REVISION 2020

SOUTH WEST RENEWABLE ELECTRICITY, HEAT AND ON SITE GENERATION TARGETS FOR 2020

FINAL REPORT

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On Behalf of
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AD	anaerobic digestion
ASN	Areas of Special Need
AONB	area of outstanding natural beauty
ATT	advanced thermal treatment
BIPV	building-integrated photovoltaics
BREEAM	Building Research Establishment's Environmental Assessment Method
CA	Countryside Agency
CAD	Centralised Anaerobic Digestion
CC	climate change
CCP	Climate Change Programme
CHP	Combined Heat and Power
CIBSE	The Chartered Institution of Building Services Engineers
CO_2	carbon dioxide
CSE	Centre for Sustainable Energy
DEFRA	Department for Environment, Food & Rural Affairs
DH	district heating
DTI	Department of Trade & Industry
EC	European Community
EEC	Energy Efficiency Commitment
EfW	energy from waste
ESCO	Energy Services Company
EST	Energy Saving Trust
ETSU	Energy Technology Support Unit
EU	European Union
FR	forestry residues
GIS	Geographical Information Systems
GO	Government Office
GOSW	Government Office for the South West
GVA	Gross Value Added
kW	kilowatt
kWh	kilowatt hour
kt/yr	kilo tonnes per year
LDA	London Development Agency
LDD	Local Development Document
LDF	Local Development Framework
LFG	landfill gas
LPA	Local Planning Authority
LUC	Land Use Consultants
MBT	mechanical and biological treatment
MW	megawatt (electricity)
MWth	megawatt (thermal)
MWh	megawatt hour (electricity)
MSW	municipal solid waste

NFU	National Farmers' Union
NHER	National Home Energy Rating
NOx	nitrogen oxides
ODPM	Office of the Deputy Prime Minister
Odt/yr	oven dry tonnes per year
ONS	Office for National Statistics
PV	photovoltaics
PPS	Planning Policy Statement
PUA	principal urban area
RA	Regional Assembly
RDA	Regional Development Agency
RDF	refuse derived fuel
RE	renewable energy
REOC	Renewable Energy Office for Cornwall
RO	Renewables Obligation
RPG	Regional Planning Guidance
RSL	Registered Social Landlord
RSS	Regional Spatial Strategy
RWS	regional waste strategy
S106	Section 106
SEA	Strategic Environmental Assessment
SOx	sulphur oxides
SPD	Supplementary Planning Document
SRC	short rotation coppice
SW	South West
SWERDA	South West of England Regional Development Agency
SWH	solar water heating
SWRA	South West Regional Assembly
WPA	waste planning authority

REVISION 2020 – FINAL REPORT

1 EXECUTIVE SUMMARY

1.1 Background

REvision 2020 is a project funded by the Government Office for the South West (GOSW) in partnership with the South West Regional Assembly (SWRA). The project follows on from a number of studies already done in the South West on target setting for renewable electricity, including the REvision 2010 report published in 2004 and the Terrence O'Rourke & Energy Technology Support Unit (ETSU) report published in 2001 (referenced in main text).

The REvision 2020 project extends the existing body of work by looking to establish targets for renewable electricity to 2020 and adding targets for renewable heat for 2010 and 2020 and a target for on-site generation within new development. The outcomes of REvision 2020 will be considered for incorporation within the new Regional Spatial Strategy (RSS). The project therefore also proposes a range of planning policies to support the implementation of these targets.

1.2 Project methodology

The approach to this project involves a combination of research and development methods including:

- desk-based modelling of technical, economic, market and policy data
- validation of assumptions with industry and sector experts
- the development of sets of target scenarios associated with renewable electricity, heat and on-site generation technologies
- drafting of planning policies
- consultation with key stakeholders to establish most-appropriate scenarios and policies
- presentation of project findings and recommendations

The consultation process has been necessarily focused, to fit within the tight schedule for the development of the RSS. The project was initiated by a presentation to the Waste, Energy and Minerals sub-group of the Regional Assembly (RA). At the core of the consultation process were two important workshops held with stakeholders from within the region, one with a particular focus on planning issues. These workshops were a crucial and influential part of the process of identifying preferred scenarios for development which could lead to the setting of realistic targets. The workshops also provided a vital sounding board for the development of the proposed planning policies. Other opportunities to canvass opinion from within the region were taken where possible, for example talking to the county energy champions network facilitated by Regen SW.

The assumptions that were fed into the development of the scenarios were validated through discussions with sector and technology experts.

The project itself was guided by a steering group that consisted of GOSW, the SWRA and Regen SW.

1.3 The targets

The targets for electricity, heat and on-site generation proposed as part of this project are as outlined below.

Proposed regional targets

Renewable electricity to 2010: 509-611MWe (onshore), 56MWe (offshore). These targets were established through the REvision 2010 project

Renewable electricity to 2020: 847MWe (onshore), 400MWe (offshore). Together, this capacity will generate approximately 20% of the region's electricity demand by 2020, assuming energy efficiency levels as per the government's Energy White Paper.

Renewable heat to 2010: 105 MWth

Renewable heat to 2020: 503 MWth

On-site generation percentage requirement within new development: 10%

The renewable heat targets and the renewable electricity targets include a contribution from the building-integrated renewables installed as a result of the on-site generation requirement. The contribution however only relates to new build and refurbishment. The electricity and heat targets also include a notional additional contribution from the retro-fit of building-integrated technologies.

The preferred scenarios for development that form the basic assumptions behind the targets are outlined below. The technology mixes suggested within these scenarios were developed to test whether the targets were achievable. The technology mixes are not defined as part of the targets. The region should retain the flexibility to take advantage of new technology development unforeseen or underestimated at this stage.

Potential renewable electricity technology mix 2010 - As per REvision 2010 project (see reference in main text)

Table 1: Potential renewable electricity technology mix 2020 (electricity scenario 2b)

	2020	
Onshore technologies	**MW**	**GWh**
Onshore wind	550	1,445
Energy crops/forest residues	100	788
Building-integrated renewables	50	44
Hydro	15	53
Energy from waste (eligible for RO[1])	100	832
Anaerobic Digestion	2	16
Landfill gas	30	250
Sub total	**847**	**3,428**
Offshore technologies		
Offshore wind	50	153
Wave	250	657
Tidal stream	100	263
Sub total	**400**	**1,073**
Total MW	**1,247**	**4,501**
% Electricity Consumption		**20.0%**

Table 2: Potential renewable heat technology mix 2010 and 2020 (heat scenario 2)

Technologies	2005 (MW)	2010 (MW)	2020 (MW)
Woodfuel heating	3	47	247
Heat pumps	2	21	107
Solar water heating	4	35	138
CHP (where heat is usefully used) from AD, EfW or biomass	0	8	42
Total MW	**9**	**111**	**534**
Total MW after de-rating for heat pumps	**8**	**105**	**503**

For the purposes of target setting, the figure for heat pumps was de-rated (using a factor of 0.71) to allow for the use of non-renewable electricity to drive heat pump systems.

Table 3: Potential impact of on-site generation requirement (10%)

Electricity technologies	2010 (MW)	2020 (MW)
PV/micro wind	9	43
Small scale wind	1	3
Sub total	**10**	**46**
Heat technologies		
Solar water heating	22	109
Heat pumps (no de-rating)	10	51
Biomass community heating	8	39
Renewable heat from CHP	8	42
Sub total	**48**	**241**
Total MW	**58**	**287**

1.4 Key issues for target delivery

Of the points outlined within the following sections, those actions or outcomes that may be influenced at a regional and/or local level are in italics.

[1] RO – Renewables Obligation

1.4.1 Renewable electricity targets

In order to meet the 2010 renewable electricity target there will need to be:

- *wider public and political acceptance of the need for renewable energy, in particular biomass, energy from waste (EfW) and onshore wind technologies*
- *greater objectivity within the planning process and more focussed planning policies within Local Development Documents (LDD), in line with PPS22 (Planning Policy Statement 22)*
- *a rapid increase in the planning success rate for onshore wind energy*
- *the Wave Hub operating and attracting developers*
- *increased regional experience of biomass and advanced EfW technologies through regional demonstrator projects, possibly instigated by the public sector*
- *Early development of biomass and EfW projects to enable longer lead in times to be accommodated before 2010*
- a revision of the Renewables Obligation (RO) to enable a theoretical target to be reached in practice, see section 8.1.4

In order to meet the 2020 renewable electricity target there will need to be:

- *an increase in land use for biomass, based on a corresponding increase in farmer enthusiasm for energy crops and a public acceptance of energy crops within the landscape*
- *a significant expansion of biomass supply chains based on effective infrastructural support mechanisms*
- a financial support mechanism introduced for renewable heat production
- continued and expanded government financial support for biomass, wave and tidal technologies
- an expansion of the RO from 2015 (as it stands now) to 2020
- economic viability for biomass and advanced EfW technologies
- *an acceptance of energy recovery via advanced EfW technologies as the primary means of dealing with secondary waste treatment*
- commercialisation of wave and tidal stream technologies
- *a strengthening of the distribution grid to accommodate growth in offshore generation and support higher levels of embedded generation within the network, possibly involving the expansion of Renewable Power Zones[2] or similar scheme*
- *a significant increase in the priority placed on energy efficiency at a regional level supported by effective central government policy*
- *high levels of energy efficiency activity at a local level*

1.4.2 Renewable heat targets

In addition to the points listed above, in order to meet the renewable heat targets there will need to be:

- *sustained levels of grant funding available to support both capital and development costs for renewable heat projects in the South West up to 2010*
- *very significant growth in market penetration of pellet stoves and boilers into the domestic retro-fit market - this will require additional support for the wood pellet sector within the region*
- *a significant adoption of community heating both for new build and existing buildings*

[2] A sector of a distribution network in which the Distribution Network Operator (DNO) can manage and develop innovative solutions to the connection of distributed generation. The DNO will be able to earn a higher return (an additional £3kW/yr) on a well-managed project. This is capped at £0.5 m/DNO/yr. The costs of the scheme will be borne by generators, while DNOs will bear the risks of a scheme. DNOs can register 2 schemes a year for 2005 and 2006. The operation of the scheme will be reviewed in 2007. RPZs were introduced with the implementation of the latest Distribution Price Control Review on 1st April 2005.

- *greater understanding of the potential mismatch between establishing new heat loads and the development of Combined Heat and Power (CHP) plants*
- *a significant utilisation of heat from large scale renewable CHP both within new build and existing buildings*
- *significant market penetration of heat pumps and biomass heating into the market for boiler replacement, driven by social housing for domestic buildings and public sector for non-domestic buildings*
- *increasing sources of wood fuel other than forest residues beyond 2010*
- *support for sector development in order to meet significantly increased installation rates for building-integrated technologies and protect installation quality*

1.4.3 On-site generation target

Key issues in relation to implementing an on-site generation target will be:

- *The need for local planning authorities in the South West to define lower thresholds for major developments where required*
- *Establishing exemplar developments in 2007-08 to demonstrate how the target can be implemented and to provide a basis for case studies*
- *Building the capacity of local planning authorities to enforce targets*
- *Supporting sector development, in order to meet significantly increased installation rates for building-integrated technologies and protect installation quality*

1.5 Recommendations for future action

The following actions will be beneficial to the process of ensuring that the region addresses the key issues for the delivery of targets outlined above:

1.5.1 Renewable electricity

- Developing sub regional targets for renewable energy to 2020
- Support for development of Local Development Frameworks (LDF)
- Training for members and officers with particular focus on onshore wind energy and energy from waste and biomass. In particular, there is a need to raise awareness of local authority officers of advanced thermal treatment as a viable alternative to mass burn incineration, where decisions on long term waste management strategies are still to be made
- Audit of public sector opportunities and action to promote demonstrator projects
- Detailed assessment of distribution grid needs with regard to expansion of renewables within the region
- Assessment of opportunities and needs for biomass fuel supply chain development within region
- Assessment of opportunities and needs for marine technology supply chain development within region
- Assessment of re-enforcement requirements for distribution and national grid networks
- Clearer regional policy on energy recovery and action to promote this within sub regional sustainable waste management strategies
- Developing a regional communications strategy on sustainable energy issues that outlines roles and responsibilities for regional and sub regional organisations
- Developing regional strategy and targets for energy efficiency and fuel poverty

1.5.2 Renewable heat

- Targeting wards with highest off-gas heat loads with support programmes for renewable heat, including awareness raising and grant support. Gain support of local politicians as champions
- Assessing the potential for the co-location of biomass CHP with high heat loads, for example as part of the development of new or extended industrial estates
- Assessing sector development needs and enhancing South West RDA plans for sector support
- Assess development needs for pellet sector in the South West, in particular looking at ways to stimulate increased uptake of retro-fit domestic pellet boilers in off-gas areas
- Carry out analysis of capital grant support required to support the “kick-start” of biomass heating in the region up to 2010, and design a funding programme, with a clear exit strategy, with the aim of securing regional or national support.

1.5.3 On-site renewable energy generation

- Supporting the roll-out of policy for on-site renewable energy generation with toolkit and training support for development control officers and developers, and construction industry – based on similar work in London on their “Renewables Toolkit”
- Regional identification of possible strategic new build developments (ideally some residential, some non-residential) to test application of on-site generation policy and to act as case studies and exemplars
- Assessing sector development needs and enhancing South West RDA plans for sector support

2 BACKGROUND

In 2001, Terence O'Rourke and the Energy Technology Support Unit (ETSU), funded by the Government Office for the South West (GOSW), published their report 'Renewable Energy Assessments and Targets for the South West'[3]. The report indicated that it is feasible for the South West to seek a 597 megawatt (MW) target for renewable electricity capacity or 545MW of new capacity by 2010. This target was included in 'Regional Planning Guidance for the South West' (RPG10) published in September 2001[4]. Policy RE6 of RPG10 requires that a minimum of 11-15% of electricity generating capacity (597MW) in the region should be from renewable sources by 2010.

RPG10 required that a review of this issue should be undertaken by the South West Regional Assembly (SWRA) in order to identify sub-regional (i.e. county) targets and to specify criteria for use in development plans and in considering applications for such proposals. As a result, SWRA and GOSW commissioned the REvision 2010 project undertaken by a consortium of organisations based within the South West, to facilitate the development and adoption of sub regional or county targets. This project published its final report in June 2004[5] having facilitated the incorporation of sub-regional targets within the structure plans for Gloucestershire, Cornwall and Devon and committee approval for targets in Dorset, Wiltshire, Somerset and the former Avon.

The development of the Regional Spatial Strategy (RSS) to replace the current RPG, provides an opportunity to extend the targets produced as a result of the REvision 2010 project.

GOSW and SWRA commissioned Centre for Sustainable Energy (CSE), Peter Capener and Wardell Armstrong International to deliver REvision 2020 to develop targets for renewable electricity and renewable heat to 2020 and propose a percentage contribution from on-site renewable energy generation within new build. This consortium was supported by planning specialists Adrian Smith and Steve Cardis and landscape architects Land Use Consultants (LUC). All the targets are to be considered as policies within the new RSS. The steering group for the project also includes Regen SW and the South West Regional Development Agency (South West RDA). Final decisions regarding the scope and content of the planning policies for the draft RSS will be made by the Waste, Energy and Minerals sub-group of the Regional Assembly.

The project incorporates consultation with key stakeholders, focussed to fit in with the schedule for the production of the RSS.

2.1 Project aims

(i) assess capacity for additional renewable electricity generation in the South West between 2010 and 2020 identifying separate targets for offshore and onshore technologies

[3] See link to document at http://www.oursouthwest.com/RegiSus/regsus.htm
[4] See links to documents at http://www.gosw.gov.uk/page.asp?pid=146
[5] REvision 2010 – Establishing County/Sub Regional Targets for Renewable Electricity Development to 2010, June 2004 http://www.oursouthwest.com/revision2010

(ii) assess potential heat demand and propose regional heat targets expressed in MW for 2010 and 2020
(iii) propose options for percentage renewable energy requirements from on-site generation for new buildings and provide guidance on how to avoid breaching the 'undue burden' criteria
(iv) propose 'most desirable' target scenarios for renewable heat and electricity and a percentage requirement for on-site generation, following peer review and based on the overall benefits to the region
(v) provide the evidence base necessary to underpin the assumptions within the target scenarios and on-site generation requirement. This will be made available in GIS (Geographical Information Systems) format displaying potential opportunities and constraints
(vi) recommend planning policies for incorporation within the Regional Spatial Strategy (RSS) to support the achievement of the recommended target scenarios and on-site generation requirement

2.2 Project team

Responsibilities within the delivery of REvision 2020 were divided amongst the consortium of organisations as follows:

- Wardell Armstrong International: delivery of resource assessment and GIS mapping and technical review
- Centre for Sustainable Energy: lead on development of renewable heat and on-site generation targets
- Peter Capener: lead on development of renewable electricity target for 2020 and consultation process
- Adrian Smith: lead on planning policy development
- Steve Cardis: specialist guidance on planning policies relating to on-site generation
- Land Use Consultants: review and updating of REvision 2010 landscape sensitivity assessment using larger 3MW reference turbine
- Warwick University: peer review and academic oversight of methodology and policy outcomes

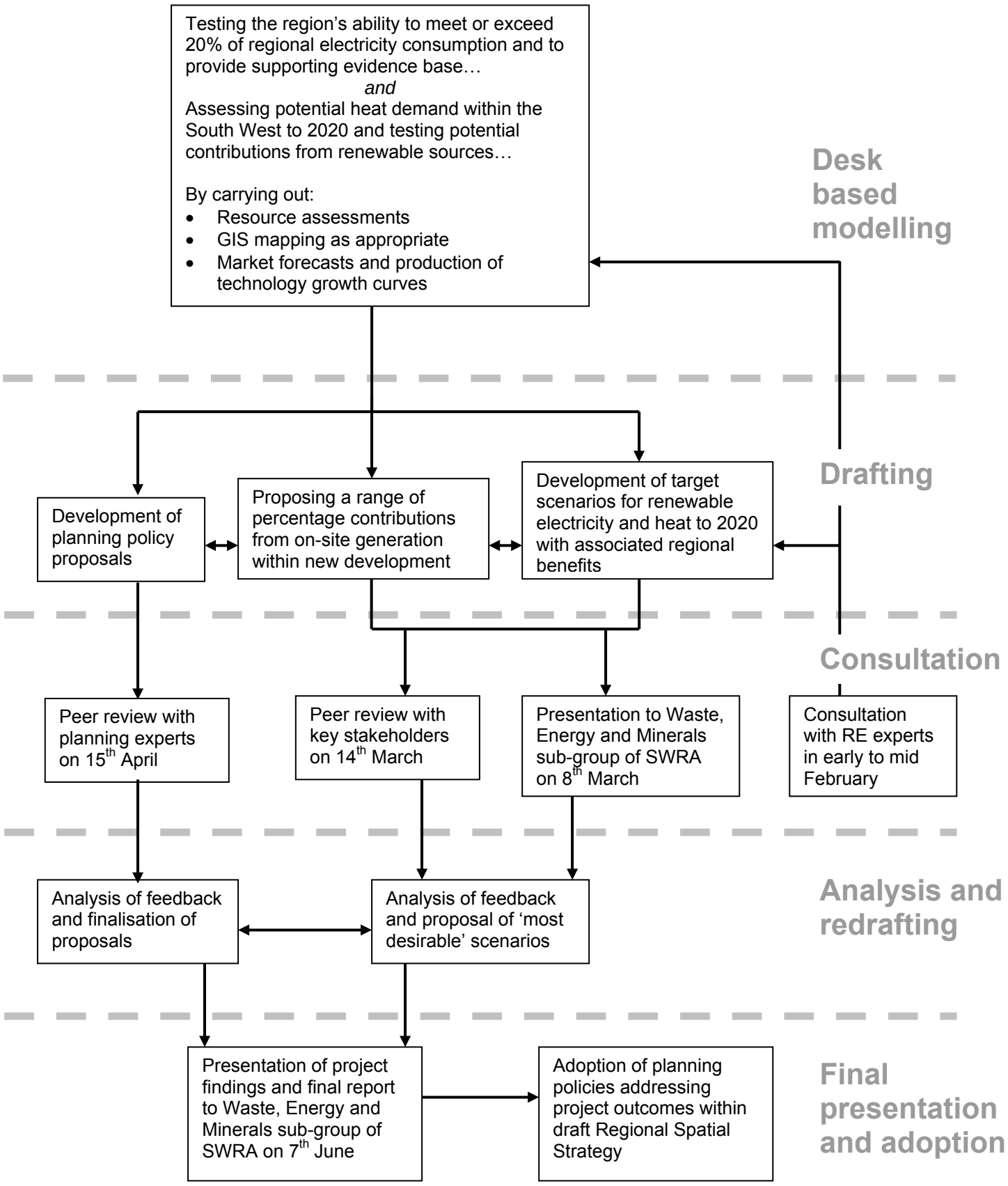
2.3 Project overview

The approach to this project involves a combination of research and development methods including:

- desk based modelling of technical, economic, market and policy data
- validation of assumptions with industry and sector experts
- the development of sets of target scenarios associated with renewable electricity, heat and on-site generation technologies
- drafting of planning policies
- consultation with key stakeholders to establish most appropriate scenarios and policies
- a presentation of project findings and recommendations.

This is outlined within the diagram below.

Figure 1: Outline methodology



3 PROJECT METHODOLOGY

3.1 Desk-based modelling

3.1.1 Resource assessments for electricity

The objective of the resource mapping exercise was to identify the renewable energy resources that could contribute to the 2020 electricity generation targets for the region.

The following renewable energy technologies were considered to be relevant:

- Wave power – offshore and shoreline
- Tidal stream
- Tidal barrage
- Small-scale hydro power
- Solar photovoltaic (PV)
- Biomass – woodlands, energy crops and straw
- Centralised anaerobic digestion (CAD)
- Poultry litter
- Landfill gas (LFG)
- Energy from waste (EfW)
- Onshore wind
- Offshore wind

A GIS-based desktop analysis was used, very similar to that used in the REvision 2010 project[6], the principal difference being a much greater emphasis on offshore technologies. The resource data was sourced in some cases directly from existing reports or extrapolated from regional data. Where variations from 2020 would have significant effects on yields, efficiency, costs, policy or legislation, the resource was re-computed from first principles. This process started with an assessment of the technical resource, e.g. land area available and efficiency, yields etc, then excluded designated areas such as Areas of Outstanding Natural Beauty (AONBs), National Parks and Heritage Coasts. A range of other practical constraints such as urban areas, inter-visibility limits, buffer zones around dwellings, roads etc were also applied where appropriate. Finally, some assumptions about the economic viability and maturity of each technology were made to estimate the accessible resource potential available within the 2020 time frame. What was left was an estimate of the maximum resource that could be exploited, if all the individual power plants concerned could get planning permission, operating permits, capital finance and electricity supply contracts, and be built by 2020.

3.1.2 Landscape sensitivity assessment

As part of the REvision 2010 project Land Use Consultants (LUC) were commissioned by the Government Office for the South West (GOSW) to undertake a broad brush assessment of the sensitivity of different landscape character areas in the region to wind turbines in order to provide a layer in the 2010 target setting exercise for sub-regions across the South West.

[6] See footnote 3, page 1

The type of turbine considered in the 2010 target setting process was a 1.3MW turbine with a hub height of 65m and a blade length of approximately 30m (95m to blade tip).

Since 2003 there have been considerable advances in technology, and the landscape sensitivity assessment now needs to take account of the new generation turbines. The largest turbine the South West is likely to see by 2020 is a three bladed 3MW machine with a rotor diameter of approx 90-100m and a hub height of 80m (125-130m to blade tip). Although larger machines already exist, e.g. 4-5MW at 112-120m diameter, they are very unlikely to be deployed in the region because of access problems.

As part of the REvision 2020 project LUC were asked to review their previous assessment and identify how landscape sensitivity with respect to these larger turbines may change.

Annex 3 provides more detail on the landscape sensitivity assessment itself. Annex 1 outlines in more detail how this assessment was used as an additional filter within the process of refining the judgements about the level of accessible resource that would actually be realised within the region. Annex 4 provides the results of the assessment.

It is important to note that this landscape sensitivity assessment **is not appropriate for use to guide site search or individual planning applications.** The assessment has been carried out based on Character Areas defined by the Countryside Agency (CA), with many of the areas covering large parts of the region. As such landscape sensitivity will vary considerably within any one character area. Whilst this broad level of analysis is appropriate within a strategic approach to target setting, **more detailed analysis would be needed in order to use landscape sensitivity assessments with reference to any particular site**.

3.1.3 Forecasting electricity demand

In developing the target proposals for renewable electricity in 2020, the project was asked to consider the feasibility of the region delivering 20% of its electricity demand from renewable sources by 2020,

For the purposes of this project two figures for the South West's electricity demand have been estimated.

The first assumes the existing energy efficiency and demand reduction policy measures contained within the government's Climate Change Programme (CCP). On this basis it has been estimated that demand in the South West may increase to 2020 by approximately 15%.

The second assumes all the savings forecast within the recent Energy White Paper[7]. On this basis it has been estimated that demand in the South West may decrease by over 11%.

Annex 5 outlines in detail how these estimates have been made. These figures take into account above average increases in housing and Gross Value Added (GVA) in the South West as forecast by the Regional Development Agency (RDA). Section 8

[7] Energy White Paper: Our Energy Future – Creating a Low Carbon Economy DTI Feb 2003 http://www.dti.gov.uk/energy/whitepaper/index.shtml

summarises the implications of using these forecasts as the basis for establishing a renewable electricity capacity target. See annex 5 for explanation for use of differing 2003 figures and adjusting of 2020 SW demand for Energy White Paper option.

Table 4: Electricity demand forecasts

GWh	UK			SW		
	2003	2020	%	2003	2020	%
Assuming Climate Change Programme measures	338,546	373,368	10.3% increase	25,120	28,888	15% increase
Assuming Energy White Paper measures	362,600	310,000	14.5% decrease	26,905	23,979 (22,509 adjusted)	11.6% decrease

3.1.4 Forecasting heat demand

For renewable heat, unlike renewable electricity, there was no requirement to achieve a certain percentage of heat supply from renewable sources. However, it was still felt to be useful to have an estimate of heat demand for the region by 2010 and 2020 to give an indication of the % contribution any given MW target for renewable heat could make.

To this end, a slightly simpler methodology than for electricity demand was used, and this is set out in annex 6. The resulting estimates of SW heat energy demand are shown in the table below[8]:

Table 5: Estimate of energy supplied for heating for the SW (000's GWh)

Sector	2003	2010	2020 with EWP measures
industry	26	28	23
domestic	33	33	28
services	12	14	14
Total	**71**	**76**	**64**

3.1.5 Forecasting quantity of new build and associated new energy demand

Residential

Details of the quantity of annual residential new build for the South West, including conversions and change of use, were obtained from the South West Regional Assembly (SWRA). The percentage of residential developments that form major developments (10 or more dwellings) was based on data from the Regional Assembly recording new-build completions for 2004 for all local authorities in the South West. This data distinguishes between new developments of 10 or more dwellings, and those with 1-9 dwellings. This data includes conversions and change of use as well as new buildings.

The estimated tenure mix for residential new build was estimated using ODPM (Office of the Deputy Prime Minister) historical house-building statistics for various

[8] The table shows figures for fossil fuel energy supplied for heat for different sectors. Strictly speaking, heat demand will be slightly less than this, as the fossil fuel heating appliances used will be less than 100% efficient.

building and tenure types by local authority area. Future energy demand and CO_2 emissions for this new build were modelled on anticipated 2005 building regulations using NHER (National Home Energy Rating) software.

Non-residential
Estimates of existing non-domestic heat loads were based on energy consumptions split by sector from the South West Eco-Footprint Study[9]. This data is presented in Annex 7.

Estimates of future non-domestic new-build heat loads were based on Functional Zone employment growth predictions to 2020 from the Cambridge Econometrics study carried out as part of the RSS development.

For the offices sub-sector, growth rate was converted to energy demand assuming a floor space of 17.9m^2 per employee, as given in the ODPM guidance note on employment land reviews (box D3). The CIBSE (The Chartered Institute of Building Services Engineers) benchmark guide (2004) of 79 kWh/m^2 for fossil fuel and 54 kWh/m^2 for electricity good practice for an open plan, naturally ventilated office were then used to estimate the energy demand for new offices.

The ODPM guidance was less specific on conversion rates for the other sectors identified above. Therefore, these sectors were assessed by scaling the value for energy demand for each sub-sector given in the Eco Footprint Study, assuming a linear relationship with employment levels. Growth rates were applied to the existing energy consumptions to predict changes up to 2020, allowing for a 50% cut in energy demand due to new building regulations.

The CIBSE energy benchmarks were then used to obtain the proportion of fossil fuel use and hence heat loads for each sector.

To estimate the proportion of non-residential new build that constitutes major development, local authority data for 2004 for new employment floor space was obtained from the SWRA. This data was incomplete, and 2004 was the first year that it had been collected. In some instances, data was missing from some local authorities. In these cases, data was extrapolated on the basis of population. Also, many local authorities did not report the thresholds they were using to report major developments, and those thresholds that were reported varied widely.

3.1.6 Mapping off-gas areas

Data was obtained from Transco giving details of all postcodes in the South West with mains gas connections. This data was used to map the extent of the existing mains gas network.

Using this data, it was possible to identify which postcode areas were **not** connected to the mains gas network. This data was then aggregated to ward level to identify the number of households in each ward not connected to the mains gas network. The off-gas annual domestic heat demand for each ward was then estimated, assuming an average annual heat load per household of 12,229 kWh. This figure was based on the average annual gas consumption per household for the South West, from DTI data for December 2003[10]. This gave an average figure of 17,470 kWh/yr, which converts to an annual heat load of 12,229 kWh at 70% boiler efficiency. The off-gas

[9] Being developed by Best Foot Forward for Sustainability South West – still to be completed at time of writing
[10] See http://www.dti.gov.uk/energy/inform/energy_trends/index.shtml

domestic heat load per ward was then mapped, to identify those wards with the greatest off-gas heat load.

The resulting maps are shown in Annex 2.

3.1.7 Estimating size of renewable heat market and levels of market penetration

Renewable heat is selling into a market in competition with fossil fuels. In the case of biomass heating and heat pumps, where they can replace conventional fossil fuel boilers, there are two key markets:

- New build
- Retro-fit as part of boiler replacement/upgrade

A key market is where the above two niches occur in areas off the mains gas network, as here they can more readily compete with heating oil, which is more expensive than mains gas. The study analysed the market potential for new build and retro-fit for the following market segments:

- Residential (split into owner occupier, private rented and social housing)
- Non-residential – split into the key sub-sectors of retail, hotels and catering, public administration, education, health and social, agriculture and other

Different market penetration rates were modelled for the different market segments. Data on the size of existing and new build off gas heat loads was estimated from the data described in section 3.1.5 and 3.1.6. The proportion of on and off gas non-domestic heat loads was taken to be the same as the ratio of on and off gas households. The market for retro-fit boiler replacements assumes a boiler replacement every 15 years – i.e. 6.7% of the total market is available each year.

3.2 Drafting

3.2.1 Developing draft target scenarios from technology growth curves

In order to enable constructive discussion with stakeholders, the multitude of options for renewable electricity and renewable heat development were restricted to three scenarios. The three scenarios can be characterised as low, medium and high intervention. The low scenario represents effectively business as usual, whilst the medium and high scenarios provide increasing levels of technological and economic security around key technologies.

For renewable electricity these key technologies include wind, biomass, wave and tidal stream and energy from waste. Onshore wind remains the dominant technology but the rate of growth between 2010 and 2020 is a fraction of the growth rates pre 2010.

The scenarios modelled technology growth rates for the four key renewable heat options, namely:

- solar water heating
- heat pumps (ground, air, water)
- wood fuelled (biomass) heating (pellets, logs, woodchip)

- heat from large scale renewable CHP – e.g. a from anaerobic digestion, energy from waste, biomass CHP

Technology-specific growth has been considered as a function of:

- the accessible resource
- technical maturity (technology development/learning rates)
- commercial viability (fossil fuel prices, government subsidy)
- environmental impact (landscape character, designated areas)
- institutional and infrastructure support (planning, biomass supply chain development, political, grid)

Sections 4 and 5 outline the results of the scenario development for renewable electricity and heat which in turn has drawn on the assumptions within Annex 1 and Annex 2 with regards technology specific growth.

Following consultation with stakeholders and sector experts these scenarios were refined to produce the proposed target scenarios outlined within section 3.3 and Annex 8.

3.2.2 Assessing impact of on-site generation targets

As well as the renewable heat technologies described above, the potential installed capacity for the following building-integrated renewable electricity technologies was also considered:

- photovoltaics (PV)
- micro-wind (roof mounted, and stand-alone)

As described in section 3.1.5, once the quantity of new build in the South West had been estimated, the impact of an on-site generation target could then be made. In order to do this, estimates needed to be made for the following:

- the potential mix of technologies that might be used to deliver a target for different types of development
- a timescale for how an on-site generation policy might roll-out across the region

The impact of an on-site generation target, in terms of installed capacity, was modelled assuming that the target would be expressed in terms of carbon reduction rather than just energy (see section 10 for a more detailed discussion of this).

The study also analysed the impact of the following, based on data on feasibility studies within the London Renewables Toolkit:

- The impact of target levels of 5%,10% or 15% on the viability of renewable energy technologies for different types of development, as well as the impact on build cost
- The difference in impact of a target between on and off gas areas

The results of this analysis are presented in section 6.

3.2.3 Developing draft planning policies

Draft planning policies together with explanatory text were developed, that captured the targets and provided guidance in terms of development criteria and spatial distribution. The planning policies are to be considered as a chapter within the developing Regional Spatial Strategy (RSS). Adrian Smith and Steve Cardis played a key role in shaping the planning document, bringing their experience of working on the PPS22 companion guide[11], the North East RSS and the development of the London Borough of Merton planning policy covering on-site generation.

Prior to the drafting of the policies Adrian Smith carried out a review of existing RSS policies across the country and their implications for the South West. This review is summarised within Annex 9.

Annex 10 presents the draft planning policies and explanatory text.

3.3 Consultation and redrafting

3.3.1 Consultation with stakeholders

The consultation process has been necessarily focused, to fit within the tight schedule for the development of the RSS. The project was initiated with a presentation to the Waste Energy and Minerals sub group of the Regional Assembly on 8th March. At this meeting the base scenarios were discussed and the approach the project was taking to developing the targets was approved.

At the core of the consultation process were two important workshops held with stakeholders from within the region, one with a particular focus on planning issues. These workshops were a crucial and influential part of the process of identifying preferred scenarios for development which could lead to the setting of realistic targets. The workshops also provided a vital sounding board for the development of the proposed planning policies.

The first event was held on 14th March at the CREATE Centre in Bristol. 14 organisations were represented. The workshop was aimed at key stakeholders within local authorities, regional bodies, and county renewable energy champions. The project team presented the three base scenarios, as outlined within sections 3.2.1 and detailed in sections 4 and 5. These three scenarios were constructed to provide the framework within which stakeholders could be introduced to the key issues relating to technology development for renewable electricity and renewable heat.

For the renewable electricity and heat scenarios, stakeholders were asked for their views on:

- Are there any technologies in scenario 2 you feel are under or over developed? Why?
- Which technologies provide the greatest potential for going beyond scenario 2? Why?
- What issues around the deployment of individual technologies should be investigated further by the project?

For on-site generation, stakeholders were asked for their views on:

[11] Planning for Renewable Energy – A Companion Guide to PPS 22, ODPM 2004

- What should be the level of the target? Should there be different targets for different sizes of development and different sectors?
- What possible policy conflicts are there (e.g. affordable housing) and how can they be dealt with?
- What issues around the deployment of individual technologies should be investigated further by the project? Why?

The second consultation event was a peer review of draft planning policies by planning experts. This was held on 15th April, in Taunton, hosted by the Regional Assembly and attended by representatives from 20 organisations including local authority officers from across the region (members of the Regional Assembly's Planning Officer Group), as well as regional planning stakeholders, and environmental organisations.

The renewable electricity scenarios had been adapted to demonstrate how the region could meet 20% of its electricity demand from renewable sources. Two further scenarios were constructed (scenario 2a and 2b) that used as a base two approaches to forecasting electricity demand in 2020 as outlined in section 3.1.3 and detailed in section 8 and annex 5.

Attendees were asked for their views on the following key issues:

- Renewable electricity
  - Should the target be based on Scenario 2a or 2b – the latter implying a greater commitment from the region to improving energy efficiency?
  - Should there be separate policies for offshore renewables?
  - How and to what extent should planning policy show broad areas for renewable energy development in the region?
  - The proposed development criteria

- Renewable heat
  - Should there be a renewable heat target in the RSS?
  - If so, what should the level of target be?

- On-site renewable energy generation for new build
  - Wording of target - should target be expressed in terms of energy or carbon?
  - Should a target percentage be expressed in the RSS, or only in Local Development Frameworks (LDFs)?
  - What should be the level of target?

The attendees were then given the opportunity to comment on the draft planning policies section by section.

The full list of attendees and notes of outputs from both events are given in annex 8.

In addition to the above, a presentation was given to the Regen SW County Champions meeting on 7th April, held at the SWRDA offices in Exeter, where stakeholders were given the opportunity to ask questions about the project and the proposed targets and policies.

A further meeting of the planning officers was held on 17th May (not attended by the consultants) at which final changes to the planning policies were agreed. A summary

of all the changes made to the documents between the two planning officer meetings was submitted to the second meeting and is reproduced within annex 8.

Lastly, a presentation on the renewable heat and biomass CHP elements of the project was made, and the findings and assumptions discussed at the SW Biomass Heat Forum meeting hosted by Regen SW on 9th June.

3.3.2 Consultation with sector experts

The assumptions that were fed into the development of the scenarios were validated through discussions with sector/technology experts. These discussions were conducted via e-mail, telephone and in a couple of instances meetings were held. The list of sector experts consulted, and who provided responses, is as follows:

- Western Power Distribution
- NFU
- Hydrogeneration Ltd
- Environment Agency – SW representative
- British Hydropower Association
- EST PV grants programme manager
- Future Foundations
- Renewable Heat and Power Ltd
- Econergy (biomass heating)
- Geoscience (heat pumps)
- Kensa Engineering (heat pumps)
- Solar Trade Association
- DTI: Projections & Modelling and Grid Infrastructure
- Windsave (roof mounted wind turbines)
- SWIFT (roof mounted wind turbines)
- Oxera
- UK Government Biomass Task Force
- Compact Power (Energy from Waste)
- Ocean Prospect/ Wind Prospect
- SW RDA
- Regen SW

3.3.3 Redrafting

Following consultation with stakeholders and sector experts the scenarios were revisited with a view to developing the most desirable scenarios for the region that could then form the basis for the target proposals as outlined within section 8. A review of regional benefits was undertaken, as outlined within section 7. In addition the planning proposals were adapted to take into account the issues raised at the planning peer review meeting and other stakeholder meetings. These planning policy proposals are outlined within Annex 10.

4 RENEWABLE ELECTRICITY TARGETS – RESOURCES AND SCENARIOS

4.1 Resources

The table below provides a summary of the accessible resource available within the South West for each renewable electricity technology.

The accessible resource is constrained by physical, technical, economic, environmental and legislative constraints and as such is markedly lower than the technical resource. For example the technical resource for solar PV (photovoltaics) or offshore wave is huge, sufficient to meet the region's target many times over. However the technology available to utilise the resource for both solar PV and offshore wave is either still in its infancy or is very expensive. The accessible resource therefore represents the resource that could be utilised if all projects received planning consent and the political, infrastructural and institutional barriers facing development were all overcome. The scenario development provided an opportunity to consider in more detail the extent to which the planning, political, institutional and infrastructural issues would really be met.

Table 6: Summary of accessible resources for 2010 and 2020

Technology	REvision 2010 resource (MW)[12]	REvision 2020 resource (MW)
Onshore wind	788	1,344
Offshore wind	50	50
Biomass – forest residues	4	6
Biomass – energy crops	96	187
Biomass – straw	7	7
Energy from waste	252	310
Landfill gas	46	30
Poultry litter	14	14
Centralised anaerobic digestion	15	2
Wave – offshore	5	285
Wave – shoreline	1	4
Tidal barrage	28	28
Tidal stream	1	122
Hydro	9	15
Building-integrated	2	100

Key differences between the resource assessments for 2010 and 2020 include (see Annex 1 for more detail):

- Onshore wind: The increase results from a reduction in the assumed economic windspeed due to improvements in technology and the opportunity to use larger turbines.

- Energy crops: The increase results from an increase in land growing energy crops by 2020 as opposed to 2010.

[12] Several of the REvision 2010 figures, including the landfill gas and wave figures, were adapted during the project in the light of revised assumptions.

- Energy from waste: The 2020 figure is based on an updated assessment of waste arisings over the period. The equivalent figure for 2010 would be 199MW. The increase is due to high annual waste arisings for secondary treatment after recycling and composting. Figures are based on Environment Agency estimates.

- Landfill gas: The reduction is due to an assumed reduction in gas production rates from landfills over the time to 2020.

- Centralised Anaerobic Digestion (CAD): The CAD figure is lower due to a change in assumptions for the mix between slurry and food waste. In addition, the accuracy of the data on food waste has been improved and has resulted in a downgrading of the resource.

- Wave & tidal stream: The increase is due to the forecasted rapid improvements in technology development and commercialisation within the timescale to 2020.

4.2 Scenarios

In order to enable constructive discussion with stakeholders, the multitude of options for renewable electricity development to 2020 were restricted to three scenarios. These scenarios were based on broad assumptions regarding the climate for renewable energy development. The description of each scenario below highlights the generic assumptions that have been used to distinguish the scenarios. The annex provides more detail on the technology specific assumptions for the key technologies that will form the bulk of a 2020 target (wave and tidal, biomass, energy from waste, and onshore wind).

Technology-specific growth has been considered as a function of:

- the accessible resource
- technical maturity (technology development/learning rates)
- commercial viability (fossil fuel prices, government subsidy)
- environmental impact (landscape character, designated areas)
- institutional and infrastructural support (planning, political, grid)

All scenarios assume that government will continue to provide political support to renewable energy and will put in place a target for 20% of UK electricity supplied from renewable sources by 2020, in line with the aspiration in the Energy White Paper[13]. It has been assumed for all scenarios that the Renewables Obligation is also extended to 20% by 2020.

Each scenario therefore forecasts the realisation of a different percentage of the accessible resource outlined within section 4.1.

4.2.1 Base Scenario 1: Low intervention

- Assumes that the current situation largely persists – i.e. onshore wind, and waste technologies remain as main source of renewable generation, and biomass (electricity generation) and marine technologies don't prove to be technically and commercially viable, though there will be some small capacity increase from demonstrator projects.

[13] See footnote 5, page 5

See Annex 1 for more detailed technology specific assumptions

Figure 2: Scenario 1 summary (electricity)

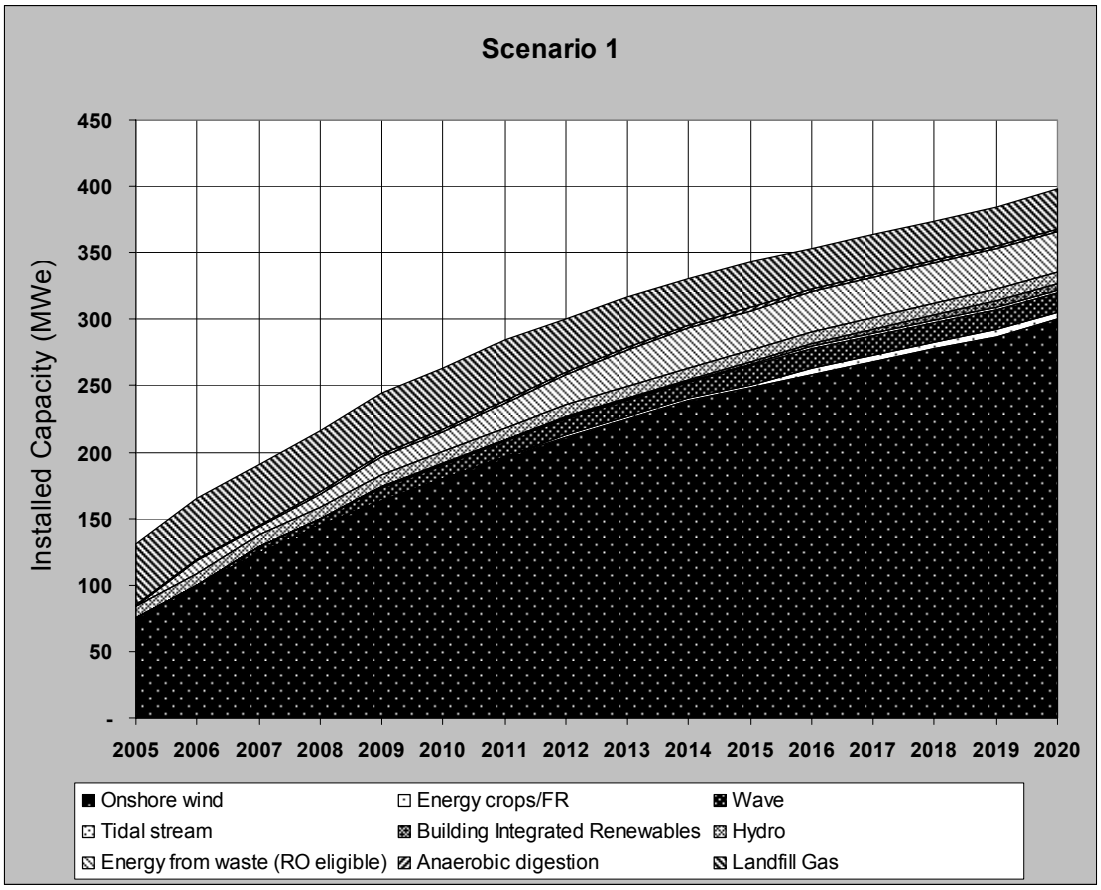


Table 7: Scenario 1 summary (electricity)

	2010		2020	
Onshore technologies	**MWe**	**GWh**	**MWe**	**GWh**
Onshore wind	180	473	300	788
Energy crops, forest residues	0	0	5	39
Building-integrated renewables	0	0	5	4
Hydro	9	32	9	32
Energy from waste (RO eligible)	15	125	30	250
Anaerobic digestion	2	12	2	12
Landfill gas	46	383	30	250
Sub total	**252**	**1,024**	**381**	**1,375**
Offshore technologies				
Wave	10	26	15	39
Tidal stream	1	3	2	5
Sub total	**11**	**29**	**17**	**45**
Total MW	**263**	**1,053**	**398**	**1,420**
% Electricity Consumption		**4.2%**		**4.9%**

4.2.2 Base Scenario 2: medium intervention

As Scenario 1, plus with the following:

- Technical viability of new technologies (biomass, marine) demonstrated, but still institutional (capacity of planning system, local public/political acceptance) and infrastructure (grid) constraints for key technologies
- Government subsidies introduced for key technologies like marine (wave and tidal stream). Revenue support for renewable heat provides some support for biomass CHP (Combined Heat and Power)
- Policy for on-site generation from renewable sources for new build in place within all local authority Local Development Frameworks (LDFs) in South West by 2010

See Annex 1 for more detailed technology specific assumptions

Figure 3: Scenario 2 summary (electricity)

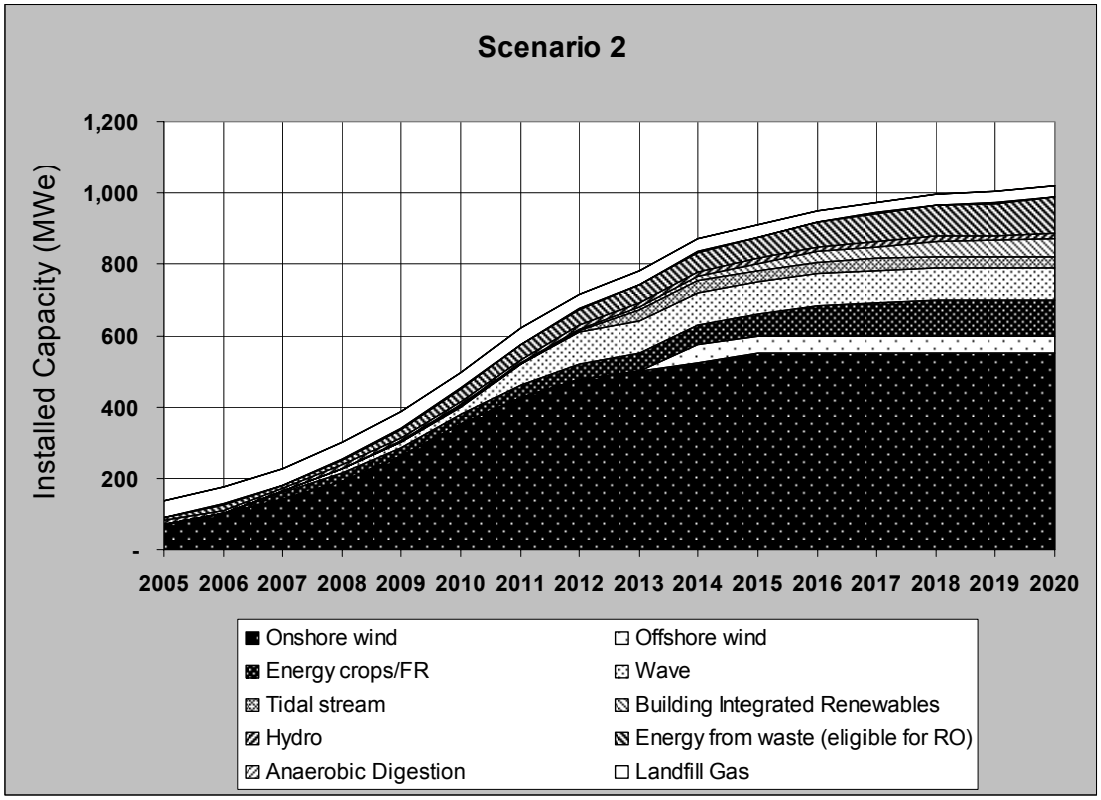


Table 8: Scenario 2 summary (electricity)

	2010		2020	
Onshore technologies	**MWe**	**GWh**	**MWe**	**GWh**
Onshore wind	350	920	550	1,445
Energy crops, forest residues	30	237	100	788
Building-integrated renewables	4	3	50	44
Hydro	9	32	15	53
Energy from waste (eligible for RO)	35	291	100	832
Anaerobic digestion	2	16	2	16
Landfill gas	46	383	30	250
Sub total	**476**	**1,881**	**847**	**3,428**
Offshore technologies				
Offshore wind	0	0	50	153
Wave	20	53	90	237
Tidal stream	2	5	32	84
Sub total	**22**	**58**	**172**	**474**
Total MW	**498**	**1,939**	**1,019**	**3,902**
% Electricity Consumption		**7.7%**		**13.5%**

4.2.3 Base Scenario 3: High intervention

As Scenario 2, plus with the following:

- Institutional (capacity of planning system, local public/political acceptance) and infrastructure (grid) constraints are addressed, allowing more rapid deployment of all technologies

- Full economic viability of key technologies delivered through combination of high technology learning rates (particularly for marine) high fossil fuel prices and/or high government support

See Annex 1 for more detailed technology specific assumptions

Figure 4: Scenario 3 summary (electricity)

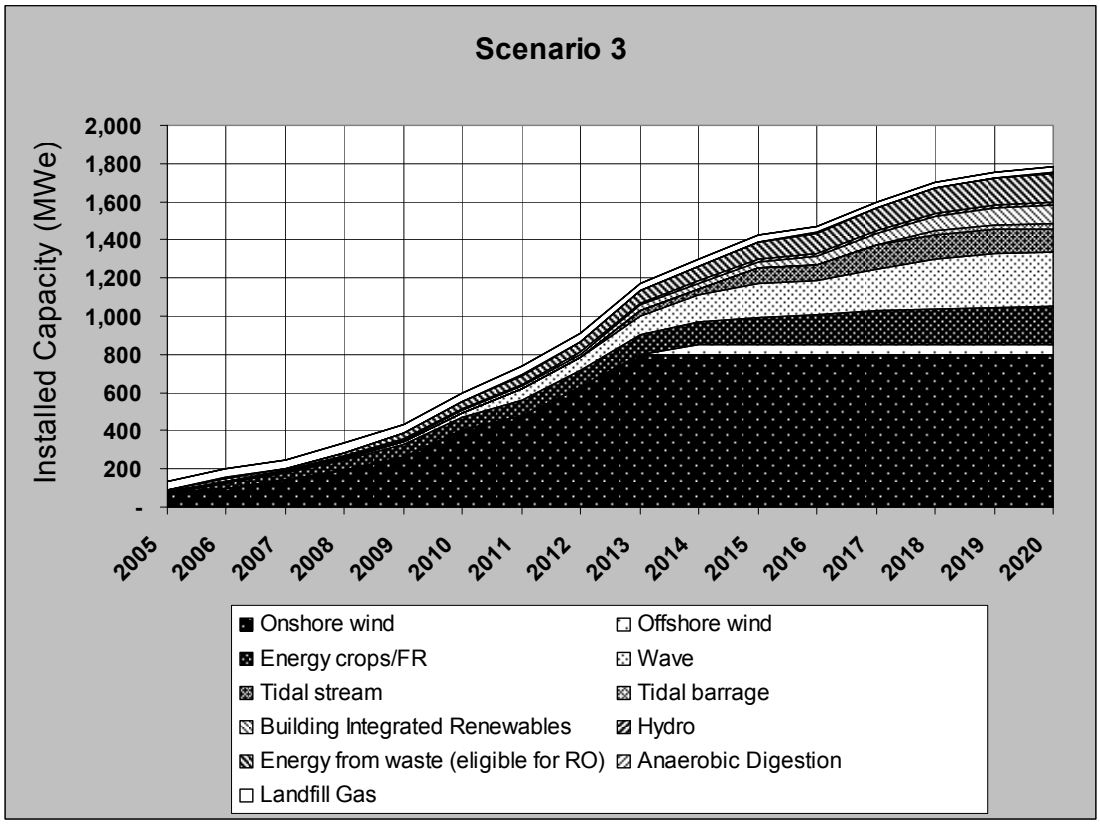


Table 9: Scenario 3 summary (electricity)

	2010		2020	
Onshore technologies	**MWe**	**GWh**	**MWe**	**GWh**
Onshore wind	400	1,051	800	2,102
Energy crops, forest residues	73	576	200	1,577
Tidal barrage	0	0	28	61
Building-integrated Renewables	5	4	100	88
Hydro	9	32	15	53
Energy from waste (eligible for RO)	35	291	150	1,248
Anaerobic digestion	2	16	2	16
Landfill gas	46	383	30	250
Sub total	**570**	**2,352**	**1,325**	**5,394**
Offshore technologies				
Offshore wind	0	0	50	153
Wave	20	53	285	749
Tidal stream	2	5	122	321
Sub total	**22**	**58**	**457**	**1,223**
Total MW	**592**	**2,410**	**1,782**	**6,617**
% Electricity Consumption		**9.6%**		**22.9%**

4.2.4 2020 Base Scenario Summary

Figure 5: Base scenario summary (electricity)

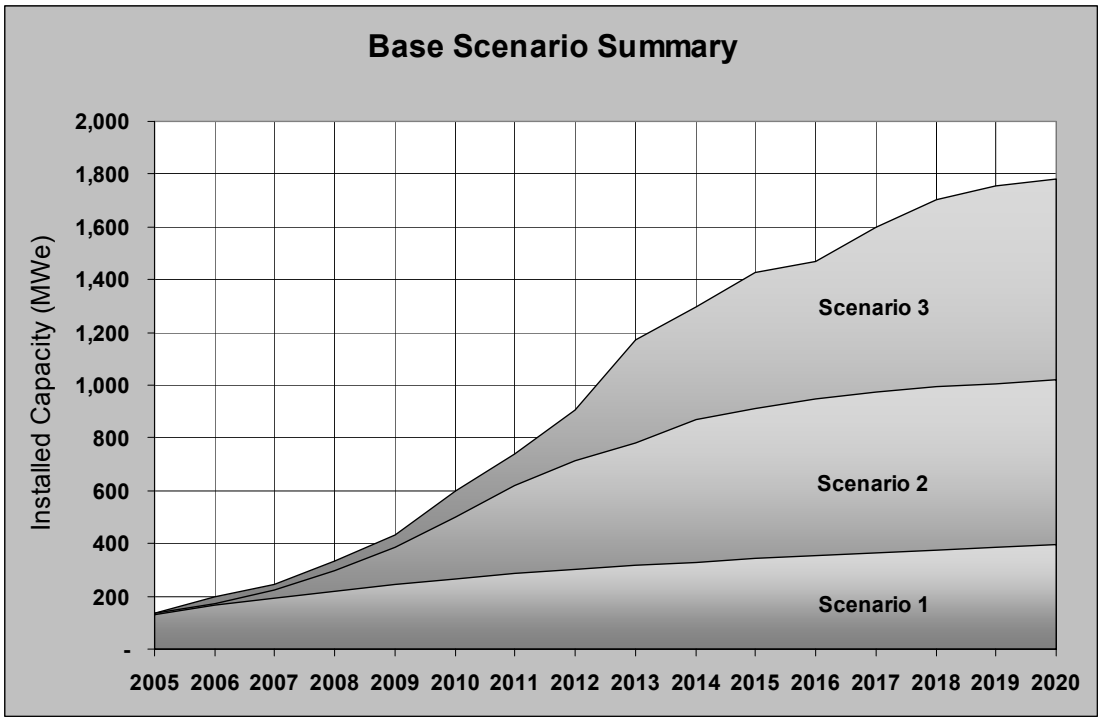


Table 10: Base scenario summary (electricity)

Onshore technologies	Scenario 1 MWe	Scenario 2 MWe	Scenario 3 MWe
Onshore wind	300	550	800
Energy crops	5	100	200
Tidal barrage	0	0	28
Building Integrated Renewables	5	50	100
Hydro	9	15	15
Energy from waste (eligible for RO)	30	100	150
Anaerobic Digestion	1.5	2	2
Landfill Gas	30	30	30
Poultry litter	0	0	0
Sub total	**381**	**847**	**1,325**
Offshore technologies			
Offshore wind	0	50	50
Wave	15	90	285
Tidal stream	2	32	122
Sub total	**17**	**172**	**457**
Total	**398**	**1,019**	**1,782**
% Electricity Consumption	**4.9%**	**13.5%**	**22.9%**

5 RENEWABLE HEAT TARGETS – RESOURCES AND SCENARIOS

5.1 Resources

The renewable heat technologies considered were:
- Solar water heating
- Wood fuel heating
- Heat pumps
- Heat from renewable Combined Heat and Power (CHP)

Of these technologies, only wood fuel heating and heat from renewable CHP are significantly resource constrained. Their resources are described more below.

5.1.1 Wood fuel

Forestry residues

The woodland resource is assumed to include brashings only (early thinnings, and 'lop and top') from ongoing management of woodland. A sustainable yield of 2 odt/ha was assumed, with 25% of this recoverable and available for fuel use. This results in an available resource of 46,572 odt/yr.

The available resource used in this study would therefore seem to be at the lower end of current estimates. In the short term, this figure could increase considerably from the 'backlog' of wood available from overgrown woodlands being renovated. See Annex 2 for further details of estimates of available wood fuel resource.

Other sources of wood fuel

Other types of wood waste, such as arboricultural residues, primary processing waste and untreated recycled wood residues may also significantly increase the resource. This suggests that up to 34,000 odt/year of arboricultural residues could be available in the South West, as well as 127,000 tonnes from packaging and pallets and sawmill residues (see Annex 2 for further details).

In terms of pellet supply, Western Wood Pellets Ltd. currently operates a plant in Shepton Mallet with a capacity of 2,000 tonnes/yr. Although outside the region, Welsh Biofuels also operates a plant in Bridgend, capable of producing 50,000 tonnes/yr.

5.1.2 Heat from renewable CHP

The available heat from this resource will depend on the levels of installed capacity of renewable electricity CHP for the following technologies:

- Energy crops/forest residues
- Anaerobic digestion
- Energy from waste (eligible under the Renewables Obligation)

The quantities of heat available from these sources are detailed in Annex 2.

5.2 Scenarios

As for renewable electricity, for the purposes of discussions with stakeholders, three scenarios were constructed based on broad assumptions regarding the climate for renewable energy development. The description of each scenario below highlights the generic assumptions that have been used to distinguish the scenarios. Annex 2 provides more detail on the technology-specific assumptions for the key technologies that will form the bulk of a 2010 and 2020 target for renewable heat (wood fuel heating, solar water heating, heat pumps, and heat from renewable CHP). Annex 7 provides more detail on the impact and possible technology mix of having a target for on-site generation of renewable energy in new build.

Technology specific growth has been considered as a function of:

- the accessible resource
- technical maturity (technology development/learning rates)
- commercial viability (fossil fuel prices, government subsidy)
- institutional and infrastructural support (planning, political, extent of mains gas network)

The deployment of renewable heat is very much demand led, and renewable heat systems have to compete with conventional fossil fuel systems and fuels. Therefore, the analysis to support the renewable heat scenarios assessed the market size and market penetration rates for different sectors.

It is important to realise that there is an interaction between the uptake of renewable heat, the deployment of larger scale renewable CHP (which is covered under the renewable electricity scenarios) and the implementation of a policy on on-site renewable energy generation. The scenarios and supporting analysis attempt to model this interaction.

All scenarios assume that government will continue to provide political support to renewable energy and will put in place a target for 20% of UK electricity supplied from renewable sources by 2020, in line with the aspiration in the Energy White Paper. It has been assumed for all scenarios therefore that the Renewables Obligation is also extended to 20% by 2020.

In order to assess the percentage of the region's heat demand that can be met from renewable sources, forecasts of heat demand by 2010 and 2020 within the South West have been made. See Annex 6 for further information on the basis of these forecasts.

5.2.1 Base Scenario 1: Low intervention

This scenario assumes that the current situation largely persists, i.e.:

- No use of heat from larger scale electricity CHP
- Deployment of heat pumps and biomass heating largely restricted to off-gas areas
- No policy for on-site renewable energy generation in new build
- No additional revenue support for renewable heat

See Annex 2 for more detailed technology specific assumptions

Figure 6: Scenario 1 summary (heat)

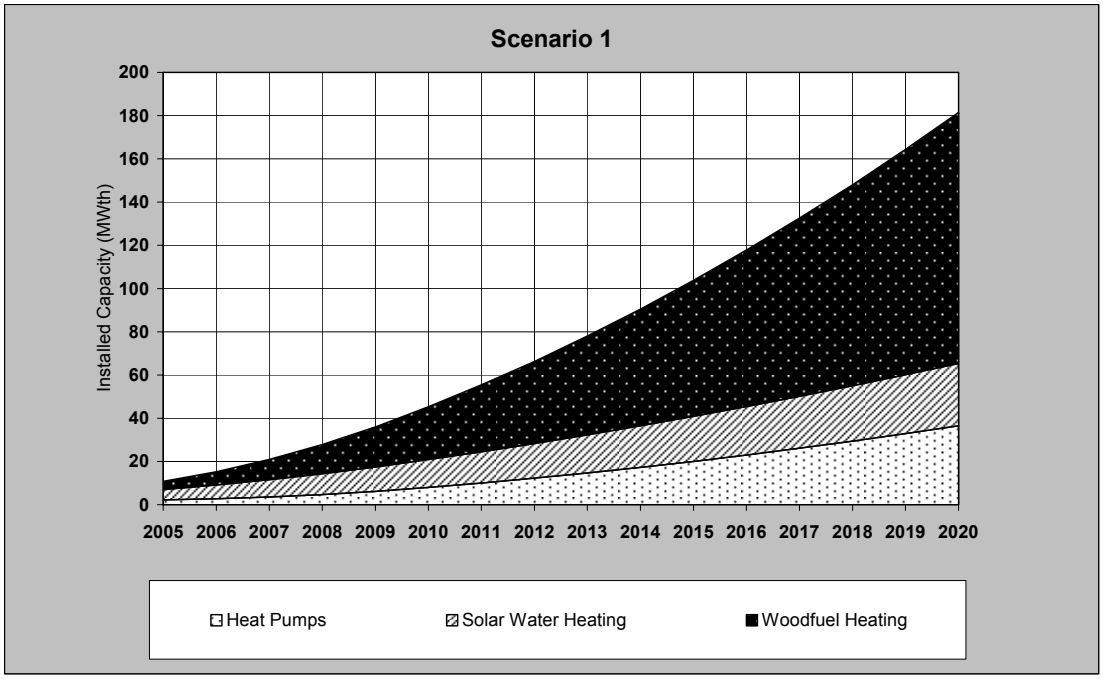


Table 11: Scenario 1 summary (heat)

	Scenario 1			
TECHNOLOGY	MW 2010	Energy 2010 (GWh)	MW 2020	Energy 2020 (GWh)
Woodfuel Heating				
new build domestic community heating	0	0	1	1
new build domestic stand-alone	1	1	4	5
new build non-domestic	1	3	6	16
retro-fit domestic stand-alone	8	11	42	53
retro-fit domestic community heating	2	2	7	9
retro-fit non-domestic	12	31	56	139
Subtotal	***24***	***48***	***116***	***223***
Heat Pumps				
new build domestic	2.1	4	8	16
new build non-domestic	0	0	0	0
retro-fit domestic	6	12	29	57
retro-fit non-domestic	0	0	0	0
Subtotal	***8***	***16***	***37***	***73***
Solar Water Heating				
new build domestic	0	0	0	0
new build non-domestic	0	0	0	0
retro-fit domestic	13	8	29	17
retro-fit non-domestic	0	0	0	0
Subtotal	***13***	***8***	***29***	***17***
CHP (where heat is usefully used) - from AD, EfW or biomass				
new build domestic community heating	0	0	0	0
new build non-domestic	0	0	0	0
retro-fit domestic community heating	0	0	0	0
retro-fit non-domestic	0	0	0	0
Subtotal	***0***	***0***	***0***	***0***
Total	***45***	**71**	***181***	**313**
Renewable CHP heat available	51		111	
% of renewable CHP heat available	0.0%		0.0%	
% of predicted SW heat demand		0.09%		0.49%

5.2.2 Base Scenario 2: Medium intervention

This scenario is as Scenario 1, plus the following:

- revenue support for renewable heat leads to greater uptake of wood fuel heating, and heat pump technologies.
- this, in conjunction with greater deployment of renewable CHP, leads to use of heat from this source
- policy for 10% on-site generation from renewable sources for new build in place within RSS, and that all local authorities in SW have defined appropriate thresholds for major developments in their LDFs. This leads to deployment of biomass and heat pump technologies in on-gas as well as off-gas areas

See Annex 2 for more detailed technology specific assumptions

Figure 7: Scenario 2 summary (heat)

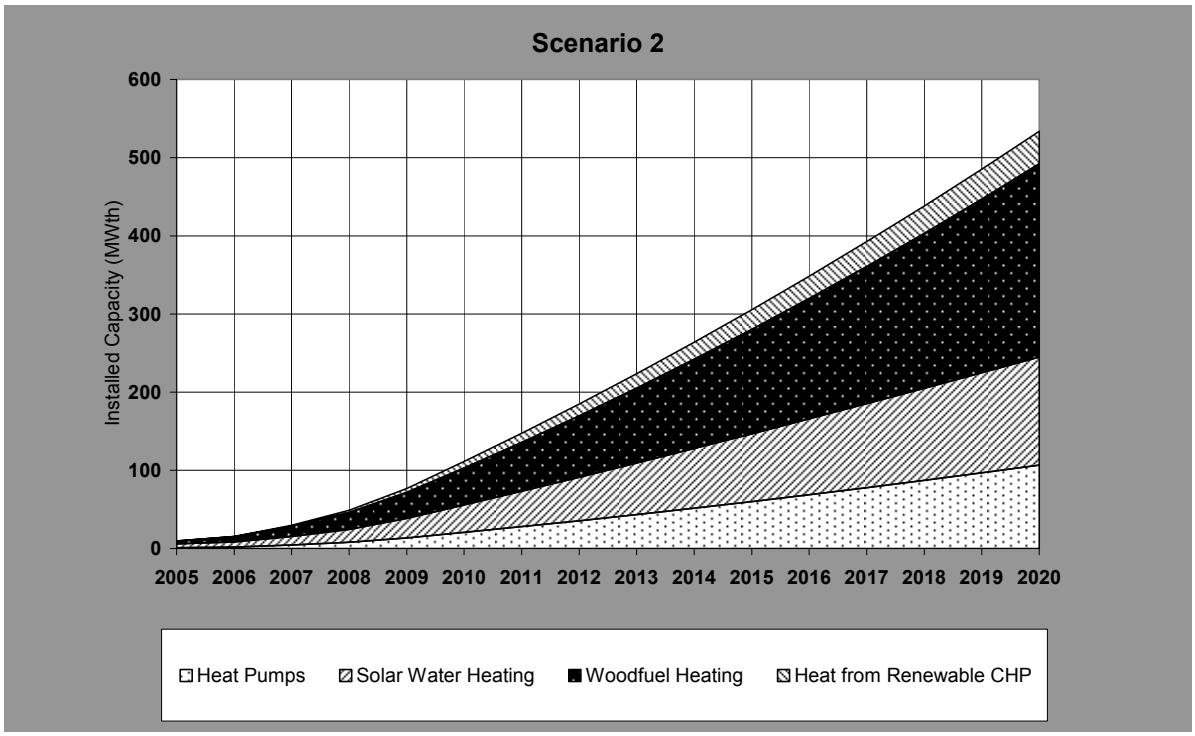


Table 12: Scenario 2 summary (heat)

	Scenario 2			
TECHNOLOGY	MW 2010	Energy 2010 (GWh)	MW 2020	Energy 2020 (GWh)
Woodfuel Heating				
new build domestic community heating	5	6	25	31
new build domestic stand-alone	1	1	4	5
new build non-domestic	3	7	14	36
retro-fit domestic stand-alone	15	19	83	105
retro-fit domestic community heating	3	3	14	18
retro-fit non-domestic	21	52	107	268
Subtotal	***47***	***89***	***247***	***462***
Heat Pumps				
new build domestic	6	13	32	63
new build non-domestic	4	10	19	48
retro-fit domestic	10	21	56	111
retro-fit non-domestic	0	0	0	0
Subtotal	***21***	***43***	***107***	***223***
Solar Water Heating				
new build domestic	21	12	101	60
new build non-domestic	2	1	8	5
retro-fit domestic	13	8	29	17
retro-fit non-domestic	0	0	0	0
Subtotal	***35***	***21***	***138***	***82***
CHP (where heat is usefully used) - from AD, EfW or biomass				
new build domestic community heating	5	13	25	62
new build non-domestic	3	9	17	42
retro-fit domestic community heating	0	0	0	0
retro-fit non-domestic	0	0	0	0
Subtotal	***8***	***21***	***42***	***104***
Total	***111***	**174**	***534***	**871**
Renewable CHP heat available	141		546	
% of renewable CHP heat available	6.0%		7.6%	
% of predicted SW heat demand		0.23%		1.35%

For the purposes of target setting, the figure for heat pumps was de-rated (using a factor of 0.71) to allow for the use of non-renewable electricity to drive heat pump systems. See section 8.2 for more details.

5.2.3 Base Scenario 3: High intervention

As scenario 2 plus:

- Greater uptake of heat from renewable CHP, in a retro-fit situation, such that 25% of total renewable available from large-scale renewable CHP is used.

Figure 8: Scenario 3 summary (heat)

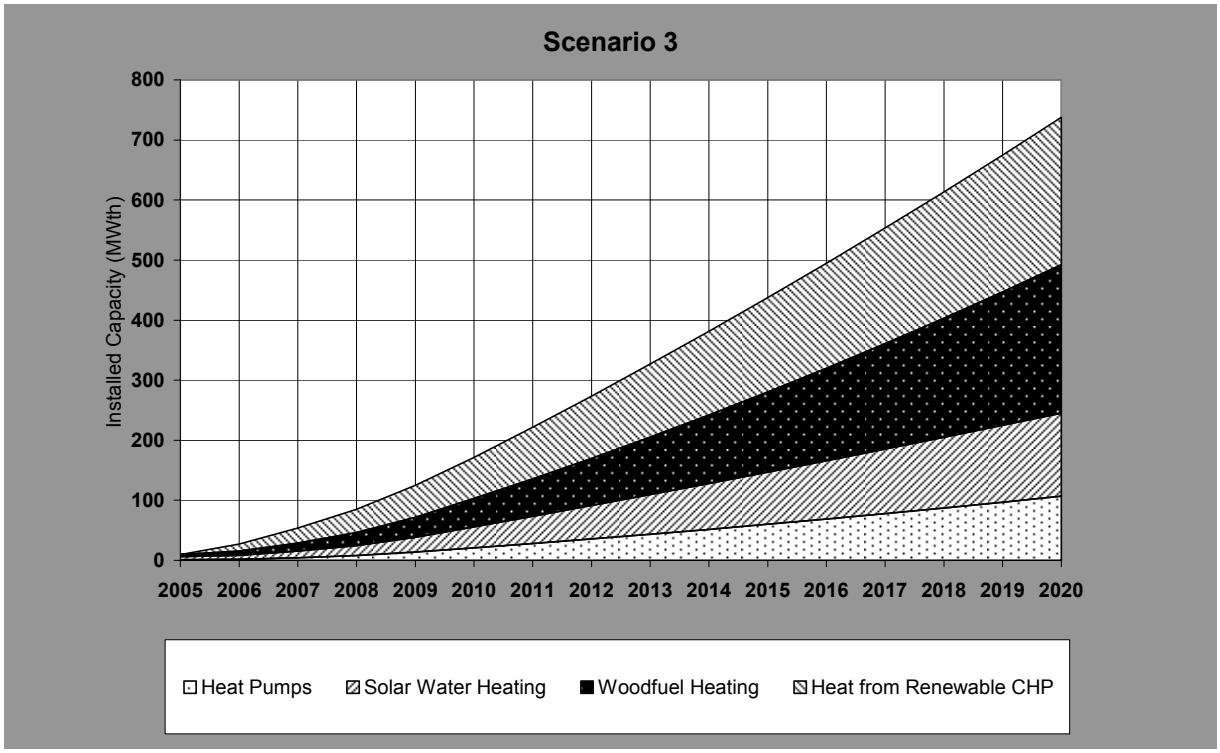


Table 13: Scenario 3 summary (heat)

	Scenario 3			
TECHNOLOGY	MW 2010	Energy 2010 (GWh)	MW 2020	Energy 2020 (GWh)
Woodfuel Heating				
new build domestic community heating	5	6	25	31
new build domestic stand-alone	1	1	4	5
new build non-domestic	3	7	14	36
retro-fit domestic stand-alone	15	19	83	105
retro-fit domestic community heating	3	3	14	18
retro-fit non-domestic	21	52	107	268
Subtotal	***47***	***89***	***247***	***462***
Heat Pumps				
new build domestic	6	13	32	63
new build non-domestic	4	10	19	48
retro-fit domestic	10	21	56	111
retro-fit non-domestic	0	0	0	0
Subtotal	***21***	***43***	***107***	***223***
Solar Water Heating				
new build domestic	21	12	101	60
new build non-domestic	2	1	8	5
retro-fit domestic	13	8	29	17
retro-fit non-domestic	0	0	0	0
Subtotal	***35***	***21***	***138***	***82***
CHP (where heat is usefully used) - from AD, EfW or biomass				
new build domestic community heating	5	13	25	62
new build non-domestic	3	9	17	42
retro-fit domestic community heating	30	75	102	255
retro-fit non-domestic	30	75	102	255
Subtotal	***68***	***171***	***246***	***614***
Total	***171***	**324**	***738***	**1381**
Renewable CHP heat available	270		996	
% of renewable CHP heat available	25%		25%	
% of predicted SW heat demand		0.43%		2.14%

5.3 Wood fuel – matching supply and demand

The table and chart below show the quantity of wood fuel required to meet the installed capacity figures for wood fuel heating under Scenario 2. Here, the stand-alone domestic elements of the target are assumed to be met by pellets and the remainder from wood chip.

The chart shows that the total pellet production capacity for the stand-alone domestic element is adequate to meet the targets up to 2020. However, the vast amount of capacity is from the Bridgend plant and if the level of pellet systems envisaged is to be met, it is likely that there would need to be additional pellet production capacity within the region.

It can be seen that the total wood heating target for 2010 is well within the available forestry residue resource. From the total amount wood fuel needed in 2020, around 25,000 odt/yr will be supplied as pellets for the domestic stand-alone market. This leaves around 80,000 odt/yr required as wood chip, of which a little over half can be met by the existing woodland resource. The remaining quantity of just over 33,000 odt will need to be sourced from woodchip elsewhere. Based on the data in section 5.1.2, this could be met from a combination of arboricultural residues, untreated recycled wood waste, and, potentially, energy crops.

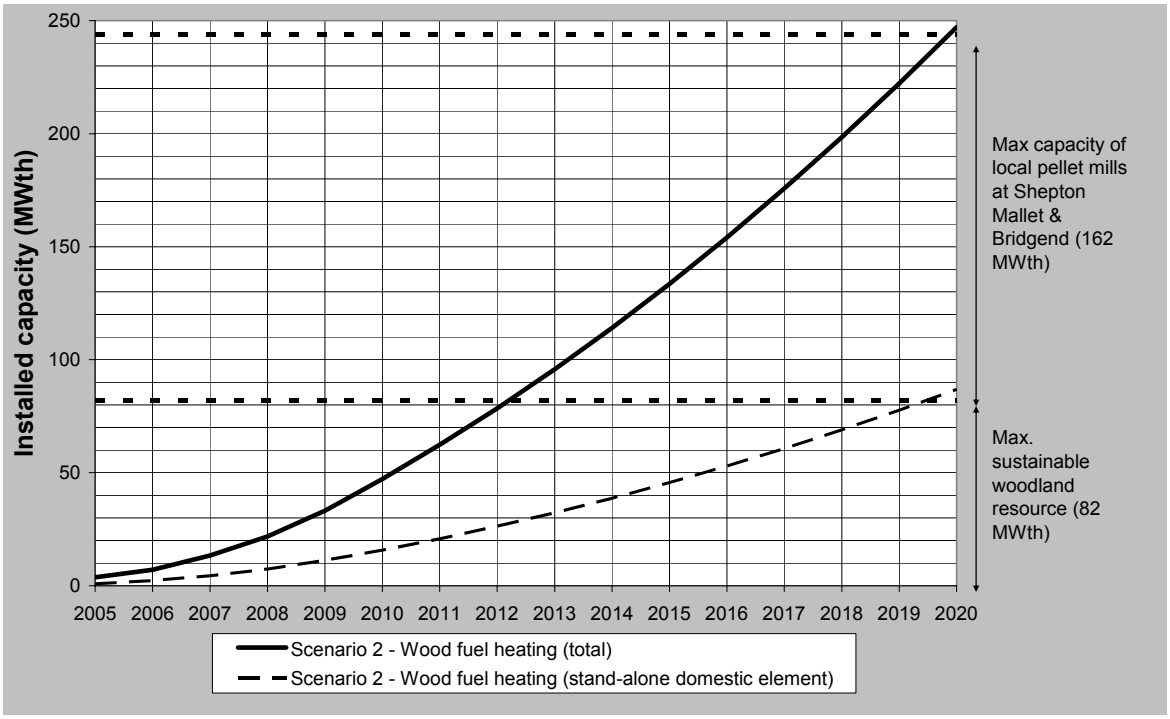
Table 14: Quantity of wood fuel required

		Scenario 2					
Wood fuel Heating	**LF**	**MW 2010**	**Wood fuel required (odt)/ MW**	**Wood fuel required (odt/yr)**	**MW 2020**	**Wood fuel Required (odt)/ MW**	**Wood fuel required (odt/yr)**
new build domestic community heating	0.14	5	285	1,434	25	285	7,047
new build domestic stand-alone	0.14	1	285	232	4	285	1,065
new build non-domestic	0.29	3	566	1,658	14	566	8,147
retro-fit domestic stand-alone	0.14	15	285	4,269	83	285	23,677
retro-fit domestic community heating	0.14	3	285	783	14	285	4,017
retro-fit non-domestic	0.29	21	566	11,735	107	566	60,562
Subtotal		***47***		***20,111***	***247***		***104,514***
Domestic pellets required				4,501			24,742
Max wood chip required				15,610			79,772
Forest residues available				46,500			46,500
Balance of wood chip required				-30,890			33,272

Notes on table:

- LF = load factor
- Assumed biomass boiler/ stove efficiency 85%
- Stand-alone domestic systems assumed to use pellets

Figure 9: Wood fuel requirement vs. available resource



6 ON-SITE GENERATION

6.1 Resources and Assumptions

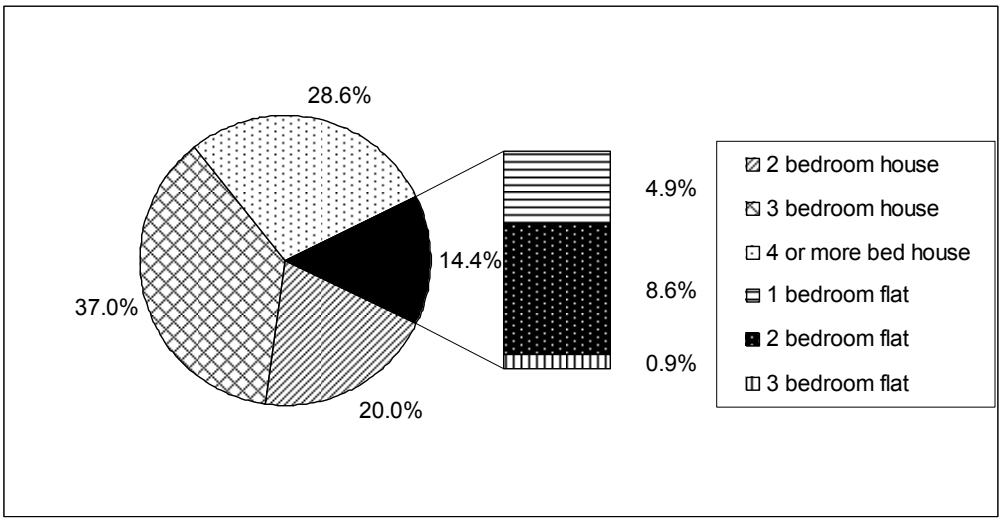
6.1.1 Quantity of new build in the South West to 2010 and 2020

Residential
The quantity of annual residential new build for the South West was taken to be 25,000 new dwellings per year, including conversions and change of use, based on discussions with the South West Regional Assembly (SWRA). This compares to a current level of new build of approx. 20,000 new homes per year (from 2003 annual monitoring report). This is an average figure for the region as a whole, and some areas will have greater housing growth than others. The final growth estimates for each local authority will emerge from the Regional Spatial Strategy (RSS) development.

The percentage of residential developments that form major developments (10 or more dwellings) was estimated to be 70%, based on data from the Regional Assembly recording new build completions for 2004 for all local authorities in the SW. Therefore, the estimated number of new dwellings per year completed as part of major developments was assumed to be 17,500.

Based on the average types of property over the 10 years from 1995 to 2004, the split is as follows:

Figure 10: Mix of property types for new dwellings (10 year average 1995-2004, source: ODPM)



The energy demand and resulting CO_2 emissions, for different property types were estimated for new buildings built according to the proposed 2005 building regulations. These estimates are shown below:

Table 15: Estimated CO_2 emissions for new dwellings built to 2005 building regulations

	gas consump-tion (kWh)	electricity consump-tion (kWh)	Gas kg CO_2/ yr	Electricity kg CO_2/ yr	total kg CO_2 / yr
House					
2 bedrooms	6,969	1,219	1,354	524	**1,878**
3 bedrooms	7,453	1,388	1,448	597	**2,045**
4 or more bedrooms	8,203	1,613	1,594	693	**2,287**
Flat					
1 bedroom	2,969	806	577	347	**924**
2 bedrooms	4,391	1,125	853	484	**1,337**
3 bedrooms	5,063	1,594	984	685	**1,669**

Notes on table:
- Assumes typical house is semi-detached
- CO_2 emission factors are 0.19 kgCO_2/kWh for gas and 0.43 kgCO_2/kWh for electricity

The table shows that a typical average figure for CO_2 emissions from energy use is about 2 tonnes per year. This is about a third of the average for existing housing stock.

Based on this mix of dwellings types, the new **annual** energy demand from 25,000 dwellings would be 213 GWh/ year, and from the 17,500 dwellings built as part of major developments, 149 GWh/ year. The corresponding new CO_2 emissions would be 49,360 tonnes per year and 34,550 tonnes per year, respectively. These figures are **cumulative**, so by 2020 the total new annual CO_2 emissions from dwellings built as part of major developments would be 493,600 tonnes compared to 2010.

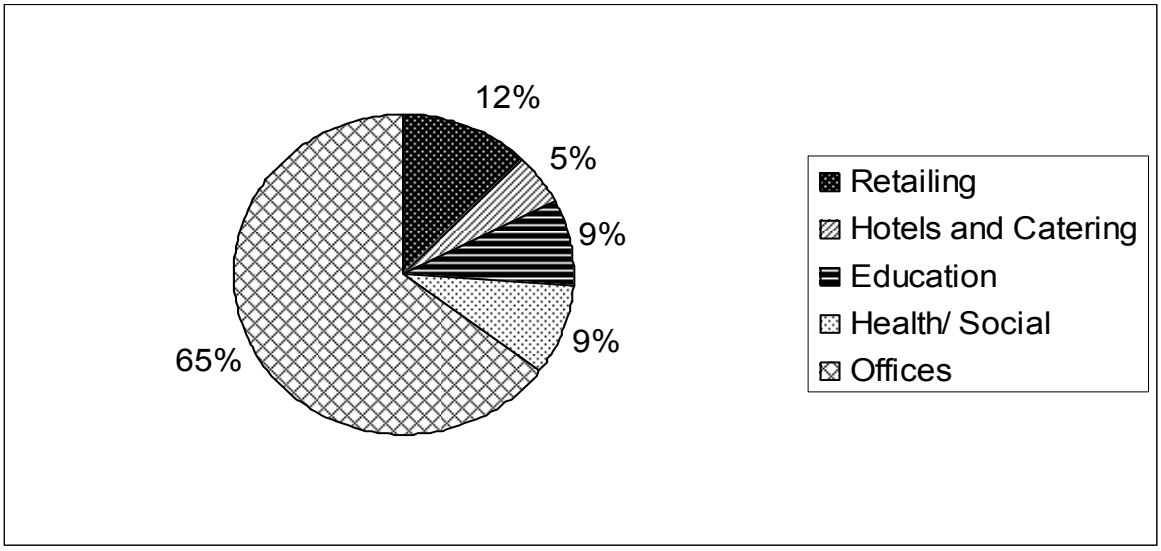
Non-residential
From the Cambridge Econometrics study carried out as part of the RSS development[14], the main sectors with positive growth rates considered in the analysis, averaged over all functional zones, were as follows:

- Retailing
- Hotels and catering
- Education
- Health and social
- Offices

The total growth in employment in these sectors, between 2006 and 2020 is estimated to be 314,000 new employees. The breakdown of employment growth between these sub-sectors is as follows:

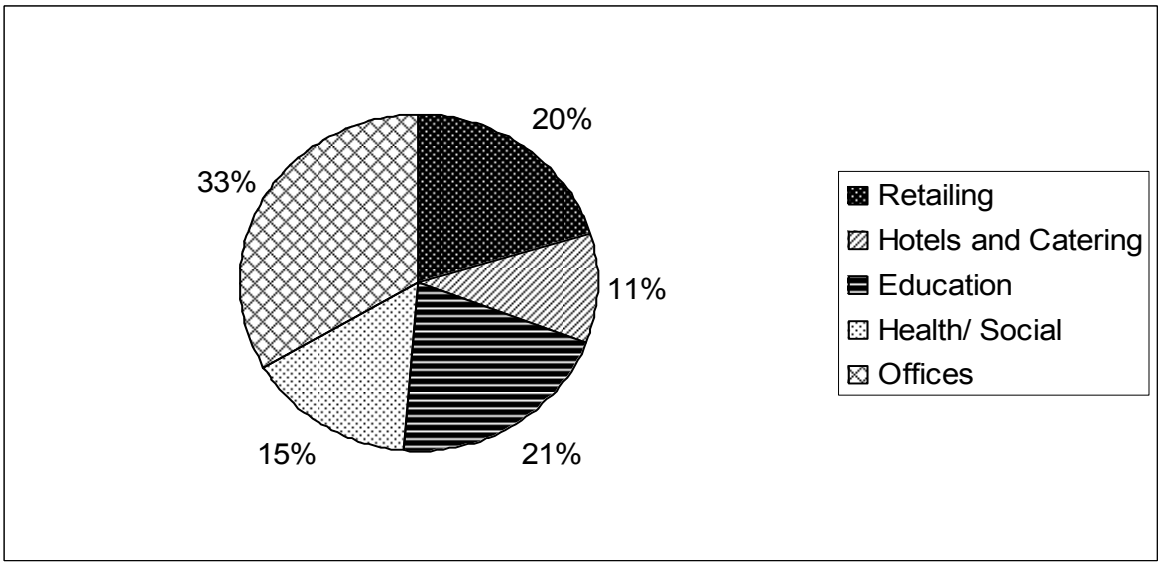
[14] interim data was supplied to the project team by the SW RDA

Figure 11: Breakdown of employment growth in expanding sub-sectors in the South West



This shows that the main growth is in the 'offices' sub-sector. The assumption is that there will be corresponding new build to accommodate these additional workers. However, the estimate of new energy demand for each of these growth sectors shows a more even split, as shown in the figure below:

Figure 12: Breakdown of estimated new annual energy demand for growth sectors



This reflects the fact that the non-office sub-sectors have a greater floor area per worker, and hence higher energy use per worker. The total new energy use each year is estimated to be about 106 GWh per year, with corresponding new CO_2 emissions of 28,500 tonnes per year. This is about half of the total annual growth for the residential new build. This shows that residential energy demand will still be the dominant source of new energy demand in new buildings in the South West, despite the prospect of new building regulations. The breakdown of energy use and CO_2 emissions for the non-residential new build is shown in the table below:

Table 16: Breakdown of estimated new annual energy demand and CO_2 emissions from non-residential new build in the South West

	Estimated annual new energy demand (GWh)			Estimated new annual CO2 emissions (tonnes)		
Growth Subsector	**Electricity**	**Heat**	**Total**	**Gas**	**Electricity**	**Total**
Retailing	6	16	21	3,313	2,475	5,788
Hotels & Catering	2	9	11	1,890	1,027	2,917
Education	4	18	22	3,733	1,760	5,494
Health/Social	2	14	16	3,045	742	3,787
Offices	14	21	35	4,419	6,153	10,572
	28	**78**	**106**	**16,401**	**12,156**	**28,557**

CSE's analysis of data on planning permission granted for floor space employment land from each local authority in the South West[15] led to an estimate of **annual** new energy demand from major new non-residential developments of 74 GWh per year, or 70% of the 106 GWh given in the table above. Therefore, the figure of 70% has been assumed to be the proportion of non-residential new build that will be classed as major development. Based on 70% of the figures in the table above, the corresponding annual CO_2 emissions for major developments would be just under 20,000 tonnes per year. Again, as with the resdinetial new build, this growth in emissions is cumulative.

6.2 Scenarios

6.2.1 Impact of different levels of target

The study analysed the impact on technical viability and build cost of a 5%, 10% or 15% carbon reduction from on-site renewable energy generation. This was based on data from the London Renewables Toolkit feasibility studies. This analysis, in the form of graphs plotting percentage carbon reduction against additional build cost, as well as a summary, is given in Annex 7.

The study took a figure of 5% additional build cost (excluding land value) as being the limit for what would not be regarded as an "undue burden" by developers. This was based on discussions with the London Development Agency (LDA). For comparison, meeting the BREEAM "Very Good" standard for non-residential buildings can add 6-10% to build cost (from SWRDA). To avoid confusion with the generation targets, this limit will hereafter be referred to as the Additional Build Cost Limit (ABCL).

The detailed assumptions on build cost and technology cost are given in Annex 7. This analysis shows that:

- for a 5% on-site RE generation target, the majority of development types have a choice of 4 or more technologies that could be installed within the ABCL
- for a 10% on-site RE generation target, the majority of development types have a choice of 3 or more technologies
- for a 15% on-site RE generation target, just over half of development types have a choice of two technologies or more, and none in one case

In should be noted that the cost of meeting the target for developers will go down in the future, due to the following:

[15] this data was supplied by the Regional Assembly

- tighter building regulations will reduce total CO_2 emissions. The Renewables Toolkit data was based on 2000 building regulations. The new 2005 building regulations are expected to reduce energy use by a further 25%, and hence CO_2 emissions by a comparable amount. This will, in effect, reduce the cost of installing renewables by a similar amount.
- the impact on build cost will reduce as newer technologies mature, particularly photovoltaics, and capital costs come down

6.2.2 Difference in impact between on and off-gas areas

In off-gas areas, all other things being equal, the baseline carbon emissions for new buildings will be higher as the fuel used for providing heat will generally be heating oil rather than mains gas. Since the CO_2 emissions per kWh of heating oil are 30% higher than for mains gas[16], it means that the percentage CO_2 reduction per kWh of renewable heat is greater in off-gas areas than on-gas areas. This means that for a given target and development, slightly less renewable heat capacity would be needed to achieve the same effect.

The contribution of renewable heat is enhanced by 9-24% depending on the type of development, and the relative mix of electricity and heat required. As an illustration, the contribution from biomass heating, solar water heating or heat pumps for a medium density residential development is enhanced by 9%, i.e. a 10% contribution from solar water heating in an on-gas area would be enhanced to 10.9% in an off-gas area.

A carbon based target would therefore give greater credit to renewable heat in off-gas areas. Also, as heating oil is a more expensive fuel than mains gas, there would be a greater incentive to convert to renewable heat sources in off-gas areas.

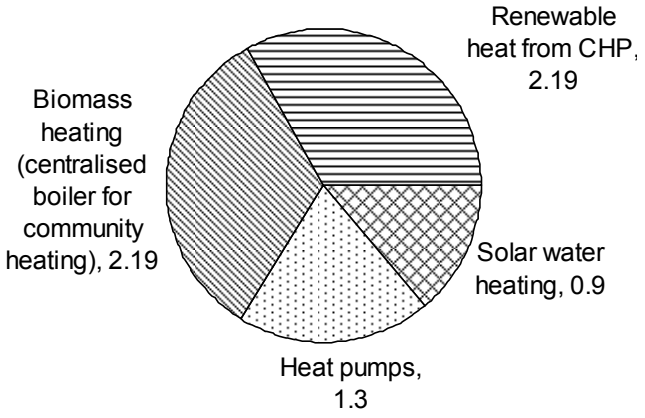
[16] 0.19kgCO2/kWh for mains gas compared to 0.25kg CO_2/kWh using standard SAP/ ODPM figures

6.2.3 Renewable energy technology mix

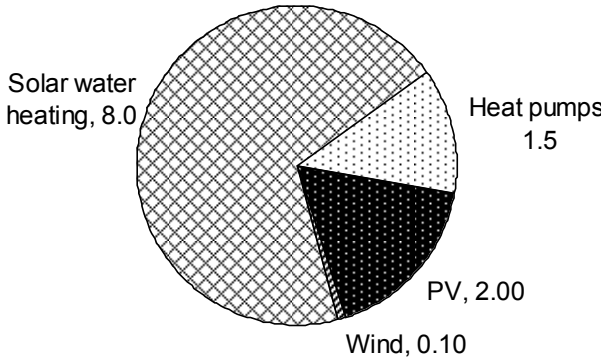
The graphs below illustrate the potential impact of a policy for on-site generation in terms of forecast annual installed renewable energy capacity. The figures assume that all major developments comply with the policy. The full assumptions behind this are given in Annex 7.

Figure 13: Forecast annual installation rates resulting from an on-site generation policy

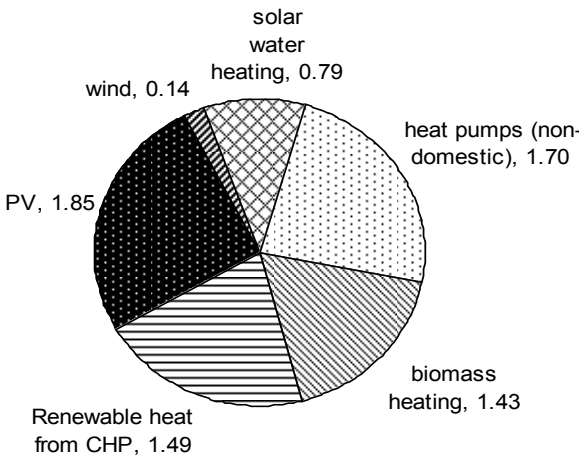
Social Housing New Build Technology Mix (Annual installed capacity in MW)



Non-Social Housing New Build Technology Mix (Annual installed capacity in MW)



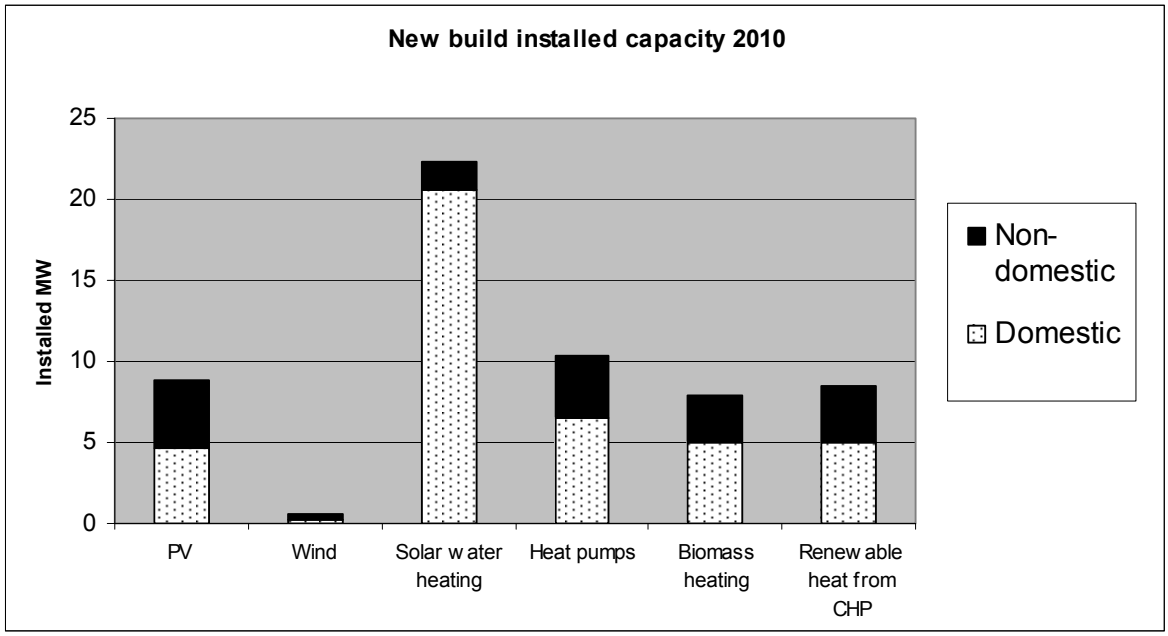
Non-Domestic New Build Technology Mix (Annual Installed Capacity in MW)



6.2.4 Resulting installed renewable energy capacity from 10% on-site generation policy

The table on the next page shows the potential new renewable energy capacity that would result from a 10% on-site generation policy, assuming the policy is based on a 10% carbon reduction, as explained in section 8.3 and 10.3.1. The table also gives the indicative number of systems that would be installed under this scenario. This assumes the policy roll-out given in 6.3.3, and the proportion of major developments set out in section 6.1. The graphs below summarise the breakdown of total new installed capacity by technology. This clearly shows the potential large contribution from solar water heating systems in the residential sector.

Figure 14: Graphs showing breakdown by technology of resulting renewable energy capacity



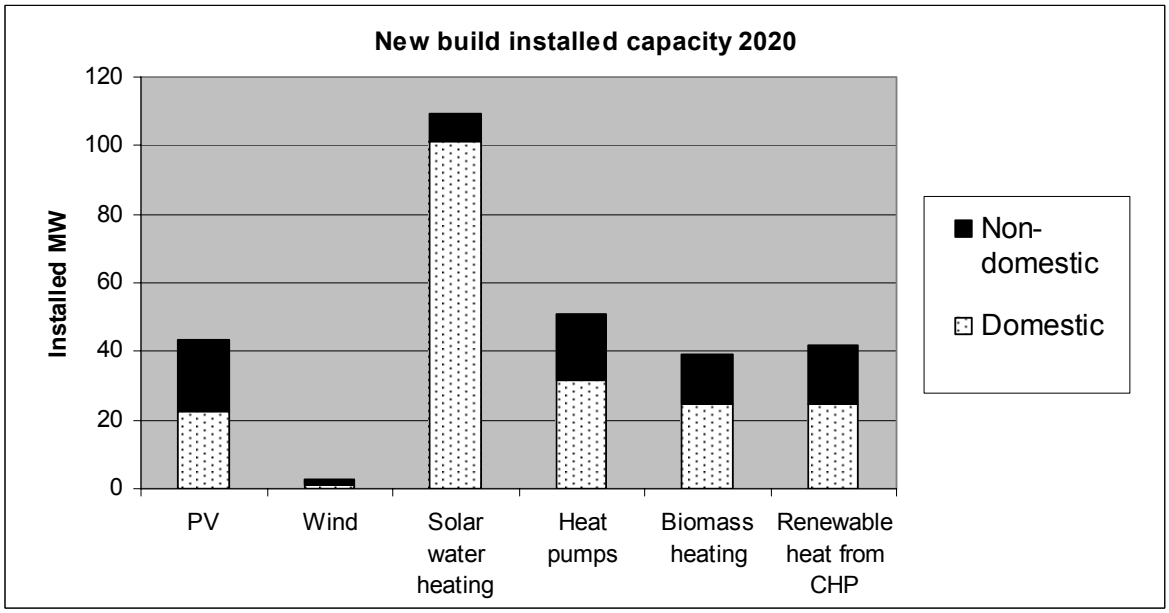


Table 17: Potential new renewable energy capacity in new build resulting from 10% on-site generation policy

Technology	New build installed capacity 2010						New build installed capacity 2020					
	Domestic		Non-domestic		**Total**		Domestic		Non-domestic		**Total**	
	MW	Indicative no. of Systems	MW	Indicative no. of Systems	**MW**	**Indicative no. of Systems**	MW	Indicative no. of Systems	MW	Indicative no. of Systems	**MW**	**Indicative no. of Systems**
Renewable electricity												
PV	4.6	2,300	4.3	850	**8.9**	**3,150**	22.6	11,300	20.9	4,177	**43.5**	**15,477**
Wind	0.2	37	0.3	55	**0.5**	**91**	1.1	181	1.6	268	**2.7**	**449**
Total	**4.8**	**2,337**	**4.6**	**905**	**9.4**	**3,242**	**23.7**	**11,481**	**22.5**	**4,445**	**46.2**	**15,926**
Renewable Heat												
Solar water heating	20.6	9,818	1.7	238	**22.3**	**10,056**	101.3	48,234	8.2	1,170	**109.5**	**49,404**
Heat pumps	6.5	2,156	3.9	52	**10.4**	**2,209**	31.8	10,594	19.3	257	**51.0**	**10,851**
Biomass heating	5.0	20	2.9	12	**8.0**	**32**	24.7	99	14.4	58	**39.1**	**156**
Renewable heat from CHP	5.0	20	3.4	14	**8.5**	**34**	24.7	99	16.8	67	**41.6**	**166**
Total	**37.1**	**12,014**	**11.9**	**316**	**49.1**	**12,330**	**182.5**	**59,026**	**58.7**	**1,552**	**241.2**	**60,577**

Notes on table:

Indicative sizes of systems used:

- Solar water heating - domestic 2.1kW, ($3m^2$), non-domestic 7kW ($10m^2$)
- PV system – domestic 2kWp, non-domestic 5kWp
- Heat pump – domestic 3kWth, non-domestic 75kWth
- Wind turbine - 6kW, for domestic and non-domestic
- Biomass non-domestic – 250kWth
- Biomass domestic (assumed to be community heating) - 250kWth
- Renewable heat CHP (domestic and non-domestic) - 250kWth

For PV installed capacity, there is the potential for the market share of PV to become partially occupied by roof mounted wind, should the latter prove to be viable. The precise split between the technologies cannot be estimated at this stage.

6.3 Other Issues

6.3.1 Targeting social housing

A logical approach, and one to be encouraged, is for the developers of major housing developments to target the social housing component for renewable energy supply. In practice, this will mean having a Registered Social Landlord (RSL) or local authority partner on board at the early stages of a development, who will have agreed in principle to any proposed measures. The advantages of such an approach are numerous, namely:

- Social landlords are in a position to take on the management, administration and metering and billing for providing community heating or would be willing to engage an heat-ESCO[17] to do so. This would be necessary for community heating
- From the end of 2005, the Housing Corporation will require all new social housing build to meet EcoHomes standard Very Good. This will further incentivise RSLs to consider renewable energy options as a way of reducing carbon emissions
- Social landlords have an interest in reducing running costs for their tenants, and in helping to reduce fuel poverty. Renewable energy systems, particularly those with no running costs (solar water heating and PV) can help in this. For this reason, RSLs can take a longer term view, and look at whole-life costs, rather than just considering upfront capital costs
- Heat pumps and community heating provide a way for social landlords to reduce the costs of annual boiler servicing and inspection, and they are already showing considerable interest in these technologies
- RSLs are likely to be able to bring additional funds to assist with the capital cost of renewable energy systems, or will have greater access to grant funds (e.g. EST community energy and EEC funding)

6.3.2 Building-integrated renewable energy – the issue of 'Undue Burden' and 'Viability'

PPS22[18] states that policies to encourage on-site renewable generation should not be framed in such a way as to place an "undue burden" on developers, and should only be required at sites where RE generation is viable. Definition of this will depend on at what stage a developer is told of a requirement for on-site generation. A developer is most likely to be able to meet the expectations of a local authority if told before the land is bought. This demonstrates the importance of having a level playing field across the region.

The London Renewables Toolkit provides some guidance on the likely cost implications of meeting a policy requirement for 10% carbon reduction from on-site RE generation. This indicates that developers should include the costs of renewables as part of their energy assessments (page 139/140 has a useful list). The tables in Annex 7 for typical developments indicate the cost implications for meeting specified renewables targets.

These indicate that in many cases the 10% target can be exceeded for less than 4% of building costs, and in many cases it is less than 1%. For most residential

[17] Energy Services Company – typically, such an organisation might own and manage the operation of a centralised heating system and sell heat to consumers. The organisation would be responsible for metering and billing.
[18] Planning Policy Statement 22: Renewable Energy, ODPM 2004

developments the provision of solar water heating can meet the 10% target for a cost of around 1%. With economies of scale in larger developments this is likely to be less than 1%.

There are a wide range of factors that will affect these costs in any particular development and therefore it will be for the developer to justify why a particular technology is not viable and why, on a particular development, the 10% target could not be achieved. The London Toolkit indicates that for many developments there is potential to exceed the 10% target with no significant cost implications.

The Toolkit refers to a whole range of factors that can influence costs. Some are difficult to quantify, for example future energy costs and grant levels. It also looks at the benefits of renewable energy, although developers may be reluctant to emphasise these.

6.3.3 Policy roll-out

In the first few years, there will be issues of a lack of capacity to implement this policy both on the part of developers as well as local planning authorities (LPAs), including the capacity of LPAs to enforce any policy. Therefore, the assumption used in the analysis is that for the first few years of the policy, up to 2007-08, the focus will be on strategic major developments. This initial period will give time to roll out the tools and training necessary to support the deployment of the strategy. The envisaged roll-out of the policy in major developments is set out below, and is based on when new developments are completed:

Table 18: Estimate of policy roll-out used for modelling

Year	% built major developments meeting policy requirement
Start - 2007	30%
2008	40%
2009	70%
2010	90%
2011	90%
2012	90%
2013	90%
2014	90%
2015	90%
2016 - 2020	90%

An estimate of the resulting new build capacity as a result of the 10% target, assuming this policy roll-out and the technology mix given in 6.1.4 is given in Annex 7 and is summarised in table 17.

It should be stressed that this assumption about how the policy might roll-out is for the purposes of modelling only. It is not intended to be a statement of how roll-out should be achieved in practice.

7 ENVIRONMENTAL, ECONOMIC AND SOCIAL BENEFITS OF BASE SCENARIOS

7.1 Environmental

The main beneficial environmental impact of the proposed renewable energy scenarios is the displacement of fossil fuels, which leads to a reduction in CO_2 emissions. These relate directly to the energy generation (MWh) figures associated with the capacity (MW) targets for each technology. Table 19 presents a summary of potential CO_2 savings for each scenario by technology. A summary of CO_2 savings that may result from the new build elements within the on-site generation target is also given.

7.2 Economic

The economic benefits of the scenarios can be estimated to some degree in terms of the revenue and employment brought to the region. Tables 20 and 21 present estimates of investment and jobs retained in the region as a result of the various scenarios. Summaries of benefits relating to the new build elements within the on-site generation target are also given.

One of the main benefits relating to the growth of technologies is the creation of jobs, particularly with regard to rural regeneration in the case of biomass. Opening up the wood fuel market will boost the value of woodlands and wood resources and will help to sustain the ailing forestry and farming communities.

The impact of the scenarios will also benefit other industries through direct and indirect multiplier effects. The economic benefits of these, however, are more difficult to quantify due to the range of industry types potentially involved. Biomass, for example, may involve the forestry sector, waste contractors, joineries, etc in relation to fuel supply. The uncertainty of the multiplier effects, such as the increased expenditure in the local area of people involved with the project, also adds to the complexity.

7.3 Social

One of the main social benefits resulting from the growth in technologies concerns the reduction in energy costs for consumers. The risk of fuel poverty will decrease if households are supplied with cheaper locally-generated renewable heat or electricity. Similarly, community-use buildings can potentially lower their running costs, which may free up resources to benefit the users in other ways.

Solar water heating, for example, typically contributes up to 50% of domestic water heating demand. Under Scenario 2, the SWH retro-fit domestic target for 2020 is 17GWh. Achieving this target could reduce annual heating bills by up to 10% for around 14,000 households.

As part of the off-gas mapping exercise, 28 wards were identified that have the highest concentration of off-gas domestic heat load (see annex 2, table 32). These wards were compared with the Fuel Poverty Indicator for the SW, to determine the

degree of correlation with the incidence of fuel poverty, and hence the potential for the use of renewable heat for tackling fuel poverty. In total 14 of the 25 wards (56%) with valid totals had levels of fuel poverty above the average for the South West.

The top 28 had 5 wards within the upper quartile of fuel poverty for the South West with four from Cornwall and 1 from Devon[19]. The ward with the highest proportion of fuel poverty, Morvah, Pendeen and St. Just (28.9%) was also in the upper quartile for England.

[19] these 5 are Morvah, Pendeen and St. Just / Rock / Porthleven and Sithney / Duloe, Lansallos and Pelynt / Holsworthy

Table 19: Carbon saving benefits associated with each scenario

HEAT TECHNOLOGIES	CO_2 Savings [thousands of tonnes/yr]					
	Scenario 1		Scenario 2		Scenario 3	
	2010	2020	2010	2020	2010	2020
Woodfuel Heating	13.0	60.8	23.8	123.9	23.8	123.9
Heat Pumps	1.9	8.8	4.7	24.4	4.7	24.4
Solar Water Heating	1.7	3.8	4.7	18.4	4.7	18.4
CHP (where heat is usefully used) - from AD, EfW or biomass	0.0	0.0	4.7	23.2	44.9	159.7
Total	**17**	**73**	**38**	**190**	**78**	**326**

ELECTRICITY GENERATION TECHNOLOGIES	CO_2 Savings [thousands of tonnes/yr]									
	Scenario 1		Scenario 2		Scenario 2a		Scenario 2b		Scenario 3	
ONSHORE	2010	2020	2010	2020	2010	2020	2010	2020	2010	2020
Onshore wind	203.4	339.0	395.5	621.5	395.5	621.5	395.5	621.5	452.0	904.0
Energy crops/FR	0.0	17.0	101.7	339.0	152.6	627.2	135.6	339.0	247.5	678.0
Tidal barrage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.4
Building Integrated Renewables	0.1	1.9	1.3	18.8	3.8	37.7	3.8	18.8	1.9	37.7
Hydro	13.6	13.6	13.6	22.6	13.6	22.6	13.6	22.6	13.6	22.6
Energy from waste (RO eligible)	53.7	107.4	125.2	357.8	125.2	536.8	125.2	357.8	125.2	536.8
Anaerobic digestion	5.1	5.1	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Landfill Gas	164.6	107.4	164.6	107.4	164.6	107.4	164.6	107.4	164.6	107.4
OFFSHORE										
Offshore wind	0.0	0.0	0.0	65.9	0.0	65.9	0.0	65.9	0.0	65.9
Wave	11.3	17.0	22.6	101.7	22.6	322.1	22.6	282.5	22.6	322.1
Tidal stream	1.1	2.3	2.3	36.2	2.3	137.9	2.3	113.0	2.3	137.9
Total	**453**	**610**	**834**	**1,678**	**887**	**2,486**	**870**	**1,935**	**1,036**	**2,845**

SUMMARY FOR NEW BUILD ON-SITE GENERATION (resulting from 10% generation policy)	CO2 Savings [thousands of tonnes/yr]	
	2010	2020
Heat Technologies (new build)	8.9	43.6
Electricity Generation Technologies (building integrated renewables - new build)	3.7	18.0
Total	**13**	**62**

Notes on Table 19

- THE SUMMARY FOR NEW BUILD GENERATION SHOULD NOT BE ADDED TO THE OTHER TWO TABLES – THE REGIONAL BENEFITS ARE ALREADY ACCOUNTED FOR UNDER THE SEPARATE RENEWABLE HEAT AND ELECTRICITY TABLES

- For heat technologies, CO_2 factors of 0.19 kgCO_2/kWh are used for mains gas areas and 0.25 kgCO_2/kWh for off-gas areas, where oil is assumed to be displaced. A factor of 0.43 kgCO_2/kWh is used for electricity generation technologies.

- In converting delivered heat targets to the equivalent amount of fossil fuel offset, fossil fuel plant efficiency is taken as 90% for woodheating, SWH, heat pumps and new build heat from renewable CHP; and 75% for retrofit renewable CHP heat.

- For each heat technology, the off-gas proportion of new build capacity is taken to be 18% – this being the overall proportion of off-gas dwellings in the region.

- For wood fuel heating, all retro-fit capacity is assumed to be in off-gas areas, and therefore displacing heating oil.

- For retrofit solar water heating and renewable heat from CHP, the off-gas proportion of installed capacity is taken to be 18% – this being the overall proportion of off-gas dwellings in the region.

- For heat pumps, electricity consumption is taken into account by assuming an average COP of 3.5 and specific load factors for the domestic and non-domestic elements of the target (See Annex 7).

- Although biomass technologies are assumed to be carbon neutral in the above tables, there will be a small amount of CO_2 emitted from fuel transport and processing. One source estimates this to be 0.025 kgCO_2/kWh (Energy Systems Trade Association), which would have the effect of decreasing savings by around 10%.

Table 20: Economic benefits associated with each scenario

HEAT TECHNOLOGIES	Installed Capital Cost/MW [£m/MW]		% of Installed Capital Cost Retained in SW	Direct Regional Financial Benefit [£millions]					
				Scenario 1		Scenario 2		Scenario 3	
	2010	2020		2010	2020	2010	2020	2010	2020
Woodfuel Heating	0.2	0.2	35%	1.7	7.3	3.3	15.6	3.3	15.6
Heat Pumps	1.3	1.1	40%	4.2	16.1	10.7	47.0	10.7	47.0
Solar Water Heating	1.2	1.1	35%	5.3	11.1	14.6	53.2	14.6	53.2
CHP (where heat is usefully used) from AD, EfW or biomass - costs refer to heat main only	0.05	0.05	50%	0.0	0.0	0.2	1.0	1.7	6.1
Total	**–**	**–**	**–**	**11**	**34**	**29**	**117**	**30**	**122**

ELECTRICITY GENERATION TECHNOLOGIES	Installed Capital Cost/MW [£m/MW]		% of Installed Capital Cost Retained in SW	Direct Regional Financial Benefit [£millions]									
				Scenario 1		Scenario 2		Scenario 2a		Scenario 2b		Scenario 3	
ONSHORE	2010	2020		2010	2020	2010	2020	2010	2020	2010	2020	2010	2020
Onshore wind	0.7	0.6	20%	25.2	36.0	49.0	66.0	49.0	66.0	49.0	66.0	56.0	96.0
Energy crops/FR	2.0	1.6	40%	0.0	3.2	24.0	64.0	36.0	118.4	32.0	64.0	58.4	128.0
Tidal barrage	2.0	2.0	20%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.2
Building Integrated Renewables	4.5	2.5	30%	0.4	3.8	4.7	37.5	13.5	75.0	13.5	37.5	6.8	75.0
Hydro	1.2	1.2	60%	6.5	6.5	6.5	10.8	6.5	10.8	6.5	10.8	6.5	10.8
Energy from waste (RO eligible)	2.5	2.2	30%	11.3	19.8	26.3	66.0	26.3	99.0	26.3	66.0	26.3	99.0
Anaerobic digestion	3.0	2.0	20%	0.9	0.6	1.2	0.8	1.2	0.8	1.2	0.8	1.2	0.8
Landfill Gas	0.7	0.7	20%	6.4	4.2	6.4	4.2	6.4	4.2	6.4	4.2	6.4	4.2
OFFSHORE													
Offshore wind	1.0	0.8	20%	0.0	0.0	0.0	8.0	0.0	8.0	0.0	8.0	0.0	8.0
Wave	1.4	1.0	50%	7.0	7.5	14.0	45.0	14.0	142.5	14.0	125.0	14.0	142.5
Tidal stream	1.5	1.1	50%	0.8	1.1	1.1	26.4	1.5	67.1	1.5	55.0	1.5	67.1
Total	**–**	**–**	**–**	**58**	**83**	**133**	**329**	**154**	**592**	**150**	**437**	**177**	**643**

SUMMARY FOR NEW BUILD ON-SITE GENERATION (resulting from 10% generation policy)	Direct Regional Financial Benefit [£millions]	
	2010	2020
Heat Technologies (new build)	15.5	68.1
Electricity Generation Technologies (building integrated renewables - new build)	12.7	34.6
Total	**28**	**103**

Notes on Table 20

- THE SUMMARY FOR NEW BUILD GENERATION SHOULD NOT BE ADDED TO THE OTHER TWO TABLES – THE REGIONAL BENEFITS ARE ALREADY ACCOUNTED FOR UNDER THE SEPARATE RENEWABLE HEAT AND ELECTRICITY TABLES

- Cost/MW figures are indicative only and are based on broad estimates of gross capital cost. Two costs for each technology are included to represent average costs up to 2010 and 2020. Figures are drawn from a number of sources including DTI's Renewable Supply Chain Gap Analysis Summary Report (2004), OXERA's report for the DTI – Results of Renewables Market Modelling (Feb 2004) and the Seapower SW Review – Resources, Constraints and Development Scenarios for Wave and Tidal Stream Power in the South West of England (Jan 2004).

- In the case of biomass, there will be an additional benefit to the region from the sale of local fuel supplies, which is not included in the above figures. For woodfuel heating, sales will be in the order of £19.8k/MW_{th} based on a cost of £35/dte and a 1MW_{th} plant requiring 566 dte/yr of fuel, based on 2500 full load running hours. For energy crops, the figure will increase to around £200k/MW_e, based on a cost of £25/dte and a 1MW_e plant requiring 8,000 dte/yr of fuel (see Annex 1). The load factors assumed are given in Section 8.1.3 and Annex 7. To illustrate, this would have the effect of increasing the direct regional financial benefit for energy crops (Scenario 2b 2010) from £32m to £40m.

- The figures listed for the proportion of investment retained in the region are speculative and are based on local manufacturing and installation capability.

Table 21: Employment benefits associated with each scenario

HEAT TECHNOLOGIES	Jobs/MW		Jobs Created					
			Scenario 1		Scenario 2		Scenario 3	
	Gross	Retained in SW	2010	2020	2010	2020	2010	2020
Woodfuel Heating	–	3	66	314	128	667	128	667
Heat Pumps	15	6	48	219	124	640	124	640
Solar Water Heating	21	6	81	182	221	871	221	871
CHP (where heat is usefully used) from AD, EfW or biomass figures refer to heat main only	8	3	0	0	27	133	219	786
Total	**–**	**–**	**195**	**714**	**500**	**2,312**	**692**	**2,965**

ELECTRICITY GENERATION TECHNOLOGIES	Jobs/MW		Jobs Created									
			Scenario 1		Scenario 2		Scenario 2a		Scenario 2b		Scenario 3	
ONSHORE	Gross	Retained in SW	2010	2020	2010	2020	2010	2020	2010	2020	2010	2020
Onshore wind	5	1	180	300	350	550	350	550	350	550	400	800
Energy crops/FR	21	7	0	37	221	735	331	1,360	294	735	537	1,470
Tidal barrage	6	2	0	0	0	0	0	0	0	0	0	67
Building Integrated Renewables (PV only)	33	5	1	25	17	248	50	495	50	248	25	495
Hydro	19	10	86	86	86	143	86	143	86	143	86	143
Energy from waste (RO eligible)	20	7	105	210	245	700	245	1,050	245	700	245	1,050
Anaerobic digestion	8	2	3	3	4	4	4	4	4	4	4	4
Landfill Gas	7	2	81	53	81	53	81	53	81	53	81	53
OFFSHORE												
Offshore wind	9	2	0	0	0	113	0	113	0	113	0	113
Wave	–	3	30	45	60	270	60	855	60	750	15	214
Tidal stream	–	3	3	6	6	96	6	366	6	300	2	92
Total	**–**	**–**	**488**	**764**	**1,069**	**2,910**	**1,211**	**4,987**	**1,175**	**3,594**	**1,393**	**4,499**

SUMMARY FOR NEW BUILD ON-SITE GENERATION (resulting from 10% generation policy)	Jobs Created	
	2010	2020
Heat Technologies (new build)	251	1,235
Electricity Generation Technologies (building integrated renewables - new build)	44	215
Total	**295**	**1,450**

Notes on Table 21

- THE SUMMARY FOR NEW BUILD GENERATION SHOULD NOT BE ADDED TO THE OTHER TWO TABLES – THE REGIONAL BENEFITS ARE ALREADY ACCOUNTED FOR UNDER THE SEPARATE RENEWABLE HEAT AND ELECTRICITY TABLES

- The figure for 'jobs retained in SW' for woodfuel heating are taken from *The Wood Fuel Opportunity: Developing the Wood Fuel industry in the South West* by Renewable Heat & Power Ltd (Jan 2004). This includes installation and O&M elements and allows for multiplier effects. No 'gross' figure is supplied.

- Figures for wave and tidal are based on the *Seapower SW Review – Resources, Constraints and Development Scenarios for Wave and Tidal Stream Power in the South West of England* SWERDA (Jan 2004). No 'gross' figure is supplied.

- Figures for heat pumps, CHP heat, tidal barrage & anaerobic digestion are assumptions made by the authors based on the regional aspects of project development, construction and operation.

- 'Gross' jobs/MW figures for other technologies are based on those used in *Renewable Supply Chain Gap Analysis - Summary Report* DTI (2004), which consider the development, construction and operation phases of a project, and include multiplier effects on 'induced' jobs. They are also 'import adjusted' to exclude the job elements allocated overseas. A further adjustment has been made to estimate the proportion of jobs likely to be retained in the region. This attempts to assess the regional manufacturing capacity along with the regional job elements of the supply chain 'Tier 0' (project developer, turnkey contractor and operator) as considered in the DTI study.

8 TARGET PROPOSALS

8.1 Renewable electricity targets

In developing the target proposals for renewable electricity in 2020, the project was asked to consider the feasibility of the region delivering 20% of its electricity demand from renewable sources by 2020,

For the purposes of this project two figures for the South West's electricity demand have been estimated.

The first assumes the existing energy efficiency and demand reduction policy measures contained within the government's Climate Change Programme (CCP). On this basis it has been estimated that demand in the South West may increase to 2020 by approximately 15%.

The second assumes all the savings forecast within the recent Energy White Paper. On this basis it has been estimated that demand in the South West may decrease by less than 3%.

How these figures have been estimated is summarised in Annex 2. These figures take into account above-average increases in housing and Gross Value Added (GVA) in the South West as forecast by the South West RDA.

In order to meet 20% of the electricity demand as forecasted, an increase in renewable electricity generating capacity to a level somewhere between Scenarios 2 and 3 is required.

The main technologies that have the potential for increased capacity in terms of the differences between Scenarios 2 and 3 include:

- onshore wind
- energy from waste
- biomass
- building-integrated renewables
- wave and tidal stream

From the initial stakeholder consultation meeting in March it was clear that there was significant, though not unanimous, concern around increasing the onshore wind contribution further than was outlined within Scenario 2. The two further scenarios outlined below therefore look to meet the two different forecasts for electricity demand in 2020 by increasing the other technologies only.

8.1.1 Scenario 2a – 20% electricity demand assuming climate change programme measures

In order to achieve 20% of electricity demand assuming only the existing policy measures already within the government's Climate Change Programme (CCP) (representing a 15% increase in electricity demand within the South West), requires:

- pushing up energy crops use to 75% of the total resource available

- increasing energy from waste so that the vast majority of the waste going for secondary treatment by 2020 will be to energy recovery
- assuming wave and tidal stream reach the maximum capacity outlined within the recent Seapower South West Review report
- that by 2020 PV more commercially viable or higher government support leading to greater retrofit – small scale generators selling ROCs and roof mounted turbines (permitted development) we have third-generation PV technology enabling a significant increase in installation rates due to greater commercial viability

All other technologies, including onshore wind, are as Scenario 2. Increasing onshore wind would obviously reduce the pressure on the technologies outlined above.

For more information on the assumptions made within the base scenarios 1 to 3, see Annex 1.

Figure 15: Scenario 2a summary (electricity)

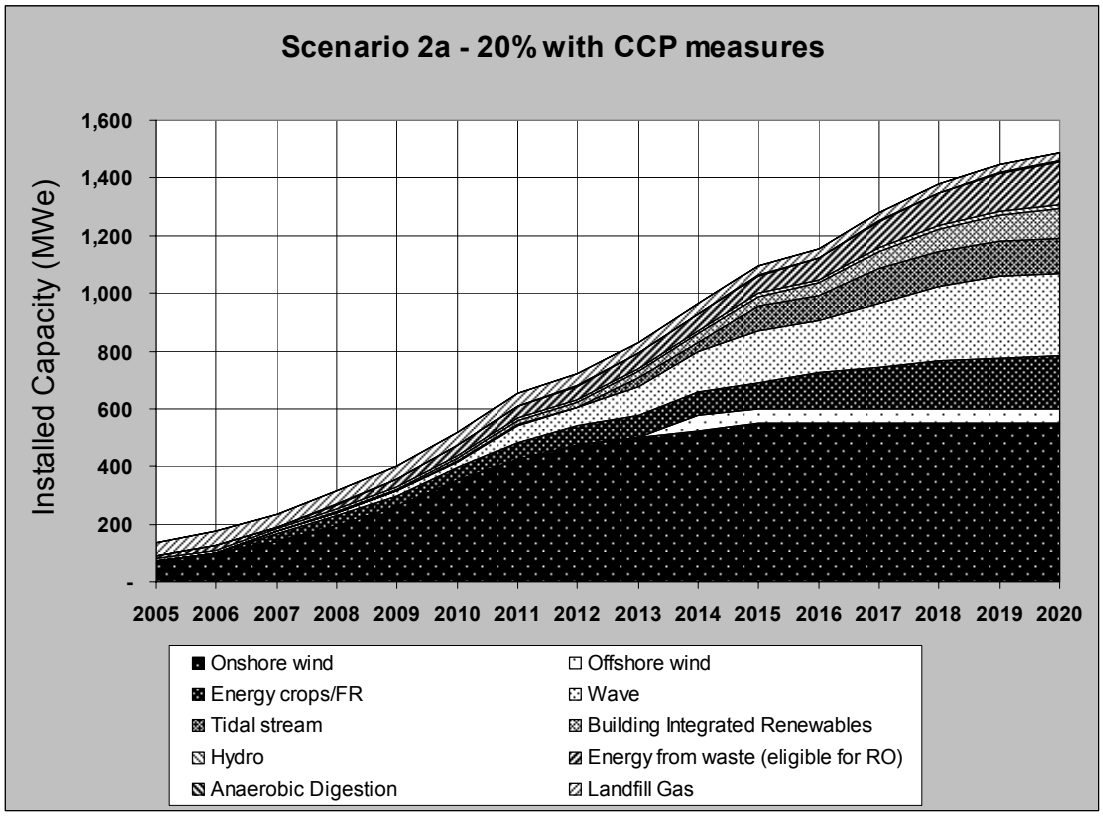


Table 22: Scenario 2a summary (electricity)

	2010		2020	
Onshore technologies	**MWe**	**GWh**	**MWe**	**GWh**
Onshore wind	350	920	550	1,445
Energy crops/FR	45	355	185	1,459
Building Integrated Renewables	10	9	100	88
Hydro	9	32	15	53
Energy from waste (eligible for RO)	35	291	150	1,248
Anaerobic Digestion	2	16	2	16
Landfill Gas	46	383	30	250
Sub total	**497**	**2,005**	**1,032**	**4,558**
Offshore technologies				
Offshore wind	0	0	50	153
Wave	20	53	285	749
Tidal stream	2	5	122	321
Sub total	**22**	**58**	**457**	**1,223**
Total MW	**519**	**2,063**	**1,489**	**5,781**
% Electricity Consumption		**8.2%**		**20.0%**

8.1.2 Scenario 2b – 20% electricity demand assuming energy white paper measures

In order to achieve 20% of electricity demand, assuming the energy efficiency and demand reductions implicit within the Energy White Paper[20] (representing an 11% reduction in electricity demand within the South West), requires:

- an assumption that wave and tidal stream capacity is increased substantially, though not as high as within scenario 2a

All other technologies, including onshore wind, are as Scenario 2.

For more information on the assumptions made within the base scenarios 1 to 3, see Annex 1.

[20] See footnote 5, page 5

Figure 16: Scenario 2b summary (electricity)

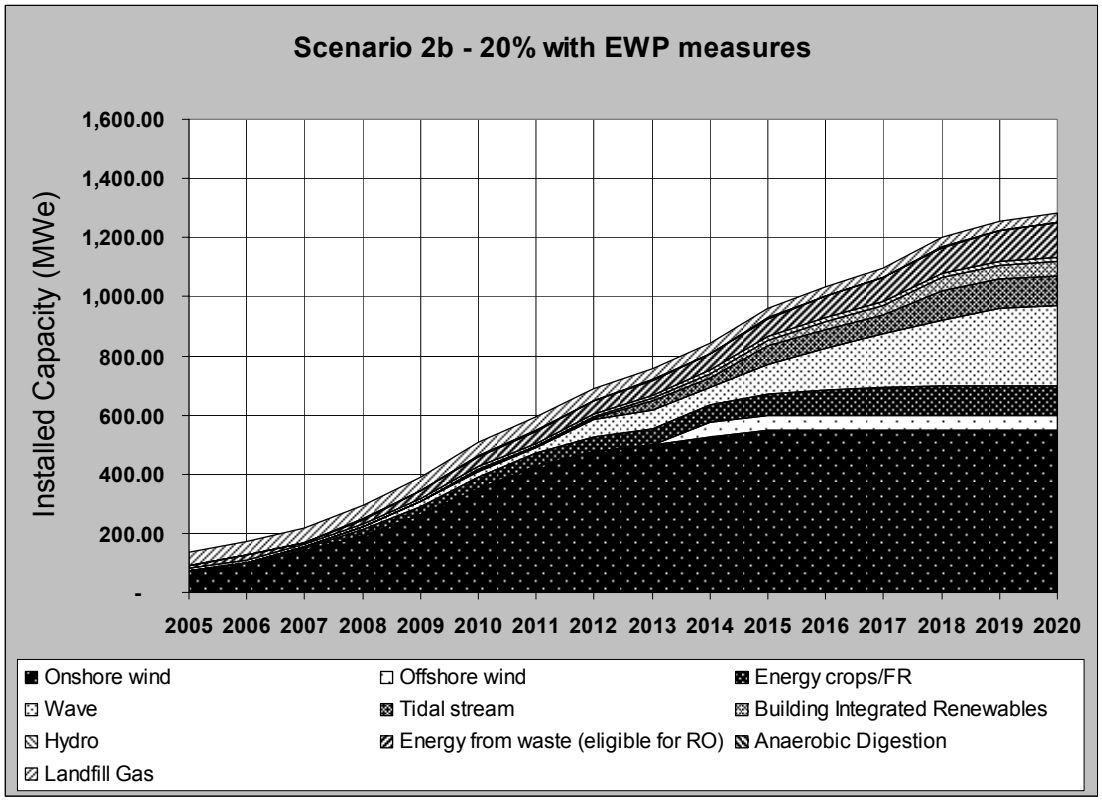


Table 23: Scenario 2b summary (electricity)

	2010		2020	
Onshore technologies	**MW**	**GWh**	**MW**	**GWh**
Onshore wind	350	920	550	1,445
Energy crops/FR	40	315	100	788
Building Integrated Renewables	10	9	50	44
Hydro	9	32	15	53
Energy from waste (eligible for RO)	35	291	100	832
Anaerobic Digestion	2	16	2	16
Landfill Gas	46	383	30	250
Sub total	**492**	**1,965**	**847**	**3,428**
Offshore technologies				
Offshore wind	0	0	50	153
Wave	20	53	250	657
Tidal stream	2	5	100	263
Sub total	**22**	**58**	**400**	**1,073**
Total MW	**514**	**2,023**	**1,247**	**4,501**
% Electricity Consumption		**8.1%**		**20.0%**

8.1.3 Achieving a 20% target – scenario summary

Scenario 2a is very challenging, pushing technologies like energy crops and energy from waste close to their resource limits. Given the other potential approaches to secondary waste treatment and the competing uses for land, if this scenario for electricity demand in 2020 is selected then it seems likely that onshore wind will have to be increased in order to achieve the 20% target.

Scenario 2b will be far from easy but its requirement to expand energy crops and energy from waste is not so challenging. Also it doesn't rely on third-generation PV technology maturing within the timescale. The potential employment benefits are significantly reduced as a result of the lower energy crops and energy from waste contributions, both of which have a relatively high employment ratio as compared to the other technologies.

Table 24: 2020 scenario summary – achieving a 20% target (electricity)

Onshore technologies	Scenario 2a (MW)	Scenario 2b (MW)
Onshore wind	550	550
Energy crops	185	100
Building Integrated Renewables	100	50
Hydro	15	15
Energy from waste (eligible for RO)	150	100
Anaerobic Digestion	2	2
Landfill Gas	30	30
Sub total	**1,032**	**847**
Offshore technologies		
Offshore wind	50	50
Wave	285	250
Tidal stream	122	100
Sub total	**457**	**400**
Total	**1,489**	**1,247**
% Electricity Consumption	**20.0%**	**20.0%**

At the planning peer review meeting in April it was agreed that scenario 2b should form the basis for the proposed 2020 renewable electricity target, primarily due to the desire to commit the region to higher levels of energy efficiency.

Table 25 summarises the load factors assumed for each technology when estimating electricity generation (GWh) and therefore the degree to which any scenario is capable of meeting a proportion of electricity demand. Where there has been some uncertainty, a low figure has been adopted to ensure the estimates are realistic.

Table 25: Load factors assumed by technology

Technology	Load factor
Onshore wind	0.3
Energy crops	0.9
Building Integrated Renewables (solar PV and micro wind)	0.1
Hydro	0.4
Energy from waste (eligible for RO)	0.95
Anaerobic Digestion	0.9
Landfill Gas	0.95
Offshore wind	0.35
Wave	0.3
Tidal stream	0.3

8.1.4 Will the South West meet its current target for 2010?

Scenarios 2A and 2B suggest that by 2010 the region may have enough capacity in place to generate between 8 – 8.5% of the region's electricity demand. Given that the

existing 2010 target for the region equates very roughly to 10% of the region's electricity demand, these scenarios are suggesting that we may undershoot the 2010 target. These estimates are in line with national predictions, for example the Renewables Innovations Review suggested that we may get 8% of the national target whilst the House of Lords suggested that it may be even less. However importantly, this is not a reason for reducing the target. It is recognised that the way the key market mechanism, the Renewables Obligation, works creates the situation that when over 70% of the target is met, the financial incentives available for further development rapidly decrease. It seems that in practice it will be very difficult to ever meet a target with the current market mechanisms in operation. The current review of the Renewables Obligation is considering this issue among many others. In short, if the target is reduced there is a danger that what we achieve will also be reduced.

8.2 Renewable heat targets

Based on the above scenarios, assuming that the policy setting described in Scenario 2 is put in place, then the following challenging but achievable targets for renewable heat set out in the table below are proposed. The capacity figures for heat pumps shown for scenario 2 have been de-rated (following input from consultation with stakeholders) to allow for the fact that non-renewable electricity will predominantly be used to drive heat pumps[21].

Table 26: Renewable heat target 2010 & 2020

Timescale	Installed Capacity (after heat pump de-rating) (MWth)
2010	105
2020	503

8.3 On-site generation target

The proposed policy is:

All developments will include a proportion of their energy from renewable sources. Major developments will be expected to provide, as a minimum, sufficient on-site renewable energy to reduce carbon dioxide emissions from energy use on-site by 10%.

The choice of a 10% carbon reduction target was chosen based on the analysis presented in section 6 and was felt to strike the balance of being both viable and challenging, without placing an undue burden on developers.

Compliance with the 10% target will be measured with reference to an Energy Use Assessment, which developers will also be required to produce for major developments. This will give a baseline figure for CO_2 emissions for a development, before the use of any renewable energy, but after the use of energy efficiency

[21] Assuming a Coefficient of Performance of 3.5, then for every 1kW of electrical power used to drive a heat pump, 3.5kW of useful heat power is produced, and therefore the net renewable capacity is 2kW. This represents 71% of the installed capacity. Therefore a de-rating of 0.71 has been applied. This reduces the heat pump installed capacity under scenario 2 from 21MW in 2010 to 15MW, and from 107MW in 2020 to 76MW.

measures and measures such as passive solar design. As well as enforcing compliance with this 10% target, Local Planning Authorities (LPAs) will need to check that built developments comply with the plans submitted as part of the Energy Use Assessment.

Although the option of having different targets for different types of development (e.g. residential vs. non-residential) was considered, it was felt by stakeholders that a simpler approach of a single target level was best.

9 KEY ISSUES FOR DELIVERING TARGETS

Of the points outlined within the following sections, those actions or outcomes that can be influenced at a regional and/or local level are in italics.

9.1 Renewable electricity targets

In order to meet the 2010 renewable electricity target there will need to be:

- *wider public and political acceptance of the need for renewable energy, in particular biomass, energy from waste (EfW) and onshore wind technologies*
- *greater objectivity within the planning process and more focussed planning policies within Local Development Documents (LDD), in line with PPS22 (Planning Policy Statement 22)*
- *a rapid increase in the planning success rate for onshore wind energy*
- *the Wave Hub operating and attracting developers*
- *increased regional experience of biomass and advanced EfW technologies through regional demonstrator projects, possibly instigated by the public sector*
- *Early development of biomass and EfW projects to enable longer lead in times to be accommodated before 2010*
- a revision of the Renewables Obligation (RO) to enable a theoretical target to be reached in practice, see section 8.1.4

In order to meet the 2020 renewable electricity target there will need to be:

- *an increase in land use for biomass, based on a corresponding increase in farmer enthusiasm for energy crops and a public acceptance of energy crops within the landscape*
- *a significant expansion of biomass supply chains based on effective infrastructural support mechanisms*
- a financial support mechanism introduced for renewable heat production
- continued and expanded government financial support for biomass, wave and tidal technologies
- an expansion of the RO from 2015 (as it stands now) to 2020
- economic viability for biomass and advanced EfW technologies
- *an acceptance of energy recovery via advanced EfW technologies as the primary means of dealing with secondary waste treatment*
- commercialisation of wave and tidal stream technologies
- *a strengthening of the distribution grid to accommodate growth in offshore generation and support higher levels of embedded generation within the network*
- *a significant increase in the priority placed on energy efficiency at a regional level supported by effective central government policy*
- *high levels of energy efficiency activity at a local level*

9.2 Renewable heat targets

In addition to the points listed in 9.1, in order to meet the renewable heat targets there will need to be:

- sustained levels of grant funding available to support both capital and development costs for renewable heat projects in the South West up to 2010
- very significant growth in market penetration of pellet stoves and boilers into the domestic retro-fit market, requiring additional support for the wood pellet sector within the region
- significant adoption of community heating both for new build and existing buildings
- *significant utilisation of heat from large scale renewable Combined Heat and Power (CHP) both within new build and existing buildings*
- significant market penetration of heat pumps and biomass heating into the market for boiler replacement, driven by social housing for domestic buildings and public sector for non-domestic buildings
- *compliance with the policy for on-site generation from renewable sources for new build for 90% of all major developments in South West by 2010. This would lead to the deployment of biomass and heat pump technologies in on-gas as well as off-gas areas*
- beyond 2010, increasing the use of sources of wood fuel other than forest residues

9.3 On-site generation target

Key issues in relation to implementing an on-site generation target will be:

- *The need for LPAs in the South West to define lower thresholds for major developments, to suit their own circumstances*
- *The need for exemplar developments in 2007-08 to demonstrate how target can be implemented and to provide basis for case studies*
- *The need to build capacity of local planning authorities to enforce targets*
- *The need to build capacity of developers to comply with targets*

10 KEY ISSUES - PLANNING POLICIES

10.1 Renewable electricity targets

10.1.1 Links with the current regional planning guidance target for 2010

The links between the 2010 target in Regional Planning Guidance (RPG) and the 2010 target proposed in Annex 10 are complex. The original target as proposed in RPG 10 was couched as a percentage of the region's electricity production. The range, from 11-15% was due not to any difference in renewable electricity capacity but due to an uncertainty as to whether new power station development in the region would take place or not. Terence O'Rourke and the Energy Technology Support Unit (ETSU) in their original study indicated that the target would equate to 597 MW.

This figure was then reviewed as part of the REvision 2010 project that sought to establish sub regional targets through an extensive consultation process within the region. The sub regional figures outlined within policy E1 in Annex 10 are the figures that were agreed by the sub-regions as their targets for 2010. The overall target for 2010 outlined within policy E1 includes only the onshore contribution to the regional target (see section 10.1.2 below). Including the offshore contribution the 2010 target for renewable electricity is 563-665 MW.

10.1.2 Split between onshore and offshore capacity

The 2010 and 2020 targets have each been developed as two separate figures, in accordance with guidance in PPS22 that recommends that the onshore target should be considered separately to the offshore resource. As a result, the target outlined within E1 of the planning document (Annex 10) only refers to the capacity attributable to onshore technologies. However, when considering the ability of the South West to meet 20% of the region's electricity demand, the total target including both offshore and onshore capacity has been considered.

10.1.3 Broad areas

The PPS22 companion guide suggests the identification of broad geographical areas suitable for renewable energy development. Whilst this is desirable in terms of providing greater clarity as to where in the region renewable energy development might occur, it does require a number of difficult assumptions to be made. For example, where there are a large number of areas available where renewable energy development is particularly appropriate, identifying just a few could create constraints on development elsewhere, even if it is stressed that this is not intended. This is certainly the case in the South West where economic windspeeds and biomass capture radii are such that large areas of the region could be appropriate for these two technologies.

As a result the planning document takes a two pronged approach to indicating potential spatial distribution of renewable energy technologies. Firstly it provides the sub regional technology mix discussed as part of the REvision 2010 project that set the 2010 targets. This is summarised as pie charts across the region in the format suggested within the PPS22 companion guide. Secondly it outlines, on a regional map, the range of spatial constraints and opportunities facing renewable energy development, for example designated areas, Principal Urban Areas (PUAs) etc. It

then provides a brief summary of the key spatial issues for each of the main technologies.

10.1.4 Meeting 20%

How and why the target is couched as a percentage of electricity demand is addressed elsewhere in this document (section 8 and Annex 5). However it was felt to be important to include reference to the 20% target within the policy E1 in order to capture the region's overarching objective and to create a link with the target within the current RPG that includes offshore capacity. As a result, a brief description of the 20% figure was also provided within the text.

10.1.5 Length of document

The planning document presented as Annex 10 is recognised as being too long for full incorporation within Regional Spatial Strategy (RSS). A shorter version that includes the core policies and brief explanatory text has also been produced to be considered for incorporation within the RSS. The fuller document in Annex 10 could well form the basis of a regional Supplementary Planning Document (SPD).

10.1.6 Supplementary planning documents

Developing SPDs could be a valuable way of capturing information that is surplus to the RSS itself, but nonetheless useful. However, a SPD could also cover the following issues.

The evidence base that supports RSS
A list and summary of the relevant background documents and the steps taken to arrive at the conclusions that have informed RSS, with particular reference to consultation undertaken.

Detailed advice
SPD can be used to provide region-wide advice on specific topics. The starting point should be the Policy E5 Criteria.

Likely candidate topics include:

- Landscape character and sensitivity
- The approach to considering cumulative visual impacts
- Listings of designated habitats and the relevant legislative safeguards
- Detailed guidance on noise and safeguarding distances
- Signposting other policies and documents which deal with access

Guidance on the content of Local Development Documents (LDDs)
Following the advice of PPS22 and the Companion Guide:

- Do not allocate sites for renewable energy development in LDDs unless they are the subject of firm developer intentions, PPS22 para 6
- LDD criteria should expand upon RSS criteria to reflect local circumstances (for example the protection of particular views or viewpoints from intrusive developments)
- On-site renewables, unpack detailed suggestions and local targets picking up on Policy E6
- Guidance on building design and layout including what to include in site briefs

- Guidance on detailed amenity issues
- Use of renewables in the local authority's own property and through procurement
- Community involvement, encouraging community schemes
- Development control issues

Whether elements of the evidence base (i.e. elements of this report) should be included or just referred to, and the balance of detail for the other potential areas that could be covered, will need to be discussed and decided upon.

10.2 Renewable heat targets

10.2.1 Should a target figure for renewable heat be in the RSS?

There was some debate as to whether there was justification for having renewable heat targets in the RSS, as, unlike renewable electricity, there is no national target for this. At the planning peer review meeting it was agreed that it was important and appropriate to have heat targets in the RSS because:

- it provides stimulus for developing action and strategies around renewable heat in the region, and supports the renewable heat actions within the regional renewable energy strategy
- the South West region has a lot to gain from harnessing its renewable heat resources, and heat targets are a way of adding regional flavour to the renewable energy policies in the RSS
- there exist some planning issues around renewable heat installations, and a target will give additional weight in favour of schemes
- it could provide added weight in favour of renewable CHP schemes where heat will be usefully used
- PPS22 provides a precedent, in that it talks about increasing the deployment of "renewable energy" in general, which is taken to cover both renewable electricity and renewable heat
- the (EC) White Paper on Renewable Energy Sources sets out a goal of doubling renewables' share of EU total energy supply, from 6 -12% by 2010. This includes renewable heat as well as electricity

10.2.2 Spatially matching major new build developments and renewable CHP

There is a key role for planners to play within the region in ensuring a synergy between sites for major new developments, and the location of renewable CHP generators, to ensure that the heat from the latter can be effectively used as part of community heating systems.

10.3 On-site generation target

10.3.1 Energy or carbon based target

There was debate about whether the target should be framed in terms of a percentage of on-site energy use, or as a percentage reduction in carbon emissions due to energy use. This mirrors a similar debate that has taken in place in London over the implementation of the target in the London Plan. The conclusion of the debate in London was that compliance with the targets is actually measured in terms of carbon rather than energy.

This has created a slightly confusing situation in that some London borough local plans refer to a 10% energy generation target for new build (the classic example being Merton), but compliance is actually measured by whether there is enough renewable energy on-site to reduce carbon emissions by 10%, compared to a baseline. The former principal planning officer for the London Borough of Merton (a member of this project team) explained that the energy-based target was adopted before detailed thought had been given to how it would be implemented, and that the carbon based approach is a later refinement.

The advantages of linking the target to a carbon reduction are that:

- it fits with existing methods for assessing sustainable construction
- it fits with the central aim of the Energy White Paper to reduce CO_2 and put UK on a path to a 60% cut in carbon emissions by 2050
- it provides better linkages to the energy hierarchy and broader sustainable energy policy - aim to reduce CO_2
- not all energy is equal – grid electricity produces twice as many carbon emissions per kWh than mains gas
- it (rightly) gives greater credit to electricity renewables as they will save more carbon
- it would avoid anomalies such as all-electric heating, and the use of inefficient heat pump systems which can actually increase CO_2 (as opposed to the use of well designed heat pump systems which certainly do reduce carbon emissions)

The disadvantage is that it is a more complex approach, and may be harder for policy makers to understand. It was agreed at the planning peer review meeting on 15th April that a carbon-based target should be used (as given in section 8). The proposed wording of the policy aims to avoid the confusion of the London situation by making it clear that compliance will be measured in terms of carbon reduction.

10.3.2 Should a target percentage be in the RSS?

Within the RSS, there is the option to simply state that “developments should include a proportion of their energy from renewable sources” and leave it to local planning authorities to state a target figure in their LDFs. However, it was agreed at the planning peer review meeting that there should be a percentage figure in the RSS because it:

- is a stronger policy statement, and therefore has greater weight in planning law
- sends out a clear message to the developer community that the South West has a level playing field in relation to such a policy. This is important to avoid the situation where developers may preferentially locate to those local authority areas in the region that don’t have a policy for on-site generation in place
- it sets a minimum target for LPAs to meet when developing their own policies – although they are free to set higher levels should they wish

10.3.3 Potential policy conflicts - impact on affordable housing

Concerns were expressed by some stakeholders about the possible impact of an on-site generation policy on affordable housing. Analysis suggests that the impact on build cost for new social housing development is likely to be minimal, based on the following:

- The 10% target can currently be met with three technologies for less than 3% extra on build cost, namely:

    - Solar water heating (1-2% extra)
    - Ground source heat pumps (2-3%)
    - Biomass district heating (3%)

- Housing associations and social landlords will be able to attract grants to reduce this impact of build cost to maybe half, e.g. from Utility EEC funds, EST Community Energy, etc.
- Housing associations will be required by end of 2005 to meet Ecohomes 'Very Good' standard – this will reduce CO_2 emissions, and hence reduce required investment in renewable energy capacity
- Renewable energy will also assist in compliance with the Ecohomes standard
- Social landlords are able to take a whole life approach to cost – an increase in build cost will be offset by lower running costs for both them and their tenants
- Furthermore, developers can be encouraged to focus compliance within social housing component of sites – thereby, the developer contribution can offset higher build cost for housing associations

10.3.4 Definition of major development

The proposed definition of a major development for the RSS, based on the ODPM PS2 definition used for reporting general developments, is:

- for dwellings, the development of 10 or more dwellings or sites of more than 0.5 ha, if the number is not given;
- for all other uses, where the floor space will be 1000m^2 or more, or the site is 1ha or more.

To suit their particular circumstances, individual LPAs may use lower thresholds for what constitutes a major development and set higher percentages for on-site generation.

The term 'major development' should be taken to include conversions, change of use and major refurbishments, whenever planning permission is required.

10.3.5 Definition of eligible renewable energy sources

There was some about whether buying in green electricity could be used as a way of meeting the target. However, as such arrangements can be temporary in nature, it was decided that this is not an eligible form of compliance. Off-site renewable energy generation would be eligible where there is a physical connection to the site, via a heat main or private wire.

Eligible forms of renewable energy for meeting the target currently include: solar water heating, PV, biomass heating, biomass CHP, wind generators, micro-hydroelectric, ground source heating and cooling, and air and water source heat pumps. It can also include heat from renewable CHP plants, such as: landfill gas, sewage gas, anaerobic digestion, biomass, and energy from waste.

10.3.6 Definition of on-site energy use

There was discussion as to whether or not industrial process heat should be included as part of the on-site energy demand. However, the decision was made to exclude this, as the process energy demand for industrial buildings may change significantly depending on who finally ends up occupying the building.

Energy use on site is defined as that used for servicing buildings and includes energy used for:

- space and water heating
- cooking
- lighting, appliances, and equipment, including computers, lifts, etc.
- ventilation and cooling

It excludes energy used for:

- industrial processes (as these can change depending on who occupies the building)
- transport
- embodied energy (e.g. energy used in building fabric)
- energy used to provide water, food, and shared infrastructure

10.3.7 The issue of 'undue burden' and 'viability'

The London Renewables toolkit provides some guidance on the likely cost implications of meeting the 10% policy requirement. This indicates that developers should include the costs of renewables as part of their energy assessments (page 139/140 has a useful list). The tables in Annex 7 for typical developments indicate the cost implications for meeting specified renewables targets.

These indicate that in many cases the 10% target can be exceeded for less than 4% of building costs, and in many cases it is actually below 1%. For most residential developments the provision of solar water heating can meet the 10% target for a cost of around 1%. With economies of scale in larger developments this is likely to be less than 1%. Therefore, the target of 10% is felt to be one that does not place an undue burden on developers. More detail is given on this in section 6 and Annex 7.

10.3.8 Measuring compliance

Compliance with the 10% target will be measured with reference to an Energy Use Assessment, which developers will also be required to produce for major developments. This will give a baseline figure for CO_2 emissions for a development, before the use of any renewable energy, but after the use of energy efficiency measures and measures such as passive solar design. As well as enforcing compliance with this 10% target, LPAs will need to check that built developments comply with the plans submitted as part of the Energy Use Assessment.

10.4 Monitoring

There may need to be more detailed discussions among key stakeholders at a regional level to agree how to best monitor the renewable energy targets. Suitable approaches to monitoring do exist and are summarised below.

- The renewable electricity capacity approved through the planning process can be monitored through the local planning authorities' annual monitoring review. Capacity installed can be monitored by the Regen SW annual survey

- For smaller scale renewable energy systems, where planning permission may not be required, the following monitoring routes may be used:

    - Details of numbers of installations from grant providers – e.g. Clear Skies, PV grants programme
    - Details of installations by SW installers – Regen SW could potentially compile this information

- Details of small-scale renewable energy systems installed on major new build developments should be captured via local authorities monitoring compliance with the requirement for on-site renewable energy generation and information compiled from the Energy Use Assessments

11 RECOMMENDATIONS FOR FUTURE ACTION

The following regional actions will be beneficial as part of the process of ensuring that the region addresses the key issues for the delivery of targets outlined above:

11.1 Renewable electricity

- Developing sub regional targets for renewable energy to 2020
- Support for development of Local Development Frameworks
- Training for members and officers with particular focus on onshore wind energy and energy from waste and biomass. In particular, there is a need to raise awareness of local authority officers of advanced thermal treatment as a viable alternative to mass burn incineration, where decisions on long term waste management strategies are still to be made
- Audit of public sector opportunities and action to promote demonstrator projects
- Detailed assessment of distribution grid needs with regard to expansion of renewables within the region
- Assessment of opportunities and needs for biomass fuel supply chain development within region
- Assessment of opportunities and needs for marine technology supply chain development within region
- Assessment of re-enforcement requirements for distribution and national grid networks
- Clearer regional policy on energy recovery and action to promote this within sub regional sustainable waste management strategies
- Developing a regional communications strategy on sustainable energy issues that outlines roles and responsibilities for regional and sub regional organisations
- Developing regional strategy and targets for energy efficiency and fuel poverty

11.2 Renewable heat

- Targeting wards with highest off-gas heat loads with support programmes for renewable heat, including awareness raising and grant support. Gain support of local politicians as champions
- Assessing the potential for the co-location of biomass CHP with high heat loads, for example as part of the development of new or extended industrial estates
- Assessing sector development needs and enhancing South West RDA plans for sector support
- Assess development needs for pellet sector in the South West, in particular looking at ways to stimulate increased uptake of retro-fit domestic pellet boilers in off-gas areas
- Carry out analysis of capital grant support required to support the “kick-start” of biomass heating in the region up to 2010, and design a funding programme, with a clear exit strategy, with the aim of securing regional or national support.

11.3 On-site renewable energy generation

- Supporting roll-out of policy for on-site renewable energy generation with toolkit and training support for development control officers and developers, and

construction industry – based on similar work in London on their "Renewables Toolkit".

- Regional identification of possible strategic new build developments (ideally some residential, some non-residential) to test application of on-site generation policy and to act as case studies and exemplars
- Assessing sector development needs and enhancing the South West RDA plans for sector support