DNV·GL

Proposal for an appraisal of options for an innovation intervention in industrial decarbonisation including industrial carbon capture and storage

Department of Energy and Climate Change

Customer Reference: TRN 1105/11/2015
Date of issue: 2015-12-16
Date of last revision: 2015-12-16

Customer Details

Customer Name:	Department of Energy and Climate Change
Customer Address:	3 Whitehall Place, SW1A 2AW, London
Customer Reference:	TRN 1105/11/2015
Contact Person:	Susannah Fairbairn susannah.fairbairn@decc.gsi.gov.uk

DNV GL Company Details

DNV GL Legal Entity:	DNV KEMA Ltd
DNV GL Organisation Unit:	DNV GL - Energy
DNV GL Address:	Palace House, 3 Cathedral Street, SE1 9DE, London
DNV GL Telephone:	+44 (0) 7964 036 380

About this document

Proposal Title:	An appraisal of options for an innovation intervention in industrial decarbonisation including industrial carbon capture and storage
Date of issue:	2015-12-16
Date of last revision:	2015-12-16
Validity of proposal:	2 months from date of issue

Confidentiality

This proposal may contain information that is business sensitive to DNV GL. No part of the proposal or information received during the bid process may be used, duplicated or disclosed for any other purpose. Any such use of DNV GL's information is regarded as an infringement of DNV GL intellectual property rights.

for DNV KEMA Ltd

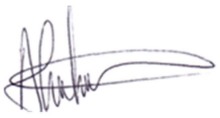
Prepared by:	Approved by:
	
Agapi Papadamou Senior Consultant, Sustainable Energy Use Europe	Ulrika Wising Head of Section, Sustainable Energy Use Europe

Table of contents

1 INTRODUCTION 2

2 TECHNICAL APPROACH 3
2.1 Methodological approach and consistency with stated objectives 3
2.2 Quality assurance approach 12

3 EXPERIENCE OF PROJECT TEAM 14
3.1 Technical capability of team 15
3.2 Ability/capability to establish contacts with industry 17

4 PRICING SCHEDULES 18

DECLARATION 1: STATEMENT OF NON-COLLUSION 19

DECLARATION 2: FORM OF TENDER 20

DECLARATION 3: CONFLICT OF INTEREST 21

APPENDIX A - PRICE SCHEDULE (EXCLUDING VAT) 22

APPENDIX B – CONSORTIUM OVERVIEW 23

APPENDIX C - CURRICULA VITAE (CV'S) 26

APPENDIX D - DNV GL MANAGEMENT SYSTEM 55

APPENDIX E – CLT INNOVATION INTERVENTION EXPERIENCE 58

1 INTRODUCTION

DNV GL, as prime contractor on the Energy Technical Specialists Framework (Lots 15 and 21), and its subcontract partners Carbon Limiting Technologies (CLT) and WSP | Parsons Brinckerhoff are pleased to submit this proposal to the Department of Energy and Climate Change (DECC) in response to its Invitation to Tender (ITT) for an appraisal of options for an innovation intervention in industrial decarbonisation including industrial carbon capture and storage.

Based on our understanding of the study objectives, we have assembled a uniquely qualified team with the skills and expertise required to delivery this project. The following key points reflect our team's experience and approach:

- DNV GL and WSP | Parsons Brinckerhoff experience and understanding of industrial decarbonisation from co-managing the DECC/BIS Industrial Decarbonisation and Energy Efficiency 2050 Roadmap project
- CLT's 10 years' experience of low-carbon innovation, management of multi-year innovation support programmes, including DECC's Energy Entrepreneurs Fund, and support to over 200 innovators
- New, low-carbon technology solutions for energy intensive industries will have to be adopted by established suppliers and end-users. Asset replacement timeframes are typically long and therefore technology innovators need to pre-sell their solutions into established industry players to ensure they are targeting specific needs and adoption challenges.
- A Technology Challenge competitions can be issued if consultation with industry and innovators has identified the key barriers to performance or adoption. Barriers may include: environmental, core technology, engineering solutions, systems integration, operational changes or costs.
- A key benefit of a Directed Challenge is that it can allow selection of the "best" combinations of companies rather than selecting from just the best grant applicants. Challenges can also be tailored to reduce adoption risk, for example by requiring that projects include partners from along the supply chain and end-users. Funding mechanisms can then also be matched to fit the type of challenge e.g. grants for R&D or equity funds for an onsite demonstrator project.
- In principle, government could set up a £25-50m equity fund to invest its funds in a small portfolio of project vehicles (SPVs) set up to develop first-of-a-kind (FOAK) demonstrators of specific Challenges to adoption of ICCS and other other low-carbon technologies. Co-investment could be from project partners providing the match in terms of seconded resources and facilities , and/or cash.

Our budget for conducting this research is estimated at £78,990 (ex VAT and expenses) and represents a level of effort that is consistent with DECC's requirements, and offers considerable value-for-money (VFM) in that we have the ability to leverage DECC's recent, relevant work in the of decarbonisation roadmaps and innovation. In addition, our overall approach, team structure, and budgeting assumptions provides DECC with flexibility to respond to developing requirements and emerging priorities.

2 TECHNICAL APPROACH

2.1 Methodological approach and consistency with stated objectives

The main objectives for this project, as set out in the tender – together with the section in which our methodology addresses each objective, are as follows:

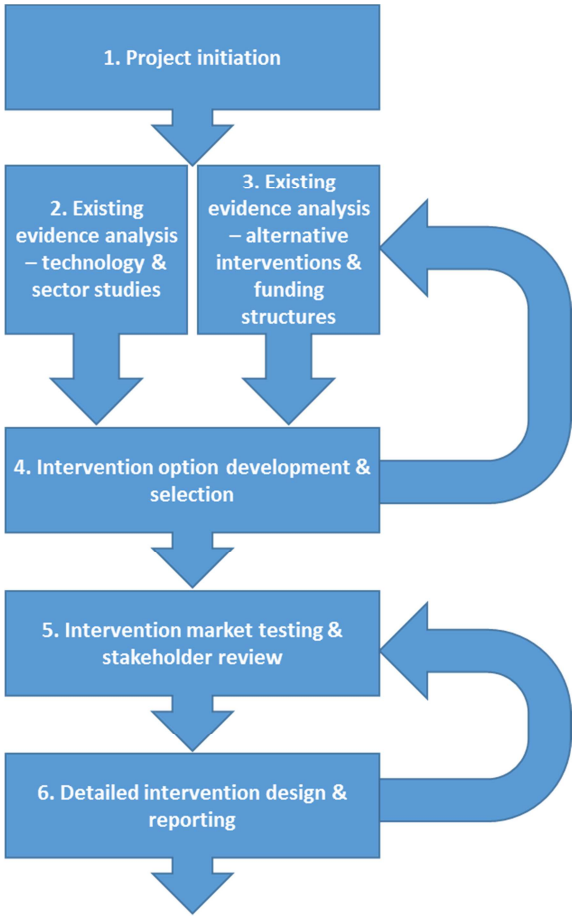
1. Design the selection and eligibility criteria for deciding which industrial decarbonisation technologies (and projects) should be prioritised (section 2.1.4); and then
2. Create a prioritised list of technologies, identify the main challenges to be overcome and types of project needed to move technical and/or commercial readiness forward (section 2.1.2); and
3. Review and design options for the structure of the innovation interventions that DECC can use to encourage industry to address the gaps and challenges, and remove barriers to adopting the prioritised technologies (section 2.1.3)
4. Identify alternative or complimentary funding sources (section 2.1.3)
5. Identification and assessment of potential bidders (section 2.1.5)
6. Determine the main factors for success of the industrial decarbonisation innovation programme (Section 2.1.5)
7. Canvas views of a range of stakeholders on the above points (section 2.1.5).

We note that criteria could include such factors as: TRL, time-to-market, scalability, complexity, emissions impacts (within specific sectors) and time-to-impact (noting the findings of the pathways), quality of technology development team / attitude of IP owner, cost per tonne-abated, breadth of market application, UK capability and expertise, current investor interest, feasible no-regrets pilot sites, cost of interventions and value-for-money.

We also note that appropriate innovation interventions will depend on the type and stage of the priority technologies. For example, if a priority technology is relatively well-developed but the barrier/challenge to adoption is integration complexity and cost, then the intervention may be to encourage pilot projects that develop simplified integration. Alternatively if consultation with industry suggests that a particular technology will never get support until its core efficiency or lifetime reaches a particular benchmark, the focus for intervention may be on core technology development.

2.1.0 Proposed technical approach

The overall approach will follow a clear strategic choice process, which is analysis, option development, choice and implementation. This will ensure that robust intervention options are produced within the required timescales. We will incorporate elements of new *product (or service) development (NPD)*, which ensures that there is interaction throughout the process between market-based insights (from stakeholders, potential beneficiaries and funders) and the form of the intervention. This process will deliver more innovative intervention design (compared to a reductionist approach where evidence is selectively sought for pre-conceived interventions). The project technical approach will consist of the stages in the flow chart opposite. These steps are not a once-through, serial process. There will be feedback in particular between steps 2, 3 and 4, as well as between steps 5 and 6. Overall project management will ensure that the above steps are co-ordinated and are delivered to the project deadlines and budget.



The table in section 2.1.7 sets out how the research methodology will answer the key research questions in the tender.

The study will combine desk-based reserach, telephone interviews, surveys and stakeholder roundtables, as well as the team's own considerable knowledge of

industrial decarbonisation and innovation-focussed interventions.

2.1.1 Project initiation

The project will commence with a project inception meeting (at DECC offices). An agenda and attendee list will be agreed with DECC in advance of the meeting but is expected to cover the following:

- Review the project approach, scope and objectives, as well as receive any updates
- Agree dates for project review meeting and milestones, as well as reporting formats
- Ensure the project team is aware of all relevant documentation
- Agree an initial list of interviewees (to ensure that key contacts can be made early and thereby meet the project timeline).

The project initiation meeting will be attended by subject experts from the project team with direct experience of:

- The relevant industrial sectors and technologies
- Industrial decarbonisation, including the previous studies
- Innovation interventions

A key outcome of this project initiation stage will be a clear understanding of the objectives of the study by all parties, including the detailed nature of the output from the study. Clarity over the study output will ensure that DECC has the insights and documents that it needs to highlight the likely future policy direction and innovation intervention(s) design and structure, as well as the contents of an evidence base to support both the intervention choice and design. This could also be used to support Phase 2 of the Industrial Roadmaps Project.

The project team is flexible on the involvement of external stakeholders in the project initiation meeting. Our recommendation however is that the above meeting is first held between DECC and the project team at which the timing, location and attendee list can be agreed for a wider project initiation meeting involving external stakeholders.

The **deliverables** from this stage are:

1.1 Project initiation meeting at DECC offices attended by DECC and the project team
1.2 Project initiation meeting with external stakeholders
1.3 Write-up of agreed actions from project initiation meeting(s)
1.4 An agreed project plan (including meeting schedule).

2.1.2 Existing evidence analysis – technology & sector studies

The review of the existing evidence base will focus on two areas: the technology & sectors and the interventions. This stage will focus on reviewing the evidence base relating to the priority industrial decarbonisation technologies (including ICCS) and the related needs of the main industrial sectors to which they can be applied (as described in the industrial decarbonisation and energy efficiency 2050 roadmaps). The next section (delivered in parallel) focuses on the various interventions that have been used across a range of challenges, including an analysis of the needs of financiers. Our team will be able to start this task with extensive knowledge of the Phase 1 Roadmaps project and the EEF project. In addition, the project will build on the considerable amount of research we have been involved in coupled with work undertaken by DECC and other organisations into industrial decarbonisation. This will be achieved through:

- An appraisal of the existing reports relating to the priority industrial decarbonisation technologies (including ICCS) as set out in the tender, as well as any more recent reports or specific reports that deal with particular gaps in the tender reports list.
- Working closely with the DECC team to ensure all the key studies and stakeholders are included
- Inclusion of experts in the project team that have been directly involved in several of the key studies
- Interviewing authors of the key research where additional information or clarity is required (examples of the organisations that may be contacted are listed in the table in section 2.1.5)

The appraisal of the existing evidence base will seek to both analyse the body of evidence developed by DECC and other UK organisations, and also seek out any significant research undertaken outside of the UK (for example in Norway on industrial decarbonisation and industrial CCS).

The analysis of the existing evidence will seek to develop a number of insights relating to:

- The nature of the decarbonisation **challenge** and barriers, how these differ by sector and how they may evolve (with and without support), as well as potential impacts if challenges are overcome (e.g. reduced costs and risks, increased energy efficiency and carbon reduction, increase energy security).
- The characteristics of the potential **solutions** (e.g. ICCS, electricity grid decarbonisation, biomass, energy efficiency and heat recovery, electrification of heat, material efficiency and fuel switching), including the current deployment levels of priority technologies.
- The characteristics of the potential solution **providers** e.g. micro/SME or corporate, supply chain position and sector focus.
- **Names** of companies (in the UK and elsewhere) that may benefit from interventions, as well as key stakeholders (both of which would be potential interviewees for later stage research).

Contact will be made with report authors or organisations to answers queries relating to reports and also gain updates for older reports or information about unpublished material (such as the upcoming TINAs on Industrial Decarbonisation and ICCS). Organisations not listed in the tender but active will also be researched (for reports and/or input) in order to identify and fill any gaps e.g. UKCCSRC, SCCS, CCSA, EPSRC/RCUK Energy Programme, IEA, Committee on Climate Change, Teesside Collective, UNIDO, CSSA and the industrial trade associations.). Some technology companies have also produced reports by working with corporate R&D centres and these reports will (where available) be analysed and/or their authors contacted.

The **deliverables** from this stage are:

2.1 A documented summary of all the reports listed in the tender and contact made with authoring organisations

2.2 A summary of other reports (where appropriate) not listed in the tender from organisations such as IEA, Committee on Climate Change and CSSA

2.3 Answers to 4.3 (i) to (iv) and initial answers (to be added to by later stages) to questions (v) to (vii)

2.4 Identification of potential interviews and intervention recipients (answering question 4.5 (i)

2.1.3 Existing evidence analysis – alternative intervention and funding structures

The focus of this section is to identify and analyse the range of potential innovation intervention options. These could include a range of technology choices but also collaborative R&D, feasibility studies, pre-FEED studies and pilot/demonstration technologies.

This analysis will seek to segment schemes by type and delineate their strengths and weakness, as well as their applicability to different innovation barriers, resource requirements and likely outputs/impacts. The previous section will generate some information on interventions applied, or recommended to be applied, to support industrial decarbonisation (including ICCS). This section will in addition examine interventions that have been successfully used to support innovation in other sectors. Such schemes will include those already used by DECC and other UK funders, such as EU funded projects, EEF (grants & incubation), Innovate UK (grants), Manufacturing Advisory Service (advice), EU streams such as NER 300/400, Horizon 2020, any new funds following COP21, foundations, corporate technology companies, and corporate R&D.

This section will also analyse investors and investor-based interventions that have, or could, support industrial decarbonisation, as well as their likely appetite for risk and technology/sectoral-focus. This review will encompass:

- Corporate-based funding e.g. balance sheet to corporate venturing
- Financial investors e.g. project and equity funding
- Public sector funds (UK, EU and international funds applicable to UK-based activity)
- Mixed investor e.g. corporate funds, public-private funds, private incubators.

Intervention information will be sourced via both desk-based research, from extensive team member experience and telephone interviews. Further detailed information will be gathered on the selected intervention(s) in the latter stages of the process.

The **deliverables** from this stage are:

3.1 Systematic analysis and segmentation of intervention scenarios/options that could be used to support industrial decarbonisation – determination of pros/cons and applicability to differing innovation needs – including interventions set out in sector-based reports (analysed in previous

section) and used in other sectors/countries (not all interventions but one or two specific schemes of each type).

3.2 Systematic analysis and segmentation of complementary funding sources available for innovation in industrial decarbonisation including ICCS.

2.1.4 Intervention option development & selection

In this work stage, the project team will draw together the findings of the previous sections into a format that enables the project team, DECC and other stakeholders to both understand clearly the industrial decarbonisation innovation challenges and the characteristics of potential intervention schemes. This will enable the selection of the preferred intervention(s) for further investigation and development.

Intervention characteristics will be summarised against a consistent set of criteria e.g. resource requirements, private-sector leverage potential and delivery timescale. A model will also be developed to allow a consistent comparison of scheme inputs, outputs and impacts, as well as modelling intervention combinations under different funding levels. Inputs to the model could include, for example, number of companies supported, intervention rate, total project cost, whilst outputs/impacts could include total costs and companies supported. (This model will be extended further for the selected intervention(s) in the final stage of the project – see section 2.1.6).

The project team will then review the findings to date and options with the DECC team. The feedback from this meeting will be used as preparation for stakeholder roundtables. The project team plans to hold roundtable meetings with key stakeholders at which the evidence will be examined, further insight obtained of the innovation challenges the technologies/sectors face (in terms of industrial decarbonisation) and feedback taken on the potential innovation intervention options. The project team is flexible on the timing and attendees at these roundtables but we recommend two roundtables – one in London and one in the North of England (e.g. Manchester or Leeds).). The stakeholders invited to the roundtables would include technology providers, industry representatives, supply chain partners, academics, public sector bodies and sector organisations.

The insights and feedback from the roundtables will be documented and reviewed with DECC. The project team will work with DECC to select the preferred intervention scenarios/options (from the output in 3.1 above) for further development.

The **deliverables** from this stage are:

4.1 A presentation of the key findings to date, industrial decarbonisation innovation challenges and intervention segmentation and characterisation

4.2 Facilitation of two roundtables external stakeholders to gain further insights to the sectors' challenges and gain feedback on the preferred intervention options under low (£10m) and high (£50m) funding scenarios (addressing question 4.4 in the ITT)

4.3 Two meetings with DECC (before and after the stakeholder roundtables) to develop and then agree the preferred intervention(s).

4.4 Write-up of meeting and roundtable findings.

2.1.5 Intervention market testing & stakeholder review

In this work stage the project team will gather detailed information relating to the preferred intervention(s) selected in the previous stage. This and next section, covering detailed intervention design, will include some iteration to ensure feedback between intervention design and market/stakeholder feedback.

Before starting the detailed research the information required will be agreed with DECC. This research will answer the research questions set out in the tender and build on the valuable information gathered from the roundtables in the previous section. Indeed, the attendees will form a core part of the quantitative research that will be conducted in this section.

A survey will be conducted amongst potential intervention recipients and stakeholders to garner both answers to research questions and scoring on the preferred intervention(s) design dimensions. The questionnaire will be designed by the project team and passed to DECC for comment before dispatch. The survey will be sent out electronically where possible or administered by phone where no email address is available (or requested at the roundtable events). The industrial trade associations will be used as a source of feedback and for the distribution of surveys.

The target recipients for any intervention will determine the survey target population. This population will then be segmented and representative target samples numbers confirmed for each sub-population

(e.g. company size, sector and geography). The use of DECC, the project team and the industrial trade associations brands, as well as the potential to help determine how funding may be spent, will encourage survey recipients to responds. The survey will also be designed to be easy to answer in under 20 minutes. Response rates cannot however be guaranteed. As a back-up, interviews with sector organisations will be used to gather proxy data. The number of interviews will be confirmed at the inception meeting, however, this will be subject to change depending on how the project progresses.

Survey recipients will be identified from the project team's network, DECC's network, existing reports, industry organisations and research, as well as the roundtables. It is planned that roundtable attendees will be handed the surveys at the workshop and asked, if possible, to complete them on the day. Examples of potential survey recipients, interviewees and attendees at the roundtable are listed in the tables below.

Type	Potential interviewees/grant recipients
Innovative Companies	CCS (including next generation low-energy amines and non-amines, carbonate and fertilizer production): Carbon Clean Solutions, C-Capture, FET, Petroc, Carbon Cycle Heat Recovery (including waste-heat to power): Heatcatcher, Libertine, Bowman, T-Flex Biomass (including hydrothermal carbonisation, gasification, anaerobic digestion and water treatment): Antaco, Intervate, Future Blends, Celtic, Industrial Phycology, Lindhurst, NVP Electrification (including industrial process heating [low-med temp], fuel cells, energy storage, power quality, demand side management and EVs): Ceres, FCL, Cress, Cumulus, HTIP, Zagres, Kiwipower, Upside, TEVVA, Vantage.
Funders	CLT have a database of 360 investors including banks, high net worths, family offices and venture capital firms. A small selection of investors have been entered in this table to give an indication of the types of firms who might be interested in innovative funding mechanisms for ICCS projects. This is by no means an exhaustive list of suggestions.Green Investment Bank, Societe Generale, Greensphere Capital, Foresight, Equitix, Guinness Funds
Industry	Pulp & Paper: Iggesund, Saica, Kimberly Clark, SCA, Palm, Smurfit, UPM, DS Smith, De La Rue Steel: Tata Steel, , Outokumpu, Celsa, Sheffield Forgemasters, Ceramics: Ibstock Chemicals: GROWHOW, SABIC, INEOS, BOC, BP, LUCITE, Exxon etc Glass: Ardagh, NSG Group, Vidrala (Quinn), Saint Gobain, O-I, PPG, Guardian Indsutries Ltd Cement: Lafarge, Hanson, Hope, CEMEX, Tarmac, Steetley, Food & Drink: British Sugar, Cargil, T&L, McCain, Archer Daniels, United, Kellogg, Heinz, Kraft, Diageo, Greencore, Britvic, Pepsico, Arla Foods, Oil Refining: Esso, Essar, Phillips 66, Valero, Total, Petroineos
Supply Chain:	Siemens, Doosan, Alstom, plus a range of companies involved in technology development in gasification of biomass, heat pumps and heat recovery (ORCs)
Research base	Universities of: Brighton, Cambridge, Cranfield, Edinburgh, Exeter, Imperial College, Leeds, Manchester, Newcastle, Oxford, Reading, Sheffield, Southampton, Surrey, UCL, Warwick and others. NPL, HVM Catapult centres, TWI, EPSRC/RCUK
Industry Trade Associations	CIA, BCC, MPA, British Glass, UK Steel, CPI, Food & Drink Federation, UK PIA, Energy Intensive User Group,

It should be noted that our team will be able to quickly establish contact with a targeted group of stakeholders. For larger organisations, care is needed to make contact with the research / innovation decision makers who may be based overseas in senior R&D positions. See also Section 3.2 on Ability /Capability to establish contacts with industry.

The **deliverables** from this stage are:

5.1 Agreed research questions and intervention details
5.2 Agreed survey questionnaire and recipient list

5.3 Administration of a survey to agreed recipients (up to 50) follow up telephone interviews (if necessary)

5.4 Statistical analysis of survey responses

5.5 Answers provided to each of the research questions listed in the tender.

2.1.6 Detailed intervention design & reporting

A final report will be produced that will document the research methodology, findings, analysis, options, selection and detailed intervention design, as well as next steps. This report will include:

- A summary of the priority industrial decarbonisation technologies and A review of the potential industrial decarbonisation innovation interventions
- A summary of stakeholder interviews
- The detailed design of the selected intervention(s), including selection criteria, resource inputs, outputs and impacts (captured in a model to enable modelling of funding scenarios).
- The funding sources available for industrial decarbonisation innovation
- The success factors for industrial decarbonisation innovation interventions
- Anonymised raw data and summary
- Potential bidders for any innovation support.

The table in section 2.1.7 sets out how the study will answer each of the research questions set out in the tender. The rows set out all of the ITT requirements, questions, and deliverables. These have been categorised against 6 proposed stages of the project, showing at what stage they will be addressed. The 6 stages will take from January – March 2015. An allocation of time and individuals needed for each area/question/ stage has been compiled separately.

These finding, insights and recommendations will be set out in the final report.

The **deliverables** from this stage are:

6.1 A draft final report will submitted for review by DECC and then any comments will be incorporated into a final report. This report will document the research methodology, findings, analysis, options, selection and detailed intervention design, as well as next steps

6.2 Attendance by the project team at a project closeout meeting (at DECC offices) to answers any questions and comments on the report

2.1.7 DNV GL Approach compared to DECC Requirements

Main Questions		Detailed Questions	1. Project initiation	2. Technology/sector studies	3. Alternative structures	4. Option development & selection	5. Market & stakeholder review	6. Detailed design & reporting	Notes
A brief summary of the priority industrial decarbonisation technologies	i	What are the priority technologies							Project team members have been directly contributed to several of the reports cited in the tender and other reports relating to industrial decarbonisation. Project team will work closely with experts in the field via both group and individual meetings to gain insight over areas such as sector needs in 2020, 2030 & 2050.
	ii	What are their TRLs							
	iii	What are the commercial readiness levels of these technologies e.g. KPIs commercial investment stakeholders would need to see before investing at various stages along the TRL trajectory							
	iv	When are they expected to be deployed in each EII sector according to Roadmap pathway projections.							
	v	What are the barriers to implementation and innovation of these technologies							
	vi	What is the extent of deployment of each technology in each industry sector both inside and outside the UK							
	vii	In the absence of UK innovation support, how might these technologies change by 2020, 2030 and 2050							
What are the scenarios/options for structuring an	i	Develop a long list of scenarios/options for structuring an innovation intervention – agree short list for further analysis with DECC							A review of existing intervention schemes will be conducted. Current schemes will be segmented (eg.

innovation intervention, basing your recommendations on whether there was access to a small budget (e.g. up to £10m) or a larger budget (e.g. up to £50m)	ii	Analyse and present and develop the pros and cons of each option including: (although not limited to) costs, technical complexities, industry readiness (i.e. integration issues to plant or site down-time), TRL levels (before and after investment), energy efficiency and CO2 reduction (before and after investment), value for money and risks (including delivery and other perceived)								collaborators, type of relationship between collaborators, funder involvement, etc.). Segmentation will be used to identify innovative structures and to aid option selection. Schemes will then be reviewed against an agreed list of consistent variables. This assessment will be based on team and stakeholder input, as well as information from literature and market assessments.
	iii	How many projects could benefit under each scenario/option								Intervention model: output
	iv	What is the appropriate scale of support offered to each project under each option								Intervention model: input
	v	What will be the likely duration of projects supported under each option for the intervention planning purposes								Intervention model: input
	vi	How will state aid rules limit the intensity of support that could be provided for each option								Team members are familiar with State Aid impacts on interventions. Intervention schemes review will also identify State Aid impacts.
	vii	What are the projected cost reductions in technologies as a result of the proposed intervention option								Intervention model: impact
	viii	What are the projected energy/carbon savings as a result of the proposed intervention option								Intervention model: impact
	ix	What are the other economic benefits resulting from the proposed intervention option								Intervention model: impact
Undertake a market assessment of who would bid for any innovation support	i	Who (include names) are the innovators who might bid to undertake innovation projects in this sector (inside and outside UK)								Survey results and stakeholder knowledge
	ii	Assessment of likelihood of finding the match-funding from the private sector where required by state aid rules								Survey results and stakeholder knowledge
	iii	Appetite of potential innovators towards alternative forms of public funding e.g. equity, convertible loans, loans, guarantees etc								Survey results and stakeholder knowledge
Are there any existing	i	UK mechanisms/funds								Survey and team knowledge

mechanisms via DECC which could spend a proportion of any innovation funding, that would leverage additional funding, or achieve greater impact/value for money	ii	Other mechanisms/funds							Survey and team knowledge
	iii	With public sector support, to what extent could these mechanisms/funds be used as match-funding							Survey and team knowledge
	iv	In what technology/industrial sectors are there funding gaps							Survey and team knowledge
What are the selection & eligibility criteria that DECC could use for selecting projects to support?	i-ix	Range of criteria							Criteria weighting varies by intervention type e.g. fund-based criteria more company biased vs. technology
On the basis of the evidence, what is the best value innovation intervention for industrial decarbonisation including ICCS	i	What are the main factors which would determine the success of an industrial decarbonisation/ICCS innovation programme							Survey and interviews – plus professional judgement of the team.

2.1.8 Project plan/schedule

The following project plan shows the delivery of the project that meets the timescales set out in the tender. The project plan includes the following key milestones:

- A project inception meeting in the week beginning 11th January 2016
- Regular Project Team – DECC meetings: weekly progress emails, bi-weekly telephone updates and face-to-face meetings to review key findings
- Roundtable meetings with stakeholders by the end January/beginning of February 2016
- Draft report submitted for review by DECC and key stakeholders by the end February 2016
- A final report and presentation submitted by 31st March 2016.

The timescales are met through the use of an experienced team with existing knowledge of both the industrial decarbonisation and industrial CCS sectors, familiarity with the key existing reports, first-hand experience of a wide range of innovation interventions and considerable experience of working with DECC. In addition, the team will work in parallel on several tasks, to ensure timescales are met, with co-ordination via robust project management.

#	Project stage	Activity	Deliverable	04/01	11/01	18/01	25/01	01/02	08/02	15/02	22/02	29/02	07/03	14/03	21/03	28/03
1	Project initiation	Preparation for project meetings	1.1													
		Project initiation meeting (DECC only)	1.1													
		Project initiation meeting (DECC & stakeholders)	1.2													
		Write up meeting actions	1.3													
		Project management schedule	1.4													
2	Existing evidence analysis – sector studies	Desk-based reasearch and follow-up calls	2.1													
		Desk-based reasearch and follow-up calls	2.2													
		Report writing	2.3													
		Desk-based reasearch and follow-up calls	2.4													
3	Existing evidence analysis – alternative intervention and funding	Desk-based reasearch and follow-up calls	3.1													
		Desk-based reasearch and follow-up calls	3.2													
		Desk-based reasearch and follow-up calls	3.3													
4	Intervention option development & selection	Report & presentation write-up	4.1													
		Set-up of 2 roundtables (DECC & 2 external)	4.2													
		DECC review meeting	4.2 & 4.4													
		Stakeholder roundtable South	4.2													
		Stakeholder roundtable North	4.2													
		Write-up findings	4.3													
5	Intervention market testing & stakeholder review	Agree questions	5.1													
		Design questionnaire & compile recipient list	5.2													
		Send out 50 questionnaires	5.3													
		20 follow-up calls	5.3													
		Statistical analysis of survey responses	5.4													
		Write up answers	5.5													
6	Detained Intervention design & reporting	Draft final report	6.1													
		Closeout meeting	6.2													
7	Project management	Inception meeting	1.1													
		Regular progress updates														
		Stakeholder roundtables	4.2													
		Draft report	6.1													
		Final report	6.1													

The project risks and intended management of these risks to the delivery of the project are set out in Appendix D.

2.2 Quality assurance approach

A considerable amount of information will be made available, in the course of the assignment, via various research activities, review of existing reports, qualitative interviews with stakeholders and report authors as well as a quantitative survey with potential intervention recipients and stakeholders. It is, therefore important that the correct levels of quality are attained.

In many projects DNV GL has performed the role of independent third party, independent third party inspector, as well as project manager, specialist, consultant and testing agent. Irrespective of the role, DNV GL strives to deliver high quality services and is an ISO 9001 certified company. All documents and deliverables will have an internal quality assurance check before submission to DECC and Paul Willson will provide this quality assurance overview for this project acting as the Chief technologist contact for the purposes of this assignment. Part of her role will be to manage the consortium partners, which will ensure a multi-disciplined approach to exploring innovative ideas, providing feedback and sense-

checking progress as well as ensuring control of the quality of the reports submitted for each specified task.

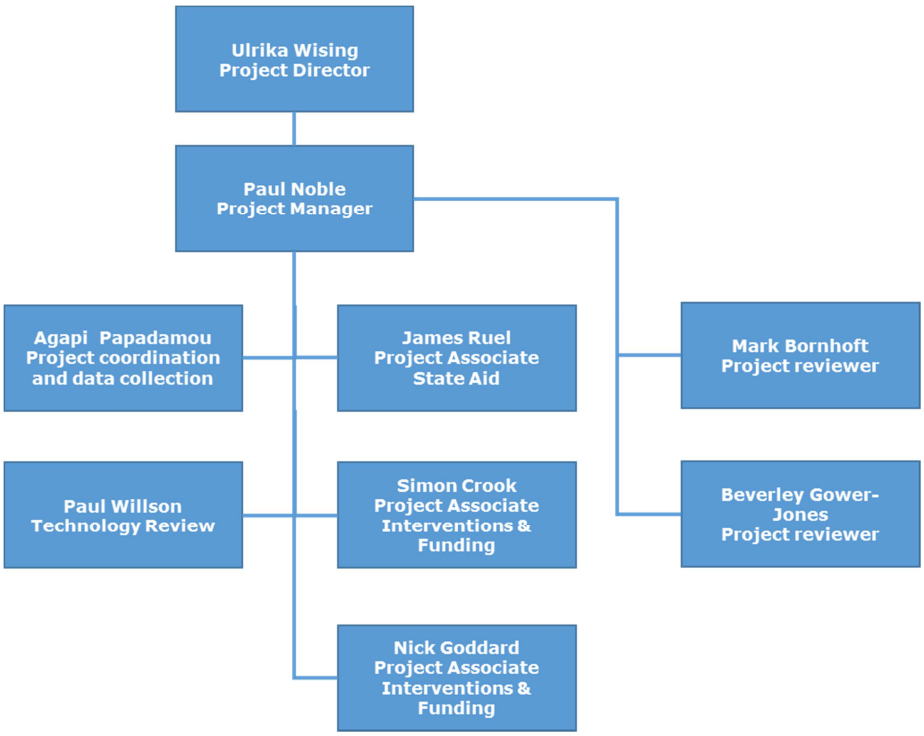
The thorough research process designed and proposed for this assignment will cover qualitative and quantitative analysis techniques, which will need to ensure a credible and impartial outcome. This requires flexibility and coordination, which we consider is given through our key appointments and the governance structure of our proposed team, described in the Project Management Approach section below. We have assigned Paul Noble as the primary data collection lead. Paul has a wide range of experience managing the collection and analysis of information from commercial and other organisations including situations with limited sets of data where using best available evidence have been key.

While we feel the level of effort for data collection described in the previous paragraphs is appropriate given the likely gaps in the existing data sources, we will revisit this plan during the project initiation phase to ensure we have matched the appropriate method and source of data with emerging information needs.

Specific to the qualitative interviews with stakeholders and authors as well as the quantitative survey with innovative companies, funders, etc., obtaining participation from all sample groups is essential to reduce the risk that respondents differ from the sample as a whole (response bias). There are two key elements to this. First, good sample management is needed to ensure all potential respondents are given an equal opportunity to take part in the research effort. And second, good recruitment and interviewing practices will be followed to ensure the right person in the organisation is selected for interview, including providing advance warning of the interview and highlighting the value of their contribution. The purpose of the interview will be explained in a clear and compelling way, we will use senior interviewers with excellent communication skills, and we will arrange interviews at convenient times and our research team will be flexible as changes are needed. We will aim to achieve responses rates of over 50% with similar respondent groups, which should be sufficient to ensure there is no or limited bias.

3 EXPERIENCE OF PROJECT TEAM

The project team organogram is show below. The project will be led by Ulrika Wising and managed on a day-to-day basis by Paul Noble. Paul Noble and Paul Willson will deliver the majority of the tasks relating to the analysis of the existing evidence on technologies and sectors with the support of Agapi Papadamou, whilst Simon Crook, Nick Goddard and James Ruel will undertake the intervention research and analysis. The whole team will contribute to interviews, stakeholder roundtables and report preparation.



The following table highlights the skills and expertise of our core project team members. We believe we have assembled a uniquely qualified leadership team that, when supported by the full range of experts from within our respective firms, demonstrates to DECC that we possess the breadth and depth needed to succeed in carrying out this research.

Mapping of Required Skills to Core Team Members' Areas of Expertise

Required Expertise	DNV GL			Carbon Limiting Technologies					WSP | Parsons Brinkerhoff
	Paul Noble	Ulrika Wising	Agapi Papadamou	Simon Crook	Nick Goddard	James Ruel	Beverley Gower-Jones	Mark Bornhoft	Paul Willson
Conducting Market Interviews	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓				✓✓
Project selection & eligibility criteria	✓✓	✓✓	✓	✓✓✓	✓✓✓	✓✓✓			✓✓✓
Innovative Financial intervention	✓✓	✓✓		✓✓✓	✓✓✓				✓✓
Detailed Intervention design	✓			✓✓✓			✓✓✓	✓✓✓	✓✓
Industry and SME engagement	✓✓✓	✓✓✓	✓	✓✓✓					✓✓✓
Qualititive Data Analysis -	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓				✓✓✓
Quantative data analysis	✓✓✓	✓✓✓	✓✓✓		✓✓✓				✓✓✓
High quality report writing	✓✓✓	✓✓✓	✓✓✓	✓✓✓				✓✓✓	✓✓✓
Knowledge of State Aid	✓	✓				✓✓✓			✓
Technical expertise of energy efficiency and decarbonisation technologies	✓✓✓	✓✓✓	✓						✓✓✓
Project management	✓✓✓	✓✓✓	✓✓						✓✓
Experience (years)	21	16	8	21	28	13	30	30	42

Key: Expert ✓✓✓ Accomplished ✓✓ Proficient ✓

3.1 Technical capability of team

3.1.1 DNV GL

DNV GL has developed a strong reputation as a prime contractor that is highly capable of managing large-scale, multi-faceted contracts with multiple subcontractors. DNV GL is currently and has recently managed several large-scale contracts for both governmental bodies (DECC, Ofgem) and private organisations (Utilities, investors, generators) in the energy sector. We have in place well-developed contract management procedures and tools to efficiently support this project in a cost-effective manner. Thus, there will be cost efficiency from the very start of the contract through lower start-up costs and well-established contract management and work authorization procedures.

In addition, as prime contractor, DNV GL will manage and coordinate the subcontractor's activities, and we will provide quality assurance such that all subcontractor deliverables meet the requirements of the study plan and that the products meet our standards of excellence. We will also manage the allocation of work to the subcontractor to ensure that the needs of the project are met in the most appropriate and cost-effective manner.

DNV GL also has considerable experience in conducting market assessments either as part of or in support of our more traditional process and impact evaluation projects. These market assessments have included baseline studies, qualitative and quantitative research and attribution analyses. DNV GL will lead the data collection tasks, with an analysis framework based on robust primary and secondary research.

As a contractor for Phase 1 Industrial Decarbonisation and Energy Efficiency Roadmaps, DNV GL has an extensive background in the technologies and pathways and also the barriers and enablers assessed within the roadmaps.

3.1.2 WSP | Parsons Brinckerhoff

WSP | Parsons Brinckerhoff provides technical assistance and project development services for power and industrial projects for industry, investors, lenders, multi-national developers, public utilities, national governments and EU. This includes power generation, transmission and distribution, energy storage assessment, carbon capture and storage and industrial energy efficiency.

As lead contractor for the Phase 1 Industrial Decarbonisation and Energy Efficiency Roadmaps, the company has an extensive background in the technologies and pathways and also the barriers and enablers assessed within the roadmaps.

The company also has a wealth of experience of innovation projects:

- supporting innovators (for example within the DECC Energy Entrepreneurs Fund project)
- undertaking engineering feasibility assessments for a very wide range of technologies including novel carbon capture technology
- through owning patents: Paul Willson, the proposed technology reviewer, is a co-inventor of patented technologies for energy efficiency in thermal desalination and a hybrid combined cycle and nuclear power concept offering exceptional thermal efficiency with simplicity and minimal impact on nuclear safety.

3.1.3 CLT

CLT are well placed to design Directed Technology Challenges. We have very relevant prior experience for designing, setting-up, and managing innovation interventions in low-carbon technology. This includes designing and running grant application competitions, designing directed research challenges undertaking sector specific landscape studies of the UK innovation community and activity, running sector workshops and facilitating companies (corporate and SME) to scope sole or collaborative project proposals, design and managing project appraisal processes at EoI and full proposal stages, liaising with project proposers to review strengths and gaps and shape RD-D projects so they are suitable for government funding, and monitoring projects in progress. Specifically CLT designed, managed, and delivered the following multi-year low-carbon innovation programmes:

- DECC Energy Entrepreneurs Fund. 2012-16. £40m grants and commercialisation support to 80 projects across industry and business sectors.
- Carbon Trust Entrepreneurs Fast Track. 2007-2012. Innovation and technology commercialisation support to c.50 low-carbon projects and ventures across all end-use sectors.
- ERDF CLT Clean Tech Incubator (South East). 2011-2014. £1m programme supporting 30 low-carbon and clean-tech companies in the South East.
- Carbon Trust Advanced Biofuel Challenge. UK landscape study, options for interventions, and selection of supply chain challenges, support to select and structure projects for funding.
- Carbon Trust Pyrolysis Challenge. 2009-11. UK landscape study, industry workshop (c.80 participants), project proposal process, support with project selection and funding negotiation.

Further details are given in Appendix B, including an assessment of the strengths and weaknesses of various intervention schemes by type.

Experience assessing Low-carbon innovation projects

CLT has a process for assessing technology and commercial readiness of low-carbon innovation projects. This has been used to review companies applying for DECC EEF grants. A summary 2x2 matrix is shown

in Appendix B (from EEF phase 4). It is used to show which applicant projects can be improved with support to progress either technology or commercial readiness.

Expertise Innovative Financing

CLT has extensive experience in a wide range of financial areas covering the raising of large funds from international investors, the making and managing of small VC investments, using asset finance instruments, raising capital from public markets through bonds and equity instruments, use of public funding schemes and the application of financial interventions to support delivery of low carbon programmes.

CLT is working with government and industry to create a £100 million equity investment fund cornerstoned by government with matching funding from industry. The Fund will invest in 15 to 20 UK cleantech engineering businesses focussed on moving the companies from proven technology to first-of-a-kind demonstrators and prototypes

3.2 Ability/capability to establish contacts with industry

SME Innovation Community

Carbon Limiting Technologies has worked assisting cleantech start-ups commercialise technical innovation for over 10 years. In that period, CLT worked with over 250 SMEs, a large number of which have focussed on Carbon Capture and Storage, biomass, heat recovery and electrification technologies. A part of the commercialisation service support provided to SMEs is focussed on assisting SMEs to establish relationships with industry partners to enable Joint Development Projects and Trial / Test projects. CLT already has comprehensive industry networks and relationships with all the key stakeholders.

Industry

With regards to industry contacts, the partners are well connected with corporates and would aim through this research to engage with them and identify their technology challenges and ways in which they would be prepared to engage with technology innovators to trial and test first-of-a-kind demonstrators in a collaborative way. This discussion would include mechanisms for project financing.

Industry Trade Associations

All three organisations in the consortium have experience working with the industry trade associations, especially the trade associations representing the energy intensive industry sector. DNV GL and WSP|Parsons Brinkerhoff's experience on the Phase 1 Industrial Decarbonisation and Energy Efficiency Roadmaps, led to the establishment of close working relations with the industry trade associations engaged in that work.

In a recent research study looking for industry groups interested in Low-carbon Technology Showcasing, CLT undertook 20 interviews with industry associations to identify low-carbon showcasing interests, activities, and opportunities. Interviewees included: Manufacturers Organisation-EIUG, Ceramics Confederation, Confederation of Paper Industries, British Glass, Mineral Products Association, Soft Drinks Association, British Retail Association, Environmental Services Association, Industrial and Commercial Energy Association, Energy Networks Association (and Energy Innovation Centre), OFGEM, British Electro-technical and Allied Manufacturers' Association. The key outcomes from this study were the identification of individuals and organisations with an interest and needs for more closely coordinated low-carbon technology showcasing.

UK Knowledge Base

The partners have existing relationships with many UK universities, research organisations and Catapults. In the course of previous low-carbon innovation programmes the partners have liaised with TTOs and academics at UK universities. This has included contracting expert opinions and consulting services. CLT has also provided commercialisation and business services to University spin-out companies. For example CLT has contracted NPL to deliver support to companies on the DECC EEF.

4 PRICING SCHEDULES

DNV GL is pleased to submit a fixed price quote of £78,990 (excluding VAT and expenses). Expenses will be charge in addition and at cost. If DECC would like to fix expenses, we are willing to fix the expenses at £1,500 (excluding VAT). Expenses will relate to travel to London and a roundtable proposed in the North of England. The additional cost of room hire may be necessary if DECC or the project team cannot provide a suitable room.

The split of project costs by day are shown below and by person in Annex A (all excluding VAT).

#	Stage	Days	Cost
1	Project initiation	8.5	£9,120
2	Existing evidence analysis – technology / sector studies	6	£5,680
3	Existing evidence analysis – alternative intervention and funding structures	7.5	£7,750
4	Intervention option development & selection	17	£18,450
5	Intervention market testing & stakeholder review	22	£22,965
6	Detained Intervention design & reporting	14	£15,025
		75	**£78,990**

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.

Signature (duly authorised on behalf of the tenderer)

Ulrika Wising, Head of Section Sustainable Energy Use Europe
Print name

DNV KEMA Ltd
On behalf of (DNV GL)

16/12/2015
Date

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.

Signature (duly authorised on behalf of the tenderer)

Ulrika Wising, Head of Section Sustainable Energy Use Europe
Print name

DNV KEMA Ltd (DNV GL)
On behalf of (organisation name)

16/12/2015
Date

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 

Name Ulrika Wising
Position Head of Section Sustainable Energy Use Europe

Please complete this form and return this with your ITT documentation - Nil returns **are** required.

***** These may include (but are not restricted to);

- A professional or personal interest in the outcome of this research
- For evaluation projects, a close working, governance, or commercial involvement in the project under evaluation
- Current or past employment with relevant organisations
- Payment (cash or other) received or likely to be received from relevant organisations for goods or services provided (Including consulting or advisory fees)
- Gifts or entertainment received from relevant organisations
- Shareholdings (excluding those within unit trusts, pension funds etc.) in relevant organisations
- Close personal relationship or friendships with individuals employed by or otherwise closely associated with relevant organisations

All of the above apply both to the individual signing this form and their close family / friends / partners etc.

If your situation changes during the project in terms of interests or conflicts, you must notify DECC straight away.

A DECLARATION OF INTEREST WILL NOT NECESSARILY MEAN THE INDIVIDUAL OR ORGANISATION CANNOT WORK ON THE PROJECT; BUT IT IS VITAL THAT ANY INTEREST OR CONFLICT IS DECLARED SO IT CAN BE CONSIDERED OPENLY.

APPENDIX A - PRICE SCHEDULE (EXCLUDING VAT)

							Estimated expenses
Grade	**Name**	**Subcontract**	**Hourly rate (£)**	**Daily rate (£)**	**No. of days**	**Cost (£)**	**Cost (£)**
Director	Ulrika Wising	N	£175	£1,400	2	£2,800	£100
Senior Consultant	Agapi Papadamou	N	£99	£795	7	£5,565	£200
Principal Consultant	Paul Noble	N	£156	£1,250	18.5	£23,125	£200
Senior Consultant	Paul Willson	Y	£125	£1,000	5	£5,000	£200
Associate	Simon Crook	Y	£125	£1,000	17	£17,000	£200
Associate	Nick Goddard	Y	£125	£1,000	11	£11,000	£200
Associate	James Ruel	Y	£125	£1,000	10	£10,000	£200
Director	Beverley Gower-Jones	Y	£125	£1,000	2	£2,000	£100
Director	Mark Bornhoft	Y	£125	£1,000	2.5	£2,500	£100
TOTAL						**£78,990**	**£1,500**

APPENDIX B – CONSORTIUM OVERVIEW

DNV GL

With more than 30 years of experience in the evaluation industry, DNV GL is a recognized international leader in the field of energy program evaluation. Our senior staff has pioneered the development of evaluation concepts, methodologies, and tools currently being used by practitioners throughout the world. Our experience cuts across a wide range of evaluation goals and disciplines, touching on virtually every type of program, technology, and targeted sector.

Our experience in conducting impact evaluations has ranged from verification-only to enhanced rigor M&V studies, has included engineering assessments, sophisticated metering and billing analyses, and complex simulation modelling and analysis, and has focused on portfolio-, program- and high-impact, measure-level impacts. Our experience conducting process evaluations typically has included assessments of program design and/or theory/logic models, program administration and management, program implementation and delivery, program marketing and outreach, and customer satisfaction.

We also have considerable experience conducting market assessments either as part of or in support of our more traditional process and impact evaluation projects. These market assessments have included baseline studies, market characterization assessments, market effects studies, and attribution analyses.

Though the bulk of DNV GL's evaluation practice has been centred on the study of energy efficiency program impacts and effectiveness, we have also completed dozens of evaluations of other types of energy programs, including demand response (DR), renewables, and transportation. We have also completed evaluations of a wide range of program impacts, including carbon emissions reductions, employment benefits, improvements in comfort, health and safety, water efficiency and conservation, and other types of non-energy benefits.

DNV GL supports policy makers and implementers in their efforts to achieve energy management and broader sustainability objectives. They share their knowledge of the energy marketplace to help policy makers and implementers make strategic decisions. Targeted research, evaluation and knowledge development provides their clients with the information to create or improve policy, planning and programme implementation.

DNV GL staff is comprised of highly experienced statisticians, engineers and social scientists dedicated to applying their expertise to understanding and addressing energy issues. Whether it is renewable technologies, energy efficiency, or demand response, their customer, market and programme research is designed to provide answers to key client questions. Their programme evaluations are designed to satisfy regulatory compliance and inform ongoing programme improvement.

Key Staff

Paul Noble - Project Manager: Paul's experience covers a range of disciplines including industrial masterplanning and roadmaps, energy efficiency and heat recovery, commercialisation support to cleantech startups, due diligence and stakeholder engagement.

Paul has particular experience in directing multi-disciplinary teams, recently for the Industrial Decarbonisation and Energy Efficiency 2050 Roadmaps and previously in leading the North South Tees Industrial Development Framework Project. He has also led technical due diligence teams and delivered energy efficiency projects within energy intensive industries.

As an environmental consultant, Paul gained wide ranging experience as project manager and director of a range of assignments within the chemical, petrochemical, oil and gas and pharmaceutical sectors.

Ulrika Wising holds a PhD in Chemical Engineering, specialized in Energy Efficiency in Industry and a Master Degree in Chemical Engineering with a process focus. Since leaving academia Ulrika has worked

in the field of Energy Efficiency in Industry. Working directly with industry has allowed Ulrika to see firsthand the effects on European Energy Policy and the regulatory framework that has been a consequence of that policy in the different member states. Since 2007 she has served as an expert for the European Commission in evaluating applications for their different funding program for energy efficiency such as FP 6 and FP 7. In 2012 and 2014, Ulrika was a speaker at the Sustainable Energy Week in Brussels, talking about how behavioral change can lead to improved energy efficiency across Europe. In 2014, Ulrika was also part of a panel discussing the energy collaboration between Europe and Northern Africa and the Middle East during the Sustainable Energy Week. Currently Ulrika is part of the Energy Efficiency Financial Institution Group (EEFIG), supporting the development of a white paper focused on how to increase the investment in energy efficiency.

Agapi Papadamou is a Senior Consultant for Sustainable Energy Use at DNV GL Energy, specialising in providing strategic and technical advice to the power sector. Agapi combines a strong technical background (MEng, MSc) with an extensive experience in the liberalised electricity markets. She has over 7 years of experience in various assignments related to developing legal and regulatory frameworks, including projects for the European Commission on the analysis of power infrastructure requirements in 2020 and 2030, and on the evaluation of energy policy.

Agapi is currently working in the Evaluation of DECC's Electricity Demand Reduction Pilot Scheme, carrying out qualitative and quantitative research with non-domestic population sectors that have participated in the first auction of the scheme. The process includes gathering evidence on how the auction functioned, what worked and what didn't work, and how the scheme has contributed to the organisational change and strategic focus on energy efficiency of the participating organisations. She is also working on a study for the European Commission which focuses on the assessment of Article 8 implementation of the Energy Efficiency Directive. Agapi is leading the quantitative survey task which involves the collection of data from various types of energy service providers and market participants (e.g. large enterprises required to carry out Article 8 compliant energy audits and the relevant suppliers of related services).

She recently led a market research study for Home Automation Systems in 5 European countries in order to increase the understanding of consumer awareness of and interest in home automation systems. Agapi has also carried out an analysis of the Home Energy Management Systems (HEMS) market in the United States of America, trying to quantify the future market opportunity.

Agapi has strong analytical, problem-solving and communication skills and is also experienced in drafting technical tender documents and functional specification papers, as well as evaluating procurement documents.

Carbon Limiting Technologies (CLT)

CLT are well placed to design Directed Technology Challenges. They have very relevant prior experience for designing, setting-up, and managing innovation interventions in low-carbon technology. This includes designing and running grant application competitions, designed directed research challenges undertaking sector specific landscape studies of the UK innovation community and activity, running sector workshops and facilitating companies [corporate and SME] to scope sole or collaborative project proposals, design and managing project appraisal processes at EoI and full proposal stages, liaising with project proposers to review strengths and gaps and shape RD-D projects so they are suitable for government funding, and monitoring projects in progress.

Specifically CLT designed, managed, and delivered the following multi-year low-carbon innovation programmes:

- DECC Energy Entrepreneurs Fund. 2012-16. £40m grants and commercialisation support to 80 projects across industry and business sectors.

- Carbon Trust Entrepreneurs Fast Track. 2007-2012. Innovation and technology commercialisation support to c.50 low-carbon projects and ventures across all end-use sectors.
- ERDF CLT Clean Tech Incubator (South East). 2011-2014. £1m programme supporting 30 low-carbon and clean-tech companies in the South East.
- Carbon Trust Advanced Biofuel Challenge. UK landscape study, options for interventions, and selection of supply chain challenges, support to select and structure projects for funding.
- Carbon Trust Pyrolysis Challenge. 2009-11. UK landscape study, industry workshop (c.80 participants), project proposal process, support with project selection and funding negotiation.

On DECC Energy Entrepreneurs Fund there were 1043 expressions of interest, all of which were screed for eligibility and approximately 800 went through the two stage grant selection process to review technical and commercial strengths of the innovative project proposals. CLT assisted DECC in the design of the technical eligibility and selection criteria, including providing a training day for the technical assessors and the assessment scoring to be used when reviewing grant applications. For the commercial Venture capital assessment day, CLT created a matrix of technical v commercial scoring [see figure on page 8, Experience section) and chaired the VC assessment day.

CLT's delivery of the business and incubation support for DECC EEF programme has included scoping and delivering over 80 tasks [27 by CLT] that were specifically to engage with industry users to determine their interest in an innovative low-carbon technology. There are around 25 technologies related to ICCS, heat recovery, biomass and electrification in the programme that CLT has engaged with on behalf of DECC [list below].

WSP | Parsons Brinkerhoff

WSP | Parsons Brinckerhoff provides technical assistance and project development services for power and industrial projects for industry, investors, lenders, multi-national developers, public utilities, national governments and EU. This includes power generation, transmission and distribution, energy storage assessment, carbon capture and storage and industrial energy efficiency.

As lead contractor for the Phase 1 Industrial Decarbonisation and Energy Efficiency Roadmaps, the company has an extensive background in the technologies and pathways and also the barriers and enablers assessed within the roadmaps.

The company also has a wealth of experience of innovation projects:

- supporting innovators (for example within the DECC Energy Entrepreneurs Fund project)
- undertaking engineering feasibility assessments for a very wide range of technologies including novel carbon capture technology
- through owning patents: Paul Willson, the proposed technology reviewer, is a co-inventor of patented technologies for energy efficiency in thermal desalination and a hybrid combined cycle and nuclear power concept offering exceptional thermal efficiency with simplicity and minimal impact on nuclear safety.

APPENDIX C - CURRICULA VITAE (CV'S)

Paul Noble

Principal Consultant

Personal Statistics:

Citizenship : United Kingdom
Company : DNV GL

Academic and Professional Attainment:

- MSc Hydrogeology, University College London, 1994
- MA Earth Sciences, The Queen's College, Oxford University, 1993

Summary of Professional Experience:

Paul's experience covers a range of disciplines including industrial masterplanning and roadmaps, energy Paul has 21 years experience of planning, delivery, management and direction of consultancy projects in the public and private sectors. Paul's experience covers a range of energy-related disciplines including decarbonisation and energy efficiency roadmaps, industrial energy efficiency and heat recovery, commercialisation support to small scale energy technology startups, due diligence and stakeholder engagement.

Paul has particular experience in directing multi-disciplinary teams and projects with integrated stakeholder engagement, recently for the Industrial Decarbonisation and Energy Efficiency 2050 Roadmaps and previously in leading the North South Tees Industrial Development Framework Project. He also managed an assessment of energy integration possibilities in an industrial area which evaluated possible challenges and opportunities relating to transfer of DNO assets into a private network.

During his time developing business in the energy sector, Paul has developed an understanding of the capacity market (including transitional arrangements, balancing and ancilliary services). In leading a programme of work within the DECC Energy Entrpreneurs Fund, Paul has also built upon his knowledge of Demand Side Response (DSR) and small scale generation technologies (including solar, wind, AD, pyrolysis, fuel cell, CCS, energy storage, waste heat recovery and biofuel) as well as the barriers and enablers to the development of small scale generation projects and technologies.

Present Position

Paul is a Principal Consultant with 21 years of experience of consultancy in the energy and environmental sectors.

Detailed Professional Experience:

DNV GL **2015, present**

Paul is a principle consultant at DNV GL (joining January 11th 2016) where he will take part in leading our energy efficiency work in the UK, including working directly with industry as well as government on projects such as policy evaluation, market potential studies, roadmaps, strategic energy plans and energy culture projects.

Parsons Brinckerhoff **2006, 2015**

Paul was a Project Manager/Director in Parsons Brinckerhoff's Energy and Industry business. Paul also led Business Development activities for Parsons Brinckerhoff's engineering business within the energy and industry sectors.

Industrial Decarbonisation and Energy Efficiency Roadmaps to 2050 for Department of Energy and Climate Change (DECC) and the Department of Business, Innovation and Skills (BIS) 2013, 2015

The project is analysing options for decarbonisation and energy efficiency for eight heat intensive industry sectors namely, cement, ceramics, chemicals, food and drink, glass, iron and steel, oil refining, and pulp and paper. Pathways to decarbonisation and improved energy efficiency will be tested within a number of scenarios using techno-economic modelling, direct technical experience and assessment of corporate activity from social research. The project also includes extensive stakeholder consultation and the development of a series of other outputs including a set of agreed emissions reduction action plans informed by the pathways and analysis of barriers and enablers. These evidence based action plans will be focused on delivery, highlighting high level actions which need to be taken by industry, government and others to achieve 2050 emissions decarbonisation goals.

Early Stage Clean Technology Ventures **2014, 2015**

Delivered a range of consultantcy support to over 12 companies within the Department of Energy and Climate Change Energy Entrepreneurs Fund. Companies supported include power generators (AD, solar thermal, wind power), power networks technology (fault current limiters and voltage optimisation), energy storage and energy monitoring systems.

Technical Due Diligence **2010**

Technical due diligence of the infrastructure of an integrated steel works complex on behalf of the purchaser.

Regional Infrastructure Study and Development Framework **2009**

This major study, undertaken on behalf of sub regional government and agencies within Tees Valley, was developed to (i) undertake technical assessments of assets and infrastructure focussing on energy, utilities (including pipelines and product storage cavities), flood risk, contamination, health and safety consultation zones, ecology, transportation and logistics, (ii) import data onto a GIS for the area (iii) identify physical constraints to development and (iv) develop a strategic framework and delivery programme justifying and prioritising intervention projects, potential investments and funding sources. The findings were presented and debated at stakeholder consultation events organised and facilitated by the project team.

Scoping Study and Options Appraisal for a District Heating Utility for the Tees Valley **2010**

For this project, Paul designed and implemented the data collection and consultation strategy with potential heat suppliers and customers from the public and private sector and facilitated two workshops where potential new district heating schemes were presented and drivers, barriers and risks investigated.

Investigation of potential integration of energy supply and consumption infrastructure in the Tees Valley **2010**

This project included the analysis of heat and electricity requirements of a range of industrial companies and investigation of the options for integration, including provision of recommended business case and delivery models for the preferred option(s).

Water Quality and Treatment Assessment **2009**

Management of a desk study and river and canal water quality sampling programme, the results of which were used to determine suitable cooling water pre-treatment designs. The

project also involved an assessment of current best practices on the design of water intake structure screens and/or barriers and suitable designs for effective dispersion of cooling tower discharge waters.

Site Investigation and Detailed Controlled Waters Risk Assessment 2008
The project comprised design and implementation of the investigation, completion of a groundwater model to simulate plume conditions, collection and assessment of MNA indication parameters, installation of multi level piezometers and preparation of a summarized options appraisial.

Investigation of Vapour Concentrations and Associated Risk Assessment 2008
Project Manager for an investigation of vapour concentrations and associated risk assessment of potential exposure to human health receptors as a result of volatile hydrocarbons from free product. The project involved active vapour sampling, testing of potential leakage using a trace gas (Helium) and risk assessment using BP Risk.

Demolition and Remediation Projects for Private Clients 2007, 2008
Project Director of the environmental consultant team during its input to a £8M demolition and remediation project. PB was required to design and supervise the remediation work and obtain regulatory signoff.

Project Manager for the preparation of detailed specification and associated cost schedule documentation for the remediation of a former oil terminal in northern Scotland. The project also included detailed tender interviews, technical and cost assessment and provision of recommendations to the client.

Project Manager for the preparation of a specification and associated cost schedule documentation for the remediation of a former engine testing and research facility. The proposed remediation included removal of free product from a major aquifer using high vacuum dual phase extraction, excavation and ex-situ treatment of identified contaminated soils above risk based cleanup standards and the use of on-site testing to provide real-time data in relation to sentencing of stockpiled and treated soils.

Project Manager for a remedial options appraisal for a free product interception and recovery scheme at a former oil terminal in Central Scotland located adjacent to a tidal river. Remediation techniques assessed in detail included sheet pile with product recover wells, product collection drain with chambers, slurry wall with product collection wells, permeable reactive barrier with product interceptor and product collection trench.

Ulrika Wising

Head of Section, Sustainable Energy Use Europe

Personal Statistics

Citizenship : Sweden
Company : DNV GL

Academic and Professional Attainment

Doctorate, Chalmers Tekniska Högskola, Sweden, Chemical Engineering, 2003,
Master of Science, Chalmers Tekniska Högskola, Sweden, Chemical Engineering, 1999

Profile

Ulrika leads the Sustainable Energy Use team in Europe for DNV GL Energy and has extensive DSM and Energy Efficiency experience. Her career has been focused on Energy Efficiency and DSM where she has combined her understanding of demand dynamics with the knowledge of the market to successfully help organisations capture the potential of DSM. She has also worked extensively with stake holder engagement activities.

Ulrika Wising has a PhD in Chemical Engineering specialized in Energy Efficiency in industry and a Master of Science in Chemical Engineering with a process focus. She spent two years as a Post-Doctoral Fellow at Ecole Polytechnique de Montréal, managing several large research projects with the objective to optimize the pulp and paper industry.

Since leaving academia, she continued to manage large complex projects. Largest project managed was a 3 MEUR project in Saudi Arabia while working for Belsim s.a overseeing project delivery, quality control and managing customer expectations for SATORP, a newly built refinery. Since 2007, she has worked for two consultancy companies in Belgium, working towards various industries such as, upstream oil& gas, fertilizer, iron & steel, pulp & paper, chemicals, cement and refining looking at both energy efficiency and DSM. She has executed over 20 energy efficiency and process optimization projects for clients such as Total, PetroCanada, Hess,Yara, Resolute Forest Products, Prayon, Rosier, Mondi, Domtar and ArcelorMittal. Having worked with both data validation and reconciliation and data mining, modelling, both first principal and black box, is part of her expertise

Ulrika Wising has successfully developed a consulting business in the field of energy cost reduction in heavy manufacturing and process industries during her tenure as CEO for Pepite s.a., a SME with 20 employees in Belgium. The approach is based on data mining and methodologies like Kaizen, lean manufacturing and 6-sigma. It contains three axes, technology, management and mindset & capabilities to asses current state of energy culture in a company as well as opportunities of DSM. In that context she collaborated with Viridity Energy in the US, to assess the potential for DSM in manufacturing industry

Present Position

Ulrika is heading up the Sustainable Energy Use section in Europe. The main activities in Europe are:

- Help industry improve its competitiveness by improving their performance – Process Optimization, Energy Audits, Energy mapping, ISO 50001 gap analysis and implementation support, Energy Culture and Training
- Policy, Advisory and Research - Help evaluate energy efficiency initiatives, developing roadmaps for the energy transition, Capacity building and market assessments for the new energy economy

When starting at DNV GL, Ulrika developed a new service focused on the change management process needed to improve the energy management culture in a company, going beyond technical solutions. Similar to the concept of Safety Culture, this approach is referred to as Energy Culture

Detailed Professional Experience

- ***Head of Section, SUS Europe - DNV GL 2013, present***

Principal Consultant → Head of Section

As a principal consultant, Ulrika has worked on a list of different projects within the section. As a energy efficiency expert, she has been involved in different industrial client project, helping the clients improve

their energy effiency, change their energy culture or develop strategic plans for the future. Key project are mentioned below:

ISO 50001 implementation and improvement of energy culture for Borealis group 2015-02, present
Project Sponsor for a group-wide implementation of an ISO 50001 energy management system for Borealis, headquartered in Vienna. This project also includes an assessment of Borealis energy culture to identify behavioral and organizational improvement opportunities linked to energy use.

Energy management and energy efficiency in the Norwegian Oil and Gas industry 2015-06, present
Serving as the energy efficiency expert on a project that is developing energy management guidelines for the Norwegian offshore oil and gas industry as well as a database of energy efficiency opportunities, case studies and best practices. This includes guidelines on how to estimate energy consumption and identifying the necessary metering. A method for calculating energy savings and its verification will also be developed.

2050 Decarbonisation roadmaps 2013-11, 2015-03
Project manager for a decarbonisation roadmap project for the Department of Climate Change and Department of Business Innovation and Skills in the UK.

- DNV GL and its project partner Parsons Brinckerhoff carried out a series of investigative workshops across eight industry sectors as part of a UK government project to develop Industrial Decarbonisation Roadmaps to support the UK's 2050 emissions decarbonisation goals.
- DNV GL was appointed to explore the technical options and breakthrough technologies needed for this transition, as well as the social and business barriers and enablers to achieving the reduction targets.
- The project focused on eight energy intensive sectors that together represent around 70% of industrial emissions in the UK: cement, iron and steel, pulp and paper, oil refining, glass, ceramics, chemicals and food/beverage.

Project manager for an Energy Culture project at Dow Corning headquarters in Europe. 2013
Aim of this project was to assess and improve the beahvioral aspects of energy use at Dow Cornings headquarters in Europe linked to how they run their manufacturing processes. The assessment consisted of a number of surveys, interviews and workshop. An action plan was developed and validated by the customer and is now underway of being implemented. Savings of 5% have been observed and sustained since the start of the project.

- ***CEO PEPITe s.a. 2010, 2013***

PEPITe is a data mining company active in the process industry. PEPITe has developed tools, a data mining tool on the cloud, and services to help energy intensive industry become more energy efficient and optimize their processes. By exploiting the process data, it is possible to identify optimal operating schemes to minimizing energy consumption while maintaining production and quality targets as well as identifying bottle necks and equipment inefficiencies. Based equally on change management, typical projects focused on engagement of personnel to achieve sustainable savings and engaged personnel through surveys, questionnaires and workshops.

Main activities at PEPITE were, leading the change from a data mining company to a consultancy and software company. Marketed, sold and executed many different data mining and change management project in different industry sectors such as pulp and paper, fertilizing and steel.

Project manager for energy efficiency project at Prayon s.a., Engis, Belgium, 2012
Managed and executed a large study to optimize the way that the different fertilizing producing processes where run in order to minimize plant energy costs.

Kaizen leader for energy efficiency Kaizen with Resolute Forest Products, 2010-2012
Helped lead Kazen "energy blitzes" for several pulp and paper mills for Resolute Forest Products, the world's biggest newsprint producer in order to help them reduce their energy costs.

- ***Director Sales & Marketing - Belsim s.a. 2007, 2010***

Belsim is a software and service company selling optimization solutions to the process industry based on a data validation and reconciliation approach. By mathematically validating and reconciling process data, faulty sensors can be identify, drift can be detected early, safety limits can be pushed as there is an more accurate picture of the plant performance. This can be then used to optimize the energy performance of a plant

Main activities at Belsim were executing energy efficiency and process optimization project in industry for clients such as Yara, Saudi Aramco and Sabic as well as lead the business development of the company.

Project team member for process optimization project for Yara s.a., Tertre, Belgium, 2007-2008
Contributed to building the process model for both the ammonia and non-ammonia part of the site in Tertre. This was then developed and used to optimize the process and how energy was used.

- ***Post-doctoral Fellow - Ecole Polytechnique de Montreal 2004, 2006***

Successfully managed a large research project related to energy optimization. Worked on different topic sush as LCA, Supply Chain Management and First principal optimization. Organized and participated in a special session at the second largest pulp and paper conference in the world.

Publications and Papers

- WISING, U., LIU, J., VETROMILE, J., "Why is this Facility Different? Measuring Energy Culture to Achieve Continual Improvement in Energy Efficiency", ACEEE Industrial Summer Study, August 2015, Albany, USA
- WISING, U., CHIREZ, S., "Energy Culture, 2014 BEHAVE conference, September 2014, Oxford, UK
- WISING, U., CHIREZ, S., ADAMS, B., "Improving industrial energy efficiency by changing the Energy Culture", ECEEE Industrial Summer Study, June 2014, Arnhem, The Netherlands
- WISING, U., LAFOURCADE, S., "Think You're Energy Efficient?", Paper360°, Sept/Oct 2011
- COUPUT, J-P., CAULIER, R., WISING, U., "Field & installation monitoring using in line data validation & reconciliation : application to offshore fields in Middle East and West Africa", SPE Intelligent Energy Conference and Exhibition, 23-25 March 2010, Utrecht, The Netherlands
- WISING, U., KALITVENTZEFF, P-B., CAMPAN, J., VRIELYNCK, B., "Improving Operations Through Increased Accuracy of Production Data", Society of Petroleum Engineers, Offshore Europe, 8-11 September 2009, Aberdeen, UK
- WISING U., CLOSON H., NOISIER, J-C., "Developing standards in refinery energy management", Petroleum Technology Quarterly, Q4, 2009
- GAUDREAULT, C., WISING, U., MARTIN, G., SAMSON, R., STUART, P., "Environmental Benchmarking of Energy-Related Kraft Mill Modifications Using LCA", Pulp & Paper Canada, Vol. 109: no 12, pp. 23-29.
- WISING U., STUART P., 2006, "Identifying the Canadian Forest Biorefinery", Pulp & Paper Canada, vol. 107: no. 6 pp. 25-30
- WISING, U., BERNTSSON, T., RIEMER, K., STUART, P., 2006, "Strategic Approach to Co-Generation Design", Pulp & Paper Canada, vol. 107: no. 4 pp. 42-46
- WISING, U., BERNTSSON, T., ÅSBLAD, A., 2006, "Energy System Consequences When Installing an Advanced Delignification Process", The Canadian Journal of Chemical Engineering, vol. 84: no.1 pp. 108-115
- WISING, U., ALGEHED, J., BERNTSSON, T., DELIN, L., 2006, "Consequences of Lignin Precipitation in the Pulp and Paper Industry", TAPPI Journal, vol.5: no.1 pp. 3-8
- WISING, U., BERNTSSON, T., STUART, P.R., 2004, "The Potential for Energy and Water Savings through Process Integration", Applied Thermal Engineering, vol. 25, pp. 1057-1066
- WISING, U., BERNTSSON, T., ÅSBLAD, A., 2002, "Usable Excess Heat in Future Kraft Pulp Mills", TAPPI Journal, vol. 1: no.9 pp. 30-32
- WISING, U., BERNTSSON, T., ÅSBLAD, A., 2002, "Energy Consequences in a Minimum Effluent Market Kraft Pulp Mill", TAPPI Journal, vol. 1:no.9, pp. 27-2

Agapi Papadamou

Senior Consultant
Sustainable Energy Use Europe

Personal Statistics

Citizenship : Greece
Company : DNV GL

Academic and professional attainment

2006-2007:MSc Environmental Engineering – Imperial College London
2000-2005:Diploma Chemical Engineering - Aristotle university of Thessaloniki, Faculty of Engineering, Greece

Profile

Agapi Papadamou is a Senior Consultant for Sustainable Energy Use at DNV GL Energy, specialising in providing strategic and technical advice to the power sector. Agapi combines a strong technical background (MEng, MSc) with an extensive experience in the liberalised electricity markets. She has over 7 years of experience in various assignments related to developing legal and regulatory frameworks, including projects for the European Commission on the analysis of power infrastructure requirements in 2020 and 2030, and on the evaluation of energy policy.

Agapi is currently working on a project for National Grid investigating into Best Practice use and implementation of Strategic Demand Side Participation/Response across relevant SOs around the world. She is also working in DNV GL's evaluation of the UK's Electricity Demand Reduction (EDR) Pilot scheme on behalf of the Department of Energy and Climate Change, carrying out qualitative and quantitative research with non-domestic population sectors that have participated in the first auction of the scheme.

Agapi has an international technical and commercial working experience, including an 18-month assignment in California where she was introduced to the energy efficiency and demand side response programmes and technologies in the USA. She also assessed market opportunities, including the policy, legislative, and regulatory context that could be transferred in the UK and European electricity markets.

Expert skills

- Policy evaluation
- Energy efficiency measure evaluation
- Cost benefit analysis
- Stakeholder engagement and workshop facilitation

Summary of professional experience

- Aug 2014 – present: DNV GL, London, Consultant, Sustainable Use Services, Policy Advisory and Research
- Dec 2012 – July 2014: DNV GL, Bay Area, CA, USA, Consultant, Sustainable Use Services
- Dec 2007 – Nov 2012: DNV GL, London, Consultant, Management and Operations Consulting.

Selected Project Experience

DECC **Oct 2015–present**

Core member team for the evaluation of DECC's Electricity Demand Reduction Pilot Scheme, carrying out qualitative and quantitative research with non-domestic population sectors that have participated in the first auction of the scheme. The process includes gathering evidence on how the auction functioned, what worked and what didn't work, and how the scheme has contributed to the organisational change and strategic focus on energy efficiency of the participating organisations

SSE Power Distribution **Nov 2015–present**

Part of core team working on the development and implementation of a randomized control trial (RCT) funded through the UK's Low Carbon Network Fund (LCNF). The initiative (Solent Achieving Value from Efficiency, or SAVE) aims to robustly trial and establish to what extent energy efficiency measures can be considered as a cost effective, predictable and sustainable tool for managing peak demand as an

alternative to network reinforcement. DNV GL was instrumental in developing this project concept and designing the detailed methodology for how it would be implemented. DNV GL is currently performing the role as Trial Design Authority and is responsible for ensuring the robustness of the final outputs of the trials.

Turkish Ministry of Energy and Natural Resources (MENR) Apr 2015–present

Assisting the Turkish Ministry of Energy and Natural Resources (MENR) and the World Bank Acquis in the Acquis Alignment & Institutional Capacity and unbundling of BOTAs. One of the main tasks of the project entails the execution of Regulatory Impact Assessments (RIA) and cost-benefit analyses (CBA) in the fields of energy efficiency, natural gas, electricity and renewable energy. It also includes the identification and development of recommendations for removal of elements hindering further development of the natural gas market in Turkey.

Xcel Energy Minnesota 2014

Electricity Efficiency Potential Study Update: In 2011 and 2012, DNV GL conducted a DSM market potential assessment for Xcel Energy's Minnesota service territory. This assessment covered the period from 2011 to 2020. Agapi was a member of a team which updated the potential assessment for the 2014-2023 period (also 10 years) for electric savings potential. Tasks included updating the measure list for the project, with a special focus on emerging technologies, as well as discount rates, inflation rates, and line loss rates to reflect the latest Xcel Energy assumptions. Additionally, reflect changes to codes and standards (particularly residential and commercial lighting standards), new technologies, and changes to rates and avoided costs

EDF Energy (now UK Power Networks) 2011

Demand Side Management Study: EDF Energy commissioned KEMA to undertake a comprehensive review of international demand response programmes and their relative suitability (and benefit) for incorporation into a UK operational environment. I conducted an international scan of demand response programmes for industrial, commercial and domestic customers; as part of a larger study aiming to identify opportunities or new schemes to defer network investment. Additionally, I carried out an analysis of the demand profile of three large LV customers of EDF, to determine periods with demand reduction potential.

Simon Crook

Associate

Personal Statistics:

Citizenship : UK
Company : CLT

Academic and Professional Attainment:

Master of Engineering, University of Nottingham, Chemical Engineering, 1993
Doctor of Philosophy, University of Cambridge, Chemical Engineering, 1996
Master of Business Administration, Kingston Business School, 2006

Summary of Professional Experience:

Simon has a proven track record in the commercialisation of technology. This experience has been gained by working as a researcher, manager, consulant and investor. This experience was gained in the energy and industrial sectors but his focus has been solely in Cleantech & Renewables for the past 12 years.

Present Position:

CLT Associate delivering consulting assignments for public and private clients in the Cleantech and Renewable sector, including incubation support under DECC's EEF scheme. Simon also invests in and manages operational biomass power project and is a non-executive Director of a energy storage business.

Detailed Professional Experience:

Carbon Limiting Technologies **2012, Present**

Associate

Advisory and management assignments with low carbon businesses and investors, including.

- Incubation assessment and support to CO2 removal technologies, anaerobic digestion, carbon sequestration, and CCS companies
- Helped an anaerobic digestion equipment OEM to extract themselves from a failing partnership and target a more attractive market.
- Worked with a smart grid provider to turnaround their sales pipeline via assessment, acceleration and product relaunch – led to additional £2m investment by shareholders.
- Sales acceleration for a high efficiency boiler manufacturer – led to a doubling of sales.

Texas Pacific Group – Greensphere Capital LLP **2013, Present**

Operating Partner

Greensphere is a specialist investment firm focused on sustainable energy and infrastructure. Greensphere is part of TPG, one of the largest global PE-funds. Responsible for the operations of two biomass plants with a combined capacity of 20MWe and over £15m revenue.

CRESS **2012, Present**

CRESS is developing a flywheel-based energy storage system for industrial energy efficiency applications (e.g. port cranes).

Non-executive Director

Non-executive Director on Board and providing support to new CEO.

CEO
Secured a field trial with one of the World's largest ports, raised over £1m and managed business and team, including recruitment of new CEO and Product Development Director.

Gazprom Marketing & Trading **2010-2012**

Head of Clean Technology
OAO Gazprom is the World's largest natural gas producer. Gazprom M&T is based in London with a worldwide staff of over 1,000 and net income of £360m (2010). The company trades a range of energy commodities as well as having a Retail gas and power operation. The Clean Energy team developed carbon reduction projects and traded resulting emission certificates.

- Member of management team that led the Clean Energy Business Unit and delivered on budget net income of £40m in 2011.
- Secured World's largest coalmine carbon emission mitigation project with Yangquan Coal Group – £60m project. Identified and structured technology supplier partnerships.
- Set up and managed partnership with Dow Chemical to deliver industrial energy efficiency projects in the Oil & Gas industry e.g. LNG liquefaction energy efficiency.
- Turned around GM&T biomass business and executed company's first biomass deal.

Noviatec **2008-2010**

Director
Interim management and consultancy assignments focussed on business planning and development for Cleantech & Renewables businesses and investors. Supported companies to become investor-ready e.g. Building Controls developer, Energy Efficient heating and C&I demand response. Worked as an interim manager for a client to set up its international business offering investment and energy efficiency advice, including a £10m investment JV in China.

Grant Thornton **2007-2008**

Senior Manager, Technology, Corporate Finance,
Full service accountancy company – 5th largest in UK with 4,000 staff and £370m revenues. I secured and managed Cleantech/Renewable corporate finance assignments, cross-sold Grant Thornton services into this sector and delivered thought leadership.
- Secured £2m equity for early-stage energy services business
- Advised on acquisition strategy for UK waste recycling business

ANGLE
2002, 2007

ANGLE, AIM-listed company with a £30m market cap, both advised and created technology businesses – ANGLE owned a portfolio of companies.

Venture Associate
Management of technology partner relationship leading to 3 new investments, and managed the exit from an existing portfolio business.

Low Carbon Incubation Manager

Director of a low carbon incubator that supported 16 companies to raise a total of £43m. Companies were developing marine energy devices, wind turbines, solar systems, fuel cell units, materials discovery, electric motors, catalysts and biofuels.

Senior Consultant
Developed multiple business plans for technology start-ups, corporate spinouts and infrastructure-based entities (e.g. science parks and innovation centres).

Scientific Generics (now Sagentia)
2000, 2002

Senior Consultant, Business Venturing team
Sagentia has revenues of £20m and develops new technologies, products and services.

- Developed a new market entry strategy for Oerlikon (£1.4b revenues) into the optical telecoms equipment market: analysis, strategy development and implementation support. Led to the creation of a £multi-million revenue business
- Worked with NCR (£3.1b revenues) to review its 1,500 patents, identify value, invest where appropriate and realise value. Led to creation of IP Advisory practice at Sagentia.

ExxonMobil
1997, 2000

Product Development Engineer
Worked within the Automotive Fuel & Lubricants team formulating both market-ready products, as well as leading multi-disciplinary teams to solve near-term technical problems.

Beverley Gower-Jones

Personal Statistics:

Citizenship : United Kingdom
Company : CLT

Academic and Professional Attainment:

B.Sc 2:1 University College Cardiff, Mining Geology

Summary of Professional Experience:

Beverley Gower-Jones is a business leader with proven track record in pre revenue, clean tech investments and commercialization. She founded CLT in 2006 and has supported low carbon ventures in a wide range of sectors including energy efficiency, transport, distributed generation, renewables. During her tenure at Shell International she gained wide exposure to businesses globally and delivered the £500 million subsurface technology transfer programme to worldwide operations. Beverley was founder and Vice President at Shell Technology Ventures In this role she was instrumental in defining Shells technology venturing strategic approach. She has 30 years industry experience, 20 of which are in technology commercialization and corporate venture management including at QinetiQ a portfolio of 8 ventures with a total value of £60 million. Currently she chairs the DECC Energy Entrepreneurs Fund VC panel responsible for final grant investment decisions and is Chair of a flywheel energy storage venture.

Present Position:

Founding Partner and Director, Carbon Limiting Technologies. CLT focuses on delivering business growth in cleantech ventures by providing specialist commercial support to incubators, corporate venturing portfolios, government agency programmes and investors. Beverley has extensive senior management experience running teams that support ventures with insightful analysis in defining customer value propositions, business strategy and planning, route to market analysis, investment readiness. The company has experience across renewables, distributed generation, industrial and buildings energy efficiency bio& waste to power, low carbon materialsm smart grid.

Her personal responsibilities include C-level client relationship management, quality of performance and deliverables, efficiency and effective team management, strategic input and engagement, presentation and facilitation at senior levels in corporate organisations.

Other Information:

Member of Energy Institute

Detailed Professional Experience:

Carbon Limiting Technologies 2006, present

Department Energy & Climate Change – Energy Entrepreneur Fund (£40 million grant Programme)

Chair the VC panel for DECC grant investment decisions. Designed grant technical assessment & claims process. Established, co-directed & managed delivery of commercial support services to 80 clean tech SME's funded by DECC. Co-developed diagnostic tool to assess commercial strengths & weaknesses of projects. Assessed over 60 SME's and written gaps analysis reports. Reviewed 80 diagnostic reports. Managed consortium team to deliver 350 support tasks to SMEs, focussing on route to market, value proposition, fund raising, licensing, business model and strategy. Assisted in strategy and preparation of business plans, industrial partner selection. Chair and shareholder of start-up in flywheel energy storage. Secured £1 million grant funding, recruited CEO and product director into business.

ERDF CLT Cleantech Incubator (1m business support programme, SE England) – Designed and won programme to deliver incubation support to innovative low carbon technology companies in SE England. Supported 30 companies over a 3 year period.

Carbon Trust Entrepreneurs Fasttrack Programme & Applied Research. Managed the incubator programme delivery to The Carbon Trust providing support to cleantech SME's. Responsible for sourcing innovative technology companies securing Carbon Trust support budget, engaging associates to deliver scopes of work.

Worked with approx. 40 low carbon companies across a broard range fo sectors.

QinetiQ 2003, 2006

Performance Director New Business Accelerator

Responsible for mentoring the portfolio of new growth businesses (7 to10 early stage, total QQ investment £60 million). Sucessfully managed re-organisation of the portfolio to meet NBA strategic goals. Creation of one new venture, closed 5, recruited new management for 2. Responsible for governance and operations of NBA (20 staff) including meeting MD's to understand key commercial issues and allocate appropriate resource(80% of NBA resource on top 10 QinetiQ issues). Accoutable for the NBA rofit and loss (£1.7 million).

Corporate Enterprise and Investment programmes.

Managed QinetiQ's Enterprise Programme (£300k) including designing and running competition events, ranking seed investment opportunities, giving inventors feedback, follow-up on investments made. Finding and building relationships with potential corporate partners who could bring the technology to market. Created stage gate processes, review processes and opportunity identification criteria for investment in potential start-up businesses.

Shell International 1986, 2003

Vice President, Shell Technology Ventures 1999, 2003

STV's key role was to grow Shell's core business by delivering novel technologies to the Shell operating units before the competition. STV invested as a corporate investor in technology start-ups that had the potential to achieve this aim. STV also managed this portfolio of start-ups. Responsibilities included:- Leading the team which ranked and recommended to Board (Shell CFO, Head R&D) which of Shell's technologies were most likely business opportunities & suitable for external partnering & investment. 4 companies spun-out of which one is now worth £1billion. Created business plans for drilling & completion technologies including drill bits, drill pressure machine, pipe welding, water purification processing technology. 4 of these are start-up businesses today with a total value of some $ 70 million.

Designed and delivered Shells International subsurface R&D programme across 15 countries worldwide. The R&D spend was approximately £500 million. This included:-Landscaping and identification of the research areas for support Designing the stakeholder engagement process including facilitating workshops Establishing and agreeing the budget spend per programme Securing top level sign off for the complete set of programme.

Geologist, Team Leader, Strategy 1986,1999

Held a broad range of line management roles at Shell International, my experiences include,

- Shells expert in subsurface 3D reservoir modelling. Setting strategy and direction for 3D reservoir modelling technology. Responsible for leading edge technology transfer from research into operating companies through teaching formal courses at Shell Training Centre and consultancy projects for operating companies.
- Senior analyst in strategy and positioning at Research Centre in Rijswijk. Responsible for identifying future business trends and evaluating Shells positioning
- Created and led a young team providing services to operating unit clients in "reservoir architecture integrated services". Experienced at mentoring graduate recruitment.
- Senior Production Geologist, multiple projects. Gorgon Field, Australia, - conducted an innovative approach to volumetric reviews called "scenario based volumetric review", increased volume of gas in place from 11 trillion cubic feet (TCF) to 30 TCF. Presented work to partners that enabled a major liquefied natural gas (LNG) development to proceed ($2 billion capex).
- Specific technical & line management roles in North Sea, Brunei, Egypt, & Holland. Worked as part of many multidisciplinary teams to analyse complex data, create and execute field development plans, well proposals.
- P319 - Developed training course in 3D reservoir modelling for senior geologist professionals, involved taking the course to Spain for a week.
- P287 - Founder and lead trainer for 2 week classroom based course for 3D reservoir modelling.
- On Site training - Exported the reservoir modelling training to Shell operating units globally including, Nigeria, Australia, Oman, Malaysia, Brunei, Norway, USA, Egypt.
- Attended formal "Train the Trainer" learning course.
- Designed and lead workshops to brainstorm innovation & strategy around a topic e.g. microseismicity

Mark Bornhoft

Partner, CLT Ltd

Personal Statistics:

Citizenship : UK

Company : CLT

Academic and Professional Attainment:

B.Sc (Joint Honours, 1st Class) Mathematics & Physics, University of Manchester, 1984
EMBA, University of Otago, 2000

Summary of Professional Experience:

Mark Bornhoft is a business leader and manager in technology commercialisation with broad experience in low-carbon and energy sectors. He has extensive experience over 10 years evaluating low-carbon technologies, early stage ventures, and supporting innovations to reach the market. His background is in the interface between technology and business and he has been CEO of a start-up business through to sale of the technology, a VC investment manager, and an earlier career in the electricity and telecommunications sectors with roles covering R&D, Product Development, Technology Marketing, Client Management, Innovation Programme Manager, and General Manager/CEO.

Present Position:

Partner and Director, Carbon Limiting Technologies, a consultancy specialising in commercialising clean technologies by delivering support to innovators, SME's and Corporates, and Government to identify target markets, market requirements, develop routes to market, business plans and raise funding. Support is delivered to private and public sector clients oftern via management of multi-year innovation support programmes.

Personal responsibilities include: programme design and management, business-project-technology appraisal and diagnosis of strengths and gaps, industry engagement, recommendations and actions to address gaps and risks in technology development and commercialization, resource direction and management. Experience across: renewables, distributed generation, industry and building energy efficiency, bio & waste to power and fuels, low-carbon materials, Smart Grid, communications technology.

Other Information:

Detailed Professional Experience:

Carbon Limiting Technologies **2011, present**

Partner and Director. Carbon Limiting Technologies is a consultancy specialising in commercialising clean technologies by delivering support to innovators, SME's and Corporates, and Government to identify target markets, market requirements, develop routes to market, business plans and raise funding. Responsible for business management and development, programme design, management and delivery. Also responsible for consulting tasks in evaluation of low-carbon technologies, technology commercialization projects, venture diagnosis and growth planning. Experience includes working with: renewables, distributed generation, industry process efficiency, building energy efficiency, bioenergy & waste to power and fuels, low-carbon transport and smart grid applications.

DECC Energy Entreprenuers Fund (£40m grant and incubation programme) 2012- present
Established, co-directed and managed business incubation support programme to 80+ clean tech ventures funded by DECC. Co-designed grant technical assessment and claims process. Developed diagnostic tool to assess commercial strengths & weaknesses of projects. Assessed business and project diagnostic reviews for all companies and guided action plans. Scoping and arranging resources for support tasks. Co-managed suppliers and consultancy team to deliver over 350 tasks to SME's across market engagement, business planning, investment readiness, route to market and industrial partnering. Undertook or directed selected tasks in market engagement and business support for low-carbon technology developers involved in: distributed energy/ microgeneration, renewables, lighting, smart-buildings, smart-grid, biomass/waste to fuel, waste heat to power.

ERDF CLT Cleantech Incubator (£1m business support programme, SE England) 2011-2014
Co-managed programme to deliver specialist business support to low-carbon innovative low-carbon technology companies in SE England. Delivered consulting tasks on behalf of grant recipients including: market engagement, growth and business planning, investment readiness, sourcing expertise, market research.

Other projects have included: due diligence for investors (dual-fuelling for HGV, energy harvesting, fault current limiters for smart grids, etc

ANGLE Plc **2006-2010**

Low-Carbon Business Programme Director

Programme Director ANGLE Low-Carbon Business Incubator for Carbon Trust. Also co-led ANGLE team setting-up Pyrolysis Challenge and landscape analysis for Advanced BioEnergy Challenge for Carbon Trust. Responsible for business development: sourcing innovative companies. Undertaking and writing applications to secure incubation support budget. Diagnosing requirements to move early stage projects forward. Scoping tasks, organizing and directing consultant resources to deliver tasks. Working with entreprenuers and technologists to develop commercialization plans. Engaging with industry to discover needs and requirements for low-carbon technology.

Worked with c.45 low-carbon technology projects building familiarity across all sectors. Responsible for team of Associate consultants and revenue of c.£2.5m over a 5 year period to deliver technology commercialisation support to clean tech projects and ventures.

Polarmetrix Ltd **2003-2006**

CEO, technology start-up

CEO for Polarmetrix a spin-out company from the University of Surrey developing distributed fibre optic sensors. Raised £0.5m in seed funding and demonstration revenue. Took patented optical fibre sensor technology from lab demo, through development and application tests, commercial engagement, and company sale. Undertook market engagement to find first application, built relationships with clients and technology acquirers. Obtained paid demo projects from BP, TOTAL, and a leading business in the security sector. Sourced a buyer and managed successful sale of the technology business to a VC backed company in the oil & gas and perimeter security sectors.

ERA Technology **2000-2002**

Business Unit Manager, for services to BT

Responsible for business unit delivering software integration, test verification and validation services to British Telecom Adastral Park including: emergency services, broadband ADSL, IP networks, and intelligent networks. Managed and grew division from 40 to 80 engineers, permanent and contract staff. Put in place team management structure to enable more efficient scaling of team sizes and transfer of knowledge to new team members. Developed

new business areas with client. Developed sales process and sales tools for Cisco IP Telephony team taking services to new clients.

Caltech Capital Partners **1997-2000**

Investment Manager

NZ venture capital fund placed $35m from AMP private capital, St Georges Bank and Taiwanese fund into software, agritech, and other technology ventures in NZ.

Consultant to Technology New Zealand Programmes

- Worked with selected technology companies to develop grant projects
- Managed project to encourage technology-led innovation within SME clusters in Food & Drink.
- Developed process to selectively commercialise outputs from Crown Research Institutes.

Electricity Corporation of New Zealand **1991-1997**

Business Account Manager

Responsible for wholesale electricity contracts with power utilities and major buying groups. Negotiated and managed contracts worth $400m pa. Designed and implemented new contract structures to accommodate separation of transmission and energy provision, and de-regulation of wholesale power trading market. Specifically developed new commercial contract structure (including "locked-box" credit control and partent company guarantees) to enable smaller unilities to club together to purchase wholesale power via "buying groups" which became the corporations largest direct customers, but lacked asset backing. Part of team structuring and issuing new half-hour spot and hedge pricing contracts.

Bell Northern Research / Northern Telecom (Nortel) **1988-1990**

Business Network Applications Team

Responsible for UK/EU market input into switch-computer interface product development. Specifically represented Nortel in EU standards fora. Designed strategy that led to a commercially viable industry standard for switch-computer interfaces and their use for novel applications. Lead the coordination of interface design and input to industry standards bodies in EU (ETSI) and into US teams (IEEE). Developed system designs for early voice-data business applications of ISDN and IP networks and presented to clients and internally to gain support for technology development and trials.

GEC Hirst Research Centre **1995-1888**

Systems R&D Engineer

Mathematical modeling of optical fibre and radio telecommunications systems. Part of team developing models to determine design for GSM use of spectra. Developed bit error rate models for homodyne and heterodyne optical communcations systems.

Visiting Engineer position with Australia Telecom, Melbourne, development mathematical models of Fabry-Perot filters and optical fibre communication systems.

Nick Goddard

Consultant

Personal Statistics:

Citizenship : United Kingdom
Company : CLT

Academic and Professional Attainment:

BA in Natural Sciences (Physics), Cambridge University, 1983
PhD in Materials Engineering, Imperial College, London, 1988
Chartered Physicist (CPhys), Institute of Physics, 1991
Chartered Engineer (CEng), The Engineering Council, 1992

Summary of Professional Experience:

Nick trained to Chartered status as both a scientist and an engineer and during the first ten years of his career gained experience in the oil & gas, power generation, aerospace and defence industries. Starting as a hands-on technologist, he migrated progressively into strategic planning, marketing and business development, ending up as the Business Development Manger at the Ministry of Defence's Structural Materials Centre with responsibility for identifying commercial opportunities for military technologies. He was seconded from the Civil Service to an investment bank which he subsequently joined full time. He worked in the City for the next eight years as a Corporate Finance Director advising technology sector companies on public and private equity funding rounds. Nick left banking in 2005, and since then has worked as a consultant specialising in the financing and commercialisation of new technologies with a particular emphasis on clean energy and advanced materials. His assignments have included technical due diligence for various private equity funds, working with multiple technology start-up companies in both executive and non-executive roles, advising Carbon Trust on its innovative 'Accelerator' model for funding the development of carbon reduction technologies, lead author on the Carbon Trust roadmap for thin film photovoltaics and the NESTA roadmap for financing industrial biotechnology, and supporting IP Group plc in the management of its early stage investment portfolio.

Present Position:

Chief Financial Officer of the IP Group portfolio company Spinetic Energy Ltd and Non-Executive Director of the IP Group portfolio company Seren Photonics Ltd.

Detailed Professional Experience:

Spinetic Energy Ltd **2013-present**
Founder Director and Chief Financial Officer of this start-up company which is developing a novel form of wind energy capture system based on modular panels. Raised an initial VC investment of £1.2m.

Thought Canal Ltd **2005-present**
Working through this wholly owned Consultancy Company since 2011 (and before that as an independent consultant), Nick has undertaken a wide range of consultancy projects.

NESTA
Lead author on the October 2011 NESTA report 'Financing Industrial Biotechnology in the UK'.

IP Group plc

Various assignments including interim CEO of C-Capture Ltd, a portfolio company with a novel CCS solvent, and due diligence on Ceres Power prior to the IP Group investment.

Infinitus Ltd
Various assignments for this consultancy company set up by a high net worth Indian family with interests in mining and logistics to advise them on investment opportunities in renewable energy.

Day 1 Energy Ltd
From October 2011 to March 2012, interim CFO of this company which was set up to originate, finance and manage energy efficiency retro-fit projects aimed at commercial and public buildings.

Angle plc
Working through Angle, acted as an advisor to the Carbon Trust responsible for devising the 'Research Accelerator' commercialisation model in which early stage R&D grant funding was committed in parallel with establishing a corporate vehicle to exploit successful outcomes from the work. Funding was allocated through this mechanism to organic photovoltaics, waste pyrolysis, algae biofuels and polymer fuel cells. Business mentor to various early stage companies through the Carbon Trust Entrepreneurs Fast Track.

Advantage West Midlands
Advisor to Advantage West Midlands on the use of ERDF funding to provide grants stimulating the formation and incubation of technology start-up companies. Mentored more than 20 SMEs during formation and investment readiness phases. This work was contracted via Birmingham Research and Development Ltd.

Pira International Ltd
Completed at least ten projects for large financial institutions carrying out technical and commercial due diligence on potential private equity investments. From 2005 to 2008 this service was offered through Pira International Ltd (then part of BASF).

Heliswirl Ltd
From 2007 to 2009, part time CFO of this VC-backed spin out from Imperial College exploiting a novel design of pipe aimed at the petrochemical and upstream oil & gas industries. Completed a £700k funding round in 2008 and multi-million pound asset sale to a large multinational in May 2009.

ABN AMRO Bank, London **2001-2005**
Executive Director in the Technology Sector Team. Marketed ABN AMRO's investment banking services to technology sector clients with a particular focus on fast-growing SMEs. Relationship manager through which clients accessed the bank's various product groups (corporate finance, advisory, capital markets). Also responsible for preparing sector analyses, risk assessments and strategic planning documents for internal use by the bank. Maintained a close relationship with key technology sector VCs. Co-opted Member of the Strategic Advisory Group at the Institute of Materials.

ING Barings Bank, London **1999-2001**
Director, Corporate Finance Group responsible for originating and executing corporate finance advisory mandates from technology sector clients across Europe.

Banque Paribas, London **1997-1999**
Joined Paribas' originally on secondment from the MOD, becoming a full time employee after six months. Worked on technical due diligence, the preparation of technology-based

investment cases and providing financial advice, mainly on public and private equity financing rounds.

DERA Farnborough (now QinetiQ) **1995-1997**
Recruited by the Defence Evaluation & Research Agency (DERA) as Sales Manager of its newly established Structural Materials Centre with revenues of £20m p.a. Subsequently transferred to the central Project Management and Consultancy Group set up to help prepare for privatisation. Selected for a six month secondment to the City to gain financial experience.

ERA Technology Ltd, Leatherhead (now Cobham plc) **1992-1995**
Joined ERA as an engineer working on the technical and economic evaluation of engineering data from power generation and chemical plant assets. Subsequently appointed Business Development Manager for the Materials Engineering Division. Responsible for marketing condition assessment services to clients in twenty countries. Elected Member of Council at the Institute of Materials.

BP Research Centre, Sunbury-on-Thames **1988-1992**
Recruited to conduct research and development projects in the area of advanced engineering materials. Subsequently moved into technical and economic analysis evaluating the potential impact of advances in materials engineering on BP's core businesses.

Rolls Royce, Derby/Imperial College **1983-1988**
Doctoral research using electron microscopy to study the relationship between microstructure and mechanical properties in titanium aerospace alloys for RB211 compressor disks.

James Ruel

Consultant

Personal Statistics:

Citizenship : United Kingdom

Company : CLT

Academic and Professional Attainment:

M.Litt, University of Bristol, 2003
MA, Medieval Studies, University of Bristol (Commendation), 1999
BA (Hons) History, University of London (First), 1998

Summary of Professional Experience:

James Ruel is an experienced freelance project and programme manager, with expertise in project and programme development, bid writing, project and programme set up, implementation and management. He has extensive knowledge and involvement with European and UK funded innovation projects and programmes. He has directed and managed programmes addressing environmental, sustainability and skills agendas. The European Regional Development Fund (ERDF) Competitiveness programme focused on promoting sustainable production and consumption, while the European Social Fund (ESF) programme focused on new and emerging high-growth technologies.

Present Position:

Consultant providing ongoing support to the Department for Energyand Climate Change's Energy Entrepreneur's Fund, business process development and supporting the integration of the Smart Systems Heat Team into the Energy Systems Catapult and bid writing for various European and national funding streams and competitions.

Detailed Professional Experience:

CLT Associate **2012, present**

Support to DECC Low Carbon Innovation Programme 2012, present
Partner in successful consortium to join Department for Environment and Climate Change Low Carbon Innovation Programme framework panel, to support the department in managing and delivering its Low Carbon Innovation Programme. Provided programme management function to the Department (Feb 2014 – Aug 2015) for the Energy Entrepreneur's Fund, including managing the third and fourth application rounds. Carrying out assessments of Energy Entrepreneur Fund applications and business incubation support assessments of successful applicants.

Energy Systems Catapult 2015
Supported the integration of the Smart Systems Heat Team into the Energy Systems Catapult and developed the Catapult's programme, project and contract management templates, processes and guidance.

Bid writing for various clients 2012 - present
Bid writing for various European and domestic funding streams and competitions for various clients, predominantly micro and small enterprises in the fields of innovation and business

support for low carbon energy, clean tech SME, rural tourism SME and NHS focused partnership.

South East England Development Agency **2003, 2012**

SEEDA was the regional development agency for the South East of England. It had one aim: to support the economic development of the South East as a world class region. The government decided to close all regional development agencies by March 2012.

European Programmes Manager (Business and Skills) 2007-12

- Managed SEEDA's ESF Co-financing programmes and the South East ERDF Competitiveness programme (c.£4m direct and c.£5m influenced expenditure pa).
- Managed the transition and closure of SEEDA's ERDF Interreg and Seventh Framework Programme projects.
- Negotiated regional programme strategies with the European Commission, central government and regional partners.
- Supported development of regional Financial Engineering Instrument.
- Acted as an ambassador for SEEDA for ERDF and ESF to key regional partners at all levels of seniority.
- Led the development and implementation of ERDF operation processes into SEEDA in line with regulatory requirements and central government guidance, including assessment and selection and management and monitoring processes.
- Liaised with other RDAs to negotiate developments on RDA role in additional European programmes, e.g. Interreg and Cross-border Co-operation.
- Raised awareness of the European funding issues in clear and accessible terms for Chair, Chief Executive and Executive Board through briefings and presentations.

European Social Fund Manager 2006–7

- Represented SEEDA on the South East ESF Regional Committee and South East Co-financing Organisations' Strategic Group.
- Negotiated SEEDA's 2007-10 ESF Co-financing programme with Government Office for the South East, Learning and Skills Council and JobCentre Plus and developed SEEDA's plan for this.
- Implemented the 2007-10 ESF programme at SEEDA, worth c. £6 million over the period
- Represented the agency as a speaker at key regional information events, including Sandown Park October 2007.
- Managed submissions for board and agency wide reports as well as input into corporate planning and business planning activities.
- Authorised interim claim payments to projects and variations to contracts.

Senior European Social Fund Executive 2005-6

- Ensured consistent approach amongst ESF project managers, to comply with the ESF regulatory framework.
- Advised ESF project managers to achieve project delivery to time and budget.
- Supervised the team in the absence of the European Social Fund Manager.
- Revision of project management systems to ensure compliance with ESF regulations (e.g. Open and Competitive Tendering rules).
- Negotiated programme budgets with Government Office for the South East and internal SEEDA staff.
- Led and advised on application assessment and contract negotiations with external providers (e.g. Business Links, universities, private training providers and local councils) at all levels.
- Produced of reports and recommendations for Core Executive and Executive Directors on programme and project performance for a portfolio of projects.

European Social Fund Contract Executive 2003-4

- Managed a portfolio of ESF and match funding projects and ensured accuracy and compliance of delivery.
- Successfully negotiated contracts with providers to ensure that projects are achievable, offer value for money and provide added value to the programme.

- Carried out assessments on ESF applications.
- Participated in the on-going systems review process within the ESF team to ensure management information is complete and accurate.
- Managed publicity for the programme and raised its profile within SEEDA and externally
- Played a leading role in compiling the Project Closure Report for the 2002 to 2003 programme.

Motability Operations **2001, 2003**

Fleet Administrator **2001-3**

- Managed process and budget to recover abandoned vehicles.
- Authorised release of contract hire vehicles to customers and return of vehicles at the end of the contract.

University of Bristol **2000, 2001**

Teaching Assistant 2000-1

- Taught Introduction to Medieval History to first year undergraduates.

Paul Willson

Consultant

Personal Statistics:

Citizenship : United Kingdom
Company : WSP|Parsons Brinkerhoff

Academic and Professional Attainment:

Master of Arts (Honours), Electrical Sciences, University of Cambridge
Institution of Engineering Technology: Fellow
Chartered Engineer

Summary of Professional Experience:

Paul Willson has broad-based international experience across a wide range of technologies for the generation of power and the application of energy in various industrial sectors. He has led projects involving fossil, renewable and nuclear energy addressing particularly the thermodynamic and economic issues in their application. Paul has been responsible for leading teams addressing the technical and commercial aspects of development of a series of major billion dollar power plant projects. He has led large scale studies addressing decarbonisation strategies and energy consumption within many sectors of the economy. Paul has performed strategic and high level studies for investors, utilities, government departments and regulatory authorities internationally, including establishing widely-used benchmark costing data for the power sector. He leads innovation activities for power generation including the invention of a series new processes and process improvements patented byWSP | Parsons Brinckerhoff.

Detailed Professional Experience:

WSP | Parsons Brinckerhoff Ltd 1980, present

Head of Innovation (2013 to present)

Project Director advising DECC on the development of an assessment methodology for small modular nuclear reactors involving industry experts and reactor vendors.

Sector Lead for one of eight industrial sectors, and senior consultant for the project, reviewing decarbonisation options for energy intensive processes, working closely with trade association and industry specialists to identify technical options and assess their impacts on carbon emission and costs to prepare a series of decarbonisation roadmaps to 2050 for DECC.

Project Director for a review for a major bank examining the UK nuclear industry and the status of and challenges facing new nuclear construction, considering particularly the technical, regulatory and construction risks.

Senior Consultant for a study for a major investor to assess the issues, costs and limitations of large scale application of solar power generation in Oman, addressing both the technical and commercial issues of introducing such technology into the privatised electricity market.

Senior Consultant to a variety of clients supporting the evaluation, optimisation and market positioning of energy and low carbon innovations. The technologies included an oxy-fuel carbon capture technology, a hybrid solar PV system and a novel energy storage cycle.

Led innovation development for WSP | Parsons Brinckerhoff funded initiatives including patent preparation for novel technologies and technology marketing for existing concepts, including WSP | Parsons Brinckerhoff's hybrid nuclear/thermal NuGas technology.

Deputy Director of Engineering, Manager of Development and Emerging Technologies Group (1999 - 2013)

Project Director for the development and contract negotiation of a 20 MW straw-burning biomass plant in Yorkshire including support for the financial analysis which lead to adjustments in plant fuel mix and capacity.

Project Manager for the update of the cost dataset for the DECC levelised cost model for a range of different power generation technologies.

Project Director for a series of studies to re-power existing combined power plants of 210-750 MW with biomass. The studies addressed the issues of fuel choice, delivery route and handling and storage on site as well as the optimum reuse of power plant assets. Two of the sites considered are progressing to implementation.

Project Director for a study to upgrade the 120,000 te/y Dundee waste to energy plant, examining the plant history and performance and identifying and evaluating options to extend the life of the plant to 2030 while taking account of the changing legislative requirements in Scotland. A comprehensive financial model was developed to assess the impact of modifications on the gate fees necessary to make the project viable.

Lead Peer Reviewer of the proposed 65 MW biomass plant design for Stallingborough, responsible for revisions to various significant elements of the specifications to reduce costs and better allocate risks between the contract packages.

Lead Author and Manager of a major WSP | Parsons Brinckerhoff funded multi-disciplinary study of UK energy consumption and carbon emissions to 2050 entitled Powering the Future. The two year study examined potential means of reducing carbon emissions in every sector of the economy, comparing their effectiveness when assessed for their direct and indirect impacts. Established the study methodology, led the WSP | Parsons Brinckerhoff team and presented the study as the IMechE prestige Thomas Hawksley Lecture. Briefed a wide range of interested governmental, political and other bodies and contributed to the extensive media coverage including radio news interviews and diverse articles and interviews for the press.

Manager of the 2010 update of the WSP | Parsons Brinckerhoff benchmark Powering the Nation generation plant costing study originally undertaken in 2006.

Co-inventor and Project Manager for the development of NuGas, a new combined cycle power plant design offering exceptional thermal efficiency. This ongoing project has involved extensive analysis of thermodynamic and economic performance and is progressing to identify a suitable host site and launch customer.

Adviser to the Office for the Regulation of Electricity and Gas and Department of Enterprise, Trade and Investment in the oversight of the award and operation of a series of licenses for gas transmission and distribution in Northern Ireland.

Responsible for the development of large scale power or power and water cogeneration projects and for Lender's Engineering, including direct involvement as Project Director for:

Advising Marubeni as investor in the Taweelah A2 IWPP

Lenders' Engineer for the 2740 MW and 800,000 m3/day Marafiq Jubail IWPP whose funding totalled $3.9 billion.

Contributed as technical lead in a joint study with NERA for the Regulatory Supervisory Board in Abu Dhabi to assess the optimum future plant provision in the face of fuel demands exceeding gas availability.

Adviser to International Power on the design and implementation of facilities to permit four IPPs on process sites in Saudi Arabia to island electrically from SEC.

Project Director for the development and successful negotiation of the acquisition and extension of the Taweelah B IWPP (Abu Dhabi) to 2000 MW and 160 migd. This assignment involved close involvement with the development of the bid followed by negotiations with Siemens and Fisia, to complete the EPC contract, and with ADWEA and their advisers to finalise the large and complex PWPA and its appendices. The overall investment on this project totalled $3 billion.

Project Director for Lenders' Engineer services for the Umm Al Nar IWPP, Abu Dhabi, for HSBC and Bank of Tokyo Mitsubishi. The scope included the successful issue of a draft due diligence report within four weeks of appointment.

Project Director leading the investigation and advising on the resolution of a steam turbine water ingress incident at AES Barry, South Wales.

Successful development and subsequent management of construction of the Shuweihat 1500 MW/100 migd power and water plant for a consortium of CMS Energy and International Power in Abu Dhabi.

Successful development of a 750 MW/40 migd power and water plant for AES Oasis for the Ras Laffan project in Qatar.

Co-inventor of a patented process improvement to the MSF desalination process which enhances the performance of the integrated water and power plants.

UK: Manager, Development Engineering (1997 - 1999)

Responsible for the management and development of power generation projects, including feasibility studies, due diligence assessments, and plant implementation projects. As a Project Manager he has had responsibility for:

Development of an 800 MW power plant in Southern England including site selection, gas and electrical connection feasibility assessment, and negotiation. The project was phased to include CHP in order to meet the requirements of the UK government's policy on gas-fired power plant.

Lenders' Engineering Services for the 710 MW and 50 migd Al Taweelah A2 independent power and water project in Abu Dhabi.

Serving as the bank's engineer for the successful refinancing of the 135 kilometre Scotland to Northern Ireland gas pipeline.

Provision of technical advice for the evaluation of force majeure claims under the gas supply agreement between Total Oil Marine and a UK CCGT power plant.

Independent evaluation of a novel enhancement to desalination processes, working with specialist water chemistry consultants and development of process models.

Serving as the independent engineer for Ballylumford's 951 MW gas fired power plant gas supply system review. The assignment required investigation of issues arising from failure of gas supply leading to a major consumer disconnection in Northern Ireland. The work included consultation with Premier Power Ltd, Premier TRANSCO Ltd, NIE, and BG International.

Performance of a feasibility study on a range of options to upgrade the integrity of gas supply to Ballylumford Power Station, Northern Ireland. These included underground gas storage in salt deposits, LNG storage, fast fuel changeover to LPG, and additional redundancy in the gas pressure reduction system.

Development of a gas strategy for future power generation in Northern Ireland for the Department of Economic Development. Following data collection, analysis and review an evaluation was made of security of supply and the environmental and economic implication of increased dependence on gas for power generation.

Senior Project Manager, Power Division (1996 - 1997)

Responsible for:

Independent engineer services for the successful financing of the 230 MW AES Barry project, the first merchant CCGT plant in the UK. Services included the preparation of a due diligence study and provision of bank's engineer services for the 230 MW plant. Also served as the bank's engineer during construction.

Performing a feasibility study for a 200 MW IPP project in Turkey working closely with the client developer and his local partners. The study included site, capacity, configuration, and technology selection for a plant to provide power to the national utility and steam to local industrial users.

Completed a due diligence report and lease development for a major international plant leasing corporation for the refinancing of Peterborough Power station. The normal scope of due diligence was extended to include the review of opportunities for CHP conversion and for life extension to 50 years. This was the first successful cross border lease deal of a power plant in the UK.

Provided technical and due diligence services for the preparation of a long term gas tolling contract worth approximately £1000 million over its term. The work included the development of contract strategy for tolling and for the evaluation and negotiation of parameters in the resulting algebra of the agreement.

Provided design and specification of the Nuclear Electric Heysham repowering project. Responsible for the conceptual design and specification of the integration of a 230 MW gas turbine and heat recovery boiler with each main reactor steam cycle. The project was cancelled when reactor deficiencies were resolved.

Technical Development Manager (1992 - 1996)
Responsible for business development and front-end conceptual and design engineering of complex power projects across all disciplines and areas of activity for the company. Provided

technical and strategic input into assembling and executing multi-disciplinary projects. Typical work included:

Leading the planning, bidding, negotiating and launching of the firm's involvement in the £8 million Windscale advanced gas-cooled reactor decommissioning project.

Assessment of a GT-based utilities system at the Sullom Voe oil terminal and review of technically and economically viable development options.

Acting as Engineer to Contract for Severn Trent Water in managing the recovery of a £30 million contract with Ferranti International in receivership.

Responsibility for development of all types of business with major clients, particularly focusing on the power industry.

UK: Director of Engineering (1990 - 1992)

Responsible for the successful application of instrumentation, control, and automation technology within the company and for the development of company capability supported by appropriate design and implementation methodologies.

Responsible for overseeing the quality management of the company and for management of the implementation of quality systems to BS 5750 part 1/ISO 9001.

Played a major role in the expansion of the company into the recently privatised UK power industry, establishing a contracting capability and developing a significant team responsible for nuclear industry safety related documentation services.

Acted as Project Director for major projects, including the refurbishment of steam driven gas circulators at the Oldbury Nuclear Power Station.

Chief Engineer (1987 - 1990)

Responsible for the development of a new technical capability and facilities within the company. Managed the Technical Development Group undertaking special studies, and providing key technical input to work development, and to the definition of designs and evaluation of technical proposals. Typical projects included major integrated telemetry and management information systems for UK and overseas water undertakings, including Yorkshire Water, Southern Water, Welsh Water, Thames Water, Sydney Water, and the Kuwait Ministry of Electricity and Water. Other major projects included large-scale integrated control and management systems in the power, nuclear and process industries.

Engineering Manager (1984 - 1987)

Responsible for the leadership of a growing team of engineers applying systems for control and supervision of utility, power, process, nuclear, and defence industries.

Responsible for the development and introduction of new techniques to the application of computer-based systems and associated software, both for clients and for the execution and supervision of work within the company.

Responsible for the definition of procurement and project strategies for several major projects for naval application. In particular, performed work in the selection of suppliers, and in the evaluation of alternative design strategies on these projects.

Senior Design Engineer (1980 - 1984)

Responsible for design and procurement of a large power distribution telecontrol system for a nuclear site. This employed dual computers and 30 outstations and involved their integration into a control room complex.

Responsible for design and special studies, preparation of specifications, tender assessment, design review and commissioning for a wide range of power stations internationally. The plant involved ranged from 10 MW diesel units to 550 MW gas turbine plant with heat recovery, including desalination units up to 5 mgd capacity.

Member of the Institute of Measurement and Control Working Party preparing a draft British Standard Code of Practice for instrument and control system installation.

Central Electricity Generating Board 1974, 1980

Research Officer, Scientific Services Department

Responsible for a team of up to three engineers and technicians performing a wide range of power plant control replacement and improvement projects.

Responsible for design and implementation of advanced systems for the control of plant including major air compressors (4 x 2.5 MW) and main generating plant such as oil and coal combustion equipment.

Scholarship Graduate Training, Central Electricity Generating Board (1970 - 1974)

Awarded a scholarship from the CEGB to Cambridge University with training including periods of operations, maintenance and construction site experience on power plant.

APPENDIX D - DNV GL MANAGEMENT SYSTEM

General

The DNV GL Management System (DMS) documents are sorted under 15 strategic areas as an index for the management system. The DMS seeks to be independent of the organisational structure, and able to show the main processes of the company.

The management system documentation consists of:

- The DMS – DNV GL's Management System documentation. This is a 2-tier system. The top tier is owned, issued and maintained at DNV GL Group level and is valid for all in DNV GL. The ownership of the various groups of strategic areas has been assigned to DNV GL Group directors, to ensure anchoring with top management, focus and development.
- Local Operating Procedures (OP's) which are specific for an operating unit, or part of the line organisation, i.e. Regional OPs.
- Country specific OPs which are valid for a country, typically covering employment items and general compliance with national legislation

All management system documentation is available to all employees on the DNV GL Intranet.

DNV GL monitors, measures and improves the effectiveness of its management system on a continuous basis where opportunities for improvement are identified through internal and external audit, experience feedback, after-action reviews and importantly through dialogue with, and feedback received from our customers. The annual Management System Review is an important instrument in this regard.

DNV GL has a common tool for follow-up of all events such as audits, non-conformities, complaints and potential quality issues called Quality Event Tracker - QET. All quality events shall be registered in QET. QET facilitates the use of root cause analysis and ensures that events are handled and closed after proper actions have been taken.

Quality

Quality Policy

We will never compromise on quality or integrity.

We commit ourselves to:

- deliver in accordance with the industry's expectations
- continually improve our performance and professionalism

Quality Management System

The strategic areas most important in relation to quality of customer-facing activities and project deliverables are:

- Customer management
- Service lines
- Production
- Innovation, research and development
- IT and information management
- Quality and management system

Under Production there are governing documents addressing:

- Project management
- Internal verification of project work and approval of deliverables

- Performance of various categories of services
- Requirements to certain types of deliverable documents
- Competence management and requirements

Further document types are:

- DNV GL Service Specifications
- Internal Service Instructions
- Internal Service Guidelines

Risk Management strategy

The purpose of this strategy is to lay the framework for the project Risk & Issue Management programme. This programme will ensure that risks and issues impacting the project and its participants are understood, transparent, clearly communicated and monitored to be maintained within agreed, acceptable levels.

Potential project risks have been identified during the bid process and will be reviewed and clarified during the project initiation phase by project participants and stakeholders as part of a risk assessment process. New risks and issues are added to the Risk Register by the Participants as they are identified throughout the project. The completeness of the Risk Register will be reviewed regularly by the Project Manager, ensuring that all risks and issues are correctly recorded, allocated to owners and remedial actions are identified and agreed (within relevant timeframes) where appropriate. The Project Manager will liaise directly with the DECC Project Manager on a regular basis with regards to visibility of the Risk Register and in the event that a risk incident occurs.

The risk assessment process takes into account all aspects of the project scope. Risks / issues will be categorised within these broad headings:

- Strategic and commercial
- Economic, financial and market related
- Legal and regulatory
- Health, Safety and Environmental
- Organisational, management and human interactions
- Technical, operational and infrastructure

Once identified, risks are assessed by the project team on the LIKELIHOOD and IMPACT of occurrence. An overall SEVERITY measure based on these factors is calculated for each risk. Risks are then sorted according to their Severity measure into three categories: Red (High risk – requires management by project leadership team); Amber (Moderate risk – requires management at a working level); Green (Low risk – requires awareness only). Issues are assessed and sorted based on IMPACT.

The project risks and intended management of these risks to the delivery of the current project are set out in the table below:

Risk	Likelihood	Impact	Mitigation
Expertise, capacity and collaboration			
Lack of knowledge of innovative intervention options	L	H	10 years' experience of working with SMEs and industry, including developing innovative means of engagement. The team has a deep and broad experience of working with energy intensive industries and of maximising the outcomes from engagements.
Lack of industrial decarbonisation and industrial CCS expertise	L	H	A broad range of expertise in CCS, including technical and commercial expertise on: pre-combustion capture, post-combustion capture, oxyfuel, CO2 transport, CO2 storage, funding, regulation and policy, innovation needs and opportunities, cost reduction opportunities, adjacent markets (e.g. gas sweetening), industrial partnering, and supply chain development.
Lack of bioenergy expertise	L	H	A broad range of expertise in bioenergy including technical and commercial expertise on: feedstocks, biomass-to-power, biofuels, use of by-products, funding, regulation and policy, innovation needs and opportunities, cost reduction opportunities, industrial partnering, and supply chain development. Consortium partners also have strong networks with other experts in the sector who the Consortium could seek additional input on for specific questions if required.
Lack of heat recovery expertise	L	H	Experience working with a broad range of expertise in heat recovery including technical and commercial expertise on: organic rankine cycle, liquid air storage, free piston expanders, underground heat storage, heat networks and distributed heating modelling, funding, regulation and policy, innovation needs and opportunities, cost reduction opportunities, industrial partnering, and supply chain development. We also have strong networks with other experts in the sector who could seek additional input on for specific questions if required.
Insufficient number of people to deliver work	L	H	Team consists of three partners all with considerable resources. The project team consists of four core members with support with an additional four members contributing on specific tasks and project oversight.
Costs			
Cost monitoring	L	L	The contract is a fixed fee contract. Expense will be closely tracked and approval sought from DECC for agreed spend limits.
Timeframes			
Report not delivered by end March 2016	L	M	Team consists of senior consultants experienced in delivery to tight deadlines. Project is also closely overseen by management team.
Stakeholder response (e.g. roundtables, surveys and telephone interviews)	M	M	Project team has strong contacts within the industry, as well as experience of delivering stakeholder engagement. Project subject (i.e. shaping the spending of considerable resources) will be of interest to industry. Multiple engagement options also used.
Reporting			
Inadequate reporting makes it difficult for DECC to monitor the project	L	M	Project team will be in regular weekly contact.

APPENDIX E – CLT INNOVATION INTERVENTION EXPERIENCE

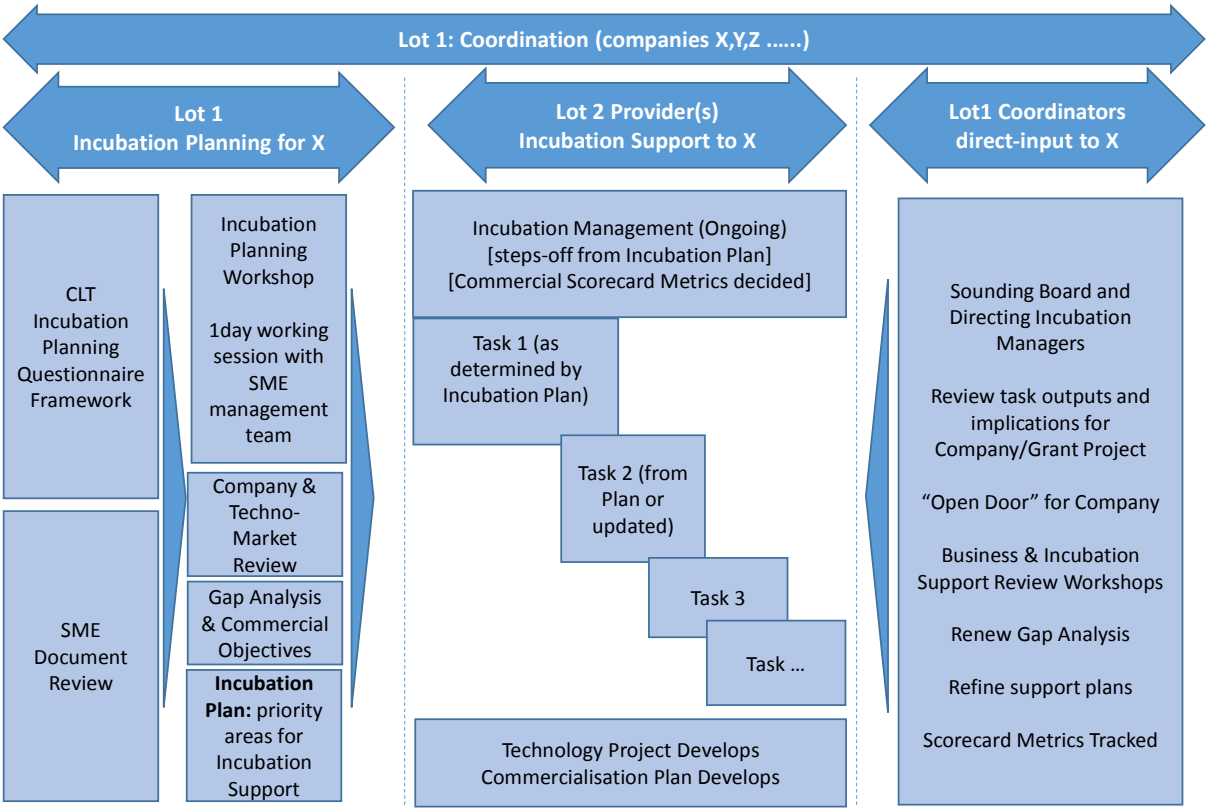
EEF Process

CLT designed much of the grant application and monitoring process that supports DECC EFF innovation intervention (included seconding a CLT Associate into the DECC team during 2014-15). CLT has an in-depth, up to date working knowledge of all the companies in the DECC EEF and LCI portfolio.

The final stage of the assessment includes a visit by CLT to the company premises and a review of the eight dimensions of the business (market, business development and sales, strategy and business planning, technology, product, supply chain, team, investment and funding)

CLT has very relevant prior experience for designing, setting-up, and managing innovation interventions for low-carbon technology. We currently coordinate and deliver business incubation support to 90 companies receiving DECC grants under Low-Carbon Innovation and Energy Entrepreneurs Fund [EEF] programmes.

The CLT process for reviewing, managing and supporting projects in the DECC EEF is summarised below:



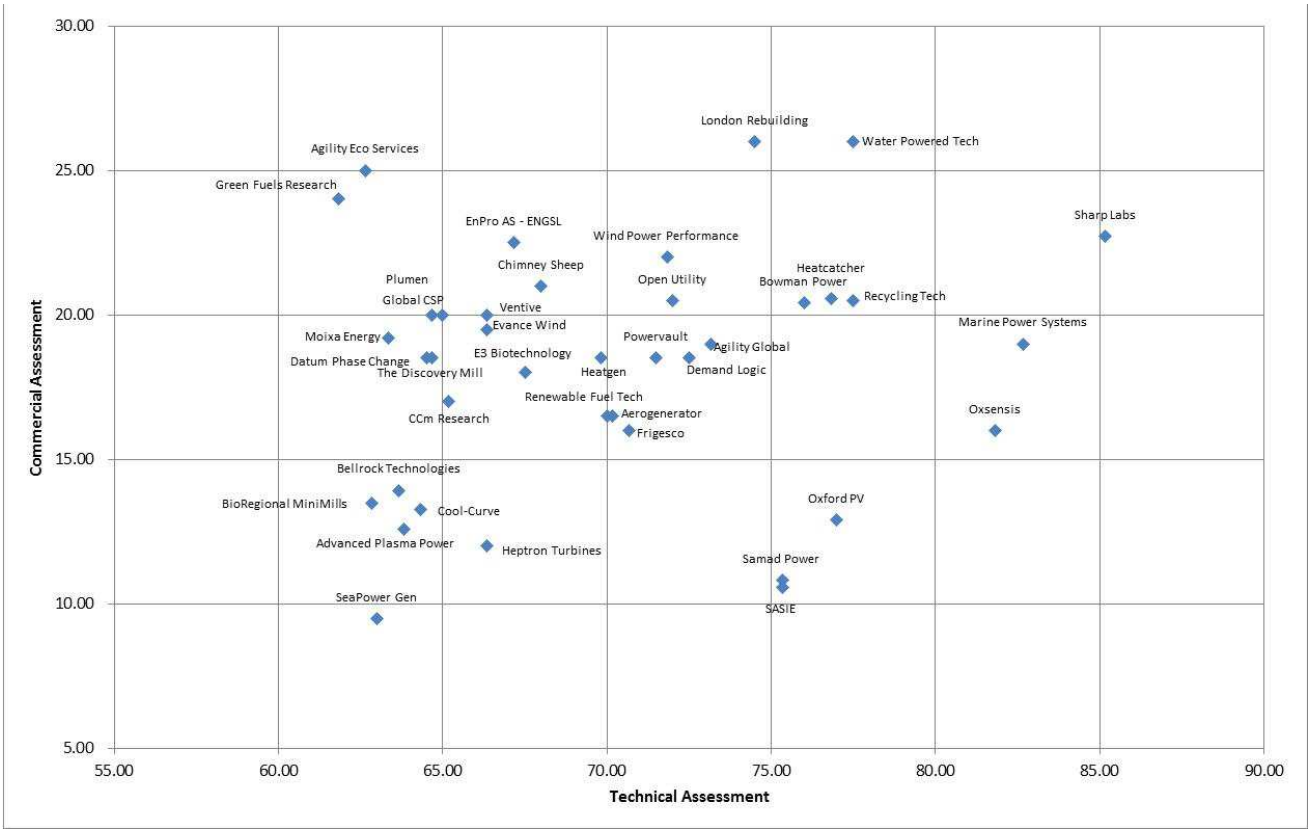
Specifically CLT has been responsible for the following:

- **Project Application process.** Designed, documented and set-up the following:
  - Eligibility Criteria checklist for screening grant project applications [all phases]
  - Updated Applicant Guidance notes, Application Form and submission process [Phases 2,3,4]
  - Application tracking database and access permissions [on-line]

- **Project Assessment Process.** Designed, documented and managed the following:
  - Technical assessment process and scoring criteria [used by DECC and grant assessors]
  - Full set of Technical Assessors documents [Phases 2,3,4]:
  - Training Workshop: design and delivery of session for 50 assessors with hand-outs

- Slide pack: Programme background, Assessment method, Guidance for scoring and writing feedback, Instructions for use of on-line database
- Assessor scoring method and guidance document (9 pages)
- Assessment template: Survey Monkey & word version
- Review and consolidation of assessor scores and feedback, ranking projects
- Shortlist for external VC-Commercial Panel members [Phases 2,3,4]
- Issued questionnaire for Commercial Panel to assess applications (Phase 3,4)
- Created Tech-Commercial Comparison Matrix for VC Panel session (Phase 3,4) – see below
- Chaired and facilitated VC Commercial Panel session (Phase 3,4)
- Assisted [when requested] to draft response letters to applicants

Commercial Readiness Assessment Tool



Intervention models

The historic model of government support has tended to be in the form of grants, from which there is limited prospect of future return to the taxpayer beyond increased future tax take. There is an increasing need in times of austerity to justify such support against other options, principally to ensure a value for money benefit can be articulated. There are clear benefits to the use of grants in terms of speed of delivery, simplicity and low cost together with some leverage over, for example, potential acquirers seeking to park new technologies which would be disruptive to their own business models. The likelihood is that for smaller commitments, grants will continue to be appropriate but for larger investments there may be a strong case for either deploying equity, option or asset finance and loan solutions. Our contacts and expertise will allow DECC an opportunity to review and if appropriate implement a number of options for investing in loans, options and equity or potentially even seeking match funding for the program.

Our background is in innovative solutions to the sorts of problems that arise in funding small businesses. For example Electrochem was a business, which developed a new way of achieving high purity gases for industrial companies, but with a huge capital demand for the cylinders needed to deliver these. Conventional lenders could not obtain adequate security over these highly mobile cylinders but a leasing solution with a turnover royalty enabled the funding to be implemented.

Specific CLT partner expertise includes:

- major investments in Laboratory of Government Chemist, SIFAM, TSO and Cromptons
- launching a technology investment trust
- running the funds business in 3i raising over Euro 3Bn of external funding

Type	Pros	Issues to manage
Royalties	• Simple & flexible • Can capture high upside	• Affects product pricing and rate of adoption • Collection costs
Loans	• Well known & understood • Plays to identified need • later stage/close to market • Some return on funding • Leverage in negotiations	• Consumer credit act issues • Financial Services issues • Balance sheet impact • Write off negotiations fraught • Rate and timing of interest • Accounting complexity
Grants	• Well understood • Low transaction and admin costs • Incremental tax take • Gain leverage	• Manage project to deliver value • Ensure value for money
Equity	• Financial return • Increasingly understood • Clean and straightforward • Formal way to steer project	• Obstacle to further fund raising negotiation • Exit timing • Cost of implementation
All		• Reputation risk • Cost of maintenance • Negotiations delay implementation

Comparison of alternative forms of financial intervention

About DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organisations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.