Future Solent and Partnership for Urban South Hampshire (PUSH)

Solent Energy Strategy

Final Report

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Executive Summary

Introduction

The Solent is a key economic hub anchored around the two cities of Portsmouth and Southampton, the Isle of Wight, the M27 corridor and the Solent waterway.

This document sets the framework for an Energy Strategy in the Solent. Arup worked with a steering group from PUSH and Future Solent in order to develop this report between October 2013 and February 2015[1].

Energy is a complex system, and changes to this system are the result of actions by a range of public, private and third sector stakeholders; locally, nationally and internationally. A successful strategy will need to combine a range of physical, behavioural and organisational actions to secure economic viability, energy resilience and informed risk management whilst meeting government targets for the reduction of carbon emissions.

This study focuses on what can be delivered locally. Whilst it is recognised that local authorities have an important leadership and facilitation role (across a range of functions, such as planning, economic development and housing), local partners, including other public sector partners, businesses, academia and the third sector will need to come together to agree a delivery plan for this strategy.

Energy in the Solent

The Solent area has a population of over 1.3 million and more than 50,000 businesses, which together used just over 26,000 GWh[2] of energy in 2011.

The economy of the Solent area reflects the rest of the UK. It is an economy based on the use of fossil fuels, predominantly gas, however new lower carbon forms of energy generation are coming online, with renewables being a small, but growing part of the energy mix for the area.

The ways in which energy is used in the Solent region includes for industry, commerce, heating and cooking, powering domestic electrical devices, exterior lighting, travel and air conditioning.

Why an Energy Strategy?

In 2011, estimates for the energy bill paid by Solent firms and households ranges was in the region of £1.9 billion[3] representing 6% of the area's Gross Value Added[4]. Predictions[5] suggest that this bill will rise by almost double the expected

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[1] Some minor further changes were made to the report following April 2014, but the data sets used to quantify energy consumption and economic outputs to the Solent area are representative of the datasets available at April 2014.
[2] From Energy Consumption in the UK, National Statistics, http://webarchive.nationalarchives.gov.uk/20121217150421/http://decc.gov.uk/en/content/cms/statistics/climate_stats/data/archive/archive.aspx (comprising domestic, commercial and industrial, road and rail transport energy).
[3] Arup Calculation based on UK National Statistics data and DECC average costs for petroleum, electricity and gas
[4] 2011 GVA bbf.uk.com

rate of inflation. The risk is that future increases in the cost of energy will come off firms and households' "disposable bottom line" undermining discretionary spending and business investment. The impact of energy price rises is already being felt in many households whose incomes have fallen or remained static for many years. Energy is also a cost rising as a proportion of spend for business and the public sector and third sectors.

Providing energy under a "business as usual" scenario is not an option for a resilient future Solent economy. Business as usual carries a substantial risk; it could lead to regular energy blackouts, poverty, and runaway climate change. It would also leave the Solent missing out on the economic opportunities associated with new energy technologies; from marine renewables to smart energy systems.

This energy strategy is intended to move the Solent towards a position where it is leading the way in the low carbon economy; creating economic opportunity from energy; contributing to reducing climate change impacts; and reducing fuel poverty.

Developing the Strategy

Arup worked with a steering group from PUSH and Future Solent to carry out desk-based research and local stakeholder engagement to understand:

- the profile of the current energy system in the Solent; where energy is generated, used, the natural resources that are available, and how the economy around the energy system operates;
- the projects currently in the 'pipeline' to improve energy efficiency and generate renewable energy in and around the Solent, and their status;
- the likely impacts of delivering the 'pipeline' projects, in terms of jobs and economic development, carbon reduction and energy security; and
- where the gaps in the current 'pipeline' might be in order to achieve the long-term benefits around economic development, fuel poverty, carbon reduction and energy security that are desired.

This research and engagement has aided the development of a strategy; setting out the key objectives and initial actions to achieve the key aims of:

- Reducing fuel poverty;
- Reducing the overall energy bill paid by all energy consumers in the region;
- Taking a leadership position within the UK in relation to the low carbon economy;
- Maximising the business opportunities relating to new energy demand and generation technologies and services;
- Reducing carbon emissions and helping to reduce the Solent's impact on climate change; and
- Ensuring that Solent businesses and people have access to uninterrupted quality supplies of energy.

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[5] DECC High Price Scenario Forecasts using forecast price data for petroleum,

Meeting the energy diversification challenge.

Energy projects go through a process that takes them from initial feasibility through to implementation. This process can be very quick for some technologies, such as solar, as the market is highly competitive. For others the challenges of gaining planning consent and attracting funding mean the projects can take many years to come to fruition. The energy projects pipeline identified for the Solent area is estimated to contain sufficient capacity to more than meet the current target for the Solent of generating 20% of its own electrical generation needs from renewable sources by 2020. This target can be achieved, even with the exclusion of Navitus Bay, an offshore wind array which is the largest renewable energy project reviewed as part of this study (situated just located off the Dorset and Hampshire coasts, to the west of the Isle of Wight).

The challenge is that over 90% of potential energy projects in the area have yet to progress beyond the initial feasibility stage. Subsequently, years of business case development, consenting and construction will be required before these projects can contribute to the solutions needed. These projects will be at a time of regulatory and funding uncertainty created by changes in the regulated market which are causing concern from investors.

The Solent benefits from particular expertise and resources which mean that the energy technology sub-sectors that are likely to offer the biggest opportunity in terms of jobs and GVA are marine renewables (an example being the Perpetuus project on the Isle of Wight) and smart energy systems (particularly as a result of the expertise at the University of Southampton). However, there is also much to be gained by raising awareness of the issues and the solutions that can deliver desirable outcomes at personal and organisational levels throughout the region.

The Strategy

This energy strategy for the Solent area sets out four objectives:

- Improving energy efficiency and conservation;
- Increasing the use of renewable energy resources;
- Maximising the uptake of business opportunities locally; and
- Ensuring focused, integrated delivery and implementation.

Analysis of existing projects and activities, and of the wider context in which these are happening (including natural resource availability; policy and wider economic activity) has been carried out. The strategy identifies gaps, informing the development of the strategy actions set out below.

Objective 1	**Improving energy efficiency and conservation**
Action 1.1	Review domestic energy efficiency programmes.
Action 1.2	Review contribution to fuel poverty targets.
Action 1.3	Scope projects that address non domestic energy efficiency.
Objective 2	**Increasing the use of renewable energy resources**
Action 2.1	Agree a renewable electrical generation target for 2020.
Action 2.2	Agree a renewable electrical generation target for 2030.

Action 2.3	Agree renewable electrical generation technology targets.
Action 2.4	Bring forward a further 200 MWe of capacity into investment readiness rating grades 2 or 3 by 2020.
Action 2.5	Carry out detailed analysis of grid constraints and opportunities.
Action 2.6	Support feasibility study development for district heating projects.
Action 2.7	Improve information on feedstock supply for biomass and district heating.
Objective 3	**Maximising the uptake of business opportunities locally**
Action 3.1	Review port infrastructure to establish suitability for offshore renewables.
Action 3.2	Develop a plan to support diversification and company development associated with support of offshore renewables.
Action 3.3	Develop a plan to support diversification and company development associated with support of smart energy sector opportunities.
Action 3.4	Develop a plan for port energy supply.
Action 3.5	Support the take up of local jobs in fossil fuel projects.
Objective 4	**Ensuring focused, integrated delivery and implementation**
Action 4.1	Strategy alignment within the Solent (e.g. across transport, economic development and other strategies).
Action 4.2	Establish a governance arrangement to provide a focus for implementation.
Action 4.3	Pipeline management and development.
Action 4.4	Learn from and promote good practice.

Next Steps

We would advocate that the primary action should be in relation to ensuring focused and integrated delivery across the PUSH area (i.e. Action 4.2). Setting up an appropriate governance structure and beginning to identify funding streams will allow more detail to be formed around other actions and for them to become more focussed in their delivery.

Once the governance arrangements are in place the focus should be agreeing renewable electrical energy targets for 2020 and 2030 (Actions 2.1 & 2.2), to allow for shared goals and to provide a monitoring framework for part of this strategy will be an important step.

Suggested targets for 2020 and 2030 are set out below, based on analysis undertaken by Arup. The project cost capital referred to in the table are the financial costs of making capital investment in a pipeline project which was based on a cost metric for installed capacity. Total Economic Value (TEV) is the summation of three sources of economic value to the local economy based on enhanced energy security; job creation and carbon savings (these are monetised benefits only). Energy security is based on an assumed relationship between GVA and installed renewable capacity. The value attributable to jobs is based on an assumed level of GVA per job. The value attributable to carbon is based on the value of carbon saved. Further detail on the approach taken to calculation of TEV can be found in the narrative of Section 5 of this report.

Solent Target	Capacity (MWe)	Capacity (GWh)	Project Cost Capital	Total Economic Value	Total Jobs
Target for 2020	90	173.8	£320 million	c.£82 million	c.300
Target for 2030	211	955,974	£456 million	c.£289 million	c.1,100

1 Introduction

1.1 Overview

The Solent area (the dark green area in Figure 1.1) is a key economic hub with a population of more than 1.3 million and over 50,000 businesses. It is anchored around Portsmouth, Southampton, the Isle of Wight, the M27 corridor and the Solent waterway; the area used over 26,000 GWh of energy in 2011.

Figure 1.1: Solent Area

Arup has been commissioned by the Partnership for Urban South Hampshire (PUSH) and Future Solent to undertake a strategic review of current and future energy use, management, generation and resource assessment across the Solent to produce a Solent Energy Strategy to inform and provide an evidence-base to further assist with local planning, decision making and investment.

1.2 Aims of the Study

The key aims of this study, and where these elements are addressed in this report, can be found in the table below.

Objective	Covered in this Report
Assessment of local council policy position on energy and low carbon generation.	Section 2.3 and Appendix D
Analysis of the baseline position of the Solent, using the 2008 Arup study[6] as a basis and updating this.	Section 3
Potential impacts of the 2013 Energy Bill & Energy Market Reform.	Appendix D

[6] Arup for PUSH, *Feasibility of an Energy and Climate Change Strategy for Urban South Hampshire,* 2008

Objective	Covered in this Report
Assessment of potential strategic options	Section 6
Financially viable infrastructure & resilience improvements	Section 7
Policies for Solent LEP & local authorities that impact on energy planning	Section 7
Strategic actions for Solent LEP, local authorities and other organisations to take to achieve the outcomes of the strategy	Section 7
Investment priorities	Section 7
Setting renewable electrical energy targets for the Solent	Section 7

The focus of this report is energy. This is clearly linked to, but different from, considerations of climate change and carbon reduction. There are a number of existing policies and strategies in the Solent that address climate change. This strategy will not aim to duplicate them; however, one of the outcomes of the successful delivery of the Solent Energy Strategy will be carbon reduction.

1.3 Methodology

The approach to developing this strategy has been made up of five key steps:

- **Step 1: Creating a baseline for the Solent:** A baseline has been developed, covering policy context, existing energy use and generation, carbon emissions and socio-economic context. This has been developed through a literature review and analysis of key national and local data sets;
- **Step 2: Review existing energy actions, projects and targets:** A review of existing planned projects (also referred to as the "energy projects pipeline") based on publicly available information, but supplemented with information received from a range of stakeholders, through semi-structured interviews, and information provided during the course of the commission;
- **Step 3: Establishing the economic case:** A review of the costs and the total economic value represented by the renewable resource and the energy project pipeline specifically;
- **Step 4: Gap analysis:** A review of the current energy projects pipeline against the stated objectives to identify areas for development; and
- **Step 5: Identify an action programme:** The strategy itself has been developed based on in-depth analysis of the information gathered, as described above, with input from the stakeholder workshop and follow-up input from key partners.

1.4 Report Structure

The remainder of this report is structured as follows:

- Section 2 sets out the high level ambitions for a Solent Energy Strategy;
- Section 3 provides an overview of the economic, social and environmental baseline for the Solent;
- Section 4 assesses the pipeline of energy projects in the Solent;

- Section 5 presents the economic case for investing in energy;
- Section 6 presents a gap analysis based on current energy activity in the Solent;
- Section 7 sets out a programme of action for Future Solent, the PUSH authorities and other key partners; and
- Section 8 highlights the conclusions from this report and explores the next steps to move towards delivery of the programme described in Section 7.

2 Vision & Objectives for the Solent

2.1 Our Energy Vision & Aims for the Solent

The Solent has the opportunity to ensure that a well informed and progressive approach to the production and use of energy has a positive impact on the world; reducing carbon emissions, improving social wellbeing and increasing economic opportunities in the area. In particular our aims for the Solent area are to:

- Reduce the overall energy bill paid by Solent residents, businesses and the public and third sectors;
- Take a leadership position within the UK on resource efficiency with respect to energy;
- Position the Solent in the top quartile of low carbon economies within ten years;
- Develop thriving businesses in the supply of local renewable energy provision, energy efficiency and installation of microsystems and smart energy management systems;
- Use the Solent's access to onshore and offshore renewable resources to build a competitive proposition in the supply of goods and services connected to the installation and maintenance of tidal, wave, wind, biomass and energy from waste generation;
- Reduce the numbers of Solent residents experiencing fuel poverty;
- Reduce carbon emissions and help to reduce the Solent's impact on climate change; and
- Ensure that Solent businesses and people have access to uninterrupted quality supplies of energy.

In bringing together these aims, and working together across the public, private and third sector, we believe the Solent can become nationally recognised for its forward thinking and resilient approach to energy.

2.2 Why a Solent Energy Strategy?

The production of all goods and services requires energy and, in common with most of the developed world, the Solent's energy needs are largely (98%) met by the consumption of fossil fuels (oil, gas, coal).

The availability of these fuels has underwritten economic growth since 1945 and supported wealth creation for over half a century. Access to fossil fuels has been taken for granted, however this assumption is now threatened. The real cost of fuels relied upon for our energy requirements has been increasing to a point where it has been outpacing the growth in wages and salaries. The reasons for this are complex; however many of these fuels now come from ever more distant locations and from increasingly hostile environments that increase the costs of production for limited gains. The use of fossil fuels also carries a future cost by promoting an increased likelihood that more extreme weather events (such as flooding) will inflict damage on coastal communities in the Solent.

These threats present the Solent with an excellent opportunity to take a positive and integrated action to embrace the economic opportunities this presents, to reduce carbon emissions, to address fuel poverty and to increase energy resilience.

The Solent has a significant role in contributing to national and international energy policy objectives. This sub-region has the potential to develop the energy sector, building on its existing skills base, using its natural resources and exploiting its capacity to deliver. Central government energy policy is fluid allowing the Solent area to benefit greatly from a sound co-ordinated sub-regional approach to energy.

2.2.1 Costs of Energy

The energy bill paid by Solent businesses and households is rising. In 2011, the energy bill stood at £1.9 billion[7] representing 6% of the area's Gross Value Added[8] recognising the energy intensive nature of some of the key industries located in the sub region.

Predictions based on government forecasts[9] suggest that the energy bill will increase to £2.8 billion in 10 years' time (2026) equivalent to nearly a 50% increase. An inflationary increase alone would mean the same level of energy consumption could cost around 23% of the areas GVA in 2026.

2.2.2 Economic Opportunities

The energy sector provides an excellent opportunity for inward investment. Jobs are supported and created in a diverse range of business sectors including construction, manufacturing, installation, operations, management and fuel processing. A comprehensive energy strategy should back renewable energy, promote sustainable transport, encourage green building standards and energy efficiency; this will provide far more employment benefits than supporting one or two of these sectors independently. However, it also needs to be recognised that a shift from high carbon to low carbon solutions will result in job losses which can be mitigated through positive policy interventions.

2.2.3 Carbon Emissions

The last 50 years have seen changes only previously seen in millennia; the world's climate is unequivocally warming, greenhouse gases have increased and sea level has risen. Atmospheric carbon dioxide (CO_2), methane and nitrous oxide levels have increased to concentrations unprecedented in at least the last 800,000 years. A 40% increase in CO_2 since pre-industrial times is primarily from fossil fuel emissions. These greenhouse gases have caused a global mean surface warming of between 0.5°C to 1.3°C, over the period 1951–2010[10]. Continued greenhouse gas emissions will cause further warming and irrevocable changes to the whole climate system. To limit this change a substantial and sustained reduction in greenhouse gas emissions will be essential.

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[7] Arup Calculation
[8] 2011 GVA bbf.uk.com
[9] DECC High Price Scenario Forecasts using forecast price data for petroleum,
[10] IPCC, *5th assessment report* (2013) http://ipcc.ch/report/ar5/wg1/

During the 21st century sea levels are predicted to continue to rise and are very likely to exceed a rise of 2mm's annually. South Hampshire has 270 km of coastline, with many communities currently vulnerable to flood risk. This sea level rise, due to climate change, will increase the flooding risk if levels increase as much as predicted.

2.2.4 Fuel Poverty

The average domestic electricity bill in the UK has increased by 60% between 2004 and 2010 (compared to general price inflation of 17% over the same period)[11]. This is one of the three factors determining whether a household is fuel poor, alongside the energy efficiency of the property and the income of the household. There is massive variation in fuel poverty across the Solent sub-region.

2.2.5 Energy Resilience

The next four decades will likely see the demand for electricity increase by 30-60% due to the electrification of heating, transport and industrial processes[12]. In addition the UK will need approximately 30-35GW of new electricity generation capacity over the next 20 years as many of the UK's current coal and nuclear power stations will need to be decommissioned[13]. Building the equivalent replacements of these large scale power plants, like nuclear, takes over a decade; short term energy supply will need to come from new, smaller scale generation sources.

Resilience of energy infrastructure can be described as resistance, reliability, redundancy, response and recovery[14]. Over 90% of energy currently being imported into the Solent, more local supply, control and recovery could increase local resilience.

2.3 Existing Policy Goals and Context

Existing energy policy has been set at EU, national and local levels; this policy framework helps to determine priorities for the Solent.

For example, the European Union (EU) has made renewable energy, energy efficiency and measures to achieve a transition to a low carbon economy key priorities from both a policy and an investment perspective.

The UK government has set a legally binding target of 80% reduction in carbon dioxide emissions (compared to those of 1990) by 2050. As part of this, the UK Carbon Plan sets out the need to have emissions from electricity to be near to zero by 2050[15]. The Electricity Market Reform (EMR) puts in place measures to attract the £110 billion investment required by 2020; this is needed to replace current

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[11] Committee on Climate Change, *Energy prices and bills – impacts of meeting carbon budgets* (December 2012)
[12] UK Carbon Plan 2011
[13] The Energy White Paper (2007) 'Meeting the Energy Challenge'
[14] As defined in Cabinet Office, *Keeping the Country Running: Natural Hazards and Infrastructure* (October 2011)
A Guide to improving the resilience of critical infrastructure and essential services
[15] The UK Carbon Plan: Delivering a Low Carbon Future (2011)

generating capacity with greener and more reliable supplies at the lowest possible cost.

The Solent area also has a number of ambitions in terms of fostering economic growth. A key aspiration of the Local Economic Partnership (LEP) is to provide a catalyst for the local economy in order to create an additional 10,000 jobs. In doing so the LEP hopes to add £1bn of Gross Value Added (GVA) to the economy[16].

Further detail on existing policies at an international, national and local level can be found in Appendix D.

2.4 Market Failure

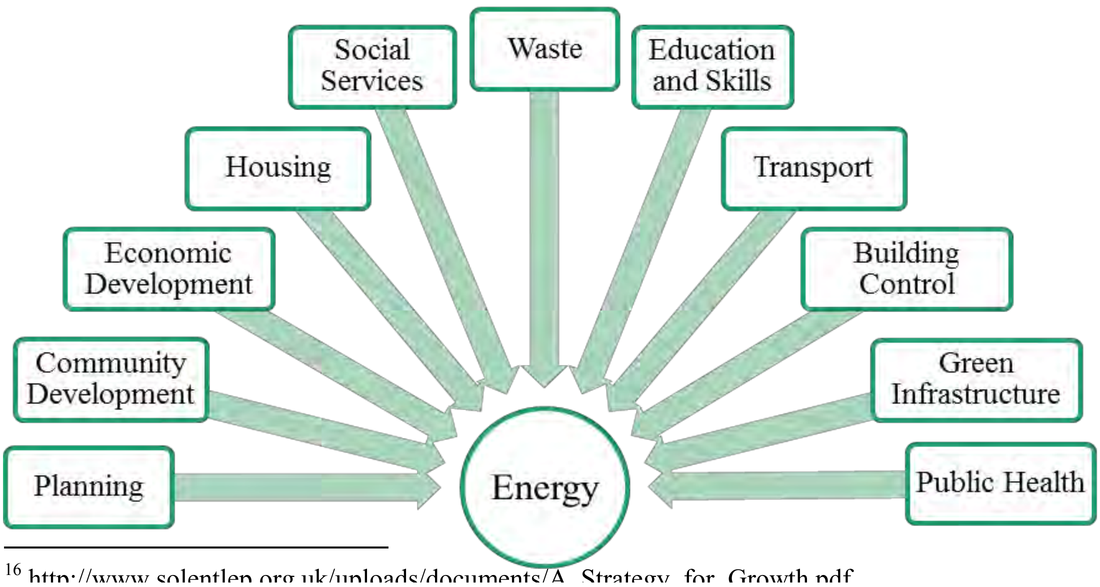
Despite the nature of the challenges identified above the price mechanism has not been successful, to date, in encouraging the rate of change needed to meet the challenges involved.

Low carbon technologies rely upon subsidies channelled from the energy bill payer into technology providers as a means of displacing yet further investment in fossil fuels. Yet these subsidies have been repeatedly tampered with creating uncertainties for investors. The result has been a gradual withdrawal of investment from key low carbon technologies e.g. the loss of major wind farms investments.

Existing buildings and infrastructure are major contributor to the use of energy. However, the key mechanism for change relies on the financing made available through the development market, which is a singularly inappropriate means of fixing legacy problems in the way towns and cities work now. A depressed property market has reduced opportunities to use development related finance like S.106 and the Community Infrastructure Levy for anything other than critical enabling infrastructure.

2.5 Policy Levers

Energy is pervasive in all areas of our lives. As can then be expected, it has an important interrelationship with a wide number of policy areas.



16 http://www.solentlep.org.uk/uploads/documents/A_Strategy_for_Growth.pdf

Figure 2.1: Policy areas with an interdependency on energy

The figure above represents the range of public policy areas that local authorities have at their disposal when considering an integrated energy strategy. They also demonstrate the complexity of developing and delivering an energy strategy that fulfils multiple aims and objectives, as there is a need to work across a plethora of services in an integrated manner.

2.6 Key Strategic Objectives

The strategic objectives for the Solent Energy Strategy must address the aims identified above within a structured approach. The energy hierarchy offers a structured approach to dealing with the issues.

The energy hierarchy is a classification of energy options, prioritised to assist progress towards a more sustainable energy system.

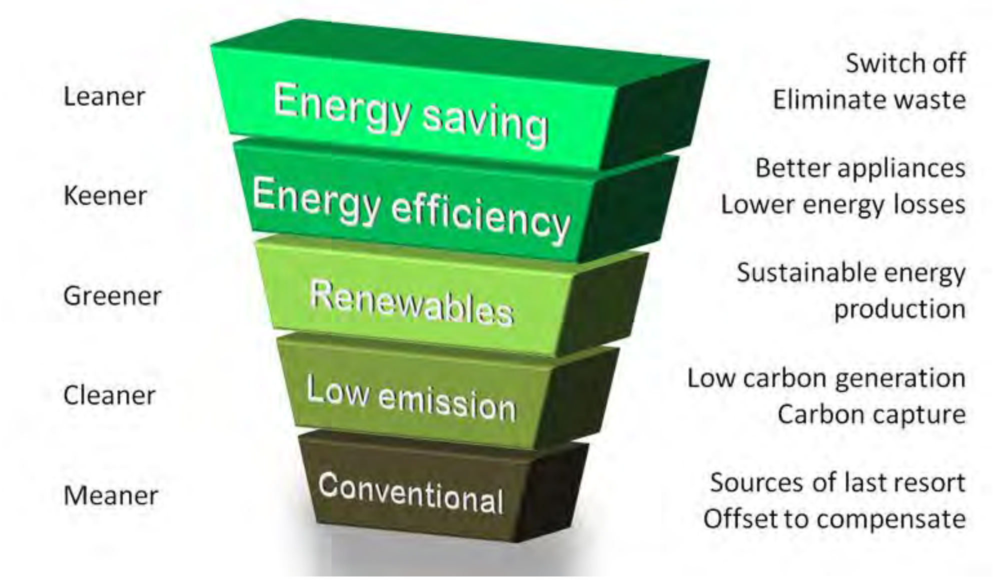


Figure 2.2: Energy Hierarchy[17]

The highest priorities cover the prevention of unnecessary energy usage both through eliminating waste and improving energy efficiency. The sustainable production of energy resources is the next priority. Depletive and waste-producing energy generation options are the lowest priority.

For an energy system to be environmentally sustainable the resources applied to producing the energy must be capable of lasting indefinitely; energy conversion should produce no harmful by-products, including net emissions, nor wastes which cannot be fully recycled; and it must be capable of meeting reasonable energy demands.

The ability to influence the energy hierarchy is likely to be much more limited in the final stages where much of the efforts to reduce emissions from fossil fuels used will occur outside the Solent.

It is therefore appropriate for a sub-regional energy strategy to focus on managing the top three levels of the hierarchy.

[17] http://en.wikipedia.org/wiki/Energy_hierarchy

The implementation of the Solent Energy Strategy will require significant investment, thus there is an opportunity to link energy specific outcomes to an economic development agenda. This will safeguard and generate jobs, promote the Solent as a prime location for energy related businesses and provide a resilient and future proofed energy supply for these businesses.

In order to ensure the delivery of the eight overarching aims of this energy strategy, the following objectives are suggested as being the key objectives:

- Improving energy efficiency and conservation;
- Increasing the use of renewable energy resources;
- Maximising the uptake of business opportunities locally; and
- Ensuring focused and integrated delivery and implementation.

The rationale for each of these objectives is set out below.

2.6.1 Objective 1: Improving energy efficiency & conservation

This objective brings together the first two layers of the energy hierarchy. The UK Government's Energy Efficiency Strategy sets out four key benefits of energy efficiency[18]:

- It saves households and businesses money on their energy bills;
- It promotes economic growth and supports jobs in the economy;
- It supports activity to revitalise our infrastructure, contributing to a more secure and sustainable energy system and reducing our reliance on energy imports; and
- It is often the most cost-effective way to decarbonise.

Energy use in domestic buildings makes up 29% of the carbon dioxide emissions in the Solent (based on 2011 figures); therefore concentrating on this will make an important contribution to the overall carbon reduction targets for the Solent.

Whilst, as a whole, fuel poverty is less of an issue in the Solent than other parts of the UK, there is inequality in affordability across the sub-region. Improving energy efficiency of domestic properties is one of the best ways to reduce fuel poverty in the longer-term and free up disposable income for recycling in the Solent economy. The commercial and public sectors also offer huge opportunities for energy efficiency and conservation in the Solent.

A reduction in the requirement for energy is beneficial from an energy security perspective, as it results in lower demands on imported energy and on the network.

2.6.2 Objective 2: Increasing the use of renewable energy resources

Renewable energy currently makes up an estimated 1.38% of energy used in the Solent area[19]; there is an opportunity to significantly increase this figure and

[18] Department for Energy and Climate Change, *Energy Efficiency Strategy: 2013 Update*, December 2013

reduce the carbon emissions associated with the use of fossil fuels. A target of 20% of energy being produced by renewables by 2020 has been set for South Hampshire[20].

In 2011/12 renewable energy global sales activities were estimated at £1.1 trillion[21], representing a significant market opportunity. Whilst the market for many renewables is mature, there are still areas where it is expected that the Solent sub-region could, if proactively supported, gain competitive advantage.

An increase in renewables produced locally could result in a rise in the local control over energy sources, as well as protecting the sub-region against the rising cost of energy imported to the Solent area generally. Both of these factors will increase resilience for the sub-regional economy, but further work will be required to ensure that the local network is resilient to a transition to renewables generation.

2.6.3 Objective 3: Maximising the uptake of business opportunities locally.

If proactively managed, an increase in energy efficiency and renewable energy will present economic development opportunities in the sub region.. With global markets at play, a specific objective to ensure that these benefits can be captured locally is considered appropriate.

The Solent has significant potential to develop a diverse energy portfolio including marine renewables, PV, SMART grid and demand control technologies, energy from waste and biomass. Developing and maintaining that competitive advantage requires a co-ordinated approach on all policy fronts. For example the Solent is competing with other areas of the UK, such as the South West (a low carbon economic area with a focus on Marine Renewables), the Humber (the Energy Estuary), and Anglesey (Energy Island), as well as globally. This objective will be important to ensure that the Solent can differentiate itself appropriately.

2.6.4 Objective 4: Ensuring focused & integrated delivery & implementation.

Crucial to the success of the energy strategy and the achievement of each of the aims and objectives will be integrated delivery and implementation and focus on complexity of energy policy. This is particularly important given both the fact that this strategy is designed to encompass actions across all 12 local authorities, as well as the wider public, private and third sectors in the PUSH area.

One of the major barriers to progress is access to commercially competitive and energy market focused funding. Both attributes are currently in short supply in the UK generally unless projects are very low risk and also significant in size with high yields. To lower the cost of funds it is necessary to offer early stage funding

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[19] This figure is based on Arup analysis of information published by DECC on operational renewable energy in 2013 and consumption figures from 2011.
[20] As described in *The South Hampshire Strategy*, October 2012
[21] Department of Business, Innovation and Skills (BIS), *Low Carbon Environmental Goods and Services (LCEGS): Report for 2011/12*, July 2013

that gets potential solutions from concept to delivery or at least to a level of proof of concept that can attract competitive capital funding to secure delivery. The early stage funding should be structured as a revolving loan facility that reinvests its returns in future projects. The most probable source of the early stage funding needed is likely to be, at least in part, from the public sector through specially structured financial vehicles working closely with the Hampshire Community Bank or equivalent suitable administrative resource.

2.7 Building on Progress

The Solent Energy Strategy has been prepared at a time when substantial progress is being made with a range of energy and low carbon projects identified across the sub-region. However, much greater progress can be made through co-ordinated action that connects individual projects, resources and skills into an integrated sub-regional scale programme.

The strategy signals that the Solent is serious about energy resilience, that it has the potential to improve the competitiveness of its economy and the ability to attract major investment through the delivery of energy projects and development of its own supply chain.

3 The Solent's Baseline Condition

3.1 The Solent Geography

The Solent area is largely urban, with the major population centres around Portsmouth and Southampton. The Solent is characterised by its coastline, and the link between South Hampshire and the Isle of Wight experiences a semi diurnal tide. The sub-region is home to the Isle of Wight Area of Outstanding Natural Beauty (AONB) and is surrounded by two National Parks, the New Forest and the South Downs.

3.2 Energy Consumption & Carbon Baseline

Energy and carbon baselines are useful to show the starting point and scale of the issue to be faced. As the data is available over a period of six years a general trend can also be shown. Baselines also allow the tracking of changes which occur in the region and any progress made.

The baseline includes information on energy consumption and carbon emissions, between 2005 and 2011. The energy demand for the Solent has been estimated using the data from DECC on the energy consumption at a local level from national statistics. This was then used to estimate future CO_2e emissions projected to 2021. The existing renewable generation sites have been identified. For the districts that are only partly within the designated Solent area (i.e. New Forest, Test Valley, Winchester and East Hampshire), the energy consumption and CO_2e emissions have been weighted again the percentage of the population of the districts within the PUSH area.

In this strategy power, or capacity, have been measured in Megawatts (MW) or Gigawatts (GW) which is a thousand MW. This is the electricity generated or used at any given moment in time. Energy is measured in Megawatt hours (MWh) or Gigawatt hours (GWh), as energy is a product of both power and time. It has been calculated assuming that the generation plant runs at full capacity 365 days a year 24 hours a day. Carbon dioxide equivalent (CO_2e) is a way of measuring global warming potential of emissions. It is the amount of CO_2 which would cause the same amount of radiative forcing as the Greenhouse Gases (GHGs), the GHGs included are carbon dioxide, methane, perfluorocarbons and nitrous oxide.

3.2.1 Energy and Carbon Use

The Solent area consumed 26,006 GWhs, in 2011, generated from a combination of different fuel types but predominantly fossil fuels (see Figure 3.1). Less than 1% came from fuels attributable to bio energy and waste. Electrical energy consumed is itself a product of the combustion of mainly fossil fuels but with a growing proportion of renewables within the mix (see Appendix F for more detail). The proportion of renewable generation feeding into the grid causes the average carbon intensity of grid supplied electricity to change. The continued growth of renewables is expected to lead to a "greening of the grid". Data shows there has been a decrease in energy consumption and associated CO_2e during the period 2005 to 2011 (the last available set of estimates).

Between 2005 and 2011, overall energy consumption in the Solent area decreased by 14.54% from 30,381 GWhs to 26,006 GWhs. This decrease is greater than the total UK energy reduction in this period of 11.9%[22]. This decrease has occurred at a time when population has increased in the Solent area, however, it is also a period that saw a reduction in economic activity, with the downturn from 2008 impacting on energy use.

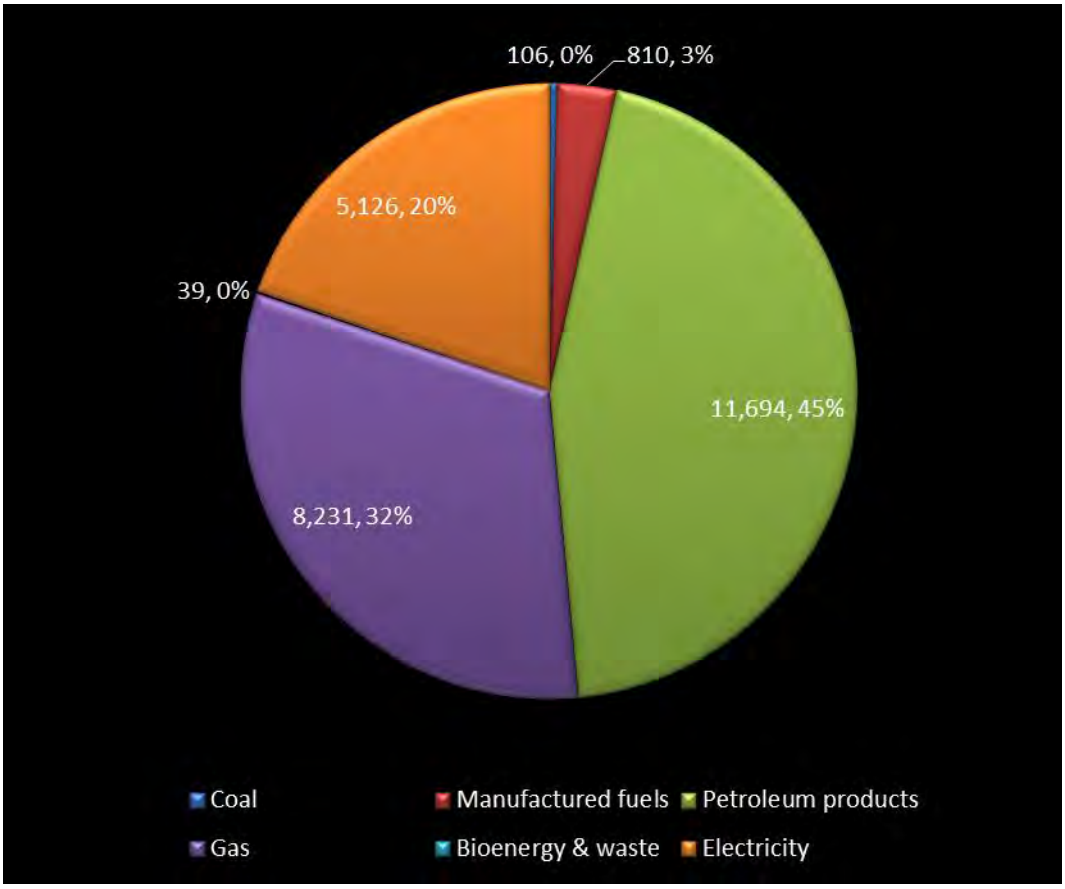

Figure 3.1: Consumption of Fuels (GWhs) by Type of Fuel, 2011 (DECC)

Overall the CO_2e emissions in the Solent area decreased from 9.2 MtCO2 in 2005 to 7.9 MT CO_2e in 2011. This is greater than the total UK emissions reduction over this period of 14%[23].

From 2011 to 2020, overall energy consumption is forecast to decrease by a further 16.42% to 21,737 GWhs in 2020. Carbon dioxide emissions are expected to decrease by 19% to 6.4 CO_2e in 2020.

Projections for energy use to 2020 have been estimated for the Solent. These are based on the continuance of consumption trends in energy use. Whilst energy reduction might be expected to be higher during a recession, the national level targets and policies to reduce consumption and decarbonise our energy use mean

[22] Energy Consumption in the UK, National Statistics, http://webarchive.nationalarchives.gov.uk/20121217150421/http://decc.gov.uk/en/content/cms/statistics/climate_stats/data/archive/archive.aspx
[23] Energy Emissions in the UK, National Statistics, http://webarchive.nationalarchives.gov.uk/20121217150421/http://decc.gov.uk/en/content/cms/statistics/climate_stats/data/archive/archive.aspx

that a continuation of current trends is not unreasonable, notwithstanding the risks outlined below.

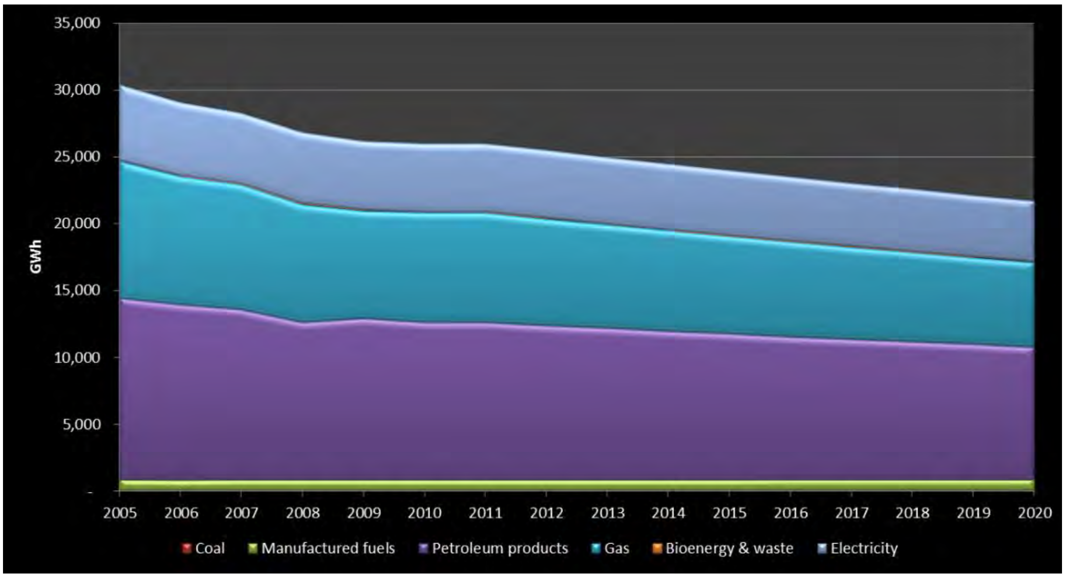

Figure 3.2: Actual and Forecast Energy Use by Fuel 2005 to 2020

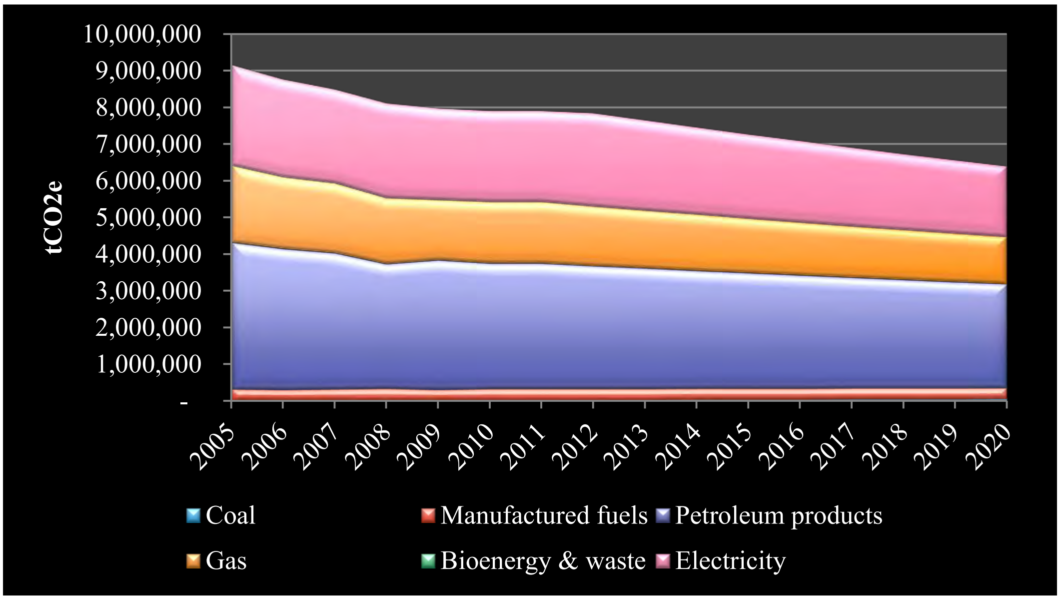

Figure 3.3: Actual and Forecast Emissions of Carbon Dioxide 2005 to 2020

3.2.2 Risks associated with projections

Any projection of energy demand carries a risk. The projection is based on an extrapolation of past trends which have shown a reduction across the fuel types even during a period of population growth. The biggest risk concerns the future consumption of electricity. The combination of industry and commercial energy demand is a potential source of risk because it brings together sectors with a high degree of internal variability. Nationally, electricity demand in the commercial sector is set to increase by 29.5% between 2014 and 2030, as 'electrification' of the commercial sector is predicted to continue. For example, DECC estimates that

40% of commercial floor space will be electrically air conditioned by 2020 compared to 10% in 1990.

Fuel switching within the transport sector represents a significant source of uncertainty. The key issue is the degree to which transportation switches from petroleum fuels to electricity. Currently, this is already significant in passenger rail services. In 2010, DECC considered four scenarios for transport based on the period up to 2050[24]. The first scenario (Level 1) assumed a very low level of switching whilst Level 4 assumes a much speedier adoption of electric traction for transport.

Under a low penetration scenario, plug-in hybrid electric vehicles (PHEVs) would cover 20% of the distance travelled by cars and vans, and fully electric vehicles (EVs) would cover only a small proportion of travel (2.5% of distance) by 2050. For buses, there is a steady adoption of hybrid vehicles and a handful of trial electric buses whilst the rail share remains as it is today with roughly half passenger miles attributable to electric vehicles and 5% of freight. Under a high penetration scenario, around 80% of passenger car distance is powered by electricity, with the remainder accounted for by fuel cells with the whole rail network electrified. Despite this narrative, there is currently a high reliance on oil products which is anticipated to extend into the future (beyond 2030) particularly for transport.

A further risk concerns the use of electrical power within the Ports. Cold ironing[25] or alternative maritime power (AMP), is the process of providing shore-side electrical power to a ship at berth while its main and auxiliary engines are turned off. Cold ironing permits emergency equipment, refrigeration, cooling, heating, lighting and other equipment to receive continuous electrical power while the ship loads or unloads its cargo.

Shore-power is a general term to describe supply of electric power to ships, small craft, aircraft and highway vehicles. Typical practice has been to turn off the main engines while in port but switch to the auxiliary diesel generators to power cargo handling equipment and other ship's services. The auxiliary engines become a source of pollutants whilst in dock which could be remedied by using shore based electrical power. The scale of power[26] needed whilst berthed can be considerable as indicated below:

- Container Ships 1-4 MWe;
- Cruise Ships 7 MWe;
- Reefers 2 MWe;
- Ro-Ros 400 kWe -1 MWe;
- Tankers 5-6 MWe; and
- Bulk/Cargo Ships 300 kWe-1 MWe.

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24 DECC (2010) “2050 Pathways Analysis”

25 Cold ironing is a shipping industry term that first came into use when all ships had coal-fired engines. When a ship tied up at port there was no need to continue to feed the fire and the iron engines would literally cool down, eventually going completely cold, hence the term cold ironing. From http://en.wikipedia.org/wiki/Cold_ironing

26 TEFLES (2012) “Technologies and Scenarios for Low Emissions Shipping” - JP-WP7-D7.1-V07-07/2012

The Southampton port hosts a significant cruise ship business which involves cruise liners taking up berths for periods of time. The Southampton port master plan makes reference to cold ironing in relation to plans for new berths in the future[27]; it does however recognise that the absence of a universal standard for electrical systems limits inter-operability. In Portsmouth, the concerns are more pressing and immediate. Projected electricity demand, accounting for the forthcoming arrival of the new aircraft carriers in addition to the substantial regeneration initiatives in the city, could overstretch the limited existing headroom in the electricity supply[28]. Southern Electrical Power Distribution has however responded that there is sufficient capacity to manage the additional load[29].

3.2.3 Energy use by sector

Figure 3.4 shows the breakdown of energy consumption by sector. Of the three major user sectors, industry and commercial consumes the largest share followed by domestic.

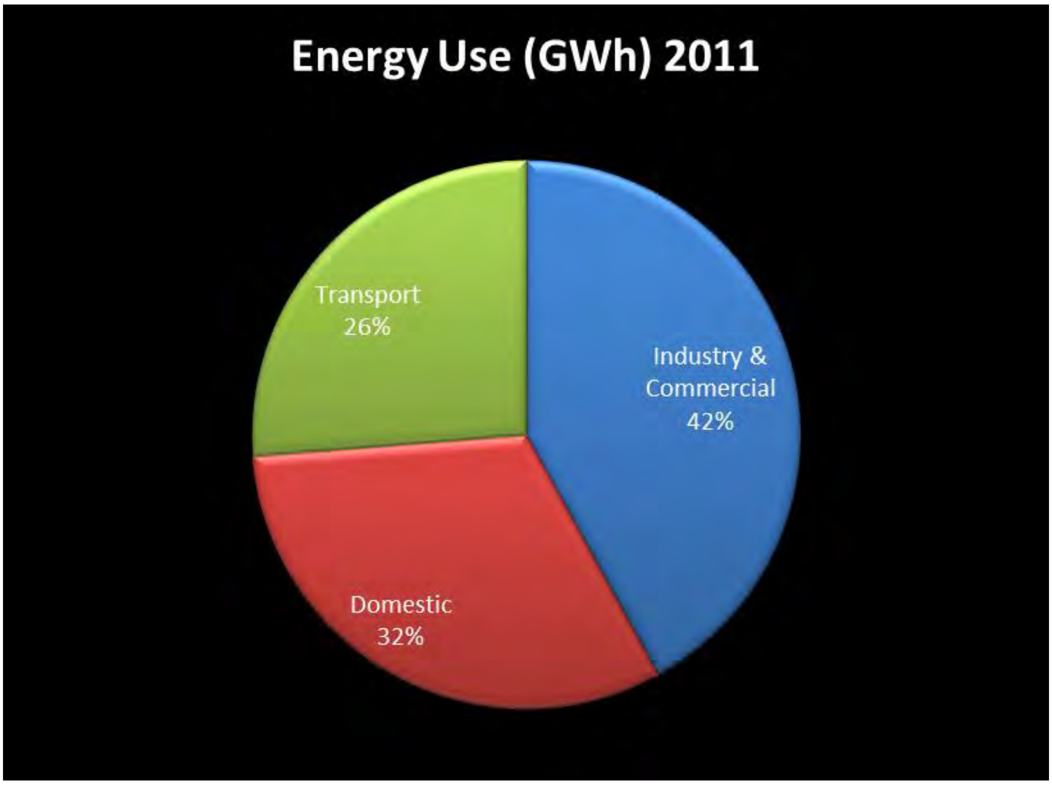

Figure 3.4: Energy use by sector 2011

A substantial amount of energy consumed in the Solent is accounted for by a sector that is already subject to a number of policies largely associated with the reduction of carbon emissions.

[27] Port of Southampton Master Plan 2009 -2030 http://www.southamptonvts.co.uk/Port_Information/Commercial/Southampton_Master_Plan/
[28] http://www.portsmouth.co.uk/news/local/concern-over-portsmouth-power-supply-ahead-of-warships-arrival-1-5959437
[29] http://www.bbc.co.uk/news/uk-england-hampshire-26744230

3.3 Built Environment

The majority of existing domestic and non-domestic building stock in the Solent was built before energy efficiency was a major concern, and much of it will still exist in 2050[30]. Thus existing stock accounts for the majority of carbon emissions, both in number of buildings and lower energy efficiency, so it is essential that energy efficiency is improved in these buildings.

Energy efficiency varies across the building stock. Although the efficiency of some older homes has been improved there is still a close correlation between the age of the building and energy efficiency.

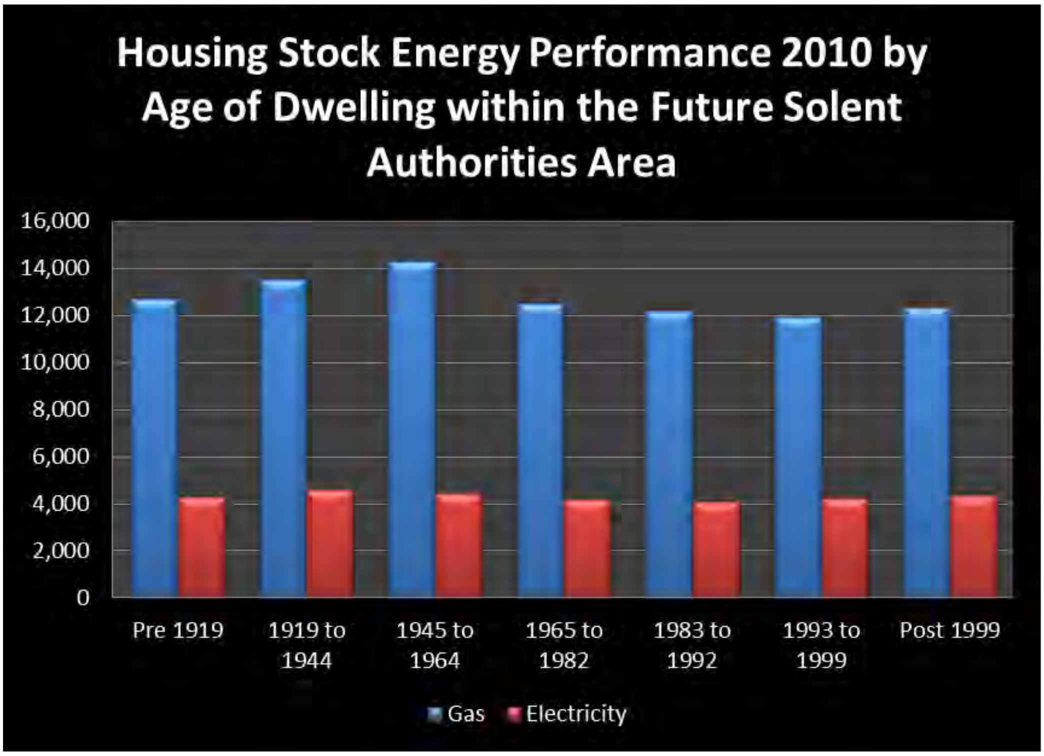

Figure 3.5: Housing Stock – Average Use (MWhs) by Age of Dwelling 2010

[30] It is predicted, for example, that 80% of existing housing in the UK will still be with us in 2050.

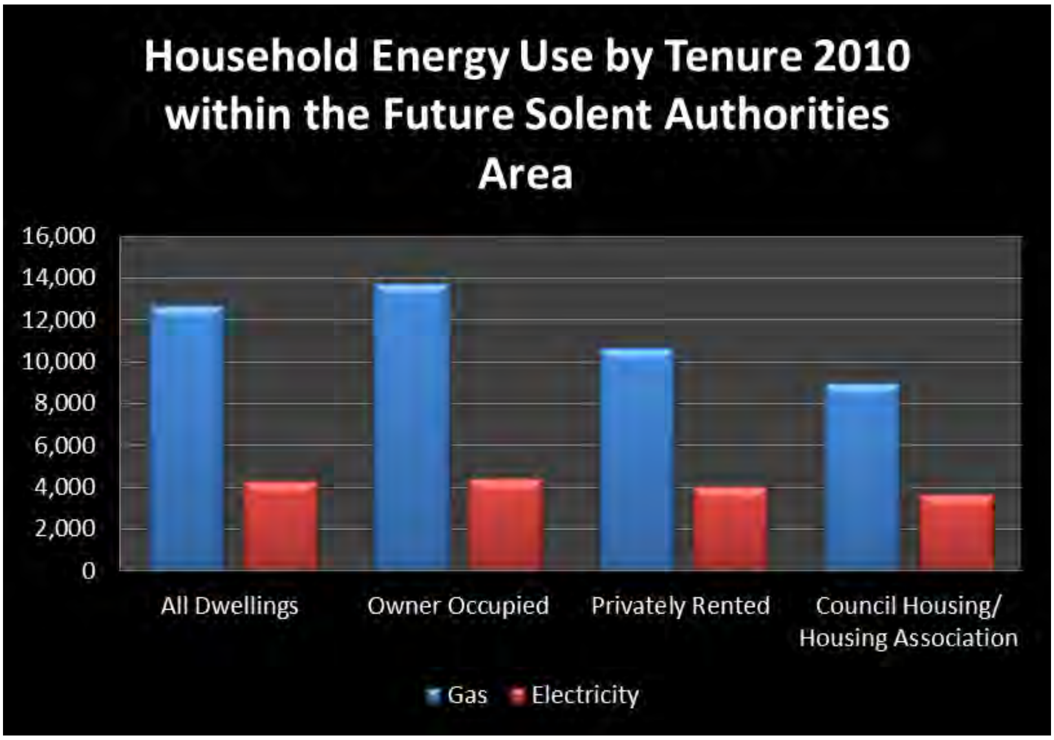

Figure 3.6: Household Energy Use (MWhs) by Tenure 2010

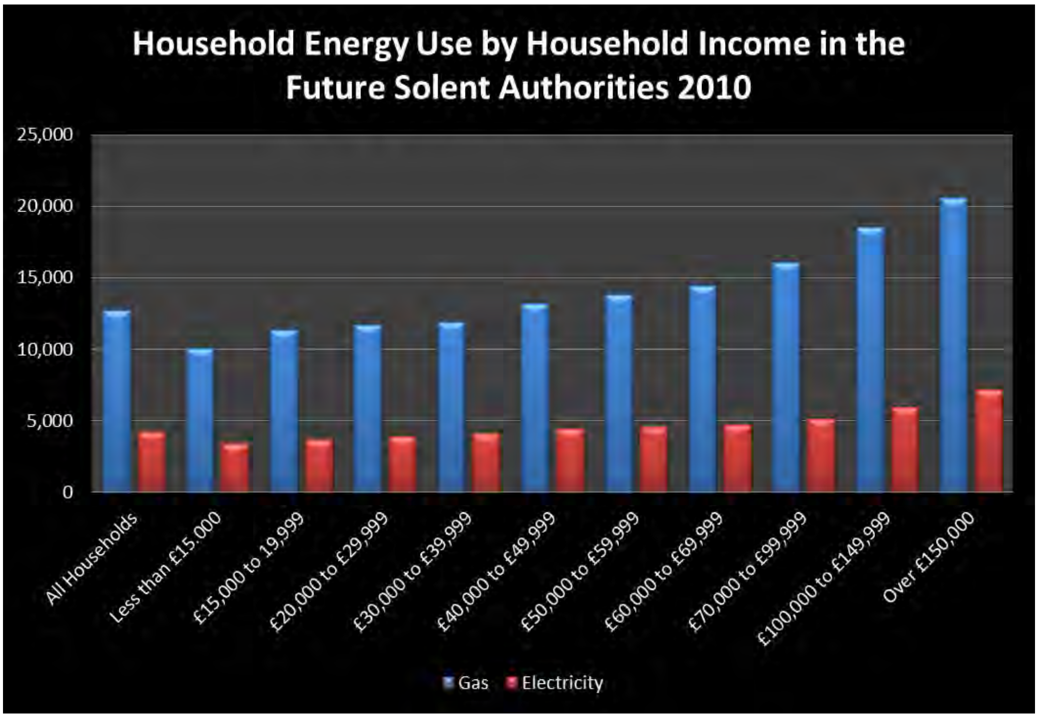

Figure 3.7: Household Energy Use (MWhs) by Household Income – Future Solent Authorities Area 2010

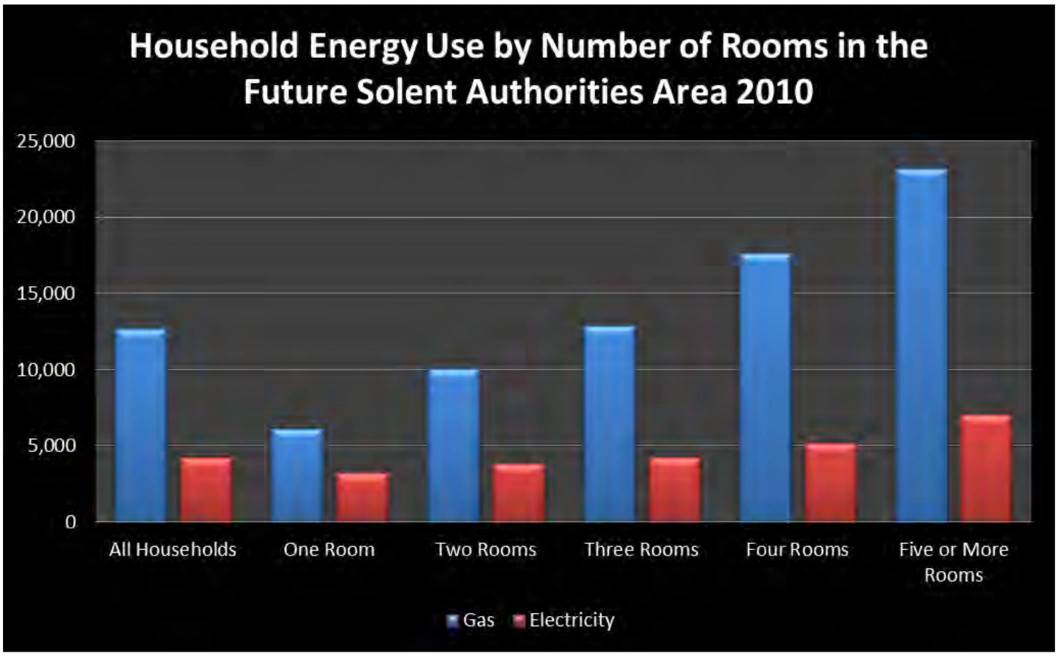

Figure 3.8: Household Energy Use (MWhs) by Number of Rooms in Future Solent Authorities Area 2010

3.3.1 Energy services

The consumption of energy supports a wide variety of needs essential to the functioning of the Solent, termed energy services, and it is these services that create value for the local economy. There are no Solent specific figures for energy services however it is possible to estimate the likely distribution across energy services using assumptions drawn from national data. In the residential sector, space heating remains the most prolific use accounting for 62% of total energy consumption (Figure 3.9). In the industrial and commercial sector, space heating and cooling is also the second largest energy service category after process related heat. The amount of energy used for space heating is a function of desired level of thermal comfort; outside temperature and cost.

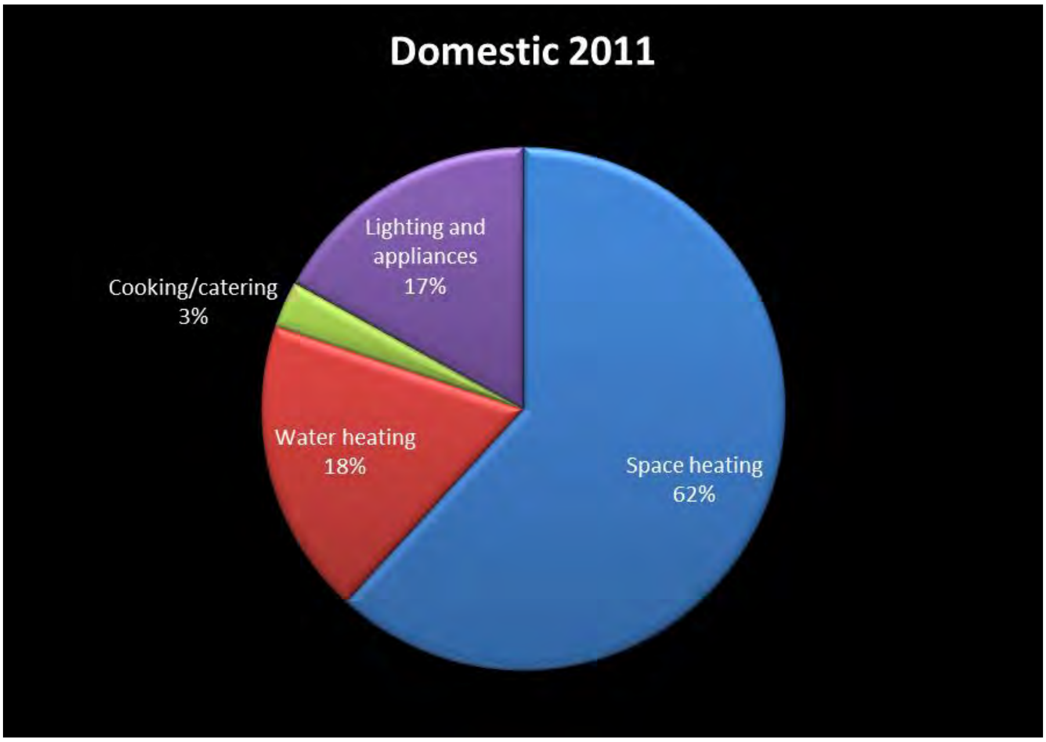

Figure 3.9: Energy Use in the Domestic Sector 2011 (Estimate based on national datasets)

For the business sector, process heat accounts for the highest share of total energy consumption followed by space heating and cooling (see Figure 3.10).

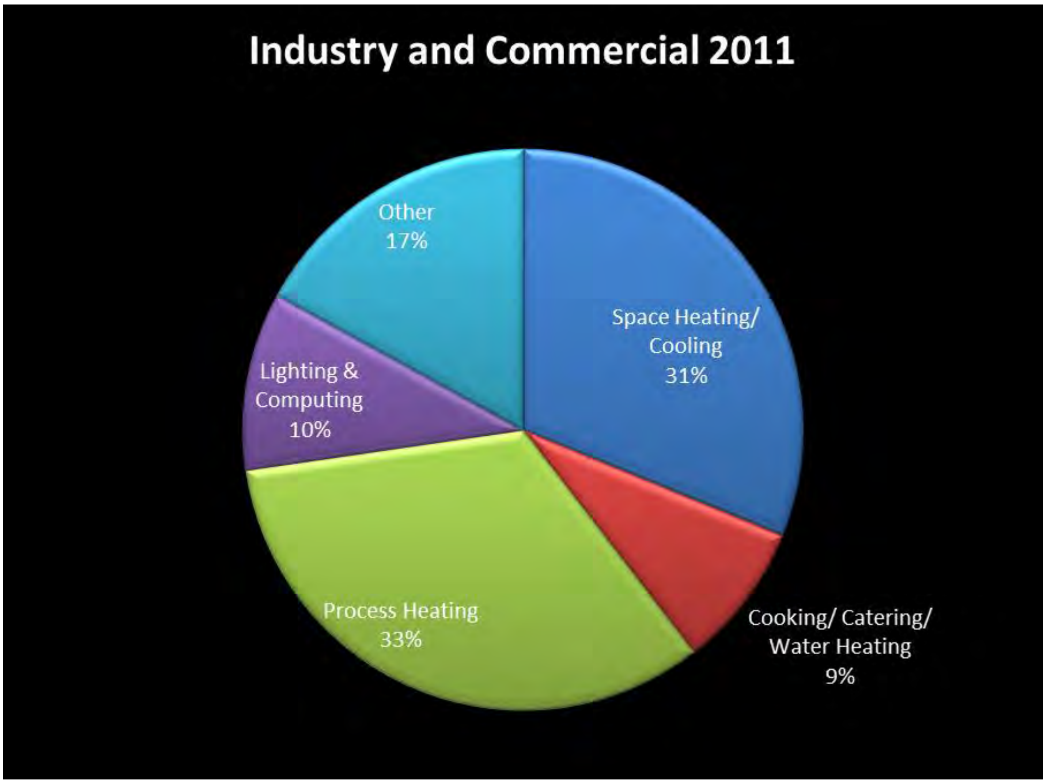

Figure 3.10: Energy Use in the Business Sector 2011 (Estimate)

3.3.2 Energy production & supply

Oil

Opened in 1921, the Fawley Oil Refinery occupies 3,250 acres with 330 tanks and storage vessels on site. There are 750 miles of pipes leading out of the site carrying ten million gallons of finished product (85% of the finished product leaves via pipelines). The refinery output supplies an estimated one in five cars in the UK. Around 2,300 oil tankers unload at Fawley around twenty million tonnes of crude oil every year. The plant consumes 125,000 gallons of cooling water every minute. Fawley produces petrol, diesel, jet fuel, heating oil and lubricating oil. It also produces the raw materials for a host of other products – from carpets to CDs; from toiletries to trainers.

The majority of oil products are still refined in the UK. However, domestic production since the middle of the last decade has decreased while imports have increased. The main markets for products from refining in the UK are:

i. Retail (forecourt service stations): ~28.5 million tonnes per year of petrol and diesel;

ii. Aviation: ~11 million tonnes per year jet kerosene;

iii. Commercial: ~16.7 million tonnes per year (commercial vehicles, heating fuels and marine);

iv. Speciality (bitumen, lubricants, LPG, solvents and petroleum coke etc.): ~5 million tonnes per year; and

v. Petrochemicals: ~2 million tonnes per year.

UK oil refining capacity has reduced from 18 refineries in the late 1970s to seven today with 2 refineries having closed between 2009 and 2012.

The whole refining sector is heavily regulated at European and UK level notably for environmental protection and safety reasons, which has significantly increased costs compared with some global competitors. The Environment Agency issues environmental permits to oil refinery operations as required by EU and domestic legislation. It regulates refineries in England under the European Union Integrated Pollution Prevention and Control Directive (IPPCD), which is transposed into law in England by the Environmental Permitting (England and Wales) Regulations 2010 (EPR).

It is estimated that more than £5.5bn worth of investment will be required, to comply with UK, EU and global legislation. Cost will also be incurred to operate new equipment, to purchase EU allowances and to pay for the UK's target carbon floor price.

The map (Figure 3.11) below shows the important position occupied by the Fawley Oil refinery within the UK's oil refining sector with supply pipelines emanating from it to supply product.

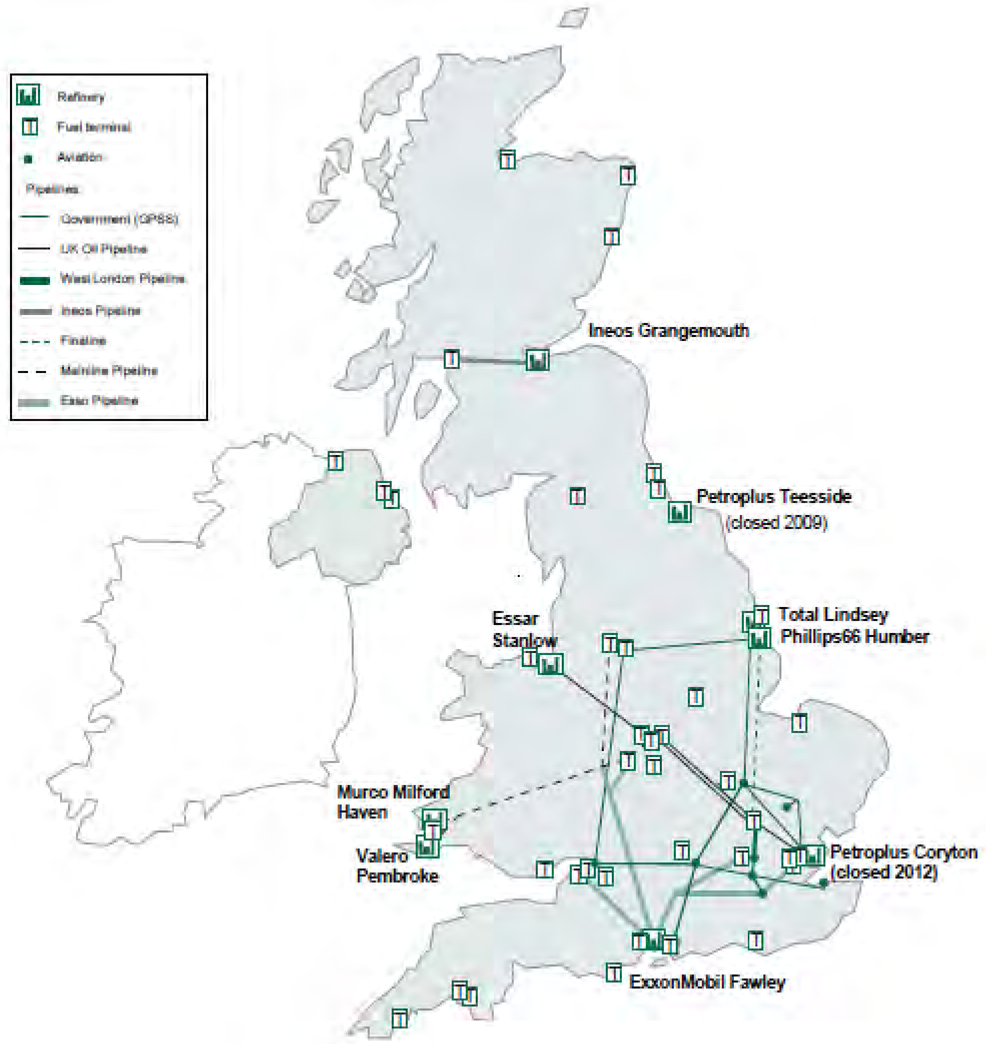

Figure 3.11: UK Oil Refinery Network

Conventional Power Generation

Marchwood Power[31] is a new £400 million state-of-the-art natural gas combined cycle (CCGT) power plant (842 MW). Scottish and Southern Energy plc ("SSE") has entered into an agreement with ESBI (Ireland's ESB International) to acquire 50% of the shares in Marchwood Power Ltd. SSE supplies all of the fuel for the power station and take from it all of the electricity generated. A 22 km long gas pipeline from Romsey to the Marchwood Power Station site has been installed to supply the fuel.

Heat

Information on Combined Heat and Power (CHP) in Hampshire has been taken from the Digest of UK Energy Statistics (DUKES)[32] that provides information on large CHP schemes over 1 MWe in size and case study data on smaller schemes from a number of sources. Large scale CHP accounts for 30 MWe of installed capacity.

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31 http://www.marchwoodpower.com/
32 https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

Southampton District Energy Scheme is the largest commercially developed scheme of its kind. From its launch in 1986, the scheme was initially served by a core of consumers from a geothermal well. The original well now provides only 15% of the system's heat input and is now supplemented by a large scale CHP. This includes a 5.7 MWe unit at the central heat station and 0.7 MWe unit at the Royal South Hants (RSH) Hospital. The heat from the CHP units is recovered for distribution through a 12 km length mains network delivering within a 2 km radius of the heat station. Southampton's scheme also has conventional boilers for "top up" and standby needs at the Civic Centre and Hospital. More than 40 major consumers in the city centre are now served by the scheme including Southampton Solent University, BBC TV and Radio Studio, four Hotels, the West Quay Shopping Centre, two private housing developments and the Quays Swimming Complex. This project has already saved 12,000 tonnes of carbon dioxide at a cost of £10 million.

In addition, there is a system installed as part of the former Community Energy Programme in Portsmouth. A 526kWe spark ignition natural gas CHP engine was installed and an existing heat network upgraded and extended to serve 538 dwellings on the Charles Dickens Estate. The dwellings range from bedsits to two and three-bedroom flats and maisonettes. The network extends to two schools and a new build arts and sports centre. Power generated by the CHP engine is re-supplied to other council facilities, using a "nominated site arrangement" with SSE. The heat network is estimated to save 424 tonnes of carbon per annum, whilst also generating £112,000 in annual fuel bill and cost savings to residents and the Council.

Energy from Waste

Under Project Integra, an agreement has been entered into with Hampshire Waste Services who have built three "Energy from Waste" facilities, two of which are located in the Solent. Currently, residual heat is not utilised representing a lost opportunity. The two Solent facilities are detailed as follows:

- Operational since December 2004 the **Integra South West** (Marchwood)[33] processes non-recyclable waste to supply up to 16MW of electricity to the National Grid, enough for around 22,600 local homes.
- **Integra South East** (Portsmouth) has been fully operational since spring 2005, processes non-recyclable household waste and supplies up to 14MWs of electricity, which is enough for around 20,600 local homes[34]. 8MW of this is used onsite by the facility; the remaining 6MW is distributed to neighbouring businesses, and the national grid[35].

[33] http://www.veoliaenvironmentalservices.co.uk/Hampshire/Energy-recovery/Marchwood/
[34] http://www.veoliaenvironmentalservices.co.uk/Hampshire/Energy-recovery/Portsmouth/
[35] Private correspondence from Portsmouth City Council (Oct 2014).

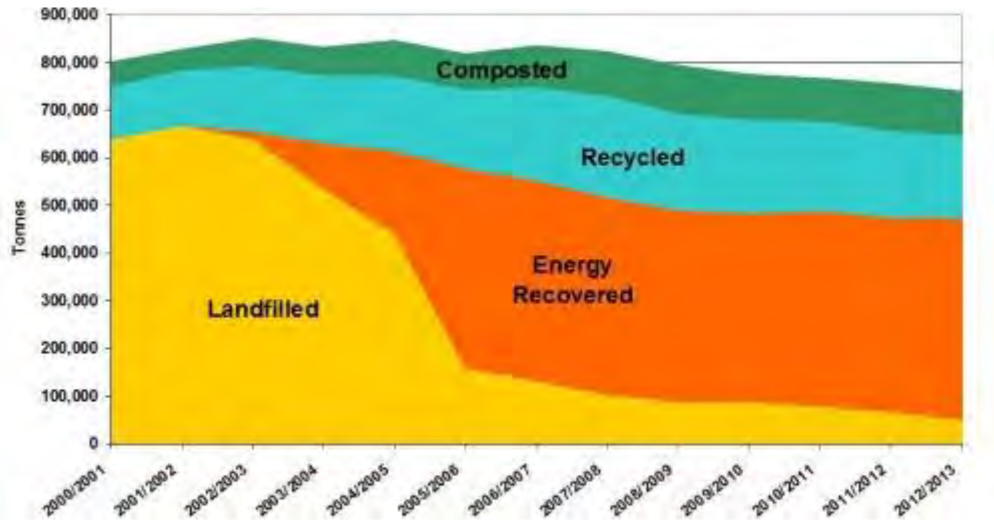

Figure 3.12: Project Integra Household Waste Treatment: 2000/01 to 2012/13[36]

3.4 Installed Renewable Generation

Table 3.1 sets out the existing operational renewable energy mix in the Solent.

Renewable Source	Capacity (MW)	MWh
PV	50.65	44,369
Landfill Gas	8.47	41,699
Wind	0.08	184
Geothermal	3.35	26,411
Total	**62.55**	**112,663**

Table 3.1: Existing Renewable Energy in the Solent[37]

3.4.1 Energy distribution & transmission networks

Electricity

National Grid owns and maintains the high voltage electricity transmission system in England, together with operating the system across Great Britain. Scottish and Southern Energy (SSE) is the local Distribution Network Operator (DNO) covering the whole of Hampshire. SSE are the owners and operators of the network of towers and cables that bring electricity from the high-voltage transmission network to homes and businesses. Southern Electric (part of Scottish and Southern Energy group) is the company which then supplies and sells electricity to domestic, commercial and smaller industrial premises.

Natural Gas Distribution

Scotia Gas Networks operating as Southern Gas Networks (Scotia) are responsible for the local distribution of gas drawn from the national high pressure transmission system (operated by National Grid Company). As a monopoly

[36] http://www3.hants.gov.uk/projectintegra/pi-documents.htm
[37] Arup analysis, based on information from DECC, factored based on population by local authority where appropriate.

operation, the company's pricing and investment activities are regulated through the Office of Gas and Electricity Markets (Ofgem). A ten year forecast of transportation system usage and major reinforcement investments are published within the Long Term Development Statement for Scotland Gas Networks and Southern Gas Networks (December 2013). Over the forecast period 2013 to 2022, Scotia is predicting a fall in annual demand of 3.02% with peak demand falling by 1.63%. Scotia has been developing a pilot project to investigate the use of their network for the distribution of biogas which offers additional options to anaerobic digester facilities wishing to connect to the grid.

Scotia are also creating the Portsdown Hill bio-methane entry facility which will take compressed bio-methane from road tankers and inject into the local transmission network. This will allow anaerobic digestion plants remote from the network to access the gas grid. In essence this will become an entry point for a number of partners (mainly in North Hampshire) who will clean up and compress their bio-methane remotely and then transport their gas to Portsdown Hill. The benefits of this method are that gas quality can be better controlled and substantial cost savings can be made by all parties involved.

Biomethane Injection Distribution[38]

Scotia completed a project that is supplying bio-methane to the ecotown of Poundbury in the Duchy of Cornwall-owned estate near Dorchester in Dorset. Whereas Scotia's previous project used water wash technology to clean the biogas, this project's scale required an even more innovative approach with membrane separation being used for cleaning. The anaerobic digester takes 41,000 tonnes per annum of locally secured feedstock including 5,000 tonnes of potato food waste, 24,500 tonnes of maize, 10,000 tonnes of one-year grass and 2,000 tonnes of chicken manure.

The project at Poundbury has also used a variety of new techniques to reduce the costs and increase the efficiency and ease of biogas clean-up and injection. The project will act as a testbed for the development of new forms of clean-up and injection equipment and will continue to drive down costs of bio-methane injection.

3.4.2 Renewable resource potential

Table 3.2 shows the overall renewable energy capacity technically available in the Solent area. This information is taken from existing published sources, which provides information at a regional or local authority level and factored down to provide information for the Solent[39].

The baseline presents an estimate of the amount of energy which could be generated if all the available renewable resources were used. For example the Solar PV is the potential from panels on all public, commercial and domestic buildings with appropriate space. There are likely to be regulatory, governance, financial and public opinion barriers to achieving this full potential.

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[38] Southern Gas Networks Long Term Development Statement, October 2013
[39] Review of Renewable and Decentralised Energy Potential in South East England, for the South East Planning Partnership Board.(June 2010) http://www.climatesoutheast.org.uk/index.php/publication

Renewable generation	Type of generation	Type of power produced	Capacity (MW)		KtCO2 saved	
Wind On-shore	Commercial Scale	Electricity	2342.12		1454.85	926.01
	Small Scale	Electricity	211.68		152.89	74.32
Biomass	Plant - Managed Woodland	Electricity	11.61		34.34	21.85
		Heat	193.69		82.11	82.10
	Plant - Energy Crop	Electricity	8.39	9.24	24.78	17.39
		Heat	109.06	120.22	46.24	50.97
	Plant - Waste Wood	Electricity	4.12	5.06	12.11	9.49
		Heat	61.94	69.18	26.29	29.35
	Plant - Agricultural Arisings	Electricity	52.26		154.98	98.72
	Animal - Poultry Litter	Electricity	2.02		4.12	2.62
	Animal - Wet organic waste	Electricity	557.28		1126.67	717.50
	Biomass co-firing	Electricity	73.43		102.53	65.31
Waste	Municipal Solid Waste	Electricity	327.81	667.48	497.02	645.01
	Commercial and Industrial	Electricity	684.97	1419.26	1040.25	1372.43
Biogas	Landfill gas	Electricity	5.1	1.68	10.18	2.12
	Sewage gas	Electricity	7.74	83.05	11.43	7.81
Hydro	Small-scale	Electricity	1.72		3.50	2.23
Micro-generation	Solar Photovoltaic	Electricity	351.87	401.19	109.28	79.36
	Solar water heating	Heat	302.65	351.97	32.08	37.31
	Heat Pumps	Heat	1880.07	2003.70	517.62	751.78
Tidal	Tidal turbines	Electricity	Estimates vary from 25.11[40] to 249[41]			
	Total	**Electricity**	**4943.05**	**6189.33**	**4771.01**	**4077.25**
		Heat	**2244.76**	**2386.79**	**672.26**	**914.2**

Table 3.2: The potential for energy generation in the Solent Area

The largest generation capacities are from onshore wind providing 2342 MW by 2020, 92% of which is commercial, and heat pumps, which have the potential to provide 1880 MW by 2020.

The largest carbon dioxide saving would be from biomass, 1614 $KtCO_2$ by 2020, and waste, 1537 $KtCO_2$. This is a greater CO_2 saving than both on-shore wind and heat pumps despite producing only half the generation capacity. Biomass

[40] David MacKay, 2009 "Sustainable Energy - Without Hot Air"; Capacity Factor of 0.30 from Carbon Trust UK Wave Energy Resource Report (2012) http://www.carbontrust.com/resources/reports/technology/marine-energy-reports
[41] ABPMer for npower juice, *Quantification of Exploitable Tidal Energy Resources in UK Waters* (2007)

generation saves more than three times the amount of CO_2 than heat pumps; heat pumps require some energy from the grid and generally produce four times more energy than the technology uses.

Solar PV, solar water heating, hydropower and biogas have a much smaller potential mainly due to the lack of suitable resource capacity in the Solent area.

Predictions of the potential from tidal power vary greatly. Research and development in the sector is still emerging, so this is not surprising. However, when compared to other coastal areas, it is clear the Solent is in the ideal position to take advantage of this emerging source of energy. The Isle of Wight has the most tidal capacity in South East England, as seen in Figure 3.13[42].

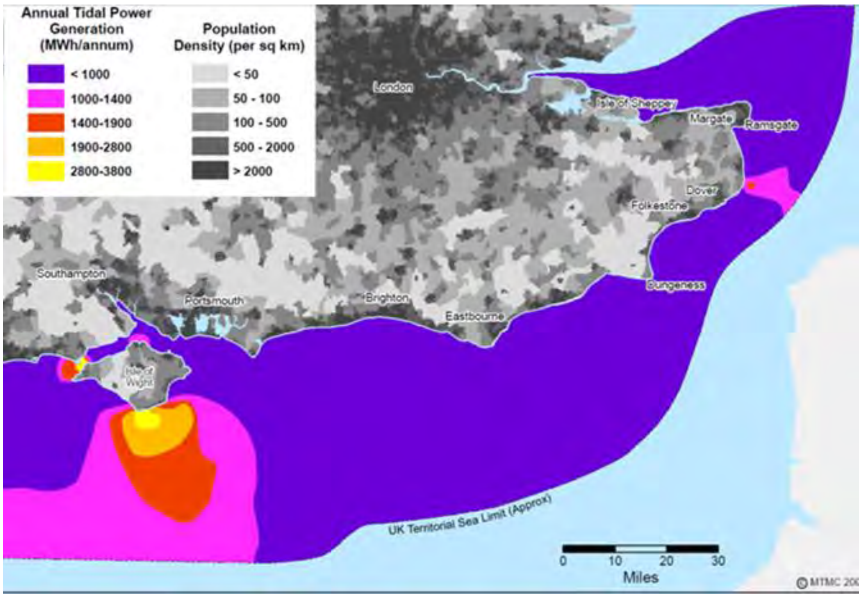

Figure 3.13 Potential annual mean power generation for areas of significant tidal stream resource in the South East with population density

3.4.3 Energy related employment

The energy sector in the Solent LEP area employs approximately 4,200 people according to the sector definition used by Hampshire County Council in their recent Economic Assessment Update[43]. This represents nearly 18% of the South East's energy sector workforce and 2.7% at a national level. Clearly this shows a higher concentration of employment in the energy sector in the Solent LEP than at both the regional and national level. Between 2009 and 2012 however, employment in the energy sector in the Solent LEP region has shrunk by over 20%. This is a loss of around 1,000 employees.

Outside of the Solent LEP, the sector has gradually grown in the wider South East region and across England there has been an increase in employment by more than 5,000 employees. However, looking at the data more closely reveals that the

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[42] Atlas of the Tidal Energy Resource on the South East Coast of England. South East of England Development Agency (SEEDA), May 2007, http://www.iwight.com/documentlibrary/download/tidal-energy-resource-atlas-for-the-south-east

[43] Hampshire County Council (2013), Hampshire Economic Assessment, Theme 3 Business and Enterprise; An update of the economic indicators for the Hampshire Economic Area and its functional geography

definition within the 2013 Hampshire Economic Assessment largely covers 'conventional' energy generation. The job losses are largely related to the gas industry. Many people in the energy sector are employed in gas, coal and electricity, although 47% of these are expected to retire in the next ten years.

Nationally, there will be a need to employ a further 15,200 in the energy sector over the next decade. The key to the Solent securing a share of this growth will be the development of a skilled workforce through the provision of apprenticeship schemes, graduate trainee schemes and securement of government funded technical programs.

The energy sector is framed in terms of a definition based upon conventional energy. This type of analysis does not efficiently capture the economic impact associated with the supply chain and unconventional energy systems (those jobs not yet captured in the statistical mechanisms used to classify employment). The current definitions also fail to capture potential such as that which might arise through the diversification of firms to service new opportunities. This is most relevant in relation to marine and ICT/ digital activities.

3.4.4 Fuel poverty

The UK government's definition of fuel poverty has recently been updated. The new definition is that a household is said to be in fuel poverty if it has required fuel costs that are above the national median level and if it were to spend that amount it would be left with a residual income below the official poverty line[44].

The three factors determining whether a household is fuel poor are:

- the cost of energy;
- the energy efficiency of the property; and
- the income of the household.

Table 3.3 presents the percentage of households which are fuel poor in the Solent area, the wider South East region and England as a whole.

Geography	Proportion of Fuel Poor Households
Solent Area	8.3%
South East	8.2%
England	10.9%

Table 3.3: Fuel Poverty in the Solent, South East & England[45]

[44] Annual Report on Fuel Poverty Statistics 2013, Department of Energy and Climate Change, May 2013.
[45] Source: Local Authority data: https://www.gov.uk/government/publications/fuel-poverty-2011-detailed-tables [accessed December 2013]

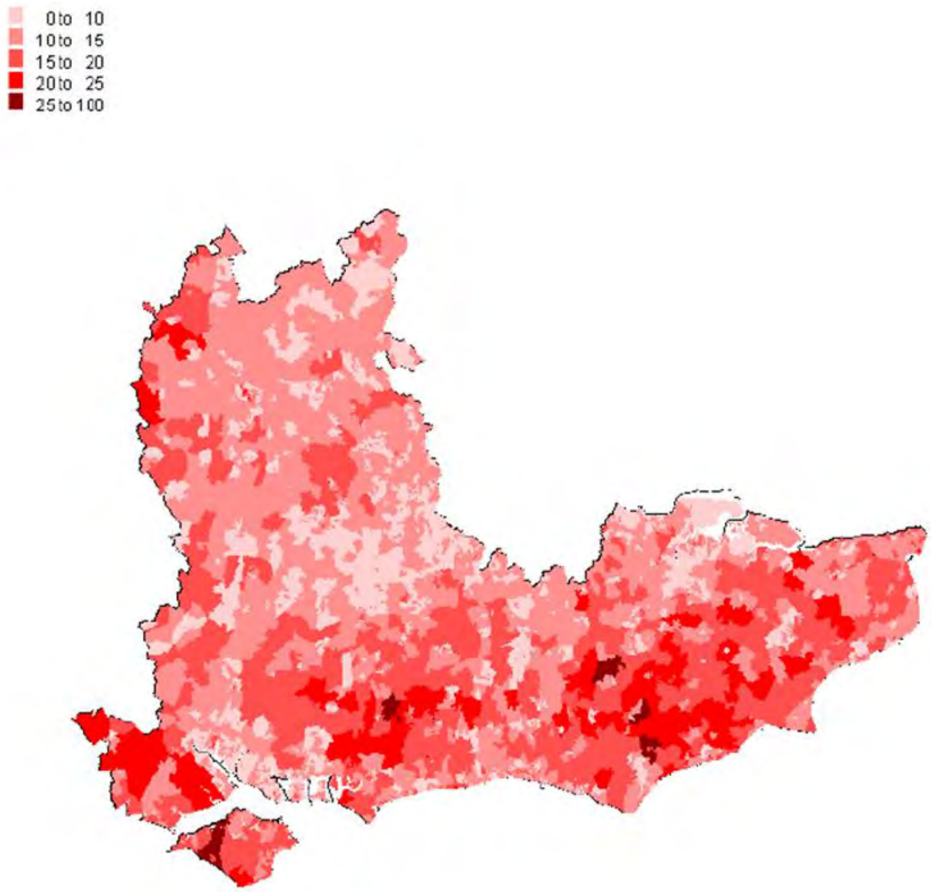


Figure 3.14: Fuel Poverty in the South East, 2011: Percentage of households in Fuel Poverty by Lower Super Output Area

As shown in Table 3.3, there is a lower proportion of fuel poor households in the Solent area than in England[46]. This statistic is not surprising as the local authorities within the Solent and the South East region as a whole score low on indices of multiple deprivation.

Looking at the variations within the Solent area, the percentage of fuel poor households in Eastleigh is only 6.4% whilst the highest percentage is in Portsmouth, where 10.7% of households are fuel poor. The Isle of Wight and Southampton have 9.9% and 9.8% of their population in fuel poverty respectively and they therefore, alongside Portsmouth, increase the average in the Solent area as a whole. The perception that the Solent has a relatively low proportion of people living in fuel poverty generally holds, however it is important to bear in mind that there are areas in the sub-region with high levels of fuel poverty. It is important to address these pockets from a social equality perspective across the Solent. Particular areas within the Solent region with very high levels of fuel poverty include Central Southsea in Portsmouth, the Bevois area of Southampton and the Brighstone area on the Isle of Wight. These areas should be considered as pilots for future residential retrofit initiatives.

[46] Annual Report on Fuel Poverty Statistics, Department of Energy and Climate Change, May 2013

In rural areas, there is a particular issue with regards to access to the gas grid. This means that householders need to use alternative fuels to provide heat to their homes. They are normally reliant on more expensive oil supplies.

4 The Solent Energy Project Pipeline

4.1 Introduction

A project pipeline has been compiled of all of the energy related projects that are currently in the pre-feasibility, feasibility and planning phases in the Solent area.

The project pipeline is the means by which strategic objectives are translated into action. The ideal circumstances are that projects are generated in response to a strategy. Partners in the Solent have, however, been engaged in the development of energy projects for many years which are themselves the products of extant strategies on energy, climate change, transport (See Appendix A). As such, there is a need to take stock of existing projects and understand how they fit into and facilitate the strategy objectives.

Arup has reviewed the project pipeline with the assistance of members of Future Solent, and other stakeholders, who have supplied information on projects. The analysis undertaken has been a function of the level and quality of information available at the time of the review. Limited information has been available for many of the projects identified in the early stages of development.

It should be noted that the projects that appear in the pipeline are representative of a certain point in time (April 2014). In reality, the pipeline will continually change as projects are developed (or are not taken forward).

4.2 Project Pipeline Mapping

The process of establishing the project pipeline has involved mapping the existing knowledge of Future Solent members. For the purposes of inclusion, a qualifying "project" must have a name, a geographical reference and a promoter as a minimum. This approach removes from consideration generic policy statements or strategic statements such as those supporting a proportion of renewables in the mix or statements concerning a commitment to renewable generation.

Assuming a project meets these tests of legitimacy, the project will need to be positioned within the pipeline in terms of its investment readiness which is assessed in terms of consenting and funding preparedness.

Information used to assess the status of a project has been taken from a combination of sources including:

- Government websites on renewable projects;
- Planning portal websites for the relevant local planning authorities;
- Project specific websites;
- Direct information from stakeholders; and
- General web searches.

A three level investment readiness grading has been adopted as follows:

Grade	Evidence Required
1	Indicating evidence of both funding and consents being sought
2	Evidence of either funding or consents being sought
3	No evidence for either funding or consents having been sought

Typically a named scheme without any project detail (e.g. generator size) would be regarded as an early stage project and assessed as a "3". Evidence of a full business case is likely to come from the progression through the consenting process and/ or proof of funding. Such cases would be assessed as a "1"

For the most part, cost details have not been available to us. In these cases, a cost per MW installed has been used to derive a likely capital expenditure figure. These figures will change in response to technical innovation over time.

4.3 Pipeline Overview

4.3.1 Top 10 Projects

Based on publically available information in April 2014, table 4.3 below sets out the top ten projects in the project pipeline in terms of Annual MWs expected to be produced.

Project Name	Generation Type	MWe	Local Authority Area
Connecting Rubble Energy to the National Grid	N/A – Transmission and Distribution	170	Isle of Wight
Western Southampton Docks Biomass Plant	Biomass (Energy Crops)	100	Southampton
Eveley Farm (Houghton)	PV	35	Test Valley
Grange Estate (Itchen Stoke)	PV	30	Winchester
Perptuus Tidal Energy Centre (PTEC)	Tidal	30	Isle of Wight
Woodmancott Down	Onshore Wind	18	Winchester
Newland Farm Solar	PV	16.87	Fareham
Upper Farm Solar Park, Bradley Nr Basingstoke.	PV	12	Winchester
Hill Farm Solar Park	PV	10.2	Isle of Wight
Funtley Refuse Tip	PV	10	Winchester

Table 4.3: Top Ten Projects by Share of Contribution to Pipeline Energy

This list excludes Navitus Bay, a proposed offshore wind farm[47], located off the Dorset and Hampshire coasts, to the west of the Isle of Wight. As with all offshore energy, the development would physically sit outside the region, but given the size and scale of the proposed development. However, from an economic perspective, there are clearly supply chain opportunities that will

[47] The figures in this report are taken from the phase four consultation in September 2013 (http://www.navitusbaywindpark.co.uk/phase-four-consultation). These were most accurate at the time of analysis – April 2014.

present themselves. The rest of the pipeline analysis therefore considers the impact with and without this project.

4.3.2 Project type

The distribution of projects across the different descriptors used is as shown below:

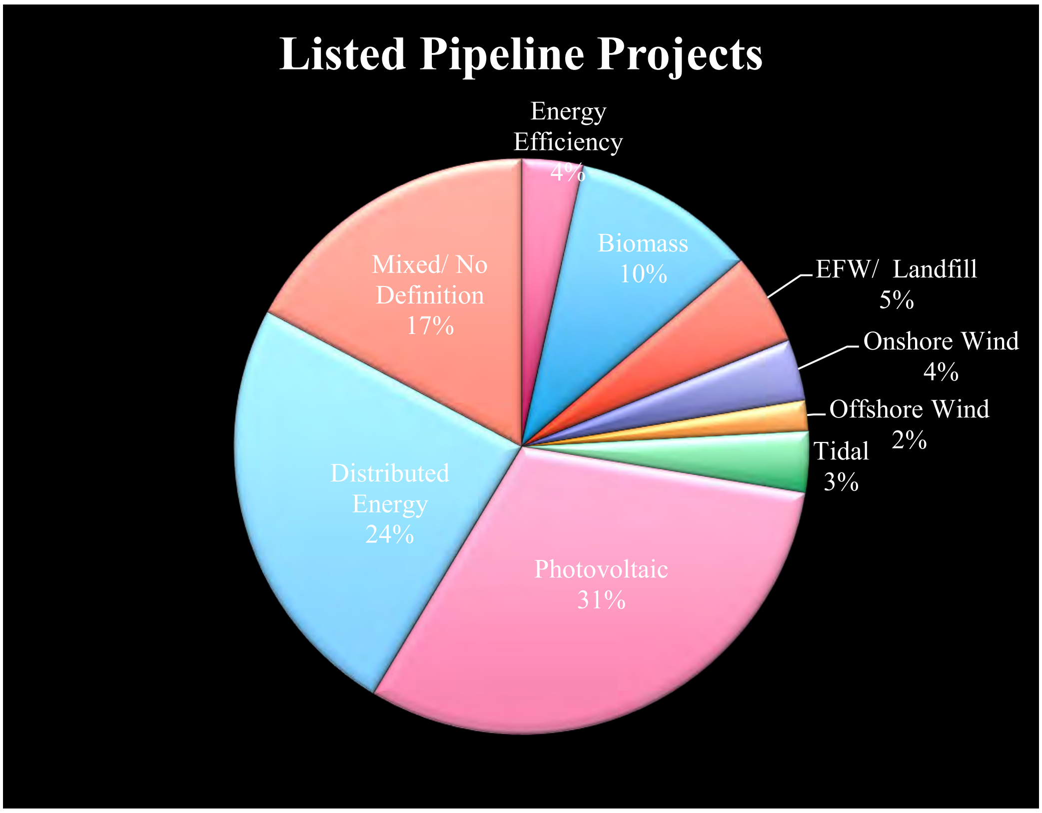


Figure 4.1: Pipeline Projects

Overall 60 named projects were identified. On investigation, for many of these, project definition was not sufficiently well defined to allow further analysis, or did not constitute a "project" (essentially consisting of a target or a policy). The pipeline review has therefore focused upon the 32 projects with sufficient detail. The focus of the pipeline in terms of projects is overwhelmingly electrical energy generation with photovoltaic installations representing the greatest number of projects overall.

4.3.3 Pipeline by energy contribution

An analysis of the pipeline by their contribution to energy need is shown below:

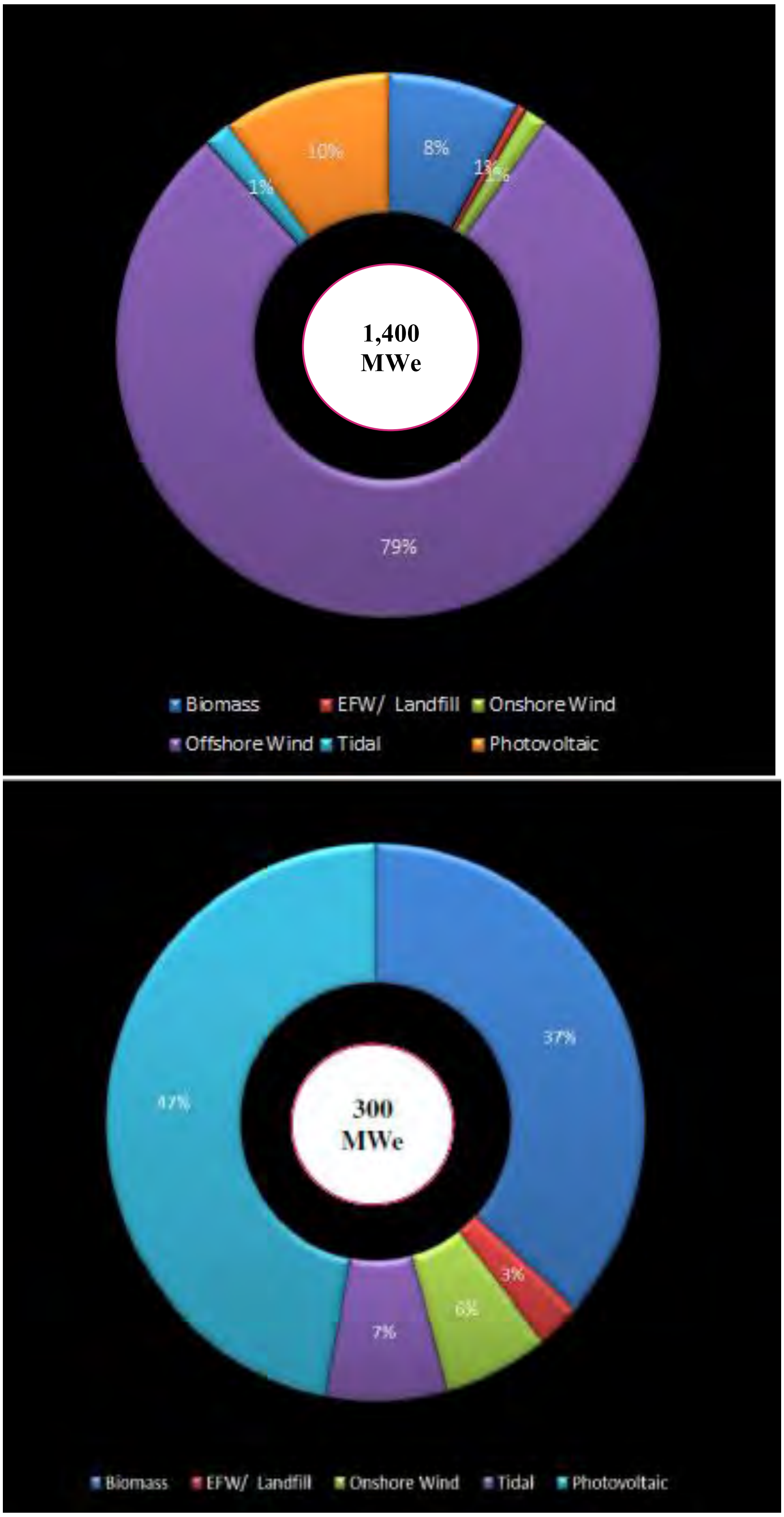
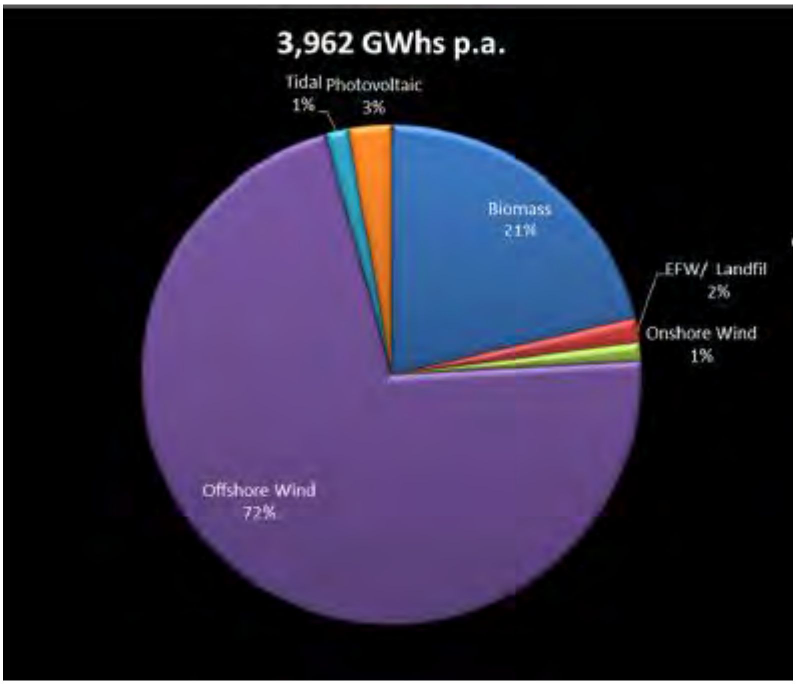


Figure 4.2: Pipeline Projects by Contribution to Installed Capacity MWe

With Navitus Bay, an installed capacity of 1400 MWe means the offshore wind project dominates the analysis of the pipeline. The exclusion of Navitus Bay results in the predicted levels of installed capacity shrinking by around 80%.

Biomass systems followed by photovoltaic systems dominate the predicted distribution of installed capacity of 300 MWe.



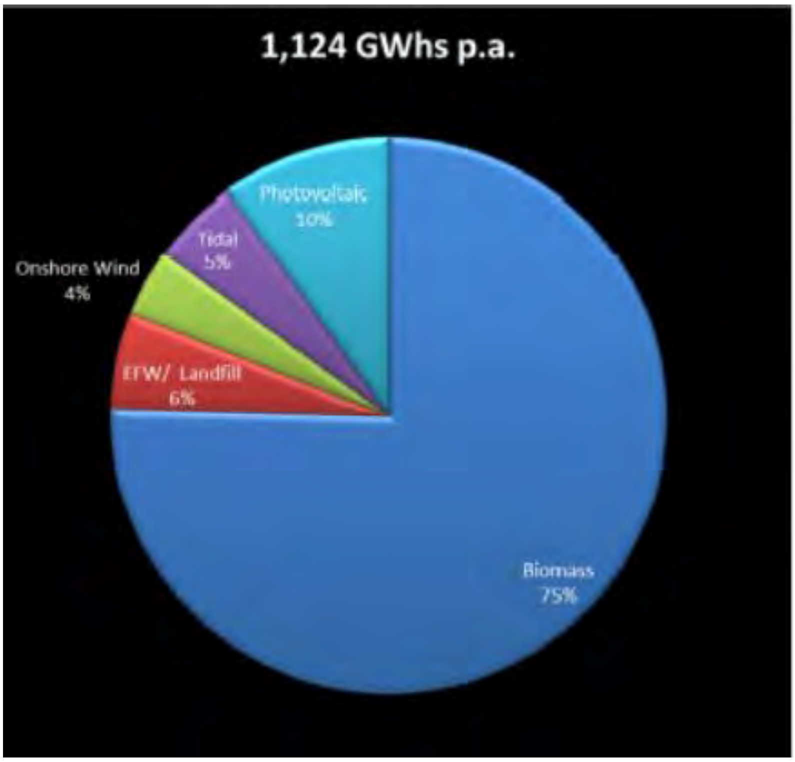
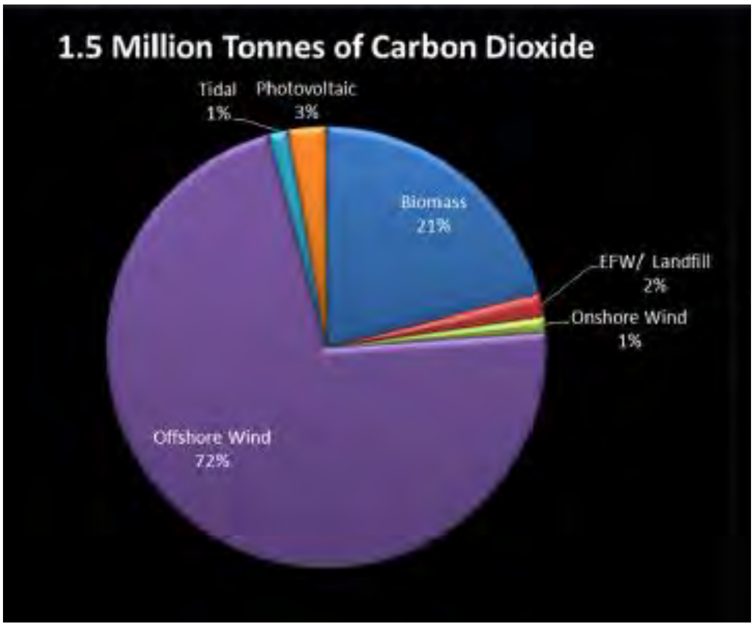


Figure 4.3: Project Pipeline by Value without Navitus Bay

4.3.4 Carbon dioxide abatement



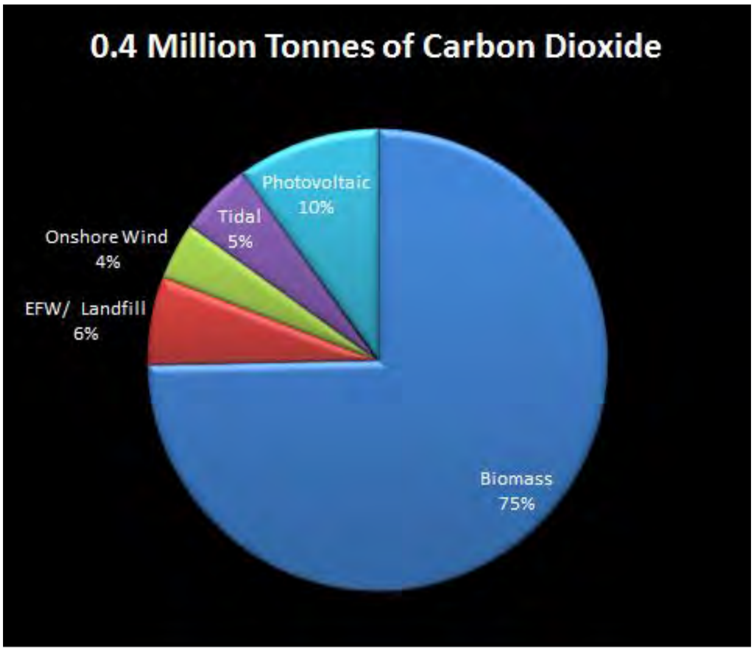
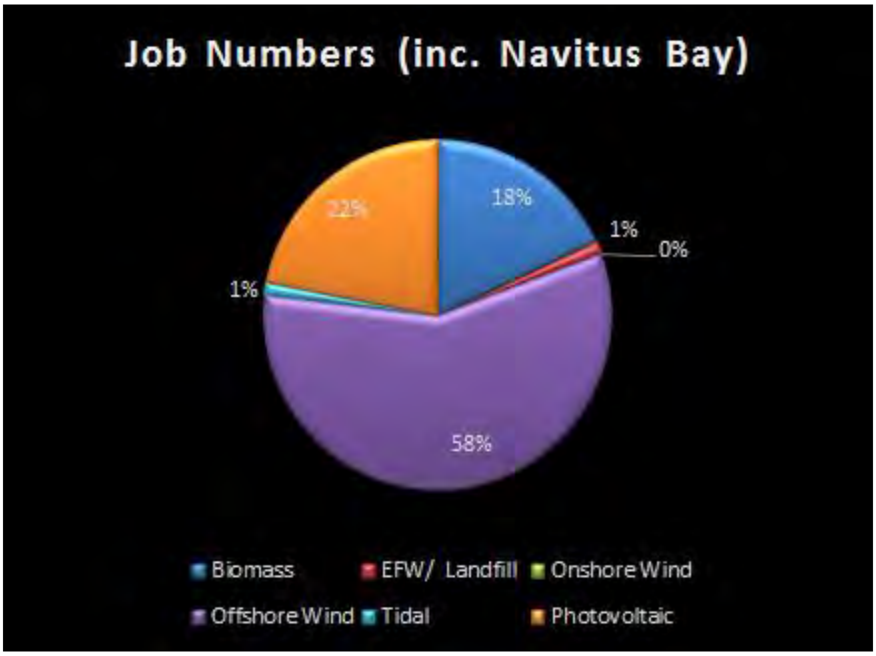


Figure 4.4: Carbon Dioxide Abatement

Full implementation of the pipeline would result in the abatement of 1.5 million tonnes of carbon dioxide with the majority coming from offshore wind followed by biomass. Without the Navitus Bay Project (see the top pie-graph in Figure 4.4), the biggest abatement contribution comes from biomass followed by photovoltaic systems.

Where no publically available data was available in April 2014, carbon dioxide abatement has been calculated using DECC figures.

4.3.5 Pipeline by jobs



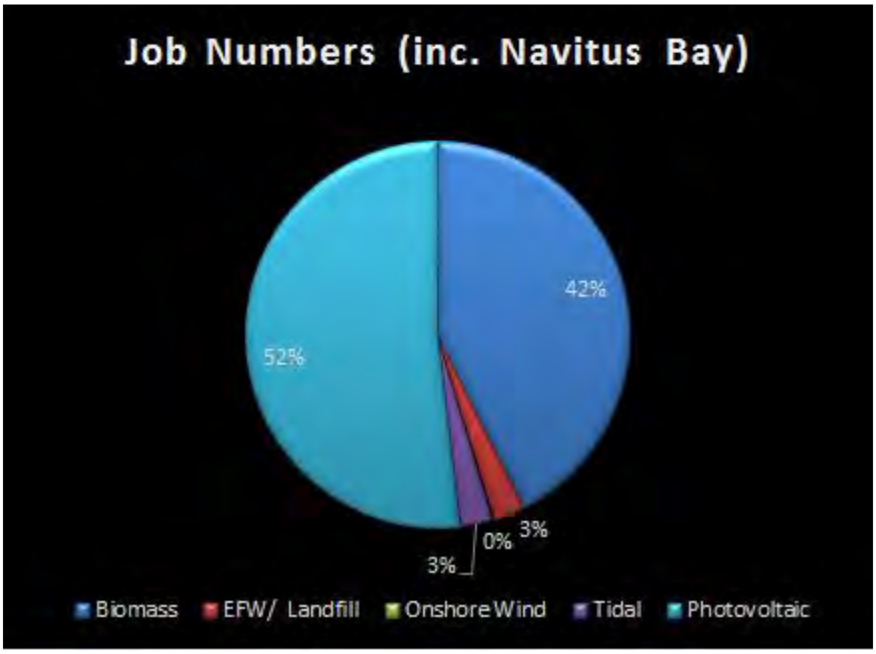


Figure 4.5: Jobs attributable to the pipeline

The project pipeline is capable of delivering 2,261jobs in total over an as yet unspecified period. This includes Navitus Bay where offshore wind accounts for the highest share. The removal of the Navitus Bay results in photovoltaic systems followed by biomass accounting for the largest share of possible jobs (958). Where no publically available data was available, job numbers have been calculated using data from BIS, English Partnerships and DTI. This is set out in more detail in Section 5.

4.3.6 Investment

The pipeline by value is dominated by one project, Navitus Bay, which accounts for 85% of the total capital expenditure.

Pipeline	Total Investment Cost (‘000s)
Biomass	£230,200
EFW/ Landfill	£28,563
Onshore Wind	£26,488
Offshore Wind	£3,500,000
Tidal	£54,900
Photovoltaic	£242,303
Total	**£4,082,454**
Without Navitus Bay	£582,454

Table 4.1: Total Investment Cost[48]

The analysis shows that the total investment value of all measures is over £4billion. Without Navitus Bay, the investment value falls to below £0.6 billion.

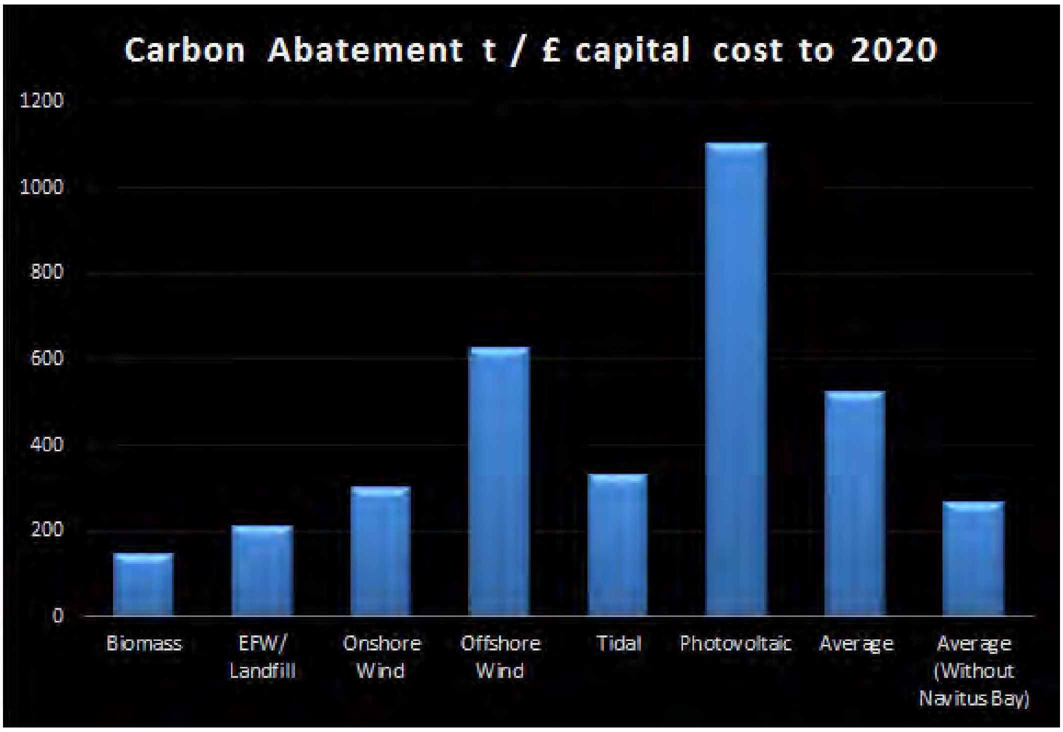


Figure 4.6: Project Pipeline – CAPEX cost of carbon abated by 2020

Figure 4.6 shows the investment cost per tonne of carbon dioxide abated as a measure of value for money. This analysis shows a considerable spread of values

48 Costs (assuming that cost are for 2020 and are the median projection) from Arup for DECC, *Review of the generation costs and deployment potential of renewable electricity technologies in the UK*, 2011

from tidal at around £9,600 to just under £800 for biomass against an average across the whole pipeline of £2,750.

Where no publically available figures were available on costs of individual projects, figures have been calculated on a per MW basis, based on work done for DECC in 2011.

4.3.7 Pipeline project structure

The analysis shows that a few projects account for the majority of the deliverable energy contribution (even with the exclusion of Navitus Bay) as shown in the graph below.

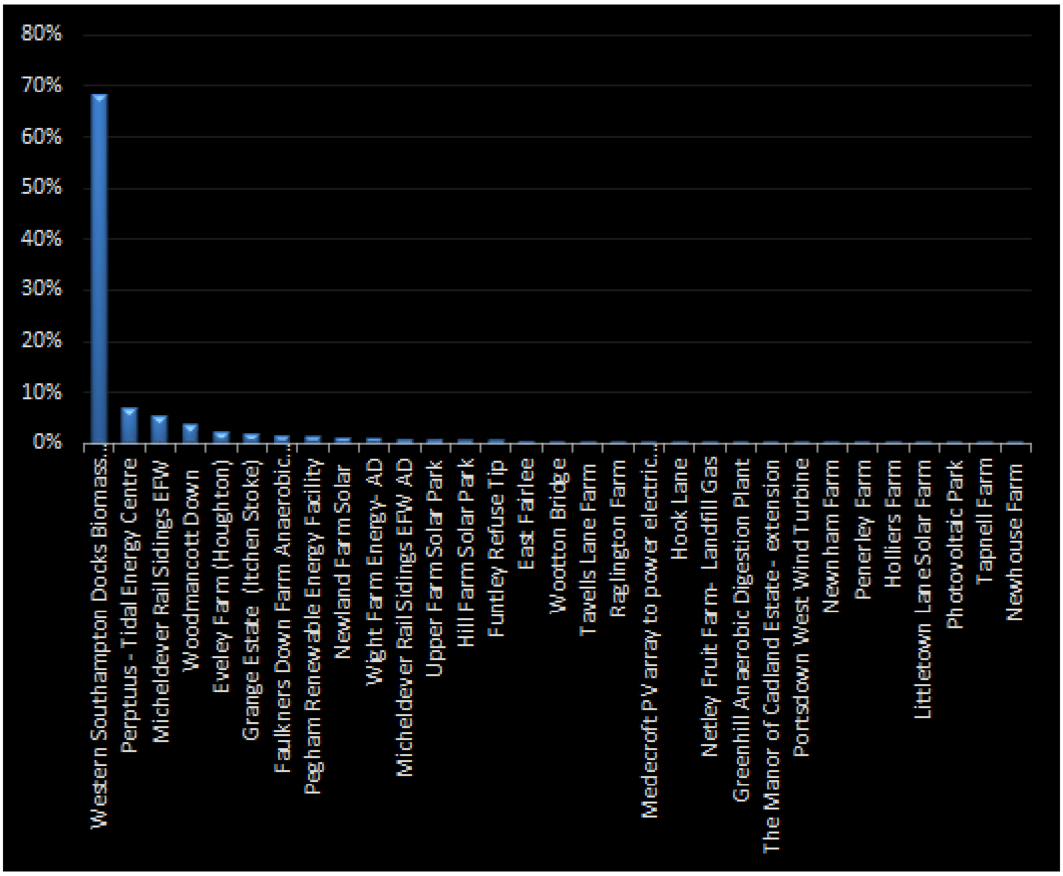


Figure 4.7: % Share of Contribution to total MWhs by Project excluding Navitus Bay

4.3.8 Pipeline deliverability

Describing the pipeline does not however help understand the likelihood of the projects actually happening. Deliverability is a function of many factors. This research has focused on two, evidence of funding and evidence of progression through the regulatory hurdles to secure a site ready project. Based on these factors, the pipeline is structured as detailed in Figure 4.8.

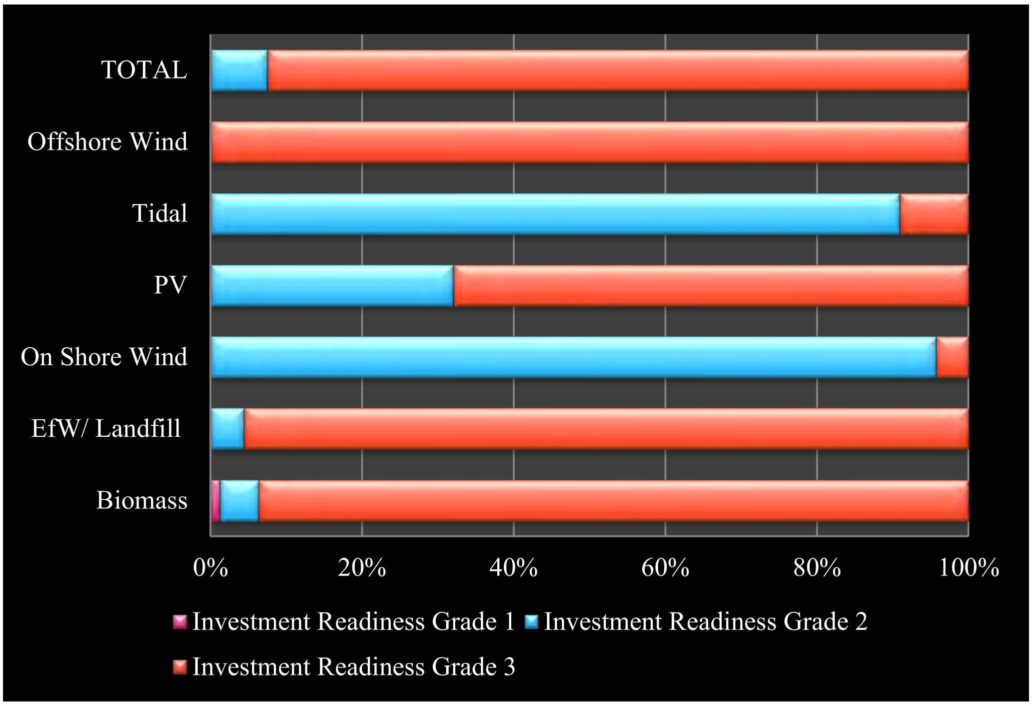


Figure 4.8: Pipeline by Deliverability excluding Navitus Bay

This analysis shows that less than 1% of pipeline projects have the highest investment readiness rating. Just over 92% of pipeline projects by value have neither valid consent nor known funding in place. Only one biomass project has evidence of both funding and planning. Onshore wind and tidal has the highest proportion of value vested in projects with either funding or planning. These results may be affected by the absence of information in the public realm on sensitive commercial matters. Nevertheless, there are grounds for concluding that deliverability could be a major impediment to the project pipeline.

4.4 Carbon Abatement

The production of renewable generation from the pipeline is expected to result in a marginal carbon abatement cost curve as detailed in Figure 4.9.

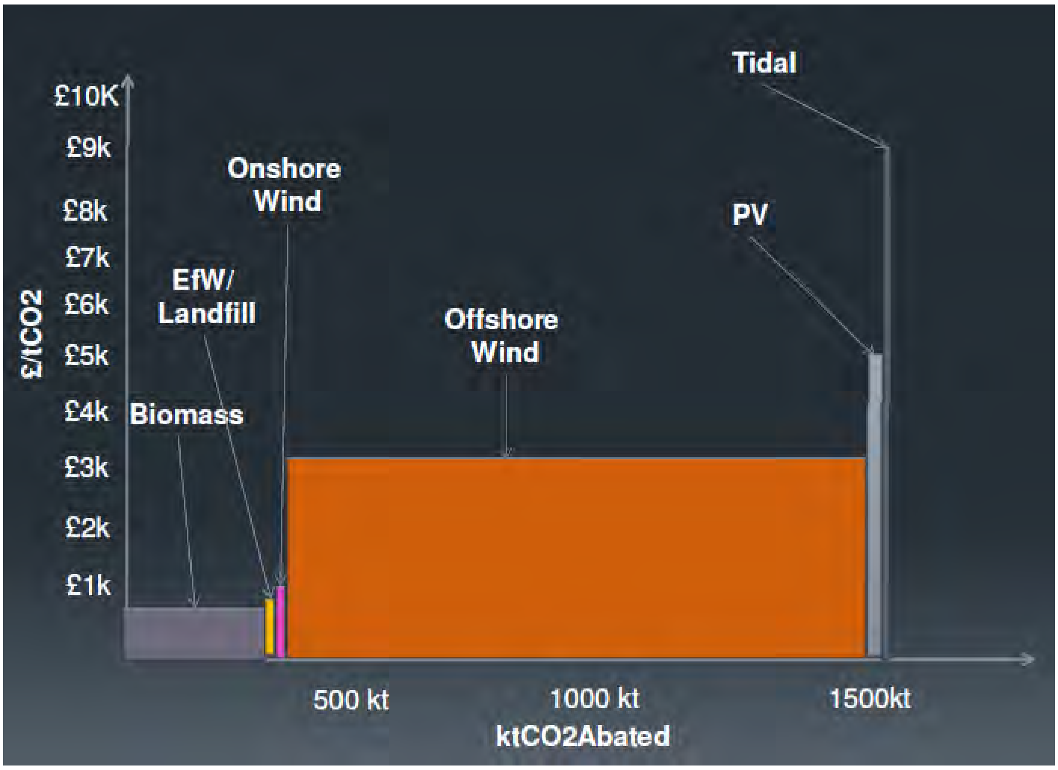


Figure 4.9: Carbon Abatement in 2020

This figure shows the scale of carbon emissions abated in 2020 subject to full implementation of the pipeline and shows the relative contribution of each technology in terms of their investment cost. The graph indicates the importance of offshore wind to the delivery of pipeline benefits.

4.5 Issues arising from analysis of the pipeline

The treatment of the Navitus Bay Project has a critical bearing on the pipeline in terms of understanding its potential. The Navitus Bay project has yet to secure consent and the underpinning joint venture between Eneco Wind UK Ltd (Eneco) and EDF Energy Renewables has yet to be concluded. Nevertheless, the project's implementation has been developed with assessment of port capacities underway, most of which are located outside the Solent (Yarmouth is being considered).

The next largest project accounts for just fewer than 2% of the total predicted energy contribution from the pipeline. The pipeline risk is illustrated by the number of large scale offshore wind arrays that stalled in 2014 following concerns over changes in policy and technical issues.

The pipeline has a number of schemes that have yet to develop in a form capable of progressing through the pipeline (these currently form the category described as 'mixed'). Some of the projects are also in support of delivering hard outputs like megawatt hours but will not deliver these outcomes.

The pipeline is strongly focused on the delivery of electrical power as opposed to heat. Whilst there are a number of projects listed under "*general distributed energy*" type proposals these are insufficiently scoped to allow any understanding as to how they might deliver heat requirements in the Solent.

Energy efficiency avoids the need to generate energy and removes the cost of maintaining an asset and supplying fuel (e.g. biomass). The Solent currently relies upon a limited range of projects (i.e. not in the pipeline) to deliver energy efficiency e.g. Green Deal and ECO. Nevertheless there are problems with the take up of Green Deal and concerns over the scale of funding available to ECO which may prompt further consideration of this important area of energy policy.

Energy efficiency in the non-domestic sector seems to lack any focus. Whilst there are limitations on possible levers to deal with this area of energy consumption from a local perspective (e.g. Fawley Oil Refinery will respond to national and international policy), there remains a long tail of smaller industrial and commercial users where opportunities may exist to help reduce energy consumption. There are some examples of local energy efficiency funds to promote non-domestic energy efficiency such as the London Energy Efficiency Fund[49].

[49] http://www.leef.co.uk/

5 Developing an Integrated Energy Assessment Model

5.1 Introduction

Investment in energy has typically been treated as a national issue. The case for investing in energy is often made at a UK level to support the action of OFGEM, who regulate energy industries or justify national programmes of intervention. This situation has been sustained by poor quality information on what is happening at a local level.

This section considers the types of monetisable non-energy benefit associated with energy projects that exist in the current pipeline or in the future. This type of approach is consistent with a recognised need to develop a broader understanding of the socio economic impacts of infrastructure projects[50] as a means of prioritising investment at a portfolio level. The absence of a competitive market in much of the energy market means these benefits will tend to be absorbed by the energy value chain long before reaching the final consumer of energy. Identifying such benefits can, nevertheless, highlight potential choices and priorities

5.2 Framework

The basic approach relies upon establishing economic value derived from the switch to a low carbon energy infrastructure. Economic value is a function of the following:

- **Energy security**: The benefit to the wider economy arising from less dependency on fossil fuels resulting in potential Gross Value Added saved;
- **Economic development:** Energy projects have employment effects like other forms of investment in a local economy. In this study analysis has focused on the total number of jobs created expressed as Full Time Equivalent (FTE) and translated into the impact on Gross Value Added (based on GVA per job);
- **Carbon savings:** Energy projects can have an effect on carbon savings and the value of the carbon saved could be translated into a benefit through the avoidance of a cost;
- **Avoided costs**: Certain projects have the potential to avoid other costs relative to a conventional alternative. For example, it may be possible to forego grid reinforcements if more localised power generation is undertaken;
- **Local tax revenue** : Different projects will have a greater potential to generate local tax revenues mainly through the Business Rate; and
- **Other environmental benefits:** Other environmental benefits relate to impacts like air quality where an energy project displaces a conventional alternative with poorer outcomes.

5.2.1 Benefit 1: Energy security.

The UK Government defines energy security having three components:

[50] http://www.mckinsey.com/insights/engineering_construction/infrastructure_productivity

- **Physical security:** avoiding involuntary physical interruptions to consumption of energy;
- **Price security:** avoiding unnecessary price spikes due to supply/demand imbalances or poor market operation; and
- **Geopolitical security:** avoiding undue reliance on specific nations so as to maintain maximum degrees of freedom in foreign policy.

Physical energy security risks arise from an excessive dependence on imported fuel from a small number of countries especially if the originating country is vulnerable to climate change, natural disaster or terrorism. Fossil fuel generators are highly dependent on international energy markets which set international commodity prices. The impacts of these higher gas prices are felt by consumers and commercial/ industrial users through higher electricity bills and higher charges for delivered gas.

Oil and gas will increasingly be imported to the UK from the Middle East, North and West Africa, and to a lesser extent central Asia together with Russia. Estimates by DECC suggest that oil prices will average $150 per barrel of oil in 2020[51]. Renewable natural resources insulate an economy against potential geo-political shocks. Currently the gas market has tended to shadow the oil price based on historical precedent and the potential for substitution. The gas price has a growing relevance as gas becomes the dominant fuel used directly for heating and in the generation of electrical power. While it is very difficult to predict the future overall level of oil and gas prices, the one reasonably certain prediction is that prices will tend to be volatile and are likely to periodically display the extreme volatility which has been experienced in recent times.

5.2.2 Benefit 2: Jobs

The deployment of energy projects are like any other investment projects and can be evaluated accordingly. Energy projects create jobs directly through employment required during construction, operation and (eventually) decommissioning. Indirectly, jobs are created through the purchase of goods and services required for the project and through the spending of workers in the wider economy. As the primary interest of this study is the Solent economy, it is appropriate to use a methodology that accounts for employment impacts. The additionality method[52] allows the calculation of likely job impacts based upon assumptions concerning the degree to which benefit will be retained within the Solent and the degree to which an energy project will simply displace something else that would employ people. The methodology has an advantage over a standard benefit cost analysis in so far as it captures job benefits rather than treating them as a financial transfer.

One of the more controversial issues concerns the capture of benefits arising from so called catalytic effects. Energy projects could act as a catalyst for growth by encouraging companies and individuals to invest in a locale where competitive energy supplies were available. District heating may, for example, encourage related investment of this type.

[51] DECC Fossil Fuel Price Projections https www.gov.uk ... 13071 decc-fossil-fuel-price-projections.pdf
[52] HCA (2014) Additional Guide, 4th Edition

5.2.3 Benefit 3 : Carbon savings

The third benefit of renewable electricity generation considered in this study is carbon savings. Savings in terms of costs of climate change can be attributed to CO_2 emissions saved resulting from the decrease in the use of fossil fuels under each scenario. The Government has provided advice on the valuation of carbon when appraising projects[53] which has been used in the calculations.

5.2.4 Benefit 4 : Avoided costs

The government's National Infrastructure Plan 2012 expects that £123 billion will be invested in energy generation with a further £53 billion in energy networks and other energy infrastructure. Based on the National Infrastructure Plan around 90% of this is supposed to be delivered by 2020. Some expert opinion suggests that National Infrastructure Plan underestimates the level of investment needed. Most of these costs will be paid by energy consumers through the bill they pay. The costs associated with the transportation of energy alone are considered to represent 23% of the final bill paid by consumers[54]. Any reduction in cost holds open the prospect of the consumer avoiding costs that would otherwise have to be paid leading to a curtailment in discretionary expenditure elsewhere in the economy.

5.2.5 Benefit 5: Local taxation benefits

Energy projects can create opportunities for local authorities to accrue additional business rates from the project itself. Energy projects can provide a source of revenue to support activity both directly and through any catalytic effects on surrounding properties. The localisation of local government finance means that the opportunity to raise additional business rates may be a significant enabler for sustained investment e.g. Tax Increment Financing of local energy projects.

5.2.6 Benefit 6: Environmental benefits

Energy projects may have a material impact on the physical environment. For example, a long term shift from petroleum based fuels to electrical traction for transport would have an effect on particulate matter and, therefore, assist air quality. Some of these benefits could be monetised as social benefits.

Benefits 4 to 6 could easily become negative especially for certain classes of project. Avoided costs could become negative in the context of renewable projects if there was a need to account for back up capacity or energy storage to manage down time. Local taxation benefits could become negative if a project were to create a basis for compensating residents for a worsening of their environmental context e.g. wind farm or shale gas projects.

[53] DECC (2009) "Carbon Valuation in UK Policy Appraisal: A Revised Approach Climate Change Economics", Department of Energy and Climate Change July 2009
[54]NAO (2013) " Infrastructure investment the impact on consumer bills"

5.3 Renewable Pipeline

The categories of benefit identified above can be applied to the project pipeline as summarised below:

Benefit Type	Description
Energy security	Based on calculating the worth of renewables based on a methodology that equates renewable deployment with economic output.
Jobs	Based on calculating net jobs using principles established in additionality assessments then converting the net figure to Gross Value Added.
Carbon savings	Based on monetising the carbon saved through the adoption of renewable generation leading to the displacement of grid based electricity.
Costs avoided	Based on monetising the flow of benefits arising from savings in infrastructure no longer needed e.g. the avoidance of transmission costs if energy is generated locally rather than transported long distance.
Local tax revenue	Based on monies paid through the business rates.
Environmental benefits	Based on the monetisation of improvements in air quality or the reduction in other pollutants.

5.3.1 Energy Security

Awerbuch and Sauter (2005)[55] estimated that a 10 percentage-point increase in the global share of wind (or other renewables) can help avoid output losses (in terms of energy security risk) of $95–$176 billion. Their findings suggest that for wind and solar this is worth $200 per kW and for geothermal and biomass $800 per kW. After adjusting for inflation and exchange rates the figures of £175/kW is used for each of the renewable energy technologies, other than off shore wind and biomass for which £700/kW is applied. This provides a conservative estimate, being at the lowest end of the range and below the average for all renewables. The results are expressed as GVA saved as result of reducing risk by increasing energy security. This analysis suggests that the societal costs associated with fuel price volatility and over reliance on fossil fuels is not being captured by the market given that renewable systems still require subsidy for delivery.

This indicator suggests that the Solent's energy security is enhanced when the electricity generating mix minimises exposure to fossil fuel price volatility. More specifically, renewable electricity generation improves energy security in the Solent electricity sector by providing:

- An indigenous, independent source of electricity;
- A supply of electricity that is not be affected by markets or political actions; and
- Energy sources that have very low cost volatility.

[55] **Awerbuch and Raphael Sauter (2005)** Exploiting the Oil-GDP Effect to Support Renewables Deployment Paper No. 129

Where renewables have fuel cost, e.g. biomass, fluctuations in this cost are likely to show poor correlation to changes in other fuel costs. This results in greater long-term certainty regarding the future cost of electricity generation from renewables, and reduces the overall cost volatility in the electricity generating sector.

5.3.2 Jobs

Renewable energy generation in the Solent will create increased local and regional employment opportunities from development during construction and the on-going operation of electricity generating capacity. The estimated number of jobs created took into account of the 'DTI Gap Report' (2004) which provides estimates of the different levels of employment potentially generated per MW by renewable technology type.

Whilst this reference is around a decade old, it still remains a frequently referenced document in the literature review and it offers a consistent basis for calculating jobs across a range of technologies. The report also differentiates between construction, installation and operation unlike some other reports providing evidence on impacts based on jobs per MW. Construction is a distinct activity which creates temporary job opportunities over the construction phase however operational related employment is typically treated as permanent employment over the life time of the asset.

The additionality method[56] has been applied to convert gross jobs to net jobs. The process of conversion takes account of factors such as assumed levels of leakage and displacement. "Leakage" takes account of the number of jobs likely to go outside the Solent (including abroad). "Displacement" covers those jobs created at the expense of other jobs in the Solent. Both these factors involve reducing job impacts attributable to the Solent. In addition, construction years are converted to full time equivalents by applying the convention that 10 construction years equate to one full time equivalent.

Construction projects tend to attract workers from a wider area than a sub region especially if it involves specialist requirements – leakage is therefore assumed to be 50%. During the operational phase of projects leakage is expected to be much lower (20%) however there is likely to be some level of displacement arising from losses in conventional energy and losses associated with reduced discretionary expenditure among consumers who will be paying towards these costs.

After allowing for leakage and displacement, the final stage involves applying a composite multiplier representing both indirect and induced effects. For the purposes of this study, a composite multiplier of 1.5 has been applied. The result of applying the methodology is the following:

Type	Net Impact (FTE)
Onshore wind	0.18
Biomass (Waste)	4.89
Biomass (Energy crops)	5.61
EFW	4.72

[56] HCA (2014) Additionality Guide 4th Edition

Type	Net Impact (FTE)
Landfill	1.00
PV	5.27
Tidal	1.78
Hydro	6.10

Table 5.1: Net Jobs Impact per MW Installed

Jobs are then converted to Gross Value Added (GVA) by matching jobs from each phase with a national GVA/ worker benchmark taken from the Annual Business Survey undertaken by the Office of National Statistics 2012.

Generation Type	GVA/MW in 2020 (£)
Onshore wind	17,650
Biomass (Waste)	844,325
Biomass (Energy crops)	969,004
EFW	815,422
Landfill	172,673
PV	911,375
Tidal	307,003
Hydro	1,055,073

Table 5.2: GVA per MW Installed

As can be observed from Table 5.2, the level of GVA arising from installed renewables varies considerably across different types of renewable technology. The highest is hydro with the lowest attributable to onshore wind. The result figure is dependent upon a range of assumptions concerning import penetration and the continuation of operational expenditures e.g. the feedstock supply chain needed to sustain biomass based systems.

5.3.3 Carbon savings

Renewable deployment will lead to the displacement of other non-renewable means of supplying energy consumption needs. This benefit has been calculated using the value of carbon suggested in guidance for project appraisal.

5.3.4 Cost avoidance

The localisation of electrical generation would, theoretically lead to a reduction in the need to transport energy over great distances. A diversity of suppliers hold open the prospect of a gradual reduction in the scope for energy generation to charge monopoly prices. The risk is that savings in an increasingly competitive generation market will be clawed back as economic rent absorbed by the distribution and transmission network operators. The costs of connecting to networks are usually met by the developer through a charge levied by the distribution network operators. The complexity and extent of the network may mean that incremental change created by a multiplicity of small generators triggers a major upstream cost in the now ageing parts of the network.

These costs might be avoided where generation meeting specific needs in the Solent are avoided or lessened (e.g. transmission costs). A current estimate would suggest that transmission costs are 0.2 pence per kWh transmitted (or £20,000 per GWh). If all pipeline capacity were connected independently of the grid then there is a reasonable expectation that transmission costs would be saved equivalent to £22.5 million. The realisation of a saving from avoiding this cost is however not guaranteed where a connection is made onto the network due to the charging structure and the need to recover upstream costs. Any cost savings from avoiding transmission costs are more likely where renewable power services a specific need. Based on the existing projects listed in the pipeline, we are not aware of any projects of this type. This particular benefit has therefore been scoped out at this stage.

Benefits related to local taxation revenue and environmental benefits are dependent upon a level of detail not available for review. As such, the pipeline has been assessed on the first three benefits.

Based on these benefits, the total economic value represented by the available renewable resources (available for electrical generation) is £3.1 billion in 2020 (based on the assumption that the pipeline could be converted to deliverable projects by that date). The pipeline delivers around £0.4 billion of value leaving a residual £2.7 billion of value locked in unutilised renewable resources. This measure of residual value discounts the contribution from Navitus Bay which is not identified as a resource.

Pipeline	Energy Security (£)	Economic Development (£)	Carbon Savings (£)	Total Economic Value (£)
Biomass	55,200,000	47,508,186	1,219,842	103,928,028
EFW/ Landfill	1,000,000	£2,932,440	£91,178	4,023,618
Onshore Wind	9,100,000	170,930	64,280	9,335,210
Offshore Wind	552,000,000	152,363,040	4,102,997	708,466,037
Tidal	11,000,000	3,036,220	83,580	14,119,800
Photovoltaic	17,640,000	57,815,735	160,837	75,616,573
Total	645,940,000	263,826,551	5,722,713	915,489,264
Without Navitus Bay	93,940,000	111,463,511	1,619,717	207,023,228

Table 5.3: Pipeline Total Economic Value

Resource	Energy Security (£)	Economic Development (£)	Carbon Savings (£)	Total Economic Value (£)
Biomass	508,041,368	612,498,803	10,971,274	1,131,511,445
EFW/ Landfill	503,230,091	108,237,077	11,940,073	623,407,241
Onshore Wind	447,056,514	45,067,560	10,726,991	502,851,065
Tidal	17,585,320	7,708,848	113,928	25,408,096
Photovoltaic	131,847,881	686,319,980	1,138,915	819,306,775
Hydro	301,142	1,814,726	13,296	2,129,164
Total	1,608,062,317	1,461,646,994	34,904,476	3,104,613,786

Table 5.4: Resource Total Economic Value

Net Resource Remaining	Energy Security (£)	Economic Development (£)	Carbon Savings (£)	Total Economic Value (£)
Biomass	452,841,368	564,990,617	9,751,432	1,027,583,417
EFW/ Landfill	502,230,091	105,304,637	11,848,895	619,383,623
Onshore Wind	437,956,514	44,896,630	10,662,711	493,515,855
Tidal	6,585,320	4,672,628	30,348	11,288,296
Photovoltaic	114,207,881	628,504,245	978,077	743,690,202
Hydro	301,142	1,814,726	13,296	2,129,164
Total	1,514,122,316	1,350,183,483	33,284,760	2,897,590,558

Table 5.5: Uncommitted Resource Total Economic Value

5.4 Energy Efficiency

Energy efficiency projects are not sufficiently detailed to review projects in same way undertaken for the current pipeline projects. It is nevertheless the case that the framework could be applied to energy efficiency investments as shown below:

Benefit Type	Description
Energy security	Based on calculating the security value of not consuming a fossil fuel that would otherwise be required.
Jobs	Based on calculating net jobs based on the value of investment in energy efficiency.
Carbon savings	Based on monetising the carbon saved through not consuming fossil fuel.
Costs avoided	Based on monetising the flow of benefits arising from not having to invest in more generation and transmission infrastructure. In addition, certain health costs may be avoided if people were able to benefit from affordable warmth.
Local tax revenue	Buildings with enhanced energy efficiency may improve property values and enhance the local tax base.
Environmental benefits	Based on the monetisation of improvements in air quality or the reduction in other pollutants.

Energy efficiency of the building stock (i.e. the building's envelop, heating, cooling and control equipment), can represent a significant source of economic advantage for the Solent.

In terms of the total economic value framework, the avoidance of energy consumption has an energy security value in so far as an economy is less vulnerable to price variations. The area would also benefit from a reduced carbon emissions allowing a carbon saving. The ability to avoid the need to generate and distribute energy creates a significant benefit is avoiding expensive infrastructure costs. A local tax benefit may arise if the market values properties that are energy efficient relative to those that are not. A higher valuation should mean an expansion of the tax base.

Demand for energy efficiency products will maintain or create employment in relevant manufacturing sectors. This employment impact tends to be difficult to quantify, as the additional demand created will tend to be small percentage of manufacturers' turnover. The installation of measures involves the installation of specific measures, such as insulation, glazing and heating systems. Additional work is involved in deliveries, and subsequently in maintenance operations. In the case of new buildings, this type of work may add to the cost and labour input at the construction stage. Depending on the type of initiative, there may be additional work in auditing, efficiency rating, marketing or advice provision.

The first two categories involve stimulating employment in manual occupations. These jobs will facilitate entry level opportunities for people seeking ways of returning to the workforce as well as for skilled person. An important indirect employment impact, which is specific to energy efficiency investments, arises from the re-spending of money saved on energy bills (if these benefits are not translated into greater consumption of energy or higher charges by suppliers).

The installation of energy efficient elements and technologies tends to be more labour intensive than manufacturing them, so that when policy is looking for areas of growth, the energy efficiency of buildings should be one of the top priorities. Job development in energy efficiency of buildings is a key field where economic growth brings with it reductions in carbon emissions and increased energy security. On average, a study of energy efficiency projects lead to the conclusion that about 19 net jobs generated per €1 million investment in energy efficiency in the buildings sector[57]. At current exchange rates, this equates to 1 job for every £43,275 spent on energy efficiency.

The response to energy efficiency programmes has been sluggish with minimal take up in both non domestic and domestic spheres. The business as usual case has been built on an extension of observable trends into 2020 and beyond. However, as time progresses, the easy to implement measures will have been done leaving hard to treat measures that are difficult to justify economically at present (this may however change as energy prices increase and technology changes). The use of scenarios represents the most fruitful way of demonstrating the potential for an effect.

Energy efficiency also brings other benefits in terms of avoiding the health costs associated with people living in cold housing. People with an existing chronic health condition or disability, the very young or older people are more at risk from the negative impacts of living in a cold home. Children living in cold homes are likely to have poorer attendance and attainment in school. The Chief Medical Officer[58] estimated the annual cost to the NHS of treating winter- related disease due to cold private housing to be £859 million and suggested that investing £1 in keeping homes warm saved the NHS 42 pence in health costs. More detailed methodologies have been developed to monetise specific conditions associated with cold housing. Analysis[59] undertaken for Sheffield City Council identified a total cost of around £19 million with a loss of almost £1million of GDP. This suggests a means of monetising key benefits and builds a case around social value.

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[57] Janssen and Staniaszek (2012) "How Many Jobs? A Survey of the Employment Effects of Investment in Energy Efficiency of Buildings", The Energy Efficiency Industrial Forum
[58] 2009 Annual Report of the Chief Medical Officer
[59] ABACUS Health (2012) *Calculating the Social Cost of Cold Homes in Sheffield*

5.4.1 Domestic energy efficiency

Government statistics on the penetration of insulation measures into the home show that 70% of homes with cavity walls have been insulated; likewise 68% of homes capable of having their lofts insulated have been insulated.

Only 3% of solid wall housing has been insulated[60]. In the Solent, there are an estimated 145,780 solid wall houses based on estimates using the association of solid wall housing with the age of construction and prevalent construction techniques associated with that time. These houses are more likely to be found in older settlements with Portsmouth followed by the Isle of Wight having the greatest number of these properties.

District	Total households	No Solid Walled	% of Stock
East Hampshire	46,068	9,275	20
Eastleigh	48,970	6,598	13
Fareham	45,121	3,732	8
Gosport	34,491	6,863	20
Havant	51,074	3,424	7
Isle of Wight	63,190	26,394	42
New Forest	76,466	12,159	16
Portsmouth	83,170	36,378	44
Southampton	95,014	21,741	23
Test Valley	46,583	7,570	16
Winchester	45,504	11,646	26
	635,651	145,780	20

Table 5.6: Solid Wall Housing by District[61]

A target based on improving energy efficiency of 25%[62] of solid wall houses by 2020 would cost around £200 million[63] resulting in around 4,600 jobs (net) with lifetime saving of around 1.5 MtCO2[64]. This intervention would save around 151 GWhs of energy, mainly gas supplied over the local transmission network, to heat otherwise "leaky" homes. A reduced need to supply may also lead to a reduced need for investment in supply infrastructure as well as security benefits that arise

[60] DECC (2013) Statistical Release Estimates of Home Insulation in Great Britain" July 2013
[61] Centre for Sustainable Energy (2006) "Identifying and Quantifying the Prevalence of Hard to Treat Homes – Final Report to the Energy Efficient Partnership for Homes (Insulation Strategy Group and Hard to Treat Sub Group)" Energy Efficiency Partnership for Homes
[62] Assuming 3% have been treated in line with the national average this would mean a net additional 22% of the stock would need to be treated by 2020 or around 32,000 homes.
[63] Based on an ECO estimate for the average cost of solid wall housing using a weighted average cost taken from the estimates of internal and external solid wall insulation measures of £6,248 using figures contained in the Impact Assessment Appendix "Calculation of the ECO targets in the Final Impact Assessment"
[64] Based on an ECO estimate for the average carbon dioxide savings over the life of the measures taken of 47 tonnes.

from a reduced reliance on what has been an imported commodity (shale gas may however change the balance between imports and domestically supplied gas although the price impacts are considered marginal).

5.4.2 Non-domestic energy efficiency

Understanding the potential opportunities for energy efficiency arising from the non-domestic sector is complicated by the lack of information available on the sector's potential locally. Nationally, non-domestic building emissions are estimated to be responsible for 18% of all UK CO2 emissions (100 $MtCO_2$); of these 49 $MtCO_2$ are attributed to "unconstrained sectors"[65] which are organisations not currently covered by existing energy efficiency policy e.g. ETS, CRC and so forth.

Nationally, organisations in the unconstrained sectors are estimated to have an annual energy use of 182 TWhs with an estimated energy efficiency potential of 28 TWhs (representing 15% of the total). These unconstrained sectors were typically regarded as the prime target for Non Domestic Green Deal.

The unconstrained sector is estimated to account for 24% of all energy consumption by industrial and commercial sectors within the UK when applied to the Solent baseline that would equate to 2,615.96 GWhs in 2011. Estimates suggested that around 15%[66] of this total could be saved using economically viable energy efficiency measures which would equate to 392.39 GWhs.

The realisation of this saving depends on the actions and motivations of the unconstrained sector businesses which are predominantly small and medium sized enterprises (employing less than 250 employees) which are likely to fall below the thresholds set for mandatory participation in the Emissions Trading Systems and CRC Energy Efficiency Scheme (formerly the Carbon Reduction Commitment). The Solent's profile of these businesses relative to the UK is shown below

Employment Sizeband	Solent[67]	%	United Kingdom	%
Micro (0 to 9)	51,485	82.2	2,170,080	82.7
Small (10 to 49)	9,065	14.5	367,055	14.0
Medium-sized (50 to 249)	1,835	2.9	76,635	2.9
Large (250+)	260	0.4	11,720	0.4

Table 5.7: Size Distribution of Local Units[68]

Table 5.7 shows that the distribution of size units between the Solent and the rest of the UK is broadly similar with slightly fewer micro enterprise local units but more "small" units compared to the UK as a whole (but under a percentage point difference). Overall, the structure is very similar to the UK as a whole.

Given the similarity in size structure, it may be reasonable to equate the 24% of the Solent's current industrial and commercial energy consumption corresponds with the 62,385 local units considered SMEs. The remaining 76% of emissions

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65 Databuild (2010) "Unconstrained sector research" DECC, June 2010
66 Arup calculation based on data contained in
67 Based on Solent LEP definition in NOMIS
68 Source: NOMIS accessed 2014

would be attributable to large local units employing in excess of 250 employees (e.g. Fawley Oil Refinery, Local Authorities and the NHS).

Data compatibility problems prevent the effective alignment of local units and savings with any degree of accuracy. Using scenario building techniques, it is possible to build a picture of what level of investment might be associated with different penetration rates into the Solent SME community[69] using rates taken from a national study developed in advance of the Green Deal launch. Table 5.8 shows differing levels of penetration and the number of local units that would be affected by employment size.

Employment Sizeband	Solent	5% Penetration Rate	7.5% Penetration Rate	10% Penetration Rate
Micro (0 to 9)	51,485	2,574	3,861	5,149
Small (10 to 49)	9,065	453	680	907
Medium-sized (50 to 249)	1,835	92	138	184

Table 5.8: Scenario for penetration rates assumed in relation to non-domestic energy efficiency

Table 5.9 applies these assumptions based on expenditure levels on packages of energy efficiency. The results are shown below:

Employment Size band	5% Penetration Rate	7.5% Penetration Rate	10% Penetration Rate
Micro (0 to 9)	£26M	£97M	£154M
Small (10 to 49)	£5M	£17M	£27M
Medium-sized (50 to 249)	£1M	£3M	£6M
Total Investment Package	£31M	£117M	£187M
Job Potential	721	2,703	4,325

Table 5.9: Energy efficiency packages with associated net job creation

Note: Assumes average cost per package for micro enterprises is £10,000; average cost per package for small enterprises is £25,000; average cost per medium sized enterprise is £30,000.

This analysis suggests that job impacts will range from around 720 to 4,325 depending on assumptions concerning package expenditure and level of penetration. The latter is particularly open to influence through the provision of advice and promotional effort.

In retrospect, it is commonly understood that the non-domestic Green Deal has failed to deliver any significant uptake of energy efficiency in the Solent or anywhere else in the UK. However it might be possible for the Solent to target a higher level of penetration based on either a re-launched non domestic Green Deal or another form of intervention targeting the non-domestic sector.

A complicating factor is that 43% of all SMEs use domestic premises[70] as the location for their business; as such there is a business gain from working in the

[69] Ernst Young (2011) "Making energy efficiency your business Understanding the potential of the non-domestic Green Deal", 2011
[70] Databuild (2010) "Unconstrained sector research" DECC, June 2010

residential sector on energy efficiency. In this context, almost all manufacturing and retail sites were in business premises, whilst most construction firms operated from an individual's home. Of the SMEs in rented premises, the average length of a new lease has been estimated as less than six years[71] reducing the pay back periods that a tenant would normally look to achieve on energy efficiency measures.

5.5 Fossil Fuel Based Energy Projects

The Solent has a longstanding involvement with the fossil fuel energy sector which is likely to extend into the foreseeable future. The Fawley refinery is the most visible part of the involvement as a processor of petroleum fuels for onward shipment into the UK via pipeline connections. UK refinery capacity will need to adapt over time to new regulatory pressures and this is likely to require restructuring and new investment.

In addition, the resurgent interest in unconventional gas and oil is likely to create opportunities in the Hampshire Basin where geological formations are likely to contain exploitable reserves of shale gas and oil. The framework can be applied to this type of project as described below:

Benefit Type	Description
Energy security	As a fossil fuel project encourages the use of fossil fuels it is not considered to provide a basis for claiming an energy security benefit. The price for any locally extracted oil and gas will be based on the international market price and there is no basis for assuming a UK contribution will lessen volatility.
Jobs	The extraction process is likely to generate jobs especially during the drilling process. These jobs are likely to be extremely mobile and the Solent share of any resulting workforce will depend on the skills available.
Carbon savings	As a fossil fuel project, carbon emissions would continue as such it would be inappropriate to assume a value for carbon saved.
Costs avoided	The continued extraction of fossil fuels will tend to reinforce the use of existing infrastructure. On this basis it is unlikely that there would be any significant costs avoided compared to current system technology.
Local tax revenue	A community benefits regime has been announced concerning Shale Gas projects which may create a long term revenue stream capable of benefiting local communities.
Environmental benefits	Reservations have been raised over the environmental impact of Shale Gas exploitation

It should be noted that the Solent is already close to a long established on shore oil field at Wytch Farm. Wytch Farm is Europe's largest known onshore oilfield on the southern shores of Poole Harbour, Furzey Island, Wareham and at Kimmeridge Bay. It is currently producing 16 000 barrels of oil equivalent per

[71] Ernst Young (2011) "Making energy efficiency your business Understanding the potential of the non-domestic Green Deal"

day[72] (comprising crude oil, liquid petroleum gas and gas). The site employs 100 staff and 250 contractors. Whilst Wytch Farm is out of area, its status is indicative of favourable geological structures for fossil fuels within the wider sub region. Hampshire County Council states that the exploration of conventional oil and gas is taking place at three locations in the County currently. These are South Wonston, near Winchester, Humbly Grove near Alton and Horndean. In April 2013, Hampshire County Council also stated that there were no shale gas extractions or 'fracking' activities taking place in Hampshire. Nevertheless, areas of interest for shale gas extraction do include Hampshire and the Isle of Wight[73].

Projects of this type will not contribute to sustainable energy security. Shale gas would become part of the energy mix alongside imported gas supplies subject to the wholesale energy supply market price which is not expected to change significantly (modelling work suggests that the effect may cause a 2% reduction in the market price). As a fossil fuel project, there would be no direct carbon savings although there would be a change in the broader carbon intensity of grid supplied energy if, say, shale gas displaced coal. The likelihood of avoiding costs seems remote as the gas extracted is likely to be distributed and combusted using the same technology supporting the Solent today. The issue of environmental benefits is probably a negative representing any monetisable costs associated with the transport, storage and waste processing involved with extraction. However, these costs are more likely to impact areas outside the Solent in rural parts of Hampshire.

Benefits related to jobs are more likely to have relevance to the Solent. The evidence on shale gas employment impacts is still forming. The Economic Affairs Committee of the House of Lords (2014) has reported that the shale gas industry has estimated that exploitation could be worth £33 billion and create 64,000 jobs[74]. A report by AMEC for the Department for Energy and Climate Change has however reported a lower estimate that at the peak the latest round of onshore oil and gas licensing would generate 16,000–32,000 full-time equivalent (FTE) positions, including direct, indirect and induced jobs[75].

A recent Ernst Young report has identified the supply chain requirements[76] needed for the fracking industry based on an assumed 4,000 wells across the UK by 2032:

- Specialised equipment and skills for hydraulic fracturing totalling £17bn which includes equipment such as pumps, trucks and blenders, which today are supplied to the industry by third parties and only partially from inside the UK. This sector provides a massive opportunity for UK-based oilfield service and manufacturing companies to get involved;
- A £4.1bn waste, storage and transportation requirement with respect to localised and centralised services;

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[72] http://www.perenco-uk.com/about-us/wytch-farm.html
[73] http://www.bbc.co.uk/news/business-15248683
[74] http://www.theguardian.com/environment/2014/apr/24/fracking-generate-investment-jobs-industry-report-uk?INTCMP=ILCNETTXT3487
[75]The House of Lords Economic Affairs Committee (2014) " The Economic Impact on UK Energy Policy of Shale Gas and Oil" published th May 2014
[76] Ernst Young (2014) "Getting ready for UK shale gas Supply chain and skills requirements and opportunities" for the UK onshore oil and gas industry April 2014 (part funded by BIS)

- A £2.3bn steel requirement in the UK – the industry will require some 12,600km of steel casing of specific diameter and quality; and
- The potential for a new £1.6bn rig manufacturing industry. The industry will need up to 50 landward rigs at peak drilling activity and a number of work-over rigs.

An individual multi-well shale gas pad could create a peak of around 400 direct, indirect and induced jobs during the initial construction and drilling stage; around 50 total jobs per year would be created during the remainder of the pad's operational life[77]. Many of these jobs are involved with mobile drilling operations and transportation services as such there are probably a greater scope for workers from outside the area to benefit.

Currently, there are no such projects in the pipeline. However, were 10 multi pad wells to be drilled somewhere in the Hampshire area that would be the equivalent of 4,000 construction years of employment (or 400 FTEs) arising through construction and drilling (based on applying the rule that 10 construction years of employment equates to 1 FTE) plus a further 500 jobs over a well's operational life.

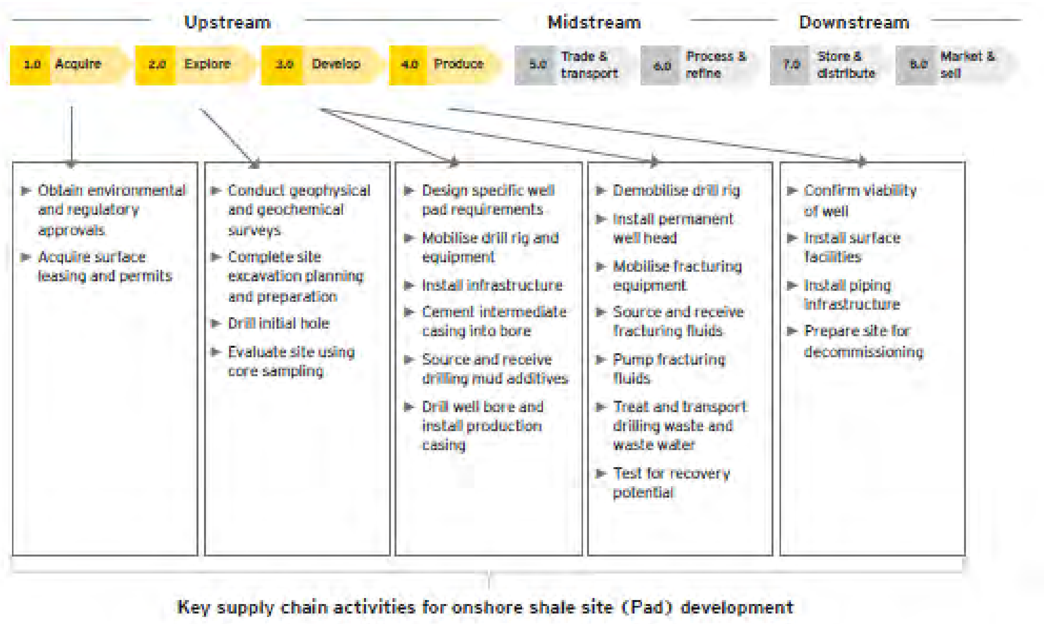

Figure 5.1: Supply Chain Activities associated with Fracking

Local tax revenues are likely to benefit from shale gas exploitation. The industry has committed to provide community benefits at the exploration/appraisal stage of £100,000 per well site where hydraulic fracturing takes place. In addition, it will provide 1% of revenues at the production stage, split approximately 2:1 between the local community and county level.

[77] Infrastructure for Business, Getting Shale Gas Working', Institute of Directors, 2013 as quoted in the SELECT COMMITTEE ON ECONOMIC AFFAIRS - The Economic Impact on UK Energy Policy of Shale Gas and Oil Oral and Written Evidence

6 Gap Analysis

6.1 Introduction

The appropriateness of the pipeline projects needs to be set in the context of the wider strategic objectives not only of this strategy but also other related strategies. The link between energy and economic development is critical. Given this the Solent LEP's strategic framework is a key consideration (see Appendix D).

Energy Strategy Objective	Evidence of coverage in project pipeline
Improving Energy Efficiency	A number of projects have been identified concerning energy efficiency. However, these are at risk as a result of changes in government priorities; In addition there are no specific measures aimed at the non- domestic sector. It is also not possible to ascertain the level of contribution they will make to realising the reduction in energy consumption forecast.
Increasing the Use of Renewable Energy Resources	The pipeline contains a range of renewable power generation schemes but detail on renewable heat is largely absent.
Maximising the Uptake of Business Opportunities Locally	The LEP's Strategic Economic Plan has ambitious targets for growing the Solent's economy especially in relation to the sectors where the sub region has a competitive edge. The City Deal and PUSH strategies underline the importance of growing these industries. Projects are needed that help capture the maximum job and GVA benefits arising from energy investment. The risk is that the jobs leak outside the Solent unless measures are taken to create associated infrastructure and develop skills; risk is also attached to full exploitation of local centres of excellence such as the University of Southampton.
Ensuring Focused & Integrated Delivery & Implementation	Mechanisms to manage the delivery of the pipeline appear to be absent. Capacity will be needed to progress projects and to generate new ones in gap areas.

Table 6.1: Gap Assessment against Objectives

6.2 Objective 1: Gaps in Relation to Energy Efficiency

The scope of work for this commission did not allow for any detailed assessment of energy efficiency. Energy efficiency is nevertheless a major contributor to any energy strategy and the baseline assumes a continuation in energy efficiency that is already observable over the period 2005 to 2011.

	Electricity (GWhs)	Gas (GWhs)	Petroleum Fuels (GWhs)
2011	5,126	8,231	11,694
2020	4,539	6,351	9,804
% Change	-11.45%	-22.84%	-16.16%

Table 6.2: Assumptions concerning energy efficiency trends on main fuels

As detailed in the baseline section there are a number of risks that might mean observable trends do not continue.

The realisation of these energy efficiency assumptions will depend upon how consumers react to changes in the cost of energy. As easy to implement measures become exhausted there is a risk that energy efficiency savings are not realised. However, the cost push pressures may mean that the business case for currently uneconomic efficiency measures improves.

6.2.1 Domestic Energy Efficiency

In terms of home energy efficiency measures, government data suggests that key energy efficiency interventions are capable of producing the annual savings detailed in Table 6.3.

Retrofit Measure	Average Saving from Energy Efficiency Measure in Residential Properties per annum (kWhs p.a.)
Cavity Wall Insulation	-1,600
Replacement Boiler	-1,800
Loft Insulation	-400
Solid Wall Insulation[78]	-2,400

Table 6.3: Energy Efficiency Savings (Source: NEEDS data, 2010)

The Green Deal and the Energy Company Obligation (ECO) are the major schemes in place to deliver energy efficiency measures across the domestic stock in the Solent. An analysis of the underpinning assumptions behind the ECO programme are provided below.

Reports on the take up of the Green Deal have shown slow progress[79] nationally. In the Solent, it is reported that no measures were installed through Green Deal between the scheme's start in the Solent in June 2013 to the end of February 2014. From over 800 enquiries received, no energy efficiency measures had been installed through the Green Deal[80].

A full national evaluation of ECO is currently underway[81]. Despite problems with the national mechanisms to implement energy efficiency in the home, the Solent has recently secured an £8.3 million package to review the impact of energy efficiency and its impact on the grid (see below). The results from SAVE are expected to inform policy development across all District Network Operators.

[78] This figure is lower than the figure used in the ECO programme for solid wall insulation.
[79] Report take up, for example, 1,173 households had committed to taking part by the end of October 2013, compared with the 10,000 projected by December 2013 (as reported by the BBC http://www.bbc.co.uk/news/uk-politics-24998830 [accessed January 2013])
[80] As reported by the Solent's Green Deal Project Manager (private correspondence, April 2014)
[81] This evaluation is being undertaken by the Centre for Sustainable Energy

SOLENT ACHIEVING VALUE FROM EFFICIENCY (SAVE)

Southern Electric Power Distribution's (SEPD) 'Solent Achieving Value from Efficiency' (SAVE) project has recently been successful in securing £8.3 million of funding from Ofgem's Low Carbon Network Fund. The Solent-based project, led by SEPD and with partners at the University of Southampton, DNV GL and Wireless Maingate will focus on local domestic customers, who will be offered new energy efficiency technology to trial in their homes and incentives for making long-term changes to their energy usage behaviour. As well as potentially lowering domestic customers' bills, the project is also investigating how reduced energy usage in the home can cut the amount of money that is required for electric network upgrades.

6.2.2 Non-domestic energy efficiency

Around 76% of non-domestic energy consumption is covered by existing policies that encourage a reduction of fossil fuel based energy consumption. Key installations like the Fawley Oil Refinery are registered under the EU Emissions Trading System (EU ETS). Large organisations like local authorities are covered by the CRC Energy Efficiency Scheme (formerly known as the Carbon Reduction Commitment) which applies to organisations that have half-hourly metered electricity consumption greater than 6,000 MWh per year. In addition, a climate change levy applies to energy intensive businesses. These mechanisms are mandatory for the companies and sectors concerned as such there is an incentive to either undertake measures that reduce energy consumption or switch to renewable sources. Despite the existence of these measures, many organisations remain outside any mechanism and are essentially unregulated. Unconstrained organisations tend to be small and medium sized enterprises which comprise of over 99% of Solent businesses.

Rising energy costs are cited as one of the biggest barriers of growth by members of the Federation of Small Businesses. Despite the government's non domestic Green Deal being officially open for business, there has been a low level of publicity attached to it and a recent report highlighted a low level of business awareness (11% of surveyed businesses were aware of the scheme). The same report concluded that SMEs are discouraged from investing in energy efficiency due to a lack of available upfront capital[82]. The Solent Green Deal does not promote the non-domestic scheme.

6.3 Objective 2: Gaps in Relation to Renewables

The identification of gaps in relation to this objective must follow from a view on how different technologies, covering generation and distribution can be configured to deliver reliable energy supplies.

Figure 6.1 illustrates how different technologies fit together and how renewable generation is enabled by grid connectivity, energy storage, biomass feedstock and processing:

[82] 'Building Efficiency: Reducing Energy Demand in the Commercial Sector' as referenced in http://www.greenwisebusiness.co.uk/news/report-calls-for-relaunch-of-green-deal-for-nondomestic-market-4179.aspx

- **Uncommitted renewable resources**: the majority of the technically available renewable energy resource has yet to be captured as projects in the pipeline[83]. This leaves a large unrealised potential;
- **Grid connectivity**: renewable generation projects need to be able to connect to the transmission/ distribution network and grid capacity is often cited as the key factor in stalled projects;
- **Grid resilience**: once connected renewable generation needs to work continuously to be effective. Part of this is dependent upon the provider but the grid also needs to be secure; and
- **Heat capture:** where ever possible waste heat should be captured from the generation of electricity and used to supply heat services.

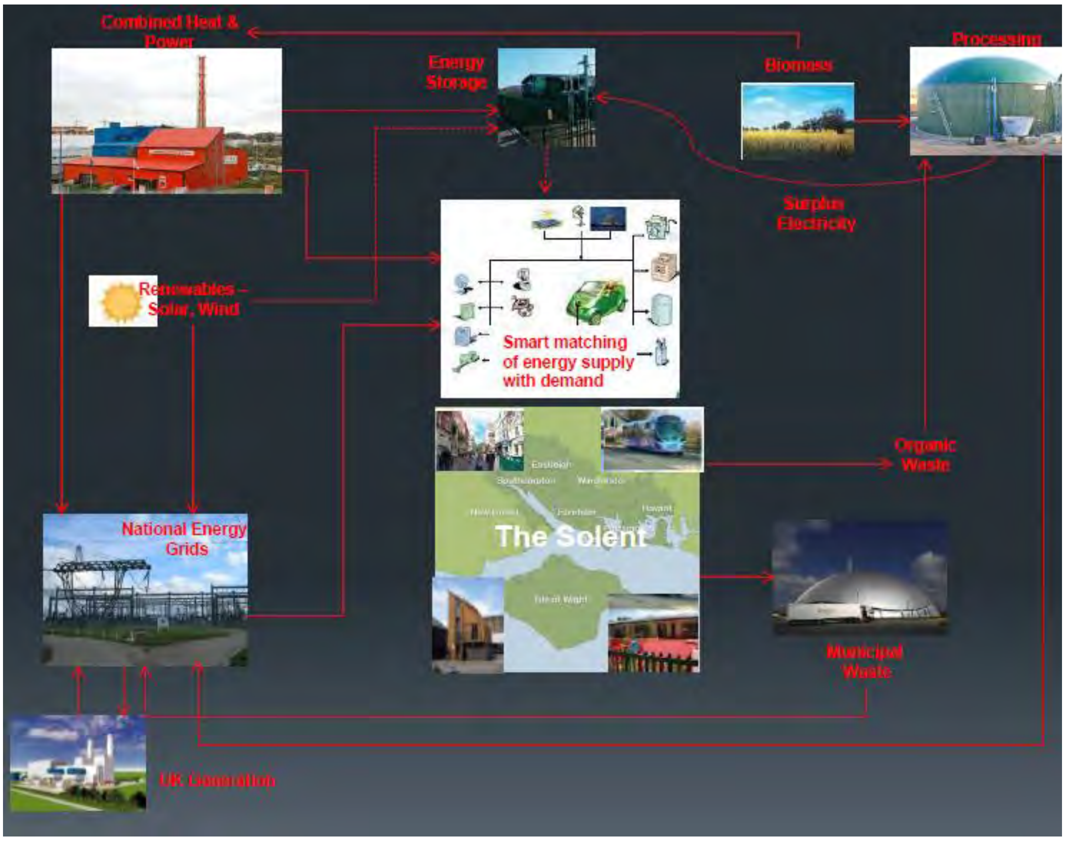

Figure 6.1: Solent Energy System

6.3.1 Renewable resource development

The pipeline (if fully exploited) will only lead to the development of 4.5%[84] of the installed capacity potential identifiable for electrical energy (see baseline).

[83] As set out in set out in 6.3.1, only 4.5% of the technically available resource identified previously would be captured if all of the projects in the pipeline were developed.
[84] Offshore wind was not included in the original assessment of Solent renewable resources.

Type of Generation	Remaining potential installed capacity (MWe)
Biomass	93.3
EFW/ Landfill	2,163.5
Onshore Wind	2,535
Tidal	Up to 217
Photovoltaic	260.1
Hydro	1.7
Total	**5,270.6**

Table 6.2: Remaining Renewable Resource Potential

Whilst the full resource potential may not be achievable due to competing constraints (e.g. viability, environmental/ planning constraints, etc.), scope exists to bring forward new projects to use up the available resource.

6.3.2 Grid connectivity

A key issue for the supply of new capacity locally is the ability of the distribution network operator to absorb new capacity.

There is currently about 990 MW of embedded generation connected to the distribution system at various voltages across the whole Southern area served by SSE.

The addition of generation to the network impacts the system fault levels, which in turn can lead to network reinforcement works being necessary to support the connection. The power flows experienced by the modified network, if not accurately analysed, monitored and controlled, could cause system overload, over and under voltage, system frequency variations and reduce system power factors; all of these are undesirable on the distribution network. As such, SSE aim to control the addition of new generation, through the provision of connection agreements with developers. These agreements are often sought prior to developers securing planning permission and can remain unfulfilled for some time. This can be perceived as 'blocking' the system by other developers.

Connection of well sited and adaptable generation could provide network support and reduce network losses.

In its Long Term Development Statement, SSE state[85] that there are no constraint areas for accepting new generation (or indeed demand load). However:

- Background fault levels at most voltages are generally high. This is due to a higher fault in-feed from the 400 kV transmission system and the lower impedance of the distribution system;

[85] Long Term Development Statement for Southern Electric Power Distribution plc's Electricity Distribution System (May 2013)

- Approximately 450 MW is concentrated around the areas supplied by Fawley and Nursling 400/132kV substations resulting in high fault levels. Therefore additional reinforcements may be required for embedded generation connection in these areas;
- SSE has confirmed in writing to Eastleigh BC that there can be no new grid connections for renewable energy schemes above domestic scale until the end of 2016 at the earliest[86]; and
- It has been reported that a solar developer is not pursuing further opportunities on the Isle of Wight, as connection to the grid is a constraint[87].

Applications for connection of generation are evaluated on an individual basis.

Below we set out examples of two districts within the Solent area, the Isle of Wight and Southampton, the grid resilience issues they are facing and compensation measures they are taking.

6.3.2.1 Isle of Wight

The Isle of Wight has several initiatives underway to improve the network capability on the island.

The key issues for the island relate to the reliance on the three high voltage interconnectors running between the mainland and the island, the current capacity of the network and the abundance of generators seeking connections to this network. This creates a scenario involving a myriad of factors, including the supply and demand challenge, balancing of the network, constraints, and security of supply.

There is a sizeable network on the island, however with the range of tidal, anaerobic digestion and solar power generators seeking to connect to the network, suddenly the once-ample capacity has been drastically reduced and there are now challenges to accept these new connections, which (SSE) is aware of and are seeking to address. Cowes power station has a legacy contract with National Grid due to its ability to rapidly respond to requests for power when there is an imbalance between supply and demand that needs resolving extremely quickly and reliably. This has a knock-on effect with the network planners needing to allow for this export capacity in any calculations they make for connecting new generators on the island. This requires a level of flexibility from all parties, which unfortunately does not suit developers of generation plants as their business cases are built on optimal figures and optimal operating conditions. These often do not factor in curtailment of generation and this causes issues when there is no compensation involved, such as that paid to curtail wind farms. There is also a need for additional investment from developers to allow for intertrips.

Attention has turned to the interconnectors, and how changing these would ease some of the challenges being faced on the island. SSE have recently begun a £13m project to replace one of these cables. Of the three cables, two are buried beneath the seabed and the third is laid on top. The project will replace this third cable, which over time has become damaged by boat anchors and movement caused by marine action. Rather than replacing with a cable laid on top of the

[86] As reported by Eastleigh Borough Council in private correspondence, October 2014
[87] Reported in private correspondence with Jim Fawley, Isle of Wight Council

seabed again, it will be buried under the seabed, which means that when the project is completed the island's electricity supplies will be securely located out of harm's way. This investment, which has gone through a long review process in the industry before approval, should, if it is maintained in the long-term, increase the network resilience and assist with the security of supply for the island.

The review and negotiation process for large capital projects such as this take several years before coming to fruition, and so future improvements on this scale are likely to be longer term measures. As such, several projects on the Isle of Wight are being undertaken by SSE which look at improving the utilisation of network, drawing upon innovative technologies proven elsewhere on UK networks and in other parts of the world. These are technologies and processes that can be deployed much quicker than a measure on the scale of a subsea interconnector, and involve elements such as attempting to operate a far more dynamic network that will allow more embedded generation to connect whilst continuing to maintain a secure supply to the already-connected customers. It has yet to be proven whether these smart technologies can replace the need for a sub-sea cable, or just delay the requirement.

6.3.2.2 Southampton

The number and range of faults have been particularly high for Southampton- three on the 11kV circuit, two 33kV faults and one 132kV fault, all within the last six months.

The 33kV fault is believed to have been caused by a faulty piece of equipment at the primary substation, which then cascaded down the network. This has been identified and repaired, which should prevent future 33kV faults being caused by that particular item.

The 11kV faults are more complex, having been caused by cable faults on different sections of cable from the same feeder. This creates a situation whereby there is an assessment that has to be made with regards to when to act on replacing a whole cable, based upon issues which include: fault levels, impact, local disruption, and cost. If the faults were on the same section of cable a decision could be made quickly to replace that section of cable, however with this particular part of the network it would involve replacing the entire feeder in central Southampton thus negotiations are required due to the possible impacts to the city centre. If the situation deteriorates further, then it is likely that talks will begin regarding a scheme to address the issue.

6.3.3 Energy storage

The Solent has ambitious plans for connecting greater quantities of renewables to the network. Renewable output is intermittent and traditionally the Solent would rely on accessing back up capacity through its grid connectivity e.g. usually gas fired capacity. Storage in this context means batteries, liquid air, hydrogen and pumped hydro. An alternative strategy would be to use local energy storage appropriate to a Solent context to balance out fluctuations in demand alongside smart energy management. A report by the Energy Storage Network to a

Parliamentary special interest group on renewables and sustainable energy[88] has suggested the need for a national target by 2020 of securing a 3% electrical storage capacity relative to total electrical demand (equivalent to 1,000 windmills). Energy storage is however currently a high cost option and the business case for storage is difficult to make.

6.3.4 Network resilience

The current pipeline of projects relies upon the grid (both transmission and distribution) continuing to deliver power from newly connected production sites. The current pipeline does not include projects aimed at enhancing resilience in the face of climate change which is the point at which strategic policies concerned with climate change need to account for energy. Figure 6.2 shows the types of risk that grid systems are potentially exposed to.

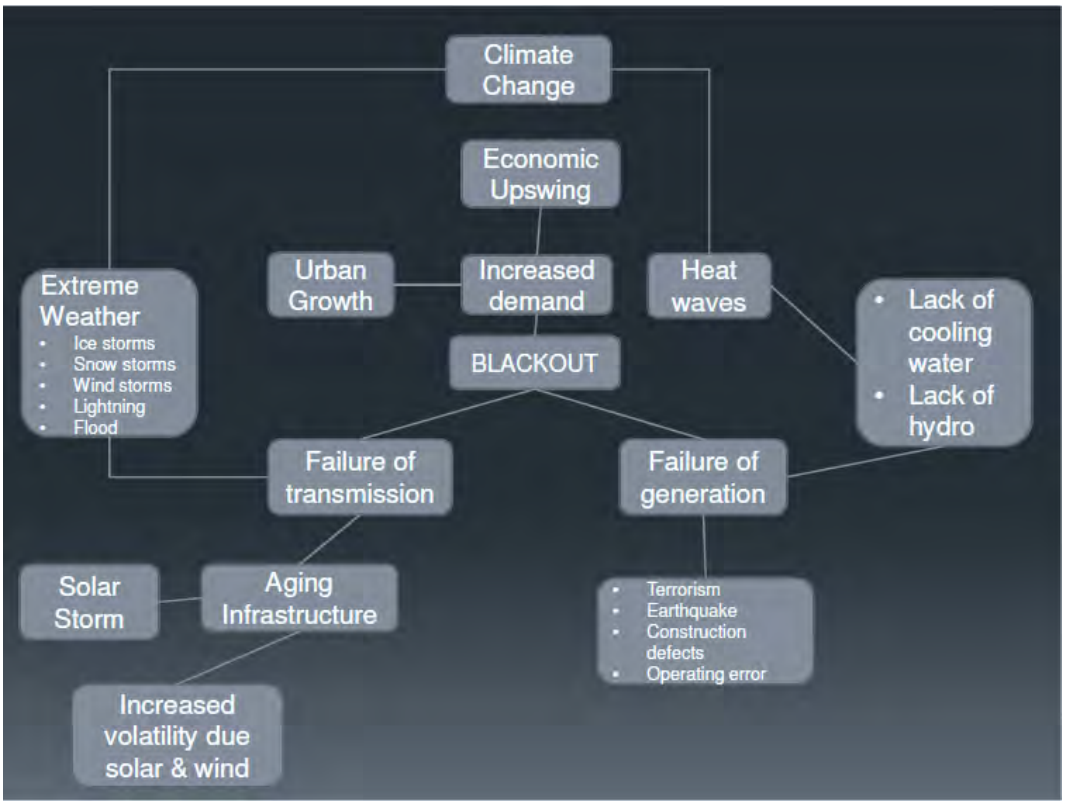

Figure 6.2: Grid Resilience[89]

Table 6.5 sets out the potential impacts on the electricity infrastructure of natural hazards, as determined by the 2010 National Risk Register.

[88] The Electricity Storage Network (2014) "Development of Electrical Storage in the National Interest"
[89] Adapted from "Potential causes of power blackouts, Cr Forum, 2011, "Power Blackout Risks Risk Management Options "Emerging Risk Initiative Position Paper, November 9" http://www.agcs.allianz.com/assets/PDFs/Special%20and%20stand-alone%20aricles/Power_Blackout_Risks.pdf as published in Goldin and Mariathasan (2014) "The Butterfly Defect" Princeton

Scenario	Reasonable worst case scenario	Other related effects	Potential impacts on infrastructure
Inland flooding	A single massive inland event or multiple concurrent regional events following a sustained period of heavy rainfall extending over two weeks (perhaps combined with snow melt or intense summer rainfall leading to widespread surface water flooding). The event would include major fluvial flooding affecting a large, single urban area. This is broadly regarded as a 0.5% annual probability flood event.	Storms and gales Snow Land Instability (including offshore and submarine) Heavy rainfall	Loss of power supplies Lack of staff availability Impaired site access Increased demand for emergency power and water supplies
Coastal flooding	Major sea surge, tides, gale force winds and potentially heavy rainfall. Many coastal regions and tidal reaches of rivers affected. Excessive tide levels and many coastal and/or estuary defences overtopped or failing (breaches). Drains „back-up‟. Inundation from breaches in defence systems would be rapid and dynamic with minimal warning and no time to evacuate. Inundation from over-topping of defences would allow as little as 1 hour to evacuate.		
Excessive cold combined with snow & ice	Snow falling and lying over most of the area for at least one week and after an initial fall of snow there is further snow fall on and off for at least 7 days. Most lowland areas experience some falls in excess of 10cm, a depth of snow in excess of 30cm and a period of at least 7 consecutive days with daily mean temperature below -3ºC.		
Windstorm: storms & gales	Storm force winds affecting most of a region for at least 6 hours. Mean speeds in excess of 70mph with gusts in excess of 85mph. Short term disruption to infrastructure including power, transport networks, homes and businesses.	Flooding Land instability Heavy rainfall Wildfire	Loss of power supplies
Prolonged periods of hot & dry weather	**Hot** Daily maximum temperatures in excess of 32ºC and minimum temperatures in excess of 15ºC over most of the region for at least 5 consecutive days. **Dry** Periodic water supply interruptions for up to 10 months.	Thunderstorms. Heavy rainfall. Flash Flooding. Drought. Dust. Haze. Smog. Land instability Wildfire	Loss of power supplies Increased demand for emergency power

Scenario	Reasonable worst case scenario	Other related effects	Potential impacts on infrastructure
	Emergency Drought Orders in place authorising rota cuts in supply according to needs of priority users as directed by the Secretary of State.		
Severe space weather	Resulting from solar eruptions causing rapidly varying geomagnetic fields on earth.	None.	Loss of power supplies

Table 6.5: Potential impacts on the electricity infrastructure of natural hazards, as determined by the 2010 National Risk Register

In addition to the natural hazards listed in the table above, metal theft also presents a threat. Like other parts of the community, the electricity industry has been plagued recently by metal theft. At its height, incidents of metal theft from electrical substations and networks were running at an average of 21 per day. Energy companies were spending more than £12m on additional security measures and the damage was costing in excess of £60m per year[90].

6.3.5 Resilience of electricity distribution

District Network Operators (DNOs) have statutory duties to develop and maintain an efficient, co-ordinated and economical system of electricity distribution, and facilitate competition in generation and supply.

The Distribution Licence contains a condition relating to network design and performance reporting. The distribution network must be designed to certain minimum standards specified in the Engineering Recommendation P2/5, but higher standards of security of supply are applied when it is considered appropriate. These are complemented by the Electricity Supply and Continuity Regulations, made by the Secretary of State, which place duty on DNOs to ensure a continuous supply of electricity except in exceptional circumstances.

The DNOs are responsible for ensuring that customers have a reliable electricity supply and restoring supply promptly in the event of interruption. The Interruptions Incentive Scheme (IIS) is the main reliability and availability mechanism in the current price control. It uses two key performance metrics to assess reliability and availability across the 14 DNOs: the number of customer interruptions per 100 customers (CI) and the duration of these interruptions to supply per customer known as customer minutes lost (CML) each year where an interruption of supply to the customer lasts three minutes or longer. Table 6.6 summarises the metrics for the DNO for the Solent area, Scottish and Southern Energy Power Distribution (SSEPD).

Metric	2010-2011 Target	2010-2011 Performance	Comment	2012/13, 2013/14, 2014/15 Targets
Customer	73.8	63.6	Performance	72.6, 72.0, 71.4

[90] Electricity Industry Review 17 (April 2013): Electrica Services Limited

Interruptions per 100 customers (CI)			better than Target	(i.e. increasing resilience targets)
Customer Minutes Lost (CML)	69.1	64.1	Performance better than Target	67.5, 66.6, 65.8 (i.e. increasing resilience targets)

Table 6.6: Interruptions Incentive Scheme (IIS) metrics for SSE

The electricity transmission and distribution networks in the UK are effective in the ability to control and manage the supply of electricity to prevent disruption. Spare capacity in the electricity distribution network and the ability to re-route supplies significantly increases the resilience.

At network voltages above 11kV, there is commonly resilience in the network in the form of numerous connections to the National Grid Transmission System operating in parallel at part load. In event of faults in a connection, automatic switches respond automatically allowing the full electricity load to be re-routed along connection(s) without faults.

At network voltages of 11kV and below, these parallel connections do not commonly exist (except in some emergency supply cases) and the switches are operated manually. This is aligned with current regulatory obligations and there are currently no incentives for DNOs to increase resilience at 11kV and below.

6.3.6 Heat capture

Any Energy from Waste and Biomass project offers the opportunity to combine generation with heat capture and distribution.

The current pipeline projects for district heating network in the Solent include an extension of the existing Southampton network[91] to reach further from the centre and connect many more public, commercial and domestic buildings. Southampton also plans to create a new separate network in Thornhill[92], a suburb of Southampton, one of the council's largest housing areas. A CHP district heating scheme is being considered for Winchester and an application has been made to the Heat Network Delivery Unit (HNDU) for funding a full business case for the scheme. Welborne, a new community currently being planned in Fareham, has an energy strategy which plans to have a district heating network or CHP from a low carbon power source[93]. Eastleigh has plans for a town centre energy network, feasibility studies have been completed and the detailed designs are to be undertaken. Eastleigh has also submitted a HNDU application for funding to support the completion of a feasibility study at the Ageas Bowl in West End.

Decentralised energy projects, such as district heating, can lead to carbon emission reductions, support economic development and inward investment, and improve energy security. There are also various support mechanisms available including the Renewable Heat Incentive, Renewable Obligation Certificates and Enhanced Capital Allowances for projects that meet the good quality CHP criteria

[91] Southampton District Energy Plan (http://www.southampton.gov.uk/s-environment/energy/Geothermal/default.aspx)
[92]http://www.southampton.gov.uk/moderngov/(S(ky1vagnhsg3f5jaszyqq1f45))/ieDecisionDetails.aspx?ID=671
[93] http://www.fareham.gov.uk/PDF/planning/new_community/complete_exhibition_boards.pdf

and/or offer renewable energy generation solutions. However despite these incentives very few schemes in the pipeline have come to the market (based on a review of pipeline project evidence) and wider evidence compiled nationally by the HNDU to support projects of this type.

6.4 Objective 3: Gaps in Relation to Business Opportunities

The Solent energy pipeline has a significant job creation potential which is much more so if energy efficiency projects are reinvigorated. Nevertheless, there is a significant risk that benefits leak out because suppliers are selected that may not be committed to the use of Solent labour.

The investment needed to exploit renewable resources available to the Solent is a potential trigger for business and job creation. Many renewable technologies have matured to a point where supply chains have already become established. These supply chains are best placed to supply the Solent's requirements on a least cost basis.

Most supply chains consist of a mix of activities ranging from the Original Equipment Manufacturers (OEMs) who control the manufacture of generating technology through to design, installation and subsequent maintenance. Our searches have not identified any OEMs in the Solent (many of these are outside the UK). Installers covering the latter stages of the process can be found in the Solent. Most of these companies are diversified builders, heating engineers and electricians who have incorporated an additional service. This is particularly the case when considering photovoltaic systems and biomass. Despite the current lack of OEM's in the Solent there would seem to be a significant opportunity around:

- Offshore renewables supply chain (particularly tidal and wave); and
- Smart energy management systems.

6.4.1 Offshore renewables supply chain

The Solent has a unique selling point through its location next to a marine renewable resource on both sides of the channel.

The most immediate opportunity is the offshore wind array promoted by Navitus Bay Development Ltd. The developer has already entered into 'memoranda of understanding' (MOU) with three local ports; one inside the Solent (Yarmouth) and two outside the Solent – Poole and Portland[94]. Feasibility work is already underway to assess factors critical to the construction and maintenance of the wind park, such as space available, depth of water and storage facilities and how these can be altered or improved to accommodate Navitus Bay's requirements.

Even though the opportunity arising out of Navitus Bay may be more distant, the Solent needs to consider its position in relation to other marine energy technologies.

[94] http://www.navitusbaywindpark.co.uk/news/navitus-bay-formalises-commitment-working-local-ports

A review of companies considered to be already engaged in the offshore wind industry shows that there are a number of conventional marine sector businesses who have already refocused their activities on off shore wind.[95] These businesses include environmental consultancies; health and safety equipment suppliers; marine surface treatments; diving; vessel services and so forth.

The marine sector already employs nearly 55,000 employees, making up 15% of the South East's marine sector jobs and 2% of the workforce in England. Analysing changes in the advanced manufacturing and marine sector[96], there has been significant growth in employment in the Solent LEP, especially relative to the South East and England. Employment in the Solent grew by nearly 11%, equating to 3,000 jobs between 2009 and 2012, whilst it shrank by over 6,000 in the South East and by nearly 20,000 in England. The marine sector accounts for 7% of workplaces in the Solent LEP region, whilst it accounts for 5% and 6% in the South East region and in England as a whole.

Any type of marine renewable will still need to draw upon marine service industries such as these. After 2020, tidal generation technologies are likely to have completed their demonstration phase and have moved to commercialisation. Over the longer term, marine environments may offer a means of managing the low power densities of renewables. Future developments may include the farming of saltwater micro algae as a form of biofuel. Both these options are too costly for exploitation in the short to medium term, however expected learning economies combined with the prospects for fossil fuel prices may convert these options into being more acceptable.

Evidence on supply chain potential is difficult to verify. The Department for Business Innovation and Skills have sought to quantify the size of the Low Carbon Environmental Goods and Services (LCEGS) sector. Whilst this is not necessarily entirely comparable with the energy sector, it may capture renewable energy and the low carbon sector better than a more conventional sector definition. The 2011-12 report finds that the LCEGS sector in the Solent employs nearly 20,000 people and includes over 1,000 businesses. Thus, it appears that the LCEGS sector is a significant component of the economy in the Solent.

BEEMS (Building European Environmental and Maritime Skills)

BEEMS is an EU Interred IVA France – funded project, co-existing across the channel in England and in France. BEEMS comprises skills for offshore wind, tidal stream and wave technologies, and aims to fill the skills gap and meet the demands of the renewable energy sectors in England and France. The project is hoping to finalise in September 2014, by which time there will be common-standard certificates for Health and Safety, Engineering and Maritime courses within the offshore wind, tidal and wave energy sectors. BEEMS will be making career paths more explicit for people wishing to move into these sectors and an extensive translated directory of marine and renewable jobs in the Solent region will be available.

PTEC (Perpetuus Tidal Energy Centre)

[95] http://www.windpowermonthlydirectory.com/search
[96] As defined in the Hampshire Economic Assessment

PTEC is planned be the world's first multi technology tidal array demonstration facility, based 2.5km off the Isle of Wight coast. The facility will produce up to 30MW (enough to power 15,000 homes)[97].

The project proponents expect it to create and safeguard several hundred jobs in the UK. PTEC has committed to source materials and services locally, utilising the marine and engineering related supply chain on the Island and around the Solent, and enhancing the local economic impact.

Port infrastructure for maritime renewables

Renewable development requires other types of infrastructure beyond grid connectivity. Both tidal and wind deployment[98] will make demands on port infrastructure in places selected to stage the deployment of new installations. Indicative requirements[99] to cover the range of renewables covered in this report will be:

- At least 80,000 m^2 (8 hectares) suitable for lay down and pre assembly of product;
- 200–300 m length of quayside with high load bearing capacity and adjacent access;
- Water access to accommodate vessels up to 140m length, 45m beam and 6m draft with no tidal or other access restrictions;
- Overhead clearance to sea of 100m minimum (to allow vertical shipment of towers);
- Sites with greater weather restrictions on construction may require an additional lay-down area, up to 300,000 m^2 (30 hectares);
- Surface transport links capable of supporting the transport of bulk items;
- Extensive provision of heavy lifting cranes; and
- Interior storage and fabrication space at the Port facility.

The view appears to be that facilities established for offshore wind would also serve tidal systems, but these might also be able to use smaller facilities. The Solent might offer a facility to service the Navitus Bay array, but also support other marine technology installations located on both sides of the channel.

There may also be different requirements for Operation and Maintenance.

Manufacturing Strategies for Offshore Wind Turbines[100]

A number of wind turbine manufacturers' preferred strategy is to establish their own turbine assembly facilities, alongside key component manufacturing facilities on a single new coastal site. Depending on the range of products and scale of operations, these could employ up to 5,000 people on each site.

The requirements for such sites are:

- Located on North Sea or English Channel to enable export to Continental projects as well as supplying to UK offshore projects;
- Up to 500 hectares of flat area for factory and product storage;

[97] http://perpetuustidal.com/
[98] Tetratech (2010) "Port and Infrastructure Analysis for Offshore Wind Energy Development"
[99] https www.scottish-enterprise.com ...renewables-reports National-renew...
[100] National Renewables Infrastructure Plan Infrastructure Demand Analysis and Port Location Consultations

- Direct access to dedicated high load bearing deep water quayside (minimum 500m length); and
- Ease of landside logistics and access to skilled workforce.

Another opportunity is to establish key component manufacturing facilities in UK where the components can be produced on a distributed basis and brought together at an installation port. This scenario is relevant for foundations, towers and blades, for example, with specific port and space requirements for each.

6.4.2 Smart energy management supply chain

Smart energy management technologies can help utilities and distributors to forecast and manage loads better, reduce the need for costly infrastructure expansion, and improve service quality and customer satisfaction. Attaching more renewables to the grid will require significant change to the way the grid operates to enable the smart principle to be applied from end-to-end. Increased deployment can fulfil two objectives: more efficiently managing energy consumption to lessen peak usage where practicable and creating a business opportunity.

The University of Southampton has a recognised lead in this field and opportunities exist for the Solent to capitalise on this lead to make in-roads into a global market forecast to be worth $220 billion by 2020 for smart grid technology[101].

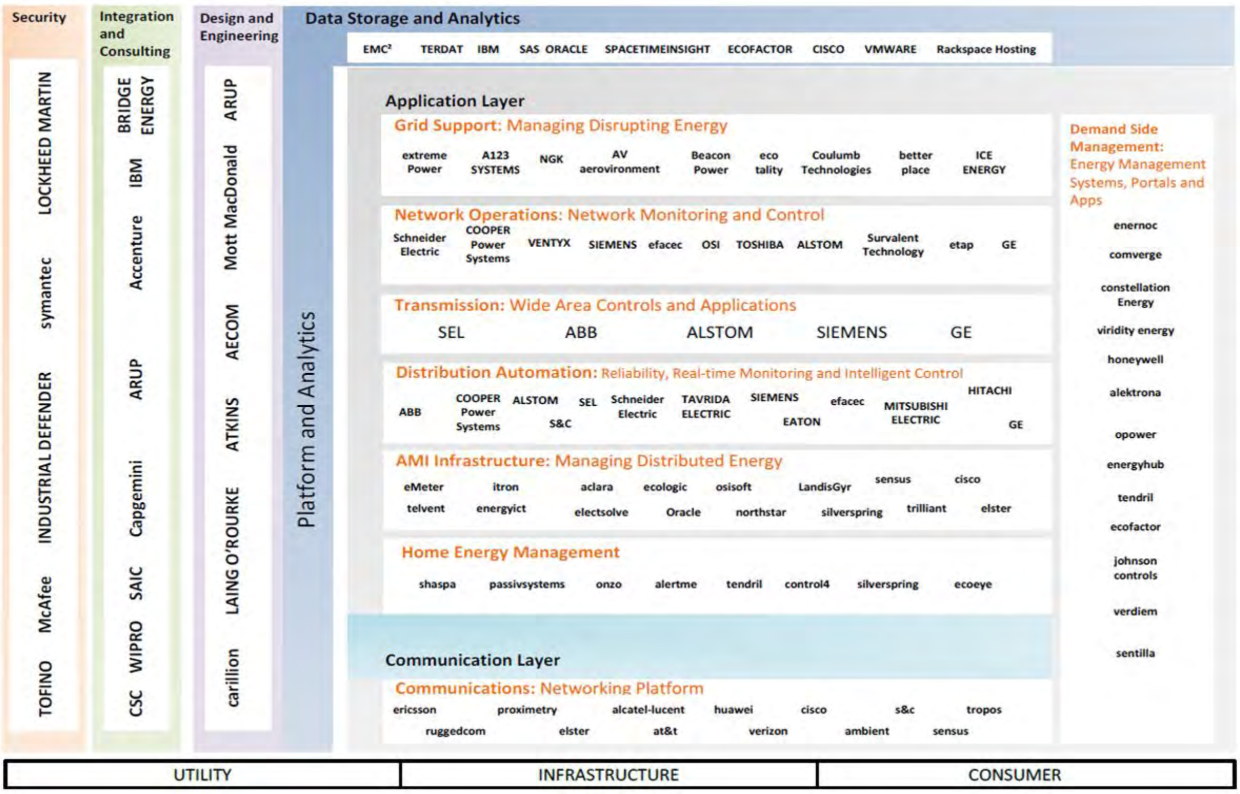

Figure 6.3: Map of Smart Energy Management Systems Companies[102]

[101] Global Smart Grid Technology Forecast (2012-2020), December 2012, Zpryme Research
[102] Source: Arup, GTM Research

Figure 6.3 shows the disparate set of products and services that make up the smart energy sector. This also serves to demonstrate the variety of economic opportunities in this emerging area. One of the companies that has been promoting smart energy solutions is IBM. In 2012, IBM (see Case Study below) participated in the development of the Future Cities Demonstrator bid to the Technology Strategy Board for Southampton.

IBM – SMARTER CITIES

IBM's operations deliver smart technologies in the Solent, where they are based at North harbour in Portsmouth. Their smart systems approach encompasses energy utilities, health and social care, public safety, transport and education. This approach aims to provide solutions to the challenges posed by the human environments we live in, it is important to note that this requires changes to human behaviour rather than simply the introduction of new technologies. IBM's capabilities bring together information services and integrated urban management which could benefit the Solent economically, environmentally and socially.

For example, IBM's smart transport policy could bring huge benefits to the Solent region through integration of transport and telecommunication services. This could provide real time traffic updates with regard to traffic flows, speeds and locations of different transport modes.

Potential exists for diversification from within the ICT and Digital Media sector. Computing in the South Hampshire area is worth £16.9 billion, making up 57% of the wider Hampshire Economic Area's computing GVA. In 2012 there were a total of 2,615 businesses in the Solent LEP in the ICT and Digital Media sector, making up 6% of the region's total business units. In 2012 there were 23,950 people employed in the sector in the Solent LEP area, which equates to 5% of the area's total workforce; this is the same as England's proportion of people in the sector, whilst for the South East region 7% of its total workforce was employed in ICT and Digital Media. The employment figure in this sector has actually shrunk between 2009 and 2012 in the Solent LEP region; this sector grew by over 8,000 and 11,000 jobs in the South East and in England respectively, but there was only a loss of around 600 jobs in the Solent LEP.

7 Future Solent Programme

This section identifies suggested actions for Future Solent based on findings related to the content and status of the project pipeline and our analysis of gaps relating to the strategic objectives suggested for energy and related strategies.

7.1 Actions to Support Energy Efficiency Objective 1

7.1.1 Action 1.1: Review domestic energy efficiency programmes.

The need to raise "up front" capital to invest in energy efficiency was the most significant barrier to tackling housing energy efficiency. Green Deal was designed to unlock householder investment by providing loan finance directly related to the savings in energy arising from investment. In line with national trends, take up of the Green Deal in the Solent to date has been non-existent[103], and alternative funding mechanisms have been sought and promoted.

Motivation to invest in energy efficiency measures is patchy, many householders still do not perceive the value or rank it lower than other types of purchases especially if householder's commitment to a house is short term. The results from the SAVE project may offer an alternative avenue to explore.

7.1.2 Action 1.2: Review contribution to fuel poverty targets.

Domestic energy efficiency programmes can have a positive impact on fuel poverty. In order to achieve these outcomes, programmes will need to be focussed on the right demographics and right properties. Fuel poverty is a factor of three elements; income, cost of energy and amount of energy used. Consideration should be given to enhancing programmes that assist with generating cheap energy or improving energy efficiency for the appropriate demographic groups.

7.1.3 Action 1.3: Scope projects that address non domestic energy efficiency.

Non-domestic energy efficiency is subject to many market failings. The split incentive between building owners with a long term interest in their asset and tenants who may have short term interest is a key barrier. Tenants fail to see an advantage in any investment unless it has a very short term payback and landlords would prefer to avoid the hassle of undertaking actions until a break point has been reached in the lease. The Green Deal for the non-domestic sector is also failing to create awareness even if its attractiveness were not an issue. Details about the industrial and commercial stock are also partial at best. Given resource

[103] In the Solent, it has been reported by the Green Deal Project Manager that no measures were installed through Green Deal between the scheme's start in scheme in the Solent in June 2013 to the end of February 2014; from the over 800 enquiries received, no energy efficiency measures had been installed through the Green Deal.

constraints efforts could be targeted at promoting the non-domestic Green Deal in the hope that a reformed package might turn out to be more attractive.

7.2 Actions to Support Renewables Objective 2.

7.2.1 Action 2.1: Agree a renewable electrical generation target for 2020.

In 2012, the South Hampshire Strategy was adopted that included Policy 18 stating that:

"20% of all electricity to be generated from renewable sources by 2020 across South Hampshire as a whole, by encouraging renewable energy generating installations/projects and adopting positive planning policies for renewable energy."

Based on the projection of the baseline position, the Solent is expected to consume 4,539 GWhs of electricity in 2020. A 20% share represents 908 GWhs and this is exceeded by the total pipeline capacity at 1,129 GWhs[104]. The size of the target is itself sensitive to the absolute size of electrical power consumption in 2020 which may vary either up or down dependent upon whether energy efficiency follows the trend line observed over 2005 – 2011.

An aggregate comparison does not however account for the delivery risk associated with a portfolio dominated by immature projects. Many of the pipeline projects will require at least two years to progress through the funding and consent stages plus the time necessary to prepare and construct the generating capacity.

Given that 2020 is only five years away, it seems highly unlikely that the current target is deliverable in its current form.

Around 92% of the current pipeline projects are "pre-feasibility" stage projects i.e. they are some distance from being ready to go. In the event that the resources were available for feasibility and scheme development work, the projects would take at least two years to progress from where they are now to a robust business case and a planning consent. Construction could take a further three years for the more complex projects. For this reason it may be more prudent to aim at a lower 2020 target:

Targets for the Solent	Capacity (MWe)	Capacity (GWh)	Project Cost Capital (£000s)	Total Economic Value	Total Jobs
Target for 2020	90	173.8	£319,707	£82,973,630	308

This analysis suggests that the pipeline will only deliver a 3.8% of electrical power consumption by 2020. When added to the existing output from identified installed renewables, a target of 6.3% (say 6%) would seem more realistic.

[104] Based on projects with basic information on installed capacity sufficient to make the calculation

7.2.2 Action 2.2: Agree a renewable electrical generation target for 2030.

A stretch target for 2030 would mean accelerating the residual pipeline schemes to the point where they are generating output (projects that have an investment readiness grade 3). The target would be:

Targets for the Solent	Capacity (MWe)	Capacity (MWh)	Project Cost Capital (£000s)	Total Economic Value	Total Jobs
Target for 2030	1,411	3,794,214	£3,956,659	£1,503,839,302	3,260

This is a 1,467% increase on the 2020 target and it is heavily reliant upon the Navitus Bay Project. If Navitus Bay is removed, there will still be a need to install 134% more capacity compared to the 2020 target.

Targets for the Solent	Capacity (MWe)	Capacity (MWh)	Project Cost Capital (£000s)	Total Economic Value	Total Jobs
Target for 2030 *without Navitus Bay*	211	955,974	£456,659	£289,593,396	1,129

Effectively, more than the current Policy 18 renewable target could be delivered but a decade later than expected and would need to be linked to the formation of adequate delivery mechanisms.

7.2.3 Action 2.3: Agree renewable electrical generation technology targets.

Based on the targets identified above, the broad sector technology targets would be as follows based on the pipeline:

MWe Installed	2020	2030	2030 without Navitus Bay
Biomass	6.2	104.2	104.2
EfW/ Landfill	1.07	8.0	8.0
On Shore Wind	18	0.8	0.8
PV	45.2	96.0	96.0
Tidal	30	32.0	32.0
Offshore Wind	0	1,200.0	0

These targets represent the current mix based on the pipeline as surveyed. The pipeline does not however represent a particular order of merit in terms of value for money from making the investment.

7.2.4 Action 2.4: Bring forward a further 200 MWe of capacity into either investment readiness rating grade 2 or 3 by 2020.

This action is based on the recognition that there is still a large amount of renewable resources left to exploit which needs to be converted into viable projects. This action requires the development of an active approach to bring forward new projects.

The bringing forward of new as yet to be identified projects does give an opportunity to apply an order of merit based upon cost. The analysis of the pipeline does show that the investment cost per MWh generated varies across the technological spectrum.

Based on the technology based investment costs, biomass and energy from waste/ landfill projects represent the best prospects for achieving the highest value for money.

The investment in biomass and EfW power generators should also exploit heat take off potential where ever possible.

The target proposed would have the result of almost doubling the size of the pipeline between 2020 and 2030.

7.2.5 Action 2.5: Carry out detailed analysis of grid constraints and opportunities.

As discussed in Section 6, there have been some issues in terms of background fault levels in the network. It is therefore recommended that a detailed analysis of the grid resilience, constraints and opportunities is undertaken in partnership with SSE, with a view to lifting real constraints as soon as possible, and communicating issues with regard to perceived constraints.

7.2.6 Action 2.6: Support feasibility study development for district heating projects.

Key challenges for heat related projects include the high upfront capital cost of installing a network; consumer reaction; retailing risk of heat contracts and guaranteeing of payments especially from domestic customers and security of feedstock supply.

A number of projects have been identified to exploit district heating however there is little accompanying detail on the technical scope of these projects suggesting that these schemes have yet to progress very far down the pipeline process or that the detail is commercially confidential. Opportunities that have been identified in Appendix E should be reviewed to determine whether the full potential for heat has been identified.

An opportunity may exist to combine a district heating project with an exemplar project for Tax Increment Financing by anticipating a growth in business rate income arising from potential occupiers attracted to being in close proximity to competitive heat and power supplies.

7.2.7 Action 2.7: Improve information on feedstock supply for biomass and district heating.

Supply risk of feedstock can be a major issue for biomass projects and CHP, with evidence of credible, long term supplies required to ensure lender support and backing for new schemes. Whilst biomass offers attractive returns each additional GWh of biomass (whether for electrical power or heat) makes new demands upon available feedstock and risks pushing the price of feedstock upwards. Securing a reliable and quality source of biomass will become increasingly difficult as the number of schemes increases relative to the available feedstock. Embedded biomass infrastructure may be placed at risk of becoming redundant, should feedstock demand exceed supply. Left unattended, the value of energy security created by switching to biomass could be eroded. There is a potential role for Future Solent to provide information that improves investor certainty concerning the availability of feedstock. In the recent past, PUSH commissioned studies have been undertaken to evaluate particular types of biomass feedstock however it may be appropriate to create a comprehensive and regular service to developers on this issue.

7.3 Actions to Support Business Opportunities Objective 3.

7.3.1 Action 3.1: Review port infrastructure to establish suitability for offshore renewables.

Section 6 identifies certain minimum requirements for ports infrastructure to sustain an array like Navitus Bay, and possibly other developments further afield. A minimum site area requirement of eight hectares has been identified but this could be bigger dependent upon how the offshore industry views prospects for the key channel resources including the continent. This review should consider requirements both for development and operation and maintenance.

7.3.2 Action 3.2: Develop an action plan to support diversification and company development associated with support of offshore renewables.

Review opportunities to draw on resources identified in the EU Structural and Investment Fund Strategy 2014-2020 to support company diversification into emergent growth opportunities in maritime renewables including access to finance and graduate placements.

7.3.3 Action 3.3: Develop an action plan to support diversification and company development associated with support of smart energy sector opportunities.

Review opportunities to draw on resources identified in the EU Structural and Investment Fund Strategy 2014-2020 to support company diversification into emergent growth opportunities in smart energy including access to finance and graduate placements.

7.3.4 Action 3.4: Develop an action plan for port energy supply.

Solent strategies emphasise the importance of maritime and marine industries where the ports provide an essential infrastructure. The project pipeline already includes two biomass proposals aimed at supplying power needs to both ports thereby enabling a shore based supply to allow berthed ships to switch off their auxiliary engines. New energy supply can help service the cruise ship trade in Southampton and the two aircraft carriers in Portsmouth. Apparent uncertainties over the necessity for reinforcement of the distribution network also need to be resolved.

7.3.5 Action 3.5: Support the take up of local jobs in fossil fuel projects.

The fossil fuel energy sector will remain important to the Solent economy for the foreseeable future. It is already a significant employer of labour both directly and in terms of the jobs tied to fossil fuel dependent technologies e.g. existing heating systems. It is already evident that firms that had been traditional heating engineers or electricians have diversified what they do creating businesses that effectively face both directions.

Shale gas is the most visible likely source of new fossil fuel based jobs although this is more likely to occur out of area. There are currently no plans for local authorities in the Solent area to actively encourage shale gas development locally. However, Solent workers could potentially benefit from shale gas exploitation in the rest of Hampshire if equipped with the right skills. It is however likely to be highly competitive and the jobs may well have a high propensity to leak out the area to a mobile work force that follows the drilling operations. Solent training bodies need to liaise with shale gas industries if drilling licenses are issued to determine whether any customised training would be appropriate to maximise local labour.

7.4 Actions to Support Delivery & Implementation Objective 4.

7.4.1 Action 4.1: Strategy alignment within the Solent.

Transport lay outside the scope of this study. However, there are a number of uncertainties which could rebound onto energy consumption as a whole. Currently, petroleum fuels are used by the domestic transport sector for the private motor car; road based freight and rail (international aviation and shipping are not accounted for at a national level due to the absence of an agreement on the apportionment of emissions). New technological options hold open the prospect of powering transport services without burning petroleum fuels. All electric vehicles and hybrid vehicles may prove attractive in which case transport services would need to be met by switching energy consumption from petroleum fuels to electricity. The impact of charging an electric car at home would be to substantially shift electricity demand towards the residential sector and to increase aggregate electricity demand. It would also increase the maximum power drawn by the household, though this would substantially depend on the rate of charge required. A substantial penetration of electric vehicles charging at home would be a substantial system load. It would also imply substantial infrastructure investments can have significant implications for the grid (see My Electric Avenue). Electricity supplied through the grid would carry the carbon intensity of the grid based on the primary energy used to sustain supply (carbon intensity is supposed to be falling despite an up surge in cheap coal imports). Local installed capacity would be a contributor to the overall grid delivered electrical energy helping to reduce carbon intensity overall. Hydrogen fuelled vehicles are another option which might emerge as a competitor. Both carry significant infrastructure investment requirements and could radically change the current consumption pattern of energy. It will, therefore, be necessary to align this strategy with plans concerning transport.

It is possible that as a result of further strategic alignment, additional gaps will be found, and that the development of further actions will be required in the fields of transport or hydrogen.

My Electric Avenue - SSE

SSE, as the host electricity distribution company, is working with EA Technology to undertake a series of trials with electric vehicle drivers to assess their cars' impact on the network. The project requires at least seven 'clusters' of ten customers who are all supplied by the same substation, to drive a Nissan Leaf for 18 months and trial a new device that will monitor and control the electricity used when the car is being charged. To date five clusters have successfully been signed up. With the excellent progress being made, Ofgem has agreed to release funding early to enable the project to provide these clusters with Nissan Leafs, and look to begin the trials.

Further alignment will be needed with the Solent's climate change strategic objectives. The impacts of climate change are likely to have a significant effect on the grid's performance. It is therefore important that measures to ensure resilience are aligned with future investments to reinforce the grid.

Section 2.5 identified the wide range of policy areas that have interdependency on energy. Consideration should be given to how plans and policies within each of these areas can be better aligned with the objectives of this strategy.

7.4.2 Action 4.2: Establish a governance arrangement to provide a focus for implementation.

Governance arrangements need to be established to oversee the implementation of the strategy and respond to performance in relation to the pipeline projects. A mechanism is also needed to link with other strategic actions in relation to e.g. transport, climate change and economic development.

This will need to set out a mechanism to bring together all of the relevant partners across the private, public and third sectors. Having established such a mechanism, it should be possible to attach owners to each of these actions. A more detailed local action plan should be developed, with timescales and owners and resources assigned to the headline actions identified here.

7.4.3 Action 4.3: Pipeline management & development.

Financial and human resources to invest in energy projects remain a challenge. Expertise exists in pockets in some local authorities, but remains at risk unless related to a statutory responsibility. Existing resources could be better shared and directed to maximise the opportunities for the Solent.

Many projects in the pipeline are at an early stage of development without a finalised business case in many instances. This is not an unusual situation, across many parts of the UK, pipeline projects have been unable to access funding for the initial preparatory work necessary for the creation of viable projects.

Both within government and the private sector, there is a lack of skilled professionals with the commercial understanding and influence to pull together convincing business and financial cases for many low carbon technologies. Shortages of resources in the public sector tend to mean that public organisations increasingly look to the private sector to provide these skills yet access to this expertise carries premium charges that are increasingly unaffordable to the public sector. Furthermore, procurement teams for developers and large multinational organisations typically lack a significant local presence, which complicates the process of securing buy-in for large local schemes.

Obtaining funding to cover the costs of both project development and project implementation is a key challenge faced by local authorities (see Appendix B for examples of funding). The cost of supporting an in house team to facilitate and develop a project pipeline can be substantial and grant funding can be limited.

Local authorities will also need to develop mechanisms to support developers and help to get pipeline projects investable and installed

As part of the pipeline management process, the economic framework identified in Section 5 should be developed with local benchmarks for different technologies and classes of project.

7.4.4 Action 4.4: Learn from & promote good practice.

The Solent has a range of examples of good practice in delivering energy projects. It is important that learning from these good practices (e.g. from existing district energy schemes in Southampton and Portsmouth in determining the feasibility and viability of new schemes) is incorporated into the actions contained within this strategy. The Solent should have confidence in promoting successful schemes more widely, building its reputation as a place to do business.

Clearly, there are also excellent opportunities to learn from elsewhere, within the UK and internationally, and there are examples of this already happening. Consideration should be given to what additional facilitation between academia, industry and the third and public sectors, could help in this regard.

8 Conclusions and Next Steps

8.1 Conclusions

The Solent is an area with enormous potential to enhance environmental, social and economic outcomes through an integrated energy strategy.

Through a co-ordinated and integrated approach, it should be possible for the area to achieve outcomes consistent with the four objectives established for this Energy Strategy:

- Improving energy efficiency;
- Increasing the use of renewable energy resources;
- Maximising the uptake of business opportunities locally; and
- Ensuring focused and integrated delivery and implementation.

Progress towards this end can be monitored through progress towards achieving the associated targets set out in this strategy.

8.2 Next Steps

It is suggested that the key initial actions will be in relation to ensuring focused and integrated delivery. Setting up an appropriate governance structure and beginning to identify funding streams will allow more detail to be formed around other actions and for them to become more easily deliverable.

Appendix A

Pipeline Projects by Type

A1 Pipeline by type

A1.1 Domestic Energy Efficiency

	Project Name	Project Sponsor	Project Status	Capex (if known)	MWhs contribution (if applicable)
1	Solent ECO				High
2	Solent Green Deal				High
3	SAVE	SSE			

A1.2 Energy from Waste and Landfill Gas

	Project Name	Project Sponsor	Project Status	Capex (if known) '000s	MWhs contribution (if applicable)
1	Micheldever Rail Sidings EFW	Clean Power Properties Ltd & Network Rail Infrastructure Ltd	3	£27,304	63,072
2	City Energy Portsmouth CHP Scheme	City Energy Ltd	3	-	0
3	Netley Fruit Farm- (Landfill Gas)	Hampshire County Council	2	£589	2,628
4	Hook Lane (Landfill Gas)	Onyx Hampshire Ltd.	2	£671	2,996
	TOTAL			£28,564	68,696

A1.3 Photovoltaic

	Project Name	Project Sponsor	Project Status	Capex (if known) '000s	MWhs contribution (if applicable)
1	Raglington Farm	Hive Energy Ltd	2	£8,585	3,942
2	Penerley Farm	New Forest Fruit Company	2	£429	197
3	Newhouse Farm	Boyd Farming	2	£172	79
4	The Manor of Cadland Estate - extension	Manor of Cadland	2	£4,293	1,971
5	Funtley Refuse Tip	Cassidy & Ashton Group Ltd	2	£17,170	7,884
6	Holliers Farm	Channel Solar Limited	2	£429	197
7	Hill Farm Solar Park	BNRG	2	£17,513	8,042

	Project Name	Project Sponsor	Project Status	Capex (if known) '000s	MWhs contribution (if applicable)
		Renewables			
8	Newnham Farm	Low Carbon Solar Ltd	3	£3,434	1,577
9	Littletown Lane Solar Farm	Mr & Mrs Griffin	3	£429	197
10	Photovoltaic Park	BNRG Renewables Ltd	3	£429	197
11	Tapnell Farm	Turneys Farming Ltd	3	£343	158
12	Newland Farm Solar	SUNSAVE 10	2	£28,966	13,300
13	Eveley Farm (Houghton)	Kronos Solar Projects GmbH	3	£60,095	27,594
14	Grange Estate (Itchen Stoke)	Kronos Solar Projects	3	£51,510	23,652
15	Tavells Lane Farm	Hive Energy Ltd	3	£8,585	3,942
16	Upper Farm Solar Park	Kronos Solar Projects	3	£20,604	9,461
17	East Fairlee	The Solar Building Company Ltd	3	£12,448	5,716
18	Medecroft PV array to power electric vehicle	Winchester University	3	£6,868	3,154
	TOTAL			£242,302	111,260

A1.4 Onshore Wind

	Project Name	Project Sponsor	Project Status	Capex	MWhs contribution (if applicable)
1	Portsdown West Wind Turbine	Defence Science and Technology Laboratory (DSTL)	3	£230,200	
2	Woodmancott Down	TCI Renewables	3	-	0
	TOTAL			£230,200	788,400

A1.5 Anaerobic Digestion

	Project Name	Project Sponsor	Project Status	Capex (if known) '000s	MWhs contribution (if applicable)
1	Faulkners Down	Yelspa Ltd	2	£13,753	19,123

	Farm Anaerobic Digestion				
2	Greenhill Anaerobic Digestion Plant	Greenhill AD	2	£1,859	2,584
3	Micheldever Rail Sidings EFW AD	Clean Power Properties Ltd & Network Rail Infrastructure Ltd	3	£7,434	10,337
4	Wight Farm Energy-AD	Wight Farm Energy	3	£8,177	11,370
5	Solent AD Plant		3	-	0
	TOTAL			£31,223	£43,414

A1.6 General Distributed Energy

	Project Name	Project Sponsor	Project Status	Capex (if known) '000s	MWhs contribution (if applicable)
1	Connecting Rubble Energy to the national Grid	The Island Strategic Project	3	-	-
2	Expanded CHP connections	Southampton City Council and COFELY District Energy	3	-	-
3	EcoTec21- funding for CHP and distributed energy feasibility	Hampshire County Council	3	-	-
4	Havant thicket reservoirrenewable energy infrastructure	Portsmouth Water	2	-	-
5	District Energy Schemes (thornhill, Western, Shirley)		3	-	-
6	Thronhill CHP	Southampton district Heating	3	-	-
7	BREEMs	Warsash Marine Academy, Highbury College, Marine Southeast	1	-	-
8	Welborne New Community		3	-	-
9	Winchester District Energy Phase 1		3	-	-
10	Winchester District Energy Phase 2		3	-	-
11	Eastleigh House, Eastleigh Town	Town Centre Energy Network	3	-	-

	Project Name	Project Sponsor	Project Status	Capex (if known) '000s	MWhs contribution (if applicable)
	Centre				
12	Ageas Bowl, West End	Ageas Bowl Energy Network	3	-	-
13	Boorley Green, Botley	Boorley Green Energy Network	3	-	-
14	Portsmouth City Centre CHP scheme		3	-	-
15	Whitehill & Bordon Eco Town Scheme: "zero carbon housing"	Whitehill & Bordon Louisburg Barracks	3	-	-

A1.7 Offshore Systems

	Project Name	Project Sponsor	Project Status	Capex '000s	MWhs contribution (if applicable)
1	Perptuus Tidal Energy Centre - Tidal Powder	Isle of Wight Council	2	£199,000	52,560
2	Wootton Bridge	Godshill Park Developments	3	£19,900	5,256
3	Tidal testing in Yarmouth Harbour (will move into the SOEC site when it is functional)	Sustainable Marine Energy Ltd	3	£0	0
4	Navitus Bay Wind Park	(Eneco) Navitus bay development limited	3	£3,500,000	2,838,240
	TOTAL			£3,718,900	2,896,056

Appendix B

Funding Opportunities

B1 Funding Opportunities

This section outlines the European, national and local funding sources that are currently available to support project development and/or investment or grant into projects within the strategic objectives of the proposed ESIF allocation to low carbon/energy infrastructure projects.

B1.1 European Commission

The European Commission has established several funding sources dedicated towards supporting low carbon/energy investing. These include project development grant facilities and debt and equity products to support project investment:

B1.1.1 Project Development Facilities

- European Local Energy Assistance (ELENA) – €15 million annually.
- European Energy Efficiency Fund (EEEF) – project development costs can be reimbursed in the event that EEEF project funding is secured.
- Intelligent Energy Europe (IEE) – €730 million. (Funding for this round closed in 2013).

B1.1.2 Project Investment Facilities

European Energy Efficiency Fund (EEEF) - €265 million+

Horizon 2020 is a seven year programme with a focus on health and demographic changes, food security, clean and efficient energy, green integrated infrastructure, climate change and transport and mobility in urban areas. Funding is available through grants, prizes, favourable procurement terms, debt finance and equity investment.

Connecting Europe Facility: With a proposed budget of up to €50 billion between 2014-20 this facility is specifically designed to promote growth, jobs and competitiveness through targeted infrastructure investment at European level. It will support the roll-out of high-performing, sustainable and joined-up trans-European networks in the fields of transport, energy, broadband and digital services.

Northwest Europe Interreges VB Programme (environment and economy focus)- €355 million. The criteria will focus on research & technological development, SME's competitiveness, low carbon and social inclusion.

Atlantic Area Programme Interreg VB - 2014 budget not confirmed but expected to be in the region of €104m. The criteria will focus improving maritime heritage, protect maritime resources, promote new economic clusters, improve accessibility and sustain the overall.

The technical and project investment facilities above are available to eligible low carbon UK programmes and projects. As it is not possible for one Structural Funds programme to provide 'match' funding to another, use of these funding sources and a local source would need to be undertaken on a complementary basis with other public or private sector funding identified for 'match' funding.

European Investment Bank

The promotion of sustainable competitive and secure sources of energy is a key EU policy objective. The EIB plays a major role in providing finance to the renewable energy sector. In the past five years its annual lending increased more than tenfold to reach €6.2bn in 2010 and since 2007 renewable energy, grid and energy efficiency projects have been the recipient of 90% of the EIB's energy sector lending.

Key criteria that they require to be met include:

- Strong project economics that support lending on commercial terms (including credit worthy feedstock and off-take agreements, where relevant);
- Evidence that a minimum of 50 % of the capital cost of a project can be met from other funding sources;
- Evidence that a project can deliver 20% energy savings;
- EIB does not typically invest directly into projects with a capital cost of less than £50 million. For this reason, it is possible that EIB may require any lending facility to be structured as a credit line via a UK financial institution;
- This would likely require evidence of a strong and, where possible, standardised project pipeline of projects that can easily be understood and managed;
- Another option could include a framework loan from EIB direct to a local authority (or combined authority), which could negate the need for an intermediary; and
- This could offer a potential source of 'match' or complementary funding alongside a low carbon fund at a project level.

B1.2 UK & regional funding sources

In the UK there are many funding sources available to support investment in low carbon energy infrastructure projects. The following are examples of these:

- Green Investment Bank (GIB) – £100 million+;
- SALIX– £149 million; and
- Green Retrofit Investment Programme (BRE & SDCL) – £100 million.

While the majority of these funding sources require capital to be committed on commercial terms, they typically have a 'double bottom line' insofar as low carbon outcomes (e.g. GHG emissions, energy efficiency) also play a role in their investment decision making process. The exception to this is SALIX funding for public sector building energy efficiency which can offer zero-interest loans.

B1.2.1 Green Investment Bank

GIB is mandated by UK Government (as its seed funder) to support the delivery of the UK's 20-20-20 strategy and with £3.8 billion of capital to invest by 2015 into sectors including those being considered for the ESIF allocation, it offers a source of possible 'match' and complementary project funding.

GIB invests on a commercial basis in projects with a capital cost of less than £30 million, through two third party fund managers (Equity and Sustainable Development Capital Limited) and directly for projects in excess of £30 million. Separately the GIB can provide funding alongside Aviva for energy efficiency projects utilising the Carbon Energy Fund. In each case it typically requires third party project co-finance on the same terms of at least 51%, however it is understood this can be flexed in some cases.

B1.2.2 Regional Growth Fund (RGF)

The RGF is a £2.4 billion fund operating across England from 2011 to 2015. It supports projects and programmes with significant potential for economic growth that can create additional, sustainable private sector employment.

The RGF allocation was awarded for investment in plant and equipment only. However if a low carbon project has a requirement for plant and equipment, it is possible this could be used as 'match' funding.

B1.2.3 Public sector

Where projects are led by local authorities, funding could be secured from the Public Works Loan Board (PWLB)[105]. The PWLB is a readily available, low cost source of funding for local authorities. However, authorities are only able to borrow where they consider it prudential to do so, and with central Government keen to reduce public sector net debt, any additional borrowings for low carbon projects will undoubtedly be weighted up against other calls on capital budgets. This source of funding, together with local authority reserves, could provide direct project finance and or 'match' or complementary finance.

In addition to this, the recently established DECC Heat Network Delivery Unit provides project development support to local authority led district heating projects with £9 million of development support committed nationally between 2013-2015.

B1.2.4 Private sector

There are a number of private sector commercial funders, such as banks and infrastructure and private equity funds that invest into low carbon projects. However, in the case of banks, their requirements are akin to those of the EIB as set out above. This suggests that to secure such funding as project or fund level 'match' or complementary funding would require

- For project level investment, projects with a capital value of £20m plus to avoid prohibitive transaction cost;
- For project investment in smaller-scale projects (e.g. sub-£20m), they will require a pipeline of largely homogeneous projects, for which a standard facility can be entered into;
- Credit worthy feedstock and off-take agreements (where relevant) at a project level; and

[105] This is a statutory body operating within the United Kingdom Debt Management Office, an Executive Agency of HM Treasury and its function is to lend money from the National Loans Fund to local authorities at rate below commercial rates for (primarily) capital projects.

- A funding term of sub-15 years, reflective of the fact that very few banks now provide long-term finance.

In the case of equity funds, projects either need to demonstrate:

- The potential for a natural exit in a period of 2-5 years through for example, a trade sale or listing (private equity); or,
- An ability to generate long-term stable returns (infrastructure funds), which requires fund managers to often target operational assets that are relatively low risk.

In the current market, low carbon / energy projects being supported by banks and/or equity funds include off-shore wind, off-shore transmission (OFTOs), waste PFIs and land-based solar PV. Some investment activity is also being seen in the district heating space, where for example Co-op, Aviva and GIB have provided debt facilities to £5-£15m energy centre projects in the health sector. This suggests that there is available equity and senior debt funding for investment in low carbon / energy projects nationally.

Appendix C

Glossary of Terms, Abbreviations and Acronyms

C1 Glossary

AD	Anaerobic Digestion
AONB	Area of Outstanding Natural Beauty
ANTC	Airbus Noise technology centre
BEEMS	Building European Environmental and Maritime Skills
BGS	British Geological Survey
BIS	Department for Business, Innovation and Skills
BREEAM	Building Research Establishment Environmental Assessment Method
CHP	Combined Heat and Power
CfD	Contracts for Difference
CH_4	Methane
CI	Customer Interruptions per 100 Customers
CLG	Department for Communities and Local Government
CM	Capacity Market
CML	Customer minutes Lost
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalents
CSH	Code for Sustainable Homes
DECC	Department for Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DH(N)	District Heating (Network)
DNO	District Network Operators
ECO	Energy Companies Obligation
EfW	Energy from Waste
EIB	European Investment
ELENA	European Local Energy Assistance
EMR	Electricity Market Reform
EPC	Energy Performance Certificate
ERDF	European Regional Development Funds
EST	Energy Saving Trust
ESCo	Energy Services Company
EU	European Union
EZ	Enterprise Zone

FiT	Feed in Tariff
GHG	Greenhouse Gas
GIB	Green Investment Bank
GIS	Geographical Information Systems
GW	Giga Watt (1,000,000kW)
GWh	Giga Watt hours
GSHP	Ground Source Heat Pump
GVA	Gross Value Added
HECA	Home Energy Conservation Act
HEI	Higher Education Institutions
ICT	Information and Communication Technology
IIS	Interruptions Incentive Scheme
IoW	Isle of Wight
JESSICA	Joint European Support for Sustainable Investment in City Areas
KTP	Knowledge Transfer Partnership
kW	kilowatt (a unit of power equivalent to 1000watts or 1000 Joules/second)
kWh	kilowatt hour (a unit of energy equivalent to the work done by one kilowatt constantly for one hour)
LA	Local Authority
LGG	Local Government Group
LCD	Low Carbon Development
LCEA	Low Carbon Economic Area
LCEGS	Low Carbon Environmental Goods and Services
LDP	Local Development Plan
LEP	Local Enterprise Partnership
LPG	Liquefied Petroleum Gas
LTB	Local Transport Body
LWPA	Local Waste Planning Authority
LZC	Low and Zero Carbon
MJ	Mega Joule
MPH	Mile per Hour
MoU	Memorandum of Understanding
MW	Mega Watt (1,000kW)
MWe	Mega Watt electrical
MW[h]	Mega Watt hour

MWt	Mega Watt thermal
MTOE	Million Tonnes of Oil Equivalent
MTP	Market Transformation Programme (DEFRA scenario)
MUSCo	Multi Utility Services Company
MSW	Municipal Solid Waste
N_2O	Nitrous Oxide
NNR	National Nature Reserve
OFGEM	The Office of Gas and Electricity Markets
ONS	Office of National Statistics
OS	Ordnance Survey
PUSH	Partnership for Urban South Hampshire
PV	Photovoltaic
REA	Renewable Energy Assessment
RER	Renewable Energy Resource
RHI	Renewable Heat Incentive
ROC	Renewable Obligation Certificate
RES	UK Renewable Energy Strategy
SDF	Sustainable Development Fund
SEDP	Southern Energy Power Distribution
SGHC	Southampton Geothermal Heating Company Ltd
SME	Medium Sized Enterprises
SOEC	Solent Ocean Energy Centre
SOREC	Solent Offshore Renewable Energy Consortium
SPG	Supplementary Planning Guidance
SSE	Scottish and Southern Energy plc
SSEPD	Scottish and Southern Energy Power Distribution
STEM	Science, Technology, Engineering and Mathematics
TER	Target Emission Rate

Appendix D

Policy Baseline

D1 European & National Policy Context

D1.1 European Policy

The European Union (EU) has made renewable energy, energy efficiency and measures to achieve a transition to a low carbon economy a key priority from a policy and investment perspective.

The European policy context is set by the Europe 2020 Strategy and regulatory changes which will govern the distribution of structural funds (2014-2021) will help the Solent and the whole of the country to invest in the transition to a low carbon economy.

There are a number of energy focused political, strategic, legislative and regulatory directives driven by the EU. These strategies position climate change mitigation at the heart of the European agenda and underline the need to encourage sustainable investments in renewable energy, these include:

- The Europe 2020 Strategy;
- The Resource Efficient Europe initiative; and
- The Fifth Cohesion Report on Economic, Social and Territorial Cohesion

European Regional Development Funds (ERDF) and in particular, the development of the new Operational Programme will trigger new funding in the 2014-2020 programming period. However, it has to be noted that largely funding is moving towards central and Eastern Europe and potentially further south and away from Western European members states. To balance this, the low carbon agenda, sustainability as well as innovation and economic development will be key areas for action.

D1.2 European Investment Bank

The European Investment Bank (EIB) provides an avenue to distribute EU funds and to drive forward the development of renewable energy. In particular, the Joint European Support for Sustainable Investment in City Areas (JESSICA) revolving fund is able to utilise ERDF grant with private finance to invest in renewables and the European Local Energy Assistance (ELENA) technical support facility to access European Investment Bank funds.

The EIB state that "ELENA support covers a share of the cost for technical support that is necessary to prepare, implement and finance the investment programme, such as feasibility and market studies, structuring of programmes, business plans, energy audits, preparation for tendering procedures - in short, everything necessary to make cities' and regions' sustainable energy projects ready for EIB funding."

D1.3 UK Policy

At a UK level the main policy instruments to drive forward the transition to a low carbon economy are a mix of subsidy, tariffs and capital investment. These are visible within the Feed-in Tariff, Renewable Heat Incentive, Renewables

Obligation, the Electricity Market Reform, and capitalisation of the Green Investment Bank.

The CRC Energy Efficiency Scheme is a mandatory carbon emissions reporting and pricing scheme which covers all organisations in the UK who use more than 6,000MWh per year of electricity. Emissions credits are bought and thus if emissions are lower, so are costs. The reported emissions are also publically published.

The UK Government and the Department for Business, Innovation and Skills (BIS), working with the Department for Energy and Climate Change (DECC) and across its agencies recognise that the "transition to a green economy presents significant growth opportunities for UK-based businesses, both at home and abroad. It will require unprecedented investment in key green sectors - an estimated £200 billion is needed for the energy system alone over the period to 2020[106]." The UK Government has established challenging targets for carbon dioxide reductions, in line with the EU Low-Carbon Economy Roadmap, over the next 40 years to address the dangers of climate change. The challenge has currently been set at a reduction of 80% in carbon dioxide emissions (compared to those of 1990) by 2050. As of July 2009, emissions had fallen 21% below 1990 levels. Local authorities are central to the drive required to achieve these targets and are instrumental in developing the policies, strategies and plans to implement carbon reduction at a local level.

The UK plans to have emissions from electricity to be near to zero by 2050[107]. The demand for electricity is likely to increase by 30-60% due to the potential electrification of heating, transport and industrial processes and so there is a need for mass deployment of renewable heat by the 2020s[108].

D1.3.1 Renewable Obligation Certificates

Renewables Obligation Certificate (ROCs, 2009) requires licensed electricity suppliers to source a specified and increasing proportion of their electricity from renewable sources, is the key current mechanism for incentivising renewable electricity within the UK. Licensed renewable electricity suppliers receive Renewables Obligation Certificates (ROCs) for each MegaWatt hour (MWh) of electricity generated. These certificates can then be sold to suppliers, in order to fulfil their obligation. Suppliers can either present enough certificates to cover the required percentage of their output, or they can pay a 'buyout' price for any shortfall. All proceeds from buyout payments are recycled to suppliers in proportion to the number of ROCs they present. ROCs have increased the profitability of renewable energy generation as the certificates have an additional value over and above the price of electricity itself.

[106] http://webarchive.nationalarchives.gov.uk/20121017180846/http:/www.bis.gov.uk/policies/business-sectors/green-economy/gib
[107] The UK Carbon Plan (2011)
[108] Ibid

D1.3.2 Feed-in-Tariff & Renewable Heat Incentive

Feed-in-Tariff (FiTs) schemes were introduced in the UK on 1 April 2010, under the Energy Act 2008. FiTs encourage the deployment of small-scale (less than 5MW) low-carbon electricity generation, particularly by organisations, businesses, communities and individuals that have not traditionally engaged in the electricity market. The financial benefits of FiTs are:

- Generation tariff – the electricity supplier of your choice will pay you for each unit (kilowatt) of electricity you generate;
- Export tariff – if you generate electricity that you don't use yourself, you can export it back to the grid. You will be paid for exporting electricity as an additional payment (on top of the generation tariff); and
- Energy bill savings – you won't have to import as much electricity from your supplier because a proportion of what you use you will have generated yourself.

Small-scale wind, solar photovoltaic panels (PV), hydro, anaerobic digestion, domestic scale micro CHP are eligible for FiTs. FiTs work alongside Renewable Obligation Certificates (ROCs) which is the primary mechanism to support deployment of large-scale renewable electricity generation.

Renewable Heat Incentives (RHI) was introduced (for non-domestic properties) in 2011, under the Energy Act 2008. The RHI acts in a similar way to FiTs but for renewable heat rather than electricity generation.

D1.3.3 The Electricity Market Reform

The Electricity Market Reform (EMR) puts in place measures to attract the £110 billion investment required by 2020 which is needed to replace current generating capacity with greener and more reliable supplies at the lowest possible cost.

The EMR Draft Delivery Plan[109], aims to give investors further certainty of how the Government is supporting private sector investment in new energy infrastructure. The details were announced amongst a raft of other announcements about energy and infrastructure investment with information published on draft strike prices and key terms for the new-style "Feed-In-Tariffs (FIT) Contracts for Difference (CfD)" renewables support contracts, the "Final Investment Decision Enabling" mechanism (preceding the FIT CfD), and details of the "capacity market" mechanism design.

CfDs are long term contacts to encourage investment in new low carbon generation. CfD payments would provide a contractual form of guarantee to generators to protect their level of revenue by removing volatility in power prices. Generators will continue to sell their electricity into the market and then receive variable payments based on estimated market electricity prices (the reference price) to ensure that they obtain the agreed "strike price". As a result, a generator may receive payments to "top-up" its electricity sales to the strike price; on the other hand a generator will be obliged to pay back money where the electricity reference price exceeds the strike price. Setting the strike price is critical as it needs to be high enough to encourage the development of low carbon energy

[109] EMR Draft Delivery Plan was published for consultation in September 2013

projects, but not too high that developers are over-incentivised, leading to a distorted market which is unsustainable in the medium to long-term.

The draft strike prices are limited to 14 broad technology types, which is less than the 35 bands of support under the Renewables Obligation. This indicates Government's certainty with respect to the sustainability of technologies, balanced against the need to avoid different prices

Capacity Market (CM) design proposals (June 2013) aims to cost effectively increase the amount of energy generation capacity to ensure supply security. It will provide a predictable revenue stream to capacity providers in Britain, which are not supported by CfD, Feed in Tariff or Renewables Obligation. It will be regular retainer payment to reliable forms of capacity (both demand and supply side), in return for such capacity being available when electricity supply is squeezed. This will reduce the threat of blackouts due to insufficient capacity on the system.

Table D1: The effect of EMR on the Solent

	Issues/ Risk	**Action for Solent**
CfDs		**Priority Actions/ Recommendations** The consultation invites views from interested stakeholders on Contracts for Difference (CfD) renewables strike prices and a Capacity Market reliability standard, to guide how much capacity is auctioned in the Capacity Market in 2014 and delivered from 2018–19. The energy strategy provides understanding of the potential for local electricity generation in Solent so that robust, credible and timely information and advice to support PUSH and Solent LEP to provide representations during the consultation of EMR via the Devolved Administration Consultation Group. This scheme will run in parallel with Renewable Obligation for the next 3 years. The proposed strike prices will be comparable to the support available under the Renewables Obligation. In this period new generators can join either scheme. In April 2017 the Renewables Obligation will close to new generators and will run for the next 20 years.
Draft strike prices are published. DECC intends to finalise Strike prices by December 2013	Ofgem's recent assessment that the probability of a supply disruption will increase from one in 47 years now to one in 12 years in 2015/2016 (or worse) highlights the urgency of putting the various strands of EMR in place. The Government identifies that the Energy Bill will receive Royal Assent by the end of 2013 and proposes to consult on secondary legislation for EMR implementation in October 2013.	
Position on various CfD contract terms is established. Work continues on the final form of CfD	Will the FiT CfD hit the mark with the published strike prices? Whilst initial reaction to the draft prices appears broadly positive, there is still missing information on CfD contracts and difference in contract lengths still leaves uncertainty over whether the support will match levels available under the RO. The question remains whether these prices will be sufficiently high to provide the confidence to attract the major investment needed to guarantee security of supply in future years.	
FID Enabling Programme		
Investment Contracts will be allocated based on evaluation for project deliverability and impact on industry development	There is also uncertainty around how useful Investment Contracts will be under the FID enabling process. In particular, Investment Contracts will be conditional on the Government obtaining EU State Aid approval. It is unclear how	
Applications for contracts will be		

	Issues/ Risk	Action for Solent
required by 6 September 2013	much certainty these contracts will provide for electricity generators and investors to reach a FID on a project until such approval is obtained.	
Capacity Market		
Electricity Demand Response will be eligible to participate subject to a pilot scheme	Success of pilot scheme and ability to avoid the need for peak generation plant and reduce the risk of hedging. Issues include: Access to finance – for some the cost of available capital may be too high to allow them to make electricity efficiency investments; Risk and uncertainty; Hidden costs – these are non-financial costs (including transaction costs) faced by consumers to undertake electricity demand reduction projects. For example, the costs of identifying reputable suppliers or shutting down production during installation; and Hurdle rate/ payback period – the rates of return which potential investors are looking for may not be achievable. This may mean many energy efficiency technologies, which are beneficial from society's viewpoint, will not be taken up.	
Renewables Obligation projects and interconnected capacity will not be eligible	Potential to limit the number of electricity generation options within Solent	
Pay-as-clear auction method is confirmed for contract allocation	The successful provider will be paid the clearing price set by the most expensive successful provider of that bid into the auction.	

D1.3.4 Green Investment Bank

The mission of the Green Investment Bank is to "to accelerate the UK's transition to a green economy and to create an enduring Institution, operating independently of Government[110]".

It has a "double bottom line" which means that their Green Impact and financial returns are equally important. They are a "for profit" bank, as this means the building of a sustainable bank, capable of making an enduring impact on the challenge of accelerating investment in the transition to a greener economy[111].

[110] http://www.greeninvestmentbank.com/who-we-are/default.html
[111] ibid

The overriding objectives of the Green Investment Bank include delivering:

- Sound finance with investments returns of 3.5% +;
- Green impact; and
- Demonstrating additionality.

Investments need to deliver a demonstrable green impact, financial return and leverage co-investment or demonstrate wider added value. This is likely to be in terms of addressing a market failure and delivering environmental, socio economic and financial returns across the UK.

The ability to deliver effective investments is vital to create a durable Green Investment Bank, once State aid clearance is reached with the EC. The investment pipeline is being developed with an initial £775 million of direct investment in 2012. Overall, the potential exists to invest up to £3 billion by 2015 when borrowing powers will be available subject to national debt falling as a proportion of GDP. There are a range of investment opportunities in the medium term across 15 broad sectors. The initial investment focus is within five technologies and sectors. These are waste processing and recycling, and energy from waste generation with up to £80 million of investment this year, alongside non-domestic energy efficiency, the Green Deal domestic energy efficiency scheme, and offshore wind projects.

D1.3.5 Solent Local Enterprise Partnership

Solent LEP – A Strategy for Growth was published in December 2012, this strategy identified 5 strategic priorities:

- Support new businesses, **enterprise** and ensure SME survival and growth;
- Focus on **infrastructure priorities** including land assets, transport and housing, reducing flood risk and improving access to superfast broadband;
- Establish a single **inward investment** model to encourage companies to open new sites in the region, supported by effective marketing;
- Invest in **skills** to establish a sustainable pattern of growth, ensuring local residents are equipped to take up the jobs that are created;
- Develop **strategic sectors** and clusters (interconnected groups and businesses) of marine, aerospace and defence, advanced manufacturing, engineering, transport and logistics businesses – establishing the area as a business gateway, both at local and international levels. A growth hub will be created; and
- developing the **enterprise zone**, supporting new and existing businesses as well as export-led growth in high-value services and employment. At the same time, the low carbon economy will be strengthened, reflecting the increasing importance of the sector to the Solent economy.

The strategy identifies energy in the context of its sector priorities identifying a competitive strength with respect to advanced manufacturing and engineering supplying renewable energy production product manufacturers. The Isle of Wight was specifically identified in this regard.

D1.3.6 Solent Skills Plan

In 2014, the Solent LEP published the Solent Skills Plan which identified 4 priorities:

- Priority 1: Support greater business engagement and skills brokerage to increase the pool of employers engaging with schools, colleges, universities and other learning providers, and providing work placements;
- Priority 2: Improve leadership and management skills to promote better employer investment in skills;
- Priority 3: Promote entrepreneurship skills; and
- Priority 4: Support innovation linked to skills.

Under Priority 4, there is a commitment to support a Graduate Innovation Placement which will support placements of between six and nine months focused on delivering projects that stimulate innovation within participating businesses. Graduate Innovation Placements will be targeted at the transfer of skills into the Marine, Maritime, Offshore engineering, Renewable energy, Low carbon transport and renewable technologies sectors will be particularly encouraged.

D1.3.7 Solent Strategic Economic Plan 2014

The Economic Plan progresses key priorities identified in the earlier strategy document. In this context, energy as a theme is treated as a market for priority production sectors where the Solent has a competitive advantage. The advanced manufacturing and marine cluster contributes £3.6 billion and £1.9 billion GVA to the economy respectively. The Plan does however identify an emergent strength in the environmental technologies sector as a growth area linked to existing expertise in aerospace, marine and advanced manufacturing. The opportunities for growth lie across a range of activities including energy generation and increasing energy, water and waste efficiency. The Plan also identifies an expertise within the Solent's universities.

In this context the Plan proposes to designate a portfolio of sites for a local Enterprise Zone on the Isle of Wight within Cowes and East Cowes and establish an Isle of Wight Infrastructure expansion fund to assist companies coming forward with suitable investment. The scheme will combine with other schemes to provide a comprehensive package to support the growth of the key strategic Solent industries of marine, aerospace, renewable energy and advanced manufacturing on the Isle of Wight.

The Plan also discusses priorities in relation to the Low Carbon Economy building upon Future Solent Strategy and capitalising upon world class research activities (such as the SMMI – part of the University of Southampton and the Solent Ocean Energy Centre) in the Solent. The Plan identifies the continued investment risk associated with many marine renewables; it highlights a rapid rise in marine fuel costs as a future threat to prioritised sectors.

The Plan identifies a need to support:

- New Low Carbon and Green Technology through capitalising on the world-class research in the sub-region into green technologies and turning these into business opportunities, growth and jobs as well as supporting strong manufacturing (see Marine Arrowhead projects, Marine Supplement);

- Resource Efficiency in Homes and Businesses through supporting with ERDF a Low Carbon Construction Hub to act as a centre of excellence for the development an adoption of low carbon construction, waste energy reduction and renewable energy production techniques across the Solent; and
- Developing large-scale renewable energy such as tidal and offshore wind, together with small scale on homes and businesses and renewable and district energy schemes incorporated into new development where practical.

The Plan also highlights the emissions associated with the production of 55,800 new homes and nearly 1.2 million square metres of new employment floor space that the South Hampshire Strategy envisages between 2011 and 2026 despite improvements in energy efficiency and standards.

D1.3.8 EU Structural and Investment Fund Strategy 2014 – 2020

This strategy covers the LEP's strategic responsibility for the delivery of £36.9m (€43.1 m) of European Social Fund (ESF) and European Regional Development Fund (ERDF) funding over the 2014 – 2020 period, alongside £2.49m (€2.9m) from the European Agricultural Fund for Rural Development (EAFRD). The strategy is designed to give clarity on how the Solent intends to use these resources and its expected impact in the context of the wider strategic priorities of the area.

In the period to 2020 the Strategy is intended to create an additional 15,500 new jobs in the Solent LEP area and achieve GVA growth of 3%. GVA per capita is expected to increase by £3,000 per head, to increase employment rates to 80% from the current 78%, and to improve economic activity rates from 80% to 81%. Additionally, birth rates are expected to increase from 3.6% to 4.1% (creating 1,000 new businesses) and to improve the business survival rate from 61.4% to 62.5%. The proportion of the population with qualifications at Level 4 and above will increase to 36% of the working age population from the current 32%, and to raise the education attainment rates to above the UK average. Finally, we aim to increase inward investment into Solent, attracting at least 5% of FDI projects entering the UK, and to improve productivity (GDP per head) closer to the South East average.

Under Activity 2: The Solent Business Growth Hub will *help businesses become more competitive by reducing their resource inputs through the adoption of renewable and low carbon fuels and by providing advice and support in energy efficient practice, e.g. designing out waste and the recovery of 'waste' heat energy.*

Under Activity 3: Access to Finance for Start-ups and SMEs priority is attached to **"***Developing a low carbon Maritime sector", with a* recognition that support may be necessary in risk areas like marine renewables. Similar priority is attached to energy efficiency.

Under Activity 4: Graduate Placements, the costs of graduates placed into industries including renewables can be subsidised.

Under Activity 5 Building Solent's Low Carbon Economy, research, prototyping and supply chain development will be supported along with support for Low Carbon Construction Hub to act as a centre of excellence for the development and adoption of low carbon construction, waste energy reduction and renewable energy production techniques across the Solent.

Under Activity 10: The Solent Jobs Pilot support will be provided for people not on the work programme but receiving Income Support, ESA or JSA with health conditions to access work. A priority will be attached to work in environmental remediation and carbon reduction. Recognition has been given to the possible link with the Energy Company Obligations/Green Deal retrofit and insulation programmes.

D1.3.9 The Green Deal

The Green Deal, launched January 2013, is a government initiative that is designed to help business and home owners to employ more green technologies in their properties. It allows new green technology to be added to a property with no up-front costs, instead the cost will be paid back the costs through energy bills over a period of time. The Green Deal will allocated between £6,500- £10,000 per property, with the longest re-payment period being 25 years. The Green Deal will provide funding for loft insulation, solid wall insulation, cavity wall insulation, and micro-generation like solar panels, wind turbines and heat pumps. The Solent Green deal has funding from the Energy Companies Obligation (ECO) is a £1.3 billion programme channelling funding from the big energy companies to help those most in need.

D1.4 Hampshire County Council

Hampshire Energy Strategy (November 2012) includes plans to invest in local energy projects which fosters economic development through sustainable long term generation and increases energy security. It also plans to integrate energy generation and infrastructure by supporting the development of Local Plans approaches and the interpretation of these policies across Hampshire local planning authorities. Also plans to consider the role of Hampshire County Council-owned land in energy generation, though wind farms have been banned on Council owned land.

D1.5 PUSH

The PUSH Energy and Climate Change Strategy aims to reduce South Hampshire's dependency on fossil fuel supply, facilitate local energy networks, tackle carbon reduction requirements in line with national and international targets, and facilitate the introduction of renewable and low carbon energy supply.

The South Hampshire Strategy, October 2012, policy 18 states that 20% of all electricity is to be generated from renewable sources by 2020 across South Hampshire as a whole. To meet this goal planning policies should be positive to renewable energy generation to encourage renewable projects in the area.

D1.6 Southampton & Portsmouth City Deal

The combined City Deal[112] agreed in 2013 takes forward many of the themes contained in the LEP strategy documents with a strong focus on the development of the maritime industries cluster. The focus of the project is the unlocking of two key sites - the Watermark West Quay site in Southampton and Tipner-Horsea in Portsmouth. The intention is to deliver:

- Over 4,700 permanent new jobs particularly focussed in marine, maritime and advanced manufacturing sectors;
- Over 13,000 construction jobs;
- Unlock 107,000 square metres of new employment floor space with a focus on supporting growth in the marine, maritime and advanced manufacturing sectors;
- Support small and medium enterprises to grow through better business support over the next three years;
- Provide £115m of local and national public sector investment;
- Lever in over £838m of private sector investment into the area through site development, skills and unemployment schemes and business support services; and
- 2,370 new homes.

Whilst the City Deal has no specific references to energy, there is a potential to include an energy component in the delivery of services to the key sites or in the development of energy industries.

D1.7 District Authorities

D1.7.1 New Forest

The Council has created the New Forest Core Strategy (Local Plan Part 1) which states that new development required to demonstrate high standards of energy efficiency, with micro-generation of renewable energy of at least 10% (10+ units). The New Forest also has a Sites and Development Management Plan Document (Local Plan Part 2) which gives renewable energy schemes significant weight, provided they avoid unacceptable impacts on nature conservation designations, landscape, residential amenity and road network. The Plan also promotes alternative energy uses for the former Fawley Power Station.

D1.7.2 Test Valley

Test Valley Borough Local Plan (2006) states that proposals for renewable energy schemes will be permitted as long as they do not adversely affect ecological, historic and cultural features, the effect on local land use is minimised and it does not have a detrimental impact on the immediate and wider landscape.

[112] https://www.gov.uk/government/publications/city-deal-southampton-and-portsmouth

Any impacts on the environment will be weight against wider environmental benefit like a reduction in GHG.

D1.7.3 Winchester

Winchester Council has developed a Low Carbon Route Map, 2013, which aims to support the growth of the green business sector. It also aims to increase external investment in the renewable energy sector by removing barriers, exploiting all financial support and encouraging community, domestic and commercial investment.

D1.7.4 East Hampshire

East Hampshire Local Plan (Second Review, 2006) has the Policy E1 which allows panning permission will for renewable energy generation as long as there are no effects on the AONB, public highways or the amenities of neighbouring occupiers.

They have also drawn up a New Joint Core Strategy (which is currently awaiting the Inspector's response) which contains policy CP22 for sustainable construction, ensures that developments meet the minimum Code for Sustainable Homes, that 10% of energy demand us from decentralised and renewable and low carbon sources and that developments provide sufficient land or funding for a waste management infrastructure.

Whitehill & Bordon Eco-Town is a planned new town in East Hampshire. The town's vision is to be carbon neutral by 2036 and so there is a recognition of the need for new low carbon supplies of heat and power.

D1.7.5 Havant

The Havant Local Plan (Core Strategy, 2011) contains policy CS14, which states that planning permission will be granted for development that 'Locally contributes to the delivery of the PUSH target of 100MW of renewable energy by 2020 for the whole of the PUSH area. Major areas of development must ensure that their on-site renewable energy production is maximised and resource efficiency is maximised'. All major levels developments (greater than 250 houses or 5,000 square meters of non-residential floor space) will have to produce on-site renewable energy.

D1.7.6 Gosport

Gosport Council, as set out in the Home Energy Conservation Act 2013, aims to promote and encourage renewable energy where possible.

Gosport Local Plan, 2006, states that the Council is in favour of renewable energy generation as long as they are of an appropriate scale and design and there are no adverse effects on areas of historical, archaeological, ecological or landscape importance (Policy R/ENV15).

D1.7.7 Fareham

The Fareham Core Strategy (adopted by the Council in August 2011) states that all new developments should maximise the use of renewable or low carbon energy sources. This is to be found particular from large schemes to help meet the PUSH target. Fareham Council has set a target of 12MW of renewable energy by 2020. It also states that the council will explore the potential of major development sites to introduce a CHP system. It is hoped that the Welborne Strategic Development Area will also make a contribution towards meeting the sub-region's targets for generating renewable energy, due to the scale of the development. Strategies relating to Welborne will be set out in Local Plan Part 3.

The Local Plan Part 2 (Development Sites & Policies) and the Local Plan Part 3 (Welborne Plan) have both been submitted and due for public examination in October/November 2014. The Local Plan Part 2 includes a Policy (DSP56) which encourages renewable and low carbon energy, and sets parameters for assisting applications. The Local Plan Part 3 includes a policy on energy (WEL36) which requires developers to optimise energy efficiency and "secure energy supply, maximising the use of low or zero carbon technologies including district energy networks".

D1.7.8 Eastleigh

Eastleigh does not charge planning application fees for renewable energy schemes. This is lead to solar PV installations, new CHP schemes and wind turbine applications. Solar farms have been built in Eastleigh and the council has retrofitted its buildings with PV panels.

Eastleigh Borough Council's Local Plan (2011) states that planning permission will only be granted for proposals which ensure sustainable construction minimise energy demands and maximises the proportion of energy that is generated from renewable sources. It also states that 'the Council would, in principle, support the provision of facilities which generate heat and power from renewable resources, provided that such proposals meet the requirements of the policies in the Local Plan.'

D1.8 Unitary Authorities

D1.8.1 Portsmouth City Council

Portsmouth Climate Change Strategy has stated that a higher proportion of energy used within the city will come from renewable and decentralised sources and that renewable and decentralised energy installation, both domestic and commercial, will be developed around the city.

The Portsmouth Plan, adopted in January 2012, includes a Sustainable Development Policy to maximise passive solar energy, contribute to the provision of renewable energy and the carbon neutrality of Portsmouth. However it also states that as the city is densely built up site for larger renewable energy generation projects are limited. Suitability of sites will be explored through Site Allocations DPD, they will be allocated with specific criteria to address any adverse impacts.

Portsmouth City Council - Southsea Town Centre Area Action Plan has been adopted in July 2007. This states that developments should incorporate renewable energy techniques into the building or be able to source energy from renewable sources, be designed to make use of passive solar design.

D1.8.2 Southampton City Council

Southampton City Local Plan, 2010, policies encourage the use of renewable energy resources to secure diverse and sustainable energy generation within the city. Thus the use and development of renewable and alternative sources will be permitted providing they do not have a negative impact on nature conservation sites, areas of landscape designation or water resources. Types of renewables particular mentioned are photovoltaic, CHP and Geothermal energy.

D1.8.3 Isle of Wight Council

One of the key drivers for the Island Plan[113] is to create sustainable economic growth and regeneration by ensuring sustainable patterns of employment development. Policy SP6 Renewables has a target of 100 MW of on-shore installed capacity, from schemes which will also be expected to contribute to the economic development. The Plan aims to provide renewable energy sources; both domestic scale, across the island, and medium and large scale, outside AONB, are suggested.

The renewable energy target can be met through the following potential minimum contributions from a range of proven technologies:

- At least 22.5 MW from wind;
- At least 15 MW from photovoltaics;
- At least 7.4 MW from waste; and
- At least 6 MW from biomass.

It is expected that the remaining 50 MW capacity will be met from a combination of smaller scale and domestic installations, schemes granted permission but not yet built and schemes using imported fuels.

The Council will support large-scale heat projects where they can demonstrate sufficient benefit to the Island and/or help to reduce the carbon emissions from existing housing and commercial buildings.

The renewable technologies report in the Isle of Wight Area of Outstanding Natural Beauty (July 2010) has considered in detail the types of renewable generation suitable in the area. It found that small scale production from ground and air sourced heat pumps, PV, solar water heaters, domestic biomass, micro-hydro, public building biomass, and anaerobic digesters on farms would not adversely impact the area. It also found that large scale renewable generation would not be suitable in the area.

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[113] Island Plan, Isle of Wight Core Strategy (including waste and minerals) and development management development plan document.

Appendix E

District Heating Options

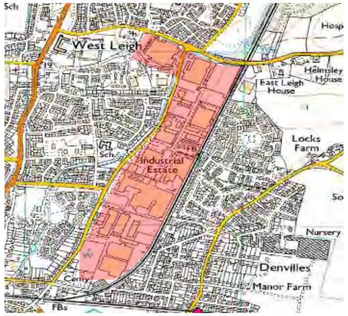
E1 District Heating Options

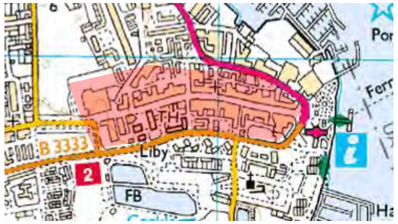
	Scheme	Image	Description	Scheme Details		Further Observations
Southampton	Scheme 1: University		The University of Southampton is located to the North of the city centre	Heat Consumption: CHP Size: CO2 Savings:	35,000 MWh/year 16.0 MWth 4,610 tonnes	Form a broad view of the Southampton heat map, the University does not appear to be close to any new housing development sites. It is close by a sports centre and a school.
	Scheme 2: City Centre and Docklands		The Docklands lie alongside the River Test and comprise of factory buildings, hotels, a leisure centre and swimming pool. The identified area of Southampton city centre includes university and hospital buildings, a number of schools and colleges, and town centre commercial and retail units.	Heat Consumption: CHP Size: CO2 Savings:	62,439 MWh/p.a. 28.5 MWth 8,225 t	The town centre poses a good opportunity for CHP since the heat demand density is high. Much of this area is bordered by the River Itchen and existing residential areas thus prohibiting extending a heat network further afield.

Portsmouth	Scheme 1: Anchorage Park and Works		Anchorage Park and nearby works areas are located between a canal and salt marches and a residential area to the Northwest of Portsmouth town centre.	Heat Consumption: CHP Size: CO2 Savings:	17,212 MWh/year 7.9 MWth 2,267 t	A sports centre is close by this industrial area which may have potentially be viable to connect to heat network. 1 or 2 kilometres West area, 3 sites identified for new housing development; Sites 27, 28 and 29 comprise 3,600 new dwellings. Since this area is surrounded by water or housing, it is unlikely there are any additional opportunities.
	Scheme 2: Dockyard and Town Centre		Several large buildings and organisation area located in the town centre including university buildings, Portsea and HM Naval Base, schools, colleges, offices and retail units, museums and tourist attractions.	Heat Consumption: CHP Size: CO2 Savings:	35,692 MWh/p.a. 16.3 MWth 4,702 t	With the whole town centre encompassed, a very large heat demand within a relatively concentrated area poses a good potential opportunity for CHP.
Eastleigh	Scheme 1: Leisure Centre (with existing CHP) and Industry		To the East of the M3 motorway there are several large buildings. These include a sports centre, school and college, fire brigade headquarters, and an industrial works area.	Heat Consumption: CHP Size: CO2 Savings:	11,636 MWh/year 5.3 MWth 1,533 t	This identified area encompasses much of the heat demand in this area. There are no planned new residential developments nearby that are apparent at the time of this study.

	Scheme 2: Industrial Estate		A relatively small industrial estate on the West of the centre of Eastleigh lies in the midst of a residential area.	Heat Consumption: CHP Size: CO2 Savings:	9,590 MWh/pa 4.4 MWth 1,263 t	The surrounding area appears to be an urbanised residential district with a relatively low heat demand density. No further connection opportunities are obvious. As stated above, no plans for new development is apparent either.
	Scheme 2: Ageas Bowl		To the north is the former Moorgreen Hospital. To the south, there are several commercial sites including the Ageas Bowl stadium, Holiday Inn Express, Virgin Active Health Club and the new Hilton Hotel at the Ageas Bowl.	Heat Consumption: CHP Size: CO2 Savings:	1,872 MWh/year 0.9 MWth 247 tonnes	The hospital appears to be the only high heat demand in this area on the same side of the M27 motorway. On the other side of the motorway there is an industrial estate and superstores approximately 1.5 km away. Eastleigh Borough Council has been awarded HNDU funding to carry out a feasibility study of the site.
Fareham	Scheme 1: Fleetlands		Fleetlands industrial area is located to the Southwest of Fareham. It can be seen from the OS map that this site consists of an indoor karting warehouse and other industrial units.	Heat Consumption: CHP Size: CO2 Savings:	11,514 MWh/pa 5.3 MWth 1,517 t	Water and residential areas make up the most of Fleetlands' surrounding areas. Further to the West of this site there looks to be more industrial and warehouse units. New development sites are not located nearby so connection opportunities look to be limited.

					It should be noted that this area crosses the boundary between Fareham and Gosport, with Fleetlands being in Gosport and the larger parts of the scheme Newgate Lane Industrial Estate and HMS Collingwood within Fareham.
Scheme 2: Segensworth Industrial Estate		Titchfield Park works is made up of industrial works building and offices and a hotel. This site lies to the West of Fareham.	Heat Consumption: CHP Size: CO2 Savings:	21,028 MWh/year 9.6 MWth 2,770 t	Plans for 10,000 new dwellings are identified on heat map 14 for this area. These are located 2 – 3 kilometres from Titchfield Park and at may be feasible to incorporate this as a single scheme. This scheme could also, theoretically, extend over the A27 to include further industrial areas and, if possible over the M27 to include Whiteley's Solent Business Park (in Winchester).

	Scheme 3: Town Centre		Within this identified area of the centre of Fareham there are hospital, school and library buildings and an industrial park and town centre office and retail units.	Heat Consumption: CHP Size: CO_2 Savings:	6,951 MWh/year 3.2 MWth 916 Tonnes	This town centre in a densely populated heat demand area which could lend itself to a heat network scheme. Adjacent to the town centre is the identified area for 10,000 new dwellings. This may also be a very good opportunity to be incorporated as part of a larger scheme. There is also potential to include further industrial areas to the north west of the boundary on the map, to include Fort Fareham and Palmerston Business Park.
Havant	Scheme 1: Industrial Estate		This industrial area to the West of Havant lies alongside the railways line.	Heat Consumption: CHP Size: CO_2 Savings:	18,179 MWh/year 8.3 MWth 2,395 Tonnes	A health centre, college and police station are located close by this industrial estate and may be significant heat demands that are viable to connect to this scheme. New development Site 33b of up to 2,200 new dwellings is also shown on heat map 15 to be in the same approximate location as the nearby health centre.

Gosport	Scheme 1: Hospital		The hospital and Immigration Removal Centre are located on the East side of Gosport overlooking the sea.	Heat Consumption: CHP Size: CO2 Savings:	15,595 MWh/year 7.1 MWth 2,054t	The buildings within this small area comprise a significant heat demand, presenting itself as a good CHP opportunity. There do not appear to be any further buildings for which to connect to this scheme.
	Scheme 2: Town Centre		To the North lies town centre offices and shops, and a library and town hall.	Heat Consumption: CHP Size: CO2 Savings:	15,429 MWh/year 7.0 MWth 2,032 t	This again appears to be a high heat demand in a relatively small area. No further connection opportunities are apparent mainly due to the fact that a marina surrounds it.

In addition to the opportunities outlined above, it is worth noting that the Isle of Wight Council has also undertaken a heat mapping study[114]. The study concluded that there are no obvious areas to suitable to install large scale district heating into existing developments as a stand-alone project, due to a lack of heat demand. However, it was recommended that new developments, particularly large housing developments greater than 250 units or 18,000m^2, are likely to be suitable. New commercial and industrial developments, of more than one building, schools, hospitals and prisons may also be suitable if economically viable.

Other district heating schemes are also under consideration, these include the Southampton Thornhill District Energy Scheme[115], covering 1,050 residents, and Daedalus Enterprise Zone, where the Supplementary Planning Document[116] makes provision for an energy strategy for the site, based around a district Combined Heat and Power network.

[114] Grontmij for Isle of Wight Council Renewable Energy Isle of Wight: Isle of Wight Heat Mapping, , August 2010
[115] www.apse.org.uk/apse/assets/File/Colin%20Rowland.pdf
[116] Gosport Borough Council, *Daedalus Supplementary Planning Document*, October 2011

Appendix F

Content of Electrical Supply

F1 Fuel mix support electricity consumption

The consumption of electricity in the Solent is a function of the fuels used to create it for unlike most fuels consumed like gas and coal, electricity has to be made and normally consumed at the same time (batteries consume electricity to store as chemical energy). The fuels used to create electricity have changed over time.

In 1970, coal accounted for about two-thirds of all electricity. Last year, it accounted for less than half, although for a number of years prior to that it made up one-third.

Apart from a sharp dip in the mid-1980s because of the miners' strike, coal use fell most dramatically during the 1990s. It has actually made something of a comeback in the past four years as the price has fallen, in part due to cheap imports from the US.

Oil use has also fallen sharply, from more than 13 million tonnes in 1970 to just 780,000 tonnes last year.

The big fall in coal and oil use in the 1990s was because of the so-called dash for gas, which was underpinned by cheap North Sea gas and the privatisation of the electricity market.

For fossil fuels, the conversion efficiency of power stations is about 40%-65%, depending on the fuel type - in other words, only half the energy stored in the primary fuel ends up as electrical energy. On top of this, power stations consume some energy themselves, while more still is lost during transmission over the national grid.

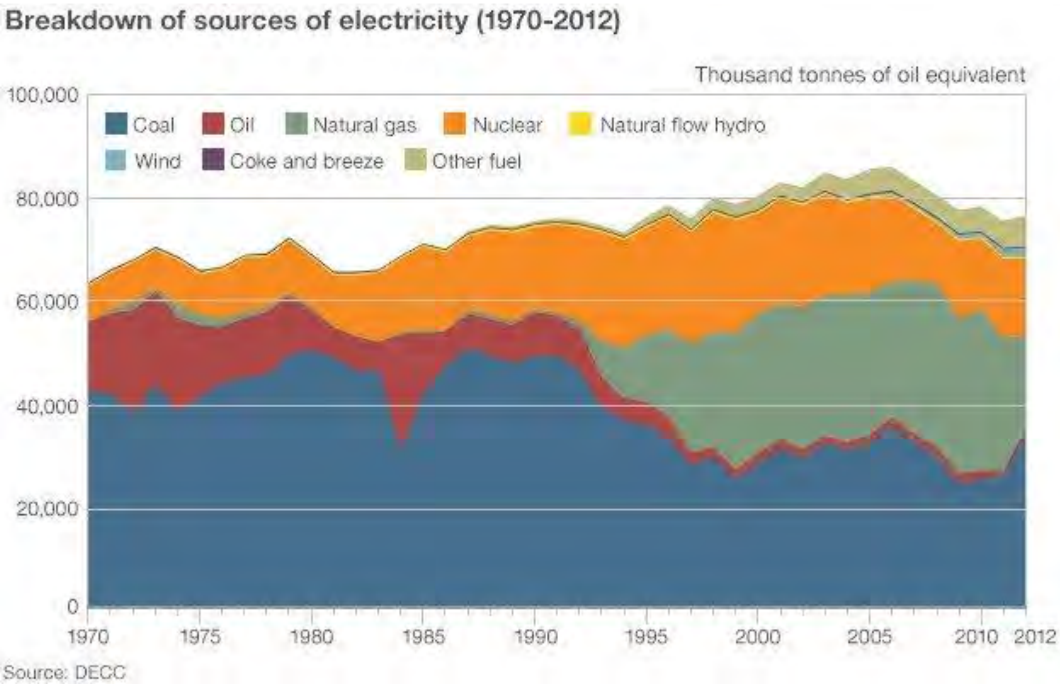


Figure F.1: Sources of electricity – primary energy units 1970 to 2012[117]

[117] http://www.bbc.co.uk/news/business-24823641

Despite the recent resurgence of coal, DECC expects its use in electricity generation to fall sharply over the next 10 years.

But it does expect coal and gas-fired power stations fitted with carbon capture and storage (CCS) - designed to siphon off CO2 and bury it underground - to start producing electricity in 2017. Some would argue this is rather optimistic given the fact there are no large-scale, fully operational CCS stations in the UK.

In the short term, DECC believes natural gas and renewables - such as wind and solar - will take up the slack, with renewables taking an ever greater share over the next 20 years. By 2030, it expects renewables to be by far the biggest source of energy used in electricity generation, making up about 40% of the overall mix.

In the late 2020s, nuclear is also set to contribute more as the UK's new generation of nuclear power stations comes online.

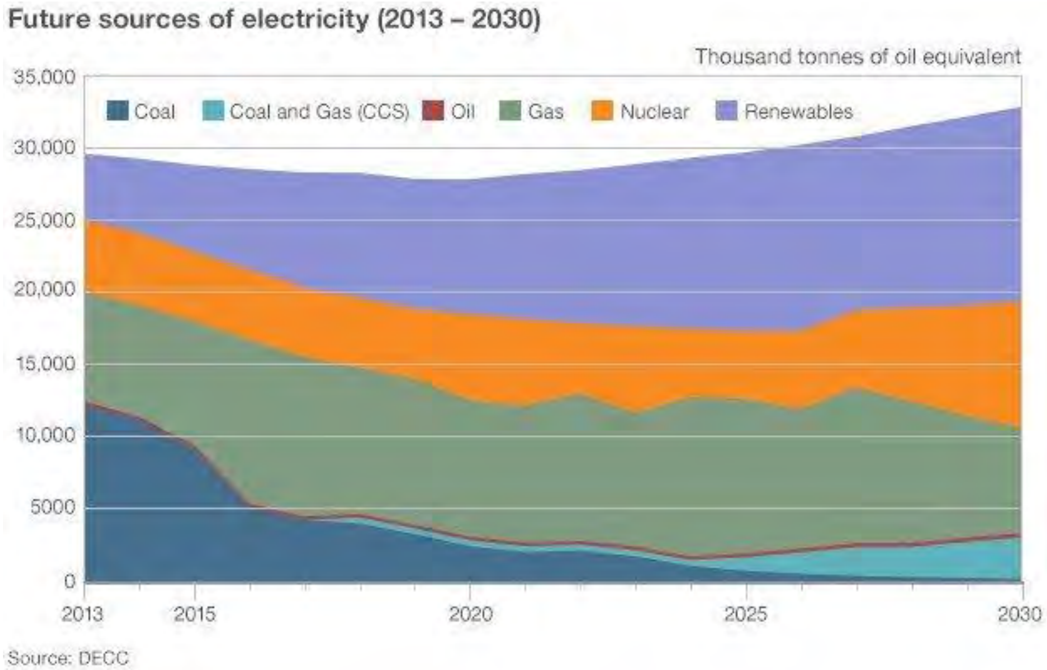


Figure F.2: Future Sources of Electricity 2013 - 2030[118]

[118] http://www.bbc.co.uk/news/business-24823641