Delta-ee proposal for DECC's ITT for Thermal Energy Storage Evidence Gathering

Redacted version

23 October 2015

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Section 1: Technical Approach

1.1 Key methodology proposed

There are six key elements to our methodology. This is made up as follows:

1. Utilise extensive existing expertise from within the team of Delta-ee and Santokh Gataora.
2. Interviews with stakeholders. This primary research will consist of detailed telephone conversations with thermal energy storage manufacturers, technology developers, technology installers, relevant industry associations, key industry individuals, research institutions etc. These interviews will be used to gather evidence.
3. Literature review. This secondary research will consist of a full analysis of any existing heat storage technologies, and other relevant literature, including academic and lab-based research that is publically available.
4. Internal analysis of evidence and interview results. This will include critiquing the evidence and results; ensuring quality control and internal consistency; and the development of the gap analysis.
5. A second round of interviews to test, explore and challenge evidence gathered & our hypotheses. Our aim will be to really challenge and test the data gathered and the analysis we have developed.
6. Synthesis of research and development of the draft final report.

1.2 Regular liaison and interaction with DECC

We propose liaising closely with DECC to ensure that, as the collection of evidence, analysis and hypotheses develops, DECC has the opportunity to feed in questions and comments during the report (rather than only at the draft report stage). We also propose agreeing the structure of the draft final report with DECC ahead of its compilation.

In addition to the regular contact, we have budgeted for two meetings with DECC during the course of the project: a kick off meeting, together with a presentation of the final report.

1.3 Detailed approach

Below, we present a more detailed approach for how we can meet the requirements of the tender. This approach fully addresses all the detailed scope in the ITT.

<u>Full status review of thermal energy storage technologies and the market</u>

The three storage technologies included within the scope will be:

- Sensible heat storage
  - Tank Thermal Energy Stores (TTES)
  - Pit Thermal Energy Stores (PTES)
  - Borehole Thermal Energy Stores (BTES)
  - Aquifer Thermal Energy Stores (ATES)
  - Thermal Mass of Buildings (TMB)
- Latent Heat Storage
  - Phase change materials
- Thermochemical Heat Storage
  - Reversible chemical reactions

In addition to the three basic technologies, we propose considering a **fourth type** of heat storage technology for analysis – this is the development of 'hybrid' heat stores, particularly for domestic applications e.g. the combination of sensible heat storage with phase change materials. We believe hybrids have interesting potential and should be explored, and we therefore propose to include them within our study scope.

The scope implies six main types of application as defined by the capacity and duration of thermal storage required. However, we believe inter-seasonal storage is only relevant at large scale in district heating applications. We therefore propose our study scope to focus on the four key applications as illustrated below:

	Intraday storage	Inter-seasonal storage
District heating	1	2
Non-domestic	3	(not applicable)
Domestic	4	(not applicable)

We have good relationships and contacts with many of the leading companies active across the main applications. These include: Danfoss, Arup Group & the UK District Energy Association (district heating); Smith Group, British Gas, N G Bailey & Gledhill Ltd (non-domestic); and Kingspan, BDR Thermea & Gledhill Ltd (domestic). These stakeholders will be important to engage with during our primary research and validation interviews. Given our study team's reputation and relationships, we will be able to engage with these companies efficiently, and have a high quality of discussion with them.

The project team has over 25 years of experience working with British Gas, Global Gas and Gledhill Ltd in the research, design and integration of sensible heat (water) stores in several applications. Much of this work focused on improving the system efficiency of heat stores, using heat stores for load shifting and on reducing running costs. This gives the team a deep understanding of the performance, operation and running costs of heat stores, as well as strong connections with industry, including many organisations that it will be important to engage with during the course of this evidence gathering study. For example, our links with companies who are leaders in thermal storage include Gledhill Ltd, Sunamp, PCM Energy (India) and Kingspan.

Our team's experience has been focused on:

- Heat pump, MCHP and gas boiler based heating systems in domestic and commercial buildings (UK and Europe)
- Distributed heat storage based heating systems in apartment blocks in UK and Europe.
- Running comparative field trials and transfer of technologies from laboratory to manufacturing.

The team also have over 10 years of experience in the study of phase change material (PCM) heat stores with Gledhill Ltd, British Gas and Sunamp.

For each of the technologies, and focusing on the four main application types identified above, we will address the ITT scope requirements as follows.

1. Current Technical Potential

Key questions to be addressed include:

- Descriptions of the current systems available, including details on key materials, key components and scalability.
- Details of how the systems vary and what are the advantages/disadvantages?
- Storage and charge and discharge capacities of systems
- Lifetime of systems
- Round trip-efficiencies of systems
- Installation barriers e.g. size, weight
- The TRL's of the main products that cover the four types of storage highlighted above.

Using existing in-house knowledge, desk-based research and interviews with industry and research contacts, we will build a detailed understanding of the technologies that are commercialised or are close to commercialisation. A member of our team has supported the development of thermal storage products so we have direct experience of evaluating system performance.

The outputs of this research will include:

a) A brief history and timeline of the development of thermal storage technologies, including TRLs for the main technologies
b) System details (typical specifications, materials, costs, applications, capacity, lifetimes, efficiencies)
c) Selected case study examples from across Europe
d) Compare/contrast of the systems to highlight advantages and disadvantages and relevance for different applications

2. Market and product review

To review the current and potential market in the UK we will:

a) Identify and gather information on existing products from manufacturers and developers in the UK and Europe
b) Summarise the technical information for each product (including costs and relevant technical parameters)
c) Assess current sales of these products in the UK and Europe
d) Evaluate the future potential market size in the UK to 2030 and 2050
e) Understand the competitive dynamics of the products on / coming to market and how this may be impacted by the small number of players

We are in a strong position to gather this data, information and analysis due to:

- Our links with companies such as Gledhill Ltd, Sunamp, PCM Energy (India) and Kingspan which are leaders in thermal storage. Santokh has gained insight from trials of sensible and latent heat stores with heat pumps, mCHP and conventional boilers in UK and Europe.
- Our excellent links with key manufacturers and key individuals in the energy and heating industries, both in the UK and Europe (as well as Japan).
- Note – on occasion it may be necessary to anonymise data in order to protect manufacturer confidentiality.
- We will carry out an internal team workshop to synthesise all the evidence and develop a hypothesis on future market size.

- Delta-ee brings excellent insight into other European heating markets; relationships with European-based manufacturers; and with the European Heating Industry trade body.

3. Costs and cost trajectories

We will use our in house and project team expertise, along with inputs from our primary research, to analyse current and future costs. We believe there is the potential for meaningful future cost reductions as current volumes are very low.

Current costs will be identified during the research in sections 1 & 2 of the methodology above.

Note: We expect to encounter some sensitivities on costs. For example, market prices for current products may not always be readily available on a basis that makes it easy to compare or analyse individual components. We will be very dependent on the openness of different manufacturers / developers. We will treat individual manufacturer insight confidentially.

Market development and increased sales volumes will impact upon future costs in a number of ways:

a) a lower cost of materials and components for thermal storage systems
b) a reduction of overhead costs as the number of customers increases and systems become more scalable
c) the impact of learning rates on cost reduction for thermal storage technologies

Therefore two scenarios will be developed for future deployment costs: a 'Hi' scenario reflecting high sales and a 'Lo' scenario reflecting low sales. The rationale and justification for each scenario will be provided to DECC. To limit the number of projections that must be developed, the cost analysis for each technology type will be based on a single application, representative of its most likely role in the market. We will discuss and agree these representative applications in advance with DECC.

We will take into account our knowledge and experience of historic cost reduction curves in other distributed energy technologies or markets when developing our forward views on deployment costs.

The storage capacity, the power input and power output are the main factors that determine the cost of heat stores. For sensible heat stores, the power rating has a small effect on costs and therefore we will present storage costs on the basis of £/MWh. For latent heat stores, both power rating and storage capacity influence the costs. Therefore for these stores, the storage costs will be analysed on £/MWh for a specified kW rating.

Key outputs of this analysis are illustrated in the following table:

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4. Future Technological Potential

Following the primary and secondary research, and drawing upon Delta-ee's extensive knowledge of other distributed energy technologies including heat pumps, solar thermal, biomass and controls (HEMS and BEMS), we will draw together our views and conclusions on how heat storage technologies would:

- Complement existing renewable heating technologies
- Enable more renewable energy to come into the energy system
- Enable renewable technologies to be integrated into existing heating systems in buildings

This analysis will be a qualitative assessment to identify the primary value drivers that thermal energy storage could unlock, and their likely relative scale for the different distributed energy technologies within the UK market context – not a quantitative modelling exercise.

5. Barriers to deployment

We will use our in house expertise, together with our discussions with manufacturers, developers, researchers, installers, industry associations etc., as necessary, to identify the key barriers to deployment.

We will group the barriers as follows:

a) Technical
b) Installation – including skills /training /weight and size
c) Market – including commercial

Within each group we will identify the key issues and provide a rating (using a scale) for each issue as follows:

- The importance of the barrier (in terms of preventing deployment)
- Likelihood of the barrier being solved (by 2030)

Having developed our evaluation of sections 3, 4 and 5 above, we will then conduct a second round of in-depth interviews with key industry stakeholders to test, explore and challenge our hypotheses. Our aim will be to really challenge and test the data we have gathered and the analysis we have developed.

6. Gap analysis

Finally, we will complete a gap analysis to conclude the research. The gap analysis and conclusions will focus on:

a) Technology costs, including the level of certainty about future cost reductions and gaps in available evidence.
b) System performance and potential improvements, including the level of certainty and gaps in available evidence.
c) Key barriers which require new innovation
d) The addressable UK market and overall carbon savings enabled through thermal storage as part of the wider energy package by 2050, including the level of certainty, gaps in available evidence and recommendations for further work.

Outputs

The main deliverables from the project will consist of:

- A desk study of findings (in PowerPoint report format)
- An excel spreadsheet of findings arranged as per specified in the ITT (pages 11-12)

1.4 Quality Assurance

We will utilise the ten-point quality assurance approach detailed in our proposal for the overall Lot 18 Framework Contract. This approach places considerable emphasis on:

- Ensuring research is perfectly aligned with project objectives
- Internal review and challenge of all research and findings
- Upfront identification of risks and critical paths, and strategies to mitigate these risks and to manage the critical paths.

This project brings some specific challenges:

- Thermal energy storage technologies are immature so data may be limited. This is likely to be particularly the case with thermochemical heat storage technologies, which remain pre-commercial. Even for sensible storage technologies, volumes deployed in the field are relatively low.
- Beyond a small number of publically funded pilot projects and trials, we do not expect to find independently validated in-use data for thermal energy storage products.
- Most insight and any in-use data will be from manufacturers and developers who have a vested interest in promoting their own products.
- There are likely to be some diverse views within the industry on the opportunity and benefits of the different thermal storage technologies.

We will address these specifically through:

- Challenging any in-use data that is available to us to ensure that we fully understand possible biases – for example in the type of houses / systems the products were tested in, how the data was gathered, what the system boundaries were etc. We will be aware of these 'influencing factors' and will assess these factors for each data-set we gather.
- Developing hypotheses that support and challenge the manufacturers and other key stakeholders we consult during this evidence gathering project.
- Use our team's extensive industry contacts to ensure we leave no stone unturned in gathering evidence from the right stakeholders and individuals.
- Use our team's expertise in thermal storage to independently evaluate data from third parties.

1.5 High level summary of proposed project plan

The Gantt chart below summaries how we will deliver key parts of the scope. This allows for submission of the draft report in w/c 25th January; and submission of the final report and presentation by the w/c 22 February. Note that we require all comments and feedback to finalise the report at least one week prior to the presentation.

The kick-off inception meeting will be held in week one; and we propose regular (weekly) updates with DECC during the project.

	Week commerncing															
	09-Nov	16-Nov	23-Nov	30-Nov	07-Dec	14-Dec	21-Dec	28-Dec	04-Jan	11-Jan	18-Jan	25-Jan	01-Feb	08-Feb	15-Feb	22-Feb
Inception meeting																
Project calls/updates		X	X	X	X	X			X	X	X	X	X	X	X	
Primary research																
Secondary research																
Current technical potential																
Market and product review																
Costs and cost trajectories																
Future technological potential																
Barriers to deployment																
Vailidation interviews																
Gap analysis																
Draft report submitted																
Peer review and revisions																
Final report and presentation																

Section 2: Experience of Project Team

2.1 Experience with appropriate analytical projects (including demonstration of work undertaken successfully within last 3 years)

The project team brings a wealth of expertise on analytical projects from many evidence-gathering projects; via specific projects on thermal storage; and via its research services for a wide range of heating appliance manufacturers, energy companies and policy makers. Many of these assignments and services focus on the heating markets across Europe, the use of thermal storage for electricity system flexibility, the integration of thermal storage with heating appliances and involve close dialogue with the heating industry and boiler manufacturers in the UK and internationally.

Santokh Gataora is a leading expert in the application of thermal energy storage having 25 years' experience with sensible heat stores via his work with British Gas, Global Gas and Gledhill Ltd in the research, design and integration of sensible heat (water) stores. He also has 10 years' experience with phase change material research via his work with Gledhill Ltd, British Gas and Sunamp. Santokh brings the following key skills and experiences to the team:

- Management of research and development teams looking at heat storage technologies
- Heat exchanger design and development – gas to water and water to water
- Thermal stores and their integration into heating systems.
- Mathematical models of thermal & control systems
- Product design & development, marketing and market analysis

Delta-ee has carried out a number of projects for DECC recently.

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Delta-ee has a range of other experience in thermal energy storage. Delta-ee is launching a research service on distributed energy storage in November this year (thermal and electrical storage), and has been carrying research for this service launch for several months. Our associate Dave Kane has acted as technical director for IE-CHP, a product development company specialising in (hot water) thermal storage. Our current consulting work involves examining how thermal storage can increase the flexibility of heat pumps in different types of housing and heating system arrangements (as part of an innovation project for Electricity Northwest).

A *selection* of relevant projects are detailed below.

Project	When undertaken	Scope of work	Relevance to this project
Technical Director, IE-CHP	2013-15	Development of the IE-CHP thermal storage product and interface with different heat sources	Technical and product design expertise of thermal storage
RHI Evidence Report – Gas Driven Heat Pumps *For DECC*	2014	Assessment of the opportunity for non-domestic GDHPs	Independent evidence gathering and analysis for DECC
State of the European energy storage market	2015	Assessment, using a Delta-ee framework, of the distributed energy storage markets in	Energy storage (including thermal storage) market and product expertise

To be published under the Delta-ee Energy Storage Service		Europe and an analysis of the opportunities	
Technical Director, Sunamp Ltd	2011-12	Responsible for technical development at thermal storage developer Sunamp	Detailed thermal storage expertise. Ran the field trial of the DECC-funded field trial of PCM heat stores coupled with heat pumps
REACTED			
Heat pump flexibility and impact on distribution networks *For ENWL*	2015	Analysis of heat pump load profiles and the flexibility that thermal stores, the building itself (and other techniques) can provide	Using thermal storage to provide flexibility for heat pump operation
Air Source and Ground Source Heat Pump Cost Reduction Scenarios *For DECC*	2014	To assess the current cost of ASHP and GSHP technologies (broken down by equipment and non-equipment costs) and identify the potential for cost reduction in the future.	Evidence gathering and analysis for DECC
Energy Storage in Europe Multi-Client Study *For a utility audience*		Status of energy storage markets in Europe, and analysis of how they would develop	Energy storage (including thermal storage) expertise
Technical Director, Gledhill Ltd	1998-2011	Field trial of heat stores with WisperGen mCHP and with heat pumps and solar thermal systems. Produced 'Specification for thermal stores', which has now been published by WMA. Investigated the application of PCM materials in thermal stores up to the proof of concept stage and this included development of heat exchanges and encapsulation of PCM materials.	Detailed thermal storage design expertise

Delta-ee has leading edge expertise, maintains innovative/creative approaches and adds value to its clients consistently. Evidence of this is summarised as follows:

- Analysis of the UK and European heating market is a core business of Delta-ee – including energy storage - and this is the primary focus of many of our Research Analysts. We have been a specialist provider of research, information, data and analysis in this field for over 10 years, and our research team has over 50 years of combined experience in this field. We are members of relevant trade bodies.
- We focus on continuous improvement in the quality and value of our services to clients. We seek detailed feedback from clients, most importantly in relation to 'how can we do better next time'. While our clients are routinely delighted with our work (90% of our research assignments are scored 4 or 5 out of 5 by clients when asked to rate their agreement with the statement "we have provided an excellent service for you"), we challenge ourselves always to innovate and improve.

- As a consequence of this, existing clients continue to ask for our services (repeat business accounts for over three quarter of our work), and we are winning new business from new clients every month. This is a key factor in enabling Delta-ee to have achieved year-on-year growth of 25% pa for the past several years.

2.2 Technical expertise of personnel and their experience in the given technology

Below, we provide short pen portraits, detailing their relevant technical expertise, for this project. The team will consist of members from Delta-ee, with Santokh Gataora acting as a technical advisor.

Jon Slowe, Project Director.

- Jon will have overall responsibility for the project, and will be an active member of the team.
- Jon is a director at Delta-ee and a joint founder of Delta-ee.
- He leads Delta-ee's work with UK government departments and agencies, with utilities and on the B2C market in the UK and across Europe, covering a range of heating, energy services, and connected home topics.
- Jon regularly advises and presents to governmental agencies, e.g. DECC, the European Commission, etc.
- Jon has 10 years' experience at Delta-ee, and prior to that managed the Micro-CHP Research Service for US-based research company E Source, and managed CHP and energy services programmes for the UK's Energy Saving Trust.

Santokh Gataora, Technical Consultant

- Santokh is a consultant with over 25 years' experience with heat storage technologies, specifically sensible heat storage and phase change material storage technologies, and a track record of working in partnership with Delta-ee.
- He has extensive experience and track record in the research, design and integration of sensible heat (water) stores in the following applications:
    - Heat stores alongside heat pumps, micro CHP and gas boilers in domestic and commercial buildings.
    - Distributed heat storage based heating systems in apartment blocks in UK and Europe.
    - Running comparative field trials and transfer of technologies from laboratory to manufacturing.
- Santokh will act as a technical advisor on the project, adding his views, knowledge and experience to the team, as well as access to strong network of industry contacts in the heat storage field.

Lukas Bergmann, Senior Analyst.

- Lukas is responsible for delivering Delta-ee's Heat Pump Research Service. He also manages and supports a range of client consulting projects, including for DECC.
- Relevant consulting assignments include (for DECC) "Assessment of the Market, Renewable Heat Potential, Cost, Performance and Characteristics of Gas Driven Heat Pumps", and "Analysis and Forecasts of the UK HVAC Market" (covering all residential and commercial buildings), for a global leader in the manufacture of residential heating products.
- Lukas joined Delta-ee in 2012, previously working for the European Heat Pump Association (EHPA) where he managed the data collection and production of annual statistical reports as well as the organisation of the annual industry conference.

Julian Jansen, Analyst

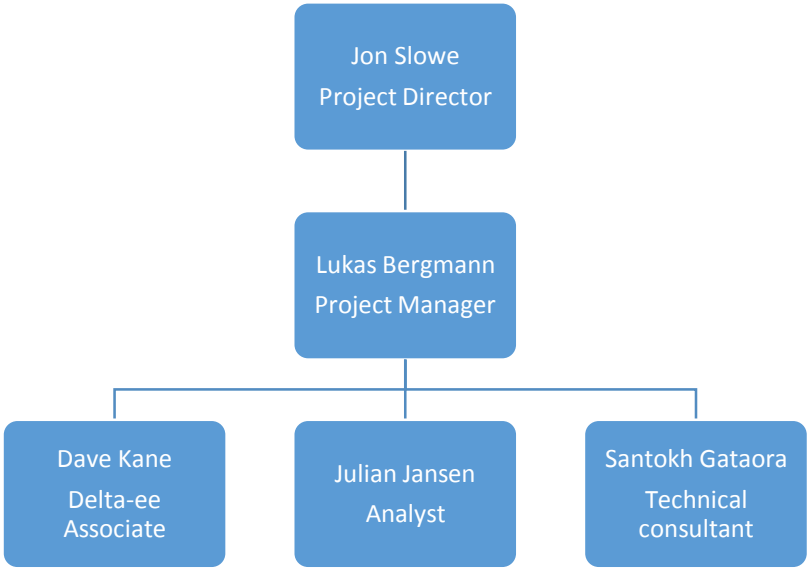
- Julian is responsible for developing and launching Delta-ee's Energy Storage Research Service – covering a wide range of storage appliances and technologies (including heat storage). He has also been a key part of the Delta-ee Heat Pump Research Service team (where he lead research on the UK heat pump market and specifically our hybrid heat pump research)
- He also manages and supports a range of client consulting projects, including for DECC.

- Relevant consulting assignments include "Analysis and Forecasts of the UK HVAC Market" (covering all residential and commercial buildings), for a global leader in the manufacture of residential heating products.
- Julian joined Delta-ee in 2014.

Dave Kane, Delta-ee Associate

- Dave has worked in the energy industry for 9 years, within R&D, project & design engineering, and consultancy roles following 4 years as a technician within the Communications and IT industry.
- After 3 years within academic research, understanding energy demand, thermal energy storage and the technical potential for low-and-zero carbon technologies in commercial and residential buildings, Dave spent some time within R&D and engineering in the Oil & Gas sector. In his most recent role, Dave acted as Technical Director for IE-CHP, a product development company specialising in hot water thermal storage. Dave's experience also includes managing a team of consultants delivering technical consultancy on energy efficiency and renewables for commercial, industrial and public sector clients.
- Dave holds a PhD in Micro-CHP and Energy Storage and a BSc (Hons) in Engineering Physics, both at Heriot-Watt University in Edinburgh. He is a Chartered Engineer and Certified Measurement and Verification Professional.

The structure of the team for this project is summarised below. Jon Slowe, Director at Delta-ee will have overall responsibility for the project and ensure quality through the inception, design, implementation, review and reporting phases. Lukas Bergmann, Senior Analyst at Delta-ee, will manage the project on a day to day basis and be the primary contact for DECC. Lukas will be supported by Santokh Gataora, our technical consultant, Dave Kane, a Delta-ee associate, and Julian Jansen at Delta-ee.



Section 3: Pricing Schedule

Part A – Staff/project team charges

Set up Costs – please specify	None
Expenses	Edinburgh – London return trips for two meetings for two people. 2 * 2 * £135 (super off peak train return) = **£540**

*Grade/level of staff	Daily rate (ex VAT)	No. days offered over course of contract	Tasks to be undertaken on this project	Total price offered per staff member
REDACTED				
REDACTED				
REDACTED				
REDACTED				
Sub-total		21		**£19,100**

[*Suppliers should also include sub-contractors]

Total fee for part A including travel expenses = **£19,640**

Part B – Non-staff/project team charges

Item	No. of items	Price per item (ex VAT)	Total price per offered
		£	£

		£	£
		£	£
		£	£
		£	£
Sub-total			**£0**

Part C – Full price offered

Sub-total (Part A + Part B)	**£ 19,640**
VAT (20%)	**£ 3,928**
TOTAL (Sub-total + VAT)	**£ 23,568**

Annex A – Resource & Pricing Structure Template

Table 1: Allocation of resource across the project

Below, we outline the allocation of resources against the 8 main elements of our approach, indicating which individuals will be working on each section.

Section of the methodology	Key tasks involved	Resource required (days)	Key resource to be used
1. Utilise extensive existing expertise from within the team of Delta-ee and Santokh Gataora.	REDACTED		
2. Interviews with stakeholders.	REDACTED		
3. Literature review.	REDACTED		
4. Internal analysis of evidence and interview results.	REDACTED		
5. Validation interviews to test, explore and challenge evidence gathered & hypotheses.	REDACTED		
6. Synthesis of research and development of the draft final report.	REDACTED		
Meetings with DECC, including presentation of results	REDACTED		
Project management	REDACTED		
	TOTAL	**21**	

Table 2: Summary Pricing Structure

						Estimated expenses
Grade / Role	**Name**	**Hourly Rate (£)**	**Daily Rate (£)**	**No of days**	**Cost (£)**	**Cost (£)**

Director / Project Director	Jon Slowe (Delta-ee)			REDACTED		
Senior Analyst / Project Manager	Lukas Bergmann (Delta-ee)			REDACTED		
Analyst & Associate / Project support	Julian Jansen (Delta-ee), Dave Kane (Delta-ee)			REDACTED		
Technical advisor / project support	Santokh Gataora			REDACTED		
TOTAL				**21**	**19,100**	

Annex B – CVs for the project team

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Section 4: Signature and Declarations

Declaration 1: Statement of non-collusion

To: The Department of Energy and Climate Change

1. We recognise that the essence of competitive tendering is that the Department will receive a bona fide competitive tender from all persons tendering. We therefore certify that this is a bona fide tender and that we have not fixed or adjusted the amount of the tender or our rates and prices included therein by or in accordance with any agreement or arrangement with any other person.

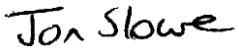
2. We also certify that we have not done and undertake not to do at any time before the hour and date specified for the return of this tender any of the following acts:

(a) communicate to any person other than the Department the amount or approximate amount of our proposed tender, except where the disclosure, in confidence, of the approximate amount is necessary to obtain any insurance premium quotation required for the preparation of the tender;

(b) enter into any agreement or arrangement with any other person that he shall refrain for submitting a tender or as to the amount included in the tender;

(c) offer or pay or give or agree to pay or give any sum of money, inducement or valuable consideration directly or indirectly to any person doing or having done or causing or having caused to be done, in relation to any other actual or proposed tender for the contract any act, omission or thing of the kind described above.

3. In this certificate, the word "person" shall include any person, body or association, corporate or unincorporated; and "any agreement or arrangement" includes any such information, formal or informal, whether legally binding or not.

Signed 

Name Jon Slowe (Director)

On behalf of: Delta Energy & Environment

Date 23 October 2015

Declaration 2: Form of Tender

To: The Department of Energy and Climate Change

1. Having considered the invitation to tender and all accompanying documents (including without limitation, the terms and conditions of contract and the Specification) we confirm that we are fully

satisfied as to our experience and ability to deliver the goods/services in all respects in accordance with the requirements of this invitation to tender.

2. We hereby tender and undertake to provide and complete all the services required to be performed in accordance with the terms and conditions of contract and the Specification for the amount set out in the Pricing Schedule.

3. We agree that any insertion by us of any conditions qualifying this tender or any unauthorised alteration to any of the terms and conditions of contract made by us may result in the rejection of this tender.

4. We agree that this tender shall remain open to be accepted by the Department for 8 weeks from the date below.

5. We understand that if we are a subsidiary (within the meaning of section 1159 of (and schedule 6 to) the Companies Act 2006) if requested by the Department we may be required to secure a Deed of Guarantee in favour of the Department from our holding company or ultimate holding company, as determined by the Department in their discretion.

6. We understand that the Department is not bound to accept the lowest or any tender it may receive.

7. We certify that this is a bona fide tender.

Signed Jon Slowe

Name Jon Slowe (Director)

On behalf of: Delta Energy & Environment

Date 23 October 2015

Declaration 3: Conflict of Interest

I have nothing to declare with respect to any current or potential interest or conflict in relation to this research (or any potential providers who may be subcontracted to deliver this work, their advisers or other related parties). By conflict of interest, I mean, anything which could be reasonably perceived to affect the impartiality of this research, or to indicate a professional or personal interest in the outcomes from this research.

Signed Jon Slowe

Name Jon Slowe

Position Director, Delta-ee

Date 23 October 2015

Declaration 5: Code of Practice

I confirm that I am aware of the requirements of the DECC Code of Practice for Research and, in the proposed project, I will use my best efforts to ensure that the procedures used conform to those requirements under the following headings:

- ☐ Responsibilities
- ☐ Competence
- ☐ Project planning
- ☐ Quality Control
- ☐ Handling of samples and materials
- ☐ Facilities and equipment
- ☐ Documentation of procedures and methods
- ☐ Research/work records

I understand that DECC has the right to inspect our procedures and practices against the requirements of the Code of Practice, and that I may be asked to provide documentary evidence of our working practices or provide access and assistance to auditors appointed by DECC.

(There is some flexibility in the application of the Code of Practice to specific research projects. Contractors are encouraged to discuss with DECC any aspects that cause them concern, in order to reach agreement on the interpretation of each requirement.)