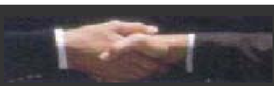
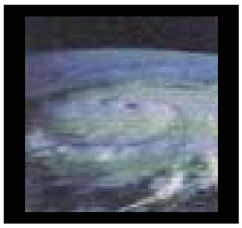
Technology & Funding



Alan Brewer MSc. Grad.MCIWM - Climate Change Mitigation & Sustainable Energy Director



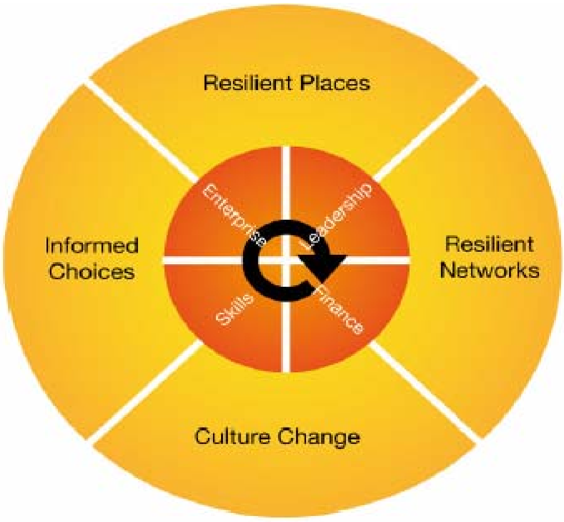
Scottish and Southern Energy

British Gas

The E.ON Energy Experience

Hampshire County Council

Mike Fitch – Property Services



New Build Developments

Guide to the Building Integration of Renewable and Energy Efficient Technologies

"Resource Ownership"

- Sustainable Energy in Schools
- Strategic Energy Company Partnership
- Large Scale biomass energy generation for Major Development Areas (MDA's)

26th September 2008

Sustainable energy in schools,

Strategic Energy company partnership &

large scale biomass energy generation in Hampshire County.

CONTENTS | Page

The Climate Change Challenge

Groundwork's One World Schools:

helping deliver the sustainable schools framework

GROUNDWORK
CHANGING PLACES
CHANGING LIVES

ONE WORLD SCHOOLS

"Climate change is emerging as a major challenge for modern society. Government, business, and wider society will all be affected and all have a role to play in tackling it."

(Professor Michael Grubb - Associated Director of Policy, the Carbon Trust - Visiting Professor of Climate Change and Energy Policy, Imperial College, London)

Foreword

This report is meant as an aid to discussion and is by no means definitive. This guide will help the County Council of Hampshire and developers achieve their Low Carbon sustainable energy aims and CO_2 reduction targets. This report will attempt link two other recent reports, indicated below submitted by ARUP and CEN to the aspirations of the Council. Hampshire could, in time take the lead in the UK as a guide for all Counties to follow in reaching a Low Carbon Economy through the adoption of the "Resource Ownership" concept. Council's are here to take Governance over and for the people within their boundaries so take governance over the energy resources within that boundary – biomass, solar, wind water, geothermal – this goes beyond the aspirations of "The Merton Rule".

Concept: Hampshire County Council (HCC) and all Councils in Hampshire Consider "Owning Renewable Energy Resources" within their boundaries of Authority and to obtain revenue streams from Renewable Energy generation in the County. Take control over resources, minimise risk and manage the renewable energy in the County together with controlling the movements of biomass within the boundary of Hampshire and generation of renewable energy in the County.

Havant Borough Council

PUSH Energy and Climate Change Strategy

Feasibility of an Energy and Climate Change Strategy

+

Link

Concept, Grants, Funding & Technology

PSECC

This initial report is submitted following a request from Mike Fitch Head of Property Services at Hampshire County Council at a meeting in May 2008 at Three Minsters House, Winchester Hampshire. Resource Ownership will enable Hampshire County Council (HCC) to commence the Low Carbon building blocks in the County.

This will be achieved initially by the Energy Savings Trust - Energy Certification for the "SUSschools" programme in Hampshire headed by Gill Hickman at Ringwood School, Jane Pownal at the Minstead Study Centre, the Department for Children, Schools and Families (DCSF) and their Sustainable Schools Framework (2006) the Secretary of State for Education, the Rt Hon Alan Johnson MP has set out challenging long-term aspirations for schools to mainstream learning about sustainable development issues and sustainable practices into everyday school life, Grants, Salix finance and additional assistance in any shortfall from the Cooperative Bank.

"We have been mindful of the importance of keeping any financial outlay and borrowing by HCC to a minimum and in order to achieve this close liaison is being maintained with the Carbon Trust (LCBP), SALIX, cooperative bank funding packages, who for example have just funded one hundred schools renewables initiative in the UK with the assistance of the Carbon Trust, and Scottish & Southern Energy. Additional revenue streams from Biomass Energy plants in the County can be achieved together with energy efficiency savings in the County, which can aid renewable energy developments.

Agreement has been obtained, if required from Scottish & Southern Energy that any costs associated feasibility studies for renewables in Major Development Area's such as the Waterlooville MDA can be met by their company."

The exact nature of any commitment to a partnership approach to Energy Services Company (ESCO) with a Utility company such as SSE and e.ON will of course be worked up and agreed to by HCC.

Energy efficiency and renewable energy technology provision from PSECC/ HNRI consortium will result in upto 40% savings on energy use in HCC property and commence renewable energy generation in the County. Scottish & Southern Energy are the preferred utility company for any partnership as they are currently working up proposals for consideration by Mike Fitch & HCC in MDA's for renewables and have already given much support t this potential initiative. E.ON have also given good support and offer a sound environmental educations software packages for school children – energy efficiency and global warming concerns, British Gas had supported the initiative, however have shown no real continued commitment.

The UK Government announced recently in September an additional £100 billion investment in the UK Renewable Energy market, which will aid this process for Hampshire.

Three key areas were identified as points of focus for this report:

1. Sustainable Energy in Schools
2. Strategic Energy Company Partnership
3. Large scale Biomass energy generation

Significant aid has been given from Sustainable Energy Installations Ltd, Carbon Trust, Scottish & Southern Energy (SSE), e.ON, PMSS Ltd, Steven Duncan of the HCC – HCC Sustainable Business Partnership, together with iTPower Ltd Broag-remeha, Sabien technology systems and the Cooperative Bank. Meetings have taken place already with following key HCC personnel to gauge their requirements and concerns: Bob Wallbridge (Capital Projects), Chris Millett, Jonathan Rou (Woodland manager), Tom Vosper CEN, Christine Watkins CE Southampton tEC, John Puddephatt Cooperative Bank, Gill Hickman of Ringwood and Ciara O' Conner of the Carbon Trust.

PSECC have been invited by the head of the "SUSschool" school programme of fourteen schools in Hampshire - Gill Hickman of Ringwood school to assist and aid them with their energy efficiency & renewable energy developments, grants and funding. It is the intention of PSECC to work closely with SUSschool and HCC in the provision to the fourteen schools in our pilot project and eventually all 528 schools in Hampshire, if required by HCC of Renewable Energy technologies, grants and funding.

Recommendations are to utilize the following Utility companies in the areas indicated:

1. Sustainable Energy in Schools………………………….e.ON & SSE
2. Strategic Energy Company Partnership……………..….. Scottish & Southern Energy
3. Large scale Biomass energy generation for MDA's…. Scottish & Southern Energy

British Gas are able to offer grants for all renewable energy technologies in the Carbon Trusts Low Carbon Building programme, however have not been supportive of this initiative.

Carbon Reduction Commitment

To achieve a Low Carbon Economy then a cultural change will be required, informed choices and informed choices made for a sustainable "way forward", increasing the possibility of HCC borrowing capacity for the progression of renewable energy projects will be required in the County. The result will be a resilient Low Carbon Hampshire with a significant CO_2 reduction possible of 40% by 2020 and widespread renewable energy generation.

Hampshire County council have made a commitment to the Carbon Reduction Commitment, likely to come into force in 2010, (CRC) is a new scheme announced in the Energy White Paper 2007, which will apply mandatory emissions trading to cut carbon emissions from large commercial and public sector organisations by 1.2 million tonnes of carbon equivalent/year by 2020.

Each of the principal sectors of the County Council's estate could result in 40% cost & CO_2 savings on energy with additional revenues from renewable energies for the schools, Hampshire County Council property and all PUSH Council's in Hampshire. In addition HCC could become a part equity partner in Biomass Energy plants, wind turbines, solar arrays and all other renewable energy technology projects with revenues streams obtained over a typical project life of 25 years. The above Resource Ownership concept could be coupled with the "Merton Rule" procedure.

PSECC - some network members:

Project Management & Support Services (PMSS)
Southampton Environment Centre (tec)
British Gas- New Energy Team
Creative Environmental Networks (CEN)
Forestry Commission – Biomass supply
Broag – remeha Ltd – woodchip & wood fuel boilers
Scottish & Southern Energy plc – MDA & ESCO formation
e.ON – Schools educational software packages
Vital Energi Ltd – district heating infra-structure
Eco-Securities Ltd / Klimat controls
Groundworks trust
Co-operative Bank – CFS – funding @ 1% to 2% above base
Carbon Trust – energy Audits
Carbon Trust - Low Carbon Building grants &
Carbon Trust – SALIX funding @ 0%
iTPower – SEI-Energy Installations Ltd Solar PV
Solar Home Energy Ltd / Southern Solar Ltd – Solar Thermal
Marine Current Turbines Ltd – water turbines
GEWind Ltd – Wind Turbines
Thames Valley Energy (TV energy) Ltd - Biomass
Sabien Technology Systems Ltd – Boiler controls
Tolbotts Ltd – Biomass equipment
Compact Lighting Ltd – high energy efficiency lighting
Business Link Hampshire & IOW

PART I **SETTING THE CONTEXT**

Chapter 1: Introduction - concept

A possible Carbon Reduction Commitment (CRC)

1.1 Background to the Proposed Options

Following the recent submission of a policy and strategy report to HCC cabinet concerning the introduction of new climate change legislation by Mike Fitch on the 31st March 2008, this additional report is submitted as a possible means of assistance and consideration for action.

Concept: "Resource Ownership" Hampshire County Council Resource Ownership (RO)

HCC – RO - Concept proposed to Bob Lisney of the HCC (HNRI) in June 2004: A copy of which has already been given to Mike Fitch in June 2008 to aid decision making and continuation of the HNRI programme aspirations highlighted in the energy network coordination by Alan Brewer.

(i) PSECC – Portsmouth Sustainable Energy & Climate Change Centre, formed in 2008 from the work with the HNRI – Renewable Energy network member companies, formed in 2002 would like to propose to Hampshire County Council (HCC) and Hampshire Natural Resources Initiative (HNRI) that HCC and all Councils in Hampshire Consider Owning Renewable Energy Resources within their boundaries of Authority and to obtain revenue streams from Renewable Energy generation in the County and energy efficiency measures.

(ii) HCC & HNRI & each respective Council in Hampshire consider the financial aid that can be given to them from PSECC with reference to Renewable Energy Project funding provision and grants. This will enable the respective Councils to ensure that property, lighting, schools and each Major Development Area (MDA) within their boundary can be provided with the funds and technologies to incorporate Solar PV & Solar Hot Water systems, Wind & Water Turbines, Biomass & Energy Crop - Energy Plants and District Heating within the MDA's.

Renewable Energy Resources under consideration are as follows:

Solar

Biomass

Geothermal

Wind

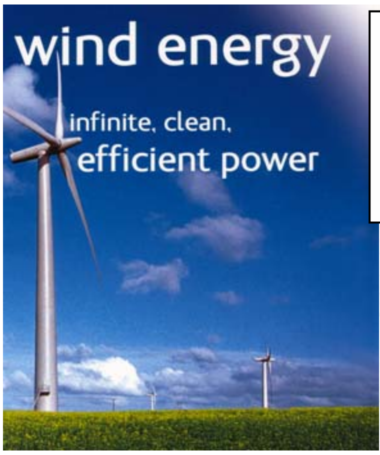
Water

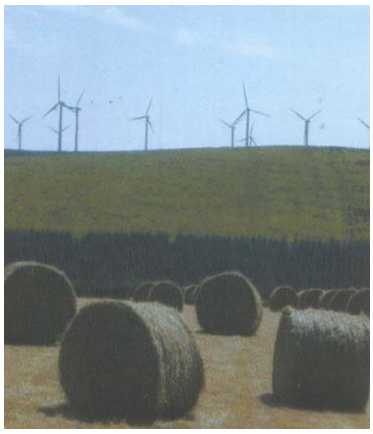
Energy from Waste

District Heating – infrastructure for MDA's

Care must be taken in the particular choice of Biomass technology and scheme adopted: Anecdotal market information would be the Wick CHP scheme where the wood gasification technology is presenting real credibility and economic challenges. Also, at the zero carbon end of market, Arup OJEU'd out for wood gasification at Heart of East Greenwich project that would have resulted in dumping 90% of generated heat into the Thames, just to achieve neutral import/ export site electricity generation - this didn't make carbon sense so backing given to gas CHP non compliant, Arups have since followed this route.

Hampshire County Council & Local Council's Resource Ownership Concept & Renewable Energy proposals for Major Development Areas (MDA's) in Hampshire





Your Energy
Our Future

ECO SECURITIES

7.4 Local Centre

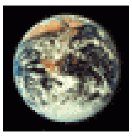
The local centre is intended to act as a focal point for the new community. It is expected to provide a limited range of shops ar services, including a small convenience store and community facilities, to serve the needs of residents of the MDA.

INTERNATIONAL MERCANTILE Group

Illustration of a Local Centre Gateway: Based on the Option 2 layout

ATKINS West of Waterlooville Major Development Area : Masterplan Framework Options

International Agenda 21 Ltd



& IMGroup

Sustainable Development Consultants Renewable Energy

IMGroup :
London Offices: 35 Grovenor Square, London SW1.

Author - Alan Brewer MSc. GradMCIWM - 12th February 2004 – 2pm - HNRI Energy Network meeting - Wessex Room - Hampshire County Council, Winchester,

EXECUTIVE SUMMARY of above report in 2004

Hampshire County Council's Renewable Energy "Resource Ownership" is the concept recommended to the Hampshire Natural Resources Initiative (HNRI) as a means of the promotion of Renewable Energy project developments in the County of Hampshire and to create revenues streams back into County Environmental Strategy programmes. No Blue Print exists for delivering Sustainable Development, however of the Resource Ownership is seen as a possible contender for Sustainable Energy use in Hampshire County Communities.

In the South East of England there are currently fourteen schemes for delivering 38 GWh of Renewable Energy of Electricity and by 2010 the potential currently identified for exploitation is one hundred and forty schemes with Solar PV which could generate 2019 GWh. The potential Renewable Energy deployment by 2010 for Hampshire & the Isle of Wight - installed capacity is estimated as the following: Biomass Combustion up to 60MW, Biomass Anaerobic Digestion - 2.5 MW, Onshore Wind 49 MW and Solar PV set at 3.1 MW - Total deployment being 115 MW by 2010. It is proposed that HCC establish a Limited energy company - possibly called Hampshire Energy Ltd. This company could obtain funding from International Mercantile Group Ltd (IMGroup) in order to develop and own Renewable Energy Technologies such as: WIND Turbines, Solar Photovoltaic's, Energy Crop Energy Plants fuelled from Miscanthus Grass and Coppiced Willow.

The reasons for HCC to Own Renewable Energy Resources are four-fold: a) Compliance with the EU - Renewable Energy Directive which sets out a 10% gross electricity consumption & production by 2010, b) to comply with and promote the HCC Structure plan policies E3-E5, c) to control Renewable Energy Developments in the County and d) obtain long-term financial revenues from the Renewable Energy Technologies. The Sustainable Energy programme example of Woking Council and the work of Allan Jones from 1992 onwards has resulted in Energy consumption savings of 43.8% (170,170,665 KWh), Carbon Dioxide Emission Savings of 1.5% (96,588 Tonnes).

Woking and more recently Essex County Council have set a precedence for other Councils to follow as the Council has established an Energy Company called Thameswey, which has been funded by Dutch Pension funds. It is once more recommended to HCC to establish a similar Energy Company - to be funded from UK funds arranged by IMGroup. The HNRI have formed a Renewable Energy Consortium of over twenty eight Environmental Based companies who can come to the aid of HCC and all other Councils in the County and offer Renewable Energy Technologies, Sustainable Development products and services together with Private financial packages.

The HCC Structure plan indicates for between 1996 - 2011 a Baseline Housing development in the Major Development Areas (MDA's) of 80,290 homes and a Reserve provision for a further 14,000 homes in the period between 2001 - 2011. It is proposed that each of these new homes should have Solar PV & Hot Water systems, Renewable Energy supplied by Wind Turbines, Energy Crops fuelled by Miscanthus Grass & Coppiced Willow. As a result of the HNRI Energy Network development since it's launch in September 2001 twenty Farmers in the North of Hampshire have expressed keen interest in the HNRI programme and wish to grow mainly Miscanthus & some Coppiced Willow and it may be possible to supply RAF ODIUM with this Renewable Energy supply with the Gasification Energy Plant on Land owned by Robert Benfold - a local Landowner and Farmer.

The introduction of Renewable Energy Technologies and Energy Efficiency measures into the Havant Borough Council Ecohome development in New Lane resulted in an additional cost of 10% over and above that for normal build dwellings. A further recommendation is made that developers of the MDA's should consider using Recycled Construction Waste, SoilBind products for Roads and Pathways which could result in savings in costs and aggregates between 40% & 60%. Case Studies of Renewable Energy projects indicate project costs of £12,880,000 for an 11MW Biomass Energy Plant and a payback period of 3.8 years is possible indicated by project two case study. Case study Six the EYE Energy Limited project indicates a then possible structure plan for HCC to adopt in any ownership establishment.

The Waterlooville MDA will see the development of over 2,000 homes - the average wind speed in the area is between 4 & 5 m per s and a case study seen indicates revenues to be expected from a wind farm in Scotland - Spurnes - Orkneys. This project indicates a Cumulative nominal cash flow over 25 years of £38,603,000 and a payback period of between 4 & 7 years.

Hampshire County Council Resource Ownership

HNRI - Concept: Initially proposed to Bob Lisney in 2004.

(i) The then International Agenda 21 Ltd & HNRI – now PSECC - Renewable Energy consortium member companies would like to propose to Hampshire County Council (HCC) and Hampshire Natural Resources Initiative (HNRI) that HCC and all Councils in Hampshire Consider Owning Renewable Energy Resources within their boundaries of Authority.

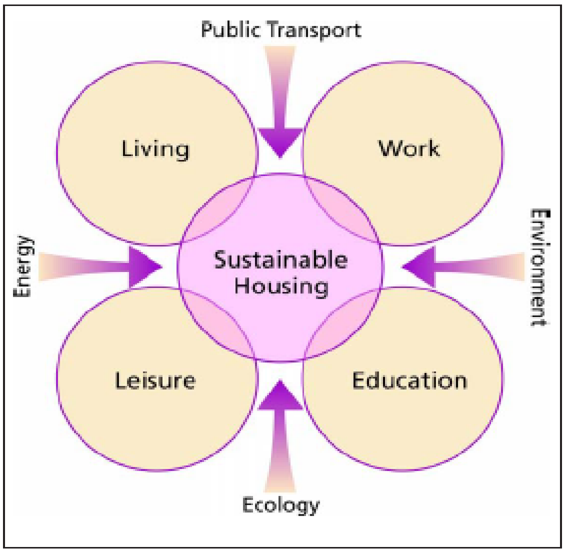
.

(ii) HCC & HNRI & each respective Council consider the financial aid that can be given to them from the IMGroup with reference to Renewable Energy Project funding provision. This will enable the respective Councils to ensure that each Major Development Area (MDA) within their boundary can be provided with the funds to incorporate Solar PV & Solar Hot Water systems, Wind Turbines, Biomass & Energy Crop - Energy Plants and District Heating within the MDA's.

Renewable Energy Resources under consideration then in 2004 were are as follows:

Solar
Biomass
Wind
Energy from Waste

FIGURE 2.1
Key Relationships in Sustainable Housing



Governance

There is no one blue-print for delivering Sustainable Development. It requires different strategies in different societies. But all strategies will depend on effective, participative systems of governance and institutions, engaging the interest, creativity and energy of all citizens. We must therefore celebrate diversity, practice tolerance and respect. However, good governance is a two-way process.

We should all take responsibility for promoting Sustainability in our own lives and for engaging with others to secure more sustainable outcomes in society.

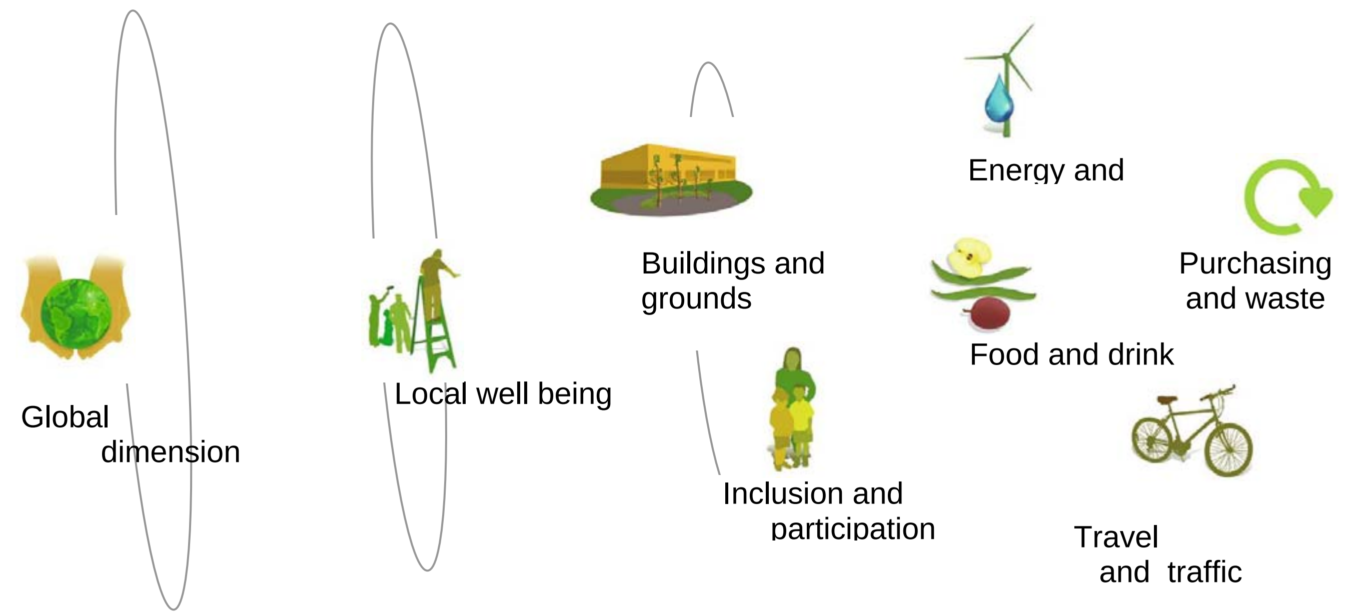
Sustainable Schools National Framework:

Eight doorways to sustainability

For pupils, communities and the environment

PSECC

The eight doorways

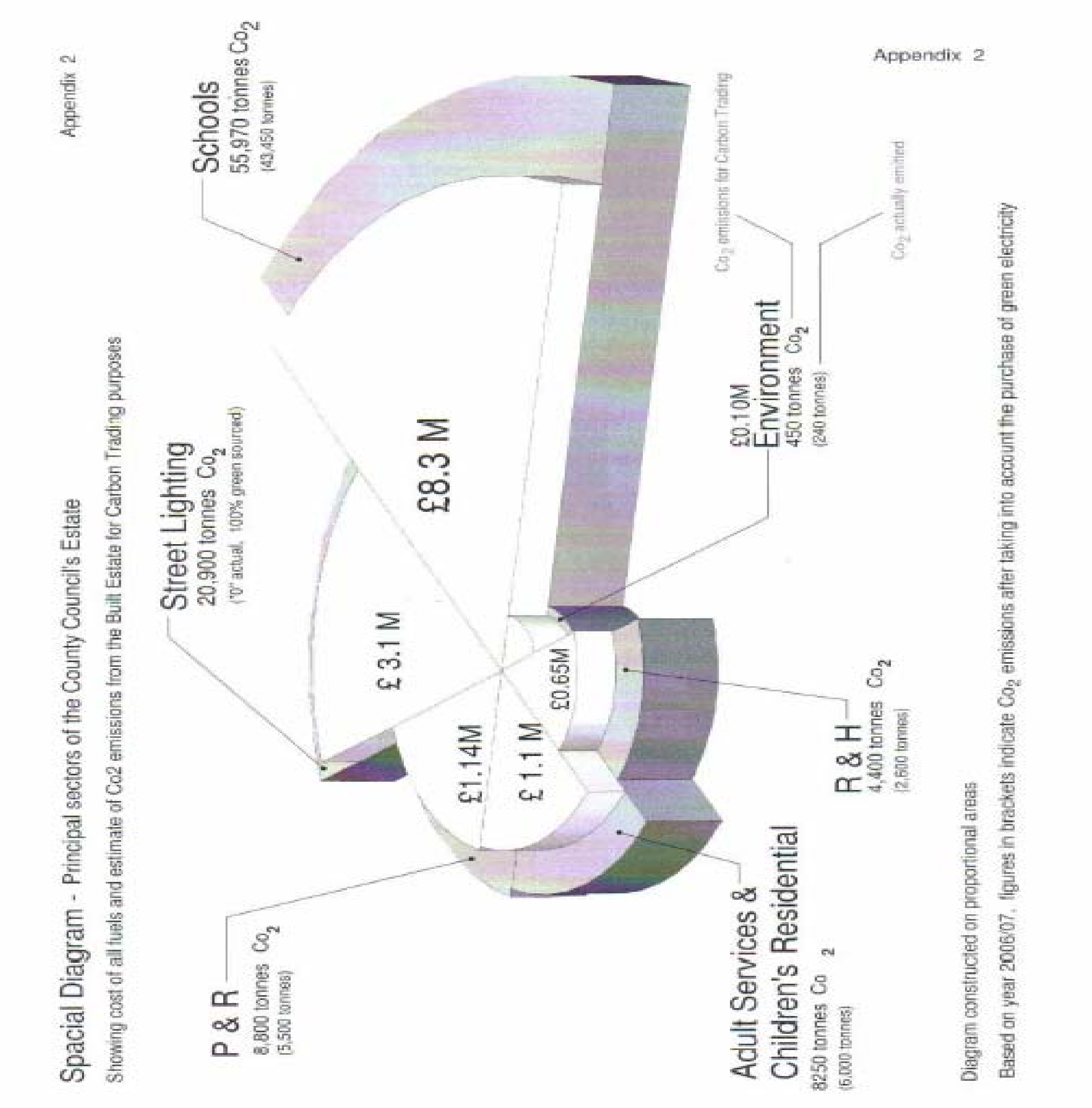


Department for
Children, schools and families

(DCSF)

PSECC and member network companies coming to Hampshire County Council aid would like to propose that it is possible to make significant reductions in energy use in Hampshire. The amount of reduction possible could be up to 40% and also Renewable Energy developments in the County could see all 528 Hampshire schools generating 100% of their own energy requirements from Renewable Energy and also sell back to the National Grid surplus supplies at a value of 18 pence per KW hour from Scottish & Southern Energy plc.

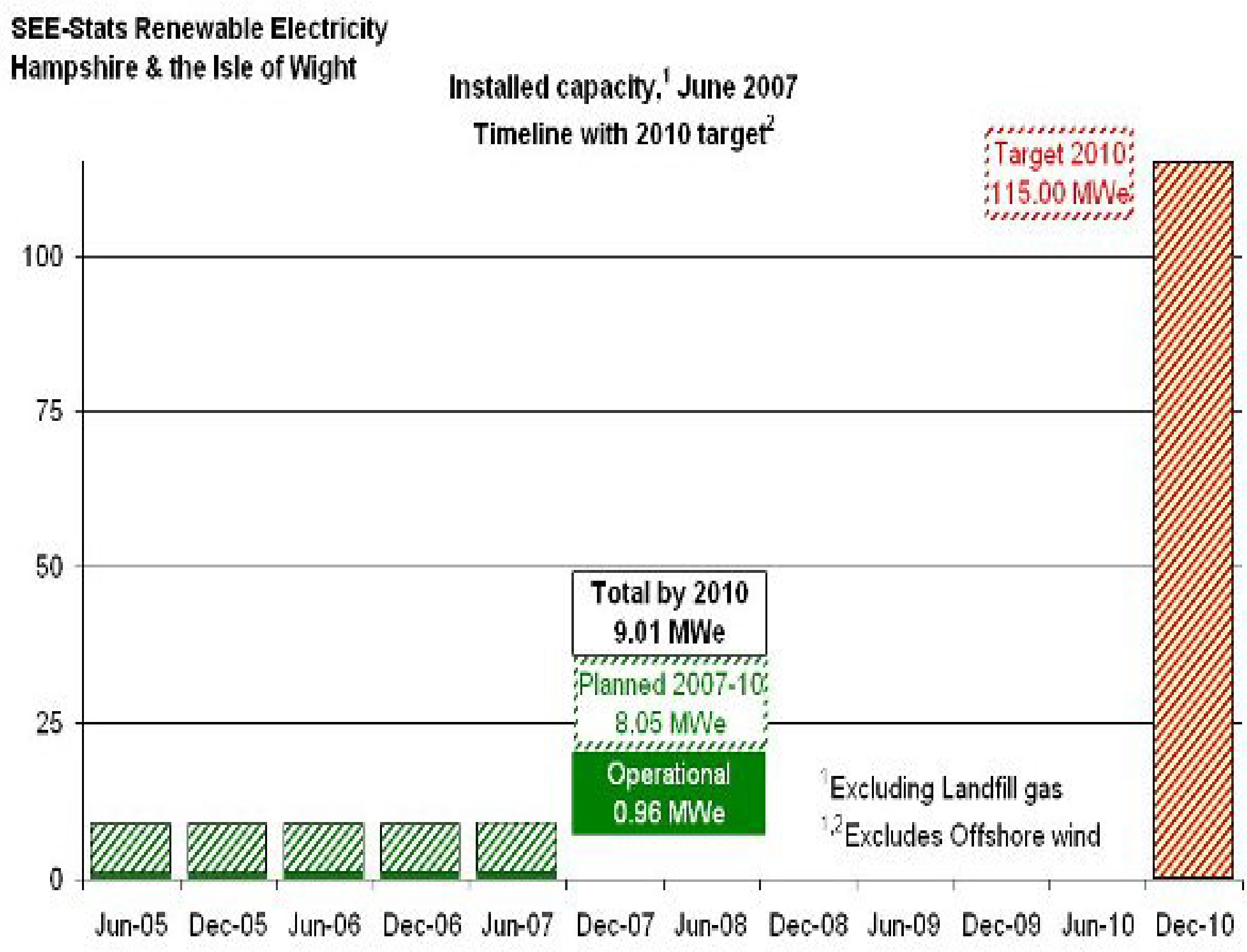
To achieve “Resource Ownership” then the Council should consider changes to current borrowing mechanisms to lead the way in the UK on a Low Carbon Economy.

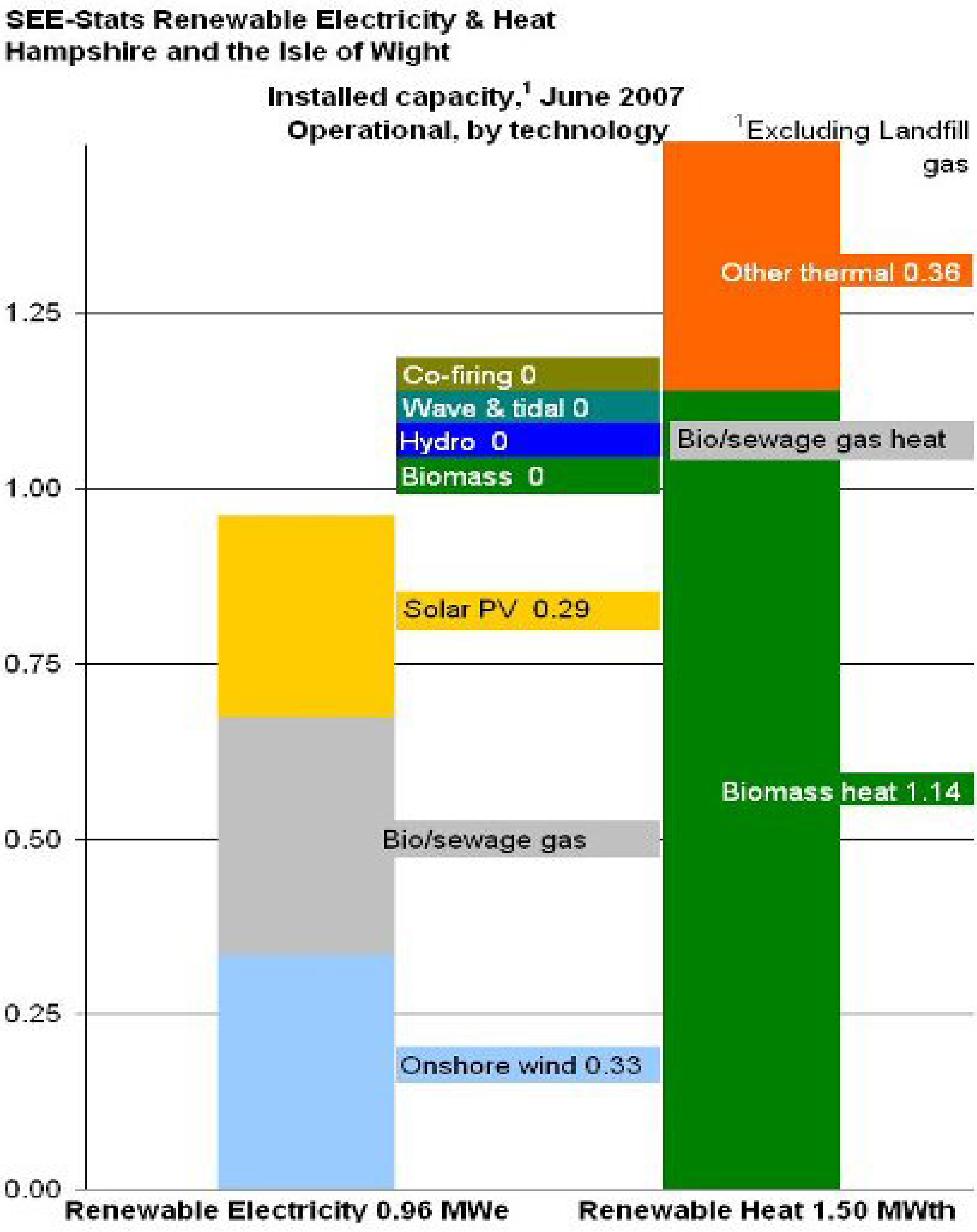


Each of the above sectors could result in 40% cost & CO_2 savings on energy with additional revenues from renewable energies for the schools, Hampshire County Council property and all PUSH Council’s in Hampshire. In addition HCC could become a part equity partner in Biomass Energy plants, wind turbines, Solar arrays and all other renewable energy technology projects.

Statistics for Hampshire and the Isle of Wight

The statistics on this page are drawn from the latest version of the full SEE-Stats database, containing more renewable energy projects than those shown on the sub-regional map pages of this site.




SEE-Stats Renewable Electricity & Heat
Hampshire and the Isle of Wight
Installed capacity,1 June 2007
Operational, by technology
1Excluding Landfill gas
Other thermal 0.36
Co-firing 0
Wave & tidal 0
Hydro 0
Biomass 0
Bio/sewage gas heat
Solar PV 0.29
Biomass heat 1.14
Bio/sewage gas
Onshore wind 0.33
1.25
1.00
0.75
0.50
0.25
0.00
Renewable Electricity 0.96 MWe
Renewable Heat 1.50 MWth

NB The above graphs represent known data; actual installed capacity may be higher.

Statistics for Hampshire and the Isle of Wight

the Environment Centre (tEC)
you · your business · your community

TV Energy

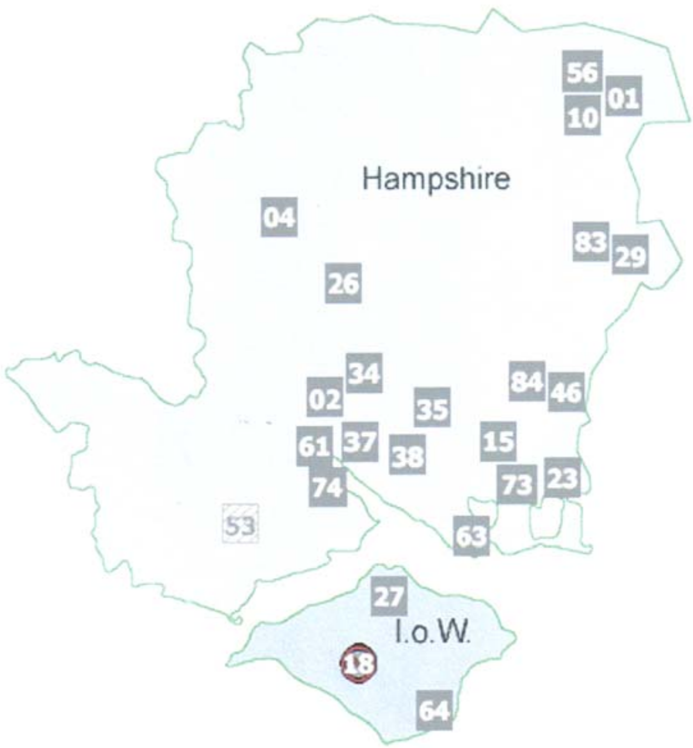
This sub-region comprises Hampshire and the Isle of Wight. The major potential renewable electricity sources for this coastal area are biomass energy and onshore wind power, with some contribution from bio & sewage gas and solar PV. In future the wave and tidal resource will be significant.

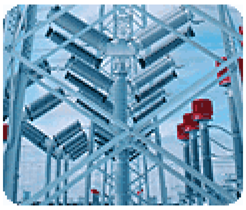
June 2007: The SEE-Stats database contains a total of 72 operational and 15 planned installations in this sub-region. The most significant installed capacity is landfill gas (awaiting data) followed by biomass heating (1 MW thermal). There has been an increase of 0.6 MW thermal biomass heating capacity since the last update in December 2007.

The data collection partners for south Hampshire and the Isle of Wight is The Environment Centre.

The data collection partners for north Hampshire (Basingstoke & Deane BC, Hart DC and Rushmoor BC areas) is TV Energy.

Location of Renewable Energy projects & case studies



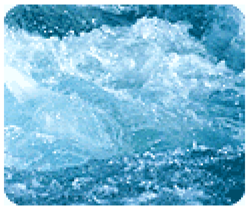


ALL RENEWABLE ENERGY

Installations generating energy across the entire range of renewable energy technologies - these are defined as devices supplying energy from sustainable natural resources.

BIOGAS & SEWAGE GAS

Installations generating electricity and/or heat from biogases produced by the anaerobic digestion of renewable biological sources. These can include organic waste, animal manure and sewage sludge.



HYDRO

Installations generating electricity from low-head hydro turbines driven by the flow of local rivers.

BIOMASS

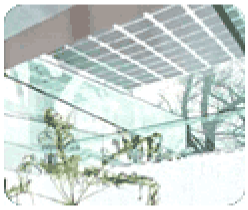
ONSHORE WIND

CO-FIRING

OFFSHORE WIND

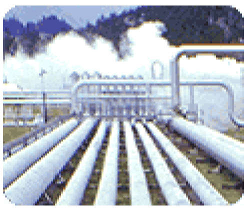
ENERGY CROPS

Renewable energy crop plantations. Plants grown here, such as willow and grasses or oilseed rape, are converted into useful energy sources (either biomass or liquid biofuels).



SOLAR PV

Installations generating electricity from energy provided by the sun. This makes use of the photovoltaic (PV) effect: solar radiation falling on a special surface triggers an electrical current.



OTHER THERMAL

Installations generating or transferring heat from energy provided by renewable sources. These include ground source heat pumps, solar energy collectors and geothermal aquifers.

TIDAL & WAVE

Installations generating electricity from energy provided by turbines driven by the movement of either the surface of the sea or tides.

Sub-regional statistics Hampshire and the Isle of Wight

Installations

01	Farnborough PV House (PDF, 459KB) - solar
02	Southampton University (PDF, 159KB) - solar
04	Leckford Estate PV (PDF, 461KB) - wind, crops, solar
10	BC Cove Community Hall (PDF, 675KB) - solar
15	Sustainability Centre (PDF, 1MB) - biomass, solar, thermal
18	Cheverton Down (PDF, 68KB) - onshore wind
23	Kyoto Terrace (PDF, 57KB) - solar, thermal
26	Sparsholt Schools Centre (PDF, 107KB) - solar
27	Medina High School (PDF, 2.44MB) - solar
29	Evergreens Solar Thermal (PDF, 70KB) - thermal
34	Eastleigh Lighthouse (PDF, 88KB) - solar, thermal
35	Wildlife Trust (PDF, 857KB) - biomass
37	Porchester BP Store (PDF, 61KB) - solar
38	Fareham Road Noise Barrier (PDF, 90KB) - solar
46	Queen Elizabeth CP (PDF, 417KB) - biomass
53	Brockenhurst Village Hall (PDF, 83KB) - thermal
56	Rushmoor Community Centre (PDF, 1.1MB) - solar
61	Chapel Housing Project (PDF, 995KB) - solar
63	Rose Court (PDF, 18.5KB) - solar
64	St Lawrence Village Hall (PDF, 19KB) - thermal
73	Lovedean (PDF, 22KB) - thermal
74	Down to Earth (PDF, 332KB) - solar, thermal
83	Kingsley Generation Homes (PDF, 30KB) - solar, thermal
84	Siward House (PDF, 21KB) - solar

How green is your electricity company?

They're all doing it, draping themselves in images of windmills and claiming green credentials – but how green are the UK's electricity companies really?

How much of what you see is spin and how much is real? That's a question we've asked ourselves often enough. And lately, with the 'Big Six' spending £millions on slick TV ads - this seems a more pressing question than ever.

The only way to judge who's really green and who's only saying they are?

Actually it's quite simple.

Just look at how much each electricity company spends **building new sources** of green electricity each year – we call it New energy. The only green electricity that does anything to reduce CO_2 emissions and our dependence on fossil fuels is the New kind, the stuff that gets built today and tomorrow. If you're not building you're not actually achieving anything green at all. It's just marketing and spin.

New sources of green electricity

We need more sources of Green Electricity in the UK, lots more. We need it to provide us with clean energy and a way to fight climate change. The only green electricity that actually does anything in either regard is the new kind - the stuff that gets built today, tomorrow and the next day. We call it New Energy.

Many companies simply repackage green electricity that's been around for up to 50 years - buying or selling this has no impact on CO_2 emissions, the fight against climate change or where the UK gets its energy. If you buy this stuff you simply take it from the person that used it before you - we call it robbing Peter to supply Paul.

We've produced a measure for spending on New Energy we call it 'pounds per customer' – it shows how much each electricity company actually spends, for each of it's customers on the new green stuff. It's a number that cuts through the fog of marketing and to the heart of the issue, irrespective of company size.

Pounds per customer spent on new sources of green electricity

Some energy companies are bigger than others of course, so the total they spend on building new green electricity sources is useful to know, but is not the whole story.

To get meaningful comparisons you need to simply see how much is spent per customer. This shows you how much of your electricity bill actually gets spent each year, building new sources of green. And how much of a difference you make by being with your supplier. It's that simple - We call it pounds per customer. And it's the acid test of green commitment. It's simple enough maths too - Just take the total number of customers each supplier has and divide that by their total spend on new green electricity sources in any given year. For the last 4 years we've been doing just this and publishing the results at whichgreen.org

These are the figures for 2007. Prepare to be surprised.

ECOTRICTY - How the figures are calculated.

It's very simple. We take the total number of customers each supplier has in any year and divide into that their total spending on building new sources of green electricity, in the same year. That gives spending in 'pounds per customer'.

Customer numbers for each supplier are sourced from the suppliers own publications. Their expenditure on building new renewables comes either from them or (if they are unwilling to provide) from figures published by OFGEM (the industry regulator). OFGEM figures show the ownership, start date, and size of all new renewable generators in the UK, each year. We take the size figures and multiply them by the average cost to build - for that form of renewable generation – and that gives the total spent by each company (Our sources are Ofgem; BWEA; Enviros 2005).

And we give all suppliers the opportunity to comment on and correct our numbers. Then we publish. The average spend of all electricity companies is the arithmetic mean of the spend per customer of all the other suppliers.

Supplier	2007 spend per customer
Ecotricity	£555.36
Powergen	£17.28
Centrica	£7.12
npower	£3.89
EDF Energy	£3.55
Scottish Power	£2.63
Green Energy UK	£0.00
Good Energy	£0.00
Scottish & Southern Energy	£0.00

Spending

Who spent what in 2007

As you can see, most of the Big Six spend less than a fiver per customer. Of the small independents, Good Energy and Green Energy spent nothing.

Ecotricity spent over £550 per customer in the same year - And once again we spent a pound on new build for every pound our customers spent with us on their electricity bills. Something no other electricity company comes near to.

The average spend of all electricity companies (excluding Ecotricity) was just £4.31 per customer!

That's how much of a typical electricity bill (£400+ per year) went into building new sources of green electricity in the UK last year.

Ecotricity spent over 100 times more than that average.

The four year story

The Big Six range from £2.50 at the bottom end (dear old Nuclear EDF) to nearly £9 for Scottish Power at the top. And that's it, none of them spending more than a tenner from each £400+ electricity bill they issue to their customers. And the small independents, consistently spend nothing – firmly at the foot of the table.

Ecotricity spent an average £460 in each of the last four years, for each customer. A vast difference.

The four year table pretty well defines the real commitment of each power company to green electricity. This is how they rank.

We can all have a bad year, or even two – but four years of data give the lie to claims of real green commitment – unless it is real.

Total Commitment

Year in, year out Ecotricity spends more per customer than the all other electricity suppliers in the UK put together – an awful lot more. We consistently spend more than a typical electricity bill, every year, for each of our customers, building New green energy sources. 'Turning electricity bills into windmills' is how we like to think of it. And there really is no greater change that you can bring with your electricity bill.

Meanwhile many of the Big Six spend more on TV advertising than they do on the real thing. And the small green electricity companies, who you'd expect to do better, or to do something (Green Energy and Good Energy) consistently spend nothing each and every year. They sit at the bottom of the commitment table with the French Nuclear giant EDF. How green (or Good) is that?

1.1 Background to the Proposed Options – MDA's

Utilising the recent ARUP Energy and CEN wood reports for Hampshire, PSECC would like to propose the following Carbon Reduction Commitment (CRC) possibilities for Hampshire County Council owed building stock, schools and Major Development Areas MDA's.:

These Renewable Energy Option proposals have been prepared for this meeting for the Waterlooville Major Development Area. In line with your Sustainability Checklist 2.2 objectives of "Development of Community Renewable Energy" The Options could form a key to Sustainable Housing.

Master plan Framework Options have been prepared
for the Major Development Area (MDA) to the West of Waterlooville to guide the development of the site and in particular to assist Winchester City Council, within the administrative boundaries of which the majority of the site lies, in taking its Local Plan to the next stage. The Options will form a key element of the Winchester Local Plan Review and will also be scrutinized during the public inquiry into the Havant Borough Local Plan.

The site is one of five Major Development Areas (MDA) in the Hampshire Structure Plan proposed, or reserved, to provide the majority of new greenfield development requirements within the County up until 2011. The site of the proposed new community is required to provide at least 2000 dwellings, with a reserve provision of 1,000 houses, and 30 hectares
of land for industrial, business and commercial purposes to meet the development needs of the South East of Hampshire. The first Housing developments will be 450 units at Old Park Farm – Planning Application submitted by George Wimpey Ltd and validated on the 07/03/2005.

Energy

“The Winchester District Local Plan Review, First Deposit, 2001 and the Revised Deposit Havant Borough District-Wide Local Plan, February 2002 and Pre-Inquiry Changes August 2002, both contain policies that require new development schemes to consider measures for energy conservation and the use of renewable energy.

These policies reflect government guidance contained in PPG12 and government policy and have been taken into account in the design of the new community:
The orientation of the site means that many of the buildings can be orientated within 45 degrees of south, a broad southerly direction being the key to optimizing solar potential”

The Strategic Development Framework may also consider the use these Renewable Energy options in the Development to enhance Sustainability.

The site of the proposed new community is required to provide at least 2,000 & 3,000 dwellings on the development land to meet the development needs of Waterlooville and the South East. These Renewable Energy Options are hoped to be commissioned by Winchester to meet strategic planning authority objective of Renewables in the development to guide the development of the site and in particular to assist The Waterlooville MDA development partnership and IOW Council in taking it’s Renewable Energy options to the next stage.

Purpose of the Options

It is hoped that preferred Renewable Energy options will be selected by the parties, from the options presented in this report, which will then be worked up into a detailed master plan and promoted through the Local Plan process thus meeting the Planning Guidance on Renewable Energy in the development.

The merits of this option are that the Waterlooville MDA development partnership are additional revenue streams from Renewables and higher house prices for the Developer. The Waterlooville MDA development partnership could take advantage of the Hampshire Natural Resources Initiative (HNRI) Energy Network companies of PSECC.

The possible Renewable Energy Options to be presented in the Master plan Framework are and will be the result of close co-ordination with the Council – The Waterlooville MDA development partnership. The various Options each address the issue of integration with the existing settlement of Aldershot and make provision for Climate Change mitigation and development of Renewable Energy whilst respecting the landscape and nature conservation interests in the area and the setting of nearby settlements. Particular emphasis has been placed on the current Interim Planning Guidance to devise a scheme, which meets the objectives of Renewable Energy and sustainable urban design.

1.3 WOKING BOROUGH COUNCIL: LOCAL SUSTAINABLE COMMUNITY ENERGY

by Allan Jones MBE IEng., FIIE
Energy Services Manager, Woking Borough Council

WOKING: LOCAL SUSTAINABLE ENERGY COMMUNITIES

In order for Hampshire County Council & the HNRI to understand the principals of Ownership and the advantages of generating their own electricity & heat the following paper summarises a practical strategy for a sustainable energy society deriving its initial energy needs from energy efficient low carbon energy resources whilst at the same time establishing a sustainable community energy infrastructure to enable future energy needs to be derived from wholly renewable energy resources via a hydrogen economy within the Royal Commission on Environmental Pollution[1] timescales to reduce CO_2 emissions by 60% by 2050 and by 80% by 2100. These concepts can be applied to any community in the UK or indeed in the world.

Woking Borough Council, like PSECC with its unique experience and expertise in local sustainable community energy systems has been able to tease out the real issues and barriers to a sustainable energy future through the actual implementation of such systems, including sustainable and renewable energy systems, fuel cell technology and low carbon transport systems.

WOKING: ENERGY SERVICES FOR THE NEW MILLENNIUM

Background

Woking Borough Council has implemented a series of sustainable energy projects in the past 11 years, including the UK's first small-scale combined heat and power (CHP)/heat fired absorption chiller system, first local authority private wire residential CHP systems, largest domestic photovoltaic/CHP installations, first local sustainable community energy systems, first fuel cell CHP system and first public/private joint venture Energy Services Company or ESCO.

The Council is recognized as the most energy efficient local authority in the UK having already achieved an average National Home Energy Rating of NHER 8.13 towards it's target to improve the energy efficiency of the Council's own public sector housing stock to NHER 9 as well as maintaining accreditation under the Institute of Energy's Energy Efficiency Accreditation Scheme since 1995.

In recognition of this pioneering work the Council gained the Queen's Award for Enterprise: Sustainable Development 2001 in respect of its Energy Services activities in the development of Local Sustainable Community Energy Systems, the only local authority ever to receive a Queen's Award for Enterprise.

Woking - Summary of Energy, Environmental and Financial Savings

Since the Council implemented it's energy efficiency and environmental policies in 1990/91 (the base year), it achieved it's target to reduce energy consumption by 40% in

1. Royal Commission on Environmental Pollution's Report: Energy – The Changing Climate – June 2000.

10 years from 1991/92 and 2000/2001, as follows:-

Energy Consumption Savings	**170,170,665 kWh**	**43.8% Saving**
Carbon Dioxide CO_2 Emissions Savings	**96,588 Tonnes**	**71.5% Saving**
Nitrogen Oxides NO_x Emissions Savings	**319.1 Tonnes**	**68.0% Saving**
Sulphur Dioxide SO_2 Savings	**976.6 Tonnes**	**73.4% Saving**
Water Consumption Savings	**340,011,000 Litres**	**43.8% Saving**
Savings in Energy and Water Budgets	**£4,889,501**	**34.3% Saving**

The above savings are for corporate property and housing stock, where the Council pays the energy and water bills, and exclude Council tenant and private sector savings brought about by the Council's Housing energy conservation and CHP/renewable energy programmes.

The Council's innovative energy efficiency recycling fund, where financial savings achieved by energy and water efficiency projects are ploughed back into the capital fund creating an ongoing recycled capital fund (ESCO finance model) has led to a total investment of **£2.7M** over the previous 11 years from the original capital fund of **£0.25M** established in 1990/91 which has enabled savings of nearly **£4.9M** over the same period to be made resulting in current annual savings of over **£885,000 a year**.

Climate Change Strategy

In December 2002, the Council's energy efficiency policy was replaced by the Climate Change Strategy for Woking, not just for Council buildings and transport but for the Borough as a whole, shifting the focus from savings in kWh's of energy to savings in tonnes of CO_2 as well as adapting to a changing climate. The key three principles of the Strategy are:-

- **Adopting an overall target to reduce Woking's CO_2 equivalent emissions to 80% of its 1990 level by 2090 in steps of 10% up to 2050 and 5% from 2050 to 2090;**
- **Adopting the concept of an Environmental Footprint for the Borough which has as its base 1,060,000 tonnes of CO_2 equivalent emissions of greenhouse gases; and**
- **Declaring itself Climate Neutral and setting up a Climate Change Fund.**

As part of a number of action plans the Strategy adopts targets for purchasing 20% of the Council's electrical energy requirements from renewable sources and 100% of the Council's electrical and thermal energy requirements from sustainable energy (including CHP) sources by 2010/11.

By 2001/02 the Council had already reduced CO_2 equivalent emissions by 8.01% of the whole of the Borough's CO_2 emissions in 1990 through its own actions alone.

1.4 Switching to Renewable Sources of Energy

Globally - technological advances offer new opportunities Hampshire and declining costs for energy from renewable sources. In the longer term, renewables can meet a major part of Hampshire the world's demand for energy. Power systems, with the addition of fast-responding backup and storage units, can accommodate increasing amounts of intermittent generation.

Renewable sources of energy used sustainably have low or no GHG emissions. There are some emissions associated with the unsustainable use of biomass—for example, from reducing the amount of standing biomass and from decomposition of biomass associated with flooded reservoirs

If the development of biomass energy can be carried out in Hampshire in ways that effectively address concerns about other environmental issues (e.g., impacts on biodiversity) and competition with other land uses, biomass could make major contributions in both the electricity and fuels markets and provide revenue stream for HCC. By and large, renewable sources of energy could offer substantial reductions of GHG emissions compared to the use of fossil fuels, provided their economic performance continues to improve and no site problems arise.

Hydropower

The technical potential has been estimated Globally at 14 000 TWhe/yr, of which 6 000–9 000 TWhe/yr are economically exploitable in the long run after considering social, environmental, geological and cost factors.

The market potential in Hampshire is very significant and also for reducing GHG emissions depends on which fossil fuel hydropower replaces. The long-term economic potential for replacing coal is 0.9–1.7 Gt C avoided annually Globally (depending on *Technologies, Policies and Measures for Mitigating Climate Change* technology and efficiency); for natural gas, the potential is 0.4–0.9 Gt C avoided annually - Globally.

For HCC benefit - the investment costs for hydro projects in 70 developing countries for the 1990s suggest that, on average, the cost of new hydroelectricity delivered to final use is 7.8¢/kWhe.

Small-scale hydro in Hampshire, regionally is important especially where cost-effective. On the other hand, the construction phase of larger hydroelectric plants has social consequences and direct and indirect environmental impacts, such as water diversion, slope alteration, reservoir preparation, creation of infrastructure for the large workforce, or disturbing aquatic ecosystems, with adverse human health impacts.

The social consequences include the relocation of people as well as a boom and bust effect on the local economy. The associated infrastructure stimulates regional economic development and also provides additional benefits for agriculture as a water reservoir.

Biomass

Potential biomass energy supplies include municipal solid waste, industrial and agricultural residues, existing forests, and energy plantations. Yields and costs of biomass energy depend on local conditions, such as land and biomass waste availability and production technology. Typically, the energy output-input ratio for high quality food crops is low compared to the ratio for energy crops, which often exceeds the former ratio by a factor of 10. Biomass production cost estimates vary over a large range. On the basis of commercial experience in Brazil, an estimated 13 EJ/yr of biomass could be produced at an average cost for delivered woodchips of $1.7/GJ.

The mitigation cost range for biomass-derived energy forms such as electricity, heat, biogas or transportation fuels not only depends on the biomass production cost but also on the economics of the specific fuel conversion technologies.

On the basis of replacing coal with biomass, the mitigation costs would range globally between $200–400/t C avoided. A future biomass-integrated gasifier/gas turbine cycle with an expected efficiency of 40–45% and biomass costs of $2/GJ could produce electricity at costs comparable to coal and/or coal prices in the range of $1.4–1.7/GJ. In this case, the specific mitigation costs could well become negligible. Advanced biofuels from woody feedstocks offer the potential of higher energy yields at lower costs and lower environmental impacts than most traditional biofuels. In addition to ethanol, methanol and hydrogen are promising biofuel candidates.

Modern biomass energy also offers the potential for generating income for HCC and in rural areas. This income could allow HCC to sustain any CRC programme and developing country farmers to modernize their farming techniques and reduce the need to expand output by bringing more marginal lands into production. In industrialized countries, biomass production on excess agricultural lands could allow governments eventually to phase out agricultural subsidies.

At present, advanced biomass conversion technologies as well as biomass plantations are technically mature and economically viable. Concerns about future food supplies have raised the issue that land will not be available for biomass production for energy in Africa and other non-Annex I countries.

Wind

Intermittent wind power on a large grid can contribute an estimated 15–20% of annual electricity production without special arrangements for storage, backup and load management. In a fossil-dominated utility system, the mitigation effect of wind technologies corresponds to the reduction in fossil fuel use.

Globally the wind potential by 2020 is projected to range from 700–1 000 TWhe); if utilized to replace fossil fuels and irrespective of costs, this translates into CO_2 emission reductions of 0.1–0.2 Gt C/yr.

The present stock average cost of energy from wind power is approximately 10¢/kWh, although the range is wide. By 2005to 201 0, wind power may be competitive with fossil and nuclear power in more than small niche markets. For average new technology, investment costs of $1 200/kW and electricity production costs of 6¢/kWh have been estimated.

Costs could be significantly lower for large wind farms. In the future, costs as low as 3.2¢/kWh have been calculated for favorable locations at a discount rate of 6%.

In this case, the specific CO_2 mitigation costs are negligible, if not zero or negative, where electricity from coal is more expensive.

1.5 Renewable Energy- Aldershott MDA

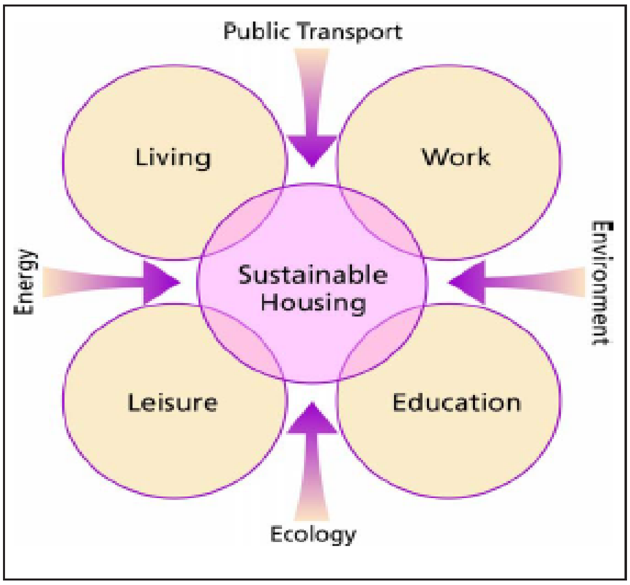
OBJECTIVE 3.7

The use of renewable-energy sources must be incorporated within the Urban Extension at Aldershott to reduce the amount of fossil-fuel energy required for the needs of the development. The use of such energy sources will need to take account of new technology and evolving best practice

3.2.11 Solar panels, photo-voltaic systems, bio-mass heating and heat pumps are renewable-energy technologies that are considered particularly well suited for widespread deployment in the Urban Extension.

The master plan and outline planning application must consider how these, and other, renewable-energy technologies can be appropriately integrated into the development, and how they will be managed and maintained thereafter. Community-owned renewable-energy schemes will be encouraged. Combined Heat and Power (CHP) plants linked to a district-heating system will also be encouraged as part of the development.

FIGURE 2.1
Key Relationships in Sustainable Housing



Part II - Renewable Options

Havant Borough Council

PUSH Energy and Climate Change Strategy

Feasibility of an Energy and Climate Change Strategy

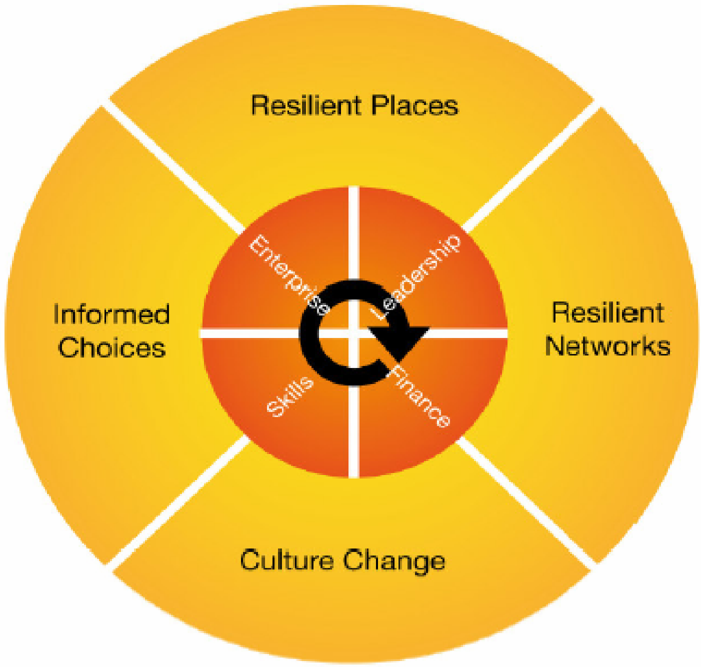
for Urban South Hampshire

April 2008

Ove Arup & Partners Ltd
The Arup Campus, Blythe Gate, Blythe Valley Park,
Solihull, West Midlands. B90 8AE
Tel +44 (0)121 213 3000 Fax +44 (0)121 213 3001
www.arup.com

9.1 Identifying Directions of Travel for South Hampshire

Figure 1 presents a limited number of strategic directions of travel that the region needs to take up as part of the long term preparation of the region to meet extremely challenging targets and future pressures.



The strategy identifies 4 primary objectives and 4 core enablers needed to realise the primary objectives.

School & Community offers Britain's schools and other community or not-for-profit organisations the opportunity to generate their own clean energy. We offer a complete advice, project management and installation service that includes

Site surveys and feasibility studies

Advice about the most appropriate technology for your site

System design and planning

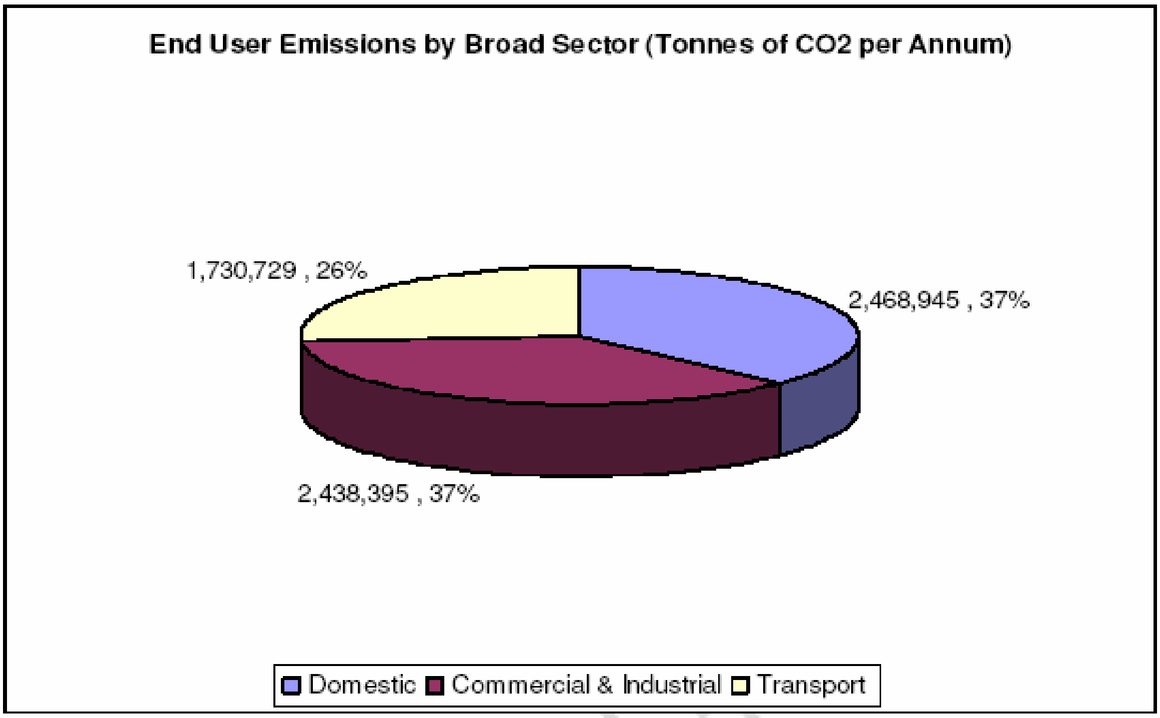
Estimates and quotations

Planning application submission

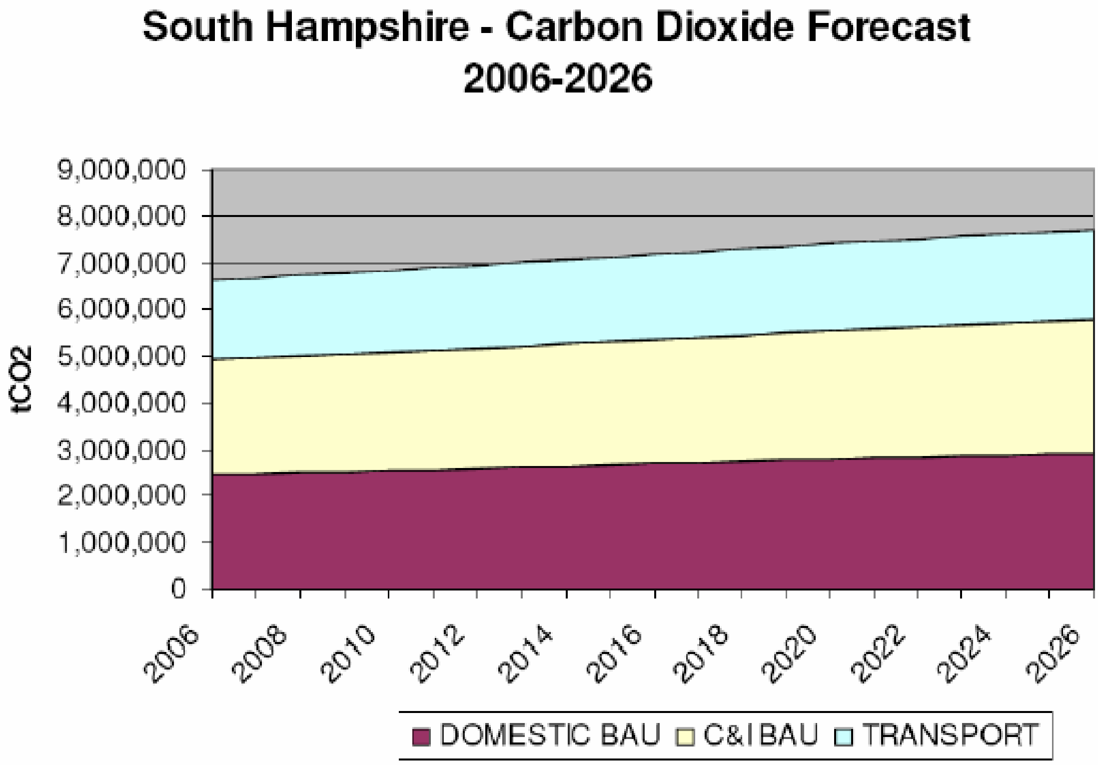
Educational and curriculum support

Access to LCBP Phase 2 - 50% grants plus BRE up to 50%

Additional grant finding services that aim to minimise your HCC capital investment



Emissions are projected to increase over the next twenty years based on extending trend line performance for the major sectors of use.



Portsmouth City Council was awarded a grant of £435,263 by the Community Energy programme in 2002. The grant funding assisted the installation of a CHP unit and community heating network serving 538 dwellings, two schools and a new arts and sports centre. 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 Scottish and Southern Energy. 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. Eastleigh BC (Beacon status Council for Climate Change) is also developing a CHP scheme delivering 200 kWe with Utilicom.

Targets

A decision needs to be taken on the level of reduction to be targeted by 2026.

The options are:

- 24% by 2010 moving to trend line reduction to achieve a 60% cut in carbon dioxide emissions by 2050 (UK Government);
- 32% cut by 2010 moving to trend line reduction to achieve a 60% reduction by 2050 (UK Government);
- 60% cut by 2026 (match Birmingham and London) – this catches all the interim targets and may align better with scientific advice;
- Something else.

. 2. Adopt the recommended District apportionment for meeting the sub regional target as detailed below:

District	MWe
East Hampshire (part)	0.88
Eastleigh	20.80
Fareham	12.06
Gosport	5.27
Havant	8.04
New Forest (part)	2.93
Portsmouth	14.53
Southampton	19.01
Test Valley (part)	6.93
Winchester (part)	9.55

Strategic Frameworks

Consider incorporating the framework detailed in Section 9 as a basis for Local Strategic Partnerships to approach the management of energy issues in their areas through the Sustainable Community Strategies.

Review membership of LSPs in terms of adequacy and breadth to deal with issues identified and recommend secondments in;

Consider the development of strategic urban/ rural compacts between South Hampshire and the rest of Hampshire over preferential access to biomass resources;

Enablers

Establish a theme group within PUSH as a focus for “leadership” but ensure actions are networked across all theme groups especially sustainability, housing and planning. Ensure a lead officer is appointed with responsibility to review changes in the market and policy environment.

A strategy is needed for the culture change needed around this agenda especially the engagement of the next generation who are going to feel the effects of the transition to a low carbon economy most acutely. This requires the skills of people involved with young people and an understanding of marketing.

Agree the need for a procurement strategy based on milestone stages to identify a specific model for the establishment of an Energy Services Company to deliver outcomes consistent with the SH14 policy targets.

Incorporate energy infrastructure into the sub region’s approach to delivering new infrastructure including the use of publicly owned property assets and revenue streams. Review existing S106 Supplementary Planning Documents and the implications for a local implementation of the Community Infrastructure Levy.

Consideration should be given to making energy efficiency and planning a key service delivery issue for senior officials in public organizations against which performance is assessed.

South Hampshire's Energy and Carbon Dioxide Emissions in 2006

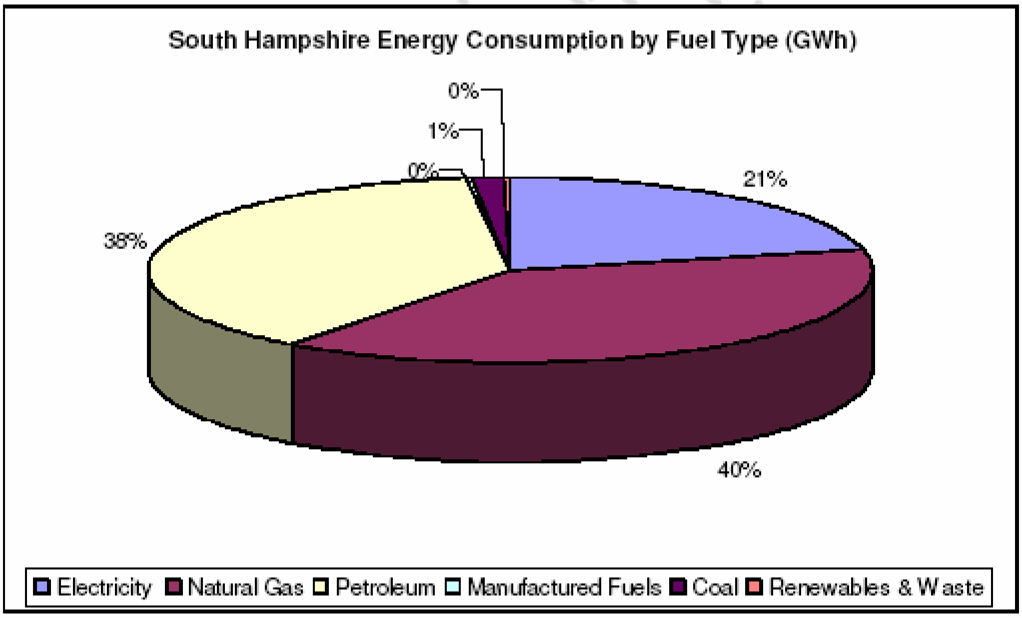
Establishing a Framework for Baseline Development

The establishment of a baseline position for South Hampshire's energy consumption and emissions in 2006 is based on available data and applying adjustments to represent "South Hampshire".

Figures for South Hampshire have been developed by aggregating local authority district data adjusted to take account of the share of population and employment for South Hampshire relative to the rest of Hampshire in districts split between the study area and the rest of the county.

The 2006 baseline has been constructed by projecting available base data for 2004/5 forward. The approach to assessing South Hampshire's emissions has been to apply emission factors to the energy projections and adding in waste and water related emissions.

The analysis of energy consumption within South Hampshire reveals the following distribution between secondary fuel types:

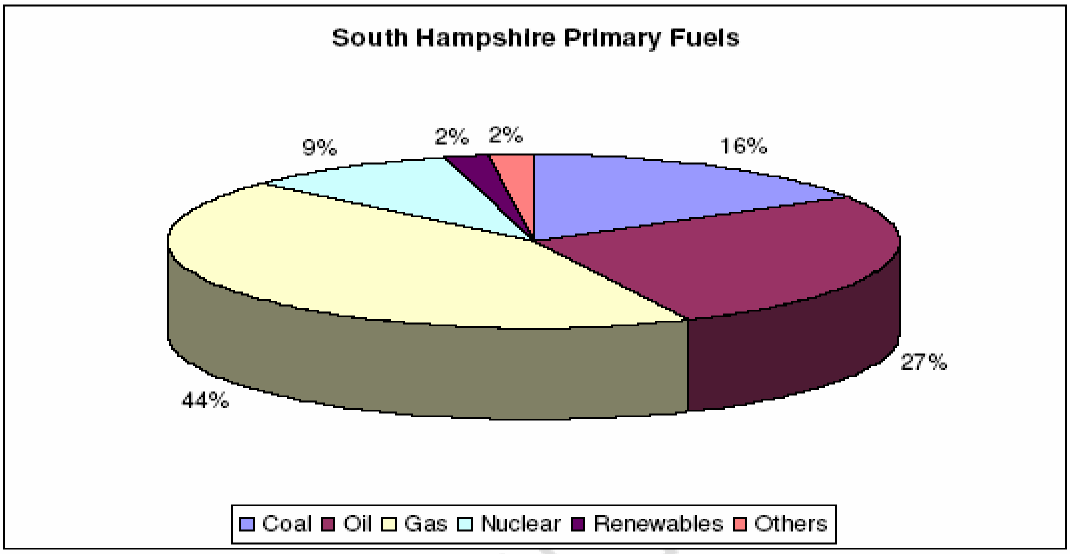


Currently, energy from renewables amounts to less than 1% whilst the majority of final consumption is accounted for by the consumption of fossil fuels. Just over a third of all energy consumption is accounted for by electricity.

Final energy consumption does not however expose the true extent of reliance on fossil fuels. Electricity consumption is itself supported by the combustion of a mix of different primary fuels which is then transmitted/ distributed to consumers in South Hampshire through the grid.

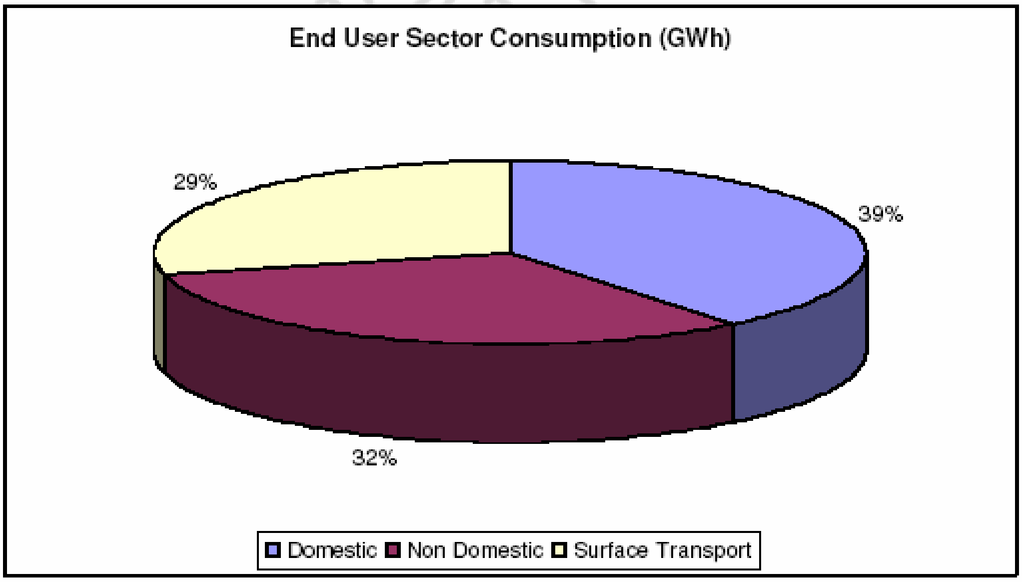
The transformation process does, however, lose much of the energy content of the fuels used through the loss of heat and the transmission process. For every unit of electricity delivered to South Hampshire around two further units have been lost in the form of rejected heat and transmission.

Figure 2 shows the primary fuel mix supporting final consumption in South Hampshire. The analysis reveals the much greater role played by coal/nuclear in the supply of energy which is not indigenous but essential to supplying the needs of the sub region:



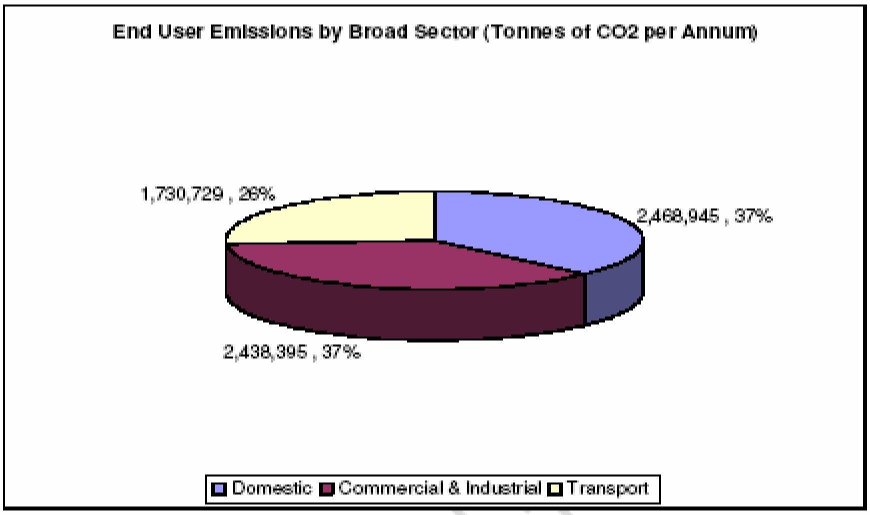
The implication for the sub region is that substituting grid based electricity with a renewable source of power production saves on the transmission efficiencies but also the extensive loss of thermal energy associated with a centralized power generation. Localized power generation also offers an opportunity to use heat generated in the process to supply space and domestic water heating. The efficiencies for power generation alone are, however, slightly lower.

The end user sectors for South Hampshire are described below:

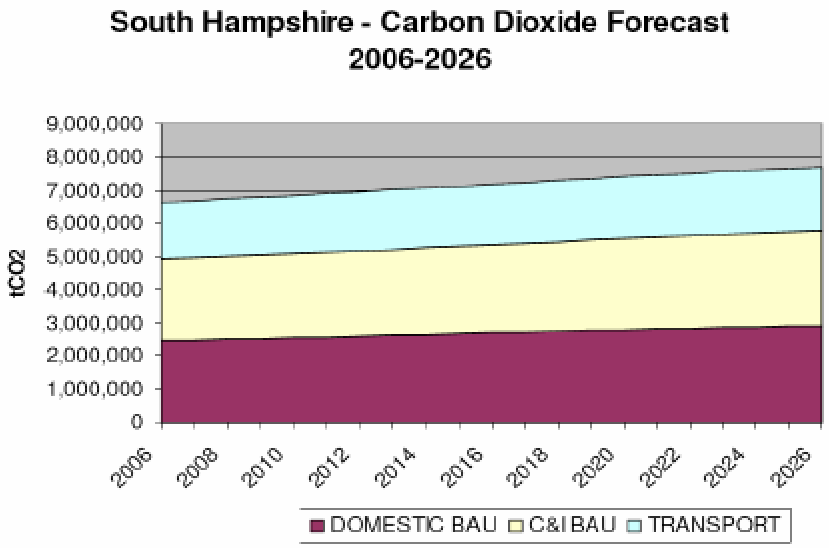


South Hampshire has lost many of its carbon intensive industries so domestic use of energy accounts for the highest share of energy consumption followed by commercial/ industrial and surface transport.

South Hampshire is responsible for 6.6 Million Tonnes of Emissions. For emissions, the higher carbon intensity of the commercial/ industrial sector result in an even split on emissions between domestic and commercial/ industrial. Based on this analysis, emissions capita have been calculated at 6.7 tonnes of carbon dioxide.



Emissions are projected to increase over the next twenty years based on extending trend line performance for the major sectors of use.



ENERGY SUPPLY IN SOUTH HAMPSHIRE

Enough solar radiation reaches the ground to cover fifty two times the amount of energy consumed by South Hampshire over the course of a year.

Whilst some of this naturally occurring solar energy is being used passively through natural solar gain in buildings, there are few examples of development using this naturally occurring resource is being used actively to generate power directly. A few innovative housing schemes mainly in the social sector have applied active technologies but they are very much in the minority.

Only a tiny fraction of solar energy is captured through photosynthesis that creates biomass (an estimated 7,250 GWh per annum or 0.64%1 of Solar Energy incident upon gardens and green-space).

Added to solar is the flow of energy available from within the earth's core as a source of geothermal energy some of which is used to supply the Southampton district heating network. In common with all developed societies, energy demand is currently met from stored biomass accumulated across geological timescales as fossilized plant and animal matter which provides high density fossilised solar energy. As localized deposits have been exhausted, the supply base has extended well beyond sub regional, regional and national boundaries.

Fossil Fuel Based Supply

Current energy needs are met by either delivering carbon based fuels to the sub region along with electricity through a set of fuel/ energy specific supply networks. The regulator Ofgem exercises regulatory control over gas and electricity transmission, distribution and supply companies.

Final consumers are free to purchase energy from a range of suppliers. Market forces drive the price that consumers pay. The forces and signals that control and influence the market are diverse. They range from international energy commodity prices to increases in demand for products driven by tax incentives or publicity. Decisions such as whether or not to install Combined Heat and Power and the level of investment in energy efficiency are made in the context of the energy market.

Oil

South Hampshire plays a significant role in the supply of fossil fuels both locally and nationally. The coastal geography of South Hampshire means that it has been an ideal location to land imported oil for processing into a variety of petroleum fuel products at the Fawley refinery complex.

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 1 in 5 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.

Electrical Generation

The Fawley area also hosts an associated heavy oil burning power station commissioned in 1969 and now owned by RWE Innogy Plc. This plant was mothballed, however a single turbine has been brought back into production (484MWe) to meet growing need (the remaining mothballed unit is 518 MWe).

In addition, Marchwood Power is building a new £400 million state-of-the-art natural gas combined cycle (CCGT) power plant (840 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, in anticipation of the construction of a new gas-fired power station near Southampton. When operational, SSE will supply 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.

Power Distribution in South Hampshire

Responsibility for the distribution of power lies with the Southern Electric Power Distribution plc which is a wholly owned subsidiary of Scottish and Southern Energy plc. The company has responsibility for the area represented by South Hampshire and beyond.

During the year 2006/7, the company distributed 33.9 TWh. The average number of minutes that customers in the Southern Electric Power Distribution area were without supply was 72 (1 minute more than the previous accounting year) and the number of interruptions was 76 compared to 78 in the previous year.

Waste to Energy

Our assessment of other sources of energy is drawn from the official datasets maintained by the Department for Business and Regulatory Reform (BERR). This dataset shows that the energy supply base includes landfill gas (30 MWe) and mass incineration of waste (30 MWe).

Under Project Integra, an agreement has been entered into with Hampshire Waste Services who have built a new generation energy from waste incinerator on the waterside near Marchwood, Southampton. Forming an important part of the integrated waste strategy for the county in disposing of those materials left over once re-use and recycling has taken place, the 165,000 tonne facility is designed to serve the needs of West Hampshire. It has the capability of generating in excess of 14 MW of electricity from the process that will be supplied to the grid powering more than14, 000 local homes.

Combined Heat and Power – PSECC have access to a new Biomass woodchip CHP system

Information on Combined Heat and Power in South Hampshire has been taken from the Digest of UK Energy Statistics 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 which includes a university and hospital. 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 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, 4 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.

TARGETS FOR SOUTH HAMPSHIRE

4.1 Policy Review – External Drivers

Public policy on energy and climate change is undergoing a rapid evolution over the last few years as concerns over the twin threats of climate change and fossil fuel depletion have spurred action. The pace of change is unlikely to diminish over the next 20 years.
The policy review (itemized review is contained in Annex B) identifies a range of targets relating to carbon dioxide emissions; sector based energy efficiency and deployment of renewables.

Key landmark policy documents include the Climate Change Bill 2007; Energy White Papers (2003 and 2007); Housing Act 2004 and the Draft South East Plan 2007.
Whilst the targets are many and varied, it is possible to extract some common features that can help inform the creation of a framework for South Hampshire. Some key targets for consideration include:

- Achieving a 24-32% decrease in carbon emissions against a 1990 baseline by 2020 and a 60% reduction in carbon emissions by 2050 (Energy White Paper, 2003);
- Securing 10% renewables contribution to electricity by 2010 and an aspiration for 20% of renewables by 2020 (Energy White Paper, 2003);
- Achieving a 20% improvement in the energy efficiency of the housing stock against a 2000 baseline by 2020 (Housing Act 2004);
- Achieving a 10% biofuels mix in transport energy fuels consumption (UK Biofuels Action Plan, 2007);
- Securing an increase in the absolute size of combined heat and power generation in the energy mix (Combined Heat and Power Action Plan, 2004);
- Achievement of zero carbon housing by 2016("Building a Greener Future", 2006)
- Achieving zero carbon non domestic buildings by 2019 (2008 Budget Statement);
- Achieving 20% renewables based on electricity, transport and heat (EU provisional statement)

Some of these policies have been developed at a national level but subsequently cascaded down to regional level using the draft South East Plan as a means of driving essentially national derived targets e.g. renewables. Other targets have been left at the national level to influence decisions taken at a local level.

Despite the profusion of targets, the basis of a framework for South Hampshire would need to account for the following:

1. Emissions Targets (Energy White Paper);
2. Technology Specific Targets (e.g. CHP);
3. Policy SH14 – Common policy framework agreed by the PUSH authorities; and
4. Local Area Agreements and Multi Area Agreement targets.

Developing a Targeting Framework for South Hampshire Emissions

The South Hampshire authorities have all adopted the climate change target as part of their Local Area Agreement targets. These targets and an emergent Multi Area Agreement provide a local setting for action in the sub region.

Technology Specific Targets

No technology specific targets exist for South Hampshire. Technology specific targets obscure underpinning assumptions about the cost competitiveness of one technological solution against another. A “picking winners” strategy is, however, inherently dangerous and could lock South Hampshire into an energy mix that will be unsuited to future need.

Policy SH14

The South Hampshire local planning authorities have agreed to a common framework for the development of low carbon technologies. South Hampshire has a specific target for achieving 100 MWe of installed capacity.

What Magnitude of Emission Reductions?

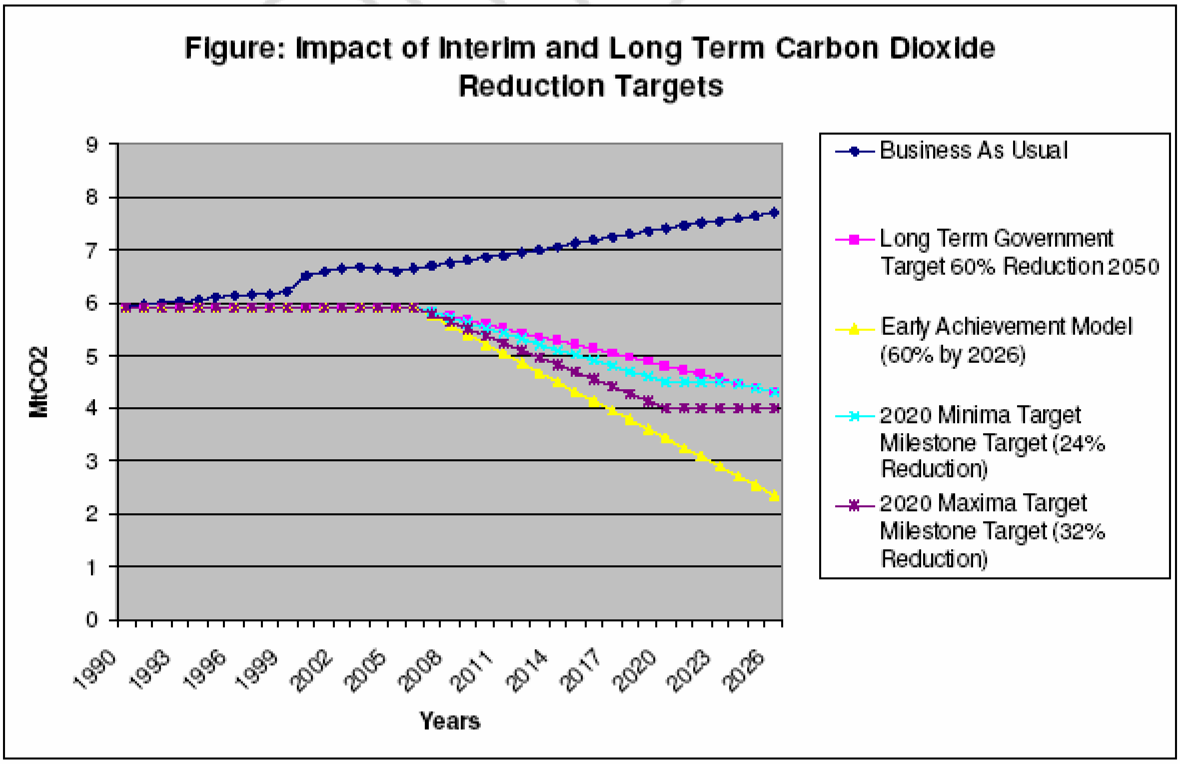
This Study has been premised on the broad scientific acceptance that the rapidity of climate change effects is associated with human action. Until comparatively recently, this strategy would need to have presented a case for substantiating the claim. Beyond the broad agreement that there is a human effect, there is still much scientific debate.

The need to reduce emissions is driven by our current understanding of the science of climate change which has focused on what level of emissions avoids tipping the climate into a chaotic state effectively reducing the carrying capacity of the planet to sustain current and predicted levels of human population.

The 60% cut in emissions contained in current government policy reflected available evidence that suggested such a cut would stabilize carbon dioxide concentration levels at levels that would stabilize the climate. The basis of this original judgement was based on an understanding of climate derived from computer models using evidence available at the time.

The evidence base concerning climate change is continually being refreshed along with the scientific community's understanding of the processes that drive climate change e.g. the role of jet stream in affecting the flooding of 2007. As the models have been improved so has thinking about the policies needed to stabilize the climate.

A contributor to the Fourth Assessment Report of the IPCC (ref) has suggested that an 80% cut would be required by 2030 to keep emissions below a level consistent with a stable climate. Changes in government policy tend to move more slowly than changes in the evidence base so current scientific thinking has yet to be absorbed by policy makers for the most part. Nevertheless, some local policy makers have accepted the merit of the most recent evidence having gone for more aggressive cuts in emissions e.g. London. As a result, South Hampshire needs to accept that emission reduction requirements may increase as government reviews the evidence base.



A second issue surrounds the management of the interim targets set for 2020 which are based on a range between 24% and 32% of 1990 emissions. On this basis, the reduction strategy has to be accelerated faster than a straight line reduction on the 2050 target would suggest.

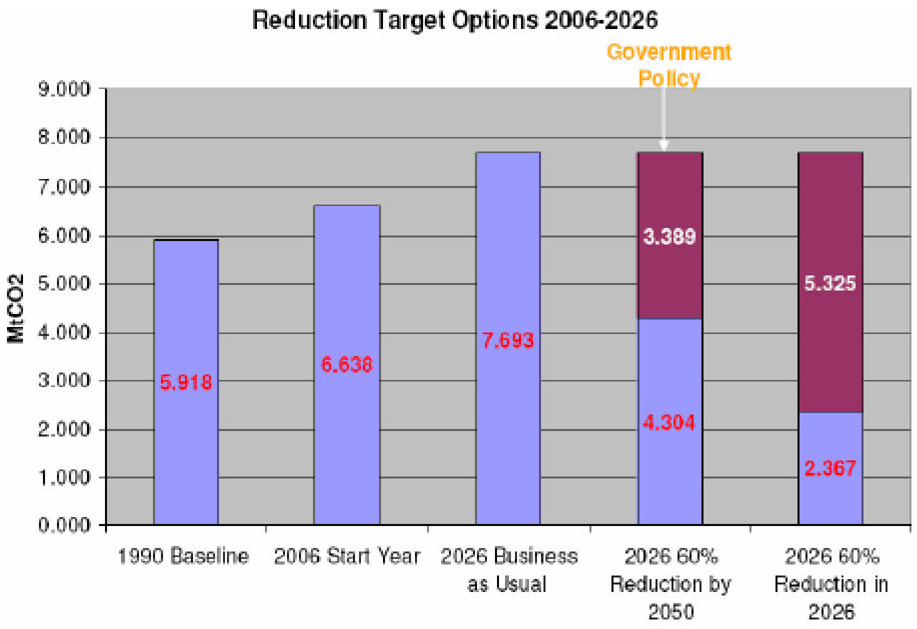
The more aggressive cut has the advantage of exceeding the maxima set for 2020 with a margin to spare. Setting a higher target than government policy currently expects does have the advantage of placing South Hampshire in advance of where central government is likely to go anyway. However, it is arguably the case that central government has not yet changed the way it regulates energy markets and encourages individuals/ businesses to meet the existing 60% target.

So the revision of the target is likely to lead to a significant share of total reductions being loaded onto actions attributable to future changes in national policy triggered by concerns. Such an approach may help South Hampshire evolve a lobbying response on these issues. South Hampshire – A Business as Usual Scenario to 2026 A South Hampshire strategy needs to account for growth as well as current patterns of use and emissions. The draft South East Plan and the commitments related to the government's

Growth Point Initiative means that South Hampshire will grow by a significant factor over the next twenty years. Around 80,000 additional houses and 2,000,000 additional square metres of employment floorspace are expected over this period which will generate additional traffic flows for both freight and personal travel.

A "business as usual" forecast must, therefore, factor in the implications of this growth on both energy consumption and emissions. Our model has, therefore, sought to develop an understanding of what energy consumption and emissions would look like if no mitigating actions were taken by 2026. The results show a steady upward drift in both energy and carbon dioxide emissions from6.6 million tonnes to 7.7 million tonnes of carbon dioxide.

This trend runs contrary to the UK's national policy framework which would require a 37% reduction in emissions by 2026 if South Hampshire were to demonstrate alignment with a 2050 reduction strategy. Business as Usual would only become viable if other parts of the UK were willing to reduce their emissions disproportionately to their actual share of the problem.



Strategic Enablers II – Finance – PSECC? we hope!

The scale of investment required to deliver this agenda is unprecedented involving comprehensive treatment of most areas in South Hampshire. The Stern Report (2006) makes the case for intervention to accelerate the rate of change faster than might occur under a "business as usual" scenario if excessive environmental and social costs are to be avoided.

Whilst the cost effectiveness of energy efficiency and non carbon sources of energy are continually changing with the price of fossil fuels making it more likely that the private sector will invest, accelerated intervention on the scale required will mean looking for new financial freedoms for key stakeholders in the public sector.

Moreover, it can not be assumed that just because a particular solution is viable that it is going to happen. The division of cost and benefit between different organizations and people can be a significant barrier e.g. landlord (making the invest in energy efficiency) and tenant (receiving the benefit).

The investment funding problem is probably greatest in the existing built environment of South Hampshire where the scale of the problem is significant but scope for intervention fragmented.

Review of Sources of Funding

From the perspective of the stakeholders in PUSH, a number of potential funding streams could be tapped to deliver South Hampshire's investment requirement include:

- Development Process;
- Loans;
- Grants;
- Capital Receipts;
- Equity;
- User Charges

These streams can be used individually or in combination to fund investment needs in South Hampshire:

Development Funding – (PSECC could aid this process)

An opportunity may exist to fund some of the investment needed through the development process using either exist powers available under Section 106 of the Town & Country Planning Act 1990 or the Community Infrastructure Levy to fund low carbon infrastructure. However,

Circular 05/2005 requires the level of obligation to be set at a level commensurate with meeting the effects of new development which may limit opportunities for comprehensively treating new build alongside the existing built environment where the two interact. Also some doubts exist as to whether utility infrastructure deemed to be within utility companies' settlement with Ofgem can be counted into the CIL calculation.

This source of investment may therefore face limitations and may not provide an answer for retrofitting existing areas.

Loans

Local Authorities have extensive experience of raising loans for capital projects whether from the Public Works Loan Board or alternative sources such as the European Investment Bank for infrastructure projects. Local Authorities have been given powers to borrow money under the "prudential borrowing power". A rolling loan fund available to building occupiers to upgrade the energy efficiency of their properties in return for regular repayments over an extended period would offer potential to intervene in the existing built up area. However, borrowing must remain within the limits set by the Treasury. However, the use of loans to finance new infrastructure does not deal with the problems of limited capacity to manage the on going revenue implications from newly created assets and the capacity/ skills problems involved in their management.

Grants

Grants have been a longstanding means of implementing energy policy through programmes like Warm Front or the Low Carbon Buildings Programme. Eligibility criteria controlling access will reflect prevailing political priorities and lessons from review programmes.

Whilst sector specific programmes targeted at energy outcomes are a means of delivering outcomes, they are often over subscribed. Energy focused programmes are also dwarfed by some of the mainstream grant funding programmes like Decent Homes or Affordable Housing development which have wider targets to deliver against. Flexing mainstream programmes to deliver higher levels of low carbon performance would create a bigger impact but at the expense of targets elsewhere.

A house built to code 6 standards could cost an additional 25% on standard build cost of an equivalent house built to standards acceptable under current regulations and the Eco Homes Very Good Standard.

The availability of grant funding is usually heavily dependent upon the general state of the economy and pressure from other service obligations. Grants are usually accompanied by targets that may not reflect energy issues. Energy efficiency is typically seen as a non core activity relative to the demands of education and social services.

Capital Receipts

Local authorities receive receipts from the sale of assets. Potentially, these receipts are recyclable into energy infrastructure investment. However, the use of receipts is controlled by regulations in relation to the redemption of debt.

User Charges

User charges can offer a revenue stream that can make a project an attractive prospect for the private investor. User charges could be paid directly by the end user or by government who is then free to determine how much of the charge is passed onto the end user.

Equity

Equity investment through the private sector can be realized on infrastructure projects where private sector funding is acceptable in terms of public objectives and the level of return available. Access to equity depends upon partnership with the private sector.

ANNEX I Fiscal and Regulatory Mechanisms

The Renewables Obligation

A1.1 Introduced on 1 April 2002, the Renewables Obligation will help to create a long-term market for renewable energy, requiring all licensed electricity suppliers to supply at least part of their electricity from eligible renewable energy sources, increasing from 3% in 2002-2003 to 10.4 per cent in 2010-2011. It supersedes the Non Fossil Fuel Obligation (NFFO) under which contracts were awarded for eligible renewable energy schemes. It is estimated that this market will be worth £1 billion by 2010 when taking account of the benefit to renewables from exemption from the Climate Change Levy.

A1.2 The Renewables Obligation creates a new market for tradable Renewable Obligation Certificates (ROCs) that will have to be presented to the Office of Gas and Electricity Markets (Ofgem) by every energy supplier to prove that have sourced a set percentage of their electricity from renewables. Suppliers who do not source sufficient electricity from renewables can still meet the Obligation through a buy out payment for the shortfall. The result will be renewable energy generators earning revenue from the electricity markets and a separate market in ROCs. The penalties paid for non-compliance will be passed on to suppliers able to meet their obligation, as an extra incentive.

Climate Change Levy

A1.3 The Climate Change Levy (CCL) was introduced in April 2001 to reduce the emissions of greenhouse gases. The Levy shifts the burden of taxation from “goods” (employment) to “bads” (greenhouse gas emissions), by doing so it seeks to encourage reduced energy use. The Levy is charged on all energy supplied to industry and commerce, agriculture and public administration and services. The rate at which the Levy is set reflects the carbon intensity of different fuels. Energy intensive industries are able to negotiate an 80% reduction in the CCL in return for meeting targets for energy reduction.

A1.4 Renewable energy and CHP plants are exempt from the Levy. These exemptions aim to give less CO_2-intensive generators an advantage in the market by keeping their prices completive.

A1.5 Parallel to the Levy the government established the Carbon Trust to assist UK businesses in reducing CO_2 emissions by funding and supporting technological innovation and energy efficiency. As the Trust is funded from a proportion of the Climate Change Levy (totalling c. £50m) any reductions it achieves in CO_2 will be included in the total for the Levy. The government estimates that by 2010 9.2 million tonnes CO_2 will be saved each year by the Levy.

Energy Efficiency Commitments

A1.6 This requires all major gas and electricity suppliers to improve the energy efficiency of their customers' homes, each company being set targets to be achieved between 2002 and 2005. The Commitment specifies that at least 50% of the measures should be targeted at priority customers in receipt of income-related benefits or tax credits. Measures include cavity wall insulation, boiler replacement, energy efficient appliances, insulation, energy efficient light bulbs, and loft insulation.

Home Energy Efficiency Scheme

A1.7 Launched in June 2000 the Home Energy Efficiency Scheme (HEES) provides financial incentives to low income consumers to improve the energy efficiency of their homes. In particular it aims to lift the most vulnerable out of fuel poverty (spending more than 10% of their income on fuel). Older households, families with children and householders with disabilities or long term illnesses are identifies as the main beneficiaries of the scheme. In total the government has allocated £600 million to the scheme that is expected to have reached 800,000 vulnerable households by 2004[1].

The Energy Saving Trust

A1.8 The Energy Saving Trust carries out a similar role to the Carbon Trust but for domestic users and small businesses, with a budget of £49m for 2001-02. It promotes the sustainable and efficient use of energy through adverts, advice centres and the endorsement of energy efficient products, and through an Energy Efficiency Partnership for Homes.

[1] DTI (2001) The Energy Report & see http://www.eaga.co.uk/programmes_we_manage/warm_front.html

A2.1 The following Planning Policy Guidance notes (PPGs) are most relevant to this strategy;

PPG 22, Renewable Energy (1993);
PPG 7, The Countryside – Environmental Quality and economic and social development (1997);
PPG2, Green belts (1995);
PPG9, Nature Conservation (1994);
PPG 20, Coastal Planning (1992);
PPG 11, Regional Planning Guidance (2000).

A2.2 The following key themes of the PPGs as regards energy efficiency and development of renewable energy may be identified:

Broad support for renewable energy

A2.3 In line with the government's Climate Change Programme, national policy provides considerable support for renewable energy.

A2.4 PPG 11advises that Regional Planning Guidance (RPG) should define broad locations for renewable energy development and set criteria to help local authorities select suitable sites in development plans. It also states that RPG should set targets for structure plan and unitary plan areas where relevant. It states 'more positive planning at regional and local levels will contribute to greater public familiarity with, and acceptance of, prospective renewable energy developments'.

A2.5 PPG 22 describes the aims of land use planning for energy-generating installations as:

- to ensure that society's needs for energy are satisfied, consistent with protecting the local and global environment;
- to ensure that any environmental damage or loss of amenity caused by energy supply and ancillary is minimised; and
- to prevent unnecessary sterilisation of energy resources.

A2.6 Reflecting the increasing potential of PV as a resource government in 2002 published an annexe to PPG 22 seeking to promote a 'positive, strategic approach' to photovoltaic (PV) systems. The annexe, which is mainly concerned with development control issues, promotes the installation of PV in new build and its retro-fitting in existing buildings.

Support for energy efficiency and Combined Heat and Power (CHP)

A2.7 PPG 11 seeks greater energy efficiency through more sustainable development patterns along with measures such as CHP, to be promoted through regional planning.

A2.8 PPG 3 advises that 'well designed layouts can…contribute to the energy efficiency of new housing'. This is endorsed by the DTI that cites this as encouragement for developers and local planning authorities to explore the feasibility of energy efficient options, including new build

Balance between the local environment and global climate

A2.9 While the benefits of renewable energy are global, the negative impacts tend to be local. National policy requires planning authorities to consider both these aspects when considering the development of renewable energy.

A2.10 PPG7 stresses the need to favour conservation when considering development in Areas of Outstanding Natural Beauty (AONBs) and that in AONBs and national parks, major developments should be demonstrated to be in the public interest before being allowed to proceed. Consideration of applications should therefore normally include an assessment of:

- the need for the development, in terms of national considerations, and the impact of permitting it or refusing it on the local economy;
- the cost of and scope for developing elsewhere outside the area or meeting the need for it in some other way; and
- any detrimental effect on the environment and the landscape, and the extent to which that should be moderated.

A2.11 PPG22 advises that renewable energy development will almost always have some local environmental effects and that the government's policies for developing renewable energy must be weighed carefully with commitments to protect the environment.

Renewable energy in the countryside and coastal areas

A2.12 Due to the location of the resource (particularly biomass fuel and wind) renewable energy development may particularly affect in rural areas. PPG 7 supports the diversification of farms into energy crops, in particular identifying the potential of short rotation coppice.

A2.13 PPG 22 advises that wind energy developments should be sited in sympathy with local features and respect the grain and form of the land, particularly in areas of high landscape value such as AONBs and National Parks. This is an issue as many of the sites most suited to wind farms are in or close to designated areas. It should be stressed that national policy does not preclude wind farm development in designated areas, rather it requires planning authorities to take particular care in assessing proposals.

A2.14 Coastal areas provide some of the greatest opportunities for the development of wind power. However coastal areas are often high quality environments, subject to environmental and landscape designations (PPG9, PPG 20, PPG 22) but also contain previously developed or industrial land that may be suitable for renewable energy development. Again policy stresses that a balance is needed between global imperatives and the local environment.

ANNEX 3 Renewable Energy Resources – (PSECC can aid this process)

A3.1 Renewable energy encompasses a number of different resources and technologies. Each of these has different requirements, potential impacts and factors affecting its development.

A3.2 The resource assessments identify the following renewable energy resources as having the most potential for deployment in the region by 2010, with particular emphasis on energy from different types of biomass and from wind.

A3.4 The assessments focus on electricity generation (to contribute to the government's targets), but this strategy also considers the role of renewable energy for space and water heating (such as solar energy or heat from biomass combustion through combined heat and power).

Biomass

A3.5 Biomass includes existing woodland, purpose grown crops or forests, or by-products and residues from forestry, saw-milling and agriculture. Dry materials can be combusted, or converted to gas and/or liquid fuels by advanced thermal treatment such as pyrolysis or gasification, to produce heat and electricity. This may be undertaken in plants of a range of sizes, or through co-firing of conventional coal-fired power plants. Sewage and wet agricultural wastes including slurries can be used to generate methane rich biogas through anaerobic digestion, which can then be burned to generate heat and electricity.

Existing woodland and energy crops

A3.6 The South East is one of the most heavily wooded regions of the UK with existing forestry producing an estimated 1 million tonnes per annum. However, only a proportion of this (estimated at between 10 & 20%) is likely to be available because of the high costs of extraction and an undeveloped market. This existing resource is important as it is likely to form the foundation on which wood fuelled energy schemes would be initially based in the region. In addition, use of existing woodland and coppice may have further socio-economic and environmental benefits through opportunities for rural development and woodland management.

A3.7 Map 4 (Annex 6) illustrates the distribution of existing woodland in the region, which informed the resource assessment. This also includes use of wood within a 40km commercial collection radius of potential combustion plants, including imports from outside of the region. There may also be potential to use wood from other sources including processing and arboriculture.

A3.8 Energy crops are specifically grown woody plants, including short rotation willow coppice. Short rotation willow coppice typically may be harvested between 3 and 5 years after planting and then on a rotation of 2-4 years. Energy crops can be grown and transported to meet market demands and so differ from other resources, such as wind, which may only be exploited where they occur. However, there are a number of physical, financial and practical factors influencing the feasibility of growing coppice.

A3.9 Map 5 illustrates estimates of the technical potential for growth of new coppice in the region based on considerations of soil type and characteristics, land cover, climate, slope, exposure and proximity to the coast. The technical potential has been tempered by economic and institutional factors in the assessment of practicable resource availability.

A3.10 It is estimated that there is potential for between 15 MW_e (if little new coppice is grown) and 55 MW_e generation (if all parts of the region deploy significant new quantities of coppice) from wood energy crops by 2010, with plants of between 5 and 15 MW_e being developed in all sub-regions.

A3.11 Using the assumption that 4,500 oven dry tonnes of wood per year is needed to fuel $1MW_e$ of installed capacity, and that short rotation coppice yields 10 oven dry tonnes per hectare per year (odt/ha/year), the amount of short rotation coppice required to fuel the additional 40 MW capacity by 2010 is equivalent to 18,000 hectares of land, approximately 3.3% of the region's land area currently under arable production. Of course, the planting of energy crops would not be uniform across the region, with higher coverage within the catchment radius of a biomass plant.

Straw

A3.12 Surplus straw from agricultural crop production may be used as a fuel source to generate electricity & heat. Map 6 illustrates estimates of existing resources across the region (based on arable land use). It is estimated that the practicably available straw could fuel 30 MW electricity generation capacity by 2010, with up to two 15 MW_e plants being developed in the region. The distribution of the resource implies one of these would be most likely to locate in the Thames Valley.

Poultry litter

A3.13 Chicken litter may be combusted to generate electricity and heat. Map 7 illustrates estimates of existing amounts of litter production. Assuming availability of other material within a 40 km collection radius, it is estimated that there is scope for one 15 MW_e capacity plant in the region by 2010, most likely in the West of the region (Thames Valley or in Hampshire).

Farm slurries and sewage

A3.14 Anaerobic digestion of slurries from cattle, pigs and poultry can be used to produce a methane rich gas that may then be burned to generate heat and electricity. The assessment estimates that there is potential for up to 5 MW_e generation capacity by 2010. The anaerobic digestion process may also be used on sewage sludge, which whilst not an agricultural waste, is included here for simplicity. A number of sewage gas schemes already exist in the region generating around 4 MW_e, and the assessment projects a potential deployment of a further 2 MW_e by 2010.

Wind energy

A3.15 Wind can be used to generate electricity through rotating turbine blades. Wind power may be generated through single turbines, or clusters of turbines. Unlike other resources, wind can only be exploited where it occurs, and this determines location of wind turbines. Turbines may be sited onshore where average mean wind speeds are sufficient, or offshore where wind speeds are generally higher and more reliable. Sizes vary but modern commercial turbines typically have three bladed rotors 50 metres in diameter supported on tubular steel towers 50 metres high. When the wind speed is sufficiently high the rotors turn at around 30 revolutions per minute, driving a gearbox and a generator.

Onshore wind – linked to the electricity grid

A3.16 Map 2 illustrates the wind resource across the region. It is generally taken that the cut-off speed for commercial exploitation is where average mean wind speed (AMWS) is above 6.5 metres/second (14.5 mph) at 45m height (to reflect the minimum hub height of most turbines). Energy output from a wind turbine increases steeply with wind speed, so low AMWS sites are much less cost-effective although there may be potential for some wind energy generation at lower wind speeds. The coarseness of the data at regional scale may not identify some sites where wind speeds are sufficiently high.

A3.17 There is a degree of coincidence between areas of highest wind resource and areas of landscape value including Areas of Outstanding Natural Beauty (AONBs) – Map 3. The assessment assumes that clusters of turbines are kept relatively small (4-10 turbines), that a mixture of small clusters and single large turbines are deployed, and that development within designated areas (AONBs) is very limited, of small scale and tightly controlled, presenting an upper estimate of potential for 120 MW_e by 2010.

Onshore wind – on-site use

A3.18 This involves turbines supplying electricity direct to individual buildings, businesses, communities or sites, with turbine sizes and siting reflecting specific demands. The relative regional contribution is likely to be small by 2010 – up to a total capacity of 2 MW_e from 50 individual 30kW turbines.

Offshore wind

A3.19 Offshore wind speeds are generally higher and more consistent than on-shore in the region. Other factors, including the region's shallow coastal waters, avoidance of environmental designations found in the windiest onshore parts of the region, and suitability of the electricity transmission network, indicate that there is significant potential for large-scale offshore wind electricity generation. Avoidance of marine areas of nature conservation importance (including Special Areas of Conservation – Map 3) will reduce potential for conflict with marine wildlife. Developments could be visible from Heritage Coasts and coastal AONBs (Map 3) although siting wind farms a minimum of 5km offshore (as advised by the British Wind Energy Association) would reduce this. Financial and technical considerations (design, construction and connection with the electricity distribution network) make larger machines and higher overall capacity deployment more economic.

A3.20 The resource assessment identifies the potential for between one and four 50 MW_e offshore wind farms (up to twenty five large 2 MW machines) with up to 200 MW_e deployed by 2010. The consent regime for offshore wind differs from on-shore wind and other technologies as it applies to the sea-bed and areas outside of local authority planning control, requiring consent from DTI and a lease from the Crown Estate. However, coastal local authorities are consultees on proposals. In the first round of licences, the Crown Estate and DTI have identified 13 sites for offshore wind development. One of these is Kentish Flats, 8km off the coast of Whitstable in the Thames Estuary where it is proposed to develop 30 turbines of 2-3MW, with a capacity of 90 MW_e by 2005[2].

Solar energy

A3.21 The energy from the sun can be used to heat spaces and water, and also be used to generate electricity.

Photovoltaics (PV)

A3.22 PV uses cells typically made from crystalline silicon to turn sunlight into electricity. PV systems have no moving parts, generate no noise or emissions, and can be integrated into all types of buildings or other structures such as motorway sound barriers. Electricity is used directly in the building with excess electricity able to be exported to the local electricity network. The resource assessment identifies a potential for deployment of up to15 MW by 2010 under an “accelerated uptake” scenario - where costs and other considerations encourage widespread installation - with 3,200 domestic, 105 commercial and 10km of motorway applications by 2010. Under a “business as usual” scenario the potential is limited to 2.4 MW from around 800 installations.

Active solar heating

A3.23 This uses solar collectors to acquire energy from the sun to heat water. Typical applications are for domestic hot water or swimming pools. They generate heat only. Deployment has been limited to date due partly to high costs of installation, but it is estimated that under an “accelerated uptake” scenario, up to 26,600 domestic installations could be in place by 2010.

Passive solar building design

A3.24 This is a mature technology where buildings are designed to make the most of natural light for heating, lighting and ventilation. Good design can then result in the displacement of energy from other (fossil fuel) sources. Passive solar design may be seen as an energy efficiency measure.

[2] www.offshorewindfarms.co.uk/sites/kentish-flats.html

Wave and Tidal Current

Wave

A3.25 Wave energy converters extract the energy in waves and convert it into electrical power using generators driven by mechanical motion, fluid or air pressure. Wave energy generators can be deployed on the shoreline of in deeper waters offshore. The South East has lower wave energy levels than much of the country and so is unlikely to be a focus for deployment to 2010, but may have potential in the longer term.

Tidal current

A3.26 Tidal current technology, where underwater currents caused by tides are used to drive turbines, is an “emerging” technology with prototypes being considered elsewhere in the country at present. It is unlikely that there is scope for deployment of this technology in the region by 2010, but there may be longer term potential (up to 10 MW from a single scheme) if the technology develops.

Small scale hydro

A3.27 This uses the flow of water in rivers to turn turbines and generate electricity. The amount of electricity generated depends on the rate of water flow and head of pressure. The resource assessments identify limited scope for deployment of this technology, (up to 1MW by 2010).

Fuel Cells

A3.28 Fuel cells use a chemical reaction (similar to a battery) to produce electricity and heat. The fuel, usually hydrogen, can be obtained from various sources including from processes using renewable energy. Fuel cells are very efficient, produce low emissions, have no moving parts and so are also quiet. The UK’s first fuel cell combined heat and power plant system is being installed at a recreation centre in Woking.

Energy from waste

A3.29 The resource assessments include energy-from-waste as a potential source of renewable energy. Waste sources include municipal and commercial and industrial wastes, in addition to agricultural, forestry and sewage wastes described above.

A3.30 Electricity and heat may be derived from combustion of municipal and commercial and industrial waste, or from fuel derived from waste. Advanced thermal treatment through pyrolysis or gasification can increase the efficiency of the process. Only the energy from advanced thermal treatment of the non-fossil fuel element of mixed waste qualifies under the Renewables Obligation.

A3.31 The methane-rich gas from landfill sites, produced when organic materials decompose, may also be collected and used as a fuel for producing heat and generating electricity. At present, landfill gas combustion accounts for most of the region’s “renewable” energy.

A3.32 The potential contribution of municipal, commercial and industrial waste, and landfill gas waste is large, particularly in the short term, contributing up to 274 MW_e (nearly 40% of the total generation capacity) by 2010, and a comparable amount up to 2016 (though the proportion declines to 28% as other technologies become more established).

A3.33 This strategy includes in its targets the assessment of the potential for energy from agricultural and forestry wastes and residues, but does not consider further the potential for energy derived from municipal (including household), commercial and industrial waste. We have taken this approach because development of energy-from-waste facilities will be developed to meet waste management needs and will be informed by waste management policy having regard to the waste hierarchy (prioritising reduction, re-use, recycling and recovery) and Best Practicable Environmental Option (BPEO). It is important that renewable energy imperatives or targets do not drive waste management decisions.

A3.34 However, it is consistent with waste management objectives, including moving up the waste hierarchy, to recover as much energy as possible from waste that is incinerated, and to recover energy from methane rich landfill gas. This may be seen as a useful alternative source of energy to fossil fuels. The Regional Waste Management Strategy being prepared by the Regional Assembly with the South East Regional Technical Advisory Body for waste (SERTAB) will indicate the likely scale and need for development of energy-from-waste facilities in the region over the next 25 years.

ANNEX 4

Tables extracted from An Assessment of the South East's Renewable Energy Capacity and Potential to 2026. Report to the South East England Regional Assembly by AEA Technology/FPD Savills (May 2002)

Table A4.1. Indicative sub-regional potential for generation of electricity from renewable sources in the South East by 2010

Table A4.2. Indicative county level potential for generation of electricity from renewable sources in the South East by 2010

Table A4.3. Indicative sub-regional potential for generation of electricity from renewable sources in the South East by 2016

Table A4.4. Illustrative Scenarios for generation of electricity from renewable sources in the South East by 2026

Notes to accompany Tables 1-4

Figures in each cell are respectively the Number of potential schemes, excluding photovoltaic installations, and within the brackets the total installed capacity from those schemes in Mega Watts (MW).

The categories of technology type and size shown within Tables 1 – 4 are indicative. In practice the nature and size of actual schemes may differ. In particular, recent emphasis upon smaller scale technology deployment might lead to opportunities for biomass at scales smaller than those shown. In addition it should be noted that these categories apply only to electricity or CHP schemes. The potential role of heat-producing schemes is discussed within the main text. From this it follows that small and micro-scale schemes do not figure explicitly within the Tables and that a zero for a particular technology does not preclude schemes of that type coming forward.

The energy outputs presented in the energy-from-waste totals assume that 60% of electricity output is from biodegradable sources. If these plants are eligible for the Renewables Obligation this also implies that the schemes will use advanced thermal treatment – no such examples currently exist in the South East. Green Waste is assumed to be clean uncontaminated biomass material arising separately from mixed waste streams. It would potentially be utilised within "hybrid" biomass / clean waste plants.

Table A4.1 Indicative sub-regional potential for generation of electricity from renewable sources in the South East by 2010

Indicative Renewable Energy Generation Type/Size		SUB-REGIONAL TOTALS BY 2010				OVERALL TOTAL
	Existing Installed Capacity	Thames Valley	Hampshire & Isle of Wight	Surrey, East & West Sussex	Kent	
Renewable Energy Sources						
Large CHP / Electricity Plants Fuelled by the Combustion of Energy Crops and/or Agricultural & Forestry Biomass (AFB) (15+ MW)	0	1 Wood (15) 1-2 Straw (15-30) Up to 1 Chicken. Litter(Up to 15)	Up to 1 Wood (up to 15) Up to 1 Straw (up to 15) Up to 1 Chicken. Litter (up to 15)	Up to 1 Wood (up to 15) Up to 1 Straw (up to 15)	Up to 1 Straw (up to 15)	1-2 Wood (30) 2 Straw (30) 1 Chicken Litter (15)
Small CHP Plants Fuelled by the Combustion of Energy Crops and/or AFB (5-10 MW)	0	Up to 3 Wood (up to 15)	Up to 2 Wood (up to 10)	Up to 3 Wood (up to 15)	Up to 2 Wood (up to 10)	5 Wood (25)
Anaerobic Digestion Plants Fuelled by Farm Biogas (0.5 MW)	0	3 (1.5)	3 (1.5)	2 (1)	2 (1)	10 (5)
Offshore Wind Farms (50-75MW ; 20-30 turbines)	0	0	1 (50)	1 (50)	1-2 (100)	3-4 (200)
Small Wind Clusters (6 MW; 4-10 Turbines)	0	5 (30)	7 (42)	1 (6)	3 (18)	16 (96)
Single Large Wind Turbines (1.5 MW)	1 (1)	4 (6)	4 (6)	4 (6)	4 (6)	16 (24)
Single Small Wind Turbines/Chargers (0.03 MW)	2 (0.55)	10 (0.3)	10 (0.3)	15 (0.45)	15 (0.45)	50 (2)
Small-Scale Hydro Power(0.1 MW)	0	1-2 (0.5)	0	0	2-3 (0.3)	5 (0.8)
Domestic PV Installations (1.5-3kW$_p$)	4 (0.005)	800 (2.1)	700 (1.85)	1050 (2.75)	650 (1.7)	3200 (8.4)
Commercial PV Installations (50kW$_p$)		38 (1.9)	20 (1.0)	25 (1.25)	23 (1.15)	106 (5.3)
Motorway PV Installations (160kW$_p$/km)		7 (0.6)	3 (0.25)	6 (0.45)	4 (0.3)	20 (1.6)
Renewables Sub-Total	***7 (1.55)***	***25-31 + PV (73-118)***	***25-30 + PV (103-158)***	***23-28 + PV (68-113)***	***27-32 + PV (129-154)***	***111 + PV (443)***
Energy-from-Waste						
CHP or Electricity Plants Fuelled by Landfill Gas	26 (54)	17 (42.6)	6 (7.0)	17 (35.4)	11 (23.0)	51 (107.9)
CHP or Electricity Plants Fuelled by Municipal or Industrial Solid Wastes	2 (14.2)	3 (52.5)	4 (41.5)	2 (30)	1 (40)	10 (164)
CHP or Electricity Plants part-Fuelled by Green Waste	0	- (2)	- (1)	- (2)	- (1)	Within Biomass (6)
Anaerobic Digestion Plants Fuelled by Sewage Gas (0.5MW)	7 (4.3)	8 (5.0)	0	2 (0.8)	1 (0.5)	11 (6.3)
Energy-from-Waste Sub-Total	***35 (72.6)***	***28 (102)***	***10 (49)***	***21 (68)***	***13 (64)***	***72 (284)***
Total	**42 (≈74)**	**53-59 + PV (175-220)**	**35-40 + PV (152-207)**	**44-49 + PV (136-181)**	**40-45 + PV (193-218)**	**183 + PV (730)**

Table A4.2 Indicative county level potential for generation of electricity from renewable sources in the South East by 2010

		TOTALS BY 2010									TOTAL
Indicative Renewable Energy Generation Type/Size	**Existing Installed Capacity**	**Thames Valley**			**Hampshire & Isle of Wight**		**Surrey, East & West Sussex**			**Kent**	
		Oxon	**Berks**	**Bucks**	**H'shire**	**IOW**	**Surrey**	**W Suss**	**E Suss**	**Kent**	
Renewable Energy Sources											
Large CHP / Electricity Plants Fuelled by Energy Crops and/or Agricultural & Forestry Biomass (AFB) (15+ MW)	0	Up to 2 (up to 30)	Up to 2 (up to 30)	Up to 2 (up to 30)	Up to 3 (up to 45)	0	Up to 1 (up to 15)	Up to 1 (up to 15)	Up to 1 (up to 15)	Up to 1 (up to 15)	4-5 (75)
Small CHP Plants Fuelled by Combustion of Energy Crops and/or AFB (5-10 MW)	0	Up to 2 (up to 10)	Up to 2 (up to 10)	Up to 2 (up to 10)	Up to 2 (up to 10)	0	Up to 2 (up to 10)	Up to 1 (up to 5)	Up to 1 (up to 5)	Up to 2 (up to 10)	5 (25)
Anaerobic Digestion Plants Fuelled by Farm Biogas (0.5 MW)	0	1 (0.5)	1 (0.5)	1 (0.5)	2 (1)	1 (0.5)	Up to 1 (up to 0.5)	Up to 1 (up to 0.5)	Up to 1 (up to 0.5)	2 (1)	10 (5)
Offshore Wind Farms (50-75MW, 20-30 turbines)	0	0	0	0	0	1 (50)	0	Up to 1 (up to 50)	Up to 1 (up to 50)	1-2 (100)	3-4 (200)
Small Wind Clusters (6 MW; 4-10 Turbines)	0	2 (12)	1 (6)	2 (12)	5 (30)	2 (12)	0	0	1 (6)	3 (18)	16 (96)
Single Large Wind Turbines (1.5 MW)	1 (1)	1 (1.5)	2 (3)	1 (1.5)	3 (4.5)	1 (1.5)	1 (1.5)	2 (3)	1 (1.5)	4 (6)	16 (24)
Single Small Wind Turbines/Chargers (0.03 MW)	2 (0.55)	3 (0.09)	4 (0.12)	3 (0.09)	8 (0.24)	2 (0.06)	5 (0.15)	5 (0.15)	5 (0.15)	15 (0.45)	50 (2)
Small-Scale Hydro Power(0.1 MW)	0	1 (0.3)	1 (0.2)	0	0	0	0	0	0	3 (0.3)	5 (0.8)
Domestic PV Installations (1.5-3kW_p)		230 (0.6)	295 (0.78)	275 (0.72)	640 (1.69)	60 (0.16)	415 (1.09)	310 (0.81)	325 (0.85)	650 (1.7)	3200 (8.4)
Commercial PV Installations (50kW_p)	4 (0.005)	10 (0.5)	20 (1.0)	8 (0.4)	18 (0.9)	2 (0.1)	15 (0.75)	5 (0.25)	5 (0.25)	23 (1.15)	106 (5.3)
Motorway PV Installations (160kW_p/km)		2 (0.16)	4 (0.32)	1 (0.08)	3 (0.24)	0	4 (0.32)	2 (0.16)	0	4 (0.32)	20 (1.6)
Renewables Sub-Total	***7 (1.55)***	***8-12 (16 –56)***	***9-13 (12-44)***	***7-11 (15-55)***	***20-25 (39-94)***	***7 (64)***	***6-10 (4-29)***	***7-11 (4-75)***	***7-11 (9-79)***	***28-33 (129-154)***	***109-111 (443)***
Energy-from-Waste											
Landfill Gas Fuelled CHP/Electricity Plants	26 (54)	4 (9.3)	5 (7.5)	8 (25.8)	6 (7)	0	9 (19.3)	5 (11.2)	3 (4.9)	11 (23)	51 (107.9)
CHP or Electricity Plants Fuelled by Municipal or Industrial Solid Wastes	2 (14.2)	1 (10)	2 (42.5)	0	3 (39)	1 (2.5)	1 (20)	0-1 (0-10)	0-1 (0-10)	1 (40)	10 (164)
CHP or Electricity Plants part-Fuelled by Green Waste	0	- (0-1)	- (0-1)	- (0-1)	- (0-1)	0	- (0-2)	- (0-1)	- (0-1)	- (0-1)	Within Biomass (6)
Anaerobic Digestion Plants Fuelled by Sewage Gas (0.5MW)	7 (4.4)	1 (0.67)	6 (3.1)	1 (0.32)	0	0	1 (0.5)	1 (0.32)	0	1 (0.5)	11 (6.3)
Energy-from-Waste Sub-Total	***35 (72.6)***	***6 (20-21)***	***13 (53-54)***	***9 (26-27)***	***9 (46-47)***	***1 (2.5)***	***11 (40-42)***	***6-7 (12-23)***	***3-4 (5-16)***	***13 (64-65)***	***72 (284)***
Total	**42 (≈74)**	**15 (52)**	**24 (71)**	**17 (55)**	**29 (106)**	**8 (67)**	**19-20 (51-66)**	**14-17 (21-96)**	**11-14 (14-89)**	**42-43 (198)**	**181-183 (727)**

Table A4.3 Indicative sub-regional potential for generation of electricity from renewable sources in the South East by 2016

		TOTALS BY 2016									OVERALL TOTAL
Indicative Renewable Energy Generation Type/Size	**Existing Installed Capacity**	**Thames Valley**			**Hampshire & IOW**		**Surrey, East & West Sussex**			**Kent**	
		Oxon	**Berks**	**Bucks**	**H'shire**	**IOW**	**Surrey**	**W Suss**	**E Suss**	**Kent**	
Renewable Energy Sources											
Large CHP / Electricity Plants Fuelled by Energy Crops and/or Agricultural & Forestry Biomass (AFB) (15+ MW)	0	Up to 2 (up to 30)	Up to 2 (up to 30)	Up to 2 (up to 30)	Up to 3 (up to 45)	0	Up to 2 (up to 30)	Up to 1 (up to 15)	Up to 1 (up to 15)	Up to 1 (up to 15)	5-7 (105)
Small CHP Plants Fuelled by Energy Crops and/or AFB (5-10 MW)	0	Up to 2 (up to 10)	Up to 3 (up to 15)	Up to 2 (up to 10)	Up to 2 (up to 10)	0	Up to 3 (up to 15)	Up to 1 (up to 5)	Up to 1 (up to 5)	Up to 3 (up to 15)	10 (50)
Anaerobic Digestion Plants Fuelled by Farm Biogas (0.5 MW)	0	2 (1)	2 (1)	2 (1)	3 (1.5)	1 (0.5)	2 (1)	2 (1)	2 (1)	4 (2)	20 (10)
Offshore Wind Farms (50-75MW; 20-30 turbines)	0	0	0	0	0	1 (50)	0	Up to 1 (up to 50)	Up to 1 (up to 50)	2-3 (200)	4-5 (300)
Small Wind Clusters (6 MW; 4-10 Turbines)	0	2 (12)	2 (12)	2 (12)	5 (30)	2 (12)	0	1 (6)	1 (6)	5 (30)	20 (120)
Single Large Wind Turbines (1.5 MW)	1 (1)	2 (3)	2 (3)	2 (3)	4 (6)	2 (3)	2 (3)	2 (3)	2 (3)	6 (9)	24 (36)
Single Small Wind Turbines/Chargers (0.03 MW)	2 (0.55)	6 (0.18)	8 (0.24)	6 (0.18)	16 (0.48)	4 (0.12)	10 (0.3)	10 (0.3)	10 (0.3)	30 (0.9)	100 (3.5)
Small-Scale Hydro Power(0.1 MW)	0	1 (0.3)	1 (0.2)	0	0	0	0	0	0	3 (0.3)	5 (0.8)
Domestic PV Installations (1.5-3kW$_p$)		460 (1.2)	590 (1.56)	550 (1.44)	1280 (3.38)	120 (0.32)	830 (2.18)	620 (1.62)	650 (1.7)	1300 (3.4)	6400 (16.8)
Commercial PV Installations (50kW$_p$)	4 (0.005)	15 (0.75)	30 (1.5)	12 (0.6)	27 (1.35)	3 (0.15)	22 (1.1)	7 (0.35)	7 (0.35)	34 (1.7)	157 (7.85)
Motorway PV Installations (160kW$_p$/km)		3 (0.24)	6 (0.48)	1 (0.08)	4 (0.32)	0	6 (0.48)	3 (0.24)	0	6 (0.48)	28 (2.24)
Tidal Current Installations	0	0	0	0	1 (10)	0	0	0	0	0	1 (10)
Wave Energy Installations (30MW)	0	0	0	0	0	0	0	0	0	1 (30)	1 (30)
Renewables Sub-Totals	***7 (1.55)***	***13-17 (19-59)***	***15-21 (20-65)***	***12-16 (18-58)***	***29-34 (53-108)***	***10 (66)***	***14-19 (8-68)***	***15-18 (13-83)***	***15-18 (12-82)***	***51-56 (278-308)***	***190-193 (692)***
Energy-from-Waste											
Landfill Gas Fuelled CHP or Electricity Plants	26 (54)	4 (9.3)	5 (7.5)	8 (25.8)	6 (7)	0	9 (19.3)	5 (11.2)	3 (4.9)	11 (23)	51 (107.9)
CHP or Electricity Plants Fuelled by Municipal or Industrial Solid Wastes	2 (14.2)	1 (10)	2 (42.5)	0	3 (39)	1 (2.5)	1 (20)	0-1 (0-10)	0-1 (0-10)	1 (40)	10 (164)
CHP or Electricity Plants part-Fuelled by Green Waste	0	- (0-1)	- (0-1)	- (0-1)	- (0-1)	0	- (0-2)	- (0-1)	- (0-1)	- (0-1)	Within Biomass (6)
Anaerobic Digestion Plants Fuelled by Sewage Gas (0.5MW)	7 (4.4)	1 (0.67)	6 (3.1)	1 (0.32)	0	0	1 (0.5)	1 (0.32)	0	1 (0.5)	11 (6.3)
Energy-from-Waste Sub-Totals	***35 (72.6)***	***6 (20-21)***	***13 (53-54)***	***9 (26-27)***	***9 (46-47)***	***1 (2.5)***	***11 (40-42)***	***6-7 (12-23)***	***3-4 (5-16)***	***13 (64-65)***	***72 (284)***
Total	**42 (≈74)**	**19-23 (39-80)**	**28-34 (73-119)**	**21-25 (44-85)**	**38-43 (99-155)**	**11 (69)**	**25-30 (48-110)**	**21-25 (25-106)**	**18-22 (17-98)**	**64-69 (342-373)**	**≈260 (976)**

Table A4.4 Illustrative Scenarios for generation of electricity from renewable sources in the South East by 2026

ILLUSTRATIVE RENEWABLE ENERGY ELECTRICITY SCENARIOS FOR 2026 IN SOUTH EAST ENGLAND						
Indicative Renewable Energy Generation Type/Size	**Existing Installed Capacity (MW)**		**Low Deployment Scenario**		**High Deployment Scenario**	
	Schemes	Capacity	No. of Schemes	Installed Capacity	No. of Schemes	Installed Capacity
Renewable Energy Sources						
Offshore Wind Farms (50-100 MW; 20-40 Turbines)	0	0	3-4	200	6-8	700
Small Wind Clusters (6 MW; 4-10 Turbines)	0	0	16	96	20	120
Single Large Wind Turbines (1.5 MW)	1	1	16	24	24	36
Single Small Wind Turbines/Chargers (0.03 MW)	2	0.55	50	1.5	100	3
Large CHP / Electricity Plants Fuelled by the Combustion of Energy Crops and/or Agricultural & Forestry Biomass (AFB) (15+ MW)	0	0	1-2 Wood 2 Straw 1 Chicken Litter	30 30 15	2-4 Wood 2 Straw 1 Chicken Litter	60 30 15
Small CHP Plants Fuelled by the Combustion of Energy Crops and/or AFB (5-10 MW)	0	0	5 Wood	25	10	50
Anaerobic Digestion Plants Fuelled by Farm Biogas (0.5 MW)	0	0	10	5	20	10
Small-Scale Hydro Power (0.1 MW)	0	0	5	0.8	5	0.8
Domestic PV Installations (1.5-3kW$_p$)	4	0.005	3200	8.4	Up to 234,000	Up to 351
Commercial PV Installations (50kW$_p$)			105	5.3	200	10
Motorway PV Installations (160kW$_p$/km)			10km	1.6	20km	3.2
Fuel Cell installations	0	0	Up to 1000	Up to 6	Up to 10,000	Up to 60
Tidal Current Installations	0	0	0	0	1	10
Wave Energy Installations (30MW)	0	0	0	0	Up to 5	Up to 150
Renewables Sub-Totals	***7***	***≈1.55***	***109 + PV / FC***	***449***	***196-200***	***1609***
Energy-from-Waste						
CHP or Electricity Plants Fuelled by Landfill Gas	26	54	51	107.9	0	0
CHP or Electricity Plants Fuelled by Municipal or Industrial Solid Wastes	2	14.2	10	164	4-8	80
CHP or Electricity Plants part-Fuelled by Green Waste	0	0	-	6	-	6
Anaerobic Digestion Plants Fuelled by Sewage Gas (0.5 MW)	7	4.4	11	6.3	4	2
Energy-from-Waste Sub-Totals	***35***	***72.6***	***72***	***284***	***8-12***	***88***
Total	**42**	**≈74**	**181 + PV / FC**	**733**	**204-212 + PV / FC**	**1697**

ANNEX 5 Planning and Land Use Issues - Key Renewable Energy Resources

PSECC once more can assist

A5.1 Given the relative importance and potential implications of biomass, wind energy and photovoltaics, the issues which these raise which will need to be addressed in planning policy and be considered when development proposals come forward are summarised below[3]:

Wind energy development

Site suitability

A5.2 Wind may only be exploited commercially where it occurs at sufficiently high average speeds. An Average Mean Wind Speed (AMWS) of 6.5 metres per second (c.14.5 mph) is generally used as the lower cut off point for commercial exploitation, although there may be scope for deployment at slightly lower wind speeds. Access and proximity to connection to the electricity distribution network will also be key considerations. Suitability of areas for offshore wind development is determined by factors including water depth, shipping lanes, and accessibility to onshore grid connection, as wind speed offshore is generally higher and more consistent.

A5.3 Map 2 identifies average wind speed and, on a broad regional scale, where wind speeds are likely to be sufficient for wind energy development. Local assessments of renewable energy resource availability will be necessary to identify in finer detail areas suitable for wind energy development where wind speeds are sufficiently high.

Visual impact, noise and interference

A5.4 In the South East higher wind speeds coincide to an extent with high and exposed land, often subject to protective landscape designation as Area of Outstanding Natural Beauty (Map3). The advice in PPG7 regarding development in sensitive landscapes is therefore of particular relevance. There are also likely to be a range of exposed coastal locations where wind speeds are likely to be adequate for commercial development.

A5.5 There is clearly potential for wind developments to affect sensitive landscapes through visual intrusion of the towers and rotation of blades. The degree of impact can be influenced through scale, design and spacing, either of individual turbines or as small clusters. Additional impacts may include noise and vibration caused by movement of the blades and gearing. The resource assessments acknowledged these issues and this is reflected in the potential contribution of wind energy in the regional and sub-regional indicative targets through a mixture of relatively scale clusters of small turbines and single larger turbines as most feasible in terms of fitting in with the grain of the landscape of the South East.

A5.6 Offshore wind development is not controlled by the planning system but coastal authorities will be consultees on proposals. The visual impact from coasts is likely to be the key issue for consideration although the distance from the shore (5-10km) and limited extent of Heritage Coast and coastal AONB (Map 3) will reduce the visibility and potential impact very significantly.

[3] For further information see www.dti.gov.uk/renewable/

Identification of areas of wind energy potential

A5.7 The resource assessments assume that wind energy development within designated landscapes will be very limited and of small scale, and tightly controlled. The identification of broad areas of search based on the broad locations where wind speed is 6.5m/s (14.5mph) and above (Maps 2 & 3) which are capable of accommodating different types and scales of wind energy will be useful in providing guidance as to where wind energy developments will be favourably considered. Application of a sequential approach to considering appropriate areas, prioritising previously developed land and non-sensitive landscapes over sensitive or designated landscape areas will help to reduced conflicts, but this should not preclude consideration of wind energy development of appropriate design and scale within or adjacent to AONBs and in greenbelt. This should be informed by consideration of landscape character, which will help identify the potential for development and its impact on the landscape, and conditions, which may be applied to development.

A5.8 In all cases the significance of the development in terms of energy generation and contribution to national objectives should be judged against the scale of local impact. In developing areas of wind energy potential it is essential that local authorities work closely with the wind energy industry, the Countryside Agency (which will be able to advise on landscape character assessment[4] and Quality of Life Capital[5] assessment), and effectively engage local communities. This will help to identify the important environmental and cultural features of an area, monitor change, understand the sensitivity to development, and provide guidance on design, scale, siting and other conditions for wind energy development.

A5.9 In considering the potential for wind development and its impacts the possibility of using time-limited consents should be considered. The life span of turbines is currently around 25 years, after which maintenance costs and technical obsolescence necessitate replacement. Proposals for replacement can then be assessed in due course in light of relevant policy concerns. Planning permission may be time limited with conditions applied for the restoration of the site to its original state should the installation be removed. The temporary nature of development may make development in more sensitive landscapes more widely acceptable.

Ecology

A5.10 Wind energy, like all development, may affect ecology if it involves loss or damage to important habitats or designated sites such as Sites of Special Scientific Interest (SSSIs). Important semi natural habitats in such windy areas include chalk grassland and coastal marshes. PPG9 provides advice on the protection to be afforded to wildlife and designated sites in particular. There is little evidence that wind energy development results in bird collision or affects bird breeding, although disturbance to habitats during construction and operation may occur. Given the limited number of developments required to achieve the regional potential, development should not be sited where significant adverse effects will occur to designated sites.

Traffic

A5.11 Heavy traffic will be limited to the construction phase with only limited visits for maintenance whilst in operation.

[4] Countryside Agency (2002) Landscape Character Assessment. Guidance for England and Scotland.
[5] Countryside Agency, English Heritage, English Nature, Environment Agency (2001). Quality of Life Capital - Managing environmental, social and economic benefits.

Biomass

Site suitability

A5.12 Biomass, in the form of wood, energy crops and coppice, and agricultural and forestry residues can be transported from where it grew to where it is fired to generate electricity and heat. The prime considerations over siting of combustion plant will be proximity of a suitable electricity network connection, transport infrastructure, proximity to the fuel source, and availability of a suitable development site. Proximity to development, especially of a range of uses, will also be a key factor in facilitating development of CHP.

Visual impact, noise and interference

A5.13 The impact will depend on the scale of the operation. Small and micro scale plants may be accommodated on a range of smaller sites and within existing development, including agricultural buildings. Plants with large capacity will generally require larger sites for buildings, delivery and storage. Chimney stacks can cause visual impact although height may decrease if advanced thermal treatments are employed. Noise may result from the operation of machinery and from lorry movements.

A5.14 The largest potential impact on landscape is likely to result from changing management of agricultural or forestry land to provide adequate supplies of fuel. The existing woodland resource is likely to form the initial basis for supply of wood fuel. However, it is estimated that 18-20,000 hectares of short rotation coppice may be needed to provide the fuel to achieve the region's potential for SRC powered electricity and heat production by 2010 ($40MW_e$), equating to around 3.3% of the land area in the region currently under arable crops. In addition, the management of and access to existing woodland could be affected through use of wood fuel from this source. It is important that planting of short rotation coppice does not adversely effect sensitive or protected landscapes, and use of the Landscape Character assessment may again be useful in identifying potential implications, constraints and conditions for new planting and generating plant development.

Ecology

A5.15 Planting of SRC on important or protected semi-natural habitat would be likely to adversely affect wildlife. SRC requires little fertiliser, herbicide or pesticide inputs, and when grown on land used for intensive agriculture may enhance biodiversity.

Economic and rural development

A5.16 Use of wood fuel and of existing and new coppice grown within the region can provide opportunities for employment, particularly in rural areas, and provides an alternative or additional source of income for farmers. More effective use of existing wood fuel resources before growing new coppice is generally favoured, but the practical and commercial exploitation of this resource may be limited by factors such as ownership and access. A range of grants is available promoting use of biomass energy and planting of energy crops.

Traffic

A5.17 Generation of traffic depends largely on the scale of the operation, and proximity of combustion plant in relation to fuel source. Estimates of traffic generation range from 6 lorries per day for a small 2.5 MW plant, 12 lorries per day for a 5 MW plant and up to 65 loads per day for a large 30 MW plant. To set this in context it may be compared with the 12 goods deliveries and up to 5,500 car journeys per day generated by a large supermarket[6].

[6] DTI & ETSU (1996) Good Practice Guidelines – Short rotation coppice for energy production.

Solar Energy

A5.18 The key planning issues concerning deployment of active solar (photovoltaics and water heating) and passive solar design include orientation and layout, and avoidance of overshadowing of installations.

A5.19 In operation, PV, water heating and passive solar design are noise and emissions free, making these technologies ideal for integration into buildings, particularly in urban areas where potential for use of other renewable resources may be limited. Retro-fitting onto historic buildings or incorporation of systems in conservation areas may raise issues of changing appearance of buildings, but the technology is rapidly developing to become less intrusive including replicating the appearance of traditional materials, for example slates and tiles.

A5.20 Passive solar design can be used for space heating, lighting, ventilation & cooling resulting in significant energy and carbon dioxide emission savings together with innovative building and urban design.

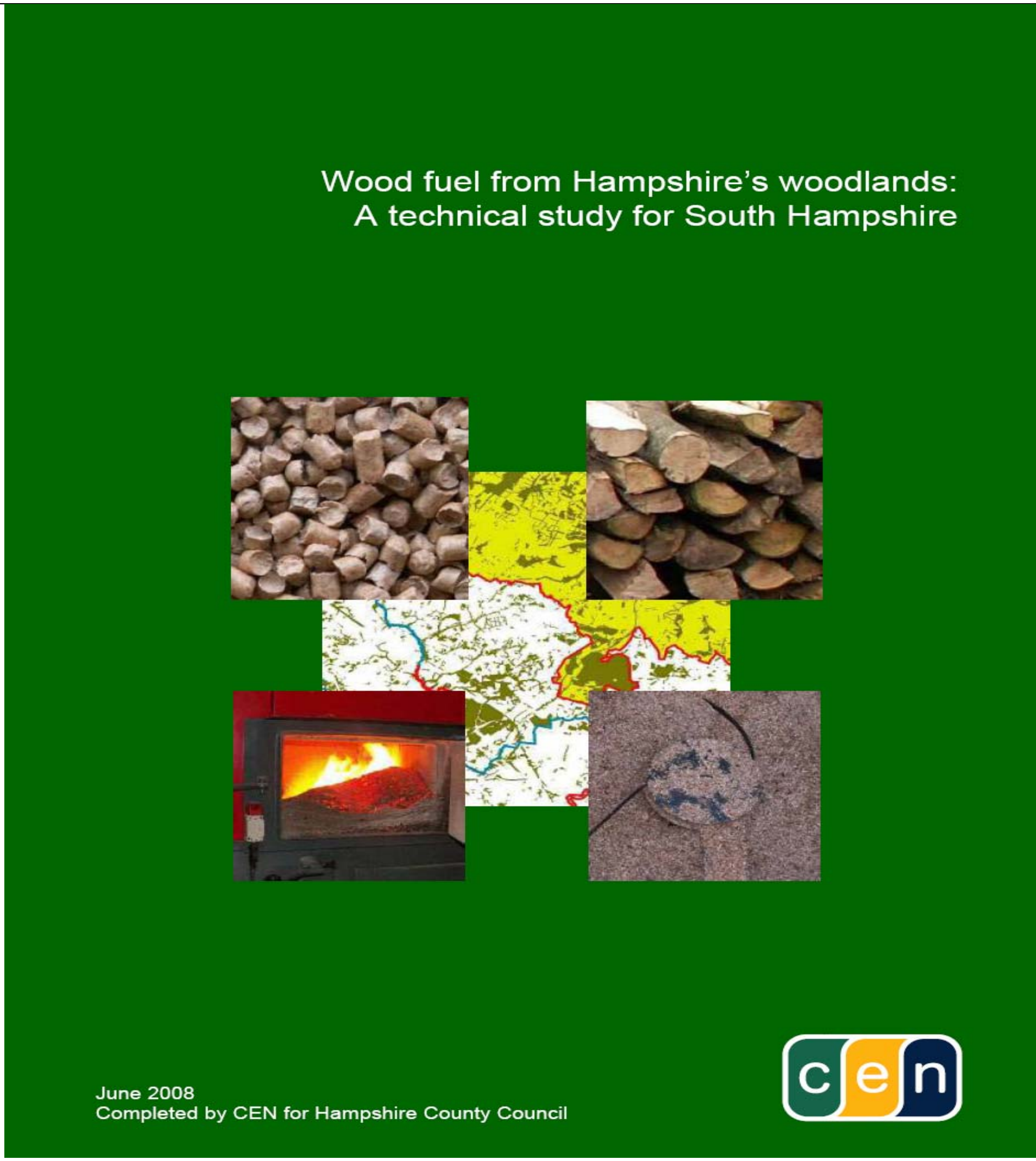
Table A5
Renewable energy resources – issues relating to different technologies and resources

Technology	Land use issues	Technical/financial issues
Biomass - Large generation/CHP plants using energy crops or agricultural and forestry biomass (AFB) residues (15+ MW)	- Traffic generation – lorries supplying fuel; - Siting – can locate on land allocated for industrial uses (B2) and previously developed land; - Building size & stack height; - Noise, dust, odour & vibration; - Fuel "cleanness" (energy crops vs residues) may affect emissions & perception; - Land use change through growth of coppice – potential impacts (+ve and –ve on landscape and habitats; - New type of development in SE.	- Lack of coppice planting and marginal economics of home-grown woodfuel; - Electricity production from biomass relatively expensive (6-8p/kWh) - High capital investment - Mature technology; - Constant generation/supply.
Biomass - small generation/CHP plants using energy crops or agricultural and forestry biomass (AFB) residues (5-10 MW)	As above, but likely to be less significant. Greater flexibility over location & can be integrated with new developments and at community scale.	As above, but less reliant on large-scale new coppice planting.
Anaerobic digestion plants - Farm biogas & sewage	Development can occur on existing farms/buildings or water company land.	Mature technology already deployed in SE.
Offshore wind	- Outwith local authority jurisdiction, but LPAs consultees; - Large turbines visible from coastline incl. AONB; - Constrained by other uses of inshore waters eg navigation, and MoD objections.	- Large scale potential; - New/developing technology in UK; - moderate cost of electricity (4-5p/kWh) - High development and maintenance costs.
Onshore wind - Small wind clusters	- Can only be deployed where wind speed sufficient, mostly on high ground or coastal areas, often coinciding with designated landscapes, and may be visible from distance. - Noise, vibration, electromagnetic interference possible; - Cumulative impact - increased if sited close together; - Limited/temporary permission possible to reflect 25 year lifespan. - limited potential impact on wildlife if sensitive sites eg SSSIs avoided.	- Proven technology; - Relatively competitive electricity price (2.5-3p/kWh) - Intermittent supply.
Onshore wind - Single large turbines	- As above, but visual impact may be less severe and location more flexible – areas of lower wind speed may be exploited; - Potential for community based schemes;	As above

Onshore wind - Single small turbines	- Limited impact and potential for widespread use.	- As above, but small scale individual and total contribution.
Small scale hydro	- Only requiring small-scale development often associated with existing infrastructure eg weirs.	Small scale generation potential
Wave & Tidal	- New/emerging technologies; - May be coincident with coastal nature conservation and landscape designations;	- Expensive electricity (> 8p/kWh) - Emerging technologies.
Photovoltaics	- Aesthetic impact, especially in historic built environments, but new designs enabling integration with buildings eg slates.	- Cost of installation for developers/householders, but capital grants available and price predicted to fall in medium term; - New applications likely as technology develops; - expensive electricity (> 8pkWh)
Active solar heating	- As above	- Cost of installation and payback period
Passive solar design	- Can be integrated into building and urban design;	- Need for cooling as well as heating.

ANNEX 6 Maps

1. Sub-regional renewable energy potential to 2010 and 2016
2. Average Wind Speed
3. Average Wind Speed plus Areas of Outstanding Natural Beauty (AONBs), Sites of Special Scientific Interest (SSSIs), Heritage Coasts, and marine candidate Special Areas of Conservation (SACs)
4. Existing woodland and tree cover
5. Technical potential for new short rotation coppice
6. Existing straw production
7. Existing broiler waste production



PSECC have formed an agreement with CEN to investigate potentials further and PSECC will utilise CEN's expertise in this Biomass field for the development of large scale biomass energy production, initially in Waterlooville MDA and then with HCC agreement throughout the County.

The following data indicates important issues for consideration for this development process – PSECC are currently working up proposals for Portsmouth City Council and West Sussex County Council for biomass energy generation – typically 10MW in size.

1 Executive Summary

This study looks at the potential for the South Hampshire Sub Region to derive energy from local supplies of wood fuel.

South Hampshire covers the whole districts of Southampton, Eastleigh, Fareham, Gosport, Portsmouth and Havant and parts of New Forest, Test Valley, Winchester and East Hampshire districts. It is home to nearly 1 million people. With regard to potential supplies of wood, the study area includes a 10km buffer around the sub region to incorporate the major forests and sawmills.

Wood fuel heating holds certain key benefits for South Hampshire including cutting carbon emissions, increasing rural employment and skills, bringing woodland back into management, improving biodiversity, reducing fuel bills, protecting against fossil fuel shortages and meeting sustainability and renewable energy targets and legislation. With more woodland than any other county in the Southeast, Hampshire in particular is set to gain from these many benefits.

Broadly, the study maintains the following methodology: resource assessment, demand assessment, overlaying supply and demand to identify high interest areas, modelling the drivers and barriers to predict overall market size under different scenarios, and making recommendations.

It was found that the total current supply of wood fuel is 4.85GWh, approximately 1,500 tonnes. By 2026, under the best possible market conditions and with ample support offered to the supply and demand markets, this could grow to a maximum of 442GWh, or around 132,000 tonnes of wood fuel. This material could be sourced from the forestry, tree surgery, sawmill and clean waste wood sectors and would comprise of a mix of wood pellet and high quality and low quality wood chip.

Under equally favourable market conditions and by the same year, the total maximum demand for wood fuel from public buildings and new developments could be as high as 447GWh, approximately 134,000 tonnes of wood fuel.

This incredible similarity between overall supply and demand in 2026 disguises a great variance between the supply and demand in previous years and in the supply and demand for specific fuel types. Figure 1.1 shows the demand steadily increasing over the study period while the supply stays constant.

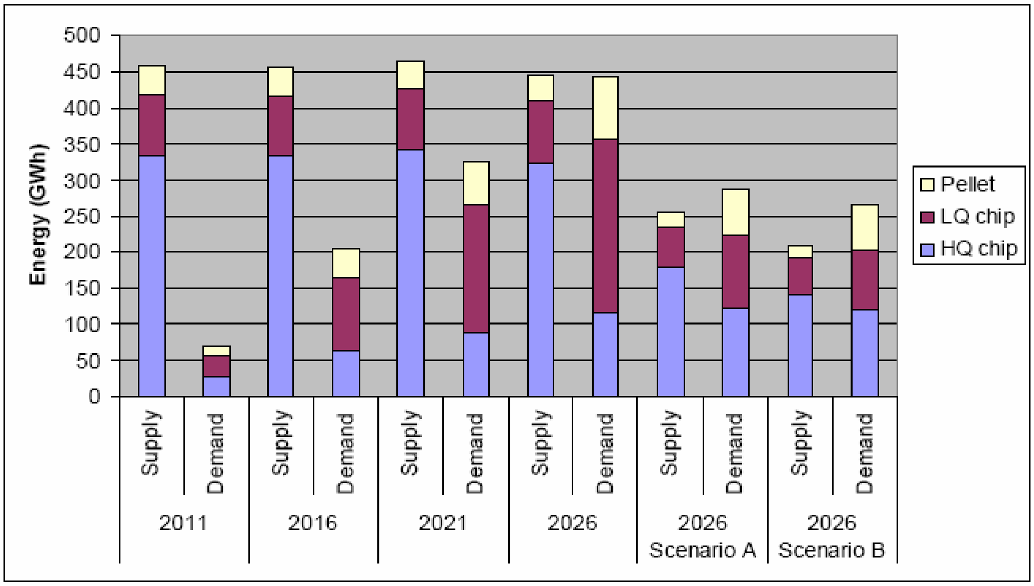


Figure 1.1 Summary of maximum supply and demand potential by year and predicted supply and demand under two projected scenarios

The actual numbers themselves, it must be remembered, refer to theoretical maxima under ideal market conditions and not to the likely market size.

An example of the disparity between supply and demand can be seen in the case of the 2026 supply and demand for wood pellet (shown in yellow in Figure 1.1). Although the overall supply and demand are very similar, the demand for pellets is more than double the supply.

A market forces model was developed to analyse the effect on market size of various drivers and barriers and to look at the most effective ways to stimulate the market. Two scenarios were then created, to look at the likely quantity of wood fuel supply and demand resulting from the use of a slightly different set of support measures. Scenario A was predicted to require around £500k investment in the first year[1] while Scenario B requires around £300k. Respectively, the predicted results for market size are around 58% and 47% of the 2026 maximum theoretical case. Scenario A saves around 46,000 tonnes of CO_2 per year while Scenario B saves around 37,000 tonnes.

In terms of additional benefits to the sub region of using wood fuel, these have been quantified where possible and converted to a monetary value of 1.87p/kWh. This correlates to approximately £4.8m and £3.9m respectively for Scenarios A and B. These values reflect the additional revenue to the rural economy and a reduction in the costs associated with emitting carbon.

In addition to the analysis undertaken for the whole sub region, geographical spread of supply and demand has enabled concentrated area of potential – referred to as hot spots – to be identified. Figure 1.2 shows the supply concentrated towards the west of the region while three areas of higher than average demand stand out – Southampton, Portsmouth and the centre of the region around the Strategic Development Areas (large new developments).

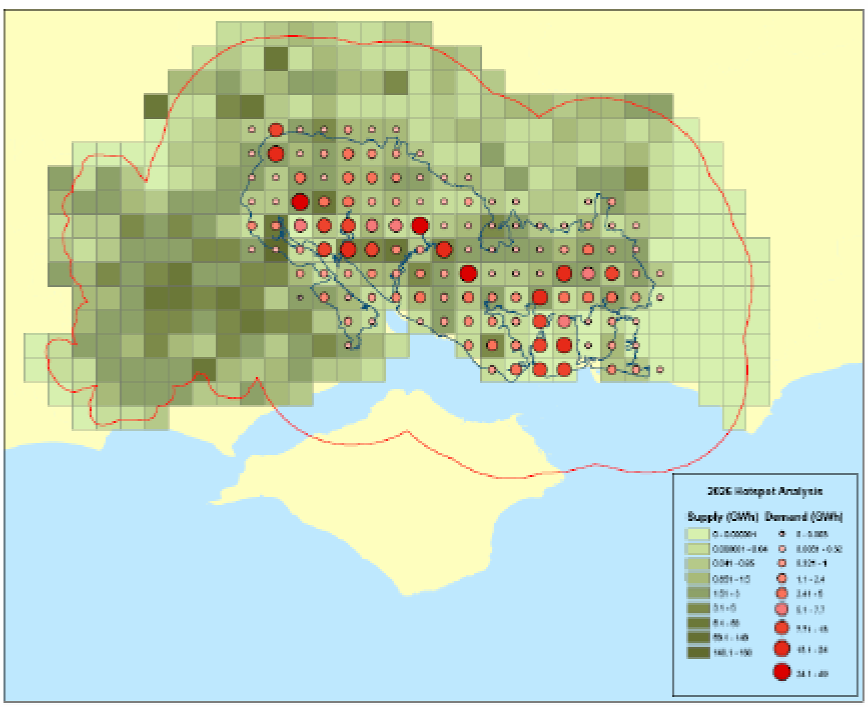


Figure 1.2 Map of potential supply and demand for the SHSR in 2026.

Geographical analysis by fuel type has led to the definition of four separate hot spots and individual solutions have been presented for each:

Based upon the research undertaken into the drivers and barriers of each side of the market, and on the lessons learned from other local authorities interviewed, the following broad recommendations have been made for developing the South Hampshire wood fuel market:

1. Develop demand in the long term by setting strong policy requiring at least 20% renewable energy from new developments
2. Develop demand in the short term by assessing the council's own building stock to identify site's suitable for conversion to wood fuel. Building installed capacity in the short term will build the confidence of the supply market
3. Support this in the medium term with an internal strategy to always consider biomass before undertaking a boiler replacement
4. Establish storage and processing sites to remove the barrier of lack of storage from the tree surgery and sawmill sectors in particular and to add confidence to the buyer
5. Commit resources, particularly time, to investigating and developing plans for medium scale wood pellet plant on the west side of the sub region
6. To achieve maximum cost effectiveness from numerous other market support activities, the council could establish a separate 'wood fuel development body'
7. Promote the market, educating key sectors and bringing all parties together will encourage greater uptake of wood fuel technology by building industry knowledge and awareness

Offering up to 79,000 tonnes of CO_2 savings per year along with £8.3m of additional annual benefit to the sub region, surely this is an industry worth investing in.

3 Results from the Resource Assessment

3.1 Calculating and mapping the sustainable yield

3.1.1 *Forestry*

Within the forestry section of the resource assessment, the most important and accurate data set obtained has been the Forest Enterprise market forecast data. In addition to this Forest Research have also supplied an availability forecast for all other woodland within Hampshire. The two datasets have been joined to provide an overarching picture of the available resource from the woodland area within the sub region and surrounding buffer zone. A summary of this oven dry tonne (odt) data is provided below in Table 3.1.

Table 3.1 Oven Dry Tonnes available from the private and public woodland in South Hampshire

Ownership	From	To	Stemwood 7-14cm	Stemwood 14-16cm	Stemwood 16-18cm	Stemwood 18cm+	Total ODT available
FE	2007	2011	5,195	1,969	2,179	29,874	39,217
Other	2007	2011	10,050	4,027	4,165	40,277	58,519
Total	2007	2011	15,245	5,996	6,344	70,151	**97,736**
FE	2012	2016	4,425	1,930	2,178	29,824	38,357
Other	2012	2016	9,010	3,856	4,180	41,588	58,634
Total	2012	2016	13,435	5,786	6,358	71,412	**96,990**
FE	2017	2021	4,257	1,839	2,196	44,281	52,573
Other	2017	2021	7,651	3,374	3,680	34,092	48,796
Total	2017	2021	11,908	5,213	5,876	78,373	**101,369**
FE	2022	2026	2,811	1,290	1,573	30,634	36,307
Other	2022	2026	8,574	3,780	4,124	38,204	54,683
Total	2022	2026	11,384	5,070	5,696	68,838	**90,990**

Clearly the wood resource represented here will not all be available for use as wood fuel. Indeed, each part of the woodland resource, meaning the various sizes of logs produced, has a different market and different values. For example, at the smaller end of the scale, stemwood of between 7 and 14cm diameter is usually sold to pulp and boardmills for around £17 per fresh tonne (at road side). Conversely, stemwood with diameter greater than 18cm can be sold to sawmills and starts at around £38 per fresh tonne (at roadside). As the sale price of wood chip increases, the actual proportion of forestry material that is economically available to the wood fuel market, will also increase. This trend has been represented within the market forces model.

The Austrian Example

Since it is difficult to judge what level of forestry material might be available to the wood fuel sector in the long term, it was decided that taking the example of a country that is much further down the road of developing and implementing wood fuel technology may provide some useful insight to enable predictions to be made.

At present, around 35% of Austria's forestry sector production is utilised directly for energy generation in biomass boilers and CHP systems[3]. There are many district heat networks allowing the improved efficiencies of large scale operation to be reached, especially with regard to electricity generation. Austria has now reached a situation where they need to develop new fuel sources (such as short rotation forestry) if they wish to continue to expand the level of energy they generate from their domestic wood production.

If the 35% is taken as a measure for South Hampshire to aim at, despite there being differences between the UK and Austria, it then becomes possible to set a target for the forestry sectors contribution to energy production. It also provides a measure of the likely upper limit of what might be achieved in the medium term. Based upon the expected forestry output levels discussed earlier, the SHSR could aim for 140GWh energy generation potential from its forests and woodlands in 2026. See Table 3.2.

Table 3.2 Converting the actual forestry resource into an available resource using the 35% factor from the Austrian example

	2011	2016	2021	2026
Total forestry (actual resource) (ODT)	97,736	96,990	101,369	90,990
Total forestry (available proportion) (ODT)	34,208	33,947	35,479	31,847
Total forestry (available proportion) (GWh)	151	149	159	140

Table 3.2 converts the maximum resource from the forestry sector (identified above in Table 3.1) into the available proportion based upon the 35% factor taken from Austria. The final row converts oven dry tonnes (ODT) into energy in gigawatt-hours (GWh).

3.1.2 *Tree Surgery*

Within the tree surgery sector, CEN sent postal surveys to 82 companies and achieved an approximately 25% response rate. Not all of these companies were based within the SHSR and where this was the case, their views were included in the analysis of market barriers but their wood production has not been included in the resource data. Follow up phone calls were made to 17 companies within the SHSR to check definitions, processes and to gain a deeper understanding of the views of those in the tree surgery industry. The data gathered regarding tonnes of arboricultural material produced in the South Hampshire Sub Region is presented below in Table 3.3.

Table 3.3 Summary of arboricultural survey data

Company	Total fresh material (tonnes)	HQ Chip (MC30) (tonnes)	HQ Chip (MC30) (GWh)	LQ Chip (MC50) (tonnes)	LQ Chip (MC50) (GWh)
A & T Tree Care	600	214	0.72	300	0.66
Ashley Tree Surgeons	100	36	0.12	50	0.11
Brammer Forestry Service	3000	1,929	6.46	300	0.66
Cedar Tree Surgeons	364	74	0.25	260	0.57
D.C Meaker	300	193	0.65	30	0.07
Edward S Brown & Son	100	43	0.14	40	0.09
Fellam Tree Services	260	111	0.37	104	0.23
Ftl	5	0.4	0.012	5	0.01
Logologist	120	43	0.14	60	0.13
Lordswood Tree Surgery & Landscaping	50	0	0	50	0.11
Titchfield Tree Services	700	150	0.50	490	1.08
Romney & Wellow Tree & Landscape Services	364	52	0.17	291	0.64
Southwick Arborculture Ltd	260	93	0.31	130	0.29
Special Branch Tree Services	60	21	0.072	30	0.07
Town & Country Tree Surgery	2500	893	2.99	1,250	2.75
Tree Care Ltd	660	177	0.59	413	0.91
W.E Barnes	2700	1,429	4.79	700	1.54
Wessex Tree Surgeons	500	179	0.60	250	0.55
45 Average non-respondees*	13,329	5,942	19.9	5,010	11.0
Total	**25,972**	**11,579.4**	**38.8**	**9,762**	**21.5**

* The average used was excluding the three largest producers (Brammer, Town & Country and W.E.Barnes)

The data collected was the total tonnes produced by each tree surgery and how much of this was stemwood (from the trunk of the tree) and how much was branchwood. It has been assumed that if processing centres could be set up, that tree surgeons would be able to dry all stemwood down to 30% moisture to allow high quality chip to be produced. The tonnes and associated energy of the high quality chip are presented in the third and fourth columns. Regarding branch material, this must be chipped on site to reduce volume. It is therefore assumed that this material cannot be dried below 50% moisture. The tonnage and energy content of this material is given in the last two columns.

With over 20GWh of low quality chip and nearly 40GWh of high quality chip potentially available, the tree surgery market is a key one for building the available supply of wood fuel. There are certain barriers commonly reported by tree surgeons, however, which, unless tackled centrally by the county council and local authorities, may prevent this material from ever contributing to the wood fuel supply. Further analysis of the tree surgery sector, in Section

3.1.3 *Sawmills*

Within the sawmill sector, CEN identified 8 sawmills operating in the South Hampshire Sub Region. All 8 were contacted to gather data regarding their processes and plans and, specifically, the tonnes of by-product that they create. RF Giddings and East Bros Ltd were by far the largest, though the contribution from the smaller sawmills is not insignificant. Table 3.4 summarises the tonnes of slab wood and sawdust produced by saw mills within the South Hampshire Sub Region buffer zone, and the potential energy generating capacity of this material.

Table 3.4 Summary of sawmill by-product created in the SHSR buffer

Company	Slab wood (MC50) (tonnes)	HQ Chip (MC30) (tonnes)	HQ Chip (MC30) (GWh)	Sawdust (MC50) (tonnes)	Pellet (tonnes)	Pellet Energy (GWh)
East Bros Timber Limited	7000	5,000	16.8	1250	679	3.19
J.W Shepherd	144	103	0.3	48	26	0.12
R.F. Rowe	50	36	0.1	2	1	0.01
RF Giddings & Co Ltd	50000	35,714	119.6	13000	7,065	33.21
S C Soffe & Sons	1020	729	2.4	6	3	0.02
The Timber Mill	730	521	1.7	550	299	1.40
3 average non-respondees	1,458	1,041	3.5	581	315	1.48
Total	**60,402**	**43,144**	**144.4**	**15437**	**8,388**	**39.43**

3.1.4 *Waste Wood*

Regarding clean waste wood produced within the sub region, CEN started by obtaining data for HCC's own domestic stream. This material is taken by members of the public to Household Waste Recycling Centres (HWRCs) where clean wood is kept separate from dirty wood. Dirty wood is anything deemed to be contaminated by nails, paints, preservatives, varnishes or other non-wood products. Clean wood is collected from HWRCs by Veolia, who hold the contract with the council, and taken to Transfer Stations or Recycling Centres operated by private companies.

These centres also receive wood from commercial streams. The Environment Agency holds data on the tonnage of woody material passing through transfer stations, but does not separate data into being of either domestic or commercial origin. Some wood passes between transfer stations before leaving the county, usually destined for either chipboard manufacture or pulp mills. To avoid double counting, it was necessary to gather as much data as possible regarding the route that various sources of wood follow. Generally, the only clear way of achieving this was to speak to each waste company directly. Some assumption have had to be made, however, and where this has been the case CEN has been conservative to avoid over-estimating the tonnes of wood available.

As the supply data collected is converted into energy, carbon and revenue, it is important to understand what these figures represent. On the whole, they relate to the maximum available supply – i.e. the whole wood resource, and not to what could realistically be purchased for fuel production. The exception to this is the Forestry data which has already been reduced to 35% of the total potential harvest. The reason for this, is that the top end of the resource has well developed markets – for example sawmills – and the 35% target would bring the South Hampshire Sub Region in line with a world leader on wood fuel production and use (Austria) – it is still a challenging target. The figures for all other sectors refer to the maximum resource. Later, in Section 6, these figures will be refined through the market forces model to take account of energy prices, market support activities and so on.

Table 3.5 Summary of maximum theoretical wood resource per annum and energy generating potential

Sector	Source wood	Annual Tonnes (source)	Wood fuel produced	Annual Tonnes (wood fuel)	Likely £/tonne delivered	Max Energy GWh	Potential Market	Carbon Saving (tCO2)	Revenue (£)
Forestry	MC50 virgin logs	181979	G30,W30	139,984	80	140	**High quality wood chip** suitable for small to large biomass boilers	71,700	9,565,500
Sawmill	MC50 sawdust	15437	8% Pellet	8,389	165	39	**Pellet** fuel suitable for small to large biomass boilers	7,100	1,384,300
Sawmill	MC50 slab wood	60402	G30,W30	43,144	80	145	**High quality wood chip** suitable for small to large biomass boilers	25,900	3,451,500
Tree Surgery	MC50 branch wood	9762	G50,W50	9,762	20	21	**Low quality wood chip** suitable for co-firing or large scale biomass boiler / CHP	3,800	195,200
Tree Surgery	MC50 stem wood	16210	G50, W30	11,578	80	39	**High quality wood chip** suitable for small/medium sized biomass boilers	6,900	926,300
Waste	MC20 various	14640	G50,W20	14640	35	62	**Low quality wood chip** suitable for co-firing or large scale biomass boiler / CHP (WID appliances only unless proven clean)	11,100	512,400
Total		**298,429**		**227,497**		**789**		**154,000**	**18,005,200**

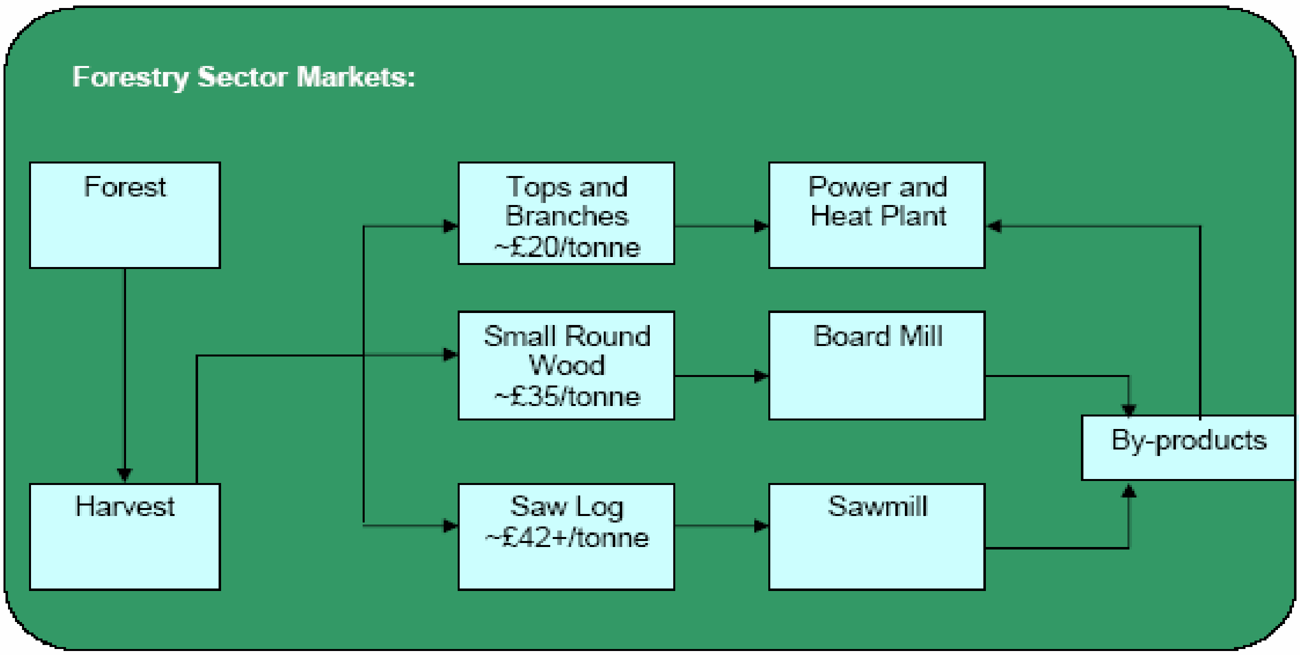
Note: The tonnes quoted in columns 3 and 5 relate to the source material and wood fuel produced from that material respectively. The two effectively differ by the amount of water dried off (either naturally or forced) during fuel preparation / processing.

We understand, therefore, that the figures represented in Table 3.5 are the absolute upper limit possible, and that the 'real' values are likely to be somewhat lower. Having said that, it is worth drawing out the key figures. If the maximum market size could be achieved (i.e. if all the wood resource identified were brought to market as wood fuel), some 789GWh of energy could be generated. This compares with around 9.3TWh of gas currently consumed per year by the domestic and commercial sectors in the sub region – i.e. around 8.5%. In addition to this 154,000 tonnes of CO_2 could be saved and the revenue of fuel sold would be in the region of £18 million. Clearly, there is potential for wood fuel to become a major industry.

3.3 Supply chain analysis

3.3.1 *Forestry*

Hampshire has approximately 72,000 ha of woodland, more than any other county in the southeast. This presents the South Hampshire Sub Region with the opportunity to derive a significant proportion of its future energy demand from wood fuel. The diagram below illustrates the markets that are currently available to foresters in Hampshire when selling their timber products. Although the market value of saw logs exceeds the value of wood for fuel production it is clear that the forestry industry could meet the increased demand for wood fuel from brash (foliage, branches and stems usually <7cm diameter), thinnings, or poor quality final crops in both conifer and hardwood crops. After contacting several foresters operating in Hampshire it was evident that the majority of the timber that they felled was not directly being sent for wood fuel production. However, it is important to acknowledge that indirectly the by-products of timber that foresters sell to board mills and saw mills may be processed into woodfuel.



Source: Forest Enterprise, 2008

Forest Enterprise (FE) manages 19% of the forest area in England and also manages 75% of the harvesting in the country. The implication of this statistic is that there is currently a considerable amount of woodland in the UK which is not being managed effectively. In the context of Hampshire, the owner of Brammer Forestry Service emphasised that a large area of the county's woodland (particularly areas with poor quality standing timber) was poorly managed. Although not appropriate for saw mill markets, the wood material in these unmanaged woodlands would certainly be suitable for wood fuel markets and should eventually provide an economic incentive to increase the proportion of well maintained woodlands. There are various reasons for why woodlands remain unmanaged (lack of access, high extraction costs, shortage of skills) and it is important that these issues are addressed in order to encourage the growth of wood fuel markets in the forestry industry in the Sub Hampshire Sub Region. Although the woodland area is currently under-utilised, it is important to acknowledge that the forestry industry is contributing to the growth of the wood fuel market. For example, Home Grown Timber source 20,000 tonnes of wood material from Hampshire every year and a share of this product is used to produce G30 Woodchip, which is distributed to clients in association with South East Wood Fuels (SEWF).

3.4 Quantifying the Additional Benefits

3.4.1 *Carbon Reduction*

The amount of carbon offset through the use of wood fuel is mainly dependent upon the type of wood fuel used and the type of fossil fuel offset. The production and delivery of wood chip at a local level incurs considerably less embodied carbon than the manufacture and delivery of wood pellets on a region, national or even international level. Equally, the carbon associated with one kilowatt-hour of natural gas is much less than for oil, LPG or electricity. So if locally sourced wood chip displaces electricity as the energy source for heating, then far more carbon will be saved than if pellet replaces natural gas. Table 3.7 shows the carbon dioxide emitted through the use of different types of fossil fuel and through the use of biomass.

Table 3.7 Carbon dioxide emission factors for various fuels (Source: Building Regs, Part L, 2006)

Fuel Type	CO_2 emission factor $kgCO_2/kWh$
Natural gas	0.194
LPG	0.234
Oil	0.265
Grid supplied electricity	0.422
Biomass	0.025

Data gathered by CEN from UK wood chip and pellet suppliers indicates that the $0.025kgCO_2/kWh$ figure attributed to biomass in the current building regulations, is perhaps too high for wood chip but about right, or a little low, for wood pellet[5]. However, the figures in the building regulations do provide a very useful benchmark and, for simplicity, CEN have used these figures to calculate the carbon offset. If it is assumed that 90% of the heat replaced is from gas, 8% from oil and 2% from electricity, then the average emission figure would be 0.204. Conservatively assuming that the 0.025 figure for biomass is correct, despite the majority of actual supply being wood chip, then the difference, that is the carbon saving, can be taken as $0.179kgCO_2/kWh$.

The internationally traded price for carbon as posted by www.pointcarbon.com on 3rd June 2008 is €27.05 (equivalent to £21.52 on the same date) per tonne. After converting from carbon to carbon dioxide, the value is £5.87 per tonne. Dividing this down to 0.179kg means each kWh of energy generated from biomass instead of fossil fuel could be attributed a monetary value of 0.105p. Although this may not sound a lot, a secondary school may use 1GWh of heating p.a. or 1,000,000kWh. In this instance, if all the heat were provided through wood fuel, the carbon saved would hold a trade value of just over a thousand pounds.

National Indicator 186
Another measure for attributing monetary value to carbon saving could be calculated through any budget allocated by Hampshire County Council for achieving its National Indicator 186 target. This means of setting a £/tonne of carbon may yield a substantially higher carbon value, but one more in line with the local nature of developing wood fuel supply chains.

A further quantification of the additional benefit through carbon reduction can be calculated from the figure suggested in the Stern Review for the "marginal social cost of carbon" – $USD85/tonneCO_2$ (year 2000 prices)[6]. Converting to GBP (average year 2000 exchange rate) and inflating to today's monetary value, gives us a figure of approximately $£70/tonneCO_2$ or 1.25p/kWh of wood fuel used. In this instance, a secondary school using 1GWh of heating would be saving carbon of marginal social value around £12,500 p.a. Importantly, Stern points out that the cost of doing nothing far outweighs the cost of acting early to tackling climate change.

3.4.2 *Increased Rural Employment*

An example breakdown of the different elements of production of wood chip from forestry roundwood is presented below. Each element contributes to the final cost of the delivered chip:

- Purchase of roundwood
- Haulage of roundwood
- Outdoor storage of roundwood
- Chipping
- Indoor storage of chip
- Loading and haulage of chip
- Element of profit for processing company

Each of these elements can also be seen to contribute to rural employment in one way or another. The cost of the roundwood material will pay, in part, for the forester and land agent looking after the trees and finding markets for the products. The haulage, chipping and loading will provide manual employment. The external and internal storage may provide a revenue to the owner of the land / barn. Even the profit will contribute to employment in rural areas of managers and owners while providing a sum to be re-invested in growing the business and extending rural employment still further. Of course, the sale of the roundwood to other markets would also pay for the upkeep of the forest so this sum should perhaps be excluded.

Each tonne of high quality, MC30 chip may sell for £80. Assuming half of this cost can be attributed to the purchase of roundwood leaves £40 that could be called 'additional benefit' – i.e. economic benefit to the rural sector in Hampshire that would not otherwise be felt. Each tonne of MC30 chip has an energy content of around 3,350kWh, giving rise to an additional benefit of 1.19p/kWh. In the case of our secondary school using 1GWh of heat, nearly £12,000 of additional benefit may be delivered to the rural economy in south Hampshire. With a lower sale value, low quality chip will deliver less economic benefit delivered to the region.

3.4.3 *Diversion of Waste from Landfill*

Through the investigation of waste wood supply chains, CEN did not find any wood that is currently being sent to landfill that could be diverted. Most wood entering the waste streams from the official domestic and commercial routes, is separated into clean and dirty wood at Household Waste Recycling Centres or Waste Transfer Stations. Only dirty wood, that is not suitable for any other market, is then sent to landfill. This material is usually contaminated with paint, varnish, preservative or other substances that exclude it from being burnt for energy. In some mainland European countries, these types of material are burnt along with other parts of the waste stream in large incinerators. The primary purpose of these plants is usually to dispose of waste rather than to create energy, however, and this is not a route that Britain has previously chosen to follow.

3.4.4 *Other benefits of improved woodland management*

Woodlands in the SE England are estimated to be worth £2 billion p.a. to the regions economy. Large parts of this sum are not direct financial returns but rather costed estimates attributed to various benefits woodlands offer society. These include biodiversity, landscape, leisure and sport opportunities and through encouraging inward investment. Hampshire holds over a quarter of the woodland in the South East, and its sustainable management for wood fuel will help maintain and enhance these wider values.

Reversing the decline of woodland species

Lack of management is contributing to a decline in the biodiversity of our woodlands. Increasing the level of ecologically sensitive management would help a range of flora and fauna including priority and declining species such as dormice, nightingales and woodland butterflies. This will help deliver the England Biodiversity Strategy and associated national and international biodiversity targets.

Enhancing sustainable forestry and protecting our ancient woodland

Sustainable management of Hampshire's woodlands will support a range of policy documents related to ancient and native woodlands (see below). Woodland biodiversity will benefit substantially, particularly from the diversification of woodland structure. An enhanced market for wood will ensure the delivery of the recently revised Habitat Action Plan targets for native woodland. The England Trees, Woodland a & Forestry (ETWF) Strategy will provide best practice guidance on managing ancient and native woodland including harvesting for woodfuel while ensuring delivery of environmental benefits.

Improved pubic access

Improved economics of woodland management should encourage greater investment in infrastructure and access networks in woodlands encouraging increased use where appropriate. A revitalised woodland sector and biomass market is a vital complement to the rural development funding that will fund some, but not all, of the necessary management.

Sustainable Woodland Management & Biodiversity - Key Policies and Strategies Met

- England Biodiversity Strategy - www.defra.gov.uk/wildlife-countryside/biodiversity/biostrat/index.htm
- Keepers of Time - www.forestry.gov.uk/Keepersoftime
- Woodfuel Strategy for England - www.forestry.gov.uk/forestry/infd-6pggqr
- South East England Regional Forestry Framework - www.forestry.gov.uk/seeingthewoodforthetrees
- Hampshire Biodiversity Action Plan - www.hampshirebiodiversity.org.uk/hampshire%20BAP.html

In terms of quantifying financially the potential benefit of the wood fuel market on the state of woodland management and biodiversity targets, a full calculation has not been undertaken. It may be possible, however, to estimate the extent to which the policies mentioned above will be impacted by wood fuel production and determine from that and the budget allocated within HCC to this work, what the financial savings might be.

3.4.5 *Quantifying the overall additional benefit*

For only two of the four factors considered above, has a monetary value been reached – those relating to carbon savings and the rural economy.

Table 3.8 Summary of monetary values attributed to the additional benefits of wood fuel

Additional Benefit Factor	Value attributed
Carbon saving	0.105 / 1.25 p/kWh[7]
Rural economy	1.19 p/kWh
Diversion of waste from landfill	N/a
Improved woodland management and biodiversity	Not quantified in financial terms
Total monetary value of additional benefits	1.295 / 2.44 p/kWh[8]
Mean of the two values presented	**1.87 p/kWh**

The overall additional value of developing the wood fuel market in South Hampshire could be taken as being 1.87p/kWh - halfway between the two figures calculated.

Returning to our 1GWh heating secondary school, the additional benefit is seen to be £18,700 per year, from the carbon saving and additional investment in the rural economy.

4 Results from the Demand Assessment

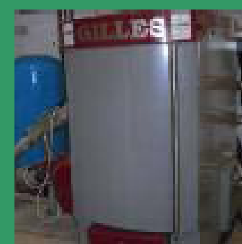
4.1 Existing buildings

CEN has gathered heat energy data for buildings owned and operated by Hampshire County Council, Southampton City Council, Portsmouth City Council and Local Authorities falling within the South Hampshire Sub Region. Building types include housing (if centralised heating), offices, schools, leisure centres, libraries, depots, country parks and community centres. Data was also gathered for other public buildings through the NHS (hospitals and health centres) and HMPS (prisons).

In some cases, postcodes were available to allow the spatial distribution of the energy demand to be determined. Where this was not the case, the spatial distribution has been set by CEN to mirror population density in the relevant area of data collection.

RJ Mitchell Primary:

The school had a wood pellet boiler fitted in 2007 to replace an ageing oil boiler. The headmaster, Barry Reid, enjoys knowing they are saving carbon and money.



See the full case study in Section 10

Not all of the existing buildings for which energy data has been gathered will be viable for conversion to wood fuel heating, though generally data has been gathered for the most suitable building types – i.e. only those buildings with centralised heating plant. It has been necessary, therefore, to make assumptions about the proportion of buildings that would be *technically feasible* for conversion to wood fuel. Based upon CEN's experience of assessing public buildings in Kent, London and Essex for biomass feasibility, approximately 10% of randomly selected sites are technically feasible. Though it is possible that this figure may be slightly higher in less built up areas and slightly lower in more urban areas, a great variance from 10% is unlikely as slightly less space tends to imply that the site is only suitable for pellet fuel rather than no solid fuel at all. In reality the major factor tends to be the location of the plant room within a site, thus determining whether wood fuel can be delivered easily or not.

Thus a 10% factor has been applied to the energy data collected for existing buildings. It has then been assumed that the lifetime of most boilers is around 20 years and that the buildings represented within the data collected will need boiler replacements at a steady rate between 2008 and 2028. This assumption has been included in calculating the expected wood fuel demand in 2011, 2016, 2021 and 2026. This has then been plotted onto a series of four GIS maps relating to the stated years. Point data has been merged within each 2.5km by 2.5km grid square so that the result is an area demand density rather than a series of dots.

4.1.1 *Existing boilers*

The total wood fuel demand from existing boilers or those that are soon to be installed is around 4,850MWh. The existing boilers and their associated wood fuel demand is summarised in Table 4.1. The demand comprises a mix of fuel types, for example the 1.5MW Heizomat boiler at Laverstoke Park can take a range of fuels including those with larger particle sizes and higher moisture contents. Conversely, the 45kW boiler at Hockney Green only accepts up to 8mm diameter wood pellets.

4.2 New buildings

The proportion of new development within the SHSR that will opt for wood fuel heating will be very much dependent upon the strength of policy in place. However, with strong policy in place and investment in developing and promoting the wood fuel supply chains, almost all new buildings could be made to work with wood fuel heating. To take account of those developments where the space requirements prohibit the use of wood fuel, it is assumed that the maximum possible demand from new developments is 75% of the calculated heat demand.

Data for new developments has mostly been provided by Hampshire County Council. As the development is spread across more than two decades, to calculate the likely heat demand, certain assumptions regarding building regulations and government policy have had to be made as follows:

- Building to current regulation until 2010
- Revision of building regulations in 2010 and 2013 to reduce energy demand by one third in total. Half of this improvement effective from 2010
- Carbon Neutral homes by 2016 – dwellings built to Code for Sustainable Homes Level 6

This gives the following heat demand per square meter per year for domestic properties:
Current development – 90 kWh/m^2/yr
Development after 2010 – 75.3 kWh/m^2/yr
Development after 2013 – 60.7 kWh/m^2/yr
Development after 2016 (CSH Level 6) – 46 kWh/m^2/yr

These figures have been used to compute the energy demand in different areas of the SHSR from new development by 2011, 2016, 2021 and 2026. Again, point data associated with individual developments has been merged within 2.5km by 2.5km grid squares, resulting in a dataset of wood fuel demand density from new developments.

4.3 Demand for different wood fuels

As already observed during the analysis of potential wood fuel supply, there different types of wood fuel and these will be suitable for different applications. Above the domestic scale, there is a very small range of applications for log fuel, so this has been ignored. The remaining wood fuels – chip and pellet are the focus of this study. Wood chip is normally graded according to its particle size and moisture content with larger, wetter chips only suitable for larger boilers.

To analyse the possible supply and demand scenarios together, therefore, it is necessary to determine how much of the potential demand identified relates to each fuel type. Table 4.2 lists the assumptions made regarding the suitability of different existing and new build sites to different fuels.

Table 4.2 Assumptions regarding suitable wood fuels for existing buildings and new developments

Sector	Sub-sector	Fuel
Existing buildings	Glass houses	30% high quality & 70% low quality chip
	All other	70% High quality chip & 30% pellet
New development	< 200 dwellings	70% pellet / 30% high quality chip
	200-500 dwellings	high quality chip
	500-1000	50% high quality & 50% low quality chip
	1000+	Low quality chip

4.4 *Total heat demand*

The two datasets generated – for existing buildings and for new developments – have been merged to provide an overall view of the spread of potential heat demand across the sub region. A set of maps relating to the situation in 2011, 2016, 2021 and 2026 have been produced and can be viewed together in Appendix C – Demand Maps. The map for 2026 is also shown in Figure 4.1.

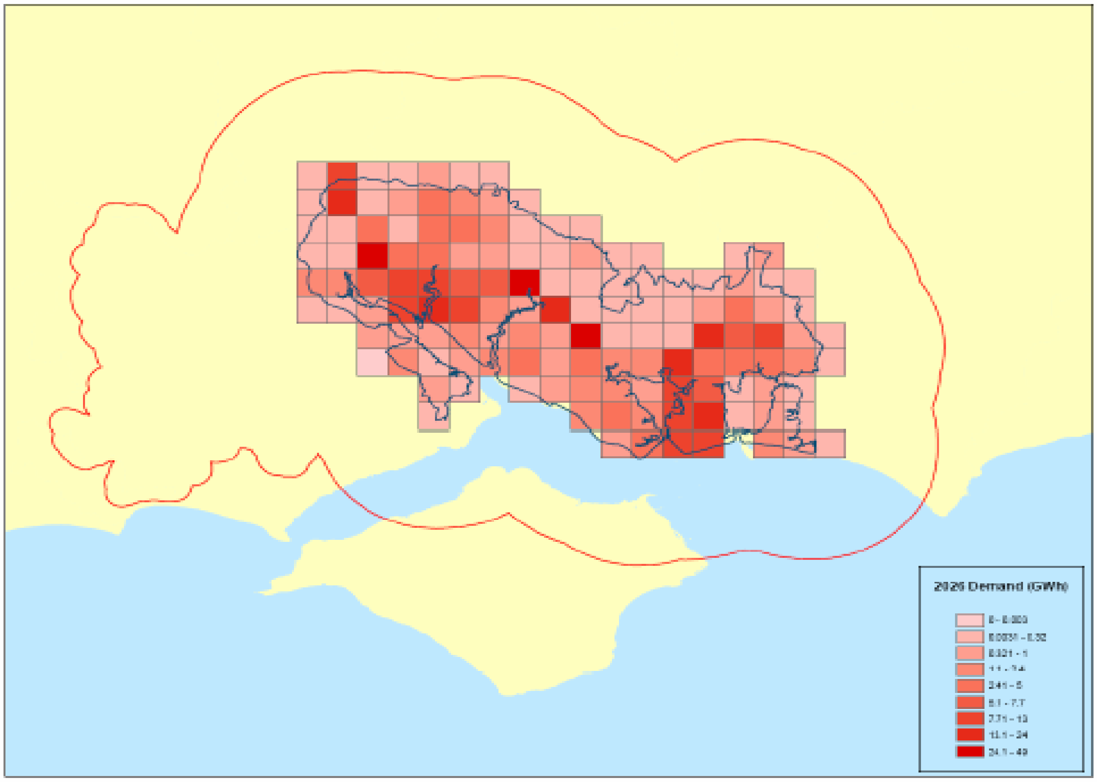


Figure 4.1 Potential demand for wood fuel across the sub region in 2026 (GWh)

As would be expected, the areas of higher potential demand tend to be around the more populated regions – Southampton to the west, Portsmouth to the east. Three brighter red grid squares are also visible in the centre of the sub region; these are the Strategic Development Areas (SDAs). Some of the larger new development projects involve many thousands of homes being built at the same time and present a significant opportunity for wood fuel heating or CHP through district / community heat networks (as demonstrated in the Park 25 Case Study, see opposite and Section 10). These larger projects also present an opportunity to create demand for some of the lower quality wood chip that could be generated in the sub region.

Park 25, Redhill:

Wood fuel heating for 250 flats and houses connected by a community heat network.

See the full case study in Section 10

It is also interesting to note not just the spatial distribution of the potential demand but also how it grows over the study period. Potential demand for each fuel type appears to grow quite evenly, see Figure 2.1. The overall trend reflects the fact that development (or retrofitting existing buildings) will happen constantly and evenly over the next two decades. Looking at the growth in potential demand for each individual fuel type implies that the construction of different sub sectors of development will also proceed fairly evenly.

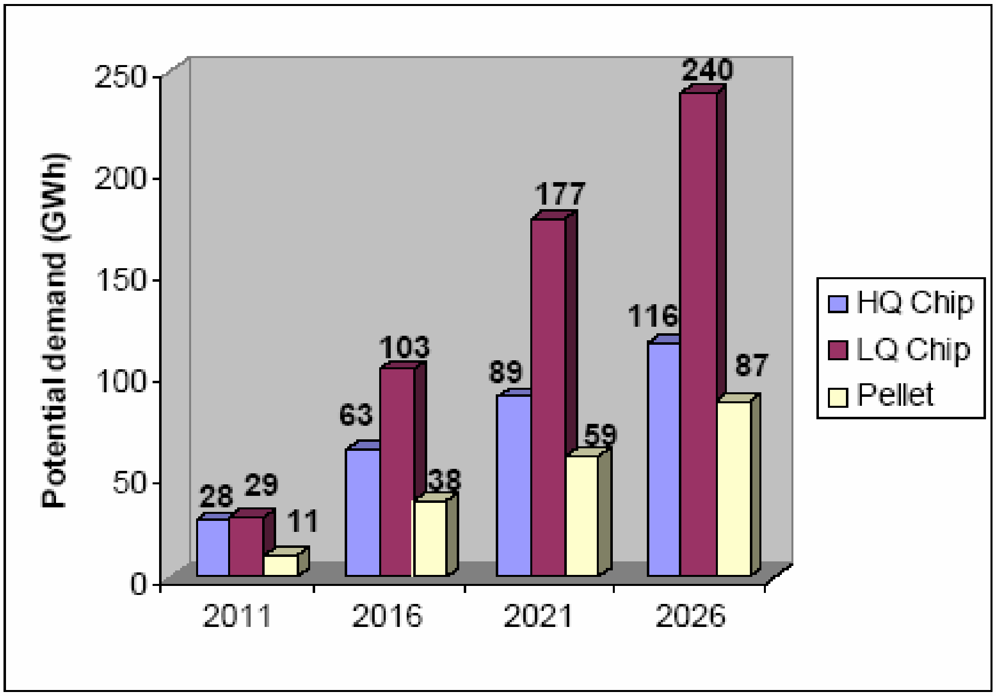


Figure 4.2 Indication of the growing potential demand for different wood fuels over the study period

It is also interesting to note, from Figure 4.2, not just the evenness of growth over the period but the scale of growth as well. The total demand in 2011 is 68GWh compared with 442GWh in 2026. Both these figures are very large when compared to today's value of just under 5GWh wood fuel demand.

Finally, it is vital to remember that the figures presented here are for *potential* wood fuel demand. It is not a prediction of what the actual demand will be as that will be analysed later using the Market Forces model.

Development Options

Table 1 - Energy ratios for a range of UK crops [1]

Crop **Energy in (MJ/ha)** **Energy out (MJ/ha)**

Ratio **Miscanthus** 9,223 300,000 + 32.53

Biomass

Willow	6,003	180,000 +	29.99
Hemp	13,298	112,500 +	8.46
Wheat	21,465	189,338 +	8.82
HEA Rape	19,390	72,000 +	3.76

Master Plan Options

Part III Detailing

Design and Implementation

PSECC recommends to the Waterlooville MDA development partnership to Commission a Feasibility Study, Design Study for the Implementation of Renewable Energies into the East The Waterlooville MDA development MDA.

A further recommendation is made that PSECC & PMSS takes the lead role in coordination of the above Studies and also acts as Finance Arrangers for all Renewable Energy inclusions into this and any MDA.

Each HNRI – Energy Network company mentioned in this report is to submit to PSECC their individual feasibility study reports for Wind & Water Turbines, Biomass Energy Plant, Solar PV & Thermal together with CHP & District Heating schemes.

Once agreement has been reached on Renewable Energy inclusions into the Waterlooville MDA and all MDA's development MDA and Planning Consent obtained then The Waterlooville MDA development partnership will ensure that the Developer utilizes said PSECC/HCC – Energy Network.

The companies listed in this report could be utilised and specifications for their technologies made, to Design, Fund and Implement the Renewable Energy identified for the development.

The above action will ensure that the Waterlooville MDA development will be seen as a true demonstration of Sustainable Development, Climate Change Mitigation & Renewable Energy.

PART IV Carbon Footprint – Carbon Trust

A carbon footprint is a measure of the amount of carbon dioxide (CO_2) emitted through the combustion of fossil fuels as part of the everyday operations of an organisation or the life cycle of a product (although it can also be a measure of the amount of CO_2 emitted through the combustion of fossil fuels as part of the daily life of an individual).

Organisations are being made increasingly aware of the need to reduce carbon emissions and mitigate climate change, either through international or domestic legislation or through a more socially responsible public.

Although there are a range of other measures such as reducing waste or carbon offsetting, cutting energy consumption and travel are the most obvious and easiest steps that can be taken by any business to reduce its carbon footprint.

Employers' Duties

Although there are no specific legislative requirements on businesses specifically to reduce their carbon footprints, the UK Government has signed up to a range of targets to reduce carbon emissions.

One of these — the Kyoto Protocol — introduces a duty on employers to pay a tax on energy used.

Employers who decide to operate "corporate social responsibility policies" with a focus on climate change and reducing CO_2 emissions may impose duties on their own operations with respect to reducing the carbon footprints of their businesses or products.

Employees' Duties

Employees can help co-operate with their company's commitment to reducing CO_2 emissions by:

- informing their employer of any wasteful practices
- following energy saving measures in relation to their work
- following procedures and other instructions that apply to their work.

In Practice
Legislation to Cut Carbon Emissions
Kyoto Protocol and the Climate Change Levy

In 1997 the Government signed up to the Kyoto Protocol along with a self-imposed target to cut CO_2 emissions by 2010 relative to 1990 emission levels. The Climate Change Levy (CCL) was the result. It is essentially a tax on the use of energy in industry, commerce and the public sector.

Carbon Reduction Commitment

Likely to come into force in 2010, the Carbon Reduction Commitment (CRC) is a new scheme announced in the Energy White Paper 2007, which will apply mandatory emissions trading to cut carbon emissions from large commercial and public sector organisations by 1.2 million tonnes of carbon equivalent/year by 2020.

Carbon Reduction Labels

"Carbon reduction labels", which were introduced by the Carbon Trust in the UK in 2007, are designed to provide a measure of a product's carbon footprint across its life cycle from source to store, to disposal of the finished products.

The labels demonstrate an organisation's commitment to manage and reduce the carbon emissions of its product and allow others to make informed decisions about the products they buy.

To qualify for a carbon label, companies will need to undertake a rigorous carbon analysis of their product supply chains following agreed methodology, and commit to reducing the carbon level of their product over the next two years.

Carbon Footprint Calculators

In order to reduce and monitor the organisation's carbon footprint, a value needs to be placed on it. There are many websites offering carbon footprint calculation services. For example:

- www.climatecare.org/calculators/business
- www.mycarbonfootprint.eu
- www.puretrust.org.uk/Home/Business/Calculator.aspx.

Steps to Reduce the Organisation's Carbon Footprint

There are several ways in which an organisation's carbon footprint can be reduced. The two easiest and most obvious of these are reducing the organisation's energy consumption and reducing the organisation's reliance on travel.

Reduce Energy Consumption

An energy survey is one method of finding opportunities for energy reductions.

A traditional energy survey revolves around a physical inspection of buildings, plant, processes and systems, augmented by key measurements. The usual output is a report recommending a package of improvements with targets assigned to each measure.

Projects to reduce energy consumption need not necessarily entail major re-engineering of the systems or modifications to the fabric of the building in question. Opportunities often arise involving relatively simple measures such as:

- turning off equipment that is not in use
- leaving plenty of space around radiators
- turning off heating and lighting over the weekend if no one is using the building
- keeping doors and windows closed and draught-proof in cold weather
- keeping the thermostat away from draughts or hot and cold spots
- avoiding putting hot equipment (e.g. photocopiers) near cooling vents
- ensuring that equipment is properly maintained.

Steps to reduce energy consumption around specific pieces of industrial equipment, such as motors, air compression units, or refrigerators, need not be complex either.

- Use high-efficiency motors, and ensure that these are well maintained. Don't keep motors running with an empty load.
- Find and fix leaks in air compression units and fittings. Try to lower the operating pressure. Ensure there is a good supply of cool air around the unit.
- Keep freezer doors closed, and ensure the system is at the right temperature.

Minimise Travel

Calculate how much road, rail and flight travel your business generates on an annual basis and then look for ways to reduce this number. Examples of ways in which this can be accomplished include the following.

- Encourage employees to join a car-sharing scheme or encourage them to use public transport to and from work.
- Use local suppliers wherever possible.
- Think about holding teleconferences with colleagues in other parts of the world rather than flying out for face-to-face meetings.

Reduce Waste

A waste audit should be carried out to identify those areas where waste can be minimised and to identify materials that might be retrievable.

Operate a waste minimisation programme and consider:

- paper-free administrative processes wherever work can be carried out online
- double-sided printing and photocopying rather than single-sided
- establishing good housekeeping procedures so that materials are not over-ordered, overused, or allowed to go missing
- creating a procedure for reworking off-specification products
- selecting raw materials which are more readily recyclable.

Carbon Offsetting

Taking active steps to reduce the organisation's carbon footprint can help demonstrate a commitment to being environmentally responsible. This can also be achieved by carbon offsetting. Carbon offsets allow CO_2 to be taken out of the atmosphere or reduced in another part of the world. For example, planting a tree offsets a carbon footprint by ensuring that an organisation's portion of the CO_2 that it produces will be taken out of the atmosphere down the line.

Carbon credits are a tradable permit scheme. They provide a way to reduce greenhouse gas emissions by giving them a monetary value. A credit gives the owner the right to emit one tonne of CO_2. It is possible to purchase these carbon credits and then not use them. This stops other organisations using them, and forces industries to take active steps to reduce emissions rather than relying on the efforts of others. Finally, it is possible to invest or donate to companies who research and develop renewable and sustainable technologies.

Carbon Footprints in the Supply Chain

Managing the carbon footprint of a product means minimising the carbon emissions required to deliver that product to the end consumer. The carbon footprint of a product is the CO_2 emitted across the supply chain for a single unit of that product. Therefore, reducing the carbon footprint of the product will require looking at the supply chain (which includes those suppliers from whom the organisation directly procures goods and services, but also indirect suppliers) to find suppliers who are working on reducing their own carbon footprints.

To do this:

- look at exactly who the organisation's suppliers are and investigate the environmental impacts of their products and services
- investigate how they are improving their environmental performance and see how they compare to their competitors
- ask suppliers to produce the same products or services using fewer natural resources, with less wastage, and less pollution
- look for suppliers who have environmental management systems or who have products or services that come from sustainable sources.

List of Relevant Legislation

- Climate Change Levy (General) (Amendment) Regulations 2006
- Building Regulations 2000
- Climate Change Bill

Further Information: Publications, Carbon Trust Publications

The following are available from www.thecarbontrust.co.uk.

GPG367 Better Business Guide to Energy Saving, BERR Publications

- CTC616 Carbon Footprints in the Supply Chain: The Next Step for Business

The following is available from www.berr.gov.uk.

- Meeting the Energy Challenge: A White Paper on Energy

Organisations

- Carbon Trust

  Web: www.thecarbontrust.co.uk

  The Carbon Trust helps business and public sector organisations to cut carbon emissions and assists with the development of low-carbon technologies.

- Department for Environment, Food and Rural Affairs (Defra)

  Web: www.defra.gov.uk

  Defra is the main government department which deals with waste and other environmental issues. It consults on new regulations and provides guidance on legislation and best practice.

- Department for Business, Enterprise and Regulatory Reform (BERR)

  Web: www.berr.gov.uk

  The Department for Business, Enterprise and Regulatory Reform brings together functions from the former Department of Trade and Industry (DTI), including responsibilities for productivity, business relations, energy competition and consumers. It also drives regulatory reform.

- Energy Saving Trust (EST)

  Web: www.est.org.uk

  The EST provides advice on saving energy in homes and businesses.

1.6 PSECC - CFS Coop - Renewable energy and technology finance

Our Structured and Asset Finance Team has significant expertise and knowledge of funding UK-based renewable energy and sustainable technology projects. This enables us to structure highly effective financing solutions that ensure a smooth transaction process. We can provide:

- up to £25m debt size with 5-20 year terms
- participation in syndicated facilities
- expert advice through all stages of the implementation process, from financial viability study to completion
- access to leading technical, legal and financial advisors
- a dedicated Relationship Manager who will work with you to achieve your business goals.

As a 'responsible' lender we actively seek to facilitate lending to the renewable energy and sustainable technologies sectors and we have first-hand experience of using a number of these technologies to help reduce our own carbon footprint.

We can provide funding for the following technologies:

- onshore wind
- combined heat and power
- district heating
- biomass
- waste to energy
- landfill gas
- geothermal/solar
- smart metering – building control systems.
- Water Turbines & Tidal Turbines

1.7 Education - Sustainable Schools, Engauge – West Sussex CC example now linked with HCC Sustainable Schools programme

School Involvement

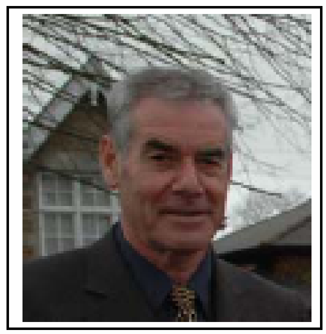
The Engauge pilot study is being undertaken in 11 schools in the Weald area of West Sussex.

About Engauge wsgfl.westsussex.gov.uk/ccm/navigation/community-based-projects/engauge/1--about-engauge

Engauge is a West Sussex County Council initiative to improve sustainability in school communities.

Schools are assessed in eight sustainability categories:

- Energy & Water
- Food & Drink
- Travel & Traffic
- Purchasing & Waste
- Local Wellbeing
- Buildings & Grounds
- Inclusion and Participation
- Social Justic



John Hoyland - Project Director

email -john.hoyland@westsussex.gov.uk

The eight different scores are uniquely displayed using a Sustainability Gauge (or 'susgauge') in the form of a flower with eight petals giving a unique performance record for each school.

A team of stakeholders (including pupils, staff, governors) from each school then choose to target areas of weakness and seek advice and action from Engauge's team of external specialists.

PSECC have facilitated the aboveWest Sussex County Council "Enguage initiative into the Hampshire County Council Sustainable Schools programme. The West Sussex Enguage project consists of eleven schools and the Hampshire Sustainable Schools project headed by Joan Pownall of the New Forest Minstead Ecologcal centre consisting of eleven schools – the Ringwood cluster.

Liason with Mike Fitch and senior staff will result in PSECC arranging free energy audits for all the Ringwood cluster schools, free lighting audits perfored by te Compact Lghting Ltd company and boiler controls investigated by Sabien Ltd – offering savings of between 25% and 40% for school boilers ad significant savngs on lighting energy use.


Food and Drink
Energy and Water
Travel and Traffic
Purchasing and Waste
Buildings and Grounds
Local Well Being
Inclusion and Participation
Social Justice

Groundwork's One World Schools:

helping deliver the sustainable schools framework

Once the findings of the initial Ringwood cluster of schools is determined and changes made in boiler controls, lighting and renewable energy technologies installed, if agreed to by the Cabinate and various committees at Hampshire County Council – then the programme, grants, technologies and funding pacakged could be roller out throughut all 528 schools in Hampshire.

The E.ON Energy Experience

The E.ON Energy Experience is a major new programme for teachers to help them teach young people about energy. The resources will help young people to understand about the different sources of energy we use, the relative merits of each, the options for energy production going forward and what their choices will mean locally, nationally and globally. Young people aged 5-16 will be given the essential facts and figures. But more importantly, will be allowed to make virtual decisions about all stages of energy production, distribution and consumption and see the different effects of those decisions.

E.ON has worked closely with the education community to ensure that the programme offers an exciting interactive resource. Teacher support materials will provide lesson plans and curriculum links for geography and science curricula in England, Scotland and Wales, to help teachers get the most out of the programme too. Teachers can sign up for the FREE half-termly E.ON Energy Experience primary e-newsletter and secondary e-newsletter to keep them informed of the latest energy issues and help engage their students with the topical theme of energy.

The E.ON Energy Experience activities require the free Macromedia Flash Player 8 or above. If you don't have this player, or if you are unsure whether you have it, you can find out more about Flash here.

Energy Home (5-7 year olds)

Visit Energy Home

Energy Town (7-11 year olds)

Visit Energy Town

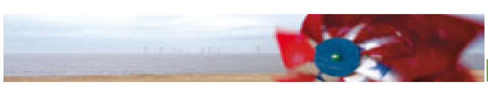
Energy Nation (11-14 year olds)

Visit Energy Nation

Energy World (14-16 year olds)

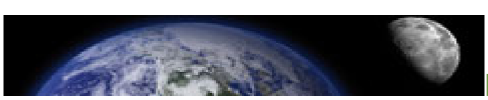
Visit Energy World

Energy - voice of a generation



Have your say!

The E.ON schools' energy conference

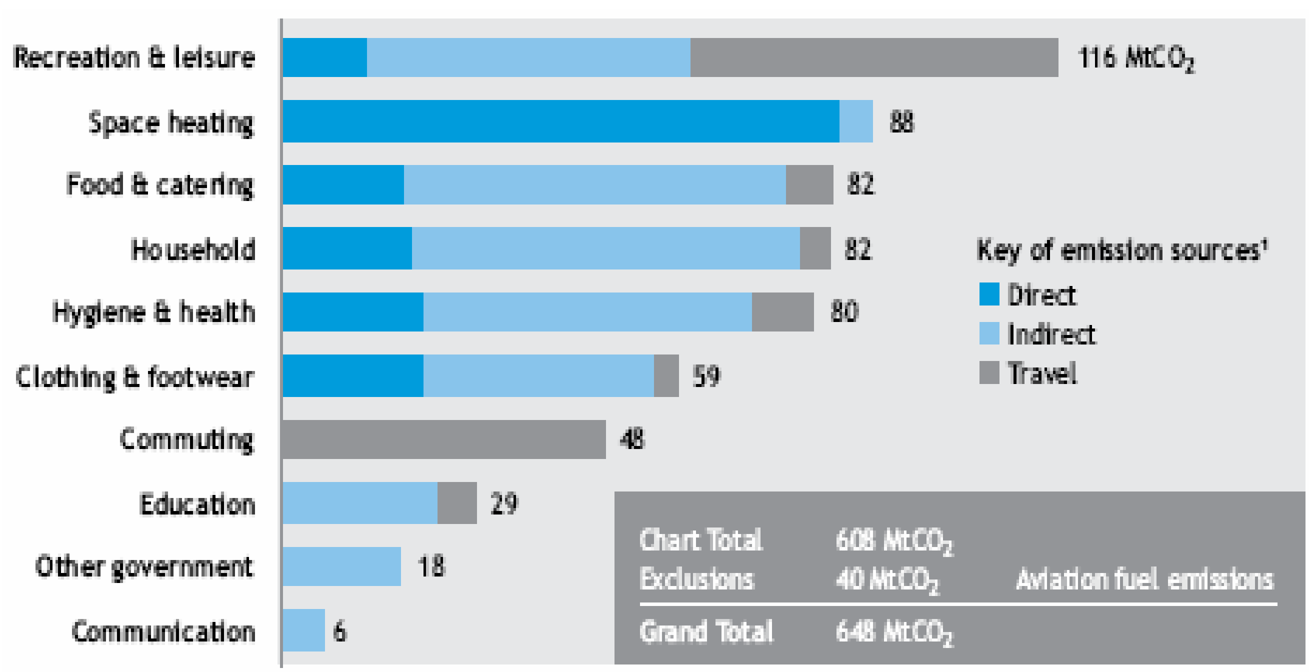


Read all about it

1. 8 The three stages of carbon emission reduction – Carbon Trust

Stage	Description
Stage 1: Direct Emissions Reduction	Reduces directly controlled emissions through, for example energy efficiency and low-carbon energy supply
Stage 2: Indirect Emissions Reduction	Reduces emissions and costs across the supply chain and helps develop revenue opportunities from low-carbon products
Stage 3 (Optional): Offsetting	If appropriate, offsets emissions using high quality offsets from verified projects that create truly additional emission reductions

A split of all emissions by consumer need



Source: Carbon Trust Report (CTC603), '*The carbon emissions generated in all that we consume*', using the UK Carbon Attribution Model, Centre for Environmental Strategy, University of Surrey, 2006.

The Local Authority Carbon Management programme

Carbon Management from the Carbon Trust provides technical and change management support to help Local Authorities (LA's) realise carbon emissions savings. The aim is to reduce emissions under the direct control of councils — whether caused by energy use in buildings, street lighting, landfill waste or vehicle fleets.

The following four tables & diagrams were obtained from the South East England Regional Assembly publication: "Harnessing the Elements"

MAY 2003 - Supporting Statement to the Proposed Alterations to Regional Planning Guidance, South East – Energy Efficiency and Renewable Energy

In order for Hampshire County Council (HCC) and the Hampshire Natural Resources Initiative (HNRI)

To consider "Ownership of Renewable Energy Resources" existing and potential total Renewable Energy available for Electricity Generation is depicted in table one.

Regional Potential for Renewable Energy Generation by 2010

Table 1.1

Regional Potential for Generation of Electricity from Renewable Energy Sources by 2010

Renewable Energy Type/ Indicative Size	Existing Situation			Prospective Total by 2010[24]		
	No. Schemes	Capacity (MW)	Output (GWh[25])	No. Schemes	Capacity (MW)	Output (GWh)
Large CHP / Electricity Plants Fuelled by Biomass Waste/Residues and Energy Crops (15+MW)	0	0	0	5	75	562.5
Small CHP Plants Fuelled by Biomass Waste/Residues and Energy Crops (5-10MW)	0	0	0	5	35	262.5
Anaerobic Digestion Fuelled by Farm Waste, Sewage and/or Biomass Waste (0.5MW)	7	4.4	37.4	36	12	102
Offshore Wind Farms (50-75MW; 20-30 Turbines)	0	0	0	3-4	200	640
Wind Farms (50-75MW; 20-30 Turbines)	0	0	0	1	50	
Small Wind Clusters (6MW; 4-10 Turbines)	0	0	0	16	96	429
Single Large Wind Turbines (1.5MW)	1	1	n/a	16	24	
Single Small Wind Turbines/Chargers (0.03 MW)	2	0.55	0	50	1.5	4
Small-Scale Hydro Power (0.1MW)	0	0	0	5	0.8	3.7
Domestic PV Installations (1.5-3kWp)				3200	8.4	
Commercial PV Installations (50kWp)	4	0.005	n/a	105	5.3	15.3
Motorway PV Installations (160kWp/km)				20	1.6	
Total	**14**	**6**	**38**	**140 + PV**	**510**	**2019**
Landfill Gas[26]	26	54	405	51	108	809

FOOTNOTES

[24] *The categories of technology type and size shown are indicative. In practice the nature and size of actual schemes may differ. In particular, there may opportunities for biomass at scales smaller than those shown.*

[25] *GWh = Gigawatt-hour. A unit of energy used to show how much energy is actually generated from a scheme (1GWh = 1000MWh = 1,000,000kWh). 1MWh is the amount of electrical energy generated by a 1MW generator running at full output for one hour.*

[26] *Landfill gas is not considered to be a renewable source by the Regional Assembly and is excluded from the targets in the proposed amendment to RPG9 (see paragraph 2.41). However, landfill gas was included in the assessment of potential conducted by AEA Technology and FPD Savills.*

South East England Regional Assembly

Hampshire & Isle of Wight Potential for Renewable Energy Deployment

Table 1.2: Hampshire & Isle of Wight Potential Renewable Energy Deployment by 2010 and 2016

Hampshire and Isle of Wight

3.54 Potential renewable energy deployment by 2010 and 2016 (MW):

	Biomass Combustion/ Thermal	Biomass Anaerobic Digestion	Onshore wind	PV	Total
Installed Capacity (MW)					
2010	up to 60	2.5	49	3.1	115
2016	up to 60	4.5	52	5.6	122

PSECC are currently reviewing the recent reports produced by CEN and ARUP.

CEN – Woodland report for Hampshire

ARUP – Energy report for Hampshire

Further detailed Renewable Energy project identification will be made in the full report submission to Mike Fitch if required.

PSECC - Approach

The framework for this analysis was the MARKAL energy system model developed in the first phase of the - *Options for a Low Carbon Future* study.

Systems models are designed to calculate the cost-optimal mix of energy technologies needed under different scenario assumptions regarding the demand for energy services, primary energy prices and limits on energy related emissions. They also estimate the cost of the energy system for each time step and over the full period of investigation, and therefore provide estimates of the cost associated with changes to the system, for example to abate carbon dioxide emissions.

The advantages of such models are that they:

- Cover a wide range of technologies in the energy system and allow some feedback between the energy supply and demand sides;

- Provide a framework to evaluate technologies on the basis of cost assumptions, check the consistency of results and explore sensitivities to key data and assumptions;

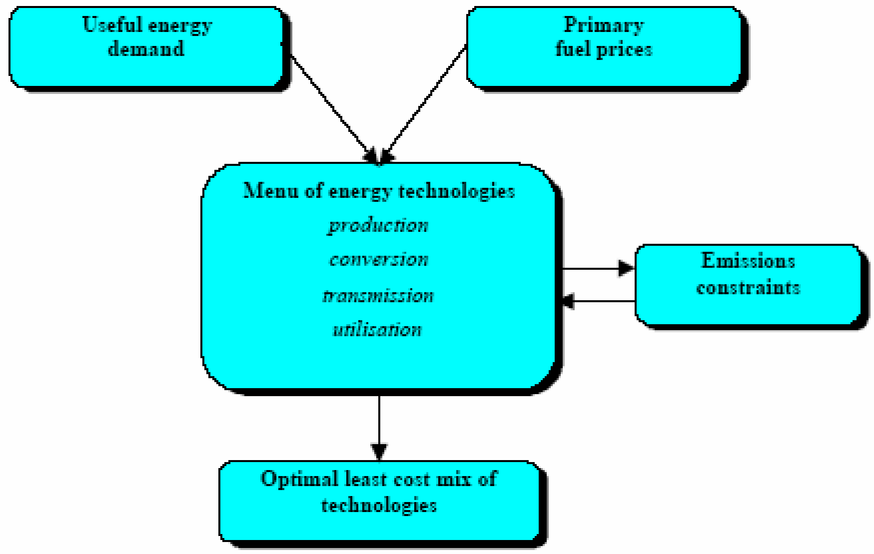
- Have the flexibility to represent a wide range of energy systems with the possibility of easy extension to meet additional requirements;

- Are able to look across a timeframe (in this case to 2050), thus providing information on the phasing of technology deployment, energy supply and use and carbon emissions;

- Enable emissions constraints to be applied, with the energy system adjusting to meet these at least cost **1**;

- Allow comprehensive analysis of the costs associated with changes to the energy system including total discounted cost, annual costs and average and marginal costs of abatement.

1.10 Schematic representation of the MARKAL Model



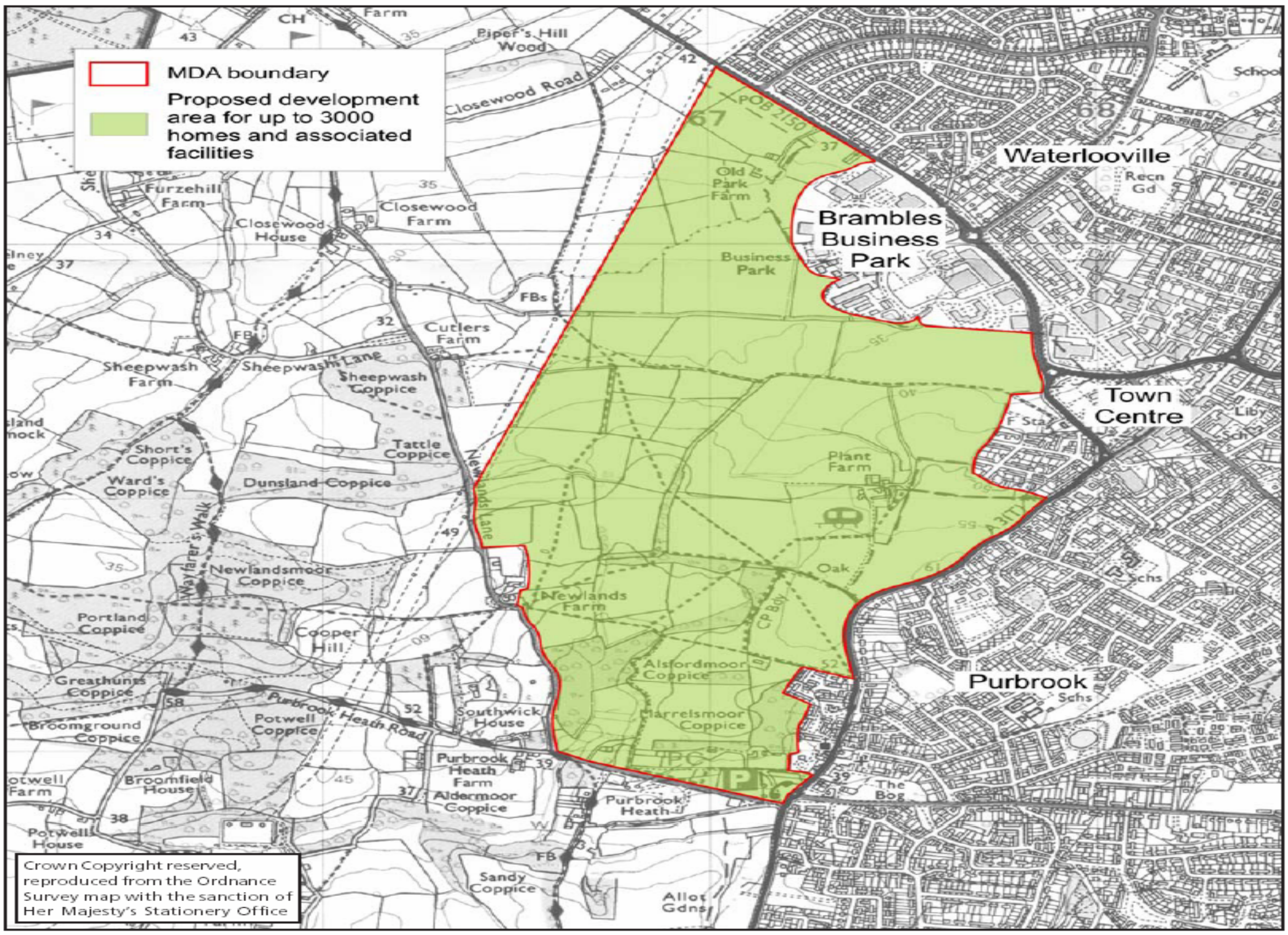
UK Government White Paper 24th February 2003

1. In this study the model only considered abatement of carbon dioxide emissions and not the other gases covered by the Kyoto Protocol.

1.11 Major Development Area's – such as: Waterlooville

Developers are not fully considering all aspects of renewable energy options for this development – based on financial implications and also possibly a lack of complete understanding of the potentials. Waterlooville MDA - when considering paybacks for renewable energy technologies then grants should be taken into accountant.

FIGURE 1.2 Site Location Plan



Each MDA should have the following:

- **HCC & Community "Resource Ownership"**
- **Sustainable Renewable Energy for all buildings**
- **Strategic Energy Company Partnership for ESCO's**
- **Biomass energy plants (10MW) & District Heating**

Grainger plc – have agreed to meet PSECC

We focus on creating desirable new homes
in prime locations

Grainger's evolving development business is increasingly focused on large and complex mixed use projects. The recently strengthened management team is based in London, Newcastle and Oxford, thus ensuring good geographical coverage. The development team works closely with local authorities, the local communities in which it develops, joint venture partners and all relevant stakeholders. It is these relationships which underpin Grainger's approach to its development business.

The current programme includes up to 7000 residential units and 2million sq ft of commercial space including health care facilities, children's nurseries, a community theatre, a cemetery, schools and sports and recreational facilities.

Grainger's development philosophy is based around:

- Understanding customers' needs
- Risk mitigation
- Effective and well considered design
- Commitment to sustainability
- Challenging conventional boundaries
- Open and straightforward approach to all relationships
- Strong team ethics
- Passionate about what we do

In the cases below from Scottish & Southern Energy plc, solar is indicated as having a long payback period.

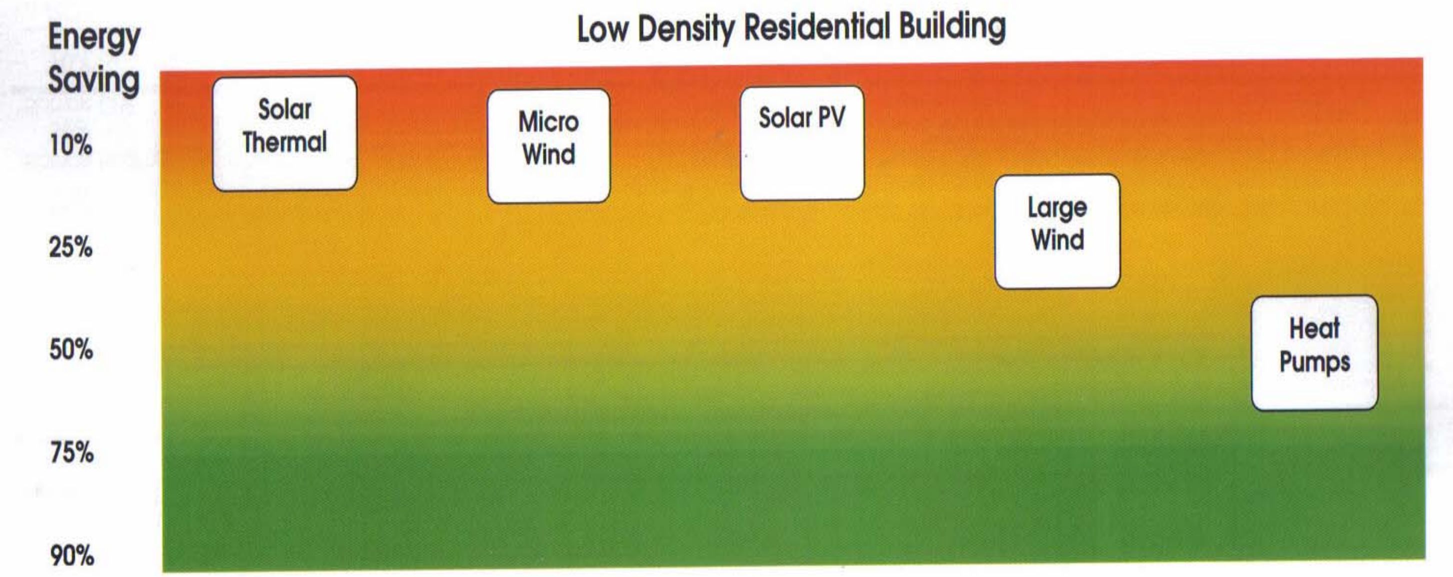
When considering paybacks for renewable energy technologies then grants should be taken into account. Their MDA renewable energy report is being amended. The payback periods below do not account for any grant system being utilised

When utilising the Low Carbon Building grants from the Carbon Trust and also the BRE Community Energy programme then it is possible to reduce these paybacks by as much as 70% 90%.

PSECC have utilised the RetScreen 4 software from Canada to indicate in the final report submission to Mike Fitch in July 2008 just how all renewable energy technologies and energy efficiency measures adopted by the Council can be payed back in shorter time periods

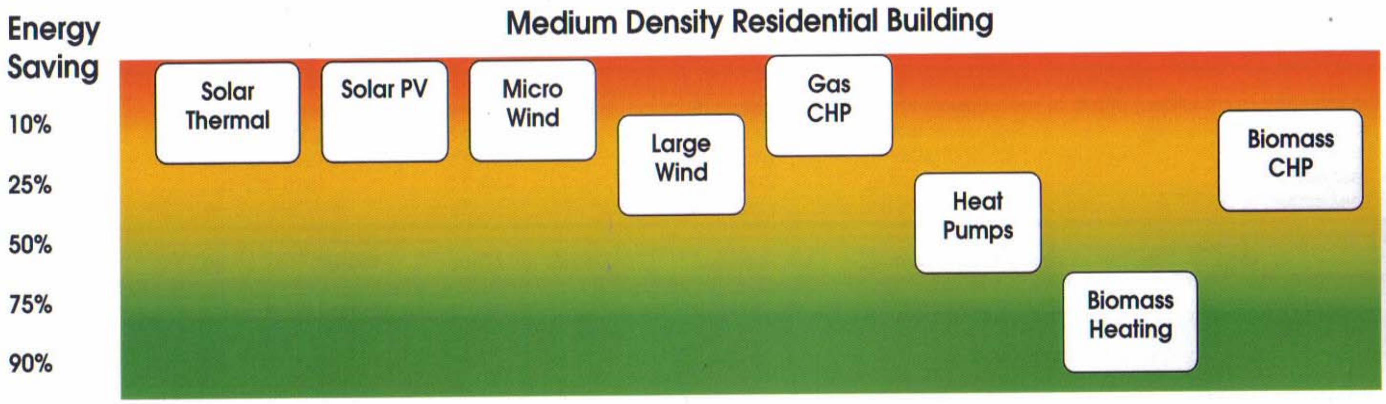
Scottish and Southern Energy

3. Guide to Technology Integration



	Max Energy Savings Total (heat; electricity)[9]	Rating per household	Installed Cost	Simple Payback Period	CO_2 savings/household
Solar Thermal	6% (8%; -2%)[10]	7m²	£1,000/m²	224 years	0.34 tonnes/year
Solar PV	10% (0%; 53%)	3.6 kW	£8,000/kW	77 years	1.36 tonnes/year
Micro Wind	10% (0%; 53%)	1.4 kW	£3,350/kW	12 years	1.36 tonnes/year
Large Wind	19% (0%; 100%)	2.4 kW	£1,500/kW	5 years	2.57 tonnes/year
Heat Pumps	52% (90%; -112%)	8 kW	£1,000/kW	Similar running costs to gas in today's terms; less expensive in the future	1.57 tonnes/year

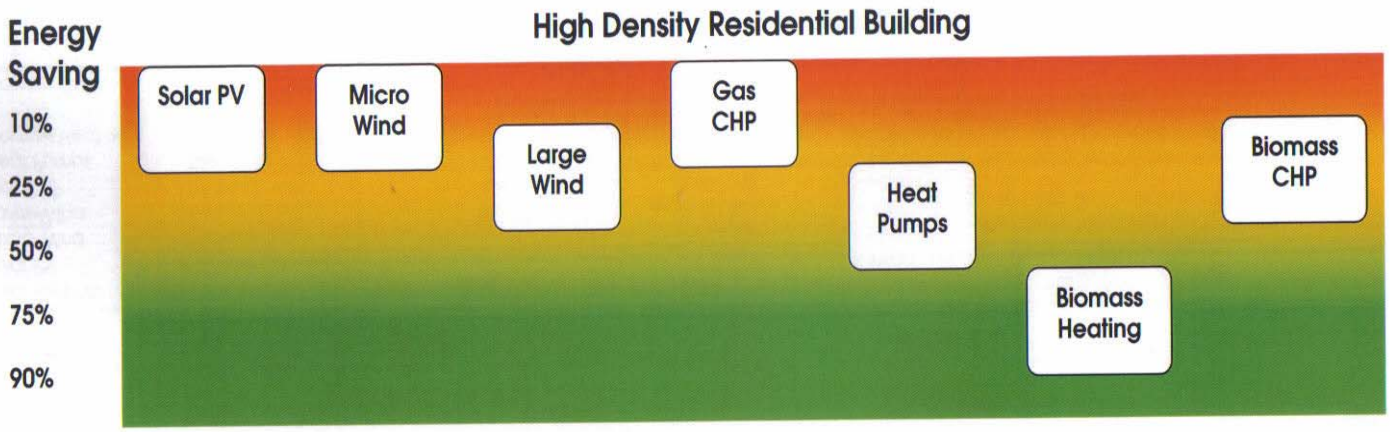
[9] Total (heat; electricity) shows the maximum total savings in energy, heat and electricity consumption (respectively) in the building in kWh for a technology.
[10] A negative reduction in energy consumption is shown when additional energy is used by a system; solar thermal systems use electricity to run a pump.



	Max Energy Savings Total (heat; electricity)	Rating per household	Installed Cost	Simple Payback Period	CO_2 savings/household
Solar Thermal	3% (4%; -1%)	2.7 m^2	£1,000/m^2	224 years	0.131 tonnes/year
Solar PV	3% (0%; 16%)	0.8 kW	£8,000/kW	77 years	0.317 tonnes/year
Micro Wind	3% (0%; 16%)	0.3 kW	£3,350/kW	12 years	0.317 tonnes/year
Large Wind	19% (0%; 100%)	1.9 kW	£1,500/kW	5 years	1.98 tonnes/year
Gas CHP	0% (-14%; 57%)[11]	1.0 kW_e [12]	£800/kW_e	5 years	0.608 tonnes/year
Heat Pumps	52% (90%; -112%)	6 kW	£1,000/kW	Similar running costs to gas in today's terms; less expensive in the future	1.20 tonnes/year
Biomass Heating	80% (100%; -4%)	12 kW	£250/kW	Similar running costs to gas in today's terms; less expensive in the future	3.71 tonnes/year
Biomass CHP	26% (24%; 35%)	0.6 kW_e	£2,000/kW_e	6 years[13]	1.6 tonnes/year

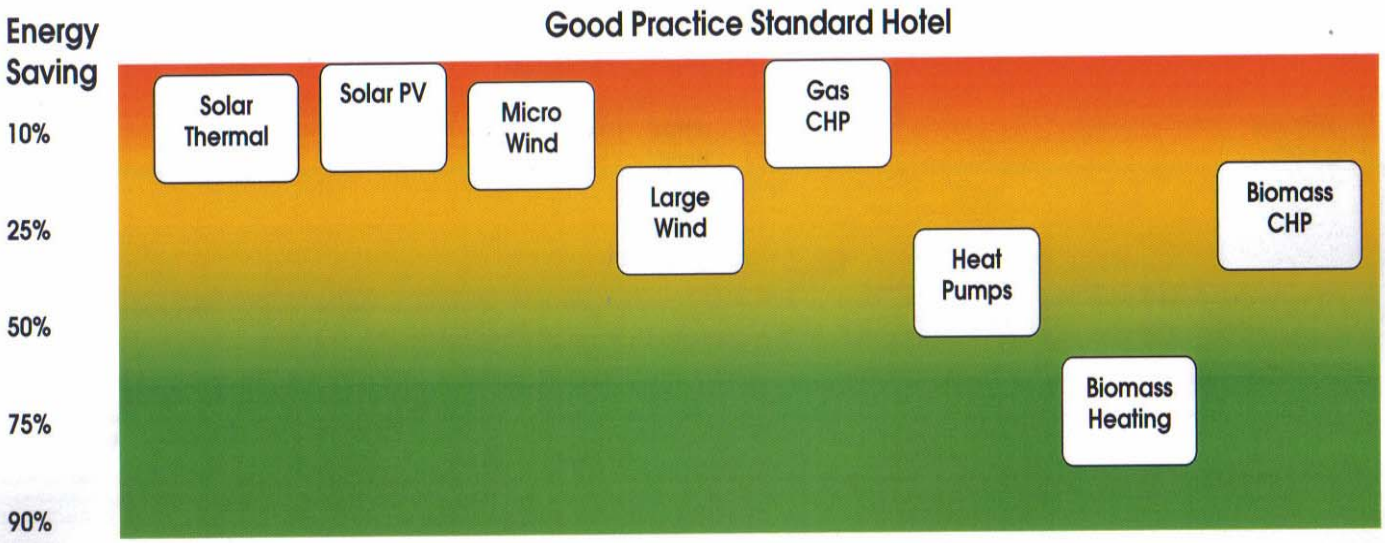
[11] The net total reduction in energy usage in kWh in a building from a CHP system is approximately 0%, as there is an increased gas consumption to generate electricity. However, on a national level there is approximately a 30% reduction in energy consumption (see Section 2.5).

[12] All gas and biomass CHP systems have been sized to provide 30% of the heat load of a building or group of buildings. The remaining heat load and annual demand should be met with a peak load boiler, which could be a standard biomass boiler or gas boiler.



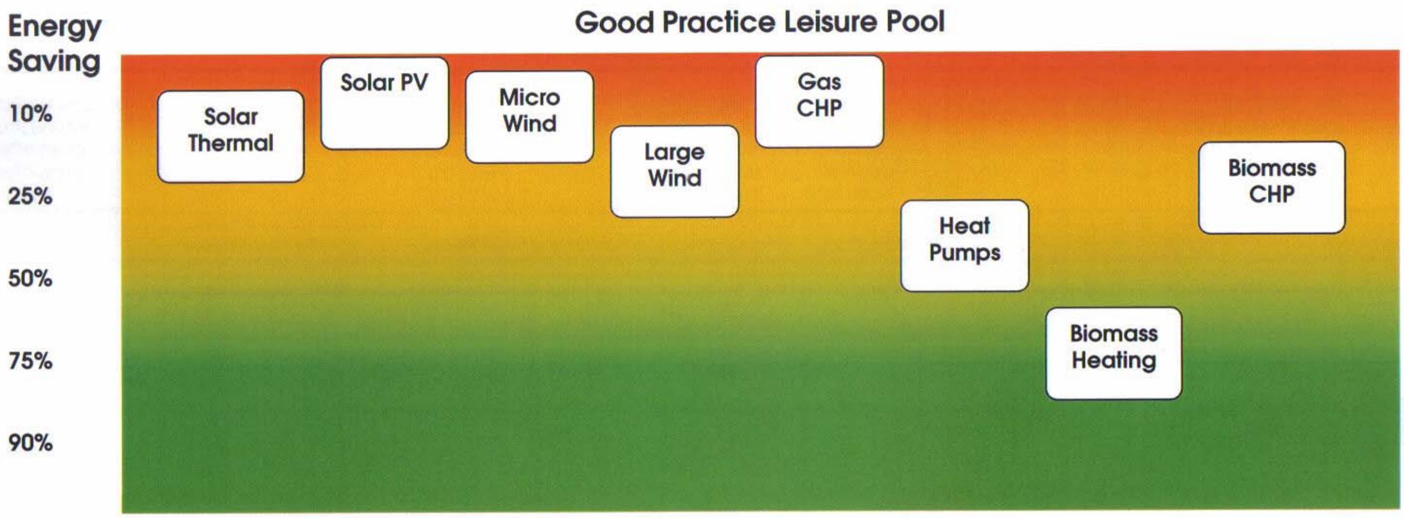
	Max Energy Savings Total (heat; electricity)	Rating per household	Installed Cost	Simple Payback Period	CO_2 savings/household
Solar PV	1% (0%; 5%)	0.2 kW	£8,000/kW	77 years	0.074 tonnes/year
Micro Wind	1% (0%; 5%)	0.1 kW	£3,350/kW	12 years	0.074 tonnes/year
Large Wind	19% (0%; 100%)	1.3 kW	£1,500/kW	5 years	1.39 tonnes/year
Gas CHP	0% (-14%; 57%)	0.7 kW_e	£600/kW_e	5 years	0.425 tonnes/year
Heat Pumps	44% (90%; -157%)	4.0 kW	£1,000/kW	Similar running costs to gas in today's terms; less expensive in the future	0.227 tonnes/year
Biomass Heating	80% (100%; -4%)	10 kW	£250/kW	Similar running costs to gas in today's terms; less expensive in the future	2.6 tonnes/year
Biomass CHP	26% (24%; 35%)	0.4 kW_e	£2,000/kW_e	6 years	1.12 tonnes/year

[13] The biomass CHP payback period assumes 95% availability. Current availability factors are approximately 30% - 40% as the technology is in the early stages of development. This is likely to increase to 95% in the future as the technology matures.

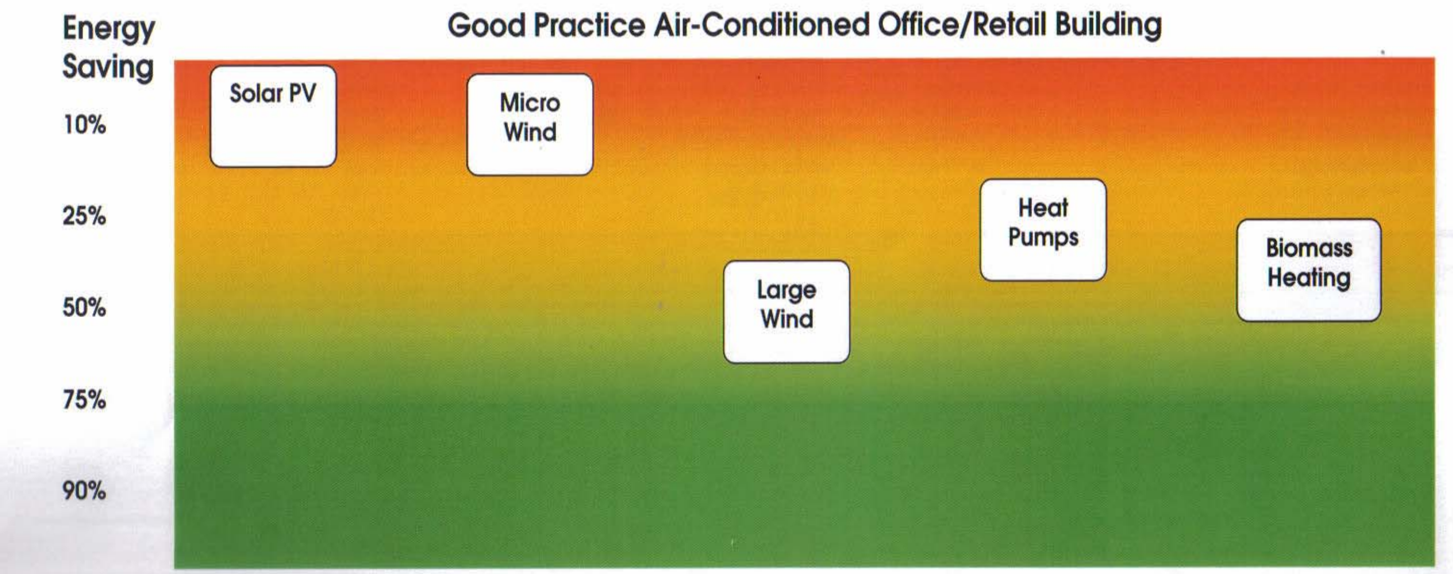


	Max Energy Savings Total (heat; electricity)	Rating per m² floor area	Installed Cost	Simple Payback Period	CO_2 savings per m² floor area
Solar Thermal	7% (10%; -2%)	0.1 m²	£500/m²	104 years	0.004 tonnes/year
Solar PV	3% (0%; 13%)	0.01 kW	£8,000/kW	94 years	0.004 tonnes/year
Micro Wind	10% (0%; 43%)	0.01 kW	£3,350/kW	15 years	0.015 tonnes/year
Large Wind	24% (0%; 100%)	0.03 kW	£1,500/kW	6 years	0.034 tonnes/year
Gas CHP	0% (-14%; 43%)	0.018 kW_e	£600/kW_e	9 years[14]	0.008 tonnes/year
Heat Pumps	41% (72%; -58%)	0.11 kW	£500/kW	79 years	0.015 tonnes/year
Biomass Heating	76% (100%; -3%)	0.09 kW	£250/kW	Similar running costs to gas in today's terms; less expensive in the future	0.048 tonnes/year
Biomass CHP	24% (24%; 26%)	0.001 kW_e	£2,000/kW_e	11 years	0.021 tonnes/year

[14] Businesses pay less for electricity than domestic customers. This affects the spark spread, which in turn results in decreased running costs (and hence a simple payback period) for heat pumps and an increased payback period for gas and biomass CHP.



	Max Energy Savings Total (heat; electricity)	Rating per m2 floor area	Installed Cost	Simple Payback Period	CO_2 savings per m2 floor area
Solar Thermal	14% (19%; -4%)	0.4 m^2	£500/m^2	104 years	0.018 tonnes/year
Solar PV	3% (0%; 13%)	0.02 kW	£8,000/kW	94 years	0.010 tonnes/year
Micro Wind	10% (0%; 45%)	0.03 kW	£3,350/kW	15 years	0.032 tonnes/year
Large Wind	22% (0%; 100%)	0.07 kW	£1,500/kW	6 years	0.071 tonnes/year
Gas CHP	0% (-14%; 46%)	0.06 kW_e	£600/kW_e	9 years	0.017 tonnes/year
Heat Pumps	45% (77%; -67%)	0.35 kW	£500/kW	102 years	0.036 tonnes/year
Biomass Heating	77% (100%; -3%)	0.28 kW	£250/kW	Similar running costs to gas in today's terms; less expensive in the future	0.106 tonnes/year
Biomass CHP	25% (24%; 28%)	0.04 kW_e	£2,000/kW_e	16 years	0.046 tonnes/year

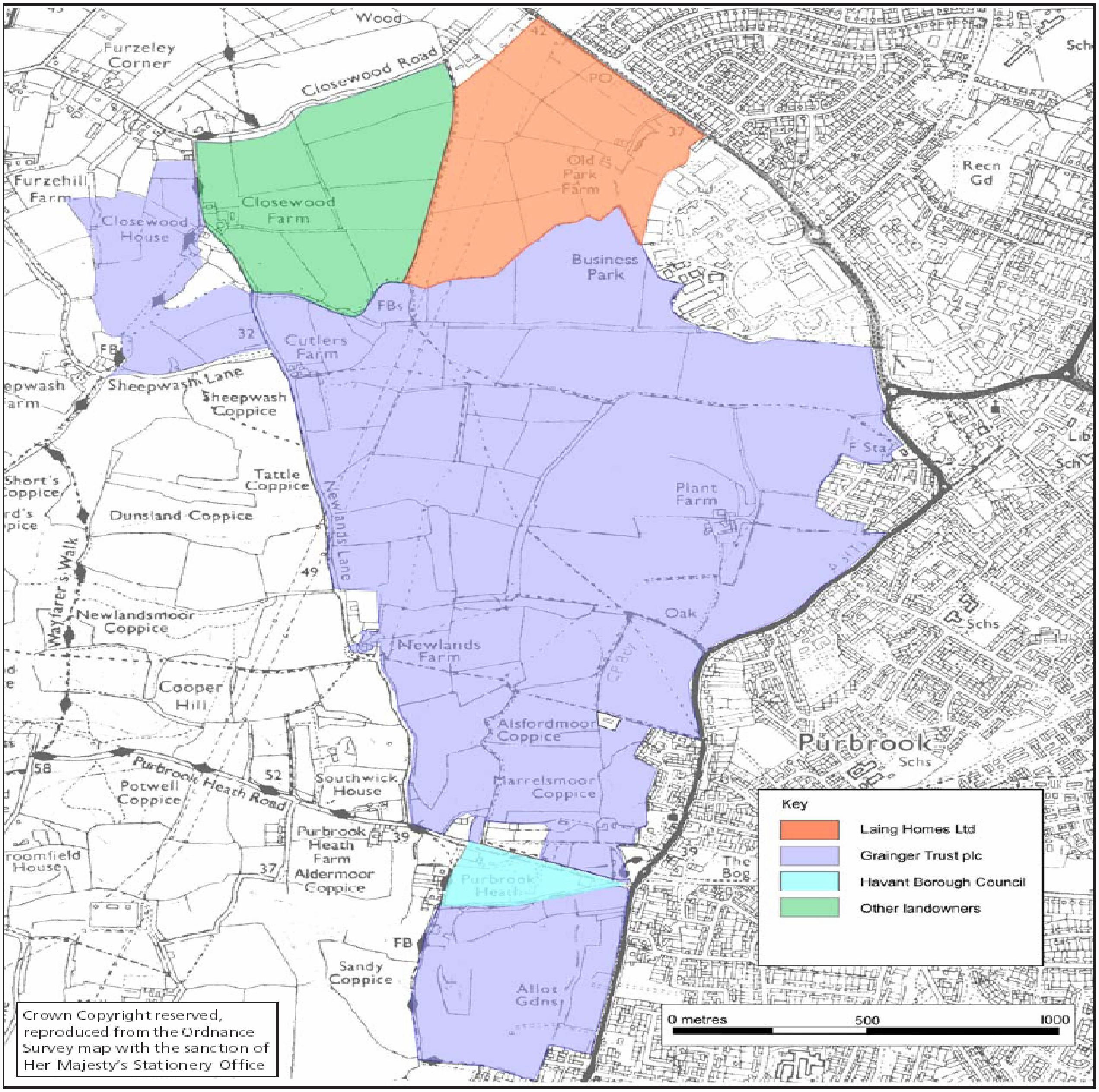


	Max Energy Savings Total (heat; electricity)	Rating per m² floor area	Installed Cost	Simple Payback Period	CO2 Savings per m² Floor area
Solar PV	3% (0%; 5%)	0.01 kW	£8,000/kW	94 years	0.030 tonnes/year
Micro Wind	10% (0%; 18%)	0.01 kW	£3,350/kW	15 years	0.010 tonnes/year
Large Wind	57% (%; 100%)	0.05 kW	£1,500 kW	6 years	0.056 tonnes/year
Heat Pumps	31% (95%; -18%)	0.05 kW	£500/kW	70 years	0.008 tonnes/year
Biomass Heating	43% (100%; -1%)	0.03 kW	£250/kW	Similar running costs to gas in today's terms; less expensive in the future	0.019 tonnes/year

Land Ownership

The two landowners and local authorities have worked closely together towards the comprehensive redevelopment of the site. The parties resolved jointly to commission Atkins Consultants to produce the masterplan framework options for the MDA to facilitate a continued partnership approach and more effective engagement of local communities, in accordance with Government Guidance.

FIGURE 1.3 Land Ownership



7.4 Local Centre

The local centre is intended to act as a focal point for the new community. It is expected to provide a limited range of shops and services, including a small convenience store and community facilities, to serve the needs of residents of the MDA.

Developers have not made proposals for a complete Low Carbon Building development.

PSECC believe that all developers for the 80,000 new build homes in Hampshire by 2026 should be educated further as to what is required to meet UK and Hampshire current and future targets for energy efficiency, renewable energy and CO_2 reductions.

"Resource Ownership" by Hampshire County Council (HCC)

could see the development of an infrastructure in all MDA's for 10MW biomass energy plants & district heating schemes.

Energy Service Company (ESCO) formation in each MDA and partly owned or fully owned by HCC is seen by PSECC as a possible means of ensuring developers must develop the infrastructure – forcing the issue and PSECC are working with Scottish & Southern Energy and Vital Energi on suitable funding mechanisms.

If HCC make known to developers of each MDA that 10MW Biomass Plants are to be encouraged and funded then this could be considered the key to a successful demonstration of truly sustainable developments .

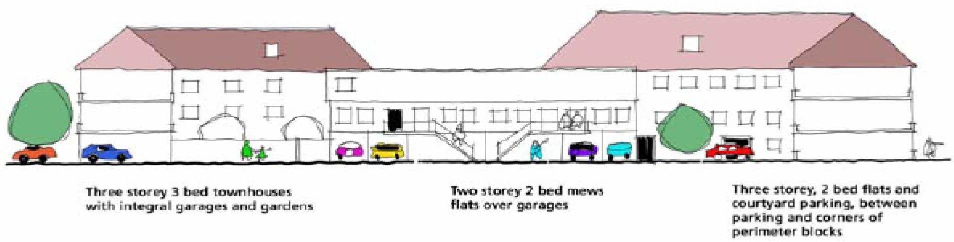
benefits of a solar roof

- Dedicated, clean and safe power source
- Reduces electricity bills
- Increases property value
- Minimal maintenance
- Long functional life
- Silent operation
- Encourages efficient use of energy
- Reduces CO_2 emissions
- Pitched roofs provide optimum position

7.5 Residential

Government Guidance on Housing contained in PPG:3 recognises the need to create mixed and inclusive communities, including a variety of housing and tenures, to secure a better social mix and meet the increased demand for smaller households over the longer term.

The Guidance promotes the creation of sustainable residential environments with links to public transport, the inclusion of a mix of land uses and good quality design as key issues for such developments. PPG 3 also encourages housing development which makes more efficient use of land (between 30 and 50 dwellings per hectare) and seeks greater intensity of development at places with good public transport accessibility or around major nodes along good quality public transport corridors.

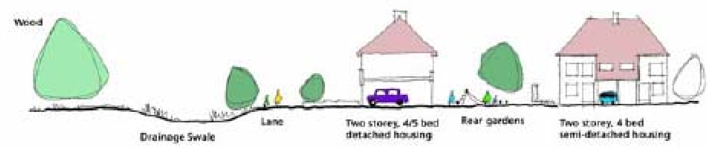


Plant Farm Character Area
High Density Housing: 50-60 dwellings per hectare

Character Areas

The residential development should be designed to respect the character of the landscape character areas which cover the site, as referred to in Chapter 3 and Figure 3.1. Specific attention must be paid to the transition from the edge of the development to the open countryside and existing urban edge.

Old Park Farm Character Area
Medium Density Housing:
40-50 dwellings per hectare

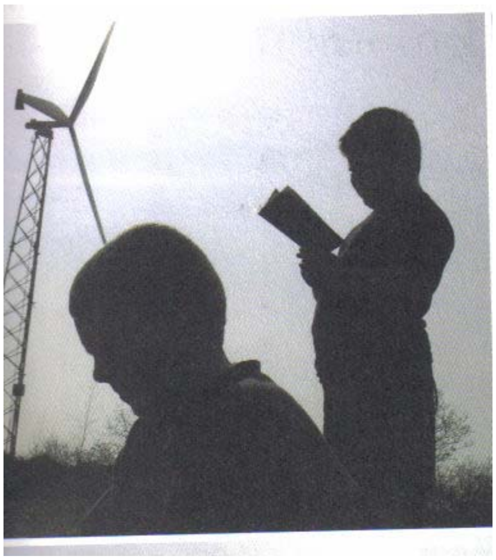


Newlands Farm Character A
Low Density Housing:
30-40 dwellings per hectare

1.12

Groundwork's One World Schools:

helping deliver the sustainable schools framework



1.13

Project Management & Support Services Ltd

PMSS is a Hampshire based company with well proven experience over many years in the development and management of Renewable Energy projects

PMSS also were amongst the first companies to support the Hampshire County Council HNRI programme and joined the Energy Network formation formed by the HNRI - Energy Coordinator.

UK Offshore Wind Acquisition Due Diligence

PMSS were retained by a prospective purchaser of an offshore project in UK waters.

The PMSS scope was to review the Data Room provided by the Vendor, and to assess the following aspects:

- Project Execution
- Regulatory Issues
- Technology
- Contract Review
- Schedule Review
- Energy Yield Verification
- Financial Review, inc Financial Analysis
- Grid Connection
- Insurance
- O&M
- Re-powering
- Decommissioning

Throughout the process, a comprehensive Project Risk Register was undertaken, with key scenarios identified and costed. The final deliverable was a technical and financial due diligence report and Client Workshop to discuss the findings.

Project Factfile

Project name:
UK Offshore Wind
Acquisition Due Diligence

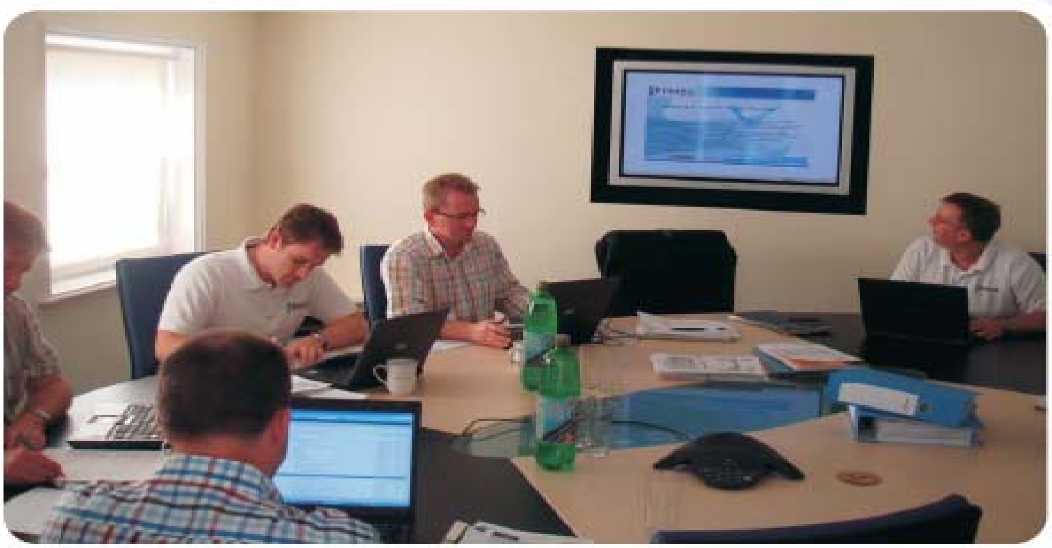
Client:
Confidential

Date:
n/a

Value:
n/a

PMSS disciplines:

- Due Diligence



OMM WMO

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

PNUE UNEP

Technologies, Policies and Measures for Mitigating Climate Change

This is a Technical Paper of the Intergovernmental Panel on Climate Change prepared in response to a request from the United Nations Framework Convention on Climate Change. The material herein has undergone expert and government review, but has not been considered by the Panel for possible acceptance or approval.

November 1996

This paper was prepared under the auspices of IPCC Working Group II, which is co-chaired by Dr Robert T. Watson of the USA and Dr M.C. Zinyowera of Zimbabwe.

Table 3: Annual Annex I buildings sector carbon emissions and potential reductions in emissions from technologies and measures to reduce energy use in buildings (Mt C) based on IPCC scenario IS92a.

	Annual Annex I Buildings Sector Carbon Emissions (Mt C)			
	1990	2010	2020	2050
Source of Emissions—Base Case[a]				
Residential Buildings	900	1 000	1 050	1 100
Commercial Buildings	500	700	750	900
TOTAL	**1 400**	**1 700**	**1 800**	**2 000**
		Annual Global Buildings Sector Carbon Emissions Reductions (Mt C)		
Potential Reductions from Energy-efficient Technologies Assuming Significant RD&D Activities[b] (from SAR)				
Residential Equipment[c]		200	260	440
Residential Thermal Integrity[d]		125	160	220
Commercial Equipment[c]		140	190	360
Commercial Thermal Integrity[d]		45	55	90
TOTAL POTENTIAL REDUCTIONS		**510**	**665**	**1 110**
Potential Reductions from Energy-efficient Technologies Captured through Measures[e] (Based on Expert Judgment)				
Mandatory Energy-efficiency Standards[f]		95–160	145–240	245–610
Voluntary Energy-efficiency Standards		g	g	g
Market-based Programmes[h]		70–115	90–150	150–380
TOTAL ACHIEVABLE REDUCTIONS		**165–275**	**235–390**	**395–990**

Note: "Potential Reductions from Energy-efficient Technologies" and "Potential Reductions from Energy-efficient Technologies Captured through Measures" are not additive; rather, the second category represents that portion of the first that can be captured by the listed measures.

Footnotes are the same as those for Table 2, except for:

[d] Potential carbon reductions for residential thermal integrity are calculated as 25% of the emissions attributed to heating and cooling energy used in the sector (50% of total residential energy use) in 2010, 30% in 2020 and 40% in 2050. Potential savings for commercial thermal integrity are calculated as 25% of the emissions attributed to heating and cooling energy used in the sector (25% of total commercial energy use) in 2010, 30% in 2020 and 40% in 2050.

Table 9: Global energy reserves and resources, their carbon content, energy potentials by 2020–2025, and maximum technical potential.[a]

	Consumption (1860–1990)		Consumption (1990)		Reserves Identified/ Potentials by 2020–2025		Resource Base/ Maximum Potentials	
	EJ	Gt C	EJ	Gt C	EJ	Gt C	EJ	Gt C
Oil								
Conventional	3 343	61	128	2.3	6 000	110	8 500	156
Unconventional	–	–	–	–	7 100	130	16 100	296
Gas								
Conventional	1 703	26	71	1.1	4 800	72	9 200	138
Unconventional	–	–	–	–	6 900	103	26 900	403
Coal	5 203	131	91	2.3	25 200	638	125 500	3 173
TOTAL FOSSIL	10 249	218	290	5.7	50 000	1 053	>186 200	4 166
Nuclear[b]	212	–	19	–	1 800	–	>14 200	–
					EJ/yr		EJ/yr	
Hydro	560	–	21	–	35–55	–	>130	–
Geothermal	–	–	<1	–	4	–	>20	–
Wind	–	–	–	–	7–10	–	>130	–
Ocean	–	–	–	–	2	–	>20	–
Solar	–	–	–	–	16–22	–	>2 600	–
Biomass	1 150	–	55	–	72–137	–	>1 300	–
TOTAL RENEWABLES	1 710	–	76	–	130–230	–	>4 200	–

[a]Table based on SAR II, B.3.3.1, Tables B-3 and B-4.
[b]Natural uranium reserves and resources are effectively 60 times larger if fast breeder reactors are used.
– = negligible or not applicable

Box 3. Technical Potential of CO_2 Emission Reductions based on the IPCC IS92 Scenarios for Different Mitigation Technologies by the Year 2020

In preparing these calculations of technical potential, it is assumed that 50% of the new installed energy conversion capacities in Annex I countries between 1990 and 2020 would employ the mitigation technologies described in this paper, irrespective of costs which would vary for different technologies. Six different mitigation technologies are considered: replacing coal with natural gas, flue gas decarbonization for coal and natural gas, CO_2 removal from coal, and replacement of coal and natural gas with nuclear power, or with biomass, respectively. This calculation does not attempt to present a comprehensive assessment of mitigation options in the energy sector. Only six examples are presented due to the limitations imposed by the IS92 scenarios. The mitigation potential of each individual technology option is based on a sensitivity analysis of the IS92a scenario and the range between IS92e and IS92c. Some of these mitigation options may be mutually exclusive and are not additive.

Each calculation includes a number of steps. First, new capacity additions between 1990 and 2020 in the IS92 scenarios are inferred; second, the profiles of new capacities that are to be partially replaced in Annex I countries by mitigation technologies are also inferred with the assumption that 50% of these capacities would consist of new technologies; third, the implied CO_2 emissions reductions are determined for all three IS92 scenarios using technology characteristics from SAR II, Chapter 19, and emissions coefficients from SAR II, Chapter B; and finally, percentage emissions reductions are evaluated for each of the three scenarios.

The extent to which the technical potential can be achieved will depend on future cost reductions, the rate of development and implementation of new technologies, financing and technology transfer, as well as measures to overcome a variety of non-technical barriers such as adverse environmental impacts, social acceptability, and other regional, sectoral and country-specific conditions.

Mitigation Technology	Technical CO_2 Reduction Potential Based on IS92a Scenario (and Range for IS92e to IS92c) Gt C	% of Annex I	% of World
Replacing Coal with Natural Gas for Electricity Generation in Annex I Countries	0.25 (0.01–0.4)	4.0 (2.0–6.0)	2.5 (1.0–4.0)
Flue Gas Decarbonization (with de-NO_x and de-SO_x) for Coal in Electricity Generation in Annex I Countries	0.35 (0.1–0.6)	6.0 (3.0–8.0)	3.5 (1.5–5.0)
Flue Gas Decarbonization (with de-NO_x) for Natural Gas Electricity Generation in Annex I Countries	0.015 (0.0–0.05)	0.5 (0.0–0.5)	0.15 (0.0–0.45)
CO_2 Removal from Coal Before Combustion for Electricity Generation in Annex I Countries	0.35 (0.1–0.6)	6.0 (3.0–8.0)	3.5 (1.5–5.0)
Replacing Natural Gas and Coal with Nuclear Power for Electricity Generation in Annex I Countries	0.4 (0.15–0.65)	7.0 (3.0–9.5)	4.0 (2.0–5.5)
Replacing Coal with Biomass (in Electricity Generation, Synfuel Production and Direct End Use) in Annex I Countries[a]	0.55 (0.25–0.85)	9.5 (5.5–12.0)	5.5 (3.0–7.0)

[a] The biomass requirements would amount to 9–34 EJ/yr, which is less than the range of 72–187 EJ for the biomass potential by 2020 to 2025 (SAR II, B.3.3.2). These figures are higher than those assessed in the SAR chapter on agriculture (SAR II, 23), and can be achieved only through actions which go beyond agricultural measures.

Table 10: Selected examples of measures and technical options to mitigate GHG emissions in electricity generation.

Technical Options	Measures	Climate and Other Environmental Effects	Economic and Social Effects	Administrative, Institutional and Political Considerations
Efficiency Improvements – Power generation thermal efficiency improvement potential from present average of 30% to 60% in the longer run – Power transmission – Refineries – Synfuel production – Gas transmission	**Market-based Programmes** – GHG taxes – Energy taxes – Tradable emission permits **Regulatory Measures** – Mandatory efficiency standards **Voluntary Agreements** – Voluntary arrangement with customers – Reduced own-use energy	**Climate Effects** – Reduction of all GHG and other pollutants; an increase in thermal conversion efficiency from 35 to 40% reduces CO_2 emissions by 12.5% – Long-term potential up to 50% emission reduction **Other Effects** – Improved local air quality and lower regional pollution	**Cost-effectiveness** – Evolutionary changes can be achievable at no or low additional costs **Macro-economic Issues** – Energy import reduction **Equity Issues** – Tend to be highly equitable and replicable	**Administrative/ Institutional Factors** – A fair share of the improvement potential may be realized even in the absence of direct GHG mitigation policies and measures – Information dissemination **Political Factors** – Create platforms and incentives for voluntary agreements
Switching to Low-carbon Fuels – From coal to natural gas – From oil to natural gas	**Market-based Programmes** – GHG taxes – Fuel-specific energy taxes – Tradable emission permits **Regulatory Measures** – Mandatory fuel use **Voluntary Agreements** – Voluntary fuel switching	**Climate Effects** – Reduction of CO_2 and other pollutants, *ceteris paribus* by 40% (from coal and 20% from oil) – In addition, natural gas often offers higher conversion efficiencies which provides further GHG reductions – Potential disbenefit of higher CH_4 emissions **Other Effects** – Improved local air quality and lower regional pollution	**Cost-effectiveness** – Cost-effective where gas available, but high gas infrastructure costs – Uncertain gas prices in the longer run **Macro-economic Issues** – In the short- to medium-term, potential for low-cost electricity supply – For countries without sufficient domestic gas availability, increasing gas-import dependence **Equity Issues** – International competition for low-cost natural gas	**Administrative/ Institutional Factors** – Need for long-term gas trade arrangements – Compatible with decentralization and deregulation of energy industries – Encourage cogeneration and independent power production **Political Factors** – Supply security concerns, geopolitics
Decarbonization of Flue Gases – CO_2 abatement (scrubbing) – Coal gasification and reforming of synthesis gas – Production of hydrogen-rich gases	**Market-based Programmes** – Carbon taxes – Tradable emission permits **Regulatory Measures** – Emission standards – Regulation of underground storage sites – International conventions on ocean storage **Voluntary Agreements** – CO_2 cascading when applicable	**Climate Effects** – Specific CO_2 reduction by up to 85%, per kWh_e – Disposal/storage with uncertain prospects of ocean storage **Other Effects** – Effective decarbonization presumes large-scale de-SO_x and de-NO_x, hence improved local and regional air quality	**Cost-effectiveness** – Involves least changes in energy sector – High scrubbing costs between \$80–150/t C and more – Additional storage costs – Loss of efficiency in electricity generation **Macro-economic Issues** – No major energy sector restructuring – Higher domestic fossil extraction and/or fuel imports **Equity Issues** – Access to CO_2 disposal sites	**Administrative/ Institutional Factors** – RD&D on disposal and ocean storage – Access to depleted oil and gas fields **Political Factors** – International agreements on large-scale ocean disposal

Table 10 (continued)

Technical Options	Measures	Climate and Other Environmental Effects	Economic and Social Effects	Administrative, Institutional and Political Considerations
Nuclear – Increased use of nuclear energy	**Market-based Programmes** – Carbon taxes – Tradable emission permits **Regulatory Measures** – Standards and codes – Non-proliferation **Voluntary Agreements** – Agreements among nuclear industry, operators and the concerned public **RD&D** – RD&D on waste disposal and safety	**Climate Effects** – Reduction of all GHG and other pollutants, such as SO_x, NO_x and particulates **Other Effects** – Local air quality improvements – Accidental radioactivity release and nuclear waste disposal	**Cost-effectiveness** – Under special conditions, cost-effective mitigation option – High up-front, large and increasing cost range – Limited to baseload operation **Macro-economic Issues** – Lower expenditures for fuel imports; uncertainty about economic feasibility – Lack of public acceptance **Equity Issues** – Limited technology access due to risks of proliferation	**Administrative/ Institutional Factors** – Lack of public support – Concerns include proliferation, waste disposal and safety standards **Political Factors** – Stable regulatory and policy climate – International agreements on large-scale nuclear waste disposal
Biomass – Energy plantation and forestry – Biomass conversion for electricity and heat generation – Biomass gasification and liquid fuel production – Hydrogen from biomass	**Market-based Programmes** – Change structure of subsidies to agriculture – Carbon taxes – Tradable emission permits **Regulatory Measures** – Emission regulation – Agricultural zoning **Voluntary Agreements** – Utilize marginal lands for energy plantation – Support of local biofuel or bio-conversion initiatives **RD&D** – RD&D support to reduce costs of advanced conversion plants	**Climate Effects** – Can result in no net carbon emissions – Could be a sequestration option **Other Effects** – Reduction of other pollutants – Concerns about biodiversity and monocultures	**Cost-effectiveness** – Advanced conversion plants not commercially available, but possible with accelerated RD&D **Macro-economic Issues** – Restructure of agriculture and perhaps forestry – Economic development in rural areas **Equity Issues** – Accessible land	**Administrative/ Institutional Factors** – Land-use conflict – Energy plantation cooperatives – Independent power production arrangements – Compatible with decentralization and deregulation of energy industries – Information dissemination **Political Factors** – Stable agricultural and rural development policy
Wind (an example of intermittent renewables) – Utilization of wind turbines at favorable sites – Remote from grid – Integrated with grid	**Market-based Programmes** – Carbon taxes – Tradable emission permits **Regulatory Measures** – Emission regulation – Zoning appropriate sites **Voluntary Agreements** – Early adopters with utilities **RD&D** – RD&D support to reduce costs	**Climate Effects** – Reduction of all GHG and other pollutants, such as SO_x, NO_x and particulates **Other Effects** – Possible impacts on landscape, noise and wildlife	**Cost-effectiveness** – Cost-effective at favorable sites – Cost range large, hence uncertain economics **Macro-economic Issues** – Economic development in rural areas	**Administrative/ Institutional Factors** – Compatible with decentralization and deregulation of energy industries – Information dissemination – Zoning for wind farms – Access to utility grids **Political Factors** – Stable energy policy

Table 19: Selected examples of economic instruments to mitigate GHG emissions.

Measures	Climate and Other Environmental Effects	Economic and Social Effects	Administrative, Institutional and Political Considerations
Subsidy Removal	– Depends on extent of existing subsidies and degree of subsidy reduction	– Increases real incomes in the long run – Changes distribution of income; effect depends on how revenues are redistributed	
Domestic Taxes	– Can be designed to achieve a specified national/international emission target	– Encourages implementation of most cost-effective mitigation measures – Tax rate determined through trial and error – Carbon tax regressive, but effect depends on how the tax revenue is recycled	– Could be linked to existing energy tax collection systems
Tradable Permits	– Can be designed to achieve a specified national/international emission target	– Encourages implementation of the most cost-effective mitigation measures – Market price for permits and cost of measures implemented is uncertain – Distributional effects depend on how permits are allocated and the disposition of revenue, if any, from the sale of permits	– Requires a competitive permit market – Administrative costs depend on the design of the system – Futures contracts for permits can spread the risks of price fluctuations
Harmonized Taxes	– Can be designed to achieve a specified national/international emission target	– Encourages implementation of most cost-effective mitigation measures – Tax rate determined through trial and error – Equity across countries depends on the transfer payments negotiated	– Little information on implementation available – Domestic policies could reduce the effectiveness of the tax
Tradable Quotas	– Can be designed to achieve a specified national/international emission target	– Encourages implementation of most cost-effective mitigation measures – Market price for quotas and cost of measures implemented is uncertain – Equity across countries depends on the quota allocations	– Requires a competitive quota market – Little information on implementation available – Allows flexibility in the choice of domestic policy
Joint Implementation	– Can reduce emissions from levels that would otherwise occur	– Transfers resources and technologies to host countries	– Administrative costs can be relatively high – Projects can be launched relatively quickly

Table A3: Annex I—primary energy consumed[a] and carbon emitted[b] in the IS92 scenarios, subdivided into the elements of the fuel cycle where the primary fuel is consumed.

	1990		2010						2020						2050					
	Energy Used	CO_2 Emitted	Energy Used			CO_2 Emitted			Energy Used			CO_2 Emitted			Energy Used			CO_2 Emitted		
SCENARIO	*all*	*all*	*a*	*c*	*e*	*a*	*c*	*e*	*a*	*c*	*e*	*a*	*c*	*e*	*a*	*c*	*e*	*a*	*c*	*e*
Supply Side																				
Energy Supply/Transformation																				
Electric Generation	96	1.3	141	120	153	1.9	1.4	2.4	165	135	183	2.2	1.4	2.9	187	135	234	1.9	1.0	3.1
Synfuels Production	0	0.0	0	1	1	0.0	0.0	0.0	2	4	5	–0.1	–0.2	–0.2	38	18	61	0.2	–0.4	0.7
Direct Use of Fuels by Sector[a]																				
Resid./Comm./Inst.	47	0.9	59	49	65	1.1	0.9	1.2	64	52	73	1.2	0.9	1.3	73	48	87	1.3	0.9	1.6
Industry[c]	68	1.4	74	63	81	1.4	0.0	0.0	74	61	86	1.4	1.2	1.6	61	42	69	1.2	0.8	1.4
Transportation	51	0.9	64	53	74	1.2	0.0	0.0	65	52	78	1.2	1.0	1.4	69	45	85	1.3	0.8	1.6
TOTAL	262	4.5	338	286	375	5.6	2.3	3.6	370	304	425	5.9	4.4	7.1	427	288	535	5.9	3.1	8.3
Demand Side																				
Resid./Comm./Inst.	86	1.4	108	91	119	1.7	1.4	2.0	116	95	132	1.8	1.3	2.2	134	92	166	2.0	1.1	2.7
Industry[c]	122	2.1	165	141	181	2.7	2.1	3.1	186	154	211	2.9	2.1	3.5	196	140	242	2.6	1.4	3.7
Transportation	53	1.0	65	0	76	1.2	1.0	1.4	68	55	82	1.2	0.9	1.4	98	56	127	1.4	0.6	1.9
TOTAL	262	4.5	338	232	375	5.6	4.5	6.5	370	304	425	5.9	4.4	7.1	427	288	535	5.9	3.1	8.3
By Source																				
Solids	77	1.9	99	79	115	2.5	2.0	2.9	113	84	140	2.9	2.1	3.5	163	76	256	4.1	1.9	6.5
Liquids	91	1.7	100	79	122	1.8	1.4	2.3	92	71	119	1.7	1.3	2.2	46	41	49	0.9	0.8	0.9
Gases	61	0.9	85	68	93	1.3	1.0	1.4	88	62	94	1.3	0.9	1.4	63	31	60	0.9	0.5	0.9
Other	34	0.0	54	60	45	0.0	0.0	0.0	77	87	72	0.0	0.0	0.0	155	140	170	0.0	0.0	0.0
TOTAL	262	4.5	338	286	375	5.6	4.5	6.5	370	304	425	5.9	4.4	7.1	427	288	535	5.9	3.1	8.3

[a]Energy expressed in EJ.

[b]Carbon expressed as Gt C.

[c]In the IS92 scenarios, the industrial sector includes industrial activities related to manufacturing, agriculture, mining and forestry.

Table A4: Annex I—energy used[a] and carbon emitted[b] by end-use sector in the IS92 scenarios, subdivided into the elements of the fuel cycle where the primary fuel is consumed.

	1990		2010						2020						2050					
	Energy Used	CO_2 Emitted	Energy Used			CO_2 Emitted			Energy Used			CO_2 Emitted			Energy Used			CO_2 Emitted		
SCENARIO	*all*	*all*	*a*	*c*	*e*	*a*	*c*	*e*	*a*	*c*	*e*	*a*	*c*	*e*	*a*	*c*	*e*	*a*	*c*	*e*
Residential/Commercial/Institutional																				
Electric Generation	40	0.6	49	41	53	0.7	0.5	0.8	51	42	57	0.7	0.4	0.9	55	40	69	0.6	0.3	0.9
Synfuels Production	0	0.0	0	0	0	0	0	0	0	1	2	0.0	–0.1	–0.1	6	4	11	0	–0.1	0.2
Direct Use of Fuels	47	0.9	59	49	65	1.1	0.9	1.2	64	52	73	1.2	0.9	1.3	73	48	87	1.3	0.9	1.6
TOTAL	86	1.4	108	91	119	1.7	1.4	2.0	116	95	132	1.8	1.3	2.2	134	92	166	2.0	1.1	2.7
Industry[c]																				
Electric Generation	54	0.8	91	77	99	1.2	0.9	1.5	111	91	124	1.5	1.0	1.9	129	93	162	1.3	0.6	2.1
Synfuels Production	0	0.0	0	0	0	0	0	0	0	1	2	0.0	–0.1	–0.1	6	4	11	0	–0.1	0.2
Direct Use of Fuels	68	1.4	74	63	81	1.4	1.2	1.6	74	61	86	1.4	1.2	1.6	61	42	69	1.2	0.8	1.4
TOTAL	122	2.1	165	141	181	2.7	2.1	3.1	186	154	211	2.9	2.1	3.5	196	140	242	2.6	1.4	3.7
Transportation																				
Electric Generation	2	0.0	1	1	1	0.0	0.0	0.0	2	2	2	0.0	0.0	0.0	3	2	3	0.0	0.0	0.0
Synfuels Production	0	0.0	0	1	1	0.0	0.0	0.0	1	1	1	–0.1	–0.1	–0.1	27	9	39	0.1	–0.2	0.3
Direct Use of Fuels	51	0.9	64	53	74	1.2	1.0	1.4	65	52	78	1.2	1.0	1.4	69	45	85	1.3	0.8	1.6
TOTAL	53	1.0	65	54	76	1.2	1.0	1.4	68	55	82	1.2	0.9	1.4	98	56	127	1.4	0.6	1.9
All End-Use Sectors																				
Electric Generation	96	1.4	141	120	153	1.9	1.4	2.4	165	135	183	2.2	1.4	2.8	187	135	234	1.9	0.9	3.0
Synfuels Production	0	0.0	0	1	1	0.0	0.0	0.0	2	4	5	–0.1	–0.2	–0.2	38	18	61	0.2	–0.4	0.7
Direct Use of Fuels	166	3.2	198	165	221	3.7	3.1	4.1	203	164	236	3.8	3.1	4.4	202	136	241	3.8	2.5	4.5
TOTAL	262	4.5	338	286	375	5.6	4.5	6.5	370	304	425	5.9	4.4	7.1	427	288	535	5.9	3.1	8.3

[a]Energy expressed in EJ.
[b]Carbon expressed as Gt C.
[c]In the IS92 scenarios, the industrial sector includes industrial activities related to manufacturing, agriculture, mining and forestry.

Appendix B

IPCC DOCUMENTS USED AS SOURCES OF INFORMATION

SAR I

IPCC, 1996: *Climate Change 1995: The Science of Climate Change. Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change* [Houghton, J.J., L.G. Meiro Filho, B.A. Callander, N. Harris, A. Kattenberg and K. Maskell (eds.)]. Cambridge University Press, Cambridge and New York, 584 pp.

SAR II

IPCC, 1996: *Climate Change 1995: Impacts, Adaptations, and Mitigation of Climate Change: Scientific-Technical Analyses. Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change* [Watson, R.T., M.C. Zinyowera and R.H. Moss (eds.)]. Cambridge University Press, Cambridge and New York, 880 pp.

SAR III

IPCC, 1996: *Climate Change 1995: Economic and Social Dimensions of Climate Change. Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change* [Bruce, J., Hoesung Lee and E. Haites (eds.)]. Cambridge University Press, Cambridge and New York, 464 pp.

SAR Syn.Rpt.

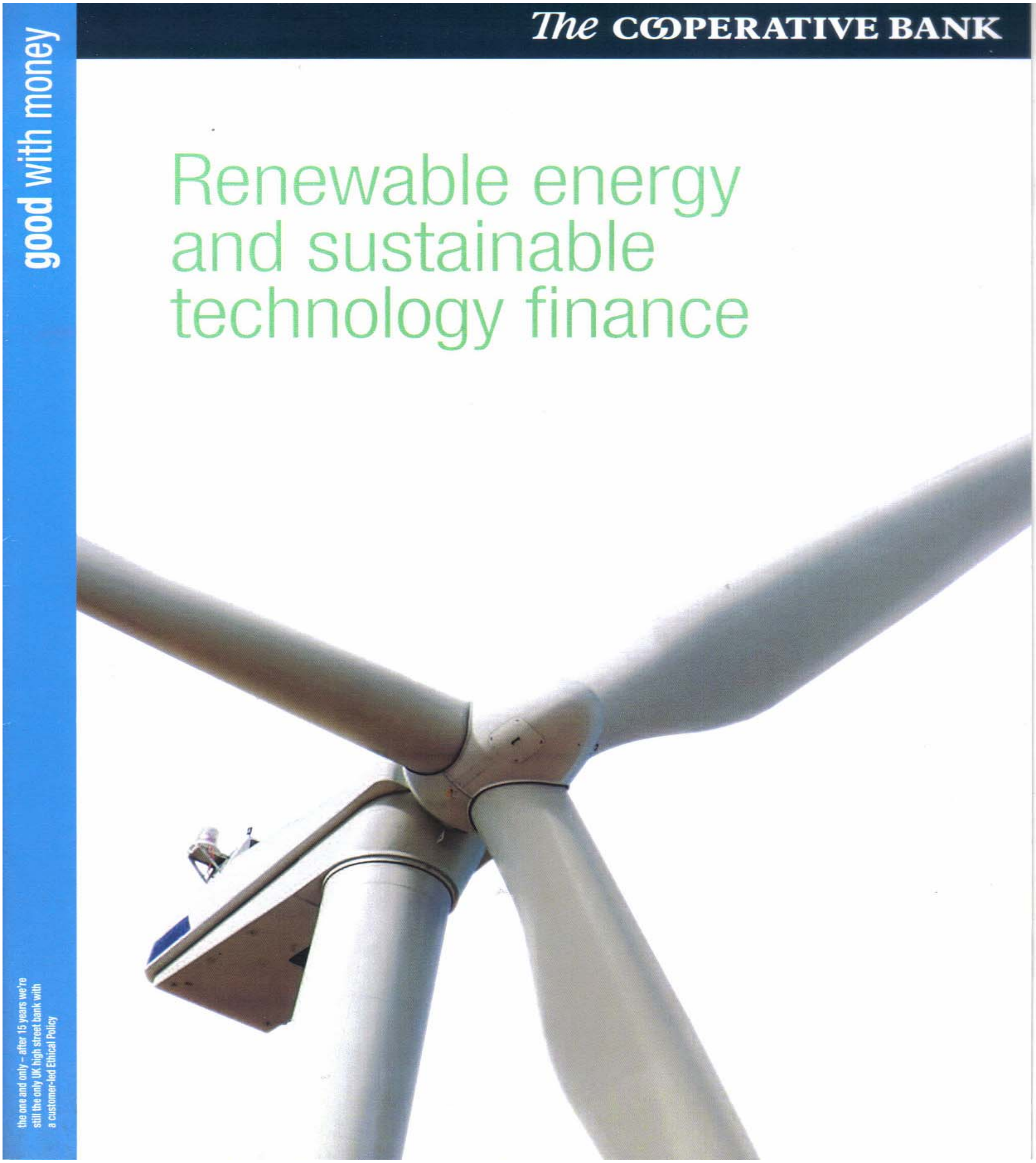
IPCC, 1996: *IPCC Second Assessment Synthesis of Scientific-Technical Information Relevant to Interpreting Article 2 of the UN Framework Convention on Climate Change*. World Meteorological Organization, Geneva, 17 pp.

IPCC 1994

IPCC, 1994. *Climate Change 1994: Radiative Forcing of Climate Change and an Evaluation of the IPCC IS92 Emission Scenarios* [Houghton, J.T., L.G. Meira Filho, J.P. Bruce, Hoesung Lee, B.T. Callander, E.F. Haites, N. Harris and K. Maskell (eds.)]. Cambridge University Press, Cambridge and New York, 339 pp.

IPCC 1992

IPCC, 1992. *Climate Change 1992: The Supplementary Report to the IPCC Scientific Assessment. Report of the IPCC Scientific Assessment Working Group* [Houghton, J.T., B.T. Callander and S.K. Varney (eds.)]. Cambridge University Press, Cambridge and New York, 200 pp.


The CO-OPERATIVE BANK
good with money
Renewable energy and sustainable technology finance
the one and only – after 15 years we're still the only UK high street bank with a customer-led Ethical Policy

A proven track record

We can provide funding for the following technologies:

- **onshore wind**
- **combined heat & power**
- **district heating**
- **biomass**
- **waste to energy**
- **landfill gas**
- **geothermal/solar**
- **smart metering - building control systems.**

Coldham Wind Farm

A joint venture between The Co-operative Group and Scottish Power, built on land owned by The Co-operative Group in Cambridgeshire. The £17m, eight turbine scheme generates 16 MW of power, saving 36,000 tonnes of CO_2 each year.

Westmill Wind Farm Co-operative Ltd

A stage payment facility amounting to £4.3m, followed by a loan facility of £3.8m, to fund the acquisition and development of a wind farm site in Oxford being progressed by Energy4All. The site, 100% community-owned, will consist of five 1.3 MW Siemens Bonus turbines.

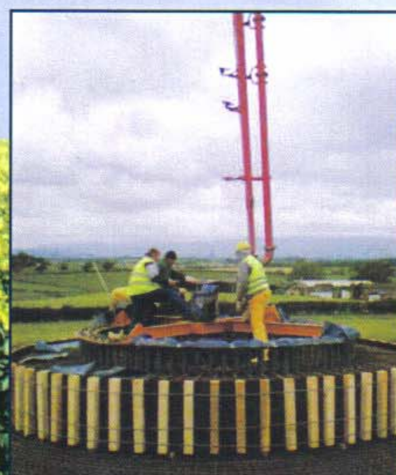
Combined Heat & Power (CHP)

We have financed over 40 CHP schemes across a variety of sectors including leisure, NHS, industrial, social housing and local authority. These schemes have helped substantially reduce the CO_2 emissions of the organisations involved.

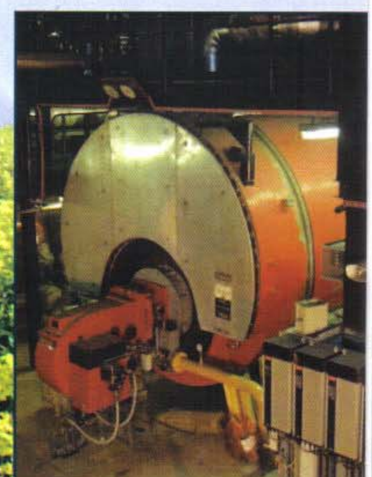
Sustainable Property Finance

We also have experience in funding property developments incorporating a wide range of renewable energy and sustainable technologies.

Shareholders at co-operative owned and managed Harlock Hill Wind Farm.



Work in progress on the construction phase of a wind turbine project.



A Co-operative Bank funded energy centre, including a CHP unit.

PMSS

UK Offshore Wind Acquisition Due Diligence

PMSS were retained by a prospective purchaser of an offshore project in UK waters.

The PMSS scope was to review the Data Room provided by the Vendor, and to assess the following aspects:

- Project Execution
- Regulatory Issues
- Technology
- Contract Review
- Schedule Review
- Energy Yield Verification
- Financial Review, inc Financial Analysis
- Grid Connection
- Insurance
- O&M
- Re-powering
- Decommissioning

Throughout the process, a comprehensive Project Risk Register was undertaken, with key scenarios identified and costed. The final deliverable was a technical and financial due diligence report and Client Workshop to discuss the findings.

Project Factfile

Project name:
UK Offshore Wind
Acquisition Due Diligence

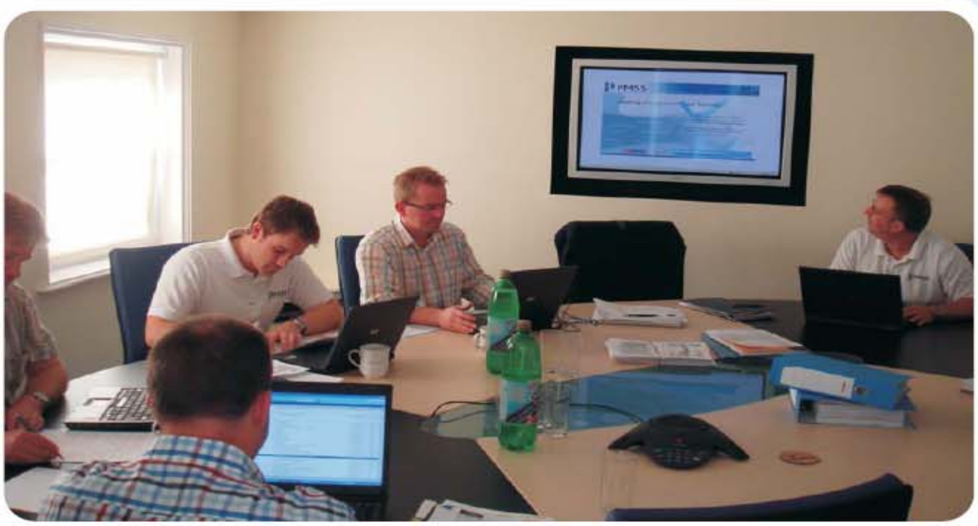
Client:
Confidential

Date:
n/a

Value:
n/a

PMSS disciplines:

- Due Diligence



www.pmss.co.uk

RES
Renewable Energy Systems

PMSS

CDM Coordination & Associated Services

From inception of the original regulations in 1994, to the projects of today under the current CDM Regulations 2007, PMSS has provided CDM Coordination (previously Planning Supervisor and Client's Agent) services for RES's Onshore Wind projects.

Our CDM Co-ordinators are individual members of the Association of Project Safety (APS), Institute of Occupational Safety (IOSH) and the International Institute of Risk and Safety Management (IIRSM).

PMSS Directors have a deeply rooted background in design and hold memberships of various construction and engineering associations. We believe all this enables us to input positively towards all aspects of design safety whilst fulfilling the role and duties as CDM Coordinator.

The most recent projects completed and now in commercial operation include:

- Callagheen Wind Farm
- Taurbeg Wind Farm
- Lough Hill Wind Farm

Projects still under construction where PMSS are appointed under the CDM Regulations 2007 are:

- Altahullion II Wind Farm
- SlieveDivina Wind Farm
- Wolf Bog Wind Farm
- Gruig Wind Farm

CDM Services provided include the following:

- Providing essential advice and guidance to Clients and other project team members on discharging their duties, compliance with the regulations and all aspects of competency.
- Working closely with Clients and project team members to ensure suitable arrangements are made and implemented on site, for the health & safety of working, visiting or affected by site works and associated activities.
- Compilation and/or review of format and content of the Pre-construction Information and distribution to relevant members of the project team.
- Regular liaison with designers to ensure they comply with their duties and provide relevant and useful information, to take through to construction phase.
- Preparation and/or review of the Health & Safety File. Including consideration for project extensions, where the project life-cycle feeds back into any new design risk information and pre-construction information.

Additional duties provided by PMSS include project review and lessons learnt analysis. A vital process, when working with multiple projects and design teams.

Project Factfile

Project name:
RES CDM Coordination

Client:
Renewable Energy Systems Ltd

Date:
Ongoing call-off

Value:
n/a

PMSS disciplines:

- CDM Coordination
- CDM advice to all duty holders, including bespoke training and support
- Competency assessment inc. full SMS review/audit
- Project review and lessons learnt

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Biomass Services

PMSS are a multi-disciplinary UK consultancy specialising in project management, development & construction, technical & commercial advice, health & safety, environmental and quality management.

With the growing activity in the UK in the generation of heat and power from biomass fuels, including organic wastes otherwise earmarked for disposal in an ever diminishing and ever more expensive landfill capacity, PMSS is able to provide clients with access to expertise and support built upon extensive experience from more mature technologies, such as onshore wind running the full extent of commercial activity from initial feasibility through development to construction and operation.

We can provide support across a wide range of biomass feedstocks and technical solutions, including conventional combustion, gasification and anaerobic digestion; from small scale opportunities delivering on-site supplies of heat and power as part of Corporate Social Responsibility and Carbon Management programmes, to larger scale facilities exporting to the electricity network.

Services Include

Development Management

- Acquisition / Bid Management
- Site Feasibility
- Stakeholder Liaison
- Site Layout & Design
- Engineering Services

Construction / Project Management

- Total Project Management solutions
- Owners / Lenders Engineer
- Construction Management
- Site Representation
- Engineering Management
- Contracts and Specifications
- Procurement
- Grid Connection management
- Electrical design / HV services
- Operation & Maintenance services

Health & Safety Management

- Design Risk Analysis
- CDM Coordinator
- Site Inspection & Auditing
- Site H&S Management
- Corporate Systems / Compliance

Consents & Environmental Management

- Environmental Impact Assessment (EIA)
- Environmental permitting (IPPC / PPC)
- Environmental Management Systems (EMS)
- Environmental Management Plans, Policies & Procedures
- Consents / Permits compliance
- Consents & Environmental Inspections & Auditing

Quality Assurance

- Project Risk Assessment
- Quality Management Systems (QMS)
- ISO9001 compliance
- 6 system implementation
- Manufacturing & Construction systems reviews
- Inspections & Auditing

Technical & Commercial

- Due Diligence
- Technical & Financial appraisal
- Financial modelling

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Spurness Wind Farm

The Spurness Wind Farm development was initiated by PMSS to install up to four 2.75MW Wind Turbine Generators, ancillary equipment and associated infrastructure on farming land surrounding the Loth ferry terminal on the promontory of Spurness, on Sanday in the Orkney Islands.

PMSS worked as project managers for Spurness Wind Energy Ltd (a joint venture company with their co-development partners) from inception, through the consenting process to financial close. The project was sold in February 2004 to the current owner and operator – Scottish & Southern Energy Ltd (SSE).

SSE constructed the project with three NEG Micon NM80 2.75MW wind turbines, with the fourth turbine awaiting possible grid reinforcement work.

Project Factfile

Project name:
Spurness Wind Farm

Client:
Spurness Wind Energy Ltd (SWEL)

Date:
2004

Value:
£10m (approx)

PMSS disciplines:

- Site Selection
- Project Manager
- Grid Negotiation
- Construction Feasibility
- Construction Tendering
- Asset Sale

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PMSSAscent

Marine Current Turbines™

SeaGen Bespoke Health & Safety Training

PMSSAscent is a joint venture company formed of 2 leading companies, PMSS – a leading UK Renewable Energy Consultancy specialising in Health & Safety in Renewables and Ascent Safety B.V. - the leading Work at Height and Rescue training provider in The Benelux.

PMSSAscent were commissioned by Marine Current Turbines Ltd to provide practical Health & Safety training for their SeaGen tidal energy device. A tailored solution was adopted, as is recommended for most renewable energy devices.

This commission initially involved the assessment of the SeaGen device during its pre-construction assembly at Harland & Wolff in Belfast, developing an access based design risk assessment.

PMSSAscent then produced a custom training package specific to the requirements of the SeaGen device. This consisted of Work at Height with tower climbing, rescue and self-rescue, use of the ResQ device, Confined Space Awareness training, First Aid and Fire Fighting all tailored to the internal layout and requirements of SeaGen.

Project Factfile

Project name:
SeaGen Bespoke Health & Safety Training

Client:
Marine Current Turbines Ltd (MCT)

Date:
August 2007 – ongoing

Venue:
PMSSAscent Training & Test Centre, Bussum, The Netherlands

PMSS disciplines:

- Device Specific Safety Assessment
- Work at Height Training
- ResQ Training
- SeaGen specific Confined Space Awareness
- First Aid Training
- Fire Fighting Training

www.pmssascent.com

PMSS

NoordzeeWind NUON

Offshore Windpark Egmond aan Zee

PMSS were commissioned in Q4 of 2005 by NoordzeeWind, a Dutch joint venture company comprising Shell Wind Energy (SWE) and NUON for specialist technical consultancy services on the Offshore Windpark Egmond aan Zee (OWEZ) project.

The OWEZ project is the first large scale wind farm to be built in the North Sea off the Dutch coast. The asset comprises 36 Vestas V90 wind turbine generators, each with a rated capacity of 3.0 MW.

The site is located 10 to 18 kilometres from the coast at Egmond aan Zee with the total area of the windpark covering around 27 km2.

PMSS were engaged to assist the owner's project team with management of the Health, Safety, Security and Environmental disciplines on the project during both design and construction stages. This entailed a rapid familiarisation with existing and impending Dutch legislation and local work practices. With the objective of delivering appropriate safety and environmental compliance to SWE and NUON's high standards, our previous project knowledge and experience was used to full advantage, and the targets achieved.

PMSS are currently engaged by Noordzee Wind on an ongoing basis as an Operational Phase HSSE Advisor.

Project Factfile

Project name:
Offshore Windpark Egmond aan Zee

Client:
NoordzeeWind

Date:
Q4 2005 – ongoing

Value:
>€200 million

PMSS disciplines:

- Health & Safety Management
- Environmental Management
- Security Management
- Site Safety Management
- Vessel Audits
- Wind Turbine Audits
- Specialist H&S Training
- Operational Phase HSSE Advisor

www.pmss.co.uk

PMSS

Wave Dragon

Pre-commercial demonstrator EIA

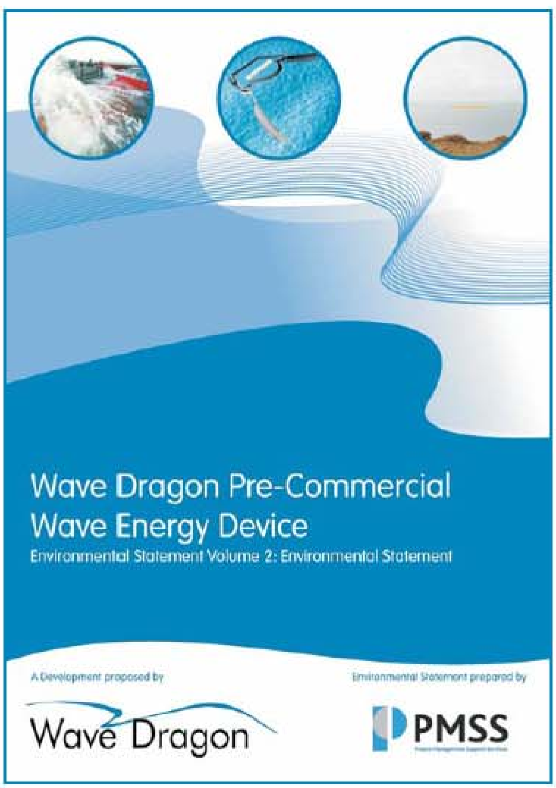
PMSS were retained by Wave Dragon Wales Ltd to manage the Environmental Impact Assessment and project consents for their proposed pre-commercial wave energy converter demonstration project.

The project is supported by the Objective I initiative through the Welsh European Funding Office (WEFO).

The location of the demonstrator is approximately 4–5 miles off the Milford Haven coast, South West Wales and covers an area of approximately 0.25 km2.

The work scope combines desk studies of existing information, consultations with key local and national stakeholders, management of surveys and the EIA and consents process.

Images courtesy of Wave Dragon Wales Ltd



Project Factfile

Project name:
Wave Dragon Pre-commercial demonstrator EIA

Client:
Wave Dragon Wales Ltd

Date:
November 2005 – April 2007

Value:
n/a

PMSS disciplines:

- Due Diligence
- Management of Scoping process
- Environmental Impact Assessment (EIA) Management
- Site Layout and Design
- GIS Management

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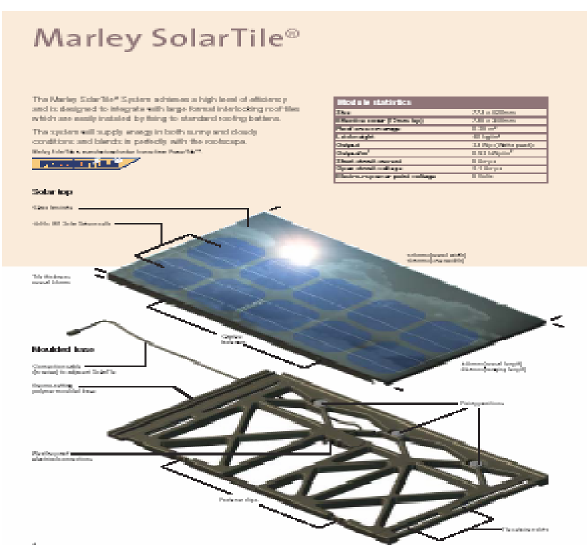
Solar Roofing System



Solar Thermal - Domestic systems

Many people believe that solar power is not a viable option in the UK, but on a sunny summer day parts of the UK experience levels of solar energy equal to 60 per cent of those at the equator.

As a rough guide, an average household with 4 people would need one Suntube solar panel to meet an average of 70% of its needs throughout the year. In winter, because there is less sun, this may drop to 30% whilst in summer it could be 100%.

Very large households may benefit from two panels.

Whether you would like to convert your existing system or you are building from scratch, Solar Home Energy Ltd & Southern Solar Ltd can advise on both vented and open systems, for domestic use or for a garden swimming pool.

We can supply and install the whole system, including pumps, vents, tank and pipework, giving you the reassurance of our expertise. On the other hand, if you are confident and technically minded we can simply send you the panel.

Grants of £400 are currently available from Clearskies and in March 2006 from the Low Carbon Building – Micro Regeneration grant scheme and remember – your local authority may have additional grant funding for renewable energies.

COMMUNITY ENERGY EXPLAINED

The Combined Heat and Power and Community Energy market is continuing to evolve at an impressive rate. Against this backdrop of on-going change and technological advancement, it can be hard to stay abreast of the latest thinking, policies and capabilities. With this in mind, this section of Vital Energi's website (which will come online soon) has been designed to act as a useful source of pertinent and easy to understand information.

So, whether you'd like to find out more about the latest funding initiatives and industry news, or you simply want an overview of CHP/Community Energy and what it entails, and we will email you when this section of our website goes live.

Welcome To Bical

Bical is one of the leaders in the successful development and production of Miscanthus (also known as Elephant Grass). Bical has invested a large amount of time and resources into developing many end uses for this crop, ranging from High value Equine Bedding, use in Composites and Bio-degradable Plastics and also as one of the most economical and renewable energy crops on the market to day.

Miscanthus is a long-term crop when grown for cane production. There are records of Miscanthus crops being well over 200 years old. At present the oldest crop in the UK is 20 years old and is still producing the same yield of cane today that it was when it reached full yield potential in year 5 of its life. (Currently cutting 22odt/Ha of cane – with no fertiliser or Pesticides) Wildlife, such as small hedge birds, foxes, deer, game birds all thrive in the cover provided by the crop.

The cane will be cut, starting after two growing seasons, this can sometimes differ how ever and solely depends on the location of where the crop is grown – the further south in the UK I.e. Penzance in Cornwall – the crop can sometimes be cut for cane in the 1st year of planting, due to the milder climate and the longer growing season, likewise with all our crops in Europe. Although it is important to point out that all crops within the UK, should reach full yield potential between years 3 – 5.

BICAL has over 250 confirmed end uses on its books and is looking for interested growers to take these opportunities forward. General information about Miscanthus.

Biomass - Environmental Benefits, Energy comparisons.

With the Governments "White Paper" hinting towards an increase in its target of energy being produced from "Renewable Energy", the future for Miscanthus growers continues to look exciting. A link to the Governments "White Paper" can be found in the news section, and here we explain the main reasons why Miscanthus makes such a good Renewable Energy crop.