the public domain, for example at conferences, seminars, or in journal articles, the Contractor shall notify the Project Manager before any agreement is made with external audiences, to allow the Department time to consider the request. The Contractor shall only present findings that will already be in the public domain at the time of presentation, unless otherwise agreed with the Department.

Congratulations on your success in being selected to undertake this Commission.

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Yours sincerely

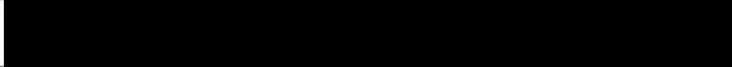
  
UK Shared Business Services Ltd

BY SIGNING AND RETURNING THIS COMMISSIONING LETTER THE SERVICE PROVIDER AGREES to enter a legally binding contract with the Customer to provide to the Customer the Services specified in this Commissioning Letter and Annexes incorporating the rights and obligations in the Call-off Terms and Conditions set out in the Framework Agreement.

Department for Business, Energy and Industrial Strategy (BEIS)

Name and Title	
Signature	
Date	04/04/2019

Signed on behalf of LONDON ECONOMICS LIMITED

Name and Title	
Signature	
Date	2nd April 2019

Annex B- specification

1. Background

**Background on nuclear fusion energy research in the UK**

Nuclear fusion is a high potential future energy source that aims to replicate the nuclear reaction that takes place in the Sun. Fusion could play an important role in the future energy landscape as a sustainable energy source, since it does not produce greenhouse gases and the fuel used is widely available, crucial to one of Grand Challenges underpinning the Industrial Strategy – Clean Growth.

The UK has been a key player in establishing the foundations to fusion energy since 1950s. The Culham Centre for Fusion Energy (CCFE) is the central site for fusion research and development in the UK.

UK Atomic Energy Agency (UKAEA) officially opened CCFE in 1965, having moved its fusion research operations from the nearby Harwell research site, which is now being decommissioned. Culham also amalgamated fusion activities that were previously undertaken at Aldermaston and other UK locations to form a national centre for fusion research.

In 1977, following protracted negotiations, Culham was chosen as the site for the Joint European Torus (JET) tokamak. Construction began in 1978 and was completed on time and on budget, with first plasma in June 1983. Since then the machine has gone on to set a series of fusion milestones, including the first demonstration of controlled deuterium-tritium fusion power (1991) and the record fusion power output of 16 megawatts (1997). JET is the world's largest and most powerful tokamak and crucial to development of the International Thermonuclear Experimental Reactor (ITER), the focal point of the European fusion research programme, currently under construction in the South of France.

In the 1980s, Culham Laboratory was instrumental in the development of the spherical tokamak concept – a more compact version of the tokamak. This is thought to offer potential advantages by enabling smaller, more efficient fusion devices. The START (Small Tight Aspect Ratio Tokamak) experiment at Culham (1991-1998) was the first full-sized spherical tokamak. Its excellent performance led to the construction of a larger device, MAST (Mega Amp Spherical Tokamak), which operated between 2000 and 2013. MAST has recently been subject to an upgrade (in practice a complete rebuild) to extend its capabilities and is currently being commissioned. The upgraded machine, MAST-U, is a UK facility but it will be also used by teams of scientists from the EU and there is also a strong collaboration with the USA.

In the 1980s, the UK's involvement in the technology development activities needed for a fusion reactor were ramped down as a result of funding cuts. Consequently, until recently the technology activities have been restricted to those needed for the JET and the MAST programmes. This narrowed the scope and restricted the scale of CCFE technology activities. More recently the EUROfusion programme has significantly increased the scale of technology R&D activities and the UK has seized this opportunity to rapidly expand its technology activities. This UK is already a major player in some aspects of the European fusion technology activities. In other areas CCFE is still at relatively early stages of rebuilding its capabilities but is making rapid progress following significant recent UK investment. Given this context there are not many examples of spin-offs in the UK and so a wider European perspective may be necessary to help to form a representative picture of the economic benefits of the fusion programme.

The Centre's current activities encompass tokamak plasma physics, technology developments for the DEMO prototype fusion power plant, the development of materials suitable for a fusion environment, engineering activities, the training of students, graduates and apprentices, and public and industry outreach activities.

This project aims to gather evidence to evaluate the impacts, i.e. costs and benefits, of

nuclear fusion research in the UK to date, this evaluation will also consider the counterfactuals and the subsequent impact on the UK to date. Possible counterfactuals will include scenarios where the Government would directly invest in technologies such as Robotics, which often benefit from Fusion spin-off research.

The UK has been leading on fusion research over several decades; a significant amount of money has been spent by the UK government and other organisations, and it is important to understand the costs and benefits that funding has had, including unintended costs and benefits such as spin-off research, to inform further fusion research spending decisions.

#### Related reviews and sources

Current published reviews on nuclear fusion research in the UK provided a body of positive evidence for the UK's leading expertise in this field with a focus on scientific impacts. However, there is limited evidence on the economic impacts of fusion research on the UK with a lack of quantitative assessments.

- EPSRC Independent Review of Fission and Fusion Research, March 2016

This review concluded that the UK's fusion research programmes are of world-class quality, in facilities, people and research impact. For example, Fusion research at CCFE helped the UK industry to win £100m EU fusion research contracts (up to 2015). These programmes were found to be world-leading and cost-effective, while being intimately woven into the international effort.

- Government Office for Science Reports: Nuclear Technologies Trajectory Review (2016)

This Review provides an independent assessment of the UK's priorities, and potential for international collaboration, in the development and demonstration of nuclear energy technologies, including both fission and fusion technologies. On fusion, the Review commends the moves in recent years to start Culham on a journey from being a fusion laboratory to being a civil nuclear laboratory.

- 2015 Triennial Review of UKAEA

In 2015, the then Department for Business, Innovation and Skills conducted a Triennial Review of the UK Atomic Energy Authority (UKAEA), which is responsible for UK and European fusion power research programs at Culham and Harwell. Apart from reviewing the budget, structure and governance of the Authority, this report also commented that CCFE's commitment to training and developing young scientists and engineers, and its contribution to the Culham/Oxford/Harwell triangle for innovation, are key to ensuring that the UK benefits from its investment in fusion technology.

In addition to the above reviews, the EU Commission published several documents related to fusion research, providing background information for fusion research in the EU and in the world:

- European Research Roadmap to the Realisation IN BRIEF of Fusion Energy

The European Fusion Roadmap outlines the research and development required to provide the basis for an electricity-generating fusion power plant in the next 50 years, but with no specific timetable outlined. In the short to medium term, the key research infrastructure is the ITER project - a worldwide endeavour for constructing a magnetic fusion device that has been designed to prove the feasibility of fusion as a large-scale and carbon-free source of energy. This is planned to lead to DEMO - nuclear fusion power station that

demonstrates first electricity production grid to the grid by fusion.

- The interim evaluation of the 2014-2018 Euratom programme

This European Commission's evaluation concluded that Europe currently has a leadership position in fusion research and this has been achieved through the Euratom programmes that have led to a coherent approach in the Member States. The fusion part of the Euratom Programme is clearly relevant as it enables Europe to address the challenge of ensuring an energy production that simultaneously meets the goal of long term sustainability, security of supply and support to the development of the economy. The evaluation recommended the JET experimental research should be extended up to 2024, and highlighted JET is a unique European fusion asset and it is a fundamental part of the ITER project. JET was found to be a clear example of European Added Value.

- [Spin-offs from fusion research](#)

This EUROfusion website describes how, while the fusion community continues its quest to harness fusion for energy needs, the research has borne some short-term benefits. Fusion research with its complex, multidisciplinary nature has pushed advances in disciplines ranging from medical technology and environment, to astrophysics and material sciences. But there are no quantitative data on numbers and value of spin-off companies and their associated impacts.

## 2. Aims and Objectives of the Project

### Project aims and objectives:

- to generate evidence to inform future UK government policy relating to nuclear fusion research;
- to assess how fusion research and its associated infrastructure has affected the UK with a focus on scientific progress, scientific impact, industry links, environmental impact and economic impact;
- to provide a suite of case studies that include both direct impacts from UK fusion research and indirect/spill-over impacts (in plain language); and
- to identify the financial costs of the UK nuclear fusion research and associated infrastructure.

This project aims to provide an independent impact evaluation of the nuclear fusion research programme to build a solid evidence base for long-term future strategic and investment decisions in wide-ranging policy contexts including spending reviews and EU-exit.

### Overarching research questions to be answered:

- What have been the public and private financial costs of the UK's nuclear fusion research?
- What impacts has UK nuclear fusion research had on the UK?
  - Scientific impact and progress
  - Environmental impact
  - Economic impact

## 1. Suggested Methodology

We would welcome bidders' alternative and innovative suggestions for methodology providing that they also meet the project aims and objectives. Below we set out in some further detail important aspects of the key research questions in terms of where we are seeking evidence and possible metrics.

- What have been the public and private financial costs of the UK's nuclear fusion research?
  - Investments in facilities and equipment
  - Administration costs
  - Skills and talent investment
  - Research programme experimental costs
  - Collaborations including business support
  - Staff costs
  
- What impacts has UK nuclear fusion research had on the UK?
  - Scientific impact and progress
    - Publications, citations & impacts
    - Major scientific/technological progress and outcomes
    - Any increased and accelerated translation of research into innovation/commercialisation of technology in the fusion industry or any other field
  - Environmental impact
    - Land use change
    - Positive or negative impacts on emissions
    - Waste issues
  - Economic impact
    - Leveraged overseas and business investments
    - Industry links and business benefits including:
      - Number of spin-offs, new firms and supply chain firms supported
      - Direct and indirect business growth such as increased profits, employment and sales or value added
      - Value of IP income or from licenses
      - General capabilities and wider benefits arising from fusion research and related quality assurance technologies
    - Value of commercial contracts won to date and potential future wins and the number of high skilled jobs created/safeguarded
      - Occupation (SOC) and wage levels of those jobs
      - Industry (SIC) of those jobs
    - Apprenticeships and training programmes
      - How these programmes contribute to future capability needs in the sector

Based on our experience, we recommend the project use Contribution Analysis, based on a mixed methods approach, to determine the contribution of nuclear fusion research in the UK to the observed effects and a causal link between the activities and the effects.

It will be necessary to describe an appropriate counterfactual in detail, consisting of what would have happened in the absence of nuclear fusion research. This will need to

consider what the research money might have instead been spent on; how the land for the Culham and Harwell centres might otherwise have been used; and what the fusion industry in the UK might have been like in the absence of UK Government funding.

We recommend the project will include the following elements:

1. **Around 5 in-depth interviews** with key staff from the Culham and Harwell centres to acquire key data on spend, scientific impacts and leveraged investment and to identify key stakeholders and beneficiaries. Prior to these interviews, the centres will be provided with a list of requested information in order for them to prepare data. Where appropriate, the answers should be accompanied by relevant documents. These interviews will be used to clarify information and acquire further data if needed.

Key research questions at this stage could include:

- What has been spent from public, private and overseas sources to date on nuclear fusion research and development in the UK?
  - What has nuclear fusion research contributed to the UK Nuclear fusion research? (e.g. in terms of publications, numbers of PhDs/apprentices trained, and major scientific progress made)
  - What evidence do you hold in relation to the scientific impact of nuclear fusion research in the UK, in terms of both progression towards the eventual commercialisation of nuclear fusion as an energy source, and the use of technologies, developed through the research, in other fields?
  - What economic impact have the CCFE and Harwell centres made on the UK? (e.g. in terms of value of commercial contracts won to date and potential future wins and leveraged overseas and business investments)
  - What environmental impacts has the nuclear fusion research to date had, in terms of emissions, waste and land use?
2. **A web-based survey** to invite submissions of evidence and findings from this survey will inform discussions in meetings with key stakeholders and case studies. A previous similar EPSRC survey (2016) received 41 responses.

Research questions may include:

- In which role did you encounter the CCFE (or other UK fusion centre)? (multiple options)
- How would you rate the UK's standing in fusion research? (multiple options)
- What is your view on CCFE's training programmes' contribution to future capability needs in the fusion sector? (multiple options and comments box)
- If your organisation has been supported by the CCFE for winning contracts from any international projects, how would you rate the support your organisation has received? (multiple choices)
- What impacts has your work with the CCFE (or other fusion centre) – in terms of investment costs, sales, additional jobs created in your organisation or its suppliers, additional profits or scientific progress?
- What synergies do you see between the Culham' activities and those of your organisation?
  - How can joint working in these areas be enhanced?

As this is a commissioned evaluation in a specialised area, there is no publicly available sampling frame/business registers for the survey and focus groups.

We expect contractors to compile a sampling frame of key stakeholders including industrial specialists, leading academics in fusion research and businesses supported by CCFE based on previous similar reviews and mainly from information provided by the CCFE. Further, the contractors could do analysis of Gateway to Research to identify projects which mention Culham or Fusion. This could give them a sample frame for academics involved in the field and some information on outcomes (if not impacts).

- 3. Around three focus groups** with representatives of key stakeholders from the industry, academia and advisory groups to unpick additionality and spill over effects of the programme. This may be complemented by around 10 in-depth telephone interviews for those who are not able to attend these group meetings. These methods will be used to refine online questions to be more in-depth and enrich the survey data.

Questions to be asked in these groups will vary by type of attendee organisations. For the industry focus group, we'll identify additional value the CCFE has added in supporting these firms to win contracts and to accelerate commercialisations. The academic and advisory groups' questions will probe attendees' views on the scientific progress of CCFE fusion technologies and its contribution to research excellence and meeting the needs of future skills in this area.

- 4. Around three case studies** can be conducted through semi-structured interviews with spin-offs and firms supported by CCFE:
  - o to assess direct and wider effects of Culham nuclear fusion research on these organisations
  - o to understand mechanisms that drive impacts.

These case studies will identify more details of spin-offs and CCFE's role in developing these technologies and supporting these firms and their suppliers. Research questions will focus on CCFE's direct/indirect effects on business growth in terms of the value of investment costs, contracts won so far, employment/sales growth, profits, and scientific progress perhaps measured partly through intellectual property generated.

- 5. Desk research and review of data** on funding, background papers and reports

The analysis should feed into an overall impact assessment carried out using HM Treasury Green Book techniques. This assessment will be quantitative, taking into account displacement and crowding out, unless there is insufficient data to monetise the benefits, in which case it will be qualitative.

## 2. Deliverables

**Project inception meeting:** contractors and BEIS steering group will meet to discuss how the project will proceed.

**Online survey and Questionnaire:** a questionnaire designed for an on-line survey on an appropriate platform (such as Citizen space). Appropriate measures (such as sending reminders) will be taken to achieve a good response rate.

**Information required for the BEIS survey control for estimating online survey respondents burden:** Occupation/profession of each respondent and length of time used to complete the survey. These can be incorporated into the questionnaire.

**Dataset of survey results:** key findings and processed/raw survey data

**Regular updates on emerging findings and project progress:** weekly catch-up with the project manager/steering group to track progress and address any issues that may arise, and priorities work as advised by the steering group.

**Undertaking research and analysis with presentations:** the contractors will implement the agreed analytical/research approaches including focus groups/telephone interviews/case studies, where needed, to respond to each research question. The contractors are also expected to present their work to the steering group to manage expectations and emerging issues.

**Interim report of findings:** the contractor will produce a draft report at the end of analysis stage. The contractor will agree the report structure with the project manager, but overall, the report should include an executive summary, context to the work, methodology, data, results, and conclusions. The report will follow the gov.uk guidelines on style, accessibility and should meet plain English requirements. With the draft report the contractors should also provide:

- fully documented software code, used for analysis, and all underlying data (with complete reference) and datasets underpinning the analysis (where the data is not publicly available, we expect contractors to organise access to the project folder in secure data service (SDS);
- all tables and figures in the report need to be in an excel spreadsheet with data included; and
- all models will be compliant with BEIS QA practice. Further information on BEIS QA practice can be found here: <https://www.gov.uk/government/collections/quality-assurance-tools-and-guidance-in-decc>.

#### **Quality assured final report for publication**

The final report for this research project must be formatted according to BEIS publication guidelines, template and adhering to BEIS accessibility requirements on gov.uk. The BEIS project manager will provide the template. The contractor needs to ensure the drafts are free from typos, grammatical or syntax errors and are accessible to technical and non-technical audience.

Please ensure you note the following in terms of accessibility:

#### Checklist for Word accessibility

Word documents supplied to BEIS will be assessed for accessibility upon receipt. Documents which do not meet one or more of the following checkpoints will be returned to you for re-working at your own cost.

- language is set to English (in File > Properties > Advanced)
- document reads logically when reflowed or rendered by text-to-speech software
- structural elements of document are properly tagged (headings, titles, lists etc)

- all images/figures have either alternative text or an appropriate caption
- tables are correctly tagged to represent the table structure
- text is left aligned, not justified
- document avoids excessive use of capitalised, underlined or italicised text
- hyperlinks are spelt out (e.g. in a footnote or endnote)

Datasets to support those to be published in the final report must be provided in an accessible format (CVS, Excel) on submission of the report.

**Project Cost Guidelines**

Where feasible, itemise the cost for each of the deliverables/methodologies in the bid.

**Staff to Deliver Guidelines**

Bidders should provide details of expertise relevant to this project for each member of the project team. The bids should also outline which team member will lead on which deliverable and how much time each member will contribute to the project.

**Project Plan and Timescale Guidelines**

The proposed high-level time table is below. Bidders should propose the overall project timeline and important milestones. In addition, they should outline how they will manage project delivery risks and ensure outputs will be delivered on time. If appropriate, add a short table with main delivery risk, potential risk owners and mitigation steps.

Project Start: March/April 2019

Interim Report: June 2019

Final report: September 2019

