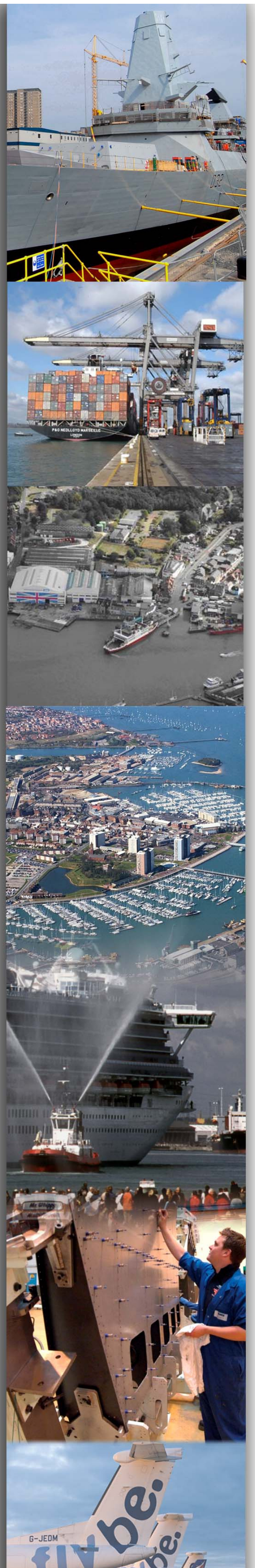
solent local enterprise partnership

Regional Growth Fund Bid Submission

21st January 2011



Application Form Part 1

General Guidance notes

The Regional Growth Fund (RGF) application form consists of two parts. Part 1 (this document) contains 30 questions related to the project and its costs and benefits. Part 2 (the Financial Annex) is an Excel spreadsheet for the key financials of the project and should be used as a tool to complete the indicated Part 1 questions.

Both Part 1 and Part 2 of the application form should be completed as fully as possible. Bids are invited for projects that will directly create jobs through private sector enterprise and growth, and from projects that will enable or unlock future private sector jobs growth, particularly in those areas and communities that are currently dependent on the public sector.

We are using one application form for all types of bids - if a question does not apply to a specific bid, please mark the answer form N/A.

In the application form the word project is used to describe both single "Projects" and "Packages of Projects". Applicants for Packages should make sure that each response adequately covers every individual component (sub-project) in the Package.

Please read the accompanying guidance notes carefully when completing the form to ensure you include the full set of information required.

Record keeping and Freedom of Information

In order to meet the requirements of the Freedom of Information Act 2000 reasons for decisions about applications and claims must be recorded properly on file at all stages. This record keeping will also ensure that there is a clear audit trail for all applications. Administrative records will be maintained for all applications irrespective of whether they were successful.

Applicants should be aware that information provided in confidence is likely to be exempt information under the terms of Section 41 of the Freedom of Information Act 2000, and that the operating department will respect its confidentiality.

Applicant Information

Applicant name *(including title)*:	Mr. John Metcalfe
Company / Organisation:	Isle of Wight Council (acting as accountable body on behalf of industry-led partners and member organisation of the Solent Local Enterprise Partnership)
Position in Company / Organisation:	Deputy Director: Economy, Tourism & Leisure
Address:	County Hall High Street, Newport Isle of Wight PO30 1UD
Telephone:	01983 821000
Mobile:	07970 009881
Email:	john.metcalfe@iow.gov.uk
Website:	www.iwight.com

Section A: Project Description

This section of the application form is designed to identify private and public sector partners involved in the project and seeks basic information about the nature of the project.

1. What is the project title?

Solent Ocean Energy Centre (SOEC).

2. What is the post code location(s) of the project?

- Marine-based nursery site at 50° 42.373'N / 1° 31.737'W (centre co-ordinate for site), known as Hurst Narrows
- Marine-based demonstration site at 50°29.00'N / 1°16.69'W (centre co-ordinate for site), known as St. Catherine's Race
- Isle of Wight local authority area – SOEC Operational Base
- Portsmouth / Isle of Wight / Southampton local authority area – Portside Facility and Technology Centre

For further details of activities at each location see Q4.

3 What good(s) or service(s) will be offered to the market directly and indirectly as a result of the project? *Where possible and applicable, please provide the relevant SIC code (see application form guidance).*
(a) goods and services directly offered to the market by the project partners as a direct result of this investment?

Figure 3a.1: SOEC – Direct goods and services and applicable SIC codes

Project Component	Goods and Services	SIC Code (2007)	SIC Code Definition
SOEC Ltd	Project management and implementation	41.1	Development of building projects
SOEC Ltd	Project development, consultancy and technical support	71.12/2 and 42.22	Engineering related scientific and technical consulting activities Construction of utility projects for electricity and telecommunications
SOEC Ltd	Berth rental for deployment of Marine Current Energy Converter (MCEC) devices	71.20 and 77.39	Technical Testing and Analysis Renting and leasing of other machinery, equipment and tangible goods (not elsewhere classified)
Technology Centre	Construction of technology centre	41.20/1	Construction of commercial buildings
Technology Centre	Research and development, operational planning	71.12/1	Engineering design activities for industrial process and production
All in water sites and onshore substation	Construction of infrastructure for renewable electricity generation by MCEC devices	42.22 and 35.11	Construction of utility projects for electricity and telecommunications Production of electricity

Project Component	Goods and Services	SIC Code (2007)	SIC Code Definition
Portside facility	MCEC manufacture, assembly, deployment and O&M	28.11 and 33.12 and 33.20	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines. (PTO) Repair of machinery Installation of industrial machinery and equipment
All sites	MCEC testing and analysis	71.20	Technical Testing and Analysis
All sites	Environmental monitoring	74.90/1	Environmental Consulting Activities
All sites	Research and development activities	72.19	Other research and development activities on natural sciences and engineering
All sites	Development of MCEC technologies and procedures	71.12/1	Engineering design activities for industrial process and production

Source: ABI 2007 4 digit SIC codes

(b) if the project will create additional market opportunities, these should be listed here.

Figure 3b.1: SOEC – Additional market opportunities and applicable SIC codes

Project Component	Goods and Services	SIC Code (2007)	SIC Code Definition
All sites	Manufacture of MCEC technologies	28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
All sites	Manufacture of MCEC technologies and devices	28.12	Manufacture of fluid power equipment
Nursery, demonstration and commercial sites	Utilisation of market mechanisms	N/A	N/A
All sites	Development of associated supply chains, skills and infrastructure	N/A	N/A

Source: ABI 2007 4 digit SIC codes

4. Set out the main project activities and proposed timescale in which they will be carried out. Include costing for these in Part 2, Section C of the application form. (a) activities carried out by project partners as a direct result of this investment?

The Solent Ocean Energy Centre (SOEC) is a collaborative, industry-led initiative to deliver a marine energy centre in the Solent area, ultimately creating some 4,800 direct and indirect jobs across the UK and helping to stimulate manufacturing capability in marine energy devices.

This is an infrastructure project designed to stimulate the low carbon economy in some of the most deprived, yet innovative, locations in the South East. The project will drive growth and rebalance the economy within the local area, but also help to advance the UK marine renewables industry and contribute significantly to the UK's leading position in the global marine energy industry. The supply of suitable in-water test facilities for marine energy devices is being outstripped by demand and there is therefore the risk the industry will lose significant momentum. The project is supported by a wide range of industry partners which recognise that this lack of adequate infrastructure for sea trials of tidal energy devices is one of the key inhibitors of growth in the sector. SOEC will help to de-risk and accelerate the technological advancement, manufacture and commercial deployment of Marine Current Energy Converters (MCECs), known generically as tidal energy devices. The project is therefore of strategic significance for the UK and supports the Coalition Government's focus on growing the green economy.

SOEC is located in and around the Isle of Wight coast and Solent region. It will comprise, on completion:

(i) A commercial site of at least 100 MW capacity (current estimates suggest that the potential capacity is in the region of 250 MW)**.**

(ii) A deployment and support centre, including:

- A pre-consented nursery site in the western Solent, adjacent to Fort Victoria on the Isle of Wight (Map 1, page 8). Capable of generating 1 MW of electricity, this will enable early stage sea trials of single MCEC prototypes, sized almost up to full-scale, and deployed from a fixed platform or the seabed. Three grid-connected testing berths will be provided for companies to rent on a monthly basis. This provides companies with the means to test new products that have advanced beyond indoor testing tanks but are not yet ready for full scale demonstration, generating data in 'real world' conditions. The nursery site will enable private sector firms to prove MCEC concept and refine design of full-size devices or component parts. The facility provides companies with the means to gather critical operational data in real sea conditions at low cost and risk.
- A pre-consented 10 MW demonstration site, for single full-size devices and small arrays in the English Channel, at St Catherine's Race off the south coast of the Isle of Wight (Map 1, page 8). This site will provide ten grid-connected testing berths and the continued monitoring of array performance, device interaction effects and environmental impact.
- Both grid-connected in-water sites will be supported by shore-side facilities for data analysis, monitoring and control. SOEC will provide full operational capacity for both technologies and procedures.

(iii) An onshore cluster of associated hard and soft assets, including a first class offshore renewables supply chain, a well established maritime and offshore skills base, and a world leading support and development infrastructure. Specific to SOEC, it will comprise a Portside Facility and Technology Centre encompassing the full range of activities associated with the MCEC technology, namely:

- Research and Development
- Manufacture and assembly
- Operational planning
- Deployment
- Operation and maintenance actions
- Performance monitoring

- Decommissioning

Within the Portside Facility and Technology Centre, tidal device and project developers will be able to establish office bases, carry out design work and modifications in workshop units and assemble up to full-size tidal turbines for deployment to nearby sites. The facility will have suitable wharfage for deployment vessels and cranes to load devices on and off the vessels.

Map 1: SOEC Location

In addition to the rich combination of existing assets, the Solent region is an ideal location for a marine energy centre due to its strong tidal flows, physically protected waters and easy access. The SOEC facilities will provide a full 'route map' from pre-prototype, to full commercial implementation of MCEC devices in one location. It will also significantly reduce the cost of device development through providing generic facilities for sea trials at pre-consented, grid-connected and fully monitored sites. Deployment, servicing and maintenance will be easier than existing test sites, allowing device developers to acquire the operational hours sufficient to demonstrate the viability of the technology that is presently required by funding and investment bodies.

Public funding for this infrastructure is considered appropriate and necessary in order to advance the offshore renewables sector so that it can fully contribute to renewable energy generation targets and maintain its leading position in the global market, with consequent employment growth. The operation of SOEC will be on a commercial basis and no further public funding will be required once the infrastructure is in place.

Designed for phased implementation, it is planned for the full range of SOEC facilities to be operational by 2014.

Phase 1 will comprise:

- Obtain consents and licences for nursery site and offshore demonstration site
- Construction of nursery site
- Establishment of SOEC Ltd (Company Limited by Guarantee) to operate facilities

It will be delivered between Q4 2011 – Q1 2013 with a total budget of £5,651,000.

Project partners principally involved in this phase will be Isle of Wight Council, Envirobusiness and University of Southampton.

Phase 2 will comprise:

- Construction of offshore demonstration site
- Development of Portside Facility & Technology Centre

It will be delivered between Q1 2013 – Q2 2014 with a total budget of £25,077,000.

Project partners principally involved in this phase will be the Isle of Wight Council and Envirobusiness.

The location of the Portside Facility and Technology Centre has yet to be determined, but there are numerous suitable locations in the Solent region – principally Portsmouth, Southampton and the Isle of Wight – and early discussions indicate a strong interest from existing facility owners to re-equip their facilities to serve the tidal energy industry, once the offshore facilities have received full consent.

Please refer to Part 2, Section C of the application form for a breakdown of capital expenditure costs for both phases.

Phase 3 – the commercial site – is a fundamental element of SOEC that will substantially drive sustainable private sector growth. Phase 3, which will be fully funded by the private sector, will be developed in association with a marine renewables project developer(s) following the successful implementation of phases 1 and 2. Although SOEC Ltd will play an instrumental role in its development and continue as a pivotal support mechanism, the actual commercial project will be separately owned and operated.

The estimated total capital cost to develop phase 3 is in the region of £1.1 billion, the roll-out of which is estimated between 2014 and 2020. A letter of support from a leading marine renewables project developer is attached to this application, which discusses the importance of SOEC and their interest in developing phase 3 if phases 1 and 2 are implemented, and sufficient market mechanisms are in play.

Therefore, delivering phase 1 will ensure the successful completion of phase 2, which will in turn unlock the private sector investment required to deliver phase 3. Early RGF funding is therefore critical to the overall success and impact of SOEC.

During 2013, SOEC Ltd will be established to maintain and operate the offshore facilities. These assets will be transferred, along with their associated liabilities, to SOEC Ltd once construction is complete. The legal structure of SOEC Ltd will be a private company limited by guarantee. It will be a non-profit distributing company, primarily concerned with the advancement of the UK marine energy industry and will employ 13 people from an operational base located on the Isle of Wight. Working capital for SOEC Ltd is included in this bid and a business model developed for SOEC Ltd shows that it can generate surpluses based on market prices for berth rental from both the nursery and demonstration sites, as well as providing specialist support services. Any surpluses generated will be used for further research and development, skills and training activities and any additional facility requirements identified by the industry.

In summary, SOEC will:

- Provide fully integrated services for MCEC device and project developers
- Fill a gap in the development roadmap for sea trials of scaled devices and arrays of full-size MCECs
- Facilitate deployment at any real-life in-water lifecycle stage
- Be suitable for all technology generations and new applications
- Increase confidence amongst investors
- Accelerate learning rates in the marine energy industry
- Prove commercial viability of MCECs
- Accelerate commercialisation of the tidal energy industry and the creation of a manufacturing sector and supply chain.

The role of the Isle of Wight Council is principally as Accountable Body for a project which is industry-led and driven. It will be delivered, in the main, by the private sector and will provide the infrastructure for private sector growth. The Council will not draw on RGF funds for the work it is required to carry out as Accountable Body and is pleased to be involved in this project as the clean energy sector will continue to contribute to the economic regeneration of the Island and help to deliver Eco Island, the sustainable community strategy.

(b) other activities which may be carried out as an indirect result of this investment? *If it is not certain that an investment will go ahead, please estimate the likelihood of it going ahead with and without the project.*

The following activities are likely to be carried out as an indirect result of this investment.

Figure 4b.1: Indirect Activities

		Likelihood of going ahead without the project
1.	Future involvement of Solent-based companies in the UK, EU and global marine energy sector through experience gained at SOEC	Low
2.	Skills development within the supply chain through construction and operation of SOEC facilities and device deployment	Low
3.	Skills development through development of further and higher education courses utilising data and knowledge gained at SOEC	Medium
4.	Mapping of marine energy supply chain in the South East	High
5.	Contribution to knowledge-base of in-water environmental effects of MCECs through pre- and post-deployment monitoring	Low
6.	Development of small-scale, localised operation and maintenance bases to service deployment sites	Low

7.	Collaboration with offshore wind farm (Round 3) developers to explore synergy between offshore wind and marine energy supply chains and operations	Low
8.	Development by private sector project developer of a commercial zone to south of the Isle of Wight for substantial renewable energy generation	Medium
9.	International investment in Solent region through co-location with demonstration facilities and clustering	Low

5. Please summarise how the project will contribute to the objectives of the Regional Growth Fund. *See application form guidance. It is recommended that the answer to this question is no longer than 750 words.*

Objective One: Supporting projects with significant potential for economic growth and sustainable private sector employment.

SOEC will provide world class facilities for Research and Development (R&D), testing and commercial deployment of 1st, 2nd and 3rd generation Marine Current Energy Converters (MCECs), together with associated opportunities for engineering, manufacturing, installation and maintenance of such technologies, as well as spill over opportunities into other sectors. A recent Department for Energy and Climate Change (DECC) report[1] summarised the UK opportunity:

- **Expertise:**

'The UK has a unique opportunity to capture the benefits of this new sector through the entire supply chain, from research and development through to engineering, manufacturing, installation and maintenance. Many of the leading device developers are located in the UK... The UK has engineering expertise in the complex systems required for power conversion, which are high value and can be exported globally.[2]

- **Supply chain:**

'The development of tidal stream technologies will lead… to a substantial supply chain, a large part of which will be based in the UK, provided the UK's technological lead is maintained and there is an attractive environment for domestic or inward investment in manufacturing facilities. In the longer term, the potential for jobs arising from the tidal stream industry is comparable to that in the wave industry, continuing to increase, peaking at 16,000 in the 2040s of which about 25% will support UK exports.[3]

- **International Competition:**

'The UK is the current leader in tidal stream technology development, due to the level of resources, its highly skilled expertise, and the world class testing facilities that are available. As a result the UK could become the natural owner of this technology and continue to lead the commercialisation process for the rest of the world. Many of the leading devices are British innovations being developed by companies located in the UK.

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[1] DECC Pathways Analysis. July 2010.

[2] Ibid. Page 205.

[3] Ibid Page 207.

Therefore the level of domestic knowledge and experience places the UK in a strong position to design and develop these technologies.[4]

Exploitation of this energy resource is clearly constrained to sites with strong marine currents. The Solent area provides one of the best opportunities for the UK. Following research into local tidal currents, Admiralty data suggests the sites selected combine strong tidal flows with physically protected waters. Together with easy access to Solent based portside facilities, such as Ventnor, Woolston, Portsmouth, Porchester, Hythe and Cowes, SOEC is an attractive opportunity for the tidal industry.

SOEC will not only bridge a gap and complement existing UK assets, it will open up opportunities for new technologies and applications, as well as accelerate the route to commercialisation and UK manufacturing opportunities. It will ensure demand is met and the development of the sector progresses efficiently. From extensive industry and Government liaison, it is understood that the key requirements are to better support, de-risk and accelerate technological advancement and commercial development. SOEC is designed to help facilitate these requirements and, in doing so, provide the essential confidence boost that the private sector needs before it will invest seriously and, subsequently, contributes to the profitable growth of the sector within a reasonable timescale.

In total and if fully developed, it is estimated that SOEC, through its development, construction and operational lifetime, and by unlocking the supply chain opportunities for MCEC devices, could result in a UK economic injection of up to £1.7 billion, creating over 4,800 jobs[5]. Linked to other indirect impacts, such as inward investment, value of electricity generated and synergies with offshore wind, the positive economic benefits within the Solent region and throughout the UK would be substantial.

Overall, the facilities will provide significant and sustainable progress in the strategically important renewable energy sector in one location, from pre-prototype to full commercial implementation of tidal energy devices, and with the potential for substantial manufacturing activity, as well as installation and maintenance work, and potentially significant spillovers into other sectors, where the advanced technology will have parallel applications.

Objective Two: Rebalancing the economy

The table below illustrates the need to rebalance the local economy. The Solent[6] as a whole has a dependency on public sector employment which is similar to that of England, but significantly higher than for the South East[7]. And in the two planned locations for

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[4] Ibid Page 208.

[5] Envirobusiness

[6] The Solent LEP follows functional economic rather than administrative boundaries. The Solent Local Enterprise Partnership outline proposal (September 6th 2010) used economic evidence from all constituent upper tier authorities and Distrct Councils which either wholly or partly fall within the LEP boundary. These are: East Hampshire, Eastleigh, Fareham, Gosport, Havant, the Isle of Wight, New Forest, Portsmouth, Southampton, Test Valley and Winchester. We have used the same approach in this section and refer to this area as 'the Solent LEP'.

[7] In addition, a total of nearly two thousand job losses have recently been announced at Hampshire County Council and the Isle of Wight Council. Source: BBC news, January 2011 and November 2010.

SOEC's physical onshore assets, direct public sector dependency is much higher still, at over a quarter of employment in both cases. The solution requires employment generation across the LEP area, building on its existing key strengths, that people in Portsmouth and the Isle of Wight will be able to access.

Indirect public sector dependency is also very great with large local employers such as BAE Systems, both on the isle of Wight and on the mainland, being heavily dependent on government contracts. The naval base at Portsmouth is a dominant employer, with significant vulnerability to rationalisation. Portsmouth is home to almost two-thirds of the Royal Navy's surface ships, including the aircraft carriers, Type 42 destroyers, Type 23 frigates and a mine countermeasure squadron, as well as fishery protection and training units. There is also associated housing for naval personnel and their families serving at the base and onboard Portsmouth-based ships, and significant private as well as public sector employment dependent on the naval base. Approximately 17,200 people work at the base at peak times, and a study by the University of Portsmouth[8] indicates that the base supports some 35,000 jobs in the wider local economy, of which the majority (21,600) are private sector.

Figure 5.1: RGF Metrics – A Summary

	Public employee job share 2008 (%)	Private sector employee job growth 2003-2008 (%)	Out-of-work benefit claimants as % of working age population April-June 2010 (%)	No. of active enterprises per 1,000 resident population 2009	Private sector employment forecast growth 2010-2015 (%)
England	19.5	5.3	12.0	39.1	8.1
South East	17.2	5.1	8.7	44.5	9.6
Solent	20.1	8.0	9.2	38.5	8.5
Portsmouth	26.3	6.2	11.8	28.2	6.9
Isle of Wight	25.1	1.1	12.6	34.7	7.6

Sources: Location Metrics for RGF Application Assessment, Department for Business, Innovation and Skills (January 2011) & Oxford Economics August 2010 Regional Employment Forecasts.

There is also a lack of broader private sector strength locally to offset high public sector dependency. In contrast to most other areas, the Isle of Wight experienced almost no employment growth in the five years preceding the economic crisis, and estimates from Oxford Economics[9] indicate that in the Solent as a whole, some 24,600 jobs have been lost during the recession. In recent years Portsmouth has done better than average in terms of private sector employment growth, but this almost certainly reflects the transfer of naval jobs to the private sector rather than underlying sustainable growth.

Partly as a result of these problems the percentage of working age people claiming out-of-work benefits is much higher in the two local authority areas where SOEC would be located than in the South East, and similar to or above the national average. This almost

[8] Socio-economic Impact Assessment of Portsmouth Naval Base. The Centre for Local and Regional Analysis, Portsmouth Business School, University of Portsmouth 2007.

[9] (Summer 2010 forecast)

certainly understates the problem, particularly on the Isle of Wight where overall dependency is noticeably higher than out-of-work dependency.

Disturbingly in terms of economic resilience and the capacity to recover, the number of active enterprises per head of population is low in the Solent as a whole, lower still on the Isle of Wight, and particularly low in Portsmouth (just 28 enterprises per 1,000 residents compared with 39 for England and 45 for the South East). Looking forward therefore, independent forecasters Oxford Economics suggest that although private sector employment in the Solent area may be slightly above the average for England, it will start later and will not match that of the South East as a whole. Crucially, Portsmouth and the Isle of Wight will significantly underperform even the rest of the Solent area.

Our view is that because of the vulnerability of local **private sector** firms to cuts in naval and military spending, the risks to this forecast are very heavily on the downside. The need for rebalancing is therefore acute. The development of the tidal energy sector is an entirely appropriate response, given the skills and traditions of the local workforce and economy, and national economic and sectoral opportunities going forward.

6. **Which entity will be the recipient of RGF funds? Who are their immediate and ultimate parents?** *Provide where appropriate details for each of these of legal status, entity name, address, company registration number or VAT registration number, sector, directors, principal shareholders, and contact details. Please also identify any recipients which are SMEs.*

PUSH (Partnership for Urban South Hampshire) is a partnership of eleven local authorities including the unitary authorities of Portsmouth, Southampton and the Isle of Wight, and the district authorities of Eastleigh, East Hampshire, Fareham, Gosport, Havant, New Forest, Test Valley and Winchester. As of 1 April 2011 **Southampton City Council** will be the Lead Authority for financial matters in accordance with the Joint Arrangement and as such will be the recipient of the RGF funds for both the Solent Gateway and Solent Futures package of projects. Details as follows:

Southampton City Council
Civic Centre
Southampton
SO14 7LY

Legal Status – Local Authority

Leader – Cllr Royston Smith
Chief Executive – Allistair Neil

Contact details:

Rob Carr

Interim Executive Director of Resources

Directorate of Resources

Southampton City Council

Tel : 02380 834370

e-mail : rob.carr@southampton.gov.uk

The immediate partner and project Lead is Isle Of Wight Council who will be the lead authority for this project and will over see 100% redistribution of the funds and be responsible for the financial risks and consequences relating to delivery and operation of the scheme.

Isle of Wight Council – will oversee 100% redistribution of funds to both the named organisations below and through competitive tender for the remaining work packages and construction contracts.
Legal status – Unitary authority
Address – County Hall, High Street, Newport, Isle of Wight PO30 1UD
VAT registration number – 108366865
Contact details – Tel: 01983 821000 Email: john.metcalfe@iow.gov.uk

EnviroBusiness South East Ltd - £430,000 for project management, procurement and contract management.
Legal status – Company limited by guarantee
Address – 1 Basepoint Business Centre, Metcalf Way, Crawley, West Sussex RH11 7XX
Company registration number – 05544744
VAT registration number – 934667883
Sector – Private, SME
Directors – Donald Charlesworth, John Myers, Anne Crean, Tim Haines
Principal shareholders – None
Contact details – Tel: 01293 813 911 Email: info@envirobusiness

The University of Southampton - £266,000 for academic contribution to detailed design, data management and analysis.
Legal status – Charity
Address – Highfield Campus, Southampton SO17 1BJ
Company registration number – RC000668
VAT registration number – GB568630414
Sector – Academic
Contact details – Tel: 023 8059 5000 Email: (finance) Anna.kerhoas@soton.ac.uk (legal) David.woolley@soton.ac.uk

Agreements will be put in place between the Isle of Wight Council and named funding recipients to ensure that it can fulfil its role as Accountable Body.

7. Are other organisations or companies part of this bid?

YES.

7(a) ***IF YES, please set out their role in the project, the relationship between different partners in delivering the project, and specify their legal status, entity name, address, company registration number or VAT registration number, sector, directors, principal shareholders, and contact details.***

The **Project Partners** are:

- Envirobusiness – which will be responsible for project management, including procurement and contract management (see Q6 for legal status etc).
- University of Southampton – which will contribute academic input to the detailed site design, data management and analysis (see Q6 for legal status etc).
- Isle of Wight Council – which will act as the accountable body (see Q6 for legal status etc).

In addition, the project is working with:

Steering Group

Comprised of Project Partners plus:

- BAE Systems
- Gifford
- Marine South East

The Steering Group will support the development and delivery of SOEC and the formation of SOEC Ltd, providing expert advice and insight on tender specifications, risk management, industry developments and workstream co-ordination. It will meet formally on a regular basis.

Industry Partners

- QinetiQ
- Halcrow
- IT Power
- Gurit
- SLP Energy
- JDR Cable Systems
- EMEC
- NaREC
- Wave Hub

Industry Partners are companies already established within the marine energy supply chain which can be called upon to assist with the development of SOEC, so that it meets the current and future needs of the industry.

Furthermore, there is a role for all marine energy centres – SOEC, EMEC, NaREC and Wave Hub – to work together on collaborative projects and share best practice.

The Renewable Energy Association, which has over 640 corporate members and more than 100 individuals in its Ocean Energy Group, is fully supportive of SOEC as a complementary facility for the progression of tidal stream energy in the UK.

Users (i.e. device and project developers)

- RWE npower renewables
- Hammerfest Strom
- Voith Hydro Ocean Current Technology
- C-Power
- Cormarent
- Minesto
- Ocean Flow Energy
- Pulse Tidal
- Water Wall Turbine Inc
- Tidal Energy Ltd
- Tidal Stream Ltd
- SMD Ltd
- Scotrenewables Tidal Power Ltd
- Flow-Gen Ltd
- Sintenergy

The User Group is made up of device and project developers which have expressed an interest in using the SOEC facilities. The Group consists of many of the leading second generation device developers and will be a useful sounding board for ensuring the SOEC facilities meets the specific requirements for sea trials and operational testing.

All of the companies and organisations named above have provided letters of support for the project which have been attached to the application. It is anticipated that as SOEC develops and industry communications continue, the level of interest will increase still further.

8. In addition to any RGF funds, how will the project be funded? *Please identify sources, amount of funding and terms of funding and indicate whether these have been confirmed. Show how these sources of funding along with the RGF support add up to the total cost of delivering the project set out in question 4.*
(a) funding for the investment itself?

Other than RGF funds, the project will be funded by:

1. Private sector leverage (unconfirmed, discussions in place) - £7,500,000 for the development of the Portside Facility and Technology Centre.

2. European Regional Development Fund (unconfirmed, discussions in place) - £1,833,000 for project development, planning and consenting, assessments and surveys, and working capital.

Q11 discusses the state of negotiations and expected terms.

The RGF requirement is therefore £21,395,000, out of a total project cost of £30,728,000. The RGF contribution is essential as the project will not materialise without it. This is discussed in detail in Section B.

Overall, the SOEC project includes the commercial site, which will be fully funded by the private sector. The initial phases of SOEC and their associated costs outlined in this application will act as a catalyst to, and be fully integrated with, its development. Considering all elements of SOEC, it is estimated that the total capital investment required will be in the region of £1.12 billion, meaning an effective total RGF contribution of only 1.9%. Full costs and impacts are discussed in Q25(b).

(b) funding of related or contingent investments?

N/A.

Section B: Without RGF support

In order to maximise the impact of the Regional Growth Fund, Government support should be restricted to those instances where the market cannot, or will not fully or in-part, bring an investment forward in the absence of public support. This section will establish a rationale for Government support by enabling us to understand whether and why the project would not otherwise go ahead as proposed.

9. In the absence of RGF support, will the project go ahead (and if so in what form)? *Please provide commercial and economic reasoning to support your argument.*
(a) will the investment project go ahead (and in what form)?

The project will not go ahead at this stage without RGF support.

The marine energy industry is struggling to secure sufficient finance to maintain current development pathways due to the high costs of device development, lack of private sector investment and the high risk nature of the industry. It is therefore not in a position to finance generic deployment infrastructure facilities, although it would be capable of renting the facilities at market rates.

Extensive consultation with the industry has led us to conclude that the industry needs fixed facilities and concentrations of effort to enable and encourage growth and that it is appropriate for the public sector to support the development of the infrastructure for sea trials.

There are no other known public funding sources capable of providing the funding required for SOEC. The project has been discussed with a number of funding bodies operating in the clean energy sector, but these currently have a focus on capital support for individual device developers, rather than on the infrastructure required to move the industry as a whole forward more quickly. To this end, officials at both DECC & BIS have advised that the Regional Growth Fund is the most appropriate source of public funding for SOEC. The case for public funding for shared facilities has been established at the European Marine Energy Centre and the SOEC project clearly provides an efficient outcome through providing numerous grid-connected berths for rent, rather than individual sites being developed for each device.

Whilst there are elements of the project that will attract private sector support, namely the Portside Facility and Technology Centre, this is dependent on initial public sector support for the development of the offshore facilities.

If the RGF is unsuccessful, the project could be moved elsewhere in the EU or further afield since this is a global industry looking across the globe for suitable facilities. If other funding streams become available in the future it could go ahead in the UK on a slower timescale, but this will jeopardise the opportunity for the UK to retain a leading position in the marine energy market. At a recent Parliamentary reception, a leading UK trade association stated: "Although the UK is currently the world leader in the development of the wave and tidal industries, other countries are beginning to catch up. The USA has recently begun very active support for ocean power, with $50 million awarded by the DoE earlier this year, and pilot projects are underway in Korea and China. The UK has a once only opportunity today to secure its leadership position and economic benefits."

This project has not yet commenced although a number of investigations have been carried out over the last 4 years to confirm the feasibility of the project. These include pre-planning discussions, stakeholder engagement, tidal velocity measurement and a grid study.

(b) will the wider development of the area, if applicable, proceed (and in what form)?

A number of Solent-based engineering and marine-related enterprises are likely to diversify into marine energy operations, although this is likely to be haphazard and reactive as domestic and global markets develop. SOEC provides the opportunity for local enterprises to gain experience in marine energy operations and to be at the forefront of an industry which is likely to provide opportunities across the globe.

On the other hand, if the tidal energy supply chain is not stimulated by the activity at SOEC, there is a clear risk of sea trials and associated activities moving abroad. This has been seen in the wave energy sector where the first grid-connected wave energy array, developed by a UK company, was installed in Portugal with a significant proportion of the total project spend occurring in Portugal. In the more developed wind energy industry, most of the UK wind farm project spend goes to foreign turbine manufacturers, a situation that is only now being addressed through public funding support.

Without the SOEC development, it is unlikely that the region will benefit from the early establishment of operation and maintenance bases for marine energy systems or international investment which may instead look to North America, Canada or the Far East where in-water facilities are starting to be developed.

10. Are there other ways of taking the project forward that will not require RGF support? *Please outline what these are and why they are considered inferior:*
(a) ways of taking the investment project itself ahead?

Having considered other funding options, there are no suitable alternatives to RGF as the main funding source at this stage and delay in implementation of the project will weaken the UK's position as the leaders in marine energy development. RGF funding will de-risk and accelerate the project, attract follow-on private sector investment, and ensure that the UK marine renewables industry is advanced, benefiting both the economy and climate change agenda.

This is an infrastructure project designed to create future growth and job creation in the marine energy sector. Public funding support is considered appropriate for the establishment of the infrastructure for sea trials of tidal energy devices, around which will develop a supply chain capable of serving an emerging global market.

Whilst RGF is the largest and most critical funding source, a package of public funding and private investment is being put forward. In addition, a business model has been developed for the operation and management of SOEC facilities which is financially sustainable and which will require no further public funding once the infrastructure is in place.

As stated in Q9, other funding sources have been explored but these are currently focusing on support for device developers, rather than the infrastructure which will help to reduce development costs across the industry as a whole. These funding bodies – Energy Technologies Institute, Technology Strategy Board, Carbon Trust – will become important once SOEC is operational, as SOEC will facilitate for device developers the operational and power generating targets required by the funders. SOEC will also open up an opportunity for developers to benefit from market mechanisms such as ROCs and, potentially, Feed-In Tariffs (FITs).

(b) ways in which the *wider development of the area would proceed?*

There is likely to be a degree of marine energy supply chain support and advice but, unless opportunities are created for device deployment, the industry will not gain operational experience. Likewise, local Further and Higher Education establishments are likely to respond to the growing activity in offshore energy with specialist practical courses and research opportunities. However, these will be greatly enhanced by the co-location of deployment sites.

As discussed in Questions 4 and 8, the development of SOEC is envisaged as the first stage in an ongoing development process leading to the leasing of a commercial tidal generation site to the south of the Isle of Wight with a potential installed capacity of 250 MW. This site will be developed by the private sector and, when the development costs are taken into account, lead to a total contribution from the private sector of more than 98% of the cost of the overall project.

11. What is the minimum amount of RGF support required to allow the project to proceed? *Please provide analysis and evidence to justify the amount and timing of support, by year, and specify the type of financial instrument envisaged (e.g. grant, loan, loan guarantee).*

£21,395,000 – this is requested as a grant to support the development of a strategic marine renewables infrastructure project. RGF contributions required as follows.

Figure 11.1: RGF Contribution Requirements

Phase 1 (project development and inshore site implementation)	**£4,172,000**
Phase 2 (onshore cluster and offshore site implementation)	**£17,223,000**
Year 1 Expenditure (Oct 11 – Mar 12)	£941,000
Year 2 Expenditure (Apr 12 – Mar 13)	£3,231,000
Year 3 Expenditure (Apr 13 – Mar 14)	£17,223,000
	£21,395,000 (includes 20% contingency)

Fiscal years have been used.

The development budget includes a 20% contingency for cost overruns and risks. This is assumed standard for similar offshore renewables projects.

Please refer to Part 2, Section C for the full project capital expenditure costs. The SOEC development budget has been created through comprehensive analysis of similar projects and initiatives, recent marine renewables reports, and relative offshore wind costs. It has also been reviewed in detail by several of SOEC's Steering Group Members and Industry Partners.

Phase 2 will not start until successful completion of Phase 1. Phase 1 is considered high risk and is critical to the implementation of phase 2. In order to secure private sector leverage for phase 2, phase 1 must be successfully completed first.

The specific workstreams for both phases, including those that will be match-funded, are shown in the table below.

Figure 11.2: SOEC Workstreams

Year	Quarter	Phase	Match-Funding Source
		Programme Project Development	
2011 - 2014	Q4 - Q1	Project management	ERDF (50%)
2011 - 2014	Q4 - Q1	Legal	ERDF (50%)
2011 - 2014	Q4 - Q1	Marketing	ERDF (50%)
2013 - 2014		Working capital	ERDF (50%)
		Planning and Consenting	
2011 - 2012	Q4 - Q4	Planning and policy framework	ERDF (50%)
2011 - 2012	Q4 - Q4	Community / stakeholder consultation	ERDF (50%)
2011 - 2012	Q4 - Q4	Environmental risk and impact assessment	
		Preparation of environmental statement	ERDF (50%)
		Submission of consenting applications	
		Permit and marine licenses	ERDF (50%)
		Consenting obtained	
		Nursery Site	
		Assessments and Surveys	
2011	Q4	Detailed grid connection study	ERDF (50%)
2011 - 2012	Q4 - Q3	Environmental survey	ERDF (50%)
2011 - 2012	Q4 - Q3	Sea bed survey	ERDF (50%)
2011 - 2012	Q4 - Q3	Landscape and seascape assessment	ERDF (50%)
2011 - 2012	Q4 - Q3	Coastal process survey	ERDF (50%)
2011 - 2012	Q4 - Q3	Offshore traffic survey	ERDF (50%)
2012	Q3	Project risk assessment	ERDF (50%)
2012	Q3	Socio-economic assessment	ERDF (50%)
2012	Q3	Health and safety assessment	ERDF (50%)
2012	Q3	Pre-construction survey	ERDF (50%)
2011 - 2012	Q4 - Q3	Shoreside facility investigation, planning and approvals	
		Engineering Design	
2011 - 2012	Q4 - Q3	Detailed design and optimisation	
2012	Q3 - Q4	Procurement and contract administration	
2012	Q4	Operating plan	
		Construction / Implementation	
2013	Q1	Construction supervision and SOEC commissioning	
2013	Q1	Shoreside substation and onshore works	
2013	Q1	Control system and substation equipment	
2013	Q1	Circuit breakers and equipment installation	
2013	Q1	Grid connection costs	
2013	Q1	Electricals, control and switching gear	
2013	Q1	Cabling and cable installation	
2013	Q1	Buoys and additional offshore monitoring / survey	

Year	Quarter	Phase	Match-Funding Source
		equipment	
		Demonstration Site	
		Assessments and Surveys	
2011	Q4	Detailed grid connection study	ERDF (50%)
2011	Q4	Detailed tidal stream velocity profiling	ERDF (50%)
2011 - 2012	Q4 - Q3	Environmental survey	ERDF (50%)
2011 - 2012	Q4 - Q3	Sea bed survey	ERDF (50%)
2011 - 2012	Q4 - Q3	Landscape and seascape assessment	ERDF (50%)
2011 - 2012	Q4 - Q3	Coastal process survey	ERDF (50%)
2011 - 2012	Q4 - Q3	Offshore traffic survey	ERDF (50%)
2012	Q3	Project risk assessment	ERDF (50%)
2012	Q3	Socio-economic assessment	ERDF (50%)
2012	Q3	Health and safety assessment	ERDF (50%)
2012	Q3	Pre-construction survey	ERDF (50%)
2011 - 2012	Q4 - Q4	Shoreside facility investigation, planning and approvals	
		Engineering Design	
2011 - 2012	Q4 - Q4	Detailed design and optimisation	
2012 - 2013	Q4 - Q1	Procurement and contract administration	
2013	Q1	Operating plan	
		Construction / Implementation	
2013 - 2014	Q2 - Q1	Construction supervision and SOEC commissioning	
2013	Q2	Shoreside substation and onshore works	
2013	Q2	Control system and substation equipment	
2013	Q2	Circuit breakers and equipment installation	
2013	Q2	Grid connection costs	
2013	Q3	Electricals, control and switching gear	
2013 - 2014	Q4 - Q1	Cabling and cable installation	
2013 - 2014	Q4 - Q1	Onshore electrical infrastructure upgrades	
2014	Q1	Buoys and additional offshore monitoring / survey equipment	
		Onshore Cluster	
2011 - 2012	Q4 - Q4	Facility investigation, planning and approvals	
2013	Q1	Facility re-development (incl. re-equipping)	Private Sector (100%)
2013	Q1	Support services and miscellaneous equipment	Private Sector (100%)

Following feedback from SEEDA and the ERDF project selection committee regarding the proposed SOEC project, it was recommended to include within the development budget appropriate workstreams that could be match-funded 50% by ERDF. As part of Round 4, the ERDF is considering a strategic marine renewables project as one of their key priority areas. SOEC’s project partners are therefore confident ERDF will match-fund the RGF, and an application will be made in due course.

Discussions are currently in place with portside facility owners across the Solent regarding the Portside Facility and Technology Centre. As device and project developers will rent the facilities directly from the portside facility owners over the operational life of SOEC, and other business opportunities are likely to be developed, a number of owners have shown initial interest in providing private sector leverage at 100% costs to re-develop and equip their existing facilities for the purposes of SOEC. As the project progresses, formal discussions will commence and terms will be negotiated. Dependant on RGF success, an agreement will be finalised subject to consents and licenses being awarded.

Section C: Sustainable Private Sector Growth

The Regional Growth Fund seeks to encourage sustainable private sector-led growth. This section will develop Government's understanding of the market context for the investment, and the likelihood that it will be deliverable and sustainable over the long term.

Questions 12-15 make reference to goods and services identified in Question 3. Where more than one good or service has been identified, the following questions should be answered separately for each good/service.

12. Using the pro-forma in Part 2, Section A of the application form, please provide a simplified forecast project Profit & Loss and cashflow over the economic lifetime of the private sector aspect of the project and explain the basis for each of the assumptions underlying the cashflow. *The answer to this question should refer to goods and services identified in Question 3(a).*

Please refer to Part 2, Section A for forecast project Profit & Loss and Cashflow.

Responses to parts (a) and (b) in Questions 13-15 should correspond to answers provided to the corresponding sub-sections of Question 3 i.e. when answering Questions 13(a), 14(a) and 15(a), responses should correspond to the goods and services identified in Question 3(a). When answering Questions 13(b), 14(b) and 15(b), responses should correspond to the goods and services identified in Question 3(b).

13. What are the characteristics of the market for the product(s) or service(s) directly or indirectly offered as a result of the project? *Please refer to product/service volumes and margins and identify key market participants.*
(a) Market for goods or services directly offered as a result of this investment?

There are two principal markets that are relevant to the SOEC; the market for electricity produced from Marine Current Energy Converters (MCECs), and the market for that technology itself. The UK is leading the world in terms of developing the marine renewables sector as a whole, although tidal stream technology is still some way from full commercialisation.[10] Different *learning pathways* are adopted by different renewable technologies. The UK marine energy sector is widely seen as needing to *learn by research* before *learning by doing.*[11] The tidal stream sector currently comprises 1.55 MW of technology capacity in the water.[12]

The tidal stream resource - summary of evidence:

- 'The most cited estimates on the potential tidal stream resource available in UK waters, suggests some 12 terawatt hours per year [13] (TWh / year) or 1.4 gigawatt

[10] Marine Energy Action Plan 2010, HM Government

[11] Technology Change and Energy Systems: Learning Pathways for Future Sources of Energy, Winskel, M., Markusson, N., Jeffrey, H., Jablonski, S., Candelise, C., Ward, D. and Howarth, P. (2008)

[12] Renewable UK, Marine Renewable Energy, State of the Industry Report March 2010

[13] In this section various electrical units are referred to, these are as follows: One terrawatt is equal to one trillion watts; one gigawatt is equal to one billion watts; one megawatt is equal to one million watts; a terrawatt hour is the energy converted by the power of one trillion watts operating for one hour; a gigawatt hour is the energy converted by the power of one billion watts operating for one hour. A megawatt hour is the energy converted by the power of one million

GW (av) would be economically exploitable. Recent reports suggest this figure could be higher but given that this technology is at such an early stage of development, the level assumed still represents a challenging target in engineering terms'. Currently the largest tidal stream turbine is the SeaGen device undergoing sea trials in Strangford Lough. This is rated at 1.2 megawatt (MW) and is expected to operate at load factors of 50%. This would mean the 1.4 GW (av) could be supplied by some 2,300 turbines.[14]

- 'It has been widely quoted that the total UK tidal stream potential is in the order of 17 TWh / year…academic research has highlighted uncertainties surrounding the calculation of practical resource and other methods of estimating the tidal stream resource have resulted in technical potentials of up to 197 TWh / year.[15]

- The offshore valuation group indicates 2 TWh / year currently allocated capacity, and 114 TWh / year additional practical resource for tidal stream technology, or 116 in total. For the purposes of their sector development analysis (see question 14b), their low and high end estimates are 33 and 200 TWh / year respectively[16].

Profit Margins

There is no available data on the profit margins of existing companies as the infrastructure to exploit tidal energy production on a full commercial basis does not yet exist. However, the acceptable internal rate of return by project developers for commercial sites will be in the region of 15-20%.[17] These targets can be achieved if public sector support, by way of capital support and market mechanisms, continues and improves until the cost of energy is reduced to a competitive figure. Most tidal energy generation products are still first generation devices with significant development needed or whose design is still being informed by further research. It has been estimated that the average investment required to progress a marine technology from concept to primary installation of a full-scale grid connected prototype is £30 million.[18] In 2010 the marine energy sector (tidal and wave) attracted some £41 million investment. The purpose of SOEC is to drastically reduce these development costs releasing additional private sector investment.

Key Market Participants

Currently the only comparable tidal research, testing and deployment facilities are located in Orkney at the European Marine Energy Centre (EMEC). EMEC was the first centre of its kind to be created anywhere in the world. The initial funding of £15 million was from a consortium of public sector partners. It offers facilities for full-scale prototype, grid

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watts operating for one hour.

[14] The Royal Academy of Engineering, Generating the future UK energy systems fit for 2050. Page 23 and 24.
[15] DECC Pathways Analysis page 204.

[16] The offshore valuation group. The Offshore Valuation. 2010.

[17] Renewable Energy Association

[18] RenewableUK, 2010. Marine Renewable Energy - State of the Industry 2010

connected testing for both wave and tidal devices. For tidal devices there are 7 test berths (rating some 5 MW combined).[19]

Nursery sites for both wave and tidal are also currently planned at EMEC, for operation in 2011. These will support devices of approximately 1/3 and 1/2 size of full scale. EMEC's nursery site will not be grid connected, unlike the SOEC nursery site. There are also mooring option limitations and there is no dedicated portside facility at EMEC. Demand for existing tidal testing berths at EMEC exceeds supply and there is a significant waiting list for device developers to occupy berths. In addition, due to the adverse weather conditions, extreme tidal currents and wave activity, some devices have been damaged during deployment and operation.

A separate facility is located at the National Renewable Energy Centre (NaREC, Tyne & Wear). The remit of NaREC is broader, cutting across all renewables not just tidal stream. NaREC comprises a barrage facility located in the River Tees which supports up to full-scale testing of tidal energy devices. In addition, expected to be available in March 2011 is *Project Nautilus*, a 3 MW rotary test rig, funded through £10 million mostly from the Environmental Transformation Fund. But this is not in an open sea location. NAREC does not provide a facility for long term open water deployment, such as that proposed by SOEC.

In April 2009, the UK had only 1.45 MW of tidal stream capacity installed in two devices. Since then several other wave and tidal stream devices are currently or about to be tested, reflecting the speed of innovation. However, the supply of suitable in-water test facilities is being outstripped by demand and there is therefore the risk the the industry will lose significant momentum. There is a need for inexpensive deployment sites for device testing and optimisation which has the capability to allow device deployment quickly, easily and inexpensively. SOEC is designed to address the following industry priorities:

- Further capacity for in-water testing of MCECs
- Facilities for small MCEC arrays
- Pre-consented sites
- Facilities in more benign seas for easier operation and cost savings
- Facilities for sea trials of devices designed for slower tidal flows
- Comprehensive local supply chains.

In closer proximity to SOEC, there are other renewable technology developments or proposed developments, summarised below. These are not competing in the same market; they are included to show the facilities supporting other forms of renewable energy development, as well as some of the issues encountered to date.

Wave Hub, a £48 million investment (£6.5 million initial from DTI and SWRDA, £21.5 million initial from ERDF and other sources, £20 million addition from European Transformation Fund, SWERDA and other sources) is located 16 kilometres off the coast of North Cornwall. Deployed in September 2010, it is grid-connected and to be used for larger scale testing of wave energy devices. There is no capacity for tidal energy devices.

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[19] www.emec.org.uk/tidal_site.asp

There are 4 berths, each with a 4-5 MW rating, and there is direct collaboration with the Peninsula Research Institute for Marine Renewable Energy, set up by the Universities of Plymouth and Exeter with funding from SWRDA. Higher Education Institutions in the South West have expressed interest in research collaborations which would be made possible by the location of both SOEC and Wave Hub.

In terms of tidal range facilities (which differ from tidal stream), plans to build a barrage across the Severn estuary were abandoned in October 2010. A feasibility study concluded that despite recognising the "significant resource" the Severn represents (potentially a barrage could supply 5% of UK electricity needs) a reluctance to shoulder much of the risk by the private sector meant that such a scheme was currently unviable.[20]

In the context of DECC's portfolio approach, this suggests a need for further development support for other forms of renewable energy generation of which tidal stream energy is one of the most promising.

(b) Market for other goods or services that may be indirectly created as a result of this investment?

This includes MCEC device development and an associated local and national supply chain. SOEC's supply chain will include the installation of devices, their operation and maintenance, testing and analysis, environmental monitoring and the manufacture and assembly of MCEC's, including turbines and all other components. Through SOEC the development of expertise in these areas will provide local companies with leading expertise in a world wide market as the sector grows. There are particular Solent capabilities which will support local supply chain development. These include:

- **QinetiQ (Haslar):** provides numerical simulation and physical modelling of marine systems, including marine current turbines. Facilities include a 270 metre long towing tank and 120 by 60 metre ocean basin. It is supported by the Ministry of Defence as a strategic facility for hydrodymanic testing. These facilities are located at the Haslar Maritime Technology Park in Gosport.
- **Sustainable Energy Research Group (SERG), University of Southampton** (which last year released the paper *Tidal velocity assessment proposed sites around the Isle of Wight*[21]). The Group was established in 1993, and is heavily involved in many aspects of marine energy. Fundamental MCEC device design work has encompassed blade design, cavitation and seminal studies quantifying device interaction effects in farms and arrays. The group has authored reports on tidal device technology assessment for DECC[22] and is presently working on an EU-funded programme developing protocols and standards for the marine energy industry. The Group has extensive ties with device developers and has conducted validation and performance assessments both experimentally and numerically. There are currently ten individuals in the Group's Tidal Stream Energy Research Group.

[20] Severn Tidal Power, Feasibility Study Conclusions and Summary Report October 2010

[21] Tidal Velocity Assessments Proposed Sites Around the Isle of Wight, Professor A.S.Bahaj et al 2009

[22] Tidal-current energy device development and evaluation protocol 2008

Marine energy is the focal point of the SERG's research; 17 of the 21 publications authored by the Group that were published in 2010 focused on tidal or wave energy.[23]

- **Wolfson Unit for Marine Technology and Industrial Aerodynamics, University of Southampton.** Created in 1979 the Unit comprises an expert staff of naval architects and marine engineers providing consultancy services in a number of areas including testing of marine renewables technology. They have performed theoretical efficiency analysis and computational fluid dynamics analyses of tidal turbine blades and have undertaken research into parameters affecting the efficiency of sub sea turbines.
- **Marine South East, Marine Information Hub**, is situated in Southampton. The business-led consortium promotes the interests of the marine sector and addresses the specific needs of marine businesses.

SOEC Industry Partners

The application involves a number of designated industry partners, these are:

- **BAE Systems (Steering Group Member):** A global company employing approximately 90,000 individuals, and the second largest defence and security organisation in the world, by revenue. BAE Systems has significant portside facilities in Portsmouth and a large site on the Isle of Wight.
- **Gifford (Steering Group Member):** A global engineering consultancy that has been involved in renewable energy systems since the 1970s. Gifford has extensive experience in offshore renewables.
- **Gurit:** A Global composites company, located on the Isle of Wight. Focus on four areas, including wind energy and marine technology.
- **Halcrow:** A global planning, design and management services firm for infrastructure and buildings projects. The firm was involved in the Wave Hub project.
- **SLP** / **Smulders:** Have been involved in tidal turbine device development and the design and manufacture of turbine foundations and gravity bases. With parent company Smulders, are looking to establish manufacturing facilities in the UK for steel foundations for MCECs.
- **QinetiQ:** (Noted above) A leading provider of technology-based services and solutions. Energy and the Environment is one of four core markets.
- **IT Power:** IT Power is a leading international energy consultancy which specialises in sustainable energy technologies and policy, and related economic, financial, commercial and environmental work. IT Power has considerable experience in marine renewables.
- **JDR Cable Systems:** JDR is a leading provider of custom-designed and manufactured subsea power cables, umbilical systems and marine cables for a broad range of applications. JDR provided the export cable for Wave Hub.

Key Market Participants (where we are now)

There are a number of projects that are currently in prototype development and testing:

[23] List of SERG publications 2010 http://www.energy.soton.ac.uk/publications/publications.html

- **Marine Current Turbines Ltd** has been testing a 1.2 MW demonstrator in Strangford Lough (Northern Ireland) since 2008.
- **Hammerfest Strom** tested a 300 kW grid-connected device over a period of 5 years since 2003.
- **Open Hydro** deployed a prototype device at EMEC during 2006.
- **Atlantis Resources Corporation** deployed a 1.2 MW prototype device at EMEC during 2010.
- **Other key participants** include over 40 active UK-based device developers. Globally, there are over 100 known device developers and this number is constantly rising. Due to its excellent resource, advanced technologies and extensive supply chain, the UK is an attractive place for international companies to test and commercialise their devices

14. How is the market forecast to change over time?
(a) Market for goods or services directly offered as a result of this investment?

Market Size and Value

The UK has a legally binding commitment to reduce its greenhouse gas emissions by at least 80% by 2050, relative to 1990 levels. The committee on climate change estimates that the UK electricity supply will need to decarbonise by 80% by 2030 to be on track to meet the 2050 target[24], underlining the scale of the opportunity that SOEC represents. In addition, to meet the 2020 commitment of generating 15% of energy from renewable sources, around 30% of UK electricity must come from those sources (currently the figure is just 7%).[25]

At this stage, various growth scenarios have been constructed for the tidal energy sector. A recent report providing a valuation of the UK's offshore renewable energy resource[26] devised three renewable technology deployment scenarios:

- Scenario 1 assumed the UK would maximise the role of offshore renewables in meeting UK electricity demand
- Scenario 2 considered the UK as a net exporter of electricity
- Scenario 3 as a net exporter of energy - but at a more ambitious level.

The role of tidal energy in the overall renewable sector development is shown below.

Figure 14a.2: Tidal Stream - deployment by technology scenarios

Scenario	1	2	3
Capacity (GW)	2	9	21
Capacity (TWh / year)	7	33	75
% of resource utilised	6	28	65

[24] The offshore valuation group. The offshore valuation. 2010. A valuation of the UK's offshore renewable energy resource

[25] Electricity Market Reform, Consultation Document, Department for Energy and Climate Change October 2010

[26] The offshore valuation group. The offshore valuation. 2010. A valuation of the UK's offshore renewable energy resource.

% UK resource utilisation (Overall Scenario by 2050)	13	29	N/S**
Supply chain revenues (Overall scenario by 2050)	£28 Billion	£62 Billion	£164 Billion
Profits (Overall scenario by 2050)	£8.5 billion	£16 billion	£24 billion
Direct Employment (Overall scenario by 2050)	70,000	145,000	340,000

Source: The Offshore Valuation. The offshore valuation group. 2010. NOTE: 'Overall scenario' denotes the impact of a number of renewable sectors, but assuming rates of development for tidal stream set out above. **Assume close to 100%.

DECC has also set out various development pathways for renewable energy sectors to 2050[27]. Their aim is threefold; to ensure emissions are reduced in line with targets; that supply meets demand; and energy security for the UK is achieved. It assumes a portfolio approach with different development pathways for different renewable energy supply sectors, within what is practical and physically deliverable. Wave and Tidal Stream energy are considered together as one sector. Both are described as 'emerging technologies with significant potential to reach commercial deployment'.

In DECC's report, four development pathways are considered for tidal stream technology development to 2050. Level one assumes sector potential is not realised, level four assumes an optimal outcome. Quantitatively, level 2 assumes 11.5 GW capacity by 2050 (25 TWh of electricity per year), Level 3 (29 GW, 68 TWh / year) and Level 4 (58 GW, 139 TWh / year).

Estimates based on these development pathways suggest that the socio-economic impacts from generating a UK marine energy industry could have an annual value to the UK of £3.7 billion by 2020, directly employing some 10,000 FTE's; or £5.9 billion by 2050, directly employing 19,000 FTEs[28].

Other forecasts indicate that the marine energy sector as a whole could be worth up to £6.1 billion per annum, contributing circa £800 million in gross value added by 2035[29], and by 2050 it is forecast to produce as much as 36 Gigawatts (GW) for the domestic market and 152 for the EU market; up from 1.5 and 2.1 GW in 2020 respectively. [30][31][32]

Despite this, a recent Ofgem study suggested some £200 billion investment is required in the UK's energy infrastructure to 2020.[33] In this context, DECC set out various 'enablers' required for the sector to become commercially viable and thus contribute to the 2050 emission target. These include:

- **Innovation and cost reduction**
  - Fundamental change in the engineering design of devices
  - More efficient use of materials

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[27] DECC 2050 Pathways Analysis – July 2010

[28] Source: RUK. Channelling the energy October 2010.

[29] Renewable UK, Marine Renewable Energy, State of the Industry Report March 2010

[30] RUK. Channelling the energy October 2010.

[31] Public Interest Research Centre, 2010, The Offshore Valuation

[32] EU-OEA, 2010. Oceans of Energy – 2020 Road Map

[33] DECC Pathways Analysis Page 38.

    - New and innovative ways of conducting installation, operation and maintenance (O&M); and
    - Increased efficiency of components.
- **Financing**
    - 'Tidal stream device development is currently very expensive. Many developers are SME's formed with the sole purpose of developing a specific device. Not only are these developers faced with trying to secure funding for development of the device but also the funds to support the day to day operations of the company. This sector requires a mixture of public and private funding to enable commercial viability of the technologies and funding will need to be applied in different forms, including grant, equity investment and market incentives. The opening up of private finance into tidal stream development is necessary for the continued development of the sector.'[34]

The volume of power produced by MCECs will inevitably increase as device design is enhanced and refined, leading to decreases in the cost of producing electricity from this source. Larger arrays (10-100 MW) should begin to be deployed close to 2020.[35] Thereafter the attraction of debt finance will be crucial to enabling rapid deployment of larger devices that will in turn bring the cost reductions per megawatt outlined below.[36]

'However, industry strongly believes that the level of capacity gains that are made will be reliant heavily upon enabling actions and policies by Government.[37] This is an early stage, pre-commercialisation industry; utilities are reluctant to devote large-scale financing without Government expressing confidence in the future of, and committing to, the sector'.[38]

To this end, more leases for marine energy projects have been granted in the UK than in the rest of the world combined.[39]

Profit Margins

Cost of energy will fall as installed capacity rises; learning rates of 85% to 90% are forecast for the total lifetime cost of marine energy.[40] Other reports calculate that for each doubling in MW capacity above 10 MW, cost reductions of 10% to 15% will be achieved, reflecting economies of scale, learning rates and design optimisation.[41] Estimates of future profits for individual firms in the MCEC sector are not available. For comparison, offshore wind turbine manufacturers typically aim for a gross profit margin of 20%.[42]

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[34] Ibid.

[35] Energy Technologies Institute & UK Energy Research Centre, Marine Energy Technology Roadmap October 2010

[36] Renewable UK, 2010. Marine Renewable Energy - State of the Industry 2010

[37] BWEA Marine Renewable Energy Report, State of the Industry Report 2009

[38] BWEA Marine Renewable Energy Report, State of the Industry Report 2009

[39] Renewable UK, 2010. Marine Renewable Energy - State of the Industry 2010

[40] BWEA Marine Renewable Energy Report, State of the Industry Report 2009

[41] Renewable UK, Channelling the energy, October 2010

[42] Source: Envirobusiness.

Recent analysis also suggests that tidal stream technology will become the second lowest cost offshore renewable technology, on a par with floating wind technology[43].

Market Participants (where we are going)

The Crown Estate has recently awarded leases for Round 1 zones in the Pentland Firth which include the following tidal energy projects:

- **SeaGeneration Ltd** to install a 100 MW array at Brough Ness, Pentlant Firth.
- **SSE Renewables and Open Hydro Ltd** plan to install a 200 MW array at Cantick Head, Pentland Firth.
- **Scottish Power Renewables** to install a 10 MW array in the sound of Islay. If successful will move to a 90 MW array at Duncansby Head, Pentland Firth.
- **MeyGen (International Power, Morgan Stanley & Atlantis Resources Corporation)** has entered into an 'Agreement for Lease' to develop up to 400 MW of tidal power in the Pentland Firth.
- **SSE Renewables** has secured a 200 MW site at Westray South, Orkney Waters

These projects represent a total installed capacity of of 1 GW, including the additional MeyGen project. However, it is universally accepted that substantial technological development and cost reductions will be required in order for these technologies to be deployed and operated cost effectively and it is unlikely that the following macro-developments can proceed without intermediate testing and small demonstration arrays. Offshore wind energy followed a progressive up-scaling and for tidal energy, with such a harsh operational environment, this should prove even more critical.

In line with the above developments and this requirement, SOEC's demonstration site which accommodates testing of small arrays, is an ideal platform that will enable these technologies to reach their potential before scale-up deployment at these sites commences.

(b) Market for other goods or services that may be indirectly created as a result of this investment?

There is a clear opportunity for the UK to become a market leader in the development of MCEC technology, research, manufacture, operation and maintenance. There are currently a large number of tidal stream devices in development and determining the most effective devices has proved difficult. Despite this, the leading devices are now converging towards a similar model – a submerged horizontal axis turbine. The need to establish a 'lead' device *'forms a strong driver for those inside the tidal industry and those seeking to invest in this 'lead' technology'.*[44] That said, this is only true for the majority of sites currently under development, where the tidal velocities are fast and the water is relatively deep; SOEC is also designed to accommodate the leading devices that are more suited to shallower water or slower moving currents. As sites across the globe vary

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[43] The Offshore Valuation Group. The Offshore Valuation 2010.

[44] Source: DECC Pathways Analysis page 206.

significantly in their characteristics, SOEC provides the opportunity to develop new market applications and ensure that the total addressable market is maximised.

For comparison, 96% of the wind farm technology market (at the end of 2003) was covered by ten manufacturers. Mergers and takeovers have resulted in an emerging *'big three*: Vestas (Danish), GE (U.S.A) and Siemens (Germany).[45] Some industry consolidation will clearly occur, but the tidal stream sector is diverse – the resource and individual site conditions differ substantially across the globe. These include coastal, shallow and deep water sites, in fast and slow currents for example. This process of consolidation will begin to start when the most successful devices can be refined and scaled up (2nd and 3rd generation arrays). Current estimates suggest this can be expected at the end of this decade.[46]

Wind power is seen as part of the solution for the UK in meeting its renewable energy targets, but not the entirety. Denmark has already established its position as the world leader thanks to continued and comprehensive Government fiscal support over the past thirty years. The UK is however leading on the development of tidal power; a more predictable resource than wind energy. Therefore, it is recognised that in the UK a mix of renewable energy sources is required, reducing intermittency of energy production and the burden on energy storage and grid reinforcement.

In terms of supply chain development, there are particular synergies between the wind, wave and tidal renewable energy sectors. Within accessible range from the Solent, two wind farm sites will be developed under the Round 3 Offshore Wind Developments. The Hastings Zone (bid won by E.ON Climate and Renewables UK), a 270.2 km^2 area 13-26 km from the West Sussex coastline with a potential yield of 0.6 gigawatts, and the West of Wight Zone (bid won by Eneco New Energy), 726 km^2 located 21.4 km from the Isle of Wight with a potential yield of 0.9 gigawatts. Construction at the Hastings site will start in 2014 and be fully operational by 2016. West of Wight will begin to be constructed in 2016 and should be fully operational by 2018.

The development of these and the Commercial Phase of SOEC are expected to overlap, presenting opportunities to achieve reduced costs through shared resources, e.g. transport vessels, portside deployment facilities, consenting and planning services, engineering, operational and maintenance expertise, and higher education and private sector research capabilities and assets.

15. **What assumptions are being made about market share?** *Include as appropriate information on customers, suppliers and competitors to support these assumptions.*

There are two business models that SOEC Ltd seeks to provide. First, MCEC berth rental and second, associated support services.

Customers

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[45] Wind farm Construction: Economic Impact Appraisal, O'Herlihy and Co Ltd, March 2006

[46] Energy Technologies Institute & UK Energy Research Centre, Marine Energy Technology Roadmap October 2010

Demand for berths at EMEC outstrips supply, as noted above. In terms of MCEC berth demand at SOEC, the business model options have assumed a flat fee (£15k) payable, per berth, per month on the nursery site and per berth (£250k), per year on the demonstration site. Two occupancy scenarios have been considered (figure 15.1).

Figure 15.1 Demand assumptions

1. Base case
Nursery site: 3 berths at 75% occupancy for 12 months
Demonstration site: 10 berths at 75% occupancy for 1 year
2. Downside case
Nursery site: 3 berths at 50% occupancy for 12 months
Demonstration site: 10 berths at 50% occupancy for 1 year

Source: Envirobusiness – business model.

Second, in terms of demand for specialist support services, which will include site and project development as well as consultancy covering R&D, deployment, test and operations, various assumptions have been made, based on available evidence and active discussions with potential customers regarding, in specific, project development of SOEC's commercial site. Comparisons to available data for offshore wind developments have also been made.

The base case assumes a 6% support services contribution to the overall cost of a generic tidal farm project[47], and considers an averaged installed CAPEX to 2040[48], based on a 25 year operational lifetime of SOEC. Using recent estimates for the UK deployment profile up to 2040[49], and latest resource estimates for regions around the UK[50], the support services contribution of the total market value was combined with a 3% English coast resource share out of the UK total[51]. A conservative 15% market share for SOEC was then assumed. The downside case assumes a 10% market share.

For both business models, the downside case includes a delay of a year.

Industry engagement carried out by Envirobusiness to date has identified some 80 organisations considered by them to be 'serious' about testing MCEC devices. Numerous letters of support and interest are attached to this application. The characteristics of these 80 firms are set out below. There are many more.

Figure 15.2 Tidal Energy Testing – Potential Customers

Location/Type	England	Scotland	Wales	International	Unknown (U.K.)	Unknown (Outside U.K)	Total
Utilities	6	1	1	1 (Norway)	1	-	10
Generation 1	3	2	-	1 (Ireland)	-	-	6
Generation 2	7	5	2	-	-	-	14

47 RUK, Challenging the Energy, October 2010

48 ETI UKERC Roadmap, 2010

49 ETI UKERC Roadmap, 2010

50 The Offshore Valuation Group. The Offshore Valuation 2010

51 The Offshore Valuation Group. The Offshore Valuation 2010

Generation 3	8	1	1		4	-	14
Other	2	1	-	27	-	8	38
Total	26	10	4	29	5	8	82

Source: Envirobusiness. *NOTE (Locations are U.S 10, Australia 3, Canada 3, Sweden 2, Norway 2, Netherlands 2, New Zealand 1, Denmark 1, France 1, Mauritius 1).

Suppliers

The market share of existing suppliers is difficult to quantify, due to the relatively early stage of the sector's development. We envisage that leading companies currently involved in the offshore wind sector, and those currently actively involved in marine renewables, such as SOEC's Steering Group and Industry Partners, will win a large proportion of business for both the supply chain of SOEC and the supply chain of SOEC's customers / partners. To date, however, the vast majority of device developers are SMEs; the supply chain size is therefore small and to a certain extent, unformed.

Competitors

In both markets SOEC's current market share is zero.

For the first business model, berth rental, the industry is not currently served with a sufficient volume of in-water MCEC device testing facilities to support its development at the rate required. The main competitor to SOEC is EMEC. EMEC currently has 100% of the UK market share. This is the only facility that is directly comparable, although this share will reduce as other tidal energy initiatives are developed.

Devices that are due to be deployed at EMEC are still in the prototype phase of development. The focus of EMEC is split between wave and tidal whilst SOEC is solely focused on the latter. Furthermore, EMEC's core focus is the testing and certification of full-scale single units, whilst SOEC provides a variety of options for companies at different stages of development. As for EMEC's nursery site, it is not advanced sufficiently to represent a barrier to the market for SOEC's nursery site and there are subtle differences that will prevent a number of technologies deploying at EMEC, such as site conditions, mooring arrangements, grid-connection and portside facilities. Finally, EMEC is at the opposite end of the UK and together with its extreme survivability testing, will not suit a number of technologies. It also has limited capacity in terms of number of berths and grid delivery.

Although EMEC may be seen as a direct competitor to SOEC, EMEC is highly supportive of SOEC due to the complementary nature and the gap provision SOEC provides along the development roadmap. Although SOEC can act as an alternative to EMEC, SOEC also acts as an industry partner, and to this end, EMEC has provided free consultancy to date.

For the same reasons, SOEC is also a partner to Wave Hub and NaREC. In summary, SOEC is highly complementary to all three organisations; the table below shows in simple terms how SOEC provides the final critical leg.

Figure 15.3 – Competitor Analysis

Organisation	Focus	SOEC Fit
EMEC	Full-scale and scaled prototype test of MCECs and WECs	Inshore site (precede) / Offshore sites (succeed)
NaREC	Test rigs and technical support for TECs and WECs	Nursery and Demonstration sites (succeed)
Wave Hub (not marine current)	Pre-commercial WECs	Equivalent to Demonstration Site

Moving forward, it is the intention that SOEC will work collaboratively with EMEC, NaREC and Wave Hub. Following discussions with the senior management of all three organisations, collaborative areas of specific interest are:

- Environmental impacts of marine energy devices
- Field testing of devices and components
- Grid connection for multiple devices
- Device to device effects
- Resource modelling
- Best practice and data share

To emphasise this proposed UK-wide collaboration, EMEC, NaREC and Wave Hub have all provided a letters of support (attached to this application).

SOEC is also globally competitive. A comprehensive gap analysis has positioned SOEC positively compared with leading foreign test centres such as FORCE and CORE.

Once operational, the demonstration and nursery sites will provide around half of the UK facilities available for sea trials. The nursery site will be operational by Q2 2013, the demonstration site by Q2 2014. The commercial site's operational start date has yet to be confirmed, although the SOEC project is likely to accelerate the development of the commercial site, with roll-out expected between 2014 and 2020.

In terms of support services, SOEC's second business model, these do not currently fully exist due to the tidal industry's relative immaturity. EMEC however, are introducing best practice protocols, including industry standards for testing, and are open to collaborative projects. In addition, major utilities are starting to develop, and looking to develop, marine renewables projects.

So far only 2,500 MWh has been supplied to the UK grid from marine energy sources.[52] SOEC will significantly bolster this.

16. What are the key risks, constraints and dependencies (e.g. planning consents) in executing the business plan and investment proposal? *Please demonstrate how these will be managed.*

(a) Risks etc. around activities carried out by project partners, directly related to the investment, as set out in Question 4(a)?

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[52] Renewable UK channelling the energy, October 2010.

Figure 16.1 – Risks and Dependencies – SOEC

Aspect	Explanation
Risk	**Planning Risk – failure to secure licences for operations at offshore sites**
Owner	Project Partners
Mitigation	During Phase 1 of the project all the surveys and assessments for the licence applications will be carried out at both the nursery and demonstration sites. Stakeholder engagement will also start at an early stage. Early investigations and discussions with stakeholders suggest that the sites will be suitable for the activities proposed. It is anticipated that the licences will be granted by September 2012. Should licence applications be unsuccessful, then the project will not proceed and the drawdown of RGF funding will cease. The business plan for SOEC Ltd includes a budget for ongoing environmental monitoring should this be imposed as a license condition.
Likelihood	N/A (no post-mitigation risk)
Impact	N/A (no post-mitigation risk)
Risk	**Planning Risk – failure to secure consent from The Crown Estate for offshore sites**
Owner	Project Partners
Mitigation	Applications for leases for the nursery and demonstration sites will be made at the same time as the licence applications and will therefore follow surveys, assessments and stakeholder engagement. Both sites have a maximum installed capacity of less than 10 MW and will therefore be dealt with by The Crown Estate as 'demonstration sites'. They will therefore fall outside of the Strategic Environmental Assessment which is currently being carried out. There is strong industry support for SOEC and it is therefore anticipated that consents will be gained by September 2012.
Likelihood	N/A (no post-mitigation risk)
Impact	N/A (no post-mitigation risk)
Risk	**Planning Risk – failure to secure planning consent for onshore infrastructure**
Owner	Project Partners
Mitigation	The onshore infrastructure will consist of a control room close to each site, a shoreside substation for the demonstration site, office accommodation for SOEC Ltd and a Portside Facility and Technology Centre. Planning applications will be considered by the relevant Local Planning Authority. The control rooms are likely to be housed in existing buildings and will therefore not require planning consent. The electricity substation for the demonstration site will be located close to Ventnor and will avoid designated areas such as Heritage Coast and Area of Outstanding Natural Beauty and a detailed study will be carried out to determine the most acceptable location and design. This will minimise the risk of planning failure. The SOEC operating base will be housed in existing accommodation and will therefore not require planning consent. The Portside Facility and Technology Centre will be located at an existing industrial site or at an allocated site for marine industrial use, of which there are a number in the Solent region. The risk of planning failure is considered to be low.
Likelihood	N/A (no post-mitigation risk)
Impact	N/A (no post-mitigation risk)
Risk	**Financial Risk – lack of industry demand for offshore facilities**
Owner	Project Partners / SOEC Ltd
Mitigation	Extensive consultations with the marine energy industry indicate that there is strong demand for both the nursery and demonstration sites (see letters of support). SOEC aims to be complementary to other facilities and its location in the sheltered waters of the Solent will make it attractive to many device and project developers. The ability to test small arrays of devices at the demonstration site is a particularly strong selling point. Through its Steering Group members and Industry Partners, the project will maintain dialogue with the industry to ensure that its offer continues to support the development of the industry as a whole. The project budget allows for initial marketing activities and the operating company – SOEC Ltd – will be responsible for the ongoing marketing of the facilities.
Likelihood	1 – Remote
Impact	3 – High
Risk	**Operational / Financial Risk – failure to mobilise the supply chain**
Owner	Project Partners
Mitigation	With the expansion of offshore wind projects, there is growing pressure on some elements

Aspect	Explanation
	of the offshore supply chain, both in terms of lead times and costs. The Project Partners have built up substantial supply chain databases, particularly for the immediate geographical area, and believe that the project can be delivered on time. A 20% contingency has been built into all costs and best value will be achieved through competitive tendering for goods and services.
Likelihood	1 – Remote
Impact	2 – Medium
Risk	**Construction Risk – failure to achieve grid connection for nursery and demonstration sites**
Owner	Project Partners
Mitigation	An initial study of grid connection issues for the nursery and demonstration sites, carried out by Grontmij, suggests that both can be achieved without reinforcement to the existing grid infrastructure. Offshore bathymetry suggests a number of options for cable routing. Detailed engineering studies will be carried out to provide specifications for all equipment and optimum routes for subsea cables so as to minimise cost and the impact on the marine environment.
Likelihood	2 – Unlikely
Impact	3 – High
Risk	**Financial Risk – failure to secure match funding**
Owner	Project Partners
Mitigation	Although the match funding from public and private sources is unconfirmed, discussions indicate a high chance of success once RGF funding is secured.
Likelihood	2 – Unlikely
Impact	2 – Medium
Risk	**Operation Risk – failure to deliver project to time and budget**
Owner	Project Partners
Mitigation	As the CVs demonstrate (see Q18), a strong and committed team has been put together to deliver the project with suitable experience of project management and marine energy. In addition to the Project Partners, a Steering Group has been established with extensive reach across the industry. All costs within the funding application have been subject to rigorous scruting and there is increasing knowledge from the offshore renewables sector of installation costs which provide further confidence in the project budgets. A 20% contingency allows for cost overruns.
Likelihood	2 – Unlikely
Impact	3 – High

All risk scores based on a 4 x 4 matrix.

(b) Risks etc. around activities not directly related to the project, in particular those set out in Question 4(b)?

As indicated in Q9b, the principal risk is that the wider benefits will not be achieved if the SOEC facilities are not developed, affecting both the local economies and employment opportunities in areas which are being severely affected by public sector job losses. From a wider perspective, this is likely to have a greater impact on the UK economy which has the ability to develop and maintain a pre-eminent position in the global marketplace for marine energy if it can continue to support UK-based enterprises and attract those from elsewhere which recognise not only the good natural resource in UK waters, but growing knowledge base and supportive supply chain.

Otherwise, the greatest risk to the rapid development of the marine energy sector is HMG policy with regards to renewable energy and particularly market support mechanisms for energy generation. In addition, the financial implications for HMG in fines are substantial if it does not achieve its mandatory renewables target, as imposed by the EU.

17. How does the project fit with the economic priorities and prospects of the locality as a whole? Where possible, this should be linked to a wider economic vision for the area and actions and policies of local partners. *Please be specific when identifying economic priorities, actions and policies, and explain how the project links with them.*

The Solent Local Enterprise Partnership

SOEC provides an excellent opportunity to deliver immediately against core strategic objectives for local and national economic development. The newly formed Solent Local Enterprise Partnership (LEP) has emphasised that business must be at heart of economic growth in the sub-region. The LEP has identified three key areas of focus:

- **Rebalancing** the local economy in favour of the private sector.
- **Reindustrialising** the economic base, supporting the development of knowledge based industries and high value added manufacturing.
- **Regeneration** - delivering a coalition between the private, public, voluntary and community sectors to continue the renaissance of the area's cities and urban areas, tackling deprivation, meeting the skills needs of the economy and taking a leading role in the low carbon revolution.

The SOEC proposal is wholly consistent with these aspirations.

Building on what has already been achieved, in its first 18 months the Solent LEP will take forward eight key areas of work. These include:

- Develop a growth hub and strategic based clusters which can deliver export-led growth in high value employment, capitalising on the sectoral strengths of the area and as a leading location and growth hub for advanced manufacturing and engineering, transport and logistics. The area has unique sectoral strengths and there is a determination to ensure the Solent continues to be recognised as the leading location and growth hub for advanced manufacturing and engineering (marine, aerospace, renewable energy, environmental technologies and composites).The application states: 'the major advanced manufacturing and marine cluster in the UK is located in the Solent area and is home to 1,750 marine related businesses. With GVA contributions of £3.6 billion, the sector represents around 18% of the Solent economy and accounts for some 48,000 jobs. The UK's largest concentration of 'clean tech' companies outside London are based in the Solent, as are the largest number of sustainability researchers, many of whom specialise in marine and maritime energy[53].

- Invest in skills to enable higher levels of employment and deliver a more balanced and sustainable pattern of growth to ensure that local residents are equipped to take up the jobs that are created.

[53] 'Solent Local Enterprise Partnership – Outline Proposal' – September 2010

- Realise the potential of our cities and supporting areas that are economically vulnerable in order to substantially reduce high levels of welfare dependency...High levels of welfare dependency are evident. The number of people claiming unemployment benefit has increased almost three fold from around 8,500 at its lowest point in October 2004, to over 23,000 in 2010.[54] In addition some 9% of SOAs are located in the 20% most deprived SOAs nationally.

- Establish a single inward investment and place marketing function building on the streamlining of services that has already taken place.

By 2026 the Solent LEP is seeking to:

- Create 10,000 new jobs, over current forecasts
- Attract inward investment contributing to GVA growth of 2.1% (or £6,400 per capita)
- Promote the area as the UK's leading hub for advanced manufacturing and marine – at home and globally - through a business led approach
- Realising the commercial potential of our universities, research, knowledge and expertise.

SOEC will directly support ongoing activity to promote the area as the UK's leading growth hub for advanced manufacturing and marine, in the UK and global marketplace. This has been a priority for Local Strategic Partnerships throughout the Solent during the past decade.

Isle of Wight – Eco Island

SOEC will make a substantial contribution towards achieving the Eco-Island vision, articulated in the Isle of Wight's Sustainable Community Strategy 2008-2020. This states:

- The Island will have the lowest carbon footprint in England by 2020 and aims for a 3% year on year reduction in carbon emissions.
- A commitment to invest in renewable energy technologies and use energy and water more efficiently. The Island will 'renew Island infrastructure to the highest ecological standards.
- Develop new sectors of employment creating a centre of excellence in renewable energies and generating capacity of over 100 MW of electricity by 2020.
- Develop a supportive environment so that our businesses can take advantage of market opportunities in the UK and worldwide from the growing demand for environmentally sensitive goods and services.
- Support economic development and regeneration…by increasing the skills of the whole community.

The importance of this vision has been subsequently emphasised through targeted actions contained within the Isle of Wight Council's economic development action plan in 2010, endorsed by the Island's public-private Economic and Environment Partnership.

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[54] Source: Solent LEP outline proposal 6th September 2010

18. Please provide a list of key project personnel who will be involved in delivering the project, including CVs.

The key project personnel involved in delivering the project are:

- John Metcalfe (Isle of Wight Council)
- Mark Francis (Envirobusiness)
- Alan Banks (Envirobusiness)
- Dr. Stephanie Merry (Envirobusiness)
- Dr. Luke Myers (University of Southampton)
- Prof. AbuBakr Bahaj (university of Southampton)

CVs for key project personnel are included below:

John Metcalfe

Organisation: Isle of Wight Council

Professional Experience

Isle of Wight Council - Deputy Director for Economic Development, Tourism & Leisure, December 2008 – present (*up to January 2010 as Assistant Director for Economic Development, Tourism, Culture, Leisure and Partnerships***). Responsibilities include:**

- The strategic planning and leadership of the following Council services: Economic Development (including events), Culture and Leisure, and Tourism.
- Business and performance management of all directorate functions including highways, planning and fire and rescue service.
- Deputise for the Strategic Director of Economy and Environment as required
- Provision of support and advice to the lead Cabinet Member for each service area.

Isle of Wight Council - Assistant Director of Community Services, February 2007 – December 2008. Responsibilities included:

- The strategic co-ordination and business management of all the services in the directorate.
- Specific responsibility for culture and leisure services, tourism and voluntary sector relationships.

  Project lead roles for modernising learning disability services, adult mental health services and workforce development.

Isle of Wight Council - Acting Assistant Chief Executive, January 2006 – February 2007.

Responsibilities included:

- The leadership and development of the Council's central business management functions including; performance management, committee administration, corporate complaints, equality and diversity
- Including a 4 month period as acting Monitoring Officer.
- Corporate organisational management responsibilities as part of the Council's Directors' Group;
- Corporate equality and diversity policy
- Liaison with public health services over Island health strategy
- Corporate organisational management responsibilities as part of the Council's Directors' Group;
- Corporate equality and diversity policy
- Liaison with public health services over Island health strategy
- The management, strategic planning, development and delivery of all:-
  - Leisure facilities - Commissioner
  - Leisure facilities management (from 2004)
  - Sports and Arts Development
  - Theatres
  - Libraries (from 2001)
  - Museums and Archives (from 2001)
  - Events (from 2002)
  - Adult, Community and Family Learning Services (from 2001)
  - Tourism (inc. TICs; from 2001 – 2002)
  - Beaches and Esplanades (until 2001)
  - Parks and Gardens (until 2001)
  - Children's Play (until 2001)
  - Member of the Council's senior management team.

Higher Education and Professional Qualifications

Masters in Business Administration, University of Southampton, 2007

- Diploma in Management Studies, Teeside Polytechnic, 1988
- BSc. (Hons) Sports Science and Administration, Trent Polytechnic, 1983

Membership of Professional Bodies

Institute of for Sport, Parks and Leisure (IPSAL)

Chief Cultural and Leisure Officers Association (CLOA)

Society of Local Authority Chief Executives (SOLACE)

Chartered Management Institute (CMI)

Mark Francis MEng, MSc

Organisation: Envirobusiness

Professional Experience

Environmental Enterprise Manager, EnviroBusiness, April 2010 – Present

EnviroBusiness works to accelerate the development of the cleantech sector by providing strategic financial and commercial advice to high-growth SMEs, and through the delivery of strategic low carbon and renewable energy projects.

- Head of offshore renewables
- Solent Ocean Energy Centre: Steering Group Chair, Project development and management lead, Fund raising, Stakeholder engagement and management
- Business development consultant and corporate finance advisor

Cleantech Business Consultant, January 2009 – March 2010

Strategic business development services for high-growth, technology-driven, cleantech companies.

- Identification and development of new business opportunities (private and public sector) – successful engagement with multiple large corporates and blue chip companies
- Strategic partnership development and management

- Project management best practice
- Due Diligence

Founder, Director & CEO, Alpha Space Technology Limited (ASTL), January 2006 – December 2008

ASTL, an innovative solutions provider, was established with the vision to reduce the carbon footprint and accelerate the competitiveness of technology-driven industry sectors through the development of a unique e-supply chain gateway.

- Accolades: 2007/08 'Most Visionary Business' BT Scotland Young E-ntrepreneur award
- Supported by: Prince's Scottish Youth Business Trust (PSYBT), Innovation Centres Scotland, Scottish Enterprise, ScotlandIS, the Society of British Aerospace Companies (SBAC) and Oracle
- Advisory network: entrepreneurs, business leaders, innovation advisors and industry specialists
- Responsibilities: business development, commercial management, project planning and management, marketing and sales, partner engagement and management, financial planning and control, due diligence, administration, legal and IP, HR, technical advisory and software testing

Principal Engineer | Business Development, Scotrenewables Ltd (SL), February 2006 – September 2007

Scotrenewables (Tidal Power) was established to develop and commercialise the SRTT (Scotrenewables Tidal Turbine) concept; sustainable 'clean' power from tidal currents.

- Start-up company (2 staff members) when appointed
- Successes: three investment rounds from TOTAL; initial to final stages of £6.2m investment from Fred Olsen Limited; grant funding from the DTI, Carbon Trust, Scottish Enterprise and £1.8m from the Scottish Executive; Shell Springboard competition – national winner
- Responsibilities: business development, commercial management, project / programme planning and management, partner engagement and management, cost of energy analysis, financial modelling, QHSE, legal and IP, HR, rotor design and optimisation, numerical modelling, control system design, scale model testing, tidal flow statistical analysis and other SRTT related R&D activities.

Education

- Master of Science (MSc), Distinction – Space Mission Analysis & Design (2004-2005, University of Glasgow)
- Master of Engineering (MEng), First Class – Aeronautical Engineering (1999-2004, University of Glasgow)

Alan Banks

Organisation: CEO, Envirobusiness

Professional Experience

Alan has an MA from Oxford University in Engineering Science, and is a Chartered Accountant.

His career has covered financial management, strategy consulting, equity research, investment banking, and clean technology commercialisation. He has founded, and led as CEO, three companies in online learning, corporate social responsibility research and renewable energy.

As an investment banker, Alan originated and executed more than 50 public M&A and capital raisings totalling more than £50 billion in transaction value.

Later, as a thought leader in CSR, he wrote many articles on the investment valuation of CSR risks, and was a guest lecturer at both Warwick and Harvard Business Schools. He was invited to be a Founder Member of the UN's Global Energy Security Forum and of the Institutional Investor Network on Climate Change.

Alan has also been actively involved as a Consultant focussing on the commercialisation of low carbon technologies. He has wide experience in the renewable energy, micro-generation, alternative transport fuels, waste recovery and low carbon buildings sectors.

As CEO of Envirobusiness – a 1,300 member organisation – Alan has helped more than 500 companies to access R&D and growth capital, develop strategic supply chain relationships, and develop and manage project consortia in areas such as offshore wind, carbon capture and storage, marine energy, and micro-generation.

Dr Stephanie Merry

Organisation: Envirobusiness

Professional Experience

Part-time Environmental Enterprise Manager, September 2010 - present, tasked with taking forward the concept of the Solent Ocean Energy Centre (SOEC). Activities include:

- Member of Steering Group for SOEC
- Project development and management support
- Liaison with the National Oceanography Centre / University of Southampton with regard to environmental monitoring
- Liaison with device developers and industry partners
- Consultation with local stakeholders and statutory consultees, for licensing and consents
- Data gathering for budgetary purposes

Director and principal technical consultant, Focus Offshore Ltd, June 2003 - present

- Recent Projects; Sector advisor on marine renewables for the Renewable Energy Association; Feasibility study for the establishment of a test centre for ocean energy technologies on the Isle of Wight, on behalf of the Isle of Wight Council; Production of an Atlas showing the tidal energy resource in the waters surrounding the South East of England; Assessor for the Technology Strategy Board Technology Programme; Assessment of novel tidal energy devices under the EnviroBusiness Programme; Marine sector specialist leading the UK Trade and Investment site visit programme for foreign delegates to the All Energy Conference; Sponsor and technical advisor to the Aluna Tidal Power project; Measurement of the Open 60 and Class 40 racing yachts in the UK and USA; Audit of hydrodynamic facilities costs worldwide, on behalf of QinetiQ; Report to NaREC: "Commercial Opportunities for the NaREC Marine Test Facility at Blyth."; Mapping the Marine Current Turbine Supply Chain in Northwest England - database for Envirolink Northwest.

Principal Engineer at QinetiQ (previously DERA) Haslar 1996 –2003

- Development of business in marine renewable energy (Oct 2002 – June 2003).
- Management of commercial Computational Fluid Dynamics projects and a team of 6 associated technical staff (2000 - 2002).
- Technical conduct and management of hydrodynamics applied research and project support tasks, plus "blue skies" research into submarine hydrodynamics and control.
- UK representative to EUCLID CEPA 10 (European Cooperation for the Long Term in Defence, Common European Priority Area 10) – Underwater Technology and Naval Hydrodynamics

Lecturer of fluid dynamics and naval architecture at the University of Southampton, Mechanical Engineering Dept and Institute of Sound and Vibration Research,1990 – 1996

Assistant professor in Ocean Engineering at Florida Atlantic University, USA, 1986 – 1990

Post graduate research and engineering consultancy into various aspects of fluid dynamics at the University of Southampton, 1980 – 1986

Higher Education and Professional Qualifications

- CEng, Institution of Mechanical Engineers, 1986
- PhD Mechanical Engineering, University of Southampton, 1976-1979
- MSc Oceanography, University of Southampton, 1972-1973
- BSc Metallurgy with German, University of Surrey, 1968-1972

Publications and Conference Papers

- Approximately 50 technical publications and reports on aspects of fluid dynamics, submarine hydrodynamics and control.

Dr Luke Myers

Organisation: University of Southampton

Professional Experience

- Lecturer, School of Civil Engineering and the Environment, Engineering and the Environment Faculty/Budgetary Group, University of Southampton, September 2004 – present

Relevant Research Grants and Contracts

- EquiMar, Development of standards and protocols for the marine energy sector, 2008-2011, funded by European Union (FP7)
- Tidal energy resource monitoring, Initial quantification of offshore tidal resource through seabed and vessel-mounted equipment, 2010, funded by Isle of Wight Council/ University of Southampton
- Performance assessment of tidal energy device, Performance quantification of blade design and validation of operational settings, 03-06/10, funded by Tidal energy device developer
- ARRAY, Seminal experimental/numerical study of interaction of tidal energy devices within arrays, 2005-2008, funded by BERR/Technology Strategy Board

Relevant research papers and reports

- Myers L. E., Bahaj A. S., C. Retzler., P. Ricci., J-F. Dhedin (2010) "Inter-device spacing issues within wave and tidal energy converter arrays." Proceedings of the 2nd International Conference on Ocean energy (ICOE), Bilbao, Spain.
- Myers L. E., Bahaj A. S., (2010) "Design of 1st-generation marine current energy converter arrays" Proceedings of the 11th World Renewable Energy Congress, Abu Dhabi, UAE.
- Myers L. E., Bahaj A. S (2010). "Experimental analysis of the flow field around horizontal axis tidal turbines by use of scale mesh disk rotor simulators." Ocean Engineering, Vol. 37, Issue 2-3, pp. 218-227.
- Myers L. E., Bahaj A. S (2009) "Near wake properties of horizontal axis marine current turbines." Proceedings of the 8th European Wave and Tidal Energy Conference, Uppsala, Sweden, 2009
- Harrison M E, Batten W. M. J., Myers L. E., Bahaj A. S (2009) "A comparison between CFD simulations and experiments for predicting the far wake of horizontal axis tidal turbines." Proceedings of the 8th European Wave and Tidal Energy Conference, Uppsala, Sweden, 2009
- Myers L. E., Bahaj A. S., Rawlinson-Smith R, Thomson M (2008) "The effect of boundary proximity upon the wake structure of horizontal axis marine current turbines." Proceedings of the 27th International Conference on Offshore Mechanics and Arctic Engineering, Estoril, Portugal, 16-21 June, 2008.
- Myers L. E., Bahaj A. S (2005) "Simulated Electrical Power Potential Harnessed by Marine Current Turbine Arrays in the Alderney Race." Renewable Energy, Vol. 30(11), pp. 1713-173.

Dr Luke Myers - Biography

Dr Myers has been active in the field of tidal energy since 2004. In this time he has published over 20 papers in professional journals and international conferences relating to tidal energy. His research base within the field is broad encompassing numerical modelling, small-scale device testing and offshore work. During 2005-2008 Dr Myers was responsible for the design, construction and testing of scale horizontal axis tidal turbines at a large hydraulics facility in Europe. This seminal project (with industrial collaboration) resulted in the first broad study investigating the flow field generated by tidal energy devices. His interest in this field has continued through other funded projects and supervision of postgraduate researcher. Most recently Dr Myers has been involved a large project funded under the EU FP7 framework. Equimar is focused on the development and publication of standards and protocols for the marine energy sector. Dr Myers is working within the technical work packages focusing on scale testing, sea trials and multi-megawatt arrays.

Parallel to centralised projects Dr Myers has conducted validation and appraisal work for a number of tidal energy device developers. These have involved both numerical and experimental work. Other work has involved device appraisal on behalf of funding bodies such as the Carbon Trust and DECC. Offshore work to date has comprised of the management and data post processing of a measurement campaign around the Solent region. Successful deployment of acoustic Doppler probes yielded valuable information regarding the validation and assessment of the tidal resource.

At present he is also responsible for managing the research activities of 4 postgraduate students involved in various aspects of tidal turbine design, array interaction effects and resource impacts. Dr Myers has good links with industry through his project and dissemination work and has presented his work to numerous marine energy stakeholders, the conservative party, incumbent Prime minister, top scientists and members of the royal family.

Prof A S Bahaj

PERSONAL INFORMATION

Name: AbuBakr Salem Bahaj, BSc, PhD, MInstPhys**,** CPhys, FICE, FRSA,

Address: University of Southampton, School of Civil Engineering and the Environment, Southampton, SO17 1BJ, United Kingdom

Nationality British

Present post: Professor of Sustainable Energy

Qualifications: PhD, Electronics Department, University Southampton (1982).

BSc (Hon), Electrical Eng. University Southampton (1976).

2. MANAGEMENT / RESEARCH / ESTEEM

Employment and management summary

After completing my PhD I was employed by the University of Southampton progressing from a researcher to a Personnel Chair of Sustainable Energy within the within the highly rated School of Civil Engineering and the Environment (2nd in the UK, RAE in 2008, with 80% of our research was judged to be either “World Leading” or “Internationally Excellent”). I am responsible for the leadership of the Energy and Climate Change Division (ECCD) and the Sustainable Energy Research Group (SERG) within the School. The Division consists of around 50 academics researchers and visiting scholars (www.civil.soton.ac.uk/research/divisions/divlist.asp?ResearchGroupID=1). In addition of being part of the management committee of the School and other University committees, I have full management responsibility for the Division within the School, in terms of research direction, delivery of outputs, finance, administration and interaction within the University and beyond. I am currently a director of a Research and Development company active in solar photovoltaics and until 2008 was a director the company aiming to deliver a 50 MW CHP district heating installation in Southampton.

Research Portfolio

Over the last 20 years, I have established the energy theme within the University of Southampton, and directed the work of

SERG, (www.energy.soton.ac.uk), now one of the UK's top research groups in energy. Our work encompasses the study of urban energy systems (including demand reduction, microgeneration and utilising ICT for monitoring building performance and feedback to users), the built environment (working at the city, village and the building scale), and ocean energy conversion studies. Set up the Sustainable Energy Research Group (SERG) in 1990 and in 2007 formulated the ECCD within the School. SERG which now sits with ECCD has 6 – 8 core researchers, currently 9 PhD students under my supervision and 11 completed. Over the last 5 years my research portfolio was in excess of £7 million, with current active projects in excess of £3 million. Core research areas are at the cutting edge of renewable energy (wave, tidal, micro wind, PV, etc), energy in buildings (including consumption assessments) and the impact of climate change on the built environment. List of current and previous research projects are at www.civil.soton.ac.uk/staff/staffbyrole/acadstaff/staffprofile.asp?NameID=4.

I have recently developed a cross department new multi-pathway MSc programme in Energy and Sustainability (including modules that cover wave and tidal energy) and have operational responsibility for two of these pathways running in my School in the University of Southampton.

Expertise highlights relevant to marine energy

Research and development within my Group are at the cutting edge of wave and tidal stream renewable energy developments. This include fundamental understanding of device performance coupled with realistic estimates of energy yields, accurate characterization of the resource, and the collection of reliable data in the marine environment. Such knowledge generation is recognised around the world, through participation in collaborative research programmes and publications in prestigious academic journals and conference series of international standing. In wave and tidal energy, currently conducted research areas are as follows:

- Wave and tidal resource assessment, including data gathering, with particular emphasis on energy extraction and its impact.

- Production of optimised blades for marine current energy converters, and analysis of their cavitation and turbine power characteristics. This work is now used within industry standard protocols for laboratory scale testing in UK.
- Fundamental understanding of performance of device and the design philosophies. Impacts to energy yields and hence economics. Device interactions within arrays or farms configurations.The skills and knowledge base available within the Division can be combination with input from industry, enable us to deliver the technology needed for the development and demonstration of survivable and efficient wave and tidal energy converters. This expertise is underpinned by specific experience gained in sustained research and development programmes. Some of these are listed below (www.civil.soton.ac.uk/staff/staffbyrole/acadstaff/staffprofile.asp?NameID=4).
- On-going confidential work investigating design issues, operational characteristics of tidal stream converters coupled with the energy extraction from resource intensive sites such those in the English Channel.
- FP7 24 partner collaborative programme "EquiMar—Equitable Testing and Evaluation of Marine Energy Extraction Devices in terms of Performance, Cost and Environmental Impact" (Project 213380) – I lead WP5 "Deployment assessment: Performance of multi-megawatt device array", and also major contribution to WP3 and WP4 "scale testing, and sea trial testing procedures for marine energy extraction devices".
- Development of the Isle of Wight, "Eco Island" theme, which aspires to make the island carbon neutral by 2020. This, in addition to other options, entailed the development of tidal stream sites around the island.
- BERR funded programme to develop protocols for laboratory scale testing of tidal stream turbines.
- BERR collaborative programme with Gerrard Hassan, Lunar Energy and SMD hydrovision on the "Performance characterisation and optimisation of issues of marine current energy converter arrays" (DTI, TP/3/ERG/6/1/16450; D05/750159)
- Collaborative KTP with Pelamis Wave Power Ltd on "Characterising the wave energy resource at potential sites for wave energy farms".
- FP6 programme "Coordinated Action on Ocean Energy" (Project 502701) with 42 EU partners.
- EPSRC funded programmes with industrial collaboration, to investigate the "Hydrodynamics of Marine Current Turbines" (GR/R50424). This work was used to validate industry tools for the design of marine current turbines.
- Industry funded programmes related to marine renewables.
- BERR funded collaborative project with Lunar Energy for large scale testing (include wave and current loading determination) of shrouded tidal stream turbines (DTI, TP/06/00236/00/00).
- E-On funded collaborative programme with the University of Karlstad, Sweden, to investigate methods to mitigate the impact of hydropower systems on fish populations.
- Work within the Division, on the hydrodynamic characteristics of a series of wave power devices since the mid-1990s with support from EPSRC and industry. These include the Pelamis (GR/N35762), IT Power Ltd, OWEL Ltd and Anaconda.
- EPSRC and EC funded programmes on the development of Anaconda (www.bulgewave.com); Prof John Chaplin, EP/F030975,) with support from Atkins and Checkmate SeaEnergy.

Esteem and distinctions

Over the last two years I have given around 12 keynote and invited lectures; in 2008 I gave evidence at the House of Lords, presented at Parliament (Feb 2009), being a panel member on various national international funding bodies, member of technical committees of international conferences and contributor to the work of international agencies. Some details are given below:

- Invited by Professor Brian Collins, Chief Scientific Advisor to the Department for Transport and the Department of Business, Innovation & Skills, to contribute to the joint Government-engineering profession project under the Government's *Infrastructure & Adaptation* programme set up to identify and examine 'strategic solutions to increase the long-term resilience of infrastructure in the energy, communications, transport and water sectors to future climate impacts' (July 2010).
- Invited by Professor John Beddington, Chief Scientific Advisor to HM Government and Head of the Government Office for Science to contribute to the workshop on the "Future of Energy" as part of the Technology and Innovation Futures Project, run by the Foresight Horizon Scanning Centre, Government Office for Science, UK (May 2010)
- Elected Chair of the next European Wave and Tidal Energy Conference (EWTC) to be held in Southampton 5 – 9 Sep 2011. This is the most prestigious academic event in ocean energy research and development.
- International Energy Agency (IEA): Contributed to the 2008 Annual Report, the section on tidal energy entitled "Status of Tidal Current Energy Conversion", Dec 2008 (published Feb 2009). This report was also selected by the IEA to be included in their book entitled *Ocean Energy: Status, Prospects and Strategies,* to be published 2009.
- Commissioned Elsevier (Dec 2008) to be the Volume Editor for the 'Marine Technology' in a new major reference work project, provisionally entitled *Comprehensive Renewable Energy*, intended for publication in 2013. The work will be 6400 pages over 8 volumes with ~192 articles.
- Member of the Committee on Energy, Task Group on Solar Energy to World Federation of Engineering organizations (WFEO), through a nomination by the Institution of Civil Engineers, Dec 2008.
- EPSRC's appointee on Tyndall Centre Supervisory Board - 2005 - 2010.

Membership of major research/grant awarding bodies:

UK Government Technology Programme - now Technology Strategy Board (TSB) - Panels: (1) Water Technology and Solar Technology - which assess multi-million pound academic/industrial/commercial proposals (2001 - 2007).

Reviewer and panel member of the Canada Foundation for Innovation (CFI – http://www.innovation.ca) 2008/09 C$1.4 Billion dollars competition to invest in world-class infrastructure projects.

Science Foundation Ireland (review of Stokes Professorships & Lectureships) and also Ireland Higher Education Authority.

EPSRC Panels and College

Reviewer for The U.S. Dept. of Agriculture Small Business Innovation Research (SBIR) programmes which supports a wide range of applied R&D projects to help move low carbon technologies into the commercial marketplace.

New Zealand Foundation for Research Science and Technology.

British Standards Institute (BSI) committee on standards for PV Energy Systems (GEL82) represent the UK on the International Electrotechnical Commission (IEC) - Working Group 2 (WG2: PV systems).

PUBLICATIONS

I have authored/co-authored more than 200 publications in my areas of research in both academic journal and conference proceedings

Full list is at http://www.civil.soton.ac.uk/staff/staffbyrole/acadstaff/staffprofile.asp?NameID=4).

19. Who will be responsible for any liabilities associated with the project e.g. cost overruns or shortfalls in receipts?

PUSH (Partnership for Urban South Hampshire) is a partnership of eleven local authorities including the unitary authorities of Portsmouth, Southampton and the Isle of Wight, and the district authorities of Eastleigh, East Hampshire, Fareham, Gosport, Havant, New Forest, Test Valley and Winchester. As of 1 April 2011 Southampton City Council will be the Lead Authority for financial matters in accordance with the Joint Arrangement and as such will be the recipient of the RGF funds for both the Solent Gateway and Solent Futures package of projects. The immediate partner and project Lead is Isle of Wight Council who will be the lead authority for this project and will over see 100% redistribution of the funds and be responsible for the financial risks and consequences relating to delivery and operation of the scheme.

The Isle of Wight Council will be responsible for liabilities. If the application is successful, agreements will be put in place with Project Partners to limit liabilities associated with the project. A generous contingency of 20% has been built into all project costs which has been based on reported costs from the offshore wind industry and early stage marine renewables projects.

20. Is the proposed level of RGF support considered to be compliant with European State aid regulations? *Please give a brief explanation of your assessment.*

Bearing in mind the nature of the organisations involved in this project the Council is confident that this project will fall outside of the scope of State Aid. Bearing in mind the subject matter of the bid, the Council believes that where a particular element of the bid might fall within the scope of State Aid, the Council will be able to rely on one or more of the exemptions under the General Block Exemption Regulations.

There are several variables within the bid that must crystallise before the Council is able to express a definitive opinion as to the bids compliance with compliance with European State Aid regulations. However, in structuring the bid and the obligations of the bid partners the Council has and will continue to give consideration to the State Aid Regulations.

21. Are any of the project partners making (or intending to make) a separate bid to the RGF? If so, please identify by project title and indicate whether these bids are considered to be mutually exclusive.

No.

22. Is the project receiving or likely to receive other public support of any type? If so, please provide full details.

As stated in Q8a, the project is seeking a total of £1,833,000 support from the European Regional Development Fund (ERDF).

The project will also receive in-kind support from the Isle of Wight Council in order to comply with its responsibility as Accountable Body. This is likely to involve a substantial amount of officer time in grant administration, financial controls and reporting, compliance with Contract Standing Orders, participation in the project Steering Group and equality monitoring.

23. Please provide a summary of the public support that any private sector partners involved in the project have received, or applied for, in the last three years.

Envirobusiness has received funding of £1,162,710 from SEEDA between Jan 2008 – Dec 2010 for delivery of a range of environmental and renewable energy programmes, and £63,817 from the European Regional Development Fund between Jul 2008 – Jun 2010 for EcoMind which is designed to help SMEs develop sustainable innovative products and services. Envirobusiness has had one unsuccessful applications for public funding – a bid to the ERDF for £175,460.

Section D: Costs and Benefits

In order to ensure good value for money for the taxpayer, it is important that the additional economic benefits associated with supporting a project exceed the costs of Government support. This section seeks to identify and characterise the full range of economic costs and benefits associated with the intervention.

24. Please provide an approximate estimate of the spread of employment impacts, by Local Authority District where possible. *Please fill in the table below, an example can found in the application form guidance.*

Area	**Approximate proportion of employment impacts**
Solent LEP Area	50%
Unknown Districts elsewhere in England/UK	50%
Total	100%

Source: Envirobusiness, from assumptions made in business plan.

25. We need to know the estimated number, type and location of jobs that will be created through this investment. These jobs can be directly or indirectly created. Indirect jobs can arise through:
- the activity of the investment, (ie through the supply chain); and
- wider economic benefits enabled or unlocked by the investment.

Please set out the gross number and type of jobs that will be:
(a) directly created and safeguarded by the project itself, using Part 2, Section B of the application form.

The direct impact of SOEC in terms of economic value and jobs created / safeguarded is twofold: through the development, construction and operation of SOEC, and through the manufacture, deployment and operation of MCECs at SOEC throughout its lifetime. However, for the purposes of this application, directly created and safeguarded jobs only relate to the direct activities resultant from this investment; to facilitate the development, construction and operation of SOEC. These are as follows:

13 FTE gross jobs will be directly created and some 93 gross jobs (some 85 FTE's) will be directly safeguarded. See Part 2 Section B. The 13 FTE gross jobs will result from the operations of SOEC Ltd. These have been generated from an analysis of SOEC expenditure[55]. Our method of converting safeguarded jobs to FTEs is set out in figure 25a.1 overleaf. Part 2 Section B of the form presents FTE numbers[56].

[55] Envirobusiness considers these jobs will be safeguarded if SOEC goes ahead.

[56] The numbers is Part 2 section B are not rounded.

Figure 25a.1 – Converting safeguarded jobs to FTE's

	Expenditure	Proportion of total expenditure	Gross Jobs	FT %	PT %	FTE	FTE Rounded
Programme Project Development	£964,724	3.1%	**2.9**	82%	18%	**2.7**	**3**
Planning and Consenting	£175,000	0.6%	**0.5**	89%	11%	**0.5**	**1**
Nursery Site (Assessment and Surveys)	£464,200	1.5%	**1.4**	89%	11%	**1.3**	**1**
Nursery Site (Engineering Design)	£117,297	0.4%	**0.4**	89%	11%	**0.3**	**0**
Nursery Site (Construction/Implementation)	£1,480,625	4.8%	**4.5**	90%	10%	**4.1**	**4**
Demonstration Site (Assessment and Surveys)	£1,451,750	4.7%	**4.4**	89%	11%	**4.1**	**4**
Demonstration Site (Engineering Design)	£645,099	2.1%	**2.0**	89%	11%	**1.8**	**2**
Demonstration Site (Construction/Implementation)	£14,057,750	45.7%	**42.5**	90%	10%	**38.7**	**39**
Onshore Cluster	£6,250,000	20.3%	**18.9**	89%	11%	**17.4**	**17**
Total (excl. contingencies)	£25,606,444	83.3%	**77.5**			**70.9**	**71**
Contingencies	£5,121,289	16.7%	**15.5**	89%	11%	**14.3**	**14**
Total (incl. contingencies)	£30,727,733	100%	**93.0**			**85.2**	**85**

Source: ABI data. See application form part b for further information. *rounded to nearest one.

(b) <u>indirectly</u> created and safeguarded by the project. Where sufficient information and certainty exists, set out details using Part 2, Section B of the application form. Where less specific information is known, use the space below to summarise the indirect employment outcomes you expect from this investment. Please describe below how these impacts will occur (i.e. through the supply chain of the project itself, or as a result of the economic activity enabled by the investment), providing as much detail as possible in terms of employer name, job title, skill level, salary level, location and timing of impact.

The total impact of SOEC in terms of its creation and the delivery of MCECs throughout its lifetime has been considered. This analysis assumes that SOEC is fully implemented, which includes the commercial site. Using recent industry figures on levelised cost of energy for different stages of development[57], value created per employee[58], the UK share of the domestic market[59], as well as reasonable assumptions on Solent market share, the impact figures (along with processes used) are summarised below. In summary, some 108 indirect jobs could be generated in the Solent, up to some 216 across the UK from the nursery and demonstration sites. Some 2,356 Solent and 4,606

57 ETI UKERC Roadmap, 2010

58 RUK, Challenging the Energy, October 2010

59 RUK, Challenging the Energy, October 2010

UK jobs if SOEC is implemented in full.

Figure 25b.1: Indirect Employment Headlines

Value/Employment Created	Impacts	Explanatory notes
SOEC (excluding commercial site)		
£168,453, 842	**Total direct and indirect Solent economic value (incl. 11 MW capacity)**	*Solent economic value, plus EBITA, operational and capital expenditure.*
108	**Total indirect Solent jobs created / safeguarded (incl. 11 MW capacity).**	*Lifetime Solent economic value divided by average value created per employee (£331,115). Source: RUK Challenging the Energy Report. N.B, excludes 106 direct jobs in 25a i.e 214-106)* *Sources of jobs: SOEC and MCEC's.*
£204,142,493	**Total direct and indirect UK economic value (incl. 11 MW capacity)**	*UK economic value, plus EBITA, operational and capital expenditure.*
216	**Total indirect UK jobs created / safeguarded (incl. 11 MW capacity)**	*Lifetime UK economic value divided by average value created per employee (£331,115). Source: RUK marine economics report. N.B, excludes 106 direct jobs in 25a (i.e 322-106).* *Sources of jobs: SOEC and MCEC's.*
SOEC (including commercial site)		
£913,491, 842	**Total direct and indirect Solent economic value (incl. 261 MW capacity)**	*Nursery and demonstration site plus commercial site value.*
2,356	**Total indirect Solent jobs created / safeguarded (incl. 261 MW capacity)**	*Indirect jobs for Nursery and demonstration sites and direct and indirect jobs for commercial site. Excludes 106 direct nursery and demonstration site jobs in 25a (i.e 2,464-108).* *Sources of jobs: SOEC, MCECs and MCEC Projects*
£1,694,281,493	**Total direct and indirect UK economic value (incl. 261 MW capacity)**	*UK economic value, based on full market opportunity, making allowance for UK market share (72%).*
4,606	**Total indirect UK jobs created / safeguarded (incl. 261 MW capacity)**	*Indirect jobs for Nursery and demonstration sites and direct and indirect jobs for commercial site. Excludes 106 direct nursery and demonstration site jobs in 25a (i.e 4,822-216).* *Lifetime economic value divided by average value created per employee (£331,115). Source: RUK marine economics report.* *Sources of jobs: SOEC, MCECs and MCEC Projects*

Source: Envirobusiness. Note: jobs are gross jobs and are not FTE's.

Figure 25b.2: Nursery and Demonstration Site – Indirect Jobs – Solent

SOEC Nursery and Demonstration Site (not including commercial site)		Explanatory notes
25	years	Total operational life
11	MW capacity	Estimated maximum electricity generating capacity of both sites
18,232	MWh - potential energy production per annum	Assuming 1 MW / 10 MW capacity and taking into account respective capacity and availability factors, taken from business and financial plan.
290	£/MWh - levelised cost of energy	Source: ETI UKERC Roadmap - 2010/2020 high end average estimate.
£5,287,208	full value per year - lifecycle	Potential energy production multiplied by the levelised cost of energy.
£132,180,188	full value over 25 years - lifecycle	Annual value multiplied by operational life.
75%		We have assumed a reduction of 25% of costs that are not required due to the development of SOEC. N.B estimated. from RUK Challenging the Energy Report.
£99,135,141	Actual value over 25 years - lifecycle	Lifetime value assuming SOEC is developed.
50%	Solent market share	We have assumed 50% of this value is retained in the Solent. For comparison the South West Wave Hub application estimated 40% for Cornwall. We consider the Solent's strength in this sector justifies a higher retention rate.
£35,688,651	Solent economic value	Life cycle value – allowing for Solent market share (50%) and then allowing for UK share of domestic market (72%). Source: RUK Marine economics report.
£30,727,733	SOEC CAPEX	SOEC development and construction (capital expenditure)
£48,796,064	SOEC EBITDA over 25 years	Taken from estimated investor returns analysis in the business and financial model (base case).
£53,241,395	SOEC OPEX over 25 years	Operational expenditure taken from investor returns analysis in the business and financial model (base case).
93	SOEC CAPEX jobs safeguarded	Direct jobs - see question 25a.
13	SOEC OPEX jobs created	Direct jobs - see question 25a.
£168,453,842	**Solent direct and indirect economic value**	***Solent economic value, plus EBITA, operational and capital expenditure.***
108	**Total Indirect Solent jobs created / safeguarded**	***Lifetime Solent economic value divided by average value created per employee (£331,115). Source: RUK marine economics report. N.B, excludes 108 direct jobs in 25a i.e 216-108.***

Source: Envirobusiness. Note: jobs are gross jobs and are not FTE's.

Figure 25b.3: Commercial Site – Indirect Jobs – Solent

SOEC - commercial site		Explanatory notes
25	years	*Total operational life*
250	MW capacity	*Estimated maximum electricity generating capacity of commercial site*
591,300	MWh - potential energy production per annum	*Assuming 250 MW capacity and taking into account respective capacity and availability factors, taken from business and financial plan.*
140	£/MWh - levelised cost of energy	*Source: ETI UKERC Roadmap (using an average. cost of energy for build-out.) Assumed cost of energy decreases.*
£82,782,000	Value per year - lifecycle	Potential energy production multiplied by the levelised cost of energy.
£2,069,550,000	Value over 25 years - lifecycle	*Value assuming lifecycle is 25 years.*
£2,069,550,000	(Full market opportunity)	
50%	Solent market share	*As above, we have assumed 50% of this value is retained in the Solent. For comparison the South West Wave Hub application estimated 40% for Cornwall. We consider the Solent's strength in this sector justifies a higher retention rate.*
£745,038,000	Solent economic value	*Life cycle value – allowing for Solent market share (50%) and and then allowing for UK share of domestic market (72%). Source: RUK Marine economics report..*
£745,038,000	**Solent economic value**	***Full economic value of commercial site***
2,250	**Solent jobs created / safeguarded**	***Lifetime Solent economic value divided by average value created per employee (£331,115). Source: RUK marine economics report.***

Source: Envirobusiness Note: jobs are gross jobs and are not FTE's. *NB: developers will be responsible for all lifecycle costs.*

26. **What, if any, research and development activities are planned as part of the project?** *Please describe these activities below (including location, nature of activities, required inputs and expected outcomes) and complete the R&D expenditure profile in Part 2, Section C of the application form.*

Figure 26.1: Research and Development Summary

Information Requested	Description
Category of Research and Development Activity	SOEC will provide the infrastructure for device developers to carry out research and development. There are no research and development activities during the development and construction phases of SOEC (the funding sought in this application). When SOEC is operational R&D activities will occur (directly and indirectly). *Enabling* R&D is a central aim of SOEC and the University of Southampton is a named partner, so a brief summary is provided below.
Key activities and inputs	SOEC will provide facilities for research and development, manufacture, assembly and deployment of scaled prototype MCEC devices and arrays, or parts of those devices. The nursery site will enable these scaled prototypes to be tested in real world conditions for extended periods of time. Maintenance actions will be simplified allowing for faster technology development and accumulation of operational hours. The demonstration site then provides a 'next step' in MCEC development.
End output	Improvements in design, improved understanding of MCEC capability, (for example hours of operation, durability) and potentially new models of MCEC devices, or parts for those devices. The demonstration site will enable larger devices or small arrays to be tested / demonstrated, proving concept. Device interaction and array optimisation studies will be conducted.
Location	Offshore facilities in the Solent and the English Channel linked to nearby onshore infrastructure.
Description of any co-funding or co-working arrangements (e.g.: SME's, HE institutions, supply chain sector peers)	See questions 6 and 7.
The mechanism for dissemination of findings and incentives for dissemination	SOEC's 13 berths will be rented on a commercial basis to any company or organisation that wishes to test devices or parts. Higher Education organisations may also utilise the facilities, where there is greater potential for the dissemination of R&D findings. The products developed through the nursery and demonstration sites have applications in other sectors, for example the manufacturing of composite materials; other sources of renewable electricity generation and their maintenance and repair. In a letter of support for the SOEC project dated 17th August 2010 to the Isle of Wight Council, Professor Powrie, Dean of the Faculty of Engineering and the Environment, wrote: *'The University of Southampton activities in marine renewables are at the cutting edge of research and development. Specifically in wave and marine current conversion, the work includes developing fundamental understanding of device performance, device/device interactions, farm/array layouts, accurate characterization of the resource coupled with realistic estimates of energy yields and the collection of reliable data in the marine environment. Such knowledge generation is recognised around the world, through participation in collaborative research programmes, academic and*

Information Requested	Description
	guidelines publications, and consultancy work spanning early stages of device development'.
Barriers to dissemination, including likely use of patenting for R&D outputs and UK capacity to absorb these technologies	The findings from any private sector testing are expected to kept commercially confidential. Despite this, the berths will be available to any organisation or companies that wish to use them. The applicants have carried out extensive private sector engagement and we attach various letters of support and interest to this bid. 'Learning rates' within the industry on MCEC device development will be materially improved through SOEC, and background IPR will be retained in the region.
What is the level of risk associated with the activities (i.e. of not meeting technical objectives)? Will useful knowledge be gained even where technical objectives are not met?	Although tidal energy is an emerging sector, there are a substantial number of firms already involved in device development. The technology is commercially immature, but sufficiently advanced in design terms to ensure that useful technical data can be realised. Overall, the risks of no useful technical improvements arising from the project are considered to be negligible.
Does the project use novel technologies? Do the activities offer the potential for path breaking proof of concept benefits?	Yes. There is also a high likelihood of path breaking proof of concept benefits in tidal energy generation emerging through SOEC.
Possible (profitable) applications in other sectors – including and indication of the economic advantage of adopting these technologies and the likelihood that the market would facilitate this technology transfer.	There are other applications in: ▪ The design and manufacture of composite materials ▪ The repair maintenance and overhaul of MCEC devices (and other renewable energy generation devices, such as wind turbines). This is complemented by the potential provision of a portside facility as part of SOEC. ▪ Development of the Solent renewables supply chain (see letters of interest and support) ▪ Development of specialist expertise with applications in other sources of renewable energy, for example tidal, wave and wind power.

27. What, if any, skills and training provision will be associated with the project? *Please describe these activities below (including location, type of training and qualification level) and where possible complete the skills and training expenditure profile in Part 2, Section C of the application form.*

There is no provision of skills and training associated with the development and construction phases of SOEC (the funding sought in this application). It is envisaged that trading surpluses from SOEC Ltd will be invested in research and development activities which will benefit the UK marine energy industry.

28. Please describe briefly, summarising and citing supporting analysis and evidence where possible, the wider secondary benefits/costs associated with the project. These cover non-employment related impacts only, as employment impacts have been addressed in Q25. If any of these wider benefits are "valued" or "monetised" in a Green Book compliant manner, the assumptions underlying the valuation must be clearly set out.

Wider impacts are benefits/costs that are not directly captured by the recipients of RGF. The following list gives examples of wider impacts. However, this list is only indicative and it may not be applicable for all applicants. Projects do not need to produce wider secondary benefits in order to be eligible for RGF. Where possible please include details of when and where these benefits will accrue. ***It is recommended that the answer to this question is no longer than 2000 words.***

(a) Wider economic effects in the locality or nationally not captured in the rest of the form – if possible making reference to the identity of beneficiaries and the nature of these benefits and how these are related to the objectives of the scheme if appropriate.
(b) *Environmental impacts - including positive or negative impacts upon greenhouse gas emissions, climate change adaptation, air quality, water quality, biodiversity, quality of place, noise, land remediation, waste, or the development of green technologies;*
(c) Transport economic efficiency e.g. safety enhancements and time savings accruing to other businesses and consumers: Please present in the form of an Appraisal Summary Table (AST):
http://www.dft.gov.uk/webtag/documents/project-manager/pdf/unit2.7.2.pdf
(d) Real option value - where the project creates a significant incremental option to make follow-on investments, or flexibility to alter the investment at some point in the future;
(e) Any implications for social cohesion and 'big society'; and
(f) Integration to national or local government policies and strategies.

(a) Wider economic effects in the locality or nationally not captured in the rest of the form – if possible making reference to the identity of beneficiaries and the nature of these benefits and how these are related to the objectives of the scheme if appropriate.

A step change in the development of commercial tidal energy: The UK is the global leader in marine renewable technology. Yet there are currently insufficient testing facilities in the UK to meet the sectors needs. Lack of clarity on technology risk is one of the factors most cited by potential investors as barriers to the development of tidal power. Device developers are generally SMEs that do not have the funds to develop commercial products independently, while utility companies and commercial lenders are unwilling to invest without either the certainty that they will win the rights to future revenue streams, or the sort of risk mitigations that the developers cannot realistically offer. SOEC will therefore address a constraint to the development of tidal power generation and make it possible for the UK to maintain its leadership of the technology. This will support of the Government's commitment to the marine energy sector.

Responding to international competition: The USA has started to realign its energy priorities and is developing a nationwide support plan for marine energy. This includes a network of National Marine Renewable Energy Centers and a Coordinated Water Power Program. Ireland, Portugal, Spain, Canada and countries further afield such as Korea and Singapore, are developing favourable political and market support environments.

Reduced UK tidal energy costs with low environmental concerns: Uniquely, even in the development phase, SOEC will enable energy to be sold to the national grid. At present tidal costs are higher than for wind but this itself is in part a reflection of the early stage of development. Also, negative externalities with tidal are small compared to other renewable technologies such as wind, which has visual and noise impacts. The market for tidal energy generation is global and the potential for costs to come down in line with volume manufacturing and enhanced scientific knowledge of the technical parameters is very large.

Supported by a unique Solent offer: EMEC, the only existing tidal energy facility in the UK, is in a remote location on the Orkney Islands. In contrast, SOEC will provide new facilities in close proximity to i) the strong and well established Solent marine supply chain, and ii) existing strengths in marine research. Three departments / units within the University of Southampton already conduct applied research in associated fields alongside Marine South East, Merex KTN, MarineTech and ABPmer.[60] There are also several pre-existing testing facilities located within the sub-region, including Wolfson Unit MTIA (University of Southampton); QinetiQ (Haslar); BAE Systems (Portsmouth); and Coastal Structures Group (University of Southampton). Vestas is building its European R&F facility for wind technology on the Isle of Wight and other companies including BAE Systems, Gurit and GKN have important R&D facilities for the marine, aerospace and advanced materials sectors. There are many other firms in the supply chain. All of these stand to benefit potentially from local clustering and agglomeration economies, knowledge transfer and IPR acquisition.

Significant Cluster Development Potential: The development of a tidal energy cluster, and associated infrastructure will be attractive to other companies seeking to invest, including Foreign Direct Investors. There are considerable supply chain, skills and training synergies between tidal and other forms of renewable energy, including wave and offshore wind, which the UK is well placed to capture, through the movement of labour, inter-firm collaboration, supply chain linkages, or through involvement of university departments and research institutions. There are also opportunities for spill-over into other sectors with similar technologies (engineering dynamics), in historically unrelated markets.

Local land and skills availability: Land exists to support the development of significant manufacturing and support facilities, and the local labour pool has many of the necessary skills, reflecting the strengths and heritage of Portsmouth and the Isle of Wight with respect to naval construction, engineering and vessel maintenance, renewables R&D and manufacture, aerospace, and composites. At the same time, wage costs are highly competitive and very different to those in the rest of the South East. Median average weekly wages are £480 in Portsmouth and just £460 on the Isle of Wight, compared with £506 for England as a whole and £541 for the South East. This means that the opportunities for attracting investors are uniquely favourable.

(b) Environmental impacts - including positive or negative impacts upon greenhouse gas emissions, climate change adaptation, air quality, water quality, biodiversity, quality of place, noise, land remediation, waste, or the development of green technologies

The operation of all three sites generates environmental benefits through the generation of zero emission, carbon neutral energy. There are two main types of environmental impact we consider:

[60] University of Southampton: Sustainable Energy Research Group, Wolfson Unit for Marine Technology and Industrial Aerodynamics, and the National Oceanographic Centre

- **Emissions reduction** – the development will produce a shift in the UK's energy mix, from sources that generate emissions as a byproduct to renewable sources where no emissions are generated.
- **Air quality improvement** – the above shift in the energy mix and consequent release of fewer emissions generates wider air quality benefits.

Following guidance from HM Treasury and DECC we can monetise these benefits, specifically with use of the Toolkit for valuation of energy use and greenhouse gas emissions.

Our calculations are based on the indicative grid capacity of the three different sites, assumptions about occupancy and availability, and 2008 ONS data on the UK's energy mix.[61] The assumptions are shown in the figure below. We estimate emission benefits over the 25 year lifecycle of the development of **£43m in 2009 prices** and air quality improvements benefiting the UK to the order of **£5m in 2009 prices**. This is a total environmental benefit of **£48m in 2009 prices.** Please refer to guidance and background documentation for the method used, and assumptions made, to estimate these benefits.[62]

Figure 28b.1 Assumptions for green house gas impact analysis

Site	Energy Generation GWh (per annum)	Capacity factor	Availability factor	Final energy demand	%
Nursery	0.495	0.3	0.75	**Domestic**	38%
Demonstration	11.664	0.3	0.8	**Commercial / other**	32%
Commercial	236.52	0.3	0.9	**Industrial**	30%

Source: Envirobusiness 2010 *SOEC Business Model* & ONS *Energy Trends* 2009. Note: analysis is fully green book compliant. Further assumptions: nursery side operation begins in 2013, demonstration & commercial site operational in 2014, and consequently we stagger the end dates so evaluation period in both cases totals 25 years. We assume no change in final energy demand.

This shift in energy mix contributes to the UK target to source 15% of energy from renewable sources by 2020. SOEC's generation of renewable energy means that less investment in other schemes is required to reach the mandatory target. This therefore generates a net saving to the exchequer. HM Treasury / DECC guidance states that it is appropriate to value this net saving or 'avoided cost of renewables' in monetary terms. Guidance assumes the marginal cost of delivering renewable energy, where there is no change in final demand, is £120 per MWh in 2020 (expressed in 2009 prices).[63] Therefore, accounting for only energy reduction in 2020 (i.e. not the cumulative change) means that the avoided cost of renewables generates some **£30m (in 2009 prices)** of benefit in contributing to the UK's Renewable Energy Strategy.[64]

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[61] ONS *Energy Trends* 2008

[62] HM Treasury & DECC *Valuation of energy use and greenhouse gas emissions for appraisal & evaluation* June 2010 and DECC *Valuation of energy use and greenhouse gas emissions for appraisal & evaluation – Background Documentation* June 2010.

[63] DECC *Valuation of energy use and greenhouse gas emissions for appraisal & evaluation* June 2010

[64] Ibid 3

There are further wider environmental benefits but these are not easily monetised. Firstly, the centre is likely to contribute to the development of tidal technology and proliferation of renewable energy not just in the UK but internationally through exports. Secondly, there are considerable strategic benefits in the security of energy supply.

f) Integration with other government policies and strategies

A review of relevant documents demonstrates that SOEC supports government policies and strategies for clean energy delivery and technological innovation.

The **UK Renewable Energy Strategy (2009)** singles out offshore wind and marine energy as sectors with high growth potential which need targeted support (section 5.10). It states that wave and tidal stream resources has the potential to make a significant contribution to our longer-term energy and climate change goals by providing up to 20% of our electricity needs, with negligible emissions (section 5.23). The UK is currently seen as a global centre for wave and tidal energy with many leading devices being developed by UK companies and many overseas device developers active in the UK (section 5.24). Responses to the Renewable Energy Strategy consultation, Government research, and ongoing work with the sector suggest there are still gaps in the support for marine energy technologies which need addressing to allow the sector to move from device development and testing through to commercial deployment (section 5.26)

The **Budget Statement (June 2010)** confirmed that the Government is committed to playing its part in moving to a low carbon economy. The transition will change the shape of industry, growth and jobs. As part of this, the UK needs £200 billion of investment to 2020 to provide secure low-carbon energy.

DECC's Marine Energy Action Plan (2010) states that the development of tidal stream devices require cost reduction and further step changes in technology development thereafter. Cost reduction is likely to be found through fundamental changes in the engineering design of devices; anchoring; more efficient use of materials; new and innovative ways of conducting installation, operation and maintenance; and increased efficiency of components. The Marine Energy Action Plan key recommendation for Technology Roadmapping theme is that the UK Government delivery partners continue to provide appropriate levels of support to ensure the effective and successful technology development by funding:

- First and second generation sea trials of wave and tidal stream devices; and
- Arrays of devices

Government considers the immediate priority is to provide targeted capital support for applied research and development through to support for demonstration and deployment. It is also imperative that cost effective installation and recovery methods are developed along with appropriate operation and maintenance techniques. Co-operation, engagement and the building of meaningful partnerships across the marine energy sector and supply chain is vital to the industry. This will enable the sector to ready itself for commercialisation and large scale deployment of wave and tidal stream technologies. The extensive development of the supply chain (manufacturers, ports, vessels, transport infrastructure) alongside skills and education of the sector will be required to provide the necessary workforce for an ever-expanding marine renewables industry. There is also scope for cross-sector co-ordination on the development of environmental baseline data of early device deployment which could form a valuable sector-wide resource.

The National Infrastructure Plan 2010 (HM Treasury) flags up the need for public sector intervention that will support investment in emerging and ecologically important technologies. This is supported by the **Chancellor's Spending Review Statement** (20th October 2010) which states that when money is short we should ruthlessly prioritise those areas of public spending which are most likely to support economic growth, including investments in our transport and green energy infrastructure, our science base and the skills and education of citizens.

The **Low Carbon Industrial Strategy**, published jointly by BIS & DECC in 2009, shows that a key barrier in the wave and tidal stream sector is the cost of testing and demonstrating devices in real marine conditions, especially as the bulk of companies in the sector are SMEs. With the wave and tidal sector at an early stage of development, the cost of technological innovation remains high. Returns on investments are only possible over longer timeframes, and with a relatively high risk profile, it is difficult for innovators to gain access to finance. By 2012, industry forecasts suggest the wave and tidal stream industry will need further support to increase the scale of demonstration and testing from demonstration stage (c. 1-5 MW) to large arrays (c. 5-30 MW).

The **Committee on Climate Change** report, "Building a low-carbon economy – the UK's innovation challenge" (July 2010), highlights that, with a sizeable share of all device developers and patent analysis indicating a very strong global position, the UK has potential to be a world leader. The UK has a significant natural resource, estimated to be around 65 GW (or 192 TWh / year), and UK based companies also have experience in marine engineering and design. The UK therefore has an important role to play in developing marine energy generation technologies for both domestic and global markets. For the marine energy sector, the Committee recommended that the UK should offer a full range of RDD&D support, tailored as necessary.

The **Prime Minister's speech on Economic** Growth (6th January 2011) highlighted that the global green energy market is going to be worth trillions of pounds in the years to come and that getting behind the industries of the future – including green energy – is crucial for the UK.

The **Local Growth White Paper (2010**) envisages that local enterprise partnerships could exploring opportunities for developing financial and non-financial incentives on renewable energy projects. To meet the UK target for renewable energy generation we will work with communities to make the most of opportunities both onshore, for example wind, bio-energy and hydropower, as well as offshore. The Government's role will include facilitating the development of UK-based supply chains in developing green markets where there are significant opportunities, but information barriers exist. This includes marine energy.

The project supports local policy, as set out in question 17.

29. For bids that involve a package of smaller projects, please identify and characterise the additional benefits associated with implementing the investment as a package rather than individual projects.

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Section E: Equality

30. Do you envisage that the project or its outcomes will have a disproportionate impact, whether positive or negative, on any of the following groups?

(a) minority or majority ethnic communities
(b) women or men, including transsexual people
(c) disabled people
(d) lesbians, gay men, bisexual or heterosexual people
(e) people with particular religious or non-religious beliefs
(f) people in particular age groups

If yes, please describe the impact or impacts the project is expected to have, the group or groups which may be affected, and any steps, if applicable, which have been taken to mitigate the impact(s).

There will be no disproportionate negative impacts on any of the specified groups as a result of the project.

As Accountable Body, the Isle of Wight Council will monitor compliance with the Equality Act 2010. The Council is committed to diversity and equality in employment. This means ensuring equality of opportunity for all, so that people can work in an environment where all are given the opportunity to fulfill their personal and professional potential. We also believe that prejudice and discrimination have no place in a modern working environment.

The Council's Equality & Diversity Policy sets out its commitment to best practice in equality and diversity across the organisation and confirms that:

- no employee will suffer unlawful discrimination by reason of his or her race, nationality, ethnic origin, gender, marital status, disability, religious belief/faith, sexual orientation, hours of work, age, or trade union membership;
- equality of opportunity is actively promoted in the workplace and individual differences are appreciated and valued;
- all individuals are entitled to fair treatment, dignity and respect; and
- the needs and aspirations of our staff are important and worthy of respect.

This publication is also available on our website at http://www.bis.gov.uk

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