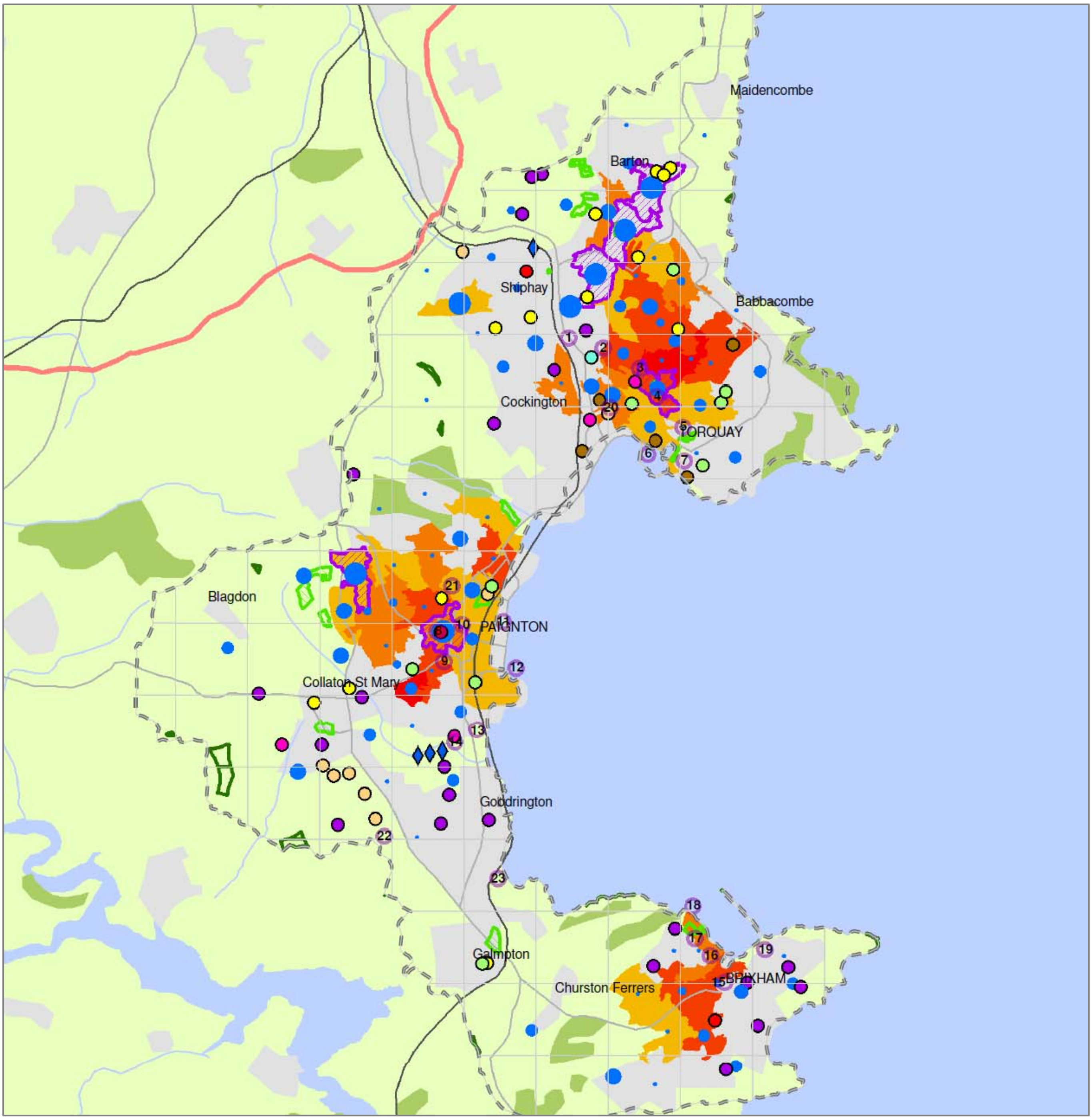
Torbay PPS1 Sustainable Energy Assessment (SEA)



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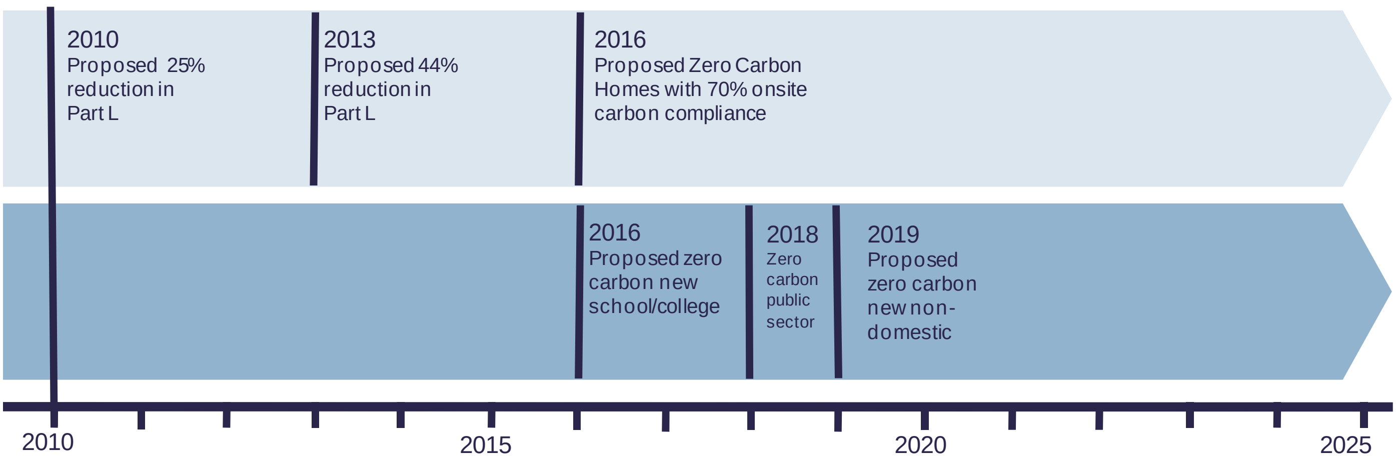
1. Executive Summary

1.1. Introduction

AECOM was commissioned by Torbay Council to help understand the local feasibility and potential for Decentralised, Renewable and Low carbon (DRLC) energy generation in the area to 2026, to inform the development of the Core Strategy. A key driver for commissioning the study was the Climate Change Supplement to PPS1 (known as the Climate Change PPS)[1]. This requires that a Council's Core Strategy should provide a framework that promotes and encourages renewable and low carbon energy generation.

For the Council, there is a clear framework throughout national policy aimed at mitigating the effects of climate change. These include legal requirements for the UK to reduce CO_2 emissions and generate more energy from renewable sources[2]. Building Regulations are a key Government mechanism being used to deliver zero carbon new buildings, as set out in the timeline below.



In addition, the existing buildings in the UK account for a large proportion of CO_2 emissions, and it is it is well known that around two-thirds of homes standing in 2050 are likely to have been built before 2005[3]. Therefore, a significant effort is needed to reduce the carbon emissions from the existing stock as well as making continuous improvements to new buildings.

Previous work for the CLG consultation on the Definition of Zero Carbon[4], indicated that achieving the level of CO_2 performance required by the definition of 'zero carbon' through purely on-site[5] solutions will not be technically possible or financially viable in all cases. A range of potential off-site solutions, referred to as 'Allowable Solutions', was provided in the consultation and perhaps the most useful in the context of this study is the possibility that developers can pay into an Allowable Solutions fund and this capital can then be used to finance carbon reduction elsewhere, including within the existing building stock.

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[1] Planning Policy Statement: Planning and Climate Change - Supplement to Planning Policy Statement 1 : http://www.communities.gov.uk/publications/planningandbuilding/ppsclimatechange
[2] UK Low Carbon Transition Plan , published on 15th July 2009
[3] http://www.communities.gov.uk/documents/planningandbuilding/doc/320213.doc
[4] http://www.zerocarbonhub.org/definition.aspx
[5] In this case, 'on-site' means measures taken to reduce emissions within the site boundary of the building with which the emissions are associated.

1.2. Deliverables and outcomes

A range of deliverables were required from the study and these are presented in this report. In summary they were:

- Establishing an energy baseline for existing development in the Torbay area;
- Present findings on energy efficiency measures for new buildings to meet zero carbon policy;
- Evaluate the existing capacity of Torbay's sustainable energy sector;
- Preparing energy mapping of the Torbay area;
- Identify large and small-scale opportunities in Torbay for zero and low carbon development;
- Use five identified strategic sites to test viability for strategic heat networks compared to individual building measures to meet zero carbon policy;
- Present details of Strategic District Heating Area (SDHA) analysis;
- Identify proposed planning policy and Council actions to support delivery of Low Carbon Development;
- Discuss options for sustainable energy targets using Code for Sustainable Homes or BREEAM standards;
- Set out 'Next Steps' in the process of delivery.

The study aims to provide the Council with an evidence base that can support carbon reductions ahead of Building Regulations and deliver a strategic approach to a low carbon Torbay with the creation of Strategic District Heating Areas (SDHAs).

The final outcome was to identify any further work needed to expand the evidence base to allow the detailed development of proposed policies.

1.3. Our Approach

Our approach to the study has been to adopt the guiding principle that new development must be as carbon efficient as possible but should also be seen as a significant catalyst to CO_2 reductions in existing building stock wherever possible. For this reason, the work primarily focuses on a number of key strategic sites within Torbay, informed by the Mayors Vision projects[6] and discussions with the Council. In so doing, the focus has been on establishing the technical feasibility and financial viability of District Heating Networks (DHNs) within the boundaries of these sites and, where these tests have proved favourable, we have termed the sites 'Strategic District Heating Areas' (SDHAs). The SDHAs encompass both potential development sites and existing building stock. The tests highlight the support required to bring these SDHAs forward and to deliver the emissions reductions associated with their implementation.

In addition to SDHAs, opportunities for other DRLC technologies have been assessed across Torbay. These assessments covered unconstrained areas of large wind opportunity, availability of biomass fuel resource, sites of potential hydro power and an overview of small wind and micro-renewable generation technologies (solar and heat pumps).

[6] The New English Riviera Action Framework Plan, LDA Design, January 2008

GIS data based on the assessments was used to create spatial analyses of the opportunities and produce a variety of constraints and opportunities maps. These are all brought together in the Energy Opportunities Plans (EOPs). These EOPs enable opportunities to be assessed within the local context of existing buildings, potential developments, and Growth Options[7].

Finally, the EOPs and the SDHA analysis are used to inform recommendations on delivery mechanisms and policy wording. To be effective, policies and targets need to have a strategy for delivery and a collaborative approach between the Council, Local Strategic Partnerships, Torbay Development Agency, utilities, private developers, other stakeholders and the community. This report describes the mechanisms available to the Council to be considered in addition to the planning policy recommendations.

Alongside the policies relating to the findings in the EOPs, a review of the existing skills in DRLC energy in Torbay is carried out to provide background to decisions around how to encourage growth in this area, and wider sustainability target setting, such as Code for Sustainable Homes and BREEAM requirements, is included.

1.4. Key Findings

Five sites were identified by collaboration with the Council, assessed for their viability for district heating and three have been recommended as SDHAs. These have been recommended based on their potential for saving CO_2 in the long term, their contribution to saving CO_2 in existing buildings and the required gap funding that would be necessary to deliver the network. Overall, two principal types of SDHA emerged from the study: greenfield, and urban. In summary, the strategic sites studied were:

1. Civic Hub in central Torquay, including new retail on Union Street;
2. New Harbourside developments in Torquay integrated with the Torquay Harbour Area Action Plan (THAAP)[8];
3. New greenfield developments west of Brixham Road, White Rock and Yalberton
4. Paignton town centre new developments and existing housing and hotels;
5. New and existing developments in Brixham town centre and harbourside.

Of these five sites, the two in Torquay, and the White Rock and Yalberton site have been recommended as SDHAs.

The areas of land shown to be potentially suitable for wind turbines in Torbay are small and scattered; each would need to be assessed locally before going forward with an opportunity. Key areas include West of Paignton, close to South Hams border and at the end of the breakwater arm in Brixham.

Four small potential hydro sites have been indentified, each estimated to be around 10kW rating. Three of the potential hydro sites are in the Clennon Valley, south of Paignton and the final site is located northwest of Torquay, on the river close to an existing weir behind a light industrial park on Newton Road.

[7] Torbay Local Development Framework (LDF) Core Strategy, Development Plan document (DPD), Regulation 25 Consultation (LDD2), September 2009
[8] Torquay Harbour Area Action Plan Regulation 27 Pre-Submission Consultation, November 2010, Torbay Council.

Biomass resource in Torbay is shown to be available from three main sources: organic food waste; poultry agricultural waste and waste wood and forestry. This biomass resource is relatively small as it accounts for around 3% of the available biomass resource (in tonnes) in the south west region.

Microgeneration capacity assessment shows that Torbay, one of 10 Local Authorities in Devon, could contribute up to 10% of the County's capacity for micro generation, which is significant considering the physical size of the area.

1.5. Policy recommendations

The report sets out a range of possible delivery mechanisms which could be adopted by the Council and which should be considered in the context of other strategic planning work and the ongoing development of the Core Strategy.

Recommendations are made around realising increased energy efficiency, uptake of microgeneration in existing development and delivering zero carbon and Allowable Solutions in new buildings. The benefit of collaboration with local partners in delivering community scale solutions is also explored.

The report sets out the current context of the available policy options and the approach to planning. It then proposes 6 potential policies which have been mapped against those set out in the South West Planners Toolkit; these are:

- Policy 1: Delivering an Energy opportunities plan
- Policy 2: Strategic District Heating Areas (SDHAs)
- Policy 3: Strategic Sites
- Policy 4: Potential areas for renewable stand-alone energy
- Policy 5: Renewable Energy
- Policy 6: Code for Sustainable Homes and BREEAM Targets

More detail on the recommended policies is included in Chapter 7 Policy options.

1.6. Policy actions

This report provides context for making decisions about which delivery mechanisms will be appropriate for Torbay as well as setting out some key areas of further work. Broadly, the further actions fall into the following categories which are listed here along with a brief summary of the topics they cover:

- Corporate and strategic actions – addressing issues of political support, the Council estate and Council owned land as well as capacity building and developing wider opportunities through strategic partners and initiatives.
- Policy actions – including designating SDHAs and supporting strategic sites, the potential use of LDOs, identifying delivery options, the involvement of the community and the development of an SPD to provide guidance to developers.
- Priority projects and technology specific actions – aimed at priority engagement with currently progressing development sites and specific actions to support wind and hydro-power opportunities

- Delivery vehicles and funding – establishing appropriate delivery vehicles and funding mechanisms including the role of the local community in supporting sustainable energy development
- Further evidence base work – highlighting work to support policy in respect of renewable energy installed capacity targets, BREEAM / Code for Sustainable Homes targets, the impact of the Renewable Heat Incentive and Allowable Solutions.

2. Introduction and context

2.1. Background

AECOM was commissioned by Torbay Council to carry out this study to understand the local feasibility and potential for Decentralised, Renewable and Low carbon (DRLC) energy generation in the area to 2026, to inform the development of the Core Strategy. A key driver for commissioning the study was the Climate Change Supplement to PPS1 (known as the Climate Change PPS). This requires that a Council's Core Strategy should provide a framework that promotes and encourages renewable and low carbon energy generation.

There is a clear and pressing need for everybody to address the impacts of their activities on the environment and the contribution of these impacts to climate change. As well as individuals, organisations, both public and private, have a responsibility to deal with climate change through measures of mitigation and adaptation. For the Council, national policy sets out a clear framework aimed at mitigating the effects of climate change. It provides for the inclusion of planning policies designed to reduce CO_2 emissions and promote DRLC energy (PPS1, PPS3 and PPS22).

NOTE TO READER: This report was prepared between June 2010 and November 2010 which was a period of change in Government policy as the new Coalition Government carried out their spending review. This has primarily affected the Regional Spatial Strategy and the budgeting for the CRC Energy Efficiency Fund. Some of the proposals are still uncertain and this report should be read in conjunction with the latest Government policy. There are more details provided in Appendix A.

2.2. Policy context

The UK has set ambitious targets under the Climate Change Act 2008 for an 80% reduction in UK CO_2 emissions against 1990 levels by 2050 (with an interim target of 34% by 2020) and to generate 15% of the UK's total energy from renewable sources by 2020. The Government's strategy for delivering these challenging targets is set out in the UK Low Carbon Transition Plan, published on 15th July 2009, which includes the Renewable Energy Strategy. These national targets alone provide sufficient justification for setting challenging energy policies in development plan documents and it is probable that the Low Carbon Transition Plan will, over the Torbay Council plan period, result in increasingly demanding targets.

These legal requirements have led to targets for new developments to become 'zero carbon' by 2016 for new homes and 2019 for non-domestic buildings, using the Building Regulations as the mechanism to ensure delivery. Below is an illustration of the zero carbon timeline.

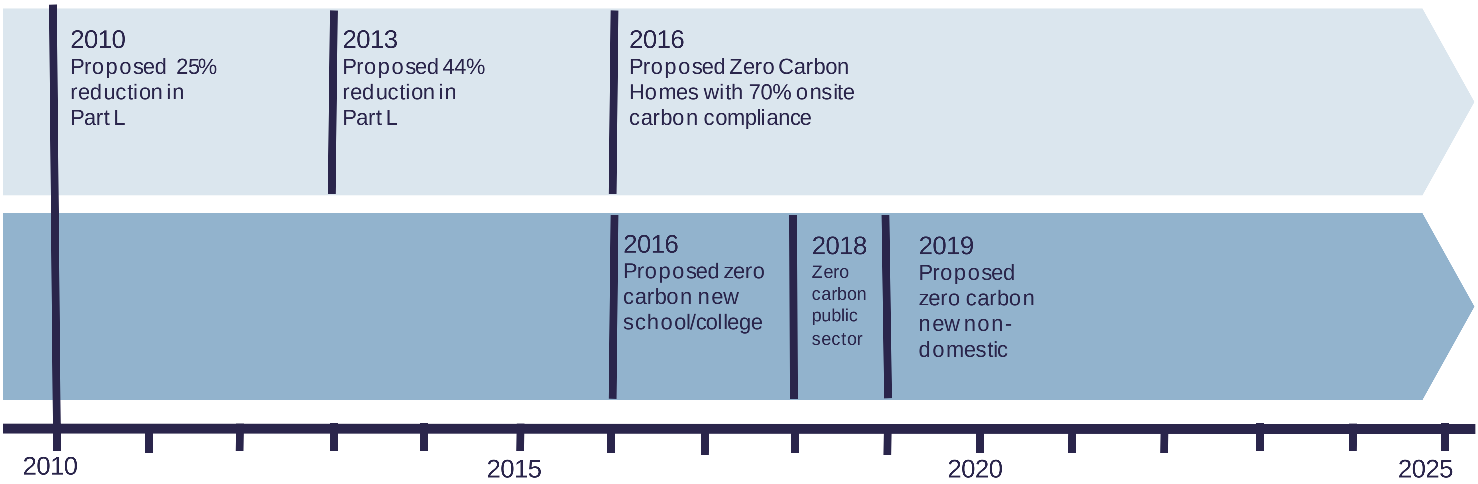

Figure 1 Zero carbon timeline

The definition for zero carbon homes was consulted on in December 2008[9] and in July 2010 the Zero Carbon Hub published the overview of findings and recommendations on meeting this level of carbon performance[10]. This stated that a zero carbon home must surpass a minimum energy efficiency standard and, with Low / Zero Carbon (LZC) energy sources, deliver a reduction in CO_2 emissions (Carbon Compliance) of at least 70% of regulated emissions[11] over the equivalent requirement in the 2006 edition of Building Regulations. Any remaining carbon emissions must be addressed through a series of 'Allowable Solutions' to give net zero CO_2 emissions overall (from both regulated and un-regulated[12] energy demands within the home).

It is expected that a similar definition will be developed for zero carbon non-domestic buildings built after 2019 meaning that considerable advances over current typical practice must be made by this time.

This Zero Carbon Policy aims to help the UK achieve the 80% by 2050 target. However, it is well known that around two-thirds of homes standing in 2050 are likely to have been built before 2005[13]. Therefore, a significant effort is needed to reduce the carbon emissions from the existing stock as well as making continuous improvements to new buildings. Clearly, legislation can be used to drive improvements to new stock but this is not the case for existing homes as owners cannot be forced to improve, for instance, the energy efficiency of their home unless they are undertaking work which is regulated (under Part L of the Building Regulations).

To meet the challenge of the national targets, any strategy developed by local authorities should, in order to be robust and have the best chance of realising the required carbon savings, address both new and existing building stock. As the mechanisms for

[9] http://www.zerocarbonhub.org/definition.aspx
[10] http://www.zerocarbonhub.org/resourcefiles/CARBON_COMPLIANCE_GREEN_OVERVIEW_18Aug.pdf
[11] Regulated CO_2 emissions is that element of a building's CO_2 emissions which are controlled by Part L of the Building Regulations (space and water heating, ventilation, lighting, pumps, fans & controls)
[12] Un-regulated CO_2 emissions are those which are not regulated by Part L of the Building Regulations and consist of energy uses associated with the processes undertaken in the building including the use of any appliances (anything which can be unplugged and moved) and cooking.
[13] http://www.communities.gov.uk/documents/planningandbuilding/doc/320213.doc

influencing these two groups are likely to be different, this suggests that a suite of policies will be needed which require the best possible performance from new buildings and also support and encourage improvements in existing stock.

2.3. Market context

Delivery of carbon reduction associated with new development should consider the local market context. The future of the market is difficult to predict, but local studies and development documents` give us some insight on possible constraints to delivery and cost associated with carbon reductions.

The Strategic Housing Market Assessment (2007) (SHMA) covers the Exeter and Torbay housing market area. The SHMA identifies the current position for the housing market area, which is likely to require 7,500 additional homes over the next five years (by 2012) to satisfy current residents. When factoring in migration, this number jumps to between 16,300 and 19,200. The SHMA predicts that 4,700 of these units will be required in Torbay.

Almost 75% of the housing requirement is for 1-2 bed dwellings. On the other hand, there are a number of homes that are under occupied. The SHMA suggests implementing policies that would facilitate sub-dividing larger properties into smaller homes to reduce the need for Greenfield development.

Affordable housing is another major shortfall in housing stock in the area. Of the additional housing requirement, 7,200 (37.5%) will need to be social rented homes, and 2,800 (14.3%) will need to be 'intermediate affordable homes.' This equates to just over half the housing need over the five year period is for low income earners, and represents a five-fold increase over current housing delivery rates.

Torbay Council currently anticipates around 12,000 new dwellings being developed by 2026[14] (2350 of which have already been built[15]).

As a result of the drastic need for affordable housing, the SHMA suggests a number of actions to promote its development in the area. As the amount of affordable housing grant funding is limited, there is a need to target land with lower values that have decreased development costs. There will be a need to think about affordable housing when the LPA is considering its own land supply both in urban and rural areas. This might include purchasing existing properties or renovating housing in the area for social tenants. There is also a recognition that there might be a need to enact policy, which facilitates vacating the 2,400 social tenants who can afford to live in market-delivered housing.

Torbay's 2008 'Planning Contributions and Affordable Housing: Priorities and Delivery' is a Supplementary Planning Document (SPD) which sets out how Torbay intends to deal with planning impacts arising from new development. The SPD considers the validity of the current affordable housing targets in the Torbay Local Plan, which provides for a minimum of 30% affordable

[14] Report to Commissioning Officers Group (COG), 22nd June 2010. Abolition of Regional House Building Targets: the Implication for Torbay, Torbay Council, 3rd June 2010, and subsequent related reports.
[15] Torbay Council email dated 28th June 2010.

housing on new developments on sites with greater than 15 dwellings. It details that three quarters of the affordable housing should be for social rent and one quarter intermediate sale or rent.

The SPD does outline that part of the developer contributions will be allocated to sustainable development, with an emphasis placed on sustainable transportation. Ultimately, potential to reduce CO_2 on-site in response to policy requirements will have to be assessed on a site by site basis. If the Council chooses to deliver additional CO_2 reductions above Building Regulations, the developer should comply unless they are able to show that additional requirements would make the development unviable. The delivery of advanced carbon reduction targets on strategic sites will have to be tested in viability terms, particularly where high levels of affordable housing are needed.

The following chapter discusses the possible role of a Local Delivery Vehicle in coordinating LPA-wide funding to ensure the most cost-effective strategies for carbon reduction are implemented to aid delivery.

2.4. Achieving zero carbon and the impact on existing stock

This chapter sets out the Government approach to the delivery of zero carbon buildings and the importance of the existing building stock in achieving the carbon reduction targets. It seeks to provide an understanding of the importance of thinking strategically about CO_2 reduction such that the methods by which this is achieved in new development can act as a catalyst for reduction in the existing building stock.

It explores the principles by which carbon emissions reduction in new buildings should be tackled by discussing the importance of energy efficiency, complying with carbon reduction legislation through both on-site and off-site means and the relative priority of these activities.

It then discusses the role of existing building stock in meeting CO_2 reduction targets in new development and how this links to planning policy.

2.4.1. Achieving zero carbon in new developments

Clearly, achieving the zero carbon target in 2016 for new homes and 2019 for other new buildings will be challenging and it is important that the approach to reducing carbon emissions is carefully considered.

In the context of buildings, carbon emissions are generated through the use of energy for the operation of the building in systems such as heating and cooling, lighting, ventilation, processes and so on. It would potentially be possible to address the carbon emissions associated with this energy use by producing the required energy from one or more low or zero carbon (LZC) generating sources[16.] The issue with moving to this solution as a primary approach is that the level of energy generation installed for any particular building or group of buildings would be more than is strictly necessary. This is because such a simplistic

[16] LZC sources include: photovoltaics, solar thermal systems, wind turbines, biomass boilers, combined heat and power plant and so on.

approach does not address the fundamental issue of reducing the demand for energy as far as possible as an initial step in the process.

A now well established principle in the design of new buildings is the energy hierarchy which suggests that the reduction of carbon emissions should be tackled first with reducing energy demand, then delivering energy efficiently and finally providing energy from renewable or low carbon sources. In the context of examining carbon reduction on a wider scale than a single building and achieving the zero carbon targets previously discussed, this must be adapted to take account of the fact that not all emissions can be dealt with through on-site measures. The Definition of Zero Carbon Homes and Non-Domestic Buildings consultation in 2008 introduced the idea of an energy hierarchy, or pyramid, to show how the zero carbon standard would cover three aspects, namely:

- A minimum energy efficiency standard
- An on-site compliance target. This means the amount of carbon reduction that must be achieved on site, or through the connection to a source of renewable or low carbon heat
- Allowable solutions. This refers to a range of solutions that developers may use to deal with their residual carbon dioxide emissions

This is illustrated in Figure 2.

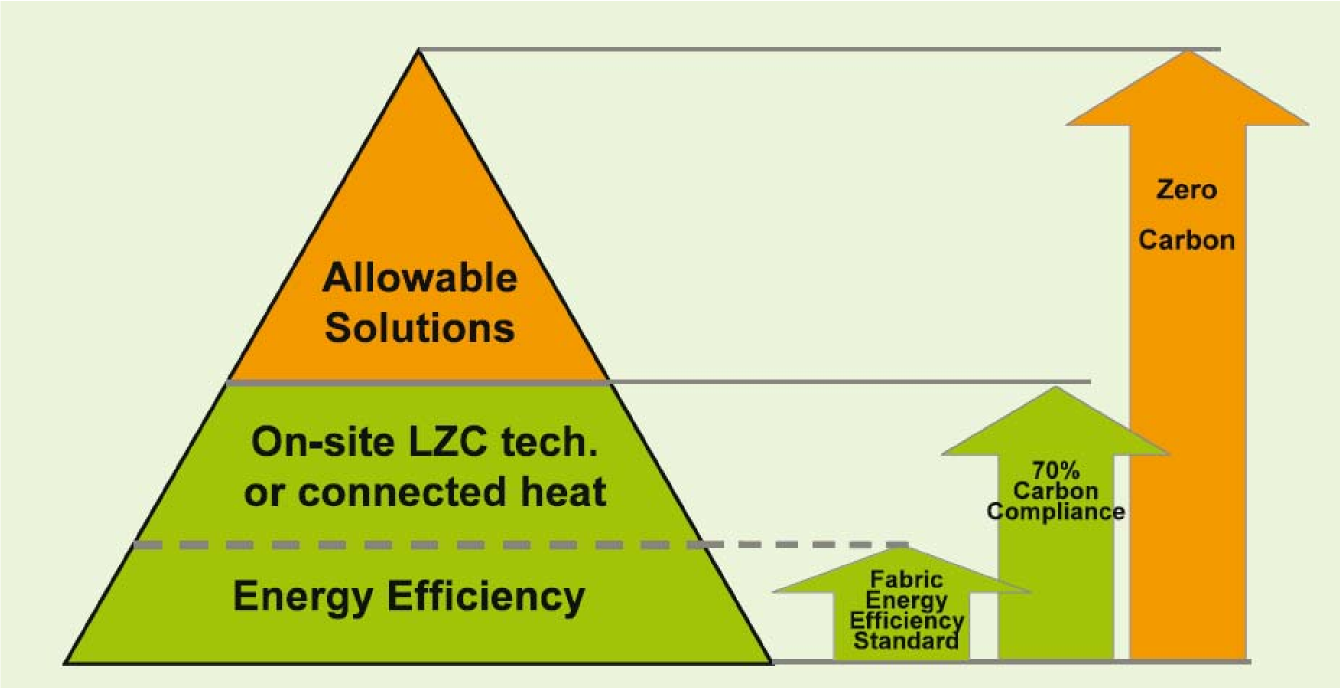

Figure 2 Illustration of the definition of Zero carbon and Carbon Compliance [Zero Carbon Hub]

Thus energy efficiency is the first measure to be taken in all cases which include both enhancements to building fabric performance and the use of efficient building services to reduce energy demand. This is followed by the use of on-site LZC technologies or perhaps connecting a local low carbon energy source (such as district heating network) and finally using off-site measures known as "Allowable Solutions". The range of Allowable Solutions, set out in the 2008 consultation included:

- further carbon reductions on site;
- energy efficient appliances;
- advanced forms of building control system which reduce the level of energy use in the home;
- exports of low carbon or renewable heat from the development to other developments, and
- investments in low and zero carbon community heat infrastructure.

At the time of writing this report, the final list of Allowable Solutions has yet to be confirmed, and other solutions to the ones given in the list above also remain under consideration. Perhaps the most useful potential Allowable Solution in the context of this study is the last one, which creates the possibility that developers can pay into an Allowable Solutions (or Community Energy) fund at a given rate per tonne of CO_2 (up to the amount of CO_2 they need to reach the target) and this fund can then be used to finance carbon reduction elsewhere, including within the existing building stock. These Allowable Solutions open up the possibility that new development, particularly where it is closely located to existing energy need as is often the case for a largely urban area like

Torbay, can be used in supporting the delivery of the infrastructure frequently required for the successful implementation of DRLC, such as heat networks.

The remainder of this chapter focuses on zero carbon for new domestic buildings as this is the area where the most work has been done and the requirements of Government are clearest however the principles should be read as applying to both domestic and non-domestic buildings.

2.4.2. Energy Efficiency

As shown in Figure 2 the first area to tackle in terms of achieving zero carbon, is to maximise opportunities for energy efficiency in the building design, fabric and construction. Since the Zero Carbon consultation in 2008, the debate on how far can we take the building fabric energy efficiency has been consulted on thoroughly and a new Standard for Fabric Energy Efficiency for Zero Carbon Homes was issued for consultation by the UK Government in December, 2009. This standard focuses on the fabric of the home, to secure long lasting benefit for home owners and occupiers, and to make sure that energy efficiency plays a proportionate part in the ultimate delivery of zero carbon homes. At the time of writing, the Government has yet to issue a formal response or policy statement in response to the consultation.

The standard was produced following an intensive period of consideration and consultation by the Task Group established by the Zero Carbon Hub. This considered not only the maximum technically feasible, but also the financial viability of each of the different levels, and the practicalities of homebuilders across the UK being able to adapt and construct such homes. In summary, the Task Group aimed to reach targets which were fair but challenging for the industry to meet. The task group chose these levels after considering nine different key areas:

- Building practices
- Future proofed construction
- Buildability at mainstream delivery scale
- Health and wellbeing
- Desirable homes
- Upfront build costs
- Long term maintenance and energy costs
- Energy security
- Broader environmental concerns

The Zero Carbon Task Group also recommended full implementation of this standard in 2016, with an interim step in 2013. Two recommended levels are provided depending on the size of the home, with apartments blocks and mid-terrace being recognised as easier to achieve low space heating and space cooling energy demand. Then there is a higher level for the maximum space heating and space cooling energy demand for semi and detached houses.

The recommendations from the ZCH Taskforce stated that the proposed Fabric Energy Efficiency Standard equates to around a 20 – 25% reduction in CO_2 emissions compared to Part L of Building Regulations 2006 assuming gas fuelled heating.[17]

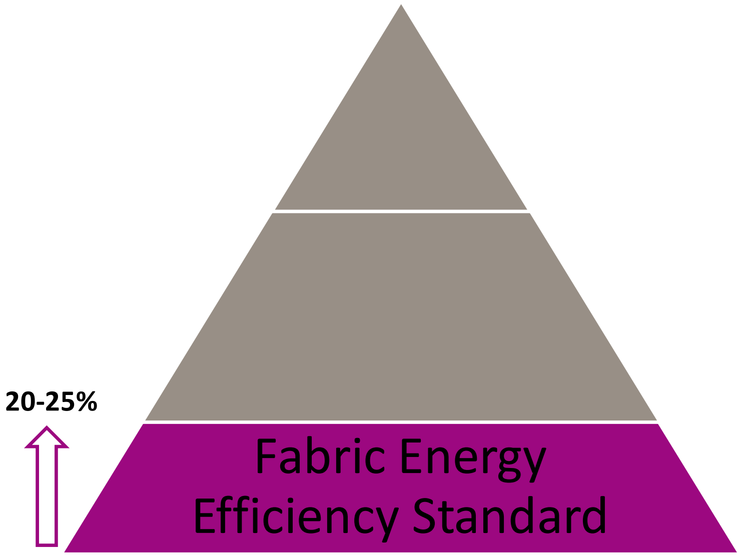

Figure 3 Fabric Energy Efficiency Standard

Appendix K provides further guidance on Energy Efficiency in new buildings.

2.4.3. Carbon compliance

Once the energy efficiency in the buildings has been maximised, there still remains 45-50% carbon reduction which must be achieved by on-site methods such as low and zero carbon technologies, or connecting to a community, or district, heat network.

[17] Defining A Fabric Energy Efficiency Standard For Zero Carbon Homes, Task Group Recommendations, November 2009

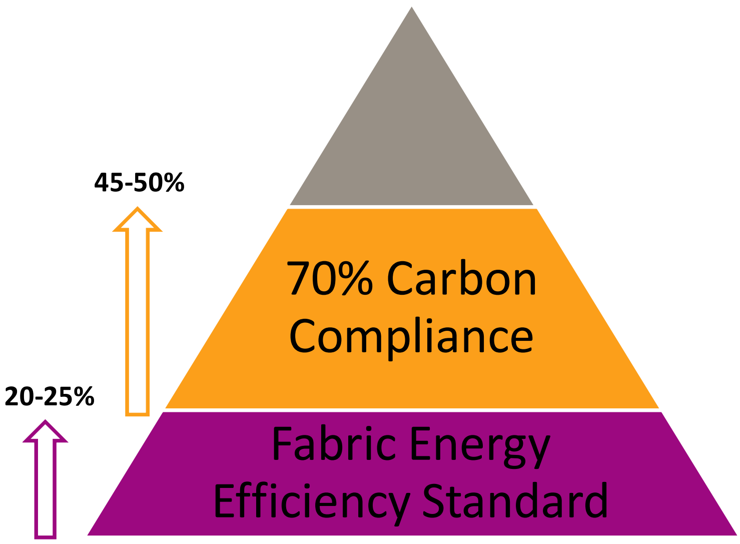

Figure 4 70% Carbon Compliance

The results of modelling undertaken for the Definition of Zero Carbon Homes and Non-domestic Buildings: Consultation (December 2008) indicate that a range of solutions could be adopted in order to meet the 70% target for onsite compliance[18]. They show that, for larger scale urban developments, where district heating is not used, the solution with the lowest uplift in capital cost is to use Best Practice Energy Efficiency and install solar photovoltaics – as such this represents a benchmark for the cost to developers if they chose not, or were unable, to connect to a district solution. It must be recognised however that this solution has limitations particularly where the limiting factor roof space available on which PVs can be mounted is an issue. The Annex also demonstrates that district heating fed by biomass, or biomass CHP in combination with BPEE could deliver the 70% on site compliance requirement. Whether or not gas engine Combined Heat and Power (CHP) together with BPEE could meet the 70% target would depend on the size (and hence efficiency) of unit that could be installed, and the emissions factors for grid electricity and gas that would apply in 2016[19].

A combination of ground source heat pumps and PV could also be used to meet the onsite compliance requirement, however, heat pumps alone would not be able to meet the 45-50% reduction required after energy efficiency had been adopted, based on the assumptions used for the Annex E analysis, due to the carbon emissions arising from the grid electricity used to run the heat pumps.

See Appendix B for extracts from the results of the Definition of Zero Carbon Homes and Non-domestic Buildings modelling work.

[18] Annex E of Definition of Zero Carbon Homes and Non-domestic Buildings: Consultation, CLG, December 2008
[19] For the assumptions used for the Annex E of the consultation document, gas CHP plus BPEE did not meet the 70% onsite target for the urban regeneration scenario. However, this was for a relatively small scale of unit (300kWe), and the carbon savings are very sensitive to the difference between the gas and the electricity carbon emission factors (which were assumed to be 0.194 and 0.43kgCO_2/kWh respectively for the consultation analysis)

2.4.4. CO_2 reduction using Off site methods

To meet the zero carbon definition (i.e. 100% of emissions), the remaining 30% reduction in regulated emissions, and now including unregulated emissions, will be required to be achieved using off site measures where it cannot be achieved on-site.

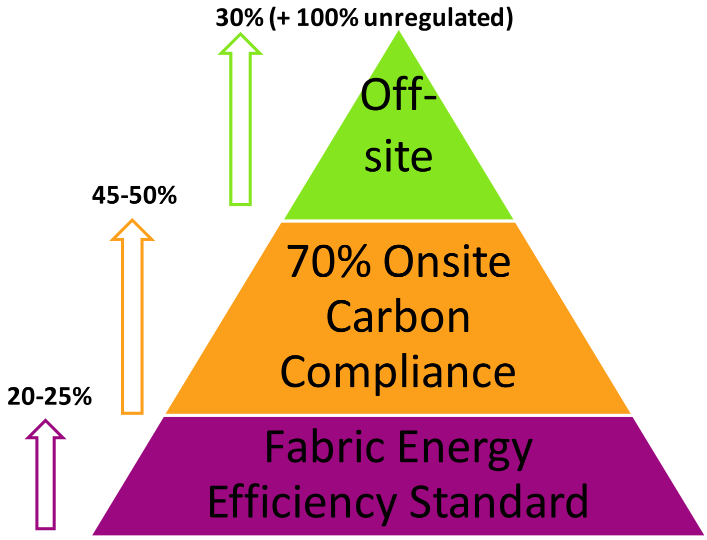

Figure 5 Figure illustrating the make-up of the reduction in CO2 emissions to achieve Zero Carbon

The range of potential off-site measures are referred to as 'Allowable Solutions' and are set out in 2.5.1 above. The need to define the solutions which can be used is important as any claimed CO_2 savings by a new development from an off-site project must be in addition to that which would have been saved, had the development not been carried out. Therefore, the allowable solution should demonstrate 'Additionality'.

It is recognised that adopting allowable solutions will be easier than for others. Therefore a 'capped cost' is likely to be used to ensure that developers can budget for the maximum financial impact of delivering a zero carbon development.

2.4.5. Existing building stock

As discussed in 2.2 policy context, for the UK to meet its national targets, reduction in carbon emissions need to be achieved in the existing building stock as well as through new development. A range of activities might be undertaken in order to encourage the reduction of energy use in existing building stock and to reduce the carbon intensity of the energy which is used through the adoption of LZCs and to reach the 2020 renewable energy target[20,] around 12 percent of the UK's heat needs to be generated from renewable sources (heat generated from renewable energy sources currently meets 1 percent of the UK's total heat demand).

[20] 15% of the UK's total energy from renewable sources by 2020,UK Renewable Energy Strategy, July 2009

The Heat and Energy Savings Strategy consultation was carried out during 2009 and the results analysed to form a UK strategy for increasing the deployment of renewable heat generation, focussing in particular on existing buildings. Following the consultation, the Department of Energy and Climate Change published the Warm Homes Strategy[21] which proposes a plan for meeting the target carbon reductions from the household sector, and is largely concentrated on improving the efficiency of energy used for heat in the home. The strategy sets out the following interim targets to meet the 2020 goal:

- 2015 every household to have installed loft and cavity wall insulation, where practical;
- 2020 up to 7 million homes to have received eco-upgrades, including improvements such as solid wall insulation or renewable energy generating technologies;
- A ‘Pay As You Save’ system to remove the deterrent of upfront costs and reduce the hassle of the move to greener living;
- Enabling Framework for District Heating and Cooling[22].

The Enabling Framework clarified the Government’s position on district heating and stated that because installing heat networks can be both expensive and complicated, there is an important role for local authorities to play in planning strategically for the energy needs of their areas and to maximise local opportunities. Figure 6, from the Enabling Framework, sets out the key strategic actions for local authorities in relation to heat networks.

[21] Warm Homes, Greener Homes: A Strategy for Household Energy Management, 2nd March 2010, http://www.decc.gov.uk/en/content/cms/what_we_do/consumers/saving_energy/hem/hem.aspx
[22] Warm Homes, Greener Homes: A Strategy for Household Energy Management, Supporting Paper VIII, March 2010

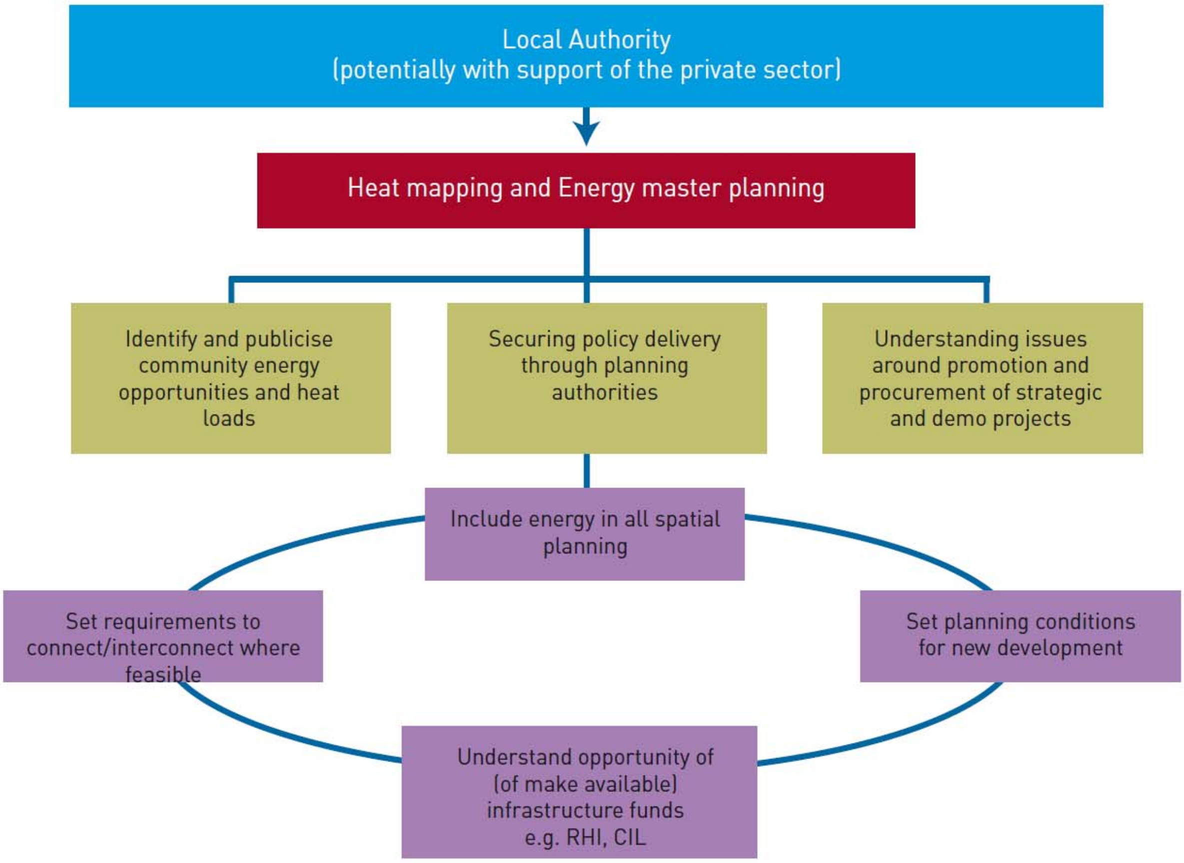

Figure 6 Strategic actions for local authorities in relation to heat networks (Source: Enabling Framework for District Heating and Cooling, DECC, March 2010)

2.4.6. Linking existing buildings to Zero Carbon policy

In view of the above Enabling Framework, the issue remains of how landlords and homeowners can be influenced or required to make energy efficiency changes. As noted previously, legislation can be used to drive improvements to new stock but this is not the case for existing homes which only become affected by Building Regulations if the owners are applying to make changes to their buildings affecting regulated emissions.

There is likely to be a gradual uptake of various energy efficiency measures by owners of existing dwellings and this will certainly go some way to achieving national CO_2 targets. However, to make real in-roads, larger scale improvements in the carbon efficiency of major systems in the home (such as heating) must be sought. A key way to do this is to connect existing homes to District Heating Networks (DHNs) which have lower carbon intensity than individual homes with their own boilers. This approach is supported by PPS1 as well as the other strategies mentioned previously in this report and should be seen as a key method for achieving targets.

In some other European countries, the use of DHNs is extensive but uptake in the UK has been much slower. There are a number of reasons for this, but significant among them is that provision of individual gas fired boilers is relatively cheap and easy due to our extensive gas main infrastructure.

Whilst the use of planning policy to encourage the development of DHNs within areas identified by the study as viable is a clear recommendation of the work, the 'consequential' connection of existing dwellings should be seen as an equally important aim of the strategic actions suggested. It is this ability for DHNs to potentially reduce the cost of compliance for new developments and to deliver carbon savings in existing stock which has seen it become a clear focus of recent policy.

Finally, movement toward these principles may allow the Council to explore the revenue and regeneration potential of decentralised energy production delivering benefits beyond reducing carbon emissions such as addressing fuel poverty issues and so on.

2.5. Approach to the study

Our approach to the study has been to recognise the guiding principle that new development should be required to be as carbon efficient as possible but should also be seen as a significant catalyst to realising CO_2 reductions in existing building stock wherever possible.

For this reason, this Sustainable Energy Assessment primarily focuses on a number of key strategic sites within Torbay, informed by the Mayor's Vision projects[23], which have the potential to not only perform well in their reducing their own CO_2 emissions but are likely to be able to deliver significant CO_2 savings to existing building stock. In so doing, the focus has been on establishing the technical feasibility and financial viability of District Heating Networks within the boundaries of these sites and, where these tests have proved favourable, we have termed the sites 'Strategic District Heating Areas' (SDHAs). The SDHAs encompass both potential development sites and existing building stock. The tests highlight the support required to bring these SDHAs forward and to deliver the emissions reductions associated with their implementation. The cost benefit analysis of the strategic sites is discussed in Chapter 6.

In addition to SDHAs, opportunities for other DRLC technologies have been assessed across Torbay. The methodology for assessed opportunities is largely based on the DECC approved SQW Methodology[24], and available Regen SW datasets. These assessments covered unconstrained areas of large wind opportunity, availability of biomass fuel resource, sites of potential hydro power and an overview of small wind and micro-renewable generation technologies (solar and heat pumps).

From these assessments, GIS data was used to create spatial analyses of the opportunities and constraints, and these maps have been referred to as Energy Opportunities Plans (EOPs), and are discussed in Chapter 5, and included in Appendix H.

[23] The New English Riviera Action Framework Plan, LDA Design, January 2008
[24] Renewable and Low-carbon Energy Capacity Methodology - Methodology for the English Regions, SQW Energy, January 2008

These EOPs enable the different DRLC opportunities to be assessed alongside existing buildings, potential developments, and the Growth Options set out in the Core Strategy[25].

Finally, the EOPs and the SDHA analysis are used to inform recommendations on delivery mechanisms and policy wording, in Chapters 7 and 8. To be effective, policies and targets need to have a strategy for delivery and a collaborative approach between the Council, Local Strategic Partnerships, Torbay Development Agency, utilities, private developers, other stakeholders and the community. This report describes the mechanisms available to Torbay Council to be considered in addition to the planning policy recommendations.

The suite of policies recommended in this report seeks to address the issues of national CO_2 reductions while providing an understandable and deliverable local response. A feature of the proposed approach is to identify the specific roles of planning policy supported by delivery from local strategic partners and other parts of the local authority, including the corporate level.

Alongside the policies relating to the findings in the EOPs, a review of the existing skills in DRLC energy in Torbay is carried out to provide guidance on how to encourage growth in this area, and wider sustainability target setting, such as Code for Sustainable Homes and BREEAM requirements, is included.

[25] Torbay Local Development Framework (LDF) Core Strategy, Development Plan document (DPD), Regulation 25 Consultation, LDD2, September 2009

3. Methodology

3.1. Introduction

This chapter describes the methodology used in this study in order to establish existing CO_2 baselines, existing demand for heat within Torbay as well as the future demand for heat presented by the various proposed developments in the area.

The approach to each area of study is provided below.

3.2. Torbay existing CO_2 baseline

The overall CO_2 baseline for Torbay was derived using a "top-down" approach and has been taken from data reported annually in the DECC National Statistics documents for Local Authority Carbon Dioxide figures[26]. As this study was concerned with CO_2 from buildings, this specific element was taken from the baseline and divided into emissions from residential and non-residential buildings to allow this to be related to the CO_2 savings identified in the analysis.

The CO_2 baselines for the individual strategic sites were developed using a "bottom-up" approach by calculating the energy demands for the site based on address point data, either from public databases or from energy meter readings from key buildings.

3.3. Assessing heat demand opportunities in Torbay

The heat demand from buildings within Torbay has been mapped to enable an assessment of the feasibility of district heating networks to be undertaken. The following criteria have been applied to draw up the Energy Opportunities Plan but can also be applied to detailed assessments:

- High heat demand areas (buildings with greater than 300MWh/yr demand, and SHLAA[27] sites with more than 50 units planned) to enable a good anchor load
- Proximity to high residential heat density areas with gas grid to enable extension into existing development
- Proximity to existing fuel sources (e.g. waste heat, managed woodland, waste treatment site) to enable easy access to renewable fuel sources
- Proximity to good transport links to enable solid fuel delivery
- Proximity to sources of waste heat (e.g. industrial processes) to enable zero carbon energy source.

It is also possible that low carbon heat networks could be implemented on a much smaller scale; perhaps between only a few buildings as long as the heat demand is sufficient. This means that there may be isolated opportunities for small heat networks within the community which are not included in this study but which may be worthy of note. In particular, the relatively large number of disused and derelict hotels and guest houses across Torbay present the potential to kick-start a small heat network as part of any renovation or refurbishment works. Where either clusters of these buildings exist, or they are surrounded by other buildings which present suitable heat loads, there could be an opportunity to link up and deliver a small low carbon heat network.

A key consideration with respect to the feasibility of such networks is whether the existing heating systems in the buildings, are compatible with either hosting the plant or connecting to the distribution infrastructure. Factors affecting this for the building hosting the plant are: whether there is sufficient space for the necessary heat generating plant and associated pumps, controls

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[26] http://www.decc.gov.uk/en/content/cms/statistics/climate_change/gg_emissions/uk_emissions/2008_local/2008_local.aspx
[27] Torbay Strategic Housing Land Availability Assessment, Baker Associates, October 2008, http://www.torbay.gov.uk/index/environment-planning/strategicplanning/ldf/ldfresearch.htm

etc. and the location of the plant room to the road where the distribution pipework is to be installed. For those buildings connecting to the system, the factors to consider are: whether the building has a wet heating system (e.g. radiators, not electric heating) and whether the location of the boiler is easy to reach from the road (as this would be replaced with a heat exchanger) for connection to the heat network. These factors would increase the ease of connection, but do not rule out whether connection is feasible, or not.

The number of hotels or guest houses which would need to be connected to provide sufficient heat demand for a viable network is not fixed; however, a combined heat demand in the range of 50-500MWh/yr is estimated to be a sufficient heat demand for a micro-CHP system[28], and a 10-bed hotel could have a heat demand in the region of 50-70MWh/yr.

For the purposes of the Torbay heat baselining, demand has been divided into four areas, namely:

- Existing residential;
- Existing non-Residential;
- Future residential;
- Future non-Residential.

The methodology for assessing the baseline demand for each of these types is described in Appendix E with the results of that analysis presented later in this chapter. Below are brief commentaries on each of the energy demand groups and relevant issues.

3.3.1. Existing residential

The starting point for establishing an energy baseline is generally existing residential building stock as this is typically the most significant of the four demand types in terms of area coverage and total demand.

Despite its clear significance, the issue with existing dwellings is that it is currently not possible to compel private home owners to improve their energy efficiency or reduce carbon emissions by connecting to a local DHN or in fact by any other means. This is often an issue, particular for authorities who have responsibility for reporting on National Indicators such as NI186.

Existing residential is therefore seen as a significant challenge in reducing the overall carbon emissions associated with buildings in the UK. This study shows, however, that the inclusion of a proportion of the existing housing stock within the SDHAs will aid the financial viability of some of the options examined as part of the report.

For this study, the heat demand for the existing residential has been calculated from the South West Heat Map[29] GIS dataset and this has been plotted on the GIS mapping. In addition, data on the locations of clusters of existing social housing have also been plotted as it can be a key area for heat networks to serve. The reasons for its importance are that: liaising with one point of contact (i.e. the housing association) is simpler than many different individual homeowners; housing associations are likely to have a rolling programme of maintenance and upgrades and coordination with this programme may provide opportunities to connect to the DHN; and the inclusion of these properties may aid those in need of support for issues such as fuel poverty.

[28] Micro-CHP Accelerator, Interim report, Carbon Trust, November 2007
[29] Regen SW, South West Heat Map, www.regensw.com

3.3.2. Existing non-residential

Existing non-residential development has been treated slightly differently to residential in that there are only a few instances where the heat demand from such buildings is useful in the context of a DHN. In the main, this is where a significant heat load exists in a single location (such as a hospital) and could act as an 'anchor load' to any DHN.

The importance of anchor loads is that they can act as a baseload for the DHN while new development is taking place thus providing an early income stream for operators so increasing financial viability. This increases the likelihood of investment by a third party (e.g. an ESCo).

For this study, key buildings (mainly public) across the Torbay area were identified with Torbay Council, covering the key buildings uses:

- Council Owned buildings (Offices, Schools, Tourism)
- Leisure buildings
- Hotels
- Healthcare (District Hospital, Community Hospital)
- Residential Care Homes
- Education (Schools and Further Education Colleges)

In each case, the location of the potential anchor load was identified on the GIS mapping so that its physical relationship with heat density from other sources could be observed.

3.3.3. Future Residential

Future residential development plays a very significant role in identifying financially viable DHNs. The importance of this group is two-fold. Firstly, new housing is likely to be developed more densely than existing housing which increases financial viability of any DHN and secondly a range of issues are made more straightforward by the housing being new, namely:

- simpler installation of the DHN infrastructure;
- initial installation of required equipment in each household easier than retro-fit;
- ability to create policy for new housing requiring connection to DHN;
- technology more readily accepted by occupants in new housing.

All of these can make the provision of a DHN to new dwellings more attractive than connecting existing dwellings.

3.3.4. Future non-residential

This is perhaps the most difficult demand to quantify as there is little definition of the likely final use of the identified non-residential development other than planning Use Class which allows for a considerable variation in final heat demand.

Our approach to quantifying this demand is outlined in Appendix E, but its usefulness is typically limited to those developments where there is a significant heat demand (or, more likely, cooling demand) which can be supplied indirectly by a DHN.

To estimate the demand from future non-residential, we have allocated figures from CIBSE TM46: Energy Benchmarks to each of the identified planning use classes for each development and scaled according to development size.

3.4. Energy efficiency in new buildings

The aim of energy efficiency measures in new buildings is to reduce the building's base energy demand as far as possible before using other methods to reduce carbon intensity of the remaining energy by using low and zero carbon technologies.

In order to base the modelling on the most robust evidence available, the approach taken for this study was to draw on the output of modelling work undertaken for the Zero Carbon Hub Fabric Energy Efficiency Standard to illustrate the levels of energy efficiency that can be expected from new buildings.

3.5. Heat mapping

The mapping exercise takes the results of the analysis carried out in the baselining stage and establishes this data into a GIS ready format. GIS software is then used to present the information spatially so that physical relationships can be observed.

The outputs are divided into two principal areas; existing heat demand and future development.

3.5.1. Existing heat demand map

- A single heat map was developed which displays a range of information with respect to the existing heat demand within the Torbay area.

Data	Notes
Heat demand from existing housing stock	These demands are mapped from the Regen SW address point data and are coloured according to their heat density
Identification of Social Housing clusters	The load from social housing is included in the Regen SW address point data and their specific postcode location is also indicated
Location of potential anchor loads	These are loads associated with a single building (or cluster of buildings such as a hospital) and are located by their OS Grid Reference
Clusters of significant non-residential heat demand	Highlighted to identify those postcodes where a significant level of non-domestic heat load appears to be present
Outlines of proposed future development parcels	This allows the physical relationship between existing heat loads and proposed development parcels to be observed

Table 1 Data used for heat mapping exercise

3.5.2. Future development heat demand mapping

The prediction of heat demand in the future must of course include an analysis of the build up of demand over time. For the purposes of the study, information from the Mayor's Vision and SHLAA projects were used for the initial heat mapping. Once the five strategic sites were identified during the stakeholder workshop, the details of the future developments were updated through discussion with the Council to reflect the latest land use, planning and phasing considerations.

3.6. Energy Opportunities Plans

Energy Opportunities Plans (EOPs) are a way of building up layers of spatial analysis related to energy opportunities in order to illustrate theoretical opportunity for one or more technologies. For example: combining a layer of data that only highlights areas more than a given distance from residential areas with one that shows areas that are not designated as Areas of Outstanding Natural Beauty (AONB's) begin to show "unconstrained" areas of land where wind turbines might be considered. This is a simplified example and in reality there are more constraints that this on the locations of wind turbines but it serves to illustrate the principle. The different layers that area used for the various EOPs are listed in Appendix D.

The spatial location of the energy demand within the area can also be used to provide strategic planning advice aimed at reducing emissions. For example: enabling a number of developers to collaborate in delivering emissions reductions through strategic projects where achieving the same goal individually may have carried an unacceptable level of risk or / and cost. District wide energy schemes are also more likely to deliver efficient solutions than those focused on individual buildings.

Buildings typically use two principal forms of energy: heat and electricity. Electricity can be generated in a variety of different ways and distributed through the national grid with minimal losses. Hence, opportunities for renewable, or low carbon, electricity generation are not limited to areas of electricity demand. For example, a tidal power scheme can be designed to generate more electricity than the local community's electricity demand, as excess can be sold to the national grid. This may have a lower financial value than the energy generator selling it to particular customers, but it has the same carbon value.

With respect to heat, there is no national heat grid because of the related energy losses and associated installation and operating costs. Hence, opportunities for renewable, or low carbon, heat generation are limited spatially to areas of heat demand. This is why heat mapping is vital to the process of gaining an awareness of the spatial relationship of potential loads, increasing the likelihood of a viable heat network.

The density of heat (e.g. MWh / km^2) is a useful metric which provides information about how much heat load is available in a given area. It also informs the analysis around the likely cost of providing the necessary infrastructure for a District Heating Network (DHN) as the closer together individual buildings to be connected are, the less infrastructure needs to be provided.

The study has assessed both heat and electricity opportunities but, the EOPs focus on the spatial distribution of heat loads for the reasons stated above.

3.7. Identifying and testing Strategic Sites

The EOPs illustrate opportunities across Torbay; however, to test the feasibility of district energy systems, the approach was to identify and analyse in detail a number of specific areas which, for the purposes of the study, were designated 'strategic sites'. It should be noted that this designation does not necessarily coincide with other definitions which the Council may have used elsewhere.

The EOP heat density mapping provided a spatial representation of the demand for heat in the Torbay area (see Chapter 5 for details). Along with assumptions made as to the energy demands of proposed new development, this facilitated the identification of five strategic sites with the potential for the use of district scale energy systems to serve selected clusters of existing and future development with heat. These strategic sites were discussed in the workshop held on the 29th July 2010, and of a possible eight, five sites were selected for more detailed analysis.

These Strategic Sites were chosen so that they met the following core criteria:

- Include new large development likely in the next 2-20 years: Low carbon planning policies would be able to influence the design;
- Existing hard-to-treat homes: increase potential for funding towards a low carbon district system;
- High heat density: a key energy demand that could be met by the district energy system;
- Anchor loads: significant existing buildings or sites with high heat demand which could act as a load for any system early in its life.

The strategic sites were modelled over a 30 year period to demonstrate the build-up of heat demand within the strategic site. For example, if a key heat load was not due to be built until 2015, this was factored in to show that financial and carbon savings would not be accounted for until this development was built. More details on the assumption in the modelling are in Appendix I.

The five sites chosen also included several options, testing different levels and mixes of development use to highlight key principles in analysing different types of site for their suitability for a district energy system. For example, if a new greenfield development were to come forward, this study aims to provide Torbay Council with an understanding of recommended mix of uses etc which might make a district energy system viable.

3.7.1. Technical and cost benefit analysis

All five sites were tested for their technical and financial viability for delivering different types of small-scale, decentralised and renewable or low carbon technologies. The purpose of this testing was to highlight which of the five strategic sites could be more viable for a District Heating Network (DHN) and which could require strategic actions from Torbay Council. The sites that demonstrated viability for a DHN were been recommended as 'Strategic District Heating Areas' or SDHA's.

Whilst the SDHAs are likely to form a key plank in any approach to delivering low carbon energy within the Torbay area, the use of other solutions, within or outside of an SDHA, should not be ruled out. In particular, the use of micro-generation technologies (such as: photovoltaics, solar thermal water heating and so on) on existing buildings and the possibility of developing medium and large scale wind power are likely to form some part of the overall solution.

Once the heat demand for the strategic sites had been modelled, there were three main steps to establishing the viability of the strategic site for a district energy system:

- Benchmark on-site carbon compliance cost. This means testing the cost of the DHN against the cost to the developer of meeting 70% on-site carbon compliance by an alternative means.
- Estimate the potential value of CO_2 saved from existing buildings. As their connection to the district energy system could count towards the remaining 30% to meet zero carbon (e.g. the "Allowable Solutions") which the developer would be required to achieve.
- Test financial viability: to ensure that any cost to the developer for connection to the district energy system, would at a rate less than the cost of an on-site compliance benchmark.

A brief explanation of these steps follows:

Benchmark on-site Carbon Compliance cost
The cost of complying with the CO_2 demands of Part L[30] using micro-generation solutions is the benchmark against which any alternative solution must be compared. If the cost of an alternative DHN solution was higher, there would be little incentive for developers to invest in it.

Estimate value of CO_2 saved from existing buildings
Any CO_2 savings from existing buildings connected to the DHN within a strategic area may, potentially, have value as an offset to enable developers to deal with their residual CO_2 (i.e. beyond 70%) emissions in order to meet the future zero carbon requirements of the Building Regulations; thus, the connection of these buildings to the DHN could form an Allowable Solution. We therefore assumed that additional capital investment would be available for a strategic site to help fund the DHN infrastructure. The value of the fund is determined by the level of CO_2 to be saved from the connection of the existing buildings to the DHN.

For this analysis, it is assumed that the AS fund from the new buildings in a particular strategic site, are only used towards DHN costs where savings are achieved in existing buildings. Therefore, a scheme with a similar number of new homes to existing homes, performs best in this analysis. However, across Torbay, AS funds may be used from new homes anywhere in Torbay to contribute to DHN costs that save CO2 emissions in existing buildings.

Test financial viability
The previous steps were brought together to establish whether a particular area could be seen to be financially viable by requiring developments within it to make a payment to connect to the DHN at a rate less than the cost of an on-site compliance benchmark (based on the use of microgeneration). This would obviously be beneficial to the developer as they could meet their

[30] Part L: The Approved Document of the Building Regulations which deals with the conservation of fuel and power: http://www.planningportal.gov.uk/england/professionals/buildingregs/technicalguidance/bcconsfppartl/

CO_2 obligations for a lower cost than would otherwise be the case. Should this be seen to be viable, the area was deemed as being a potential Strategic District Heating Area and relevant delivery mechanisms and policies proposed.

In general, areas which are not viable at this stage cannot be designated as potential SDHAs, but can still offer benefit in CO_2 terms by complying with a further set of policies and guidance. They may also benefit from the application of additional capital funding. The model looks at increasing the AS funding available to improve viability but other measures may include: increasing capital funding, reducing the required Internal Rate of Return (IRR), or accessing low cost grants or loans. These other approaches could form the basis of further work outside the current scope of this report.

Where no viable solution exists for connection to a DHN, it may be beneficial to adopt a policy which states that developers will still need to either achieve the same CO_2 performance (as would have been achieved if the dwelling had been connected to a DHN) by utilising additional on-site solutions (such as micro-generation) or making a financial contribution to a Torbay fund. The level of contribution is suggested as being equal to the financial value of the CO_2 difference between the level achieved on-site and the level which would have been achieved if the development had connected to the DHN.

The lessons learnt from this analysis are then able to be applied to other sites that may come forward in the future growth of Torbay.

Figure 7 illustrates the process of identifying Strategic Sites and testing for financial viability and ultimate identification of SDHA's.

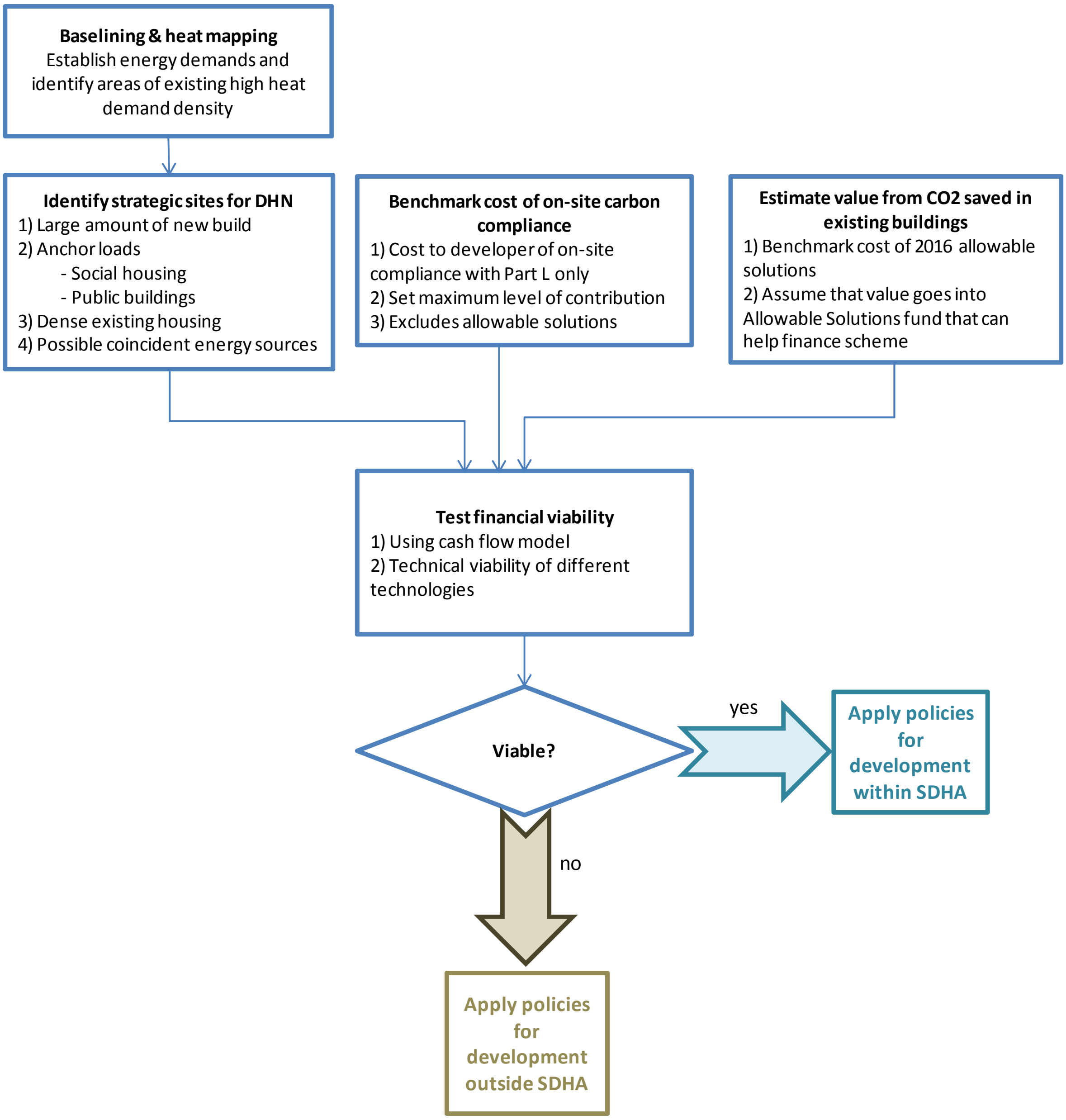

Figure 7 Overview of approach to identifying Strategic District Heating Area's (SDHA's)

3.8. Torbay existing renewable energy sector

The approach taken for assessing the existing capacity of the renewable energy sector in the area was to gather data in three key areas:

- Installers in Torbay and the surrounding areas: using the list of installers certified under Microgeneration Certification Scheme (MCS) in the south west[31];
- Renewables Installations in Torbay: Regen SW Heat Map[32] and additional installation data known to the Council;
- Historic skills growth in the renewable energy sector in the south west. The Regen SW Jobs and GVA survey[33] reports on the growth of the renewable energy sector since 2008. This is a limited survey, but does set out an indication of potential growth in the field.

The results of this review are presented in Chapter 4.3.

3.9. Delivery and policy options

This stage of the assessment was a key deliverable and outcome of the study. It provides suggestions for the strategic delivery mechanisms and policies to assist in the delivery of the principal opportunities for DRLC energy opportunities identified on the EOPs.

The delivery mechanisms for the Sustainable Energy Assessment have been broken down into the following areas:

1. Existing development – Effective ways to retrofit existing building, including delivery mechanisms and funding that can facilitate it
2. New development – Programmes and funding options available to Torbay, an outline of the housing market and its potential appetite for carbon efficient building and the role of local delivery vehicles in addressing viability in new development
3. Strategic Community-Wide Interventions – How private investment and local partners can help implement renewable energies
4. Delivery Factors for Strategic Sites – Opportunities for each of the five strategic sites, whether they have been classed as SDHA's or not. This is intended to build the understanding of what should be considered when assessing suitability for district heating on other sites in Torbay.

Following the delivery mechanisms, policy options are put forward regarding the reduction of carbon associated with energy use in the Torbay LPA area. The policy options presented would be split into two principal themes:

- Those which are applied to development within Strategic District Heating Areas (SDHA)
- All other development

In addition, the policy options suggested are either:

- supported in the evidence base provided in the Sustainable Energy Assessment;
- or they require additional evidence, outside of the scope of the Sustainable Energy Assessment, to support the policy.

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[31] SW MCS installer list 18 June 2010 http://www.regensw.co.uk/download/1282555539_804.pdf
[32] http://www.southwestheatmap.co.uk//login/login.php?redirect=/
[33] Jobs and GVA regen SW survey 2009

4. Baselining and benchmarking

4.1. Introduction

This chapter aims to build on the broad context set out previously in the report by focusing on specific areas which will affect both the more detailed analysis carried out as part of the study and provide more detailed Torbay specific understanding of the current position in a number of areas.

This chapter provides details of the existing situation in Torbay; firstly by setting out data on the current CO_2 emissions baseline as used in the Torbay Climate Change Strategy[34] and then by providing the results of research into the existing renewable energy sector within Torbay. It then goes on to discuss the main financial incentives which are currently available, or are likely to become available, to developers of Low and Zero Carbon technology installations at a variety of scales.

The cost of carbon compliance with Part L of the Building Regulations is then set out in order to establish a benchmark against which further analysis can be assessed and the cost of delivering future requirements of regulation through Allowable Solutions is also discussed in some detail.

Finally, the chapter provides the details of research carried out elsewhere on the typical costs of achieving certain levels of performance under both The Code for Sustainable Homes and BREEAM.

4.2. Torbay existing CO_2 baseline

The purpose of establishing the existing CO_2 baseline in Torbay is to develop an understanding of the magnitude of the likely savings which will be required for Torbay to meet its obligations as part of achieving national carbon reduction targets.

Torbay's CO_2 emissions are reported annually by the Department of Energy and Climate Change (DECC) under the National Statistics documents for Local Authority Carbon Dioxide figures[35]. The table below shows the CO_2 figures for Torbay over the 2005-2008 period.

	Buildings			**Transport**	**Land Use Change**	**Total**
	Gas	Electricity	Other fuels			
	kT CO_2/year	kT CO_2/year	kT CO_2/year	kT CO_2/year	kT CO_2/year	**kT CO_2/year**
2005	216	298	45	157	3	**719**
2006	205	299	39	157	3	**702**
2007	190	287	38	158	3	**676**
2008	196	277	38	150	3	**665**

Table 2: CO_2 figures for Torbay over the 2005-2008 (Source: DECC National Statistics)

[34] A Climate Change Strategy for Torbay 2008 – 2013, Torbay Council, June 2008, http://www.torbay.gov.uk/climatechangestrategy
[35] http://www.decc.gov.uk/en/content/cms/statistics/climate_change/gg_emissions/uk_emissions/2008_local/2008_local.aspx

This data is used in the Torbay Climate Change Strategy 2008-2013[36], and includes emissions from activities such as transport and construction. For the purpose of this Sustainable Energy Assessment, the study examines CO_2 emissions related to building energy use. Hence, Table 3 focuses on building related emissions data and breaks the figures down in terms of residential and non-residential.

	Gas		Electricity		Other fuels	**Total**
	Resi	Non-resi	Resi	Non-resi		
	kT CO_2/year	kT CO_2/year	kT CO_2/year	kT CO_2/year	kT CO_2/year	**kT CO_2/year**
2005	160	56	141	158	45	560
2006	152	53	144	155	39	543
2007	143	46	142	144	38	513
2008	148	49	137	140	38	512

Table 3 Building Related CO_2 figures (Torbay 2005-2008)

This table breaks down types of energy use in Torbay and enables identification of ways to reduce the overall CO_2 emissions.

Further analysis was carried out in the "Analysis of Torbay's Climate Change Strategy" follow-up report[37], and breaks down the CO_2 emissions further showing that 60% of the domestic emissions are related to heating and hot water, and, based on a survey of the private housing stock in the area, Torbay housing has a poorer thermal performance than the UK average and that 94% of the existing private housing stock has scope for energy efficiency improvement[38].

The Torbay Climate Change Strategy sets out two key climate change responses related to CO_2 emissions:

- EM1 – reduce carbon footprint of energy in domestic property
- EM2 – reduce the carbon footprint of energy in industrial and commercial property

These are reductions over the 2005/2006 baseline.

This Sustainable Energy Assessment supports the delivery of these two targets.

4.3. Torbay existing renewable energy sector

The existing capacity for Torbay to deliver renewable energy technologies can be used as an indicator of the ability of the sector to service locally the potential future demand which may be generated by any carbon targets and policies adopted by the Council.

[36] A Climate Change Strategy for Torbay 2008-2013, Torbay Council, June 2008, http://www.torbay.gov.uk/climatechangestrategy
[37] An Analysis of Torbay's Climate Change Strategy, ADS Norton, Internal Document Number 723, December 2009
[38] Private Sector House Condition Survey 2008, Torbay Council, May 2009

4.3.1. Installers

The list of installers certified under Microgeneration Certification Scheme (MCS) in the south west[39] was used to establish renewable energy installers within a reasonable distance from Torbay[40].

demonstrates that there is a wide choice with regards to installing micro generation technologies such as Solar Hot Water (SHW) Solar PV and Heat Pumps. There are fewer Wind and Biomass installers (3 and 6 respectively) and there are no hydropower installers. This distribution of skills in different renewable energy technologies reflects the distribution across the whole south west and not just in proximity to Torbay. For example, there is only one MCS certified hydro power installer included in the Regen SW study

These statistics can be used to show the level of choice that is available to the customer; however customers would readily use installers from across the south west.

[39] SW MCS installer list, Regen SW, 18 June 2010 http://www.regensw.co.uk/download/1282555539_804.pdf
[40] A 70mile maximum distance was used.

Ref	Name	Postcode	BIOMASS	HEAT PUMPS	HYDRO	PV	SOLAR THERML	WIND	MCS certified?
1	4 Seasons AC Ltd	EX8 4JD				✓			✓
2	A Stephens Plumbing, Heating and Rer	PL6 7AE		✓			✓		✓
3	Atlantic Plumbing and Solar	TQ7 3QU		✓			✓		✓
4	Beco Limited trading as Becosolar & C	TQ9 5JA				✓		✓	✓
5	Celtic Solar Ltd	PL15 8RZ					✓		✓
6	Chris Rudge Renewable Power	EX12 2HA				✓			✓
7	Connaught Partnerships Ltd	EX2 5TZ		✓		✓	✓		✓
8	Cooks Plumbing & Heating Ltd	TQ12 2BD		✓			✓		✓
9	Dunster Wood Fuels Ltd	TA24 6NY	✓						✓
10	Eco-Exmoor Ltd	EX31 4QE	✓			✓	✓		✓
11	Eco NRG Ltd	PL21 9JR		✓		✓			✓
12	Fair Energy CIC	TQ10 9JQ	✓				✓		✓
13	Microgeneration Ltd	PL10 1LA	✓	✓		✓	✓		✓
14	Naturalwatt Ltd	EX4 3SR				✓	✓	✓	✓
15	New Generation Energy Ltd	PL19 8JL		✓		✓	✓	✓	✓
16	Nu-Heat Renewables	EX14 1SD		✓			✓		✓
17	Optimum Heating Ltd	EX31 3TD	✓				✓		✓
18	Rainbow Renewables Ltd	EX34 8FH				✓	✓		✓
19	RES (Devon) Ltd	EX32 7AA		✓			✓		✓
20	Safeheat (Torbay) Ltd	TQ4 7QN		✓			✓		✓
21	Source Renewable Ltd	EX32 7AA				✓			✓
22	South West Energy Services Ltd	PL3 4BB		✓		✓	✓		✓
23	Sundial Solar Solutions Ltd	EX20 1FJ				✓			✓
24	Sungift Solar	EX4 2JH		✓		✓	✓		✓
25	The Good Heat Company (UK) Ltd	TQ9 7NJ					✓		✓
26	Treco Ltd	EX16 6SB	✓						✓
27	Mark group	EX2 8QE		✓		✓	✓		

Table 4 Renewable energy installers near Torbay

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4.3.2. Installations

Various sources were used to identify the total number of renewable energy installations in Torbay area. From the Regen SW Heat Map[41] installations are shown based on the survey carried out in January 2010. This data has been supplemented with additional installations known to the Council. Table 6 shows a summary of the installations in Torbay that are on non-domestic buildings.

This table shows that there are 3 biomass boiler installations and 2 Solar PV installations on key non-domestic buildings. In addition, Table 5 shows that there are a few micro-generation installations on residential buildings in Torbay, based on planning applications granted. However this is likely to underestimate uptake due to the extension of permitted development rights, reducing the number of installations where a planning application is required.

4.3.3. Skills growth

The Regen SW Jobs and GVA survey[42] reports on the growth of the renewable energy sector since 2008. Therefore, this is a limited survey, but can begin to indicate potential growth in the field.

The study was carried out by DTZ to identify and quantify the impact of the recession on the economic contribution of the Renewable Energy (RE) and Energy Efficiency (EE) sectors to the south west economy. 100 of the 152 companies originally surveyed were contacted and the following key trends were identified:

- Total employment in these companies (all sectors) had risen by two percent since 2008, with average employment per company increasing from 73 to 75 employees.
- Total employment in the RE and EE sectors has increased from 1,510 (2008) to 2,110 (2009) – an increase of 40%. Employment in EE has increased by 47% since 2008, whilst employment in RE has increased by 32%.
- Total turnover in RE and EE has increase from £107m to £200m – an increase of 86% over the past year.
- Turnover per head has increased from £71,000 in 2008 to £95,000 in 2009 – an increase of 34%.

Future growth in the renewable energy sector will also be dependent on relevant education and training available in Torbay. South Devon College has been identified as a training hub for the ‘Higher Skills Low carbon’ initiative and has started to deliver courses in renewable energy from September 2010[43].

Technology	No of Installations on residential buildings
Solar thermal	4
Solar PV	2
Micro-Wind	3

[41] South West Heat Map, http://www.southwestheatmap.co.uk//login/login.php?redirect=/
[42] Jobs and GVA Regen SW survey, Regen SW, 2009
[43] South Devon College - Renewable Energy Sector Position Paper, July 2010, as quoted in the Renewable Energy Report, Torbay Development Agency, 2010

Table 5 Summary of number of installations of micro-scale renewable energy in residential buildings in Torbay at the time of report[44].

Ref	Project name	Owner/developer	Installed capacity (kW)	Source of data	BIOMASS	HEAT PUMPS	HYDRO	PV	SOLAR THERML	WIND	MCS certified?	Other details
1	Paignton Crocodile Swamp	Paignton Zoo	10	1	✓							
2	Occombe Farm PV	Torbay Coast and Countryside Trust	4.8	1				✓				
3	Torre Church of England School	Torre Church of England School	45	2	✓							funded by - Torbay Council's Children's Services, - Low carbon Buildings Programme - Co-operative's Green Energy for Schools Programme and BERR.
4	Occombe Farm Biomass	Torbay Coast and Countryside Trust	30	3	✓							Two installations. Pellet stove (6kW) and Pellet boiler (24kW)
5	Eden Park Primary school	Eden Park Primary school	10	4				✓				Solar panels to the old Infant School building roof

Data Source:
1 http://www.surveys.energysw.com/devon-overview.php)
2 http://www.torbay.gov.uk/pr2702.doc
3 http://www.countryside-trust.org.uk/mainintro.cfm?id=497
4 http://www.eden-park-primary.torbay.sch.uk/ecoschool/greener.htm

Table 6 Summary of number of installations of micro-scale renewable energy in Torbay

[44] This is based on latest information from Regen SW and there are likely to be more residential installations than reported here due to data protection related to residential buildings.

4.3.4. Biomass fuel suppliers

The availability of biomass fuel can also have an effect on the uptake of biomass energy and therefore the publicly available database, Biomass Energy Centre Database, was used to list the available biomass suppliers in Torbay and surrounding areas.

	Name	Location	Woodchip	Wood Pellets	Logs	Processed shavings	Charcoal	Kindling	Briquettes
	eco-Plumb	Christow		yes	yes				yes
	East Devon Firewood	Exmouth			yes	yes			
	John Hooper	Chagford			yes		yes	yes	
	Logs2U	Callington			yes		yes	yes	yes
	Forest Fuels Ltd	Shebbear	yes	yes	yes			yes	
	Bioshred	Kingsbridge	yes						
	Brendon Hill Tree Services	Wiveliscombe	yes		yes				
	Brookridge Timber / Ecowood Fuels Ltd			yes					
	Burnswood	Plymouth			yes				yes
	Devon Briquettes	North Molton							yes
	Dr Heat	Tiverton			yes				yes
	Ford Barton Wood Fuels	Tiverton	yes						
	Forever Fuels	Okehampton		yes					
	Mid Devon Wood Fuels				yes				
	Thornes Renewable Energy Solutions Ltd Honiton	Honiton		yes					
	Woof Woodfuels	Axminster		yes					
	National suppliers list	Woodfuel suppliers who deliver throughout the UK	yes	yes	yes				yes

Table 7 Biomass Suppliers listed in the Biomass Energy Centre database[45] administered by the Forestry Commission

The following figure shows the proximity of these fuel suppliers to Torbay.

[45] Wood Fuel Suppliers, Biomass Energy Centre, checked December 2010, http://www.biomassenergycentre.org.uk/portal/page?_pageid=77,225275&_dad=portal&_schema=PORTAL

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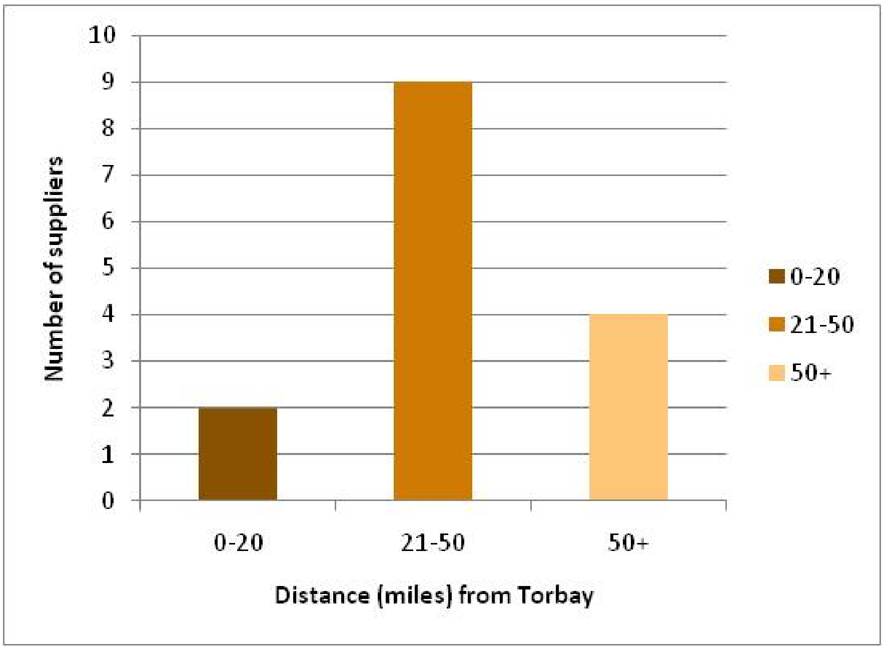

Figure 8 Biomass suppliers proximity to Torbay

Figure 8 shows that there are only a limited number of suppliers within 0-20 miles of Torbay, which is expected considering the urban and sub-urban nature of Torbay. The majority of the suppliers in Table 7 are within 20-50 miles of Torbay.

4.4. Financial incentives

A number of financial incentives now either exist or are proposed which increase the viability of certain types of LZCs and therefore enhance the likelihood of their adoption. This chapter briefly sets out those which are directly relevant to this report. Further information about other incentives can be found at http://www.regensw.co.uk/climate-change-pps/policy-context/mitigation/key-incentives.

4.4.1. Feed-In Tariff (FIT)

FIT is aimed at encouraging the uptake of small-scale LZC systems and is designed to work alongside the existing Renewables Obligation Certificate (ROC) scheme which supports large scale systems. FIT is available for any system below 5MW which produces electricity from low carbon sources. Eligible technologies are currently given as[46]:

- Wind;
- Solar photovoltaics (PV);
- Hydro;
- Anaerobic digestion; and
- Domestic scale microCHP (with a capacity of 2kW or less)*

[46] DECC Feed-in-tariff information website, http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/feedin_tariff/feedin_tariff.aspx

* Domestic scale microCHP pilot will support up to 30,000 installations with a review to start when the 12,000th installation is completed.

The principal benefit of FITs is likely to be to encourage the uptake in existing building stock of small scale, distributed electricity generation. A key consideration for Torbay is ensuring there is a robust method in place for the monitoring and reporting of such installations so that adequate responses to the relevant National Indicators can be provided. It is likely that Development Management officers will be key to this process as their activities will need to include processes to capture any required data. Refer to Section 9 Next Steps for more information regarding monitoring of polices.

It is likely that, over the coming months and years, there will be an increase in the amount of applications which include systems eligible for FIT. It may be worth considering making provisions for such installations in policy

4.4.2. Renewable Heat Incentive (RHI)

The RHI is a scheme which is aimed at significantly improving the viability of certain sustainable energy options (particularly renewable district heating) as well as increasing the likelihood of uptake for eligible microgeneration technologies (such as solar thermal water heating). There is still uncertainty regarding its implementation although it has undergone a public consultation, and there has been a recent announcement as part of the Government's Comprehensive Spending Review (CSR) that the RHI would be launched from June 2011, two months later than planned. Further information on the Government's comprehensive spending review is included in the Appendix A.

Overall, it appears likely that some form of RHI will be implemented and indications are that it will be broadly in line with the proposals set out in the consultation documents.

4.5. Benchmarking the cost of compliance with Building Regulations Part L

In delivering new buildings, developers must comply with Part L of the Building Regulations which govern the level of regulated CO_2 emissions which are permissible from any given building. Any measures which might be taken to achieve the CO_2 performance required through on-site solutions carry an associated cost for which the developer is wholly responsible.

A key test of viability for policies to support District Heating Networks (DHNs) for new development areas is to compare the potential cost to developers of connecting to such networks, and thereby enabling them to meet their zero carbon requirements, with the cost of alternative solutions that they would need to use to meet zero carbon, if they did not connect to the DHN.

If the cost to the developer of connecting to the DHN, or the level of payment required to an ESCo to provide the connection is comparable to or less than the developer's alternative means of compliance then this would suggest that such a requirement is unlikely to be regarded as an "undue burden" on a developer. In fact, if the cost is less, it could be regarded as a mechanism that actually assists developers in meeting their future zero carbon requirements, and could have value in encouraging the development of sites in Torbay.

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Furthermore, as set out in Chapter 2, helping to fund DHNs can also provide developers with a mechanism for not only meeting their on-site, carbon compliance targets but could also form an Allowable Solution that enables them to offset their residual carbon emissions.

Therefore, this chapter sets out the results of our analysis for the potential cost of complying with future carbon reduction requirements (Part L) for residential and non-residential development, without connection to a low carbon heating network. This will then be benchmarked against the results of the financial viability assessment for the Strategic District Heating Areas (SDHAs) in Chapter 6.

4.5.1. Residential development

Without strategic planning policies it would be up to individual developers to decide how to meet the legal maximum CO_2 emissions rates set out in Part L1A of the Building Regulations (which apply to new dwellings).

The cost of their approach would be made up of the cost of minimum energy efficiency backstop levels required, the cost of any LZCs which would further reduce the CO_2 emissions towards on-site carbon compliance and, after 2016, the cost of allowable solutions required to achieve zero carbon. With district heating (based on LZC energy generation) connection to a DHN should achieve on-site CO_2 reduction in excess of the requirements of Building Regulations.

Area	Assumption	Notes
Energy efficiency	Backstops increased in 2013 from current 2006 levels to a current 'best practice' level	This level would yield a 20% CO_2 emission reduction (i.e. 20% against the 44% reduction expected in 2013)[47]
On-site carbon cap (TER)	overall permitted on-site CO_2 emissions cap tightened by 25% in 2010 and 44% in 2013	
2016 zero carbon definition	On-site carbon compliance level increased further to 70% reduction on 2006 TER	
Allowable solutions contribution	used to reduce the residual CO_2 emissions from the carbon compliance level of 70% to net annual zero carbon (including unregulated emissions).	

Table 8 Key assumptions used in cost of compliance calculations

[47] Energy Saving Trust Best Practice Standard http://www.energysavingtrust.org.uk/business/content/view/full/67745 Note that the level of energy efficiency backstop is to be consulted on before the end of 2009.

From previous modelling, we estimated that the most cost effective general route to Part L compliance where no DHN was available, would be increased levels of energy efficiency and PV. Although PV is currently relatively expensive in upfront costs, the new feed-in-tariffs would provide customers with an annual income based on the electricity generated in kWh. This generally brings down the financial payback from 50+ years, to around 12-15 years. However, it is worth noting that, at least for freehold dwellings, the FiT would not benefit the developer and therefore this does not make using this method of compliance any more cost effective. In addition, we have used global learning rates[48] to estimate the fall in costs over time due to higher global manufacturing volumes. Therefore, we have benchmarked the on-site compliance cost to a combination of current best practice energy efficiency and PV panels: This was assessed for different dwelling sizes, and the average costs to the developers for meeting the targets are set out in the table below:

Part L standard	Cost of energy efficiency	Cost of additional Carbon Compliance	Total cost
2010 (25% CC)	£24.09	£9.94	£34.03
2013 (44% CC)	£23.80	£40.94	£64.74
2016 (70% CC)	£23.51	£75.19	£98.69

Table 9 Average estimated costs per m^2 of residential development to meet carbon compliance (using PV)[49].

Overall, in assessing the viability of a DHN the cost to the developer needs to be established to ensure that is less than the cost of meeting the same carbon target, through using PV. Therefore, as costs to meet the energy efficiency measure will need to be met by the developer, regardless of whether they connect to a DHN or not, we shall use the cost of meeting the 70% carbon compliance target to create our benchmark to assess DHN viability, which is £75/m^2.

An important element of any DHN implementation would be clarity between any ESCo and developers over which costs the ESCo connection package would cover, and what aspects the developer would need to provide. This, and similar matters require detailed consideration and are beyond the scope of this study.

[48] See report on Research to Assess the Costs and Benefits of the Government's Proposals to Reduce the Carbon Footprint of New Housing Development, by Cyril Sweett, Faber Maunsell and Europe Economics, for CLG, September, 2008
[49] Annex E of Definition of Zero Carbon Homes and Non-domestic Buildings: Consultation, CLG, December 2008

4.5.2. Non Residential Development

Non residential development will have to comply with the new Building Regulations Part L2A due to be released in October 2010. The criteria of future amendments to Part L2A of the Building Regulations have been based on the following assumptions

Aspect	Assumption
Energy efficiency backstops	No energy efficiency backstops increase[50]
Overall permitted on-site carbon emissions cap	Tightened by 25% in 2010 based on the aggregate method[51]
2013 and 2016 revision	On-site carbon compliance level remains at 25%[52]
Allowable solutions	Used to reduce the residual CO_2 emissions from the carbon compliance level of 25% to zero regulated and unregulated carbon.

Table 10 Assumptions made in assessing non-residential cost of compliance

Building Type	Compliance cost per m^2 floor area
Hotel	£19
Office (Deep, AC)	£29
Office (Shallow, AC)	£42
Office (Shallow, Heated)	£26
Retail	£48
Warehouse (No RL)	£2
Warehouse (With RL)	£7
Weighted average:	**£21**

Table 11 Non-residential cost of compliance for different building types based on aggregate method of Part L 2010 consultation

To benchmark the cost of compliance for Torbay we took cost figures from the 2010 Part L consultation. In the same way as with the residential connection cost, we calculated a weighted average connection cost based on the floor area of non-residential development within Torbay. This yielded a figure of approximately £20/m^2 and is shown in Table 11. Unlike the case of

[50] Proposals for amending Part L and Part F of the Building Regulations, *Consultation,* Communities and Local Government (CLG), June, 2009
[51] Ibid, CLG, June 2009
[52] This is our 'best assumption' based on information available at the time of the study.

residential development, district heating may not achieve the full carbon saving required by Building Regulations, especially if district cooling is not considered viable. In this case additional measures would be required for compliance.

4.5.3. Benchmark for new development

In summary, to benchmark the cost of meeting carbon compliance for both residential and non-residential, an average of the £/m^2 has been used. This gives a benchmark of **£50/m^2** which is used in Chapter 6 Cost benefit analysis, to compare the different district heating network schemes against, ensuring that the cost to the developer for connecting to the DHN, would not cost more than the developer meeting the 70% CC target onsite with PV.

4.6. Allowable Solutions cost and carbon benchmark

After 2016 it will be necessary for all new dwellings to be delivered as ‘zero carbon’ homes. Current proposals see this being the case for non-domestic buildings after 2019. Previous modelling work by AECOM for regional and central Government has indicated that achieving this level of CO_2 performance through purely on-site solutions will not be technically possible or financially viable in all cases.

The Government solution to this issue has been to propose a range of ‘Allowable Solutions’ which can be adopted by developers to deliver the difference between the performance they are able to achieve through on-site solutions and the CO_2 performance target of the building.

One of the selections of Allowable Solutions proposed would allow credit for carbon emissions where heat is exported from the site to nearby existing buildings via a DHN.

4.6.1. Using Allowable Solutions funds

This approach provides the potential to raise funds from developers in Torbay (even those who are not connected to a DHN) to pay for connection of existing buildings to a DHN thereby assisting developers achieve their required level of carbon compliance.

By estimating the amount of CO_2 emissions which are likely to be dealt with using the Allowable Solutions approach after 2016 (we have calculated this at 8,500 tonnes of CO_2 for residential development alone based on RSS figures as explained in Appendix C) and applying the average cost of delivering AS compliance of £100/TCO_2, as assumed in the July 2009 impact assessment, we arrive at the revenue which might be generated via this route. We have estimated this figure to be in the region of £25.5M, assuming 30 years of residential emissions would need to be covered by an allowable solution payment. It might also be possible for this revenue to be secured in advance through negotiation with the developer and this approach is discussed further in Chapter 8. To arrive at this figure the CO_2 savings have been assumed to be sold to developers at a rate 10% less than the average cost of compliance for any given year. This is calculated as revenue within the cashflow modelling and is set at £100/tonne CO_2 and does not rise in real terms.

The coalition Government announced in June 2010 that Community Energy Funds (CEF) would be introduced to provide a mechanism to deliver community schemes that would otherwise not go ahead because of risk to one individual developer. These funds could contribute to the delivery of community energy schemes including all renewable and low carbon technologies. They could also be used to finance connection of existing dwellings to SDHA networks, as long as the resulting carbon savings were equal to or greater than the CO_2 savings required by the new build developers.

The study has not considered the above Torbay ‘Community Energy Fund’ in detail, but has taken account of the potential value of CO_2 savings made within SDHAs by the connection of existing housing to DHNs. As an example of how the CO_2 emissions reductions from new buildings could be met by community schemes, such as district heating, Figure 9 shows the contribution made by three of the five DHN schemes discussed in detail in this report, and therefore highlights the shortfall which would need to be met by alternative measures. The total potential Torbay-wide CO_2 emission saving from connecting existing dwellings to DHNs is estimated to be in the region of 4,000 tonnes CO_2. This figure is based on connecting only existing homes within the three Strategic Sites recommended for SDHA’s, and considering a maximum uptake of 75% of the homes.

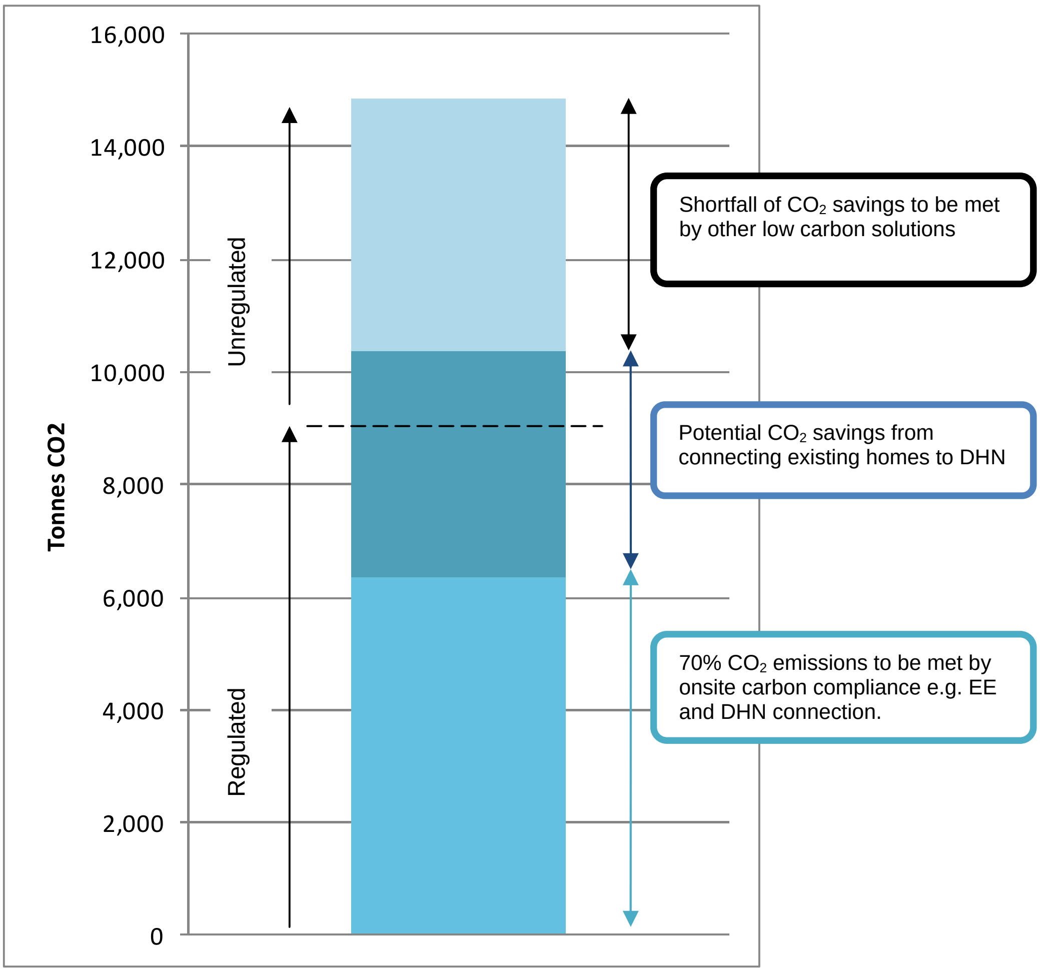

Figure 9 Summary of CO_2 emissions related to new domestic building in Torbay requiring 70% CO_2 emissions to be saved from on-site compliance and the remaining 30% of the regulated emissions and 100% of the unregulated emissions from Allowable Solutions.

The shortfall between what is needed by developers to meet their zero carbon targets, and what could be offered by this solution is around 4,500 tonnes CO_2, as illustrated in Figure 9. However, the DHNs will also make savings in existing non-residential development that could contribute to meeting Allowable Solutions, which could address this shortfall. If additional CO_2 savings are required, then the Council and TDA could consider investing in wind opportunities and solar PV[53]. This would provide developers with an additional mechanism for dealing with residual CO_2 emissions, and demonstrate corporate actions towards reducing CO_2 emissions.

[53] Renewable Energy Report, Torbay Development Agency, 2010

The relative cost of CO_2 savings from connecting existing housing would likely be much greater than developers would pay for Allowable Solutions elsewhere. Therefore, as developers could only be expected to pay a contribution in return for the CO_2 savings, such funding is only likely to aid the viability of connecting existing dwellings for financially marginal sites, rather than paying outright for the connection of existing housing.

4.7. Cost of compliance with BREEAM and Code for Sustainable Homes (CfSH) Assessments

Environmental assessment methods, such as BREEAM and Code for Sustainable Homes (CfSH) are used to demonstrate an holistic approach to sustainability, considering elements other than energy and CO_2 emissions, such as water, ecology, waste, materials, management and pollution. The PPS1 Supplement states that planning authorities should specify requirements for sustainable buildings "in terms of achievement of nationally described sustainable buildings standards, for example in the case of housing by expecting identified housing proposals to be delivered at a specific level of the Code for Sustainable Homes". Where such local requirements go beyond national requirements including the Building Regulations, the evidence base must justify this based on local circumstances. The use of the code is reinforced by the draft PPS. The evidence base in this report focuses on sustainable energy, and further evidence base work would be required to support a policy on a BREEAM and CfSH target. This chapter gives an overview of the level of costs that could be expected by the developer from applying BREEAM standards. Further information on how to develop a sustainable building policy can be found at http://www.regensw.co.uk/climate-change-pps/objectives/se-policy-objectives/se5.

4.7.1. Code for Sustainable Homes

Since May 2008 it has been compulsory for new homes to have a CfSH rating. There is currently no national minimum requirement for the rating that they achieve, however proposed changes to the Building Regulations are expected to reflect the requirements of the Code for energy. Residential developments supported by Homes and Communities Agency funding are currently required to achieve Code level 3, expected to rise to Code level 4 from 2011.

An industry report on the costs of building homes to full Code levels has been used to show the financial implications of achieving Code targets.[54] The costs were predicted, and are not yet fully supported by the development industry. Only a handful of real Code assessments have been completed due to the recent economic climate so there is not yet sufficient final cost data to establish robust cost benchmarks.

Predictions show that costs associated with meeting advanced Code for Sustainable Homes levels are relatively modest for most elements. A significant proportion of the costs of delivering Code levels are in meeting the standards for CO_2 emissions, which after 2010 will become necessary for meeting Building Regulations. The percentage uplift in build costs arising from the additional Code requirements (i.e. all Code criteria excluding the energy and CO_2 requirement) is around 3% for flats and around 5% for houses for Code Level 4. This relates to achieving **all** additional Code credits; however, homes must actually achieve 57% of available credits to achieve Code Level 3 and 68% of available credits to achieve Code Level 4.

There is a significant jump in cost when moving from Code Level 4 to Code Level 5 due to the need for water re-use and recycling systems in order to meet the mandatory water requirements for Code Level 5 and above. [54] The percentage uplift in build costs for Code Level 5 (excluding the mandatory energy criteria) is around 4.5% for flats and nearly 12% for houses.

The graphs below show the predicted cost to deliver Code targets 4, 5 and 6, broken down by the assessment category areas for a flat and a house. The graphs exclude the costs associated with credits ENE 1, 2 and 7 which are assumed to be covered in the costs discussed in the following Chapters to deliver the mandatory energy requirements.

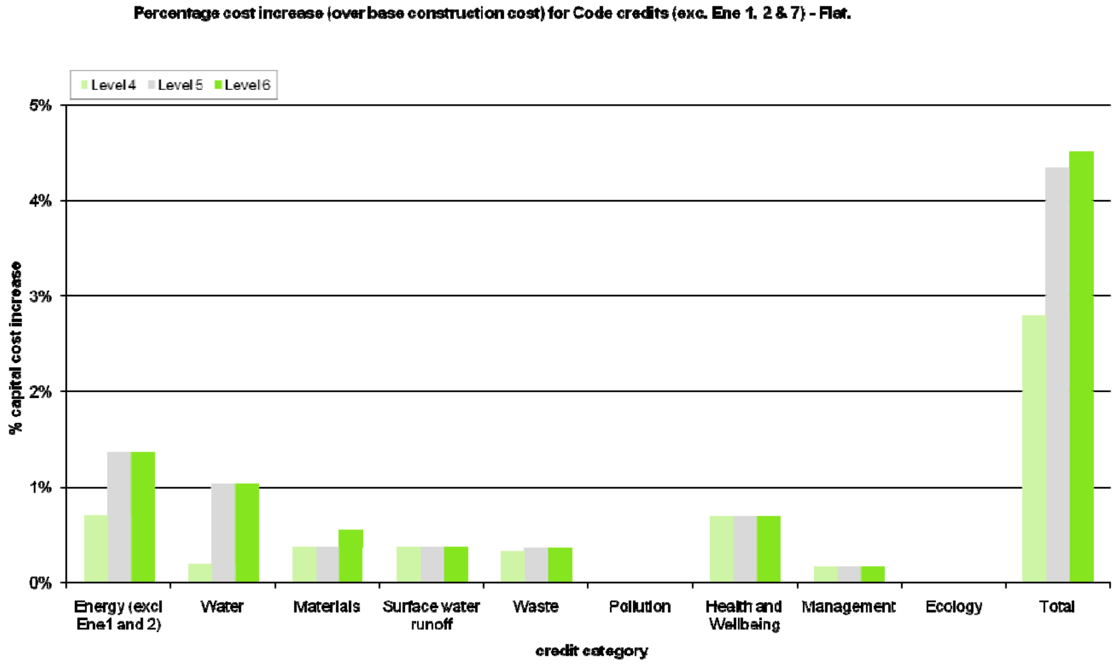

Figure 10 Costs (over base construction cost) for delivering Code credits as required to levels 4, 5 & 6 for a flat

[54] Cost analysis of the Code for Sustainable Homes, produced for department for Communities Local Government by Cyril Sweett , July 2008

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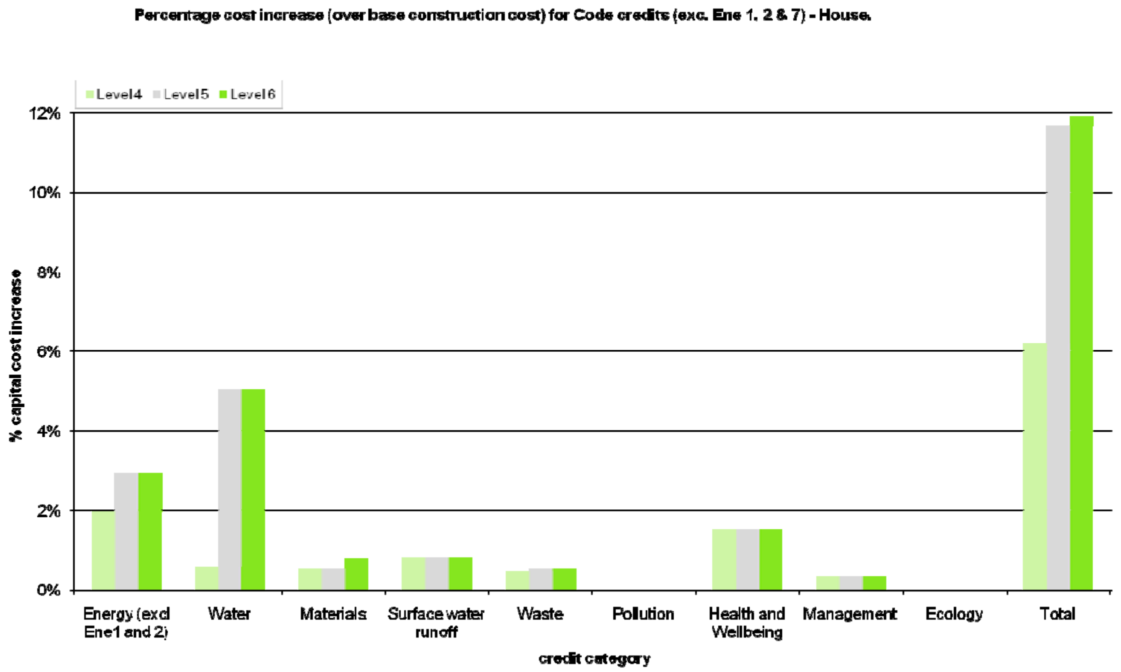

Figure 11 Costs (over base construction cost) for delivering Code credits as required to levels 4, 5 & 6 for a house

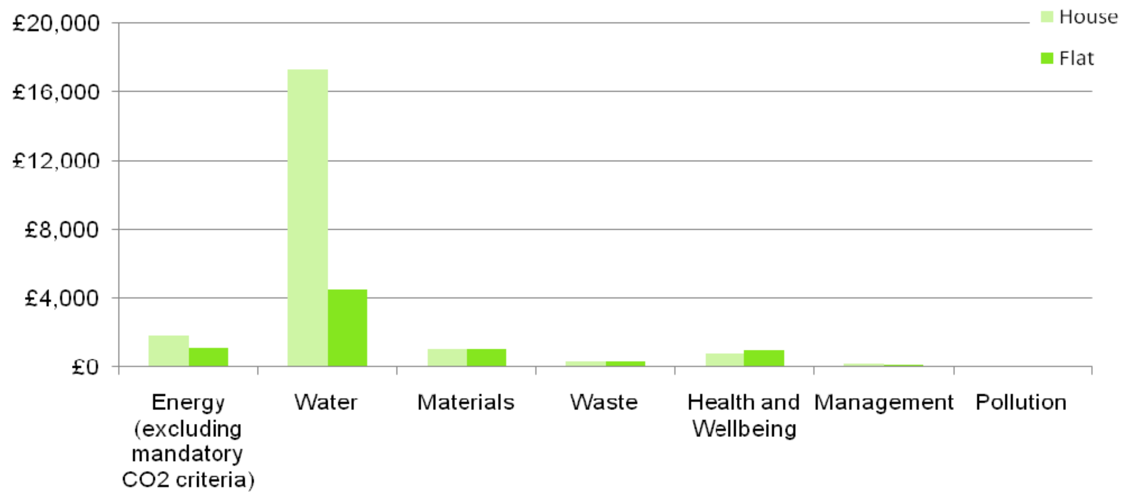

Figure 12 Cost of meeting all Code credits in each issue excluding the mandatory Energy for a detached house and a flat Homes must achieve 57% of available credits to achieve Code Level 3 and 68% of available credits to achieve Code Level 4 (Source: Cost Analysis of The Code for Sustainable Homes, Cyril Sweett, 2008).

4.7.2. BREEAM

BREEAM (Building Research Establishment Environmental Assessment Method) is an assessment scheme for non-residential buildings, the use of which is often a requirement of funding bodies, clients or local authority planning policy although it is not required in every case. Like the Code for Sustainable Homes, BREEAM allows the environmental implications of a new building to be assessed at the design stage by independent assessors to provide an easy to understand comparison with other similar buildings. It therefore provides a consistent and independent assessment tool which can be used in planning. An overall rating of the building's performance is given using the terms Pass, Good, Very Good, Excellent, or – new for BREEAM 2008 - Outstanding. The rating is determined from the total number of BREEAM criteria met, multiplied by their respective environmental weighting.

The figure below shows the % increase on the base build cost to deliver Good, Very Good and Excellent ratings under BREEAM Offices (2004) and BREEAM Schools. Both costing exercises were led by the BRE Trust. They were supported by Cyril Sweett for the Office costing exercise (Putting a price on sustainability, BRE Trust and Cyril Sweett, 2005) and Faithful & Gould for the Schools work (Putting a price on sustainable schools, BRE Trust and Faithful & Gould, 2008). The costs shown in the figure below under 'school' are for a secondary school block of 3,116m^2.

We are not aware of any published cost data on meeting BREEAM office targets since 2004, certainly none is yet available showing the costs of delivering any of the various BREEAM 2008 schemes, which contains a number of fairly significant changes, compared with earlier BREEAM versions.

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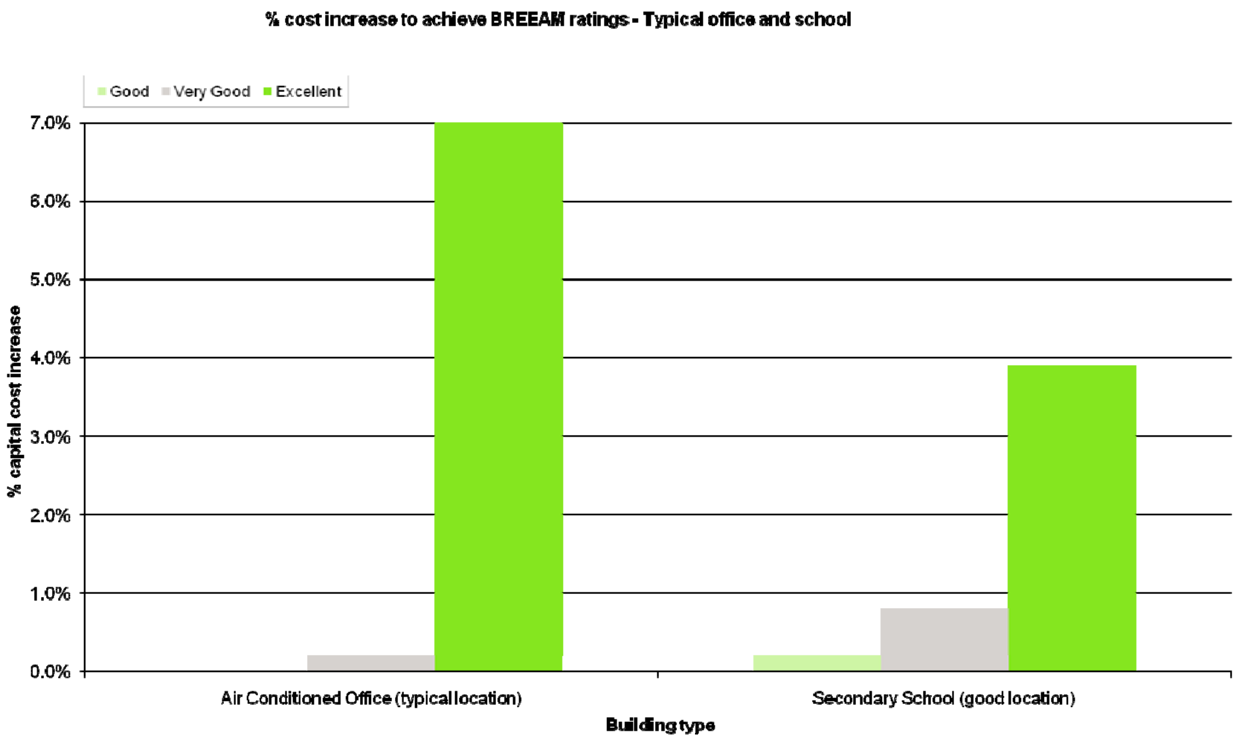

Figure 13 Costs (over base construction cost) for delivering BREEAM Offices (2004) and BREEAM schools ratings.

The cost analysis above shows that the ‘Very Good’ level of BREEAM is achievable with a small increase to build costs, while the costs associated with BREEAM ‘excellent’ are much more substantial.

5. Results of mapping

5.1. Introduction

A series of GIS mapping exercises has been undertaken as part of this study and has resulted in the production of a number of maps illustrating opportunities for low and zero carbon energy production across Torbay as well as providing an indication of the level of resources such as biomass fuel.

A key output from the mapping work are the Energy Opportunities Plans (EOPs) which draw together data from a number of sources to present key specific opportunities particularly for community scale and stand alone energy generation. EOPs have been produced for Torbay as a whole, Torquay, Paignton and Brixham and the key features of each is discussed in this chapter.

The EOPs have been used to identify whether opportunities exist within the five strategic sites (discussed in Chapter 6) and each site is discussed in the sections within this chapter, covering the EOP on which it is shown. A brief summary of the approach to identifying opportunities within the sites is also provided in Appendix F.

This chapter also discusses the other constraints mapping for onshore wind (both large and small scale), offshore wind, hydro power, biomass resource and microgeneration capacity.

The following GIS mapping has been undertaken as part of this study and is presented in Appendix H, with the building key provided in Appendix G:

- Existing heat demand including key potential anchor heat loads;
- Large scale wind;
- Small Scale wind;
- Offshore wind;
- Hydropower;
- Biomass resource.

5.2. Overview of the five Strategic Sites

By analysing the heat mapping, areas were identified which appear to be likely to yield sufficiently dense load to make a DHN financially viable. Appendix F provides details of the eight originally identified areas, which were then reduced to five strategic sites. Some of these five strategic sites have had core and extended options examined due to uncertainties in the mix of use, and to demonstrate the suitability of extending the network outside the core area.

Of the five strategic sites identified, three, potentially, could be viable for district heating and we have characterised these sites as Strategic District Heating Areas (SDHAs). These SDHAs include all forms of heat load identified; new and existing residential stock, new non-residential development and specific existing non-residential loads.

The principle of these SDHAs is to identify where the Council might feasibly use planning policy to help deliver a number of low carbon district heating systems.

In addition, sites with greater potential for Torbay Council to influence delivery have been highlighted. For example, Council-owned buildings and those at an early stage of the planning process. This is because the practical delivery of these schemes can be the crucial element of securing the required heat demands to effectively ‘kick-start’ a DHN in that area. Delivery policy options are discussed in more detail in the Chapter 8 ‘Delivery’.

The table below highlights key characteristics of the five strategic sites which affect potential viability for a DHN.

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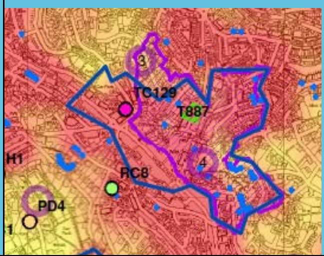
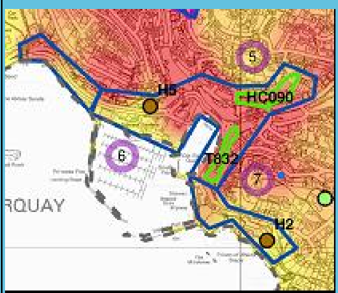
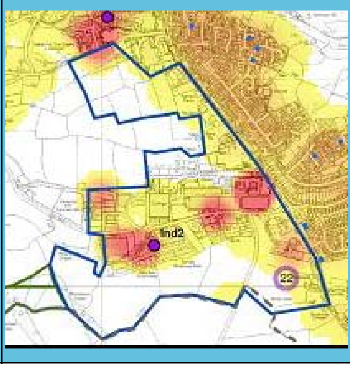
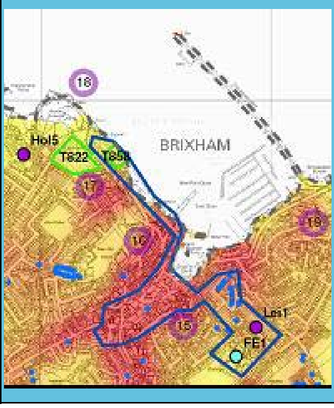
	Strategic Site	CESP area	Social Housing	Existing Housing	Mayor's Vision	SHLAA	Key existing Non-residential	Greenfield	Possible Extensions	Mixed Use	Major Retail area	Physical barriers e.g. railway	Anchor Buildings	Opportunity to influence	Good financial viability	**SDHA**
1	**Castle Circus and Union St** 	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓
2	**Harbourside** 				✓	✓	✓		✓	✓		✓	✓	✓	✓	✓
3	**White Rock & Yalberton** 				✓		✓	✓		✓			✓	✓	✓	✓

Capabilities on project:
Building Engineering

	Strategic Site	CESP area	Social Housing	Existing Housing	Mayor's Vision	SHLAA	Key existing Non-residential	Greenfield	Possible Extensions	Mixed Use	Major Retail area	Physical barriers e.g. railway	Anchor Buildings	Opportunity to influence	Good financial viability	SDHA
4	**Paignton** 	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✘
5	**Brixham** 		✓	✓	✓	✓	✓		✓	✓				✓		✘

5.3. Energy Opportunities Plan (EOP)

The Energy Opportunities Plan (EOP) consists of a number of key outputs from the mapping exercise. The maps bring together a number of GIS datasets which contain the results of the modelling work undertaken as part of the project as well as information on constraints affecting wind power opportunities. The modelling itself assesses a range of factors around the viability of the identified SDHAs.

There are 12 maps included in Appendix H which accompany this chapter. Appendix H should be read alongside the commentary presented in this chapter. The 12 maps are:

1. EOP Torbay Overall: This shows the overall energy opportunities map for Torbay at a high level (1:65,000). The energy opportunities shown include onshore wind resource, hydro and areas of high residential heat density. This can be used to place the opportunities in relation to each other across Torbay. The following maps split Torbay into the three core areas, Torquay, Paignton and Brixham at a more detailed scale of 1:20,000 to enable a more detailed assessment of areas of high heat demand.
2. EOP Torquay: This EOP shows the most northern parts of Torbay, around Torquay and north towards Teignmouth.
3. EOP Paignton: This EOP shows the central area of Torbay around Paignton.
4. EOP Brixham: This EOP shows the most southern part of Torbay around Brixham and Berry Head.
5. Onshore Wind constraints map: Using the principal constraints to wind energy, as set out in the DECC methodology and the Regen SW data sets, this EOP sets the unconstrained areas of Torbay that could be suitable for wind energy at a high level of 1:65,000.
6. Onshore Wind constraints map highlighting Torbay's Adopted Local Plan designations: This EOP (1:65,000) shows the unconstrained areas from EOP 5 and overlays the local plan designations to allow further discussion on the appropriateness of the unconstrained wind energy areas.
7. Onshore Wind constraints map highlight Bat Flight Paths: Similarly, this EOP (1:65,000) shows the unconstrained areas from EOP 5 and overlays the Bat Flyways and Corridor from the South Hams report to demonstrate how they interact with the possible wind energy sites.
8. Offshore Wind constraints map: This is a 1:6,000 constraints map focussed in on the offshore wind potential at the end of the Brixham Breakwater.
9. Small Scale Wind constraints map: This constraints map (1:65,000) shows both the land classification (Urban, Sub-urban, or Rural) and average wind speeds from the national NOABL database. From these two layers of information a more accurate average wind speed is deduced, and hence areas suitable for small scale wind are highlighted.
10. Biomass EOP Food Waste: This EOP (1:65,000) shows the total amount of food waste available in tonnes of wet waste per $1km^2$. This has been summed from two sub sets: Municipal Solid Waste (food waste) and Commercial and public sector food waste.
11. Biomass EOP Agricultural Waste: This EOP (1:65,000) shows the total amount of agricultural waste available in tonnes of wet waste per $1km^2$. There are four sub data sets assessed as part of the Regen SW study including Cattle, Dairy, Pig and

Poultry slurry. However, this EOP has only identified Poultry resource in Torbay even though there may be other agricultural resources that could be included in a more detailed ground-truthing exercise. .

12. Biomass EOP Timber Waste: This EOP (1:65,000) shows the total amount of timber waste available in oven dried tonnes per 1km^2. This EOP is made up of five sub-sets covering Demolition (treated waste wood); Municipal Solid Waste (MSW) waste wood; Arboriculture waste wood; Industrial and construction (clean waste wood) and Forestry.

5.3.1. EOP Torbay Overall

The energy opportunities shown include onshore wind resource, hydro and areas of high residential heat density.

Wind resource

Overall, there is a small proportion of unconstrained wind area in Torbay. The unconstrained wind resource areas are generally small and scattered due to the high proportion of residential development and environmental constraints which limit the opportunities for wind turbines. The two single largest areas of unconstrained wind resource are to the south west of Paignton on the ridge between South Hams and Torbay. These are generally in the Shopdown Copse and Windmill Hill areas. These do not necessarily indicate areas which are recommended for development as wind farms, but rather they indicate large areas which are unconstrained from residential, environmental and aviation constraints which increase the potential that a suitable location could be found for a wind turbine.

Other smaller sites are scattered around Torbay in the following areas, starting from north Torbay southwards:

- On the coastal area north of Babbacombe: with predominately south westerly winds, this site could be too sheltered from Torquay;
- Two areas to the west of Cockington:
- One area to the west of Great Parks, and Blagdon: this site is close to the potential new development at Great Parks and could be studied further in conjunction with this development;
- On the border with South Hams to the west of Churston Ferrers: due to its close proximity to South Hams, this site should be examined with close involvement of the neighbouring Local Authority;
- At the end of Brixham Breakwater: this could be studied further as part of the northern arm development in Brixham Harbour, however, due to predominately south westerly winds, this site could be too sheltered from the rising hills of Brixham;
- On the tip of Berry Head: this site is not looked at any further due to its close proximity to the Coastal Protection Area.

Hydro resource

There are four blue diamonds in this EOP which represent sites identified in the EA Hydro Opportunities report as having a 10kW potential each. This is relatively small in terms of hydro power however there are three of them in the Clennon Valley area which may provide a more attractive development opportunity. The fourth site is north of Torquay close to the railway line and Torbay District General Hospital.

Heat opportunities mapping

For assessing opportunities for district heating networks using these EOP’s, there are three areas to consider:

1. Existing residential heat demand (as shown by colour shading)
2. Existing non-residential heat demand (shown as point data)
3. New developments (Mixed-use Mayor's Vision sites, SHLAA sites, or new private developments)

In this EOP, the residential heat density colour shading represents existing residential heat demand only based on National Statistics data sets of residential gas consumption in Lower Super Output Areas (LSOAs). Initially, the EOP illustrates three core areas of existing heat demand: Torquay, Paignton and Brixham. Torquay has the highest proportion of high residential heat density, all of which is concentrated to the east of the railway line. Paignton has a larger proportion of lower residential heat density, indicating that the residential heat demand is more spread out across the area. Paignton's areas of high residential heat density are also located to the west of the railway line, indicating that to the east of the railway there is less demand, however this colour shading only includes residential demands, and would not include the many hotels along the seafront (this heat demand is explored as part of the SDHA option testing).

In addition, this EOP shows that there are no CESP areas in Brixham, however there are such areas in both the centre and outskirts of Paignton and Torquay. These areas are often difficult to treat using measures other than a low carbon heating system, particularly in the conservation areas of Torquay and Paignton where solutions such as increasing energy efficiency using external cladding may not be feasible.

Overall, this suggests an initial indication that central Torquay may be better suited to a district heating network than Paignton or Brixham because more heat is required in a smaller area and the Council have indicated that they have areas of hard-to-treat housing and such a solution may present an opportunity to address this issue.

Considering existing non-residential buildings, there are leisure centres with swimming pools and hospitals that would provide high heat demands from a single building. These include Torbay District General Hospital in north west Torquay and Torbay Leisure Centre in south Paignton. The EOP shows that both of these sites are located on the outskirts of the town and away from other heat demands. Therefore they may not be useful in the context of a district heating network; however, they may still be suitable for more localised heat networks, in particular for the Torbay Leisure Centre with any proposed Clennon Valley development.

The new developments across Torbay are shown by the Mayor's Vision sites and land identified in the SHLAA (Strategic Housing Land Availability Assessment). Also of relevance are the growth areas identified in the Core Strategy.

Overall, this EOP can be used to understand the physical relationship of the opportunities across Torbay. The following maps split Torbay into the three core areas of Torquay, Paignton and Brixham at a more detailed scale of 1:20,000 to enable a more detailed assessment of areas of high heat demand.

5.3.2. EOP Torquay

This EOP highlights building level detail such as key roads with high residential heat density and clusters of social housing.

Wind resource
There are three small wind resource areas shown in this EOP:

- On the coast side at Shag Cliff, north of Petit Tor Beach;
- Two sites, west of Cockington.

The areas marked on the EOP's indicate unconstrained areas based on the DECC methodology, however a practical ground-level assessment needs to be made of the appropriateness of the sites including measured average wind speeds.

The EOP for the assessment of small scale wind indicates that, based on the NOABL database, the coastal cliff at Shag Cliff could have average wind speeds of 5 – 5.5m/s (at 10m hub height). Nevertheless, predominantly south westerly winds result in a sheltered Torbay, and therefore may reduce the suitability of this site. It is also close to a Scouts' campsite and a wind turbine could be used as part of an education project on renewable energy.

The two sites near Cockington Country Park may also prove to be too sheltered from the south westerly wind and hence local wind monitoring would be required to confirm average wind speeds. This would also be a prominent location for Torbay as it would be seen from across the bay as a strong visual statement of Torbay's commitment to a low carbon future by being seen from the main road into Torquay (A 3022). Overall, their close proximity to Cockington Country Park means that these sites could be examined further in conjunction with Torbay Coast and Countryside Trust as a key delivery partner.

Hydro resource
This EOP has identified one potential hydro site on the river running along the main road into Torquay (A 3022) and the railway line. It is close to an existing weir behind a light industrial park on Newton Road. This is also close to the Torbay District General Hospital. The EA report has classified this site as having a 10kW potential which is broadly equivalent to the annual CO_2 emissions for 3-4 homes.

Heat opportunities mapping
From the overall EOP, Torquay was shown to have an existing residential high heat density compared to Paignton and Brixham. In this EOP, a more detailed assessment highlights the principal routes of existing residential high heat density from Torquay train station towards the Harbour along Union Street, and reaching north along Market Street and behind Torquay Town Hall. There is also a CESP area behind the Torquay Town Hall indicating there is the potential to deliver large carbon savings through implementing a low carbon heat network. This central area of Torquay also has seven Mayor's Vision sites including Torquay Central station, Castle Circus Civic Hub, Torquay Harbourside and Victoria Parade. This indicates a good opportunity for the delivery of a low carbon heat network to be integrated into the new developments.

Consideration should be given in this area to the flood risk to the west of Union Street. A flood risk area would not affect the location of heat pipework, however, it would affect the design and location of the energy centre.

There is also a stretch of existing residential high heat density along Babbacombe Road towards St Marychurch. This is quite a narrow and linear area of high heat density which is without large non-residential anchor loads and therefore is not initially attractive for a low carbon heat network.

Another interesting area of this Torquay EOP is in the central north area, around Combe Pafford, where there are three large CESP areas and a significant proportion of existing social housing. These are not shown on the EOP as having a high heat demand so it can be assumed that this social housing is relatively new build with better insulation. These sites are in close proximity to SHLAA sites and reasonably large schools. This illustrates that there could be a large district wide demand for heat, however it is not a dense site and the heat network costs may outweigh the financial benefits of the network.

To the west of this area, along the main road entering Torquay, there are two growth locations identified in the Core Strategy:

- Edginswell; and,
- Scotts Meadow

Edginswell is a proposed new employment (2ha) and residential (750 units) area. This would be a suitable mix for district heating, and as this is a new development, it would be easier to integrate into the designs than retrofitting and integrating into existing infrastructure. Scotts Meadow has been proposed for 250 units in the Draft Core Strategy and this is generally below the typical size for a district heating network. However, if there was a key anchor load adjacent to Scotts Meadow with a heat demand of approximately 200-300MWh/yr that would be able to connect to the network, then this could prove to be a more viable scheme. Currently, adjacent to Scotts Meadow, on the same side of the railway line, is the retail park, The Willows, which could be considered for this purpose.

Other key anchor loads in Torquay include Torbay District General Hospital, Rowcroft private hospital, Mount Tryon Nursing Home and the large hotels on the seafront.

Overall, there are potential sites around Torquay that could be viable for a district heating network as they include areas of existing high heat demand and proposed new mixed use development to aid delivery.

5.3.3. EOP Paignton

Paignton, the central area of Torbay, is shown to have a wide number of options covering unconstrained wind areas, three hydro opportunities, and three characteristic high heat demand areas.

Wind resource

There are four unconstrained wind sites, shown on this EOP, west of Paignton. These are:

- Small area near to Rams Hill Copse, west of Great Parks;
- Small area close to South Hams Border and the Angling Centre, however this site is too close to the national grid pylons and would likely be completely removed from this EOP in a more detailed constraints mapping exercise.

- Largest single unconstrained area at 0.119km^2, south of Windmill Hill. This site is also close to the national grid pylons and crosses Aish Road, therefore this area would likely be approximately a third smaller following a more detailed constraints mapping exercise.
- Second largest single area at 0.046km^2, west of Torbay Business Park near Shopdown Copse; this site is constrained by the business park as these are classified as 'occupied buildings'. However, as these would solely be non-residential uses, the wind opportunity area could increase through a more detailed constraints mapping exercise, moving closer in to the proposed land for further employment land between E1.17 and Shopdown Copse. Hence, this wind opportunity should be further investigated, with the development of this land, to assist in its delivery.

The majority of these sites are on the border with South Hams and therefore any further investigation should be carried out in conjunction with any wind turbine studies South Hams might be carrying out. This can help combine strengths in positioning of wind turbines, and minimise conflicts regarding visual impacts and downwind implications on wind resource.

Hydro resource

There are three potential hydro sites all in the Clennon Valley, south of Paignton. All three of these sites are classed in the EA report as 10kW capacity, totally 30kW which could power 10 homes. Further investigations on the actual head height available from this site would need to be carried out to confirm the potential. This could be investigated further as part of the Clennon Valley Mayor's Vision project for leisure and tourism facilities. However, there are flood risk issues that are currently trying to be resolved.

Heat opportunities mapping

As in the Torquay EOP, the building level heat density mapping begins to illustrate the residential heat density routes, and, combined with the information on new developments, the delivery options can also be discussed. The heat network opportunities in Paignton can broadly be split into three characteristic sites:

- High density town centre network;
- Lower density social housing network;
- New Greenfield mixed use network.

High density, town centre network; Paignton Town Centre is shown to have an existing residential high heat density predominately on the west of the railway line close to the station, but also to the east of the railway line in a small area close to the pier. There is also a CESP area in the centre of Paignton, Paignton Community Hospital and five Mayor's Vision sites at Crossways and Victoria shopping centres, Paignton Train station and Oldway Mansion. This indicates an area of major new development which could be used to deliver a district heating network. These sites have also been tested for high rise residential blocks which would increase the viability for a heat network, as there are minimal piping costs relative to the heat demand to be met. Depending on the spatial growth plan for Torbay, and hence the residential density on these sites, this would affect the viability of any network.

One consideration could be taken on the location of the high rise flats; locating the highest density of residential units on the west side of the railway line, and as close to the hospital as possible. This would increase the viability of a network to connect this housing to a key anchor load in the area. Additionally, the larger heat network pipes would be shorter, but also they would not be required to cross the railway line, which would be costly.

Overall, in high density town centres, there is increased viability for a heat network, however there are more existing infrastructure issues that need to be resolved, such as the railway line in this case.

Lower density, social housing network; There is a significant group of social housing on the west of central Paignton which are in a CESP area and surrounded by three large SHLAA sites at Great Parks. These three SHLAA sites (Great Parks- Phase 2: Allocation H1:011, 012, and 013) have a combined total number of proposed new residential units of 448. This is around the size to be suitable for a district heating network, and combined with the nearby social housing, this could deliver a viable district heating network. However, this is not a dense site and there is no non-residential anchor loads nearby which could help the financial viability of the network.

Overall, there is a good mix of new and existing housing but this is generally low density meaning that any network would have high heat network costs. Therefore if a non-residential anchor load could be identified in the area, this would increase the viability of a potential network.

As part of the Spatial Growth Strategy a number of small sites are proposed at the end of Preston Down Road in the north of Paignton. These sites would typically be too small to make a district heating network viable, unless they were located close to anchor loads with heat demand of approximately 300MWh/yr.

New Greenfield mixed use network; Land west of Brixham Road including Yalberton, White Rock and Torbay Business Park has been identified for development in the Local Plan. The Core Strategy Growth Options paper identifies land for development around Totnes Road. There is currently development interest in land both north and south of the existing South Devon College, Torbay Business Park and Waddeton Industrial Estate, and include residential, hotel, employment, local centre and student accommodation. Depending on the spatial growth option in this area, the land could deliver between 1,000 and 5,000 residential units.

Overall, this type of site has the most potential as there is a mix of uses, including significant residential use, includes greenfield and development would involve new road infrastructure which could be integrated with the heat network pipe routes thus reducing capital costs. In addition, there is a central existing heat demand, Torbay Business Park and Waddeton Industrial Estate, which could house the initial energy centre while the remaining land is being developed phase by phase.

Totnes Road could also be classified in this category, however there is less non-residential use and there could be issues with crossing Totnes Road with heat network pipes due to road closures.

Capabilities on project:
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5.3.4. EOP Brixham.

Brixham has less energy opportunities than the rest of Torbay. This EOP identifies only a few small unconstrained wind areas, no hydro opportunities and there is a lower residential heat density overall.

Wind resource
There are three unconstrained areas in this EOP:

- Narrow area on the border with South Hams close to the reservoir off Kennels Road, this site is on the ridge which shelters Torbay from the south westerly winds, therefore it is likely to have the highest wind energy yield. Also, as shown in the later EOP on Bat Constraints, this site is crossed by a Bat Corridor which is likely to restrict wind turbine development further;
- End point of Brixham Breakwater, which could be investigated further in conjunction with the Brixham harbour redevelopment, however, the wind speeds would need to be monitored, as the area is generally sheltered.

In summary, there may be a small potential on the Brixham breakwater and a narrow site on the border with South Hams near Kennels Road, west of Brixham.

Heat opportunities mapping
This EOP shows that the main routes of existing residential heat density are centred around Brixham market place and then the high heat density areas spread outwards along the valley routes: New Road, Bolton Street, Berry Head Road and Overgang Road. There are small clusters of social housing which could provide an opportunity, however they are generally spread-out and are not initially attractive for a district heating network.

There are however large non-domestic anchor loads close to these routes including the Brixham Community Hospital, Brixham Community College and Admirals Swimming Pool. There are five Mayor's Vision sites in this area and this would bring new residential and mixed use development, and heat network pipes could be integrated into the redevelopment infrastructure works. This supports the idea of a Central Brixham heat network.

As mentioned in Paignton and Torquay, if the Spatial Growth Strategy favours high density high rise buildings, then there could be a strong case for looking into district heating here, however, if the density is reduced, this decreases the viability.

5.3.5. Onshore wind constraints map

This constraints map is based on Regen SW GIS data provided by Wardell Armstrong[55] for large scale wind turbines and shows the environmental and landscape constraints that exist in the Torbay area and were used to physically limit the area available for Wind Turbines.

The Wardell Armstrong assessment is based on a 2.5MW turbine and sets different offset / radius used for the various features in the constraints mapping, for example:

[55] Regen SW Wind Resource Assessment for the South West Following SQW energy Methodology, Wardell Armstrong, June 2010

Feature	Radius (m)
A roads & primary road	20
B roads	12.5
Motorways	30
Railways	10

Table 12 Feature Offsets

This constraints mapping also takes into account MOD constraints and residential noise mitigation. Wardell Armstrong's experience of noise modelling shows that an estimated offset of 600m for this scale of turbine is the minimum requirement to site a turbine.

This constraints map shows that there are large environmental constraints in the coastal areas of Torbay, with other large areas to the west of Brixham, and around Cockington. In addition, with the large proportion of urban areas in Torbay, there are limited areas remaining that could be physically accessible for Wind Turbine development.

5.3.6. Onshore wind constraints map highlighting areas Torbay's Adopted Local Plan designations

This constraints map shows the additional local land designation areas in Torbay and indicates that all the unconstrained wind areas fall within the Area of Great Landscape Value.

Therefore all of the sites could be required to demonstrate how any adverse visual impacts can be minimised. This is often a crucial aspect of wind turbine developments and should be approached with consideration for the neighbouring communities. Often, community involvement at the early stages is vital in the understanding of the implications of a wind turbine and working with the community to resolve issues can integrate a successful scheme.

5.3.7. Onshore wind constraints map highlight Bat Flight Paths

This Bat constraints GIS data was provided by Torbay Council along with the Guidance report from South Hams[56]. The greater horseshoe bat is one of Britain's largest and rarest bats, and this guidance report sets out suitable land management practices to maintain a favourable habitat for these bats. Greater horseshoe bats require, in particular, low level linear paths to assist in their navigation such as lines of vegetation (e.g. hedgerows, woodland edge, vegetated watercourses, etc). Therefore, a wind turbine installed close to a bat flyway or sustenance route would need to be designed in accordance with this planning guidance.

[56] South Hams SAC – Greater Horseshoe Bat Consultation Zone Planning Guidance, Natural England, June 2010

The guidance report states that based on current knowledge, and applying the precautionary principle, wind turbines (both micro and full scale) would be classed as a high risk development. They are likely to cause adverse impacts on a strategic flyway and within sustenance areas, and consequently adversely affect the favourable conservation status of the SAC.

The constraints map shows that the only unconstrained area that conflicts with the Bat Corridors or Flyways is the narrow site on the border with South Hams near Kennels Road, west of Brixham. However, due to the nature of a wind turbine close to a greater horseshoe bat conservation area, any of the unconstrained sites would need to carry out bat monitoring on the site to ensure there was no negative impact. In particular, Rams Hill Copse, near Great Parks, is surrounded by Bat Corridor Lines; and a Bat Corridor line runs between the two large sites west of Paignton. In addition, although the Bat Corridor Lines are not shown far off shore, they indicate that there is bat corridor line between Clennon Valley and Berry Head, which would cross the end of the breakwater, and potentially the unconstrained site in Brixham Harbour.

In summary, this constraints map highlights the following sites:

- Kennels Road at border with South Hams, which is also crossed by a radio tracking line
- Rams Hill Copse, Windmill Hill and Shopdown Copse, which are located close to bat flyways and corridor lines;
- All other sites, which would require surveys to be carried out to detect bat commuting routes.

5.3.8. Offshore wind constraints map

This constraints map shows that there is an unconstrained wind area on the Brixham breakwater, meaning that there could be an offshore wind turbine opportunity close to the shore. However, the constraints map also shows the wind rose for Brixham and that there are predominately south-westerly winds which could be sheltered by the cliffs in Brixham town and therefore reduce the wind speeds at the end of the breakwater. In Brixham, the breakwater is beyond a 600m residential buffer; any turbines on the proposed Northern Arm would be within this.

5.3.9. Small scale wind constraints map

This constraints map is based on GIS data provided by Wardell Armstrong[57] for small scale wind turbines and shows the Annual Average Wind Speed (AAWS) for 1km grid square, based on the NOABL wind speed database[58] at the reference height of 10m, and the land classification: Urban; Sub-urban; Rural. Together, this information can indicate if there are areas of good small scale wind resource in Torbay.

An area considered of good wind resource has an AAWS of greater than 4.5m/s because below this speed, the power output from the turbine steeply decreases. Furthermore, most wind turbines are designed to have a cut-in speed of 4.5m/s, e.g. they would not generate electricity at lower wind speeds.

[57] Regen SW Wind Resource Assessment for the south west Following SQW energy Methodology, Wardell Armstrong, June 2010
[58] NOABL wind speed database is the UK DTI Wind Speed Database: http://www.bwea.com/noabl/index.html

The AAWS shown in this constraints map includes the effects of local topology, and obstructions (such as trees and buildings) on the wind speeds. As stipulated in the SQW DECC Methodology the AAWS is dependent upon the urban / rural classification, which sets a different scaling factor to be applied. This scaling factor reduces AAWS in urban locations down by a factor of 56%. E.g. an urban site with an AAWS on the NOABL database of 5m/s becomes an AAWS of 2.8m/s. This significantly affects the wind power outputs and hence the suitability for small scale wind. The full scaling factors are shown below:

Classification	Scaling Factor
Urban	56% (x 0.56)
Sub-urban	67% (x 0.67)
Rural	100% (1.0)

Table 13 Wind speed scaling factors

The Wardell Armstrong report for Regen SW uses the DEFRA Rural Definition dataset (based on LSOA dataset) which has all areas within Torbay attributed to 'Urban' and thus the AAWS, once scaled by 56% falls below the 4.5m/s threshold. The Census OA dataset, which is slightly more detailed, attributes some of the outer areas of Torbay as 'Rural' and 'Sub-Urban' areas. This constraints map shows the Census OA dataset in order to illustrate more variety in the land classifications in Torbay.

Using the Census OA dataset highlights the northern Torbay area near Barton, which is close to a 'sub-urban' and a 'Rural' area. This is also an area with an unadjusted AAWS of around 7m/s and scaling this to the sub-urban factor, instead of the urban factor applied in the Wardell Armstrong report, increases the adjusted AAWS to 4.69m/s. Another area of interest is near the clusters of homes to the north west of Torquay which are classed as rural and have an unadjusted AAWS around 6m/s which could have potential when investigated in more detail. Hence, this EOP can be used to inform initial decisions on planning applications for small scale wind turbines, as to their suitability, in that area.

Overall, based on this EOP there are no areas of significant opportunity for small scale wind, however this is a very high level assessment and sites may be considered following local wind speed testing.

5.3.10. Biomass resource

The above Biomass EOPs cover the following:

- Biomass EOP Food Waste: This EOP (1:65,000) shows the total amount of food waste available in tonnes of wet waste per $1km^2$.
- Biomass EOP Agricultural Waste: This EOP (1:65,000) shows the total amount of agricultural waste available in tonnes of wet waste per $1km^2$.
- Biomass EOP Timber Waste: This EOP (1:65,000) shows the total amount of timber waste available in oven dried tonnes per $1km^2$.

Capabilities on project:
Building Engineering

These EOP’s show that for the timber waste and the food waste, the majority of the waste resource is located around the town centres, particularly in the case of the food resource. The sub sets of data for the food resource show that 77% of the resource comes from Municipal Solid Waste (food waste) and the remaining 23% is from Commercial and public sector food waste.

Similarly for the Wood and Forestry EOP, Table 14 shows the breakdown of the sub sets of data for Demolition (treated waste wood); Municipal Solid Waste (MSW) waste wood; Arboriculture waste wood; Industrial and construction (clean waste wood) and Forestry.

Wood and Forestry Breakdown	
Demolition (treated waste wood)	20%
Municipal Solid Waste (MSW) waste wood	25%
Industrial and construction (clean waste wood)	28%
Arboricultural waste wood	12%
Forestry	15%

Table 14 Breakdown of sub datasets for Wood and Forestry Biomass Resource

The Regen SW assessment also gives the total resource for the whole SW region, and this is shown in Table 15.

	Food (m^3 CH4)	**Agricultural Waste (m^3 CH4)**	**Wood and Forestry (odt)**
Torbay Total	1,310,142	7,863	7,162
SW total	54,800,000	59,159,000	255,745
% of SW total	**2.39%**	**0.01%**	**2.80%**

Table 15 Summary of Biomass Resource in Torbay and SW Region[59] [NB. m^3 CH4 = volume of wet methane; odt = oven dried tonnes]

This shows that Torbay has a small potential of the biomass resource in the SW region, with some of the largest potential from collecting organic MSW waste. Regen SW Methodology report[60] state the importance of local authorities and their waste management plans, as these are an essential consideration when seeking to maximise the use of waste streams as potential energy resources. In addition to the theoretical potential resource in the area, local authorities need to understand who is producing it and how it is currently being disposed of in order to ensure waste plans prioritise waste streams for energy. An additional important issue is supporting local authorities to develop waste contracting agreements that do not prevent future diversion of waste streams to energy production.

[59] This uses a conversion factor of 1 tonnes of wet waste = 86m3 CH4
[60] The South West Renewable Energy Resource Assessment: Methodological Report, Regen SW, November 2010 (Section 4 on Biomass)

5.4. Microgeneration capacity

Regen SW have recently completed their microgeneration capacity assessment as based on the DECC SQW Methodology[61]. This aims to cover renewable energy systems that can be integrated into buildings to primarily serve the on-site energy demand. They are applicable to both domestic and non-domestic buildings and can be connected to the grid although this is not required as most of the output is used on-site.

In this chapter, the Microgeneration technologies covered are solar and heat pumps, because the other microgeneration technologies (Wind, biomass, and hydropower) and not directly constrained by the built environment and more specifically by what can be installed on-site as other deployment options are available, e.g. off-site or large scale capacity development.

Table 16 shows the maximum potential microgeneration capacity in Torbay for the following technologies:

- Solar Hot Water (SHW)
  - The potential depends on available roof space, orientation and exposure, and finally hot water demand on-site because generating excess hot water than can be used on site would be wasted as this cannot be exported to a national grid network.
  - Average generation capacity of an individual system would be 2kW for a domestic scale installation, and 5kW for a commercial scale installation.
  - The DECC SQW Methodology assumes an uptake of 25% for existing domestic, 40% for existing commercial; 80% for existing industrial stock and 50% for all new build developments.
- Solar photovoltaics (PV)
  - The potential depends on available roof space and orientation and exposure. NB. the SQW DECC Methodology uses a single set of parameters for both SHW and PV to avoid any double counting in assessing potential roof area available.
  - The DECC SQW Methodology assumes the same average generation capacity and the same uptake for PV as for SHW.
- Heat pumps – grounds source heat pumps (GSHP) and air source heat pumps (ASHP).
  - The regional assessment of the potential for heat pumps is therefore based on the premise that most buildings (existing stock and new build) are suitable for the deployment of at least one of the heat pump options.
  - Average generation capacity of an individual system would be 5kW for a domestic scale installation, and 100kW for a commercial scale installation.
  - The DECC SQW Methodology assumes the following uptake rates: 100% of all existing off-grid domestic properties; 75% of all existing detached and semi-detached properties; 50% of existing terrace properties; 25% of existing flats; 10% of existing commercial and 50% of all new build domestic properties.

[61] Regen SW Microgeneration Capacity Assessment, October 2010

For each of the technologies, an assumption is included on the percentage of existing and new buildings that will take up these technologies, as set out in the SQW DECC Methodology. It should be noted that planned new housing statistics were taken from the south west Regional Spatial Strategy (RSS), which could be now out of date for Torbay.

	Solar (Overall - assumes all PV)	**Solar Hot Water**	**PV**	**Heat Pumps**
	(kW)	(kW)	(kW)	(kW)
Domestic	48,589	48,589	48,589	215,280
Non-domestic[62]	11,030	6,440	11,030	22,950
Torbay Total	**59,619**	55,029	59,619	**238,230**
Devon	**589,441**	550,921	589,441	**2,069,130**
% of County Capacity	**10%**	10%	10%	**12%**

Table 16 Microgeneration Capacity for Torbay compare to overall County total (Source: Regen SW, October 2010)

It is important to note that the two columns for solar water heating and photovoltaic generation should not be summed as the SQW methodology is based on available roof space. The figure for photovoltaic generation is higher in each case as solar water heating has not been included for commercial buildings in line with the SQW methodology. The figures for solar should therefore be regarded as the maximum for both technologies and the split between them can be arbitrary, up to the maximum figure for solar photovoltaic.

The Regen SW Methodology report[63] also raises their concerns for the viability of heat pumps considering the recent EST trials[64] showing that many of the installations monitored had COP's[65] below the EU standard required to be classified as a renewable technology. Therefore, EST are recommending that for domestic properties heat pumps should only be considered for installation in well-insulated, off-gas existing or new build dwellings. In summary, the figures given in Table 16 should be taken as an overestimate of the heat pump potential in Torbay.

There are also concerns raised in the Regen SW Methodology report with the applicability of SHW on retrofit to existing buildings, as they point out that generally, only buildings with stored water systems are considered suitable for SHW which would therefore reduce the actual commercial deployment potential in reality. Similarly, for the retrofit of heat pumps which require low temperature distribution systems, which are particularly difficult to retrofit to buildings. Standard advice from installers is that heat pumps work best in properties which are already very well insulated and airtight. This is not the case for the majority of the south west building stock and is likely to prove a major constraint.

[62] These numbers based on VAT Based Enterprise Statistics, which only shows the number of registered businesses and not the number of buildings.
[63] The South West Renewable Energy Resource Assessment: Methodological Report, Regen SW, November 2010, (Section 6 on Microgeneration)
[64] Getting Warmer: a field trial of heat pumps, EST, September 2010
[65] Co-efficient of performance (COP) is a performance factor related to the efficiency of a technology.

Finally, Regen SW state it is their view that the spatial analysis output of the SQW methodology is of very limited value at local level. This is due to the broad and arbitrary constraints selected as well as the lack of certainty in the datasets used, where building numbers and types are not always up to date. Additionally, this does not take into account local constraints that in many cases may inhibit commercial viability for microgeneration technologies.

Overall, Table 16 shows that Torbay, one of 10 Local Authorities in Devon, could contribute up to 10% of the County's capacity for micro generation, which is significant considering for Torbay's size. This could be used as a target figure for deployment of microgeneration technologies. This table also shows the expected contribution that domestic scale heat pumps could contribute, compared to non-domestic installations. It should be noted that a community connected to a district heating network, would be unlikely to find it cost effective to install a heat pump as well as connecting to a DHN, as both technologies are competing for the same heat demand. However, heat pumps could still play a large role in reducing Torbay's heat demand by being encouraged in homes that could not connect to a DHN, and also the central energy centre for the DHN could install large scale heat pumps to generate heat for the DHN at a more cost effective scale. This method of a grid-electricity heating network could become increasingly attractive as the national grid is decarbonised after 2030.

6. Cost benefit analysis

6.1. Introduction

A key requirement of the Torbay Sustainable Energy Assessment (SEA) is to establish whether deliverable opportunities for DHNs exist within Torbay and, where they do, demonstrate their viability in order to provide an evidence base for policy to support their development.

In this chapter, all of the five Strategic Sites are assessed along with their associated options. For each of the Strategic Sites the input and outputs from the model are shown and discussed in this chapter with a summary table comparing all of the different options across the strategic sites provided at the end of this chapter.

By identifying SDHAs in which it is proposed to establish DHNs, the inevitable question of how such a scheme might be financed is raised. The cost for establishing a DHN is significant and, along with planning policy, forms the fundamental hurdle to deliverability. In all but the most extreme cases, it is possible to overcome any technical difficulty associated with the installation and operation of DHNs but it is the question of the level of investment required for that installation and ongoing operation versus the likely revenue that might be generated which is the equation to be balanced if viability is to be demonstrated.

The majority of the work described in this report thus far has been used to feed into the crucial step of assessing the financial viability of each potential SDHA opportunity. This assessment compares the cost benefits of delivering a DHN with three different fuel sources:

1. Gas CHP: This is a commercially available technology and demonstrated across the UK from micro (~2kW) to large scale (>1MW). Therefore it can be used in single domestic installations, larger building installations, district and city wide schemes. The unit runs off mains gas and generates both electricity and heat.
2. Biomass CHP: This is becoming more common in the UK, but is generally only seen in medium to large scale installations (greater than 300kW). Generally there are issues to consider around fuel security, delivery and de-ashing which make larger scale schemes more commercially viable than smaller installations.
3. Biomass heat only: This technology has the same issue of fuel security, delivery and de-ashing as Biomass CHP however generates heat only and not electricity; this makes the technology simpler and cheaper.

For biomass schemes of any size (whether CHP or heat only), air quality issues must be considered, particularly where schemes are in urban locations. Typically, this is unlikely to affect commercial viability but may have an impact in particularly sensitive areas where additional installation costs for mitigation measures could be incurred.

Each of these technologies is compared against the cost of meeting carbon compliance in the most cost effective way, as set out in the CLG energy modelling, which maximises energy efficiency and then uses Solar PV panels to meet the remaining carbon target. Appendix B includes tables from this CLG analysis to support the decision to set the basecase as Solar PV. It should also be noted that the CLG assessment uses the 2006 Part L Building Regulations carbon emissions factors for grid electricity which are lower than the current factors for 2010. This therefore makes heat pumps appear to save more carbon than they would under current regulations further justifying the decision to use PV as the base case. There is also an increase in gas carbon emissions factor, but it is not as large as the electricity increase.

As the study is an early stage assessment to inform strategic planning, this cost benefit analysis is at a high level, but aims to demonstrate viability while using a development timeline based on the latest thinking from Torbay Council. This includes the delivery of new homes within the strategic sites, their location on the strategic sites, and hence when the associated district heating pipework would need to be installed. The analysis also takes into account the cost of building an energy centre to house the primary unit and associated plant. A more detailed methodology for this financial analysis is included in Appendix I.

The key inputs to the model are based on the number of proposed new build residential units, the number of existing residential units available to connect (assuming a maximum uptake of 75%), the area of new non-residential space proposed and the area of existing non-residential area from key anchor buildings that have been identified for connection. This information is input into the model year by year to show how the heat loads build up over time, and the summary tables shown in this chapter illustrate the final connected buildings and areas.

The key outputs shown in this chapter are the carbon and cost outputs. The carbon savings are shown in three different ways:

- CO_2 savings over 30 yrs: This is the overall figure that shows how much CO_2 is saved from this option over the life time of the assessment. 30 years is also the length of time period for Allowable Solutions. For example: a developer that needs to meet the final 30% of a building's CO_2 emissions using Allowable Solutions, needs to find a solution that will save the equivalent of 30% of the CO_2 which would be produced by the building over 30 years.
- CO_2 savings in 2013: This is the annual CO_2 savings of the option in the year 2013. This can be used to show how this option could affect Torbay's Climate Change Strategy 2013 targets.
- CO_2 savings in 2040: This is the annual CO_2 savings of the option in the year 2040. This shows the ultimate annual CO_2 emissions that would be expected from this option.

In addition, the percentage CO_2 saved in existing buildings due to the DHN connection is shown in the CO_2 savings analysis tables. This represents the CO_2 savings from supplying heat to existing buildings from the DHN, including any additional CO_2 savings from generating electricity with CHP, as a percentage of the heat related CO_2 emissions from those existing buildings. Therefore, a percentage greater than 100% is possible for options with CHP units, as electricity is being generated as well as heat. This percentage is important to assess, as a scheme which can deliver significant CO_2 savings to the existing building stock can achieve more across Torbay as a whole because these CO_2 emissions, which are not controlled through Building Regulations, are the more difficult CO_2 emissions to reduce.

The outputs from the financial analysis are the 30-year Net Present Value (NPV) of the option. NPV is a metric which allows options with different investment timescales, rates of return and so on to be compared against each other. It captures capital costs, operating costs and discounted cash flows. This analysis shows the 30yr NPV at two different discount factors (DF):

- 6%: this represents a discount factor which is more likely to be acceptable to the public sector who may take a longer view on projects than private investors;
- 12%: this represents a discount factor which is more likely to be acceptable to private sector investment.

The financial analysis also shows the effect of accounting for contributions from Allowable Solutions (AS) in Torbay. As discussed in Chapter 2.3 ‘Achieving Zero Carbon and the impact of existing stock’, zero carbon developments in Torbay are expected to use a financial mechanism to pay into a community carbon reduction project. A contribution has been accounted for in this financial model based on the number of new zero carbon buildings included in the option and the shadow price of carbon.

Contributions from developers at a £/m^2 have not been included in the cash flow analysis but instead, the required £/m^2 which would be necessary for the scheme to have a positive NPV is shown. This can then be compared to the expected cost to the developer of on-site compliance, which has been benchmarked at **£50/m^2** in Chapter 4 Baselining and Benchmarking.

Graphs are also used to show the timeline of the year by year increase of heat-related CO_2 savings of each of the three technologies compared to the baseline emissions for the site. These graphs show the heat CO_2 emission baseline for the site assuming:

- New buildings meet the energy efficiency standards set for the year they are delivered in;
- Heat demand in new buildings is met using high efficiency gas boilers (90% efficiency);
- Heat demand in existing buildings is met using standard gas boilers (85% efficiency).

These graphs show how there is a year-by-year increase in CO_2 savings as new development increases and the network can deliver more heat. This enables a comparison of how the different technologies perform over time.

6.2. Strategic site 1: Castle Circus and Union Street, Torquay

Overview

This strategic site encompasses two Mayor’s Vision sites:

- MV 3: Castle Circus containing the refurbishment of the Town Hall, new business hub and retail.
- MV 4: Union Street Retail, shopping destination and strong urban link between the retail centre and harbourside.

Additional key anchor buildings include:

- Tor Hill House, close to the Town Hall, mainly offices with some retail and is owned by the Council.

There are also a number of SHLAA sites included within this strategic site.

Heat demand profiles

There are two heat demand profiles that are modelled for this Strategic Site. This is to take into account of uncertainty over the delivery of some components of Union Street.

The two options are:

Option 1: Castle Circus and Union St

Including the Castle Circus site MV3, Tor Hill House as the catalyst property connecting in the first years then Union Street connecting after 2016 with 335 new residential units (including all SHLAA sites), 8,000m^2 office and 18,000m^2 retail.

Option 2: Castle Circus and Union St (Option 2)
As Option 1 with Castle Circus, however; Union Street has a reduced number of residential units and increased retail space (159 new residential units (including all SHLAA sites); 5,000m^2 office; 5,575m^2 food retail; 31,000m^2 retail).

		Castle Circus and Union St	Castle Circus and Union St (Option 2)
Option		**1**	**2**
No. of new resi (final)	No.	335	159
Area of new resi (final)	m2	20,100	9,540
No. of existing resi	No.	760	760
Area of new Non-resi (final)	m2	39,942	55,517
Area of existing Non-resi	m2	6,572	6,572
Total R+NR heat load at energy centre	MWh/year	16,576	16,574
Available existing housing CO2	tonnes CO2	2,599	2,599
Total Potential Income from AS	£	1,584,353	759,212
District Heating CAPEX	£	4,335,135	4,240,051

Table 17: Heat Demand data for Castle Circus [NB. R= Resi; NR= Non-resi]

This shows that decreasing the residential by 53% and increasing the retail by 39% results in a negligible change in the total heat demand of the site. Therefore with demand being the same for the two options, a similar amount of heat is delivered over a year resulting in similar carbon savings.

A change in emphasis from residential to retail does mean a slight increase in peak heating demands (kW) and this affects the more detailed costing and sizing of the associated equipment e.g. energy centre, buffer vessel, and heat network piping, but not the sizing of the main plant. Hence it should be expected that there will be a slight increase in capital costs associated with Option 2, but there will not be a change in the main size of CHP or boiler unit.

The contribution from Allowable Solutions will also be affected in Option 2 as there will be less homes being built after 2016, and therefore less financial contribution for the same size of scheme.

Capabilities on project:
Building Engineering

Summary of CO_2 savings

		Castle Circus and	
Gas CHP			
Unit Installed		1.6MW x 2	1.6MW x 2
Energy Centre + Plant CAPEX		3,552,642	3,636,161
CO_2 savings over 30 yrs		50,888	51,014
CO_2 savings in 2013		- 56	- 56
CO_2 savings in 2040		2,448	2,447
Existing buildings CO_2 saved by DHN connection		1,926	1,926
Biomass CHP			
Unit Installed		3.2MW x 1	3.2MW x 1
Energy Centre + Plant CAPEX		7,635,192	7,718,141
CO_2 savings over 30 yrs		98,559	98,506
CO_2 savings in 2013		- 56	- 56
CO_2 savings in 2040		5,080	5,080
Existing buildings CO_2 saved by DHN connection		4,093	4,093
Biomass Heat Only			
Unit Installed		1.6MW x 2	1.6MW x 2
Energy Centre + Plant CAPEX		4,170,968	4,254,400
CO_2 savings over 30 yrs		51,340	51,469
CO_2 savings in 2013		- 44	- 44
CO_2 savings in 2040		2,488	2,487
Existing buildings CO_2 saved by DHN connection		1,969	1,969

Table 18 Summary of CO_2 savings Analysis for Castle Circus

Table 19 shows the CO_2 savings analysis of this option. Firstly, as expected, the unit (i.e. the plant producing the heat to be distributed in the network) sizing is not affected by the change in mix of use, because overall, the same heat demand is required. For all technologies, the total size of unit is 3.2MW. For the Biomass CHP option, this is installed as one single unit, rather than two separate units because Biomass CHP operates more efficiently in larger sizes.

The CO_2 savings in 2013 are negative for all three of the technologies, due to the timing of the development, and the heat demand on the site not being sufficient to install any of the technologies before 2013. However, due to the overall size of the scheme, there are substantial CO_2 savings to be made overall, and in 2040 annual savings of 2,400 – 5,000 tonnes of CO_2 are being made each year. The timeline of the year by year increase in CO_2 savings of each of the three technologies is shown in Figure 14 and Figure 15.

These graphs also show when the modular CHP/boiler units are installed. For example, the first Gas CHP unit is installed in 2015 when there is sufficient heat demand for it to meet, and then in 2019, the second unit is installed as the final build out of the phases is finished. Modular units allow heat demands to be met as the development grows. However, it does increase capital costs because more than one unit is needed. Therefore, if phasing of the developments can be designed so that all the large heat demand buildings are built and connected at the same time it may be possible to use just one single unit, reducing costs and carbon.

Summary of financial analysis

		Castle Circus and Union St	Castle Circus and Union St (Option 2)
Option		**1**	**2**
Gas CHP			
Annual revenue from energy sales in 2013	£/yr	64,187	64,187
Annual revenue from energy sales in 2040	£/yr	1,528,428	1,497,818
Baseline 30 yr NPV @6%	£	- 3,168,101	- 3,404,968
Baseline 30yr NPV @12%	£	- 3,386,185	- 3,548,785
With AS contribution 30 yr NPV @6%	£	- 2,184,062	- 2,945,577
With AS contribution 30yr NPV @12%	£	- 2,752,399	- 3,258,481
Developer Contribution 6% IRR per area of new build	£/m2	36	45
Developer Contribution 12% IRR per area of new build	£/m2	46	50
Biomass CHP			
Annual revenue from energy sales in 2013	£/yr	64,187	64,187
Annual revenue from energy sales in 2040	£/yr	1,646,470	1,615,843
Baseline 30 yr NPV @6%	£	- 4,126,940	- 4,332,105
Baseline 30yr NPV @12%	£	- 4,620,430	- 4,759,628
With AS contribution 30 yr NPV @6%	£	- 3,142,901	- 3,872,715

With AS contribution 30yr NPV @12%	£	- 3,986,644	- 4,469,324
Developer Contribution 6% IRR per area of new build	£/m2	52	60
Developer Contribution 12% IRR per area of new build	£/m2	66	69
Biomass Heat Only			
Annual revenue from energy sales in 2013	£/yr	64,187	64,187
Annual revenue from energy sales in 2040	£/yr	1,144,713	1,114,157
Baseline 30 yr NPV @6%	£	- 4,092,382	- 4,330,647
Baseline 30yr NPV @12%	£	- 3,905,786	- 4,069,387
With AS contribution 30 yr NPV @6%	£	- 3,108,343	- 3,871,256
With AS contribution 30yr NPV @12%	£	- 3,271,999	- 3,779,084
Developer Contribution 6% IRR per area of new build	£/m2	52	60
Developer Contribution 12% IRR per area of new build	£/m2	54	58

Table 19 Summary of Financial Analysis for Castle Circus

Table 19 Summary of Financial Analysis for Castle Circus. Table 19 shows that between the baseline Options 1 and 2 there is on average a 5% increase in NPV for all three of the technologies when the residential units decrease and retail use increases.

The largest difference is seen between the baseline NPV and the NPV including the contribution from Allowable Solutions (AS). AS contribution is determined by the number of residential units built after 2016, and the associated emissions they can offset through connected existing buildings. Therefore, in this case, reducing the number of new residential units by 53% in turn reduces the possible contribution from Allowable Solutions and hence the overall NPV. For example, Gas CHP Option 1 has a 30% better NPV (6% DF) when including the Allowable Solutions, whereas Option 2, with less residential, only achieves a 13% better NPV (6% DF).

Overall, this option delivers good CO_2 savings but gap funding of between £2-4.5million would still be required to deliver the scheme. The gap funding per m^2 of new build for these options is comparable to the benchmark of £50/m^2 for developers to meet the 70% carbon compliance on site with the gas CHP option being the lowest. None of the options give £/m^2 costs less than the benchmark.

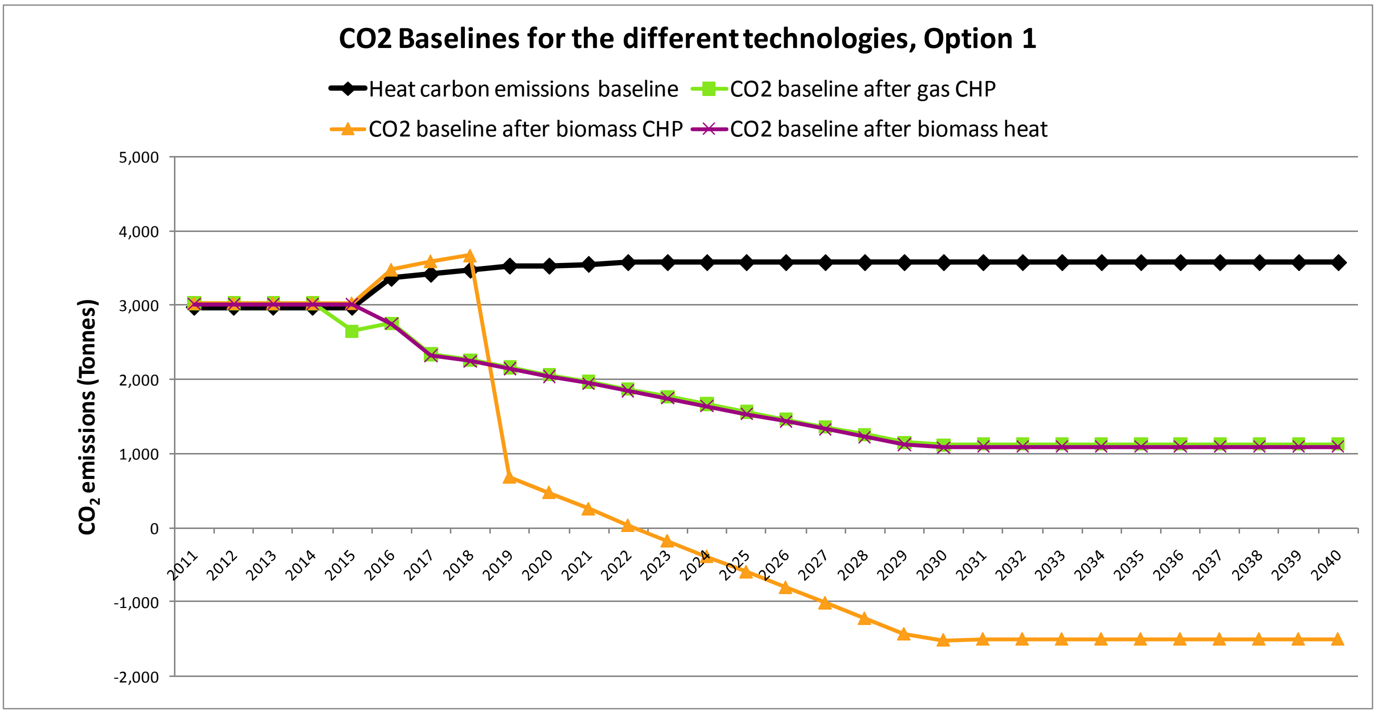

Figure 14 Option 1 CO_2 savings for different technologies over 30 years

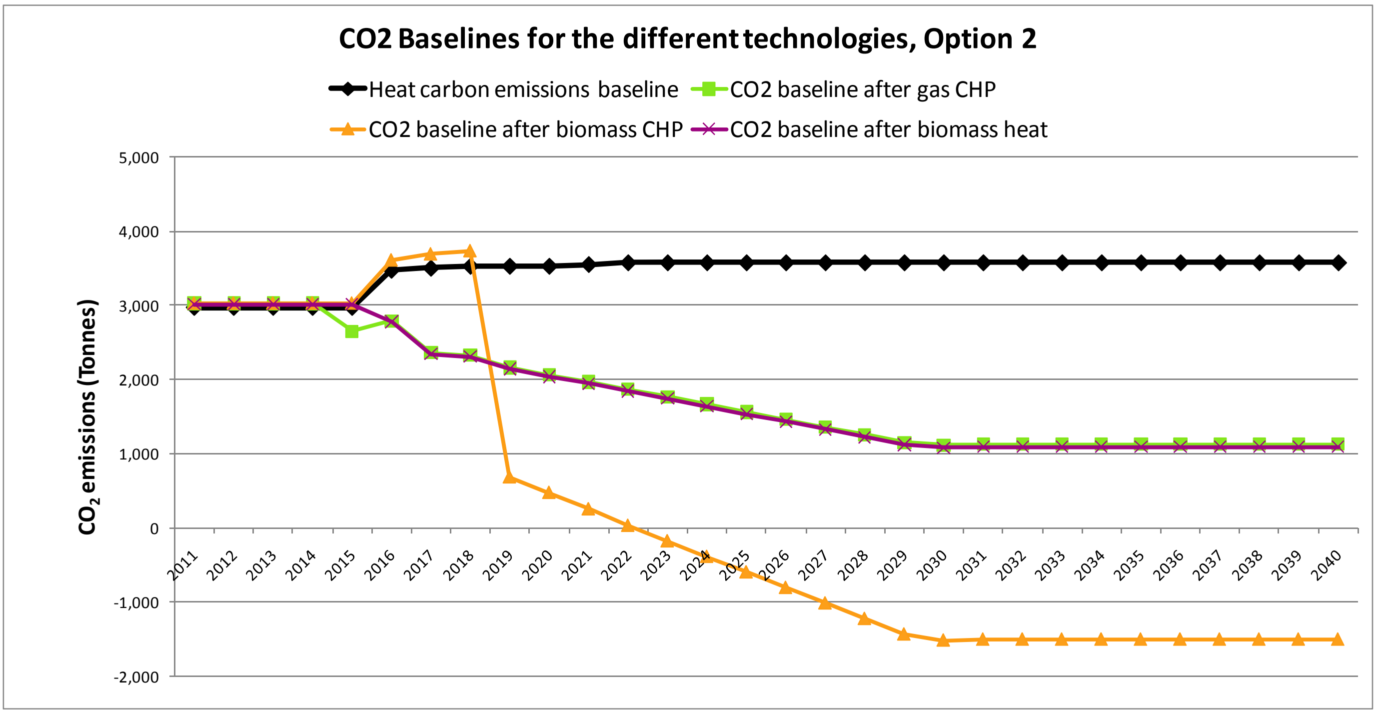

Figure 15 Option 2 CO_2 savings for different technologies over 30 years

6.3. Strategic site 2: Torquay Harbourside

Overview

Torquay Harbourside includes three Mayor's Vision sites:

- MV 5: Harbourside including a 100 unit SHLAA site and mixed use development with new cinema, hotel, retail and restaurant.
- MV 6: Princess and Royal Terrace Gardens new residential, hotel and entertainment to enhance the waterfront.
- MV7: Victoria Parade containing residential and retail.

These three sites form the core of the Strategic Site and there are routes to expand the network to the east and west along the sea front. These could connect to key anchor buildings: the Palm Court Hotel redevelopment to the west along Abbey Crescent; and Imperial Hotel, Parkhill Road to the east.

Heat demand profiles

There are four heat demand profiles that are modelled within this Strategic Site. This is to take into account uncertainty over components of the Mayor's Vision site 6 and examine the different options to extend the network.

The four options are:

Option 3: Harbourside

Including Harbourside MV5 as the catalyst site connecting in the first year and expanding to MV 6 and 7 as they are built.

Option 4: Harbourside (Option 2)

Including Harbourside MV5 as the catalyst site connecting in the first year and expanding to MV 6 and 7 as they are built with a variation for the uses in MV 6 to provide a smaller hotel and 100 residential units.

Option 5: Harbourside extd Abbey Crescent

An extension of network Option3 towards the currently derelict Palm Court Hotel, which is planned for redevelopment. This redevelopment is currently proposed to be a 100-bed hotel, 2,619 m^2 commercial and 8No. 2-bed apartments.

Option 6: Harbourside extd Parkhill Rd

An extension of network Option3 towards the existing Imperial Hotel (152 bed hotel, with indoor pool and gym).

		Harbourside	Harbourside (Option 2)	Harbourside extd Abbey Crescent	Harbourside extd Parkhill Rd
Option		**3**	**4**	**5**	**6**
No. of new resi (final)	No.	202	262	225	217
Area of new resi (final)	m2	12,120	15,720	13,500	13,020
No. of existing resi	No.	221	221	245	222
Area of new Non-resi (final)	m2	14,888	13,528	20,081	14,888
Area of existing Non-resi	m2	774	774	774	1,825
Total R+NR heat load at energy centre	MWh/year	7,891	7,874	9,009	8,318
Available existing housing CO2	tonnes CO2	892	892	978	973
Total Potential Income from AS	£	411,264	690,025	515,324	479,129
District Heating CAPEX	£	1,362,419	1,410,749	1,618,103	1,434,652

Table 20: Heat Demand data for Harbourside [NB. R= Resi; NR= Non-resi]

Table 20 shows that between Options 3 and 4, where there is the same strategic site boundary, but variations in the mix of use, there is a 30% increase in residential units (60 more units) and a 9% decrease in hotel which together, results in only a small change in total heat demand.

Options 5 and 6 extend the boundary of the strategic site. Option 5 extends the boundary along Torbay Road, to Abbey Crescent, which is due to be refurbished as part of the Torquay Harbour Area Action Plan (THAAP)[66].Therefore, laying the heat network pipe along Torbay Road, to Abbey Crescent could be integrated with the groundworks planned as part of the THAAP to reduce costs. There are no existing anchor buildings along Torbay Road which the network could connect to. Therefore, this option aims to assess if the costs of additional pipework are reclaimed by the additional heat sales later on.

Option 6 extends the DHN boundary to the east along Parkhill Road to the existing Imperial Hotel. The heat demands of the Imperial Hotel were based on benchmarks for hotels of this size and use, rather than actual gas consumption data. This assessment could be improved when the data becomes available. Similar to Option 5, this option aims to assess whether the cost of the additional pipe work will be repaid in heat sales. This option does not have as much additional length of pipework as Option 5 because the site already extends to the Mayor's Vision site 7. In addition, this is a larger hotel then the proposed hotel

[66] Torquay Harbour area Action Plan, Regulation 27 Pre-Submission Consultation, November 2010, Torbay Council.

on Abbey Crescent, and there is a heated swimming pool and gym which increase the heat demand and therefore potential heat sales.

Summary of CO_2 savings

The table below shows the financial analysis for Strategic Site 2, Harbourside and associated extensions.

		Harbourside	Harbourside (Option 2)	Harbourside extd Abbey Crescent	Harbourside extd Parkhill Rd
Option		**3**	**4**	**5**	**6**
Gas CHP					
Unit Installed		1.5MW x 1	1.5MW x 1	1.7MW x 1	1.6MW x 1
Energy Centre + Plant CAPEX	£	1,612,737	1,619,669	1,857,672	1,700,261
CO_2 savings over 30 yrs	TCO_2/30yrs	24,970	24,862	28,626	26,658
CO_2 savings in 2013	TCO_2/yr	- 71	- 71	- 71	- 78
CO_2 savings in 2040	TCO_2/yr	1,143	1,141	1,303	1,207
Existing buildings CO_2 saved by DHN connection	TCO_2/yr	633	633	695	691
Biomass Heat Only					
Unit Installed		0.8MW x 2	0.8MW x 2	0.9MW x 2	0.8MW x 2
Energy Centre + Plant CAPEX	£	1,907,101	1,913,399	2,193,718	2,010,551
CO_2 savings over 30 yrs	TCO_2/30yrs	26,986	26,910	29,125	29,005
CO_2 savings in 2013	TCO_2/yr	364	364	- 58	424
CO_2 savings in 2040	TCO_2/yr	1,162	1,160	1,325	1,227
Existing buildings CO_2 saved by DHN connection	TCO_2/yr	648	648	710	706

Table 21 Summary of CO_2 savings Analysis for Harbourside

Biomass CHP was not assessed in this option because the total heat demand is too low and a Biomass CHP size of less than 2MW is currently not considered technically feasible.

Table 21 and Figure 16 to Figure 19 show the year by year timeline highlight that in the Harbourside Strategic Site, CO_2 savings can be made by 2013 by utilising a biomass heat only system. The biomass heat only option also has higher savings over 30 years than the Gas CHP option which is not installed till 2015 when the heat demand is of sufficient level. This is an attractive option, but consideration needs to be given to utilising biomass (heat only) in dense urban locations. This requires early planning of the energy centre to ensure ease of fuel delivery and minimising impacts to air quality.

Table 21 also shows that across the different options in Harbourside Strategic Site, there are only slight differences in plant size (1.6MW to 1.8MW). Therefore, the heat demand in the network and the size and location of the energy centre, does not vary significantly between the options. This demonstrates there is little sensitivity in the core design of the DHN and this strategic site could be allocated as a Strategic District Heating Area (SDHA) with a good estimation of the required size of network. This is largely due to the key anchor loads.

(MV's 5, 6 and 7) being central and close to each other, creating a secure heat demand in the early years of the scheme. The decision to extend to either of the hotels, or to surrounding existing housing, could then be re-examined as part of more detailed assessments.

Overall, the total heat demand in this strategic site is not as high as the other strategic sites, however there is a high residential heat density which makes this a potentially viable district heating area with biomass (heat only) being a stronger option than gas CHP.

Summary of financial analysis

The table below shows the financial analysis for Strategic Site 2, Harbourside and associated extensions.

		Harbourside	Harbourside (Option 2)	Harbourside extd Abbey Crescent	Harbourside extd Parkhill Rd
Option		**3**	**4**	**5**	**6**
Gas CHP					
Annual revenue from energy sales in 2013	£/yr	93,198	93,198	93,198	104,455
Annual revenue from energy sales in 2040	£/yr	690,354	699,527	783,522	723,344
Baseline 30 yr NPV @6%	£	- 1,257,177	- 1,265,296	- 1,554,371	- 1,339,286
Baseline 30yr NPV @12%	£	- 1,539,096	- 1,562,442	- 1,834,759	- 1,630,125
With AS contribution 30 yr NPV @6%	£	- 1,067,624	- 989,453	- 1,355,503	- 1,015,858
With AS contribution 30yr NPV @12%	£	- 1,406,323	- 1,374,122	- 1,695,651	- 1,402,772
Developer Contribution 6% IRR per area of new build	£/m2	40	34	40	36
Developer Contribution 12% IRR per area of new build	£/m2	52	47	50	50
Biomass Heat Only					
Annual revenue from energy sales in 2013	£/yr	137,027	137,027	93,198	155,089
Annual revenue from energy sales in 2040	£/yr	507,681	517,247	574,981	530,787
Baseline 30 yr NPV @6%	£	- 1,781,413	- 1,784,562	- 2,098,050	- 1,906,712
Baseline 30yr NPV @12%	£	- 1,945,991	- 1,965,738	- 2,158,328	- 2,084,211
With AS contribution 30 yr NPV @6%	£	- 1,587,608	- 1,502,532	- 1,894,722	- 1,577,232
With AS contribution 30yr NPV @12%	£	- 1,810,239	- 1,773,194	- 2,016,099	- 1,852,741
Developer Contribution 6% IRR per area of new build	£/m2	59	51	56	57
Developer Contribution 12% IRR per area of new build	£/m2	67	61	60	66

Table 22 Summary of Financial Analysis for Harbourside

Table 22 shows that the change in mix of use between Options 3 and 4 has a small affect on the 30yr NPV because a similar amount of heat is being supplied. However Option 4 performs better than Option 3 when the AS contributions are included, because there is an increased amount of new build residential which would need to use Allowable Solutions to meet Zero Carbon requirements.

Assessing Option 5 in particular, the additional cost on the backbone network to connect to Palm Court Hotel on Abbey Crescent is around £255,000 including pipework and connection costs. The connection to this building increases the NPV of the scheme by approximately £290,000 therefore the cost of the additional extension is not recovered in the heat sales to the new hotel. However, this is still an attractive option because of the groundworks which are being proposed as part of the THAAP and should be considered in more detail when assessing the proposals for the new hotel.

Option 6 however, extending to Parkhill Road, does make back the costs of the additional pipework and at 12% discount factor, this option has a better NPV than the core option, Option 3. When including AS contribution and a discount factor of 6%, NPV is reduced by £50,000 for the gas CHP option.

Finally, Table 22 shows that the gap funding required per area of new build is less than the £50/m^2 benchmark for the Gas CHP option with 6%DF and therefore developer contributions could potentially fund the network.

Capabilities on project:
Building Engineering

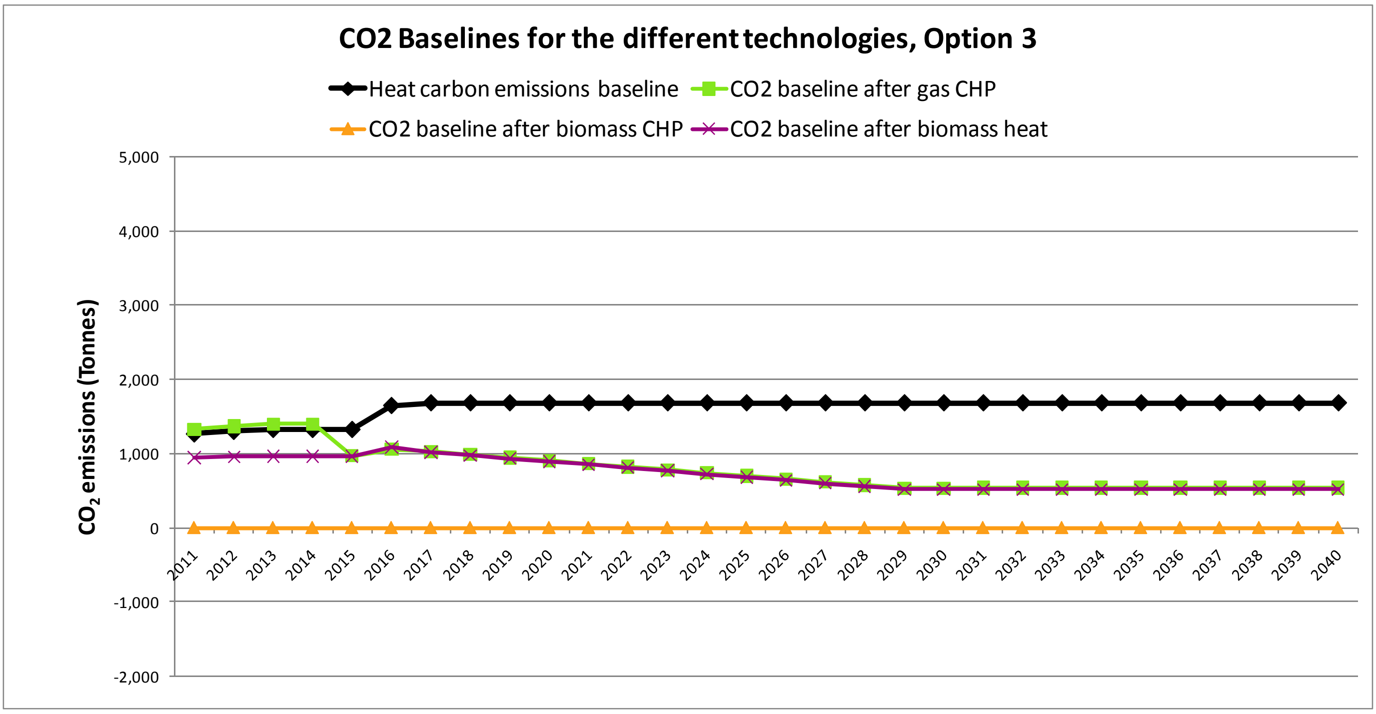

Figure 16 Option 3 CO_2 savings for different technologies over 30 years

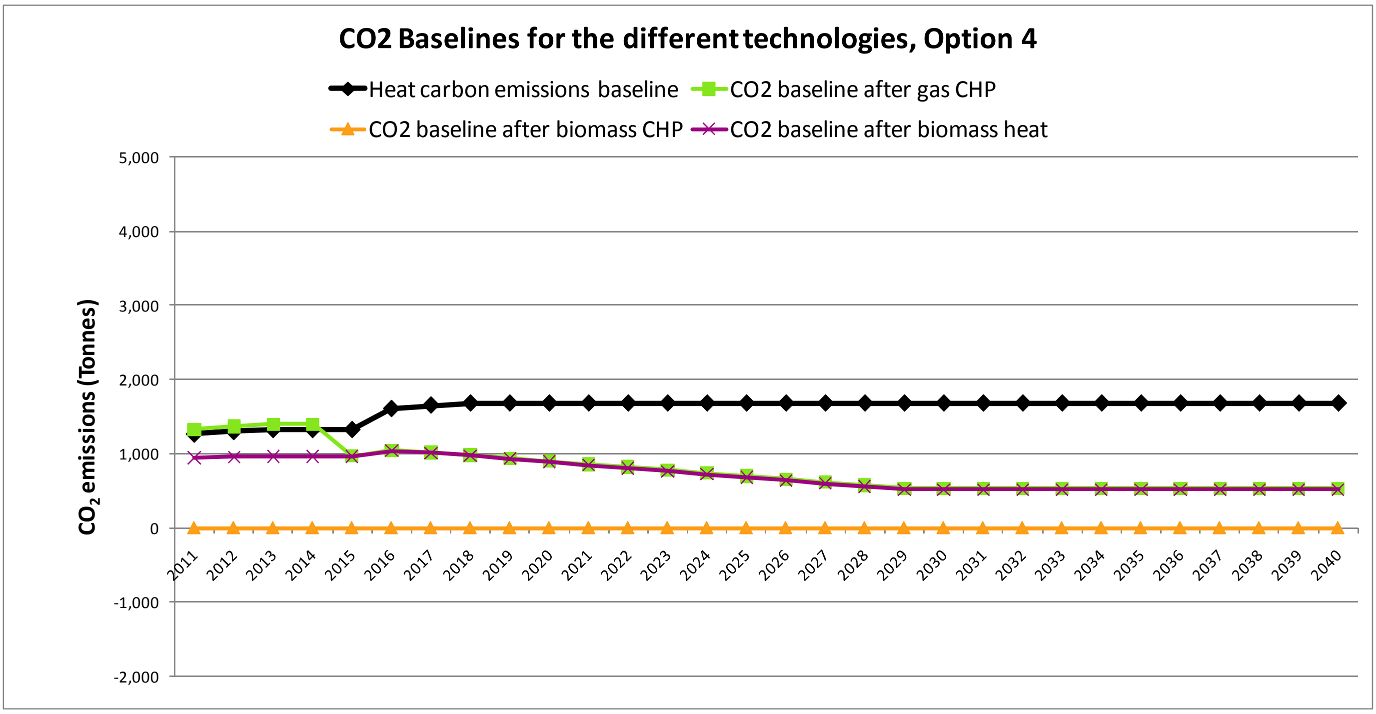

Figure 17 Option 4 CO_2 savings for different technologies over 30 years

Capabilities on project:
Building Engineering

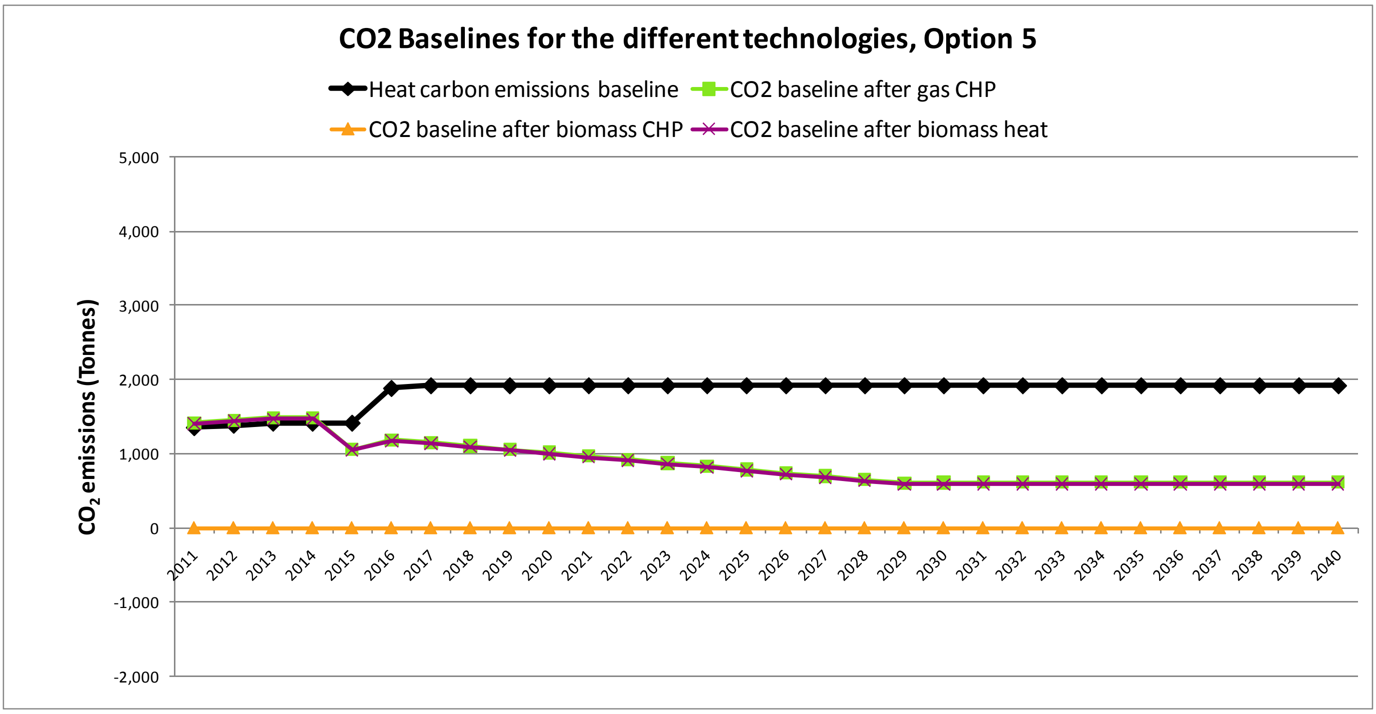

Figure 18 Option 5 CO2 savings for different technologies over 30 years

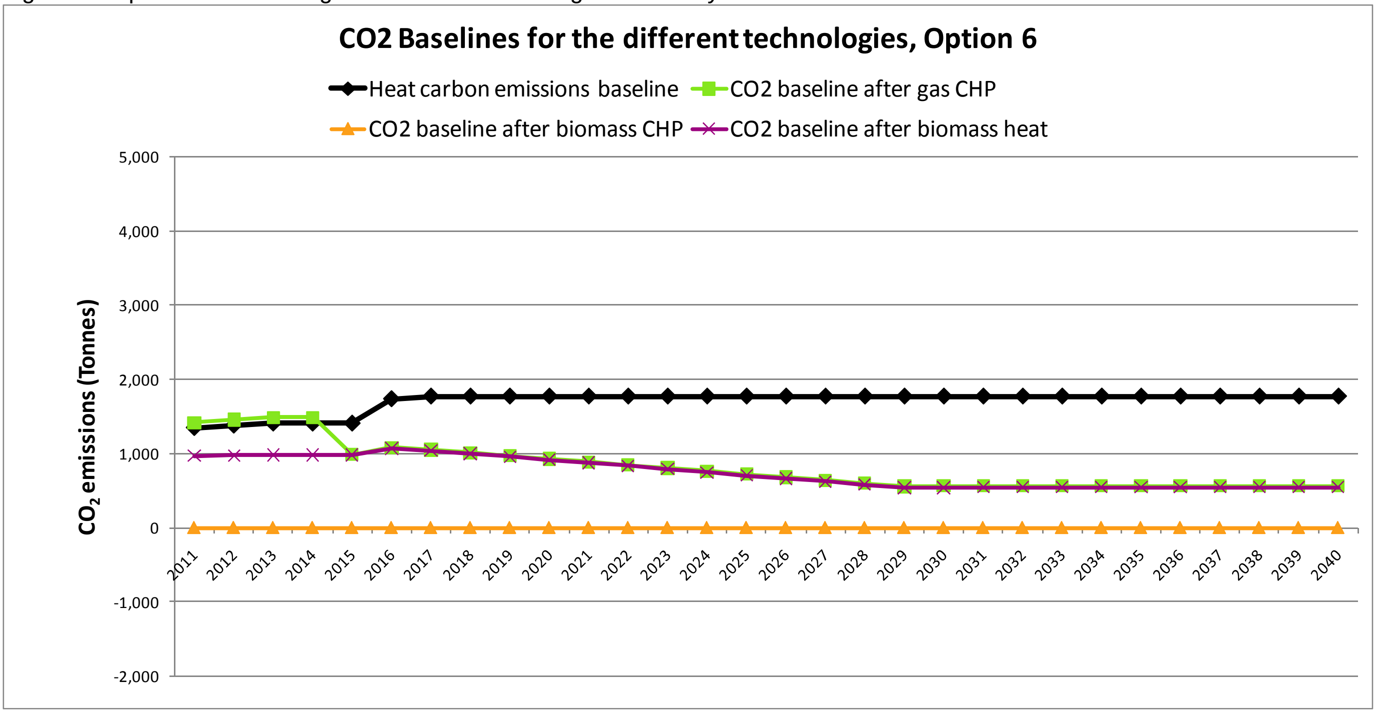

Figure 19 Option 6 CO2 savings for different technologies over 30 years

6.4. Strategic site 3: White Rock and Yalberton

Overview

White Rock and Yalberton consists of the existing developments and planned developments to the west of Brixham Road, and includes a variety of development types.

Heat demand profiles

The following new developments are included :

- Parkbay Garden Centre: 95 dwellings;
- Yannon's Farm: Large mixed use development consisting of 220 dwellings, 5,600m^2 office and local centre;
- Jacksons Land: a further 75 dwellings;
- Yalberton: a further 30,000 m^2 planned to be allocated in this area;
- Waddenton Close: Mixed use, 60-bed hotel and 75-unit student accommodation;
- White Rock: current planning proposals for 375-unit residential and 4,500m^2 employment space;
- Shopdown Copse: current planning proposals for a further 29,000m^2 employment space to be allocated.

This site demonstrates the largest potential to influence new developments on the outskirts of the town, which could incorporate soft-dig heat networks (i.e. heat networks installed beneath grass etc rather than roads) and reduce overall costs for deliverability. There are also key existing anchor load buildings that could lever the initial phases of a heat network, including South Devon College, Torbay Business Park and Waddeton Industrial Estate. There is only one option modelled for this assessment: Option 7.

		White Rock and Yalberton
Option		**7**
No. of new resi (final)		840
Area of new resi (final)		66,123
No. of existing resi		11
Area of new Non-resi (final)		70,800
Area of existing Non-resi		8,261[See note 1]
Total R+NR heat load at energy centre		12,175
Available existing housing CO2		515
Total Potential Income from AS		2,983,074
District Heating CAPEX		2,980,049

Table 23: Heat Demand data for White Rock and Yalberton [NB. R= Resi; NR= Non-resi]

Note 1. The area of Non-residential included in this model is for South Devon College only. Therefore this strategic site could perform better if more of the NR buildings are brought into the model. At this stage, this is a reasonable assumption.

Table 23 shows that this option has the highest number of new residential and non-residential units. This strategic site is largely greenfield which makes this an attractive site for DHN as the heat network can be integrated with new infrastructure design and installation.

The disadvantage of the DHN in a greenfield site is that it potentially has limited CO_2 savings to be achieved through connecting to existing housing. This means that the DHN scheme would have limited capacity to offer carbon savings for other new developments as part of their Allowable Solutions.

There is existing housing on the opposite (east) side of Brixham Road, but this has a low residential heat density (as seen in the Paignton EOP) and with Brixham Road being a primary road in Torbay, already with issues of traffic congestion[67], crossing this road with main heat pipework has not been included as an option. If more AS contributions were required in order to make the DHN viable, then this could be revisited as an option.

[67] Torbay Local Development Framework (LDF) Core Strategy, Development Plan document (DPD), Regulation 25 Consultation, LDD2, September 2009

Summary of CO_2 savings

The table below shows the financial analysis for Strategic Site 3.

		White Rock and Yalberton
Option		**7**
Gas CHP		
Unit Installed		1.2MW x 2
Energy Centre + Plant CAPEX	£	2,983,818
CO_2 savings over 30 yrs	TCO_2/30yrs	32,486
CO_2 savings in 2013	TCO_2/yr	466
CO_2 savings in 2040	TCO_2/yr	1,342
Existing buildings CO_2 saved by DHN connection	TCO_2/yr	281
Biomass CHP		
Unit Installed		2.4MW x 1
Energy Centre + Plant CAPEX	£	5,892,586
CO_2 savings over 30 yrs	TCO_2/30yrs	73,980
CO_2 savings in 2013	TCO_2/yr	- 92
CO_2 savings in 2040	TCO_2/yr	3,649
Existing buildings CO_2 saved by DHN connection	TCO_2/yr	777
Biomass Heat Only		
Unit Installed		1.2MW x 2
Energy Centre + Plant CAPEX	£	3,348,198
CO_2 savings over 30 yrs	TCO_2/30yrs	41,605
CO_2 savings in 2013	TCO_2/yr	597
CO_2 savings in 2040	TCO_2/yr	1,745
Existing buildings CO_2 saved by DHN connection	TCO_2/yr	374

Table 24 Summary of CO_2 savings Analysis for White Rock and Yalberton

Table 24 shows that the Gas CHP and Biomass boiler options could be achieving CO_2 savings by 2013 however the Biomass CHP option, despite being installed later in 2020, will save more CO_2 across the project life. Figure 20 also shows that, with the phasing assumed, it is not until 2020 that the Biomass CHP is installed. In this situation, the majority of the development is new buildings and therefore the energy centre supplying them will need to be built first. So, if Biomass CHP were chosen as the most suitable route, a smaller temporary biomass boiler could be installed in the energy centre along with the back up gas boilers until the heat load was sufficient to install the main unit and this could increase CO_2 savings. Installing an interim biomass boiler could also begin to build skills within Torbay for handling large volumes of biomass fuel and maintenance of biomass boilers. Thus, in 2020, when the more complex Biomass CHP is installed, there are the skills available to maintain and manage the system.

Summary of financial analysis

The table below shows the financial analysis for Strategic Site 3.

		White Rock and Yalberton
Option		**7**
Gas CHP		
Annual revenue from energy sales in 2013	£/yr	304,296
Annual revenue from energy sales in 2040	£/yr	954,677
Baseline 30 yr NPV @6%	£	- 4,145,100
Baseline 30yr NPV @12%	£	- 4,007,135
With AS contribution 30 yr NPV @6%	£	- 3,527,778
With AS contribution 30yr NPV @12%	£	- 3,572,402
Developer Contribution 6% IRR per area of new build	£/m2	26
Developer Contribution 12% IRR per area of new build	£/m2	26
Biomass CHP		
Annual revenue from energy sales in 2013	£/yr	162,919
Annual revenue from energy sales in 2040	£/yr	1,105,093
Baseline 30 yr NPV @6%	£	- 4,824,206
Baseline 30yr NPV @12%	£	- 4,768,788
With AS contribution 30 yr NPV @6%	£	- 3,183,849
With AS contribution 30yr NPV @12%	£	- 3,677,202
Developer Contribution 6% IRR per area of new build	£/m2	23
Developer Contribution 12% IRR per area of new build	£/m2	27
Biomass Heat Only		
Annual revenue from energy sales in 2013	£/yr	232,461
Annual revenue from energy sales in 2040	£/yr	736,565

Baseline 30 yr NPV @6%	£	- 4,610,188
Baseline 30yr NPV @12%	£	- 4,363,069
With AS contribution 30 yr NPV @6%	£	- 3,794,018
With AS contribution 30yr NPV @12%	£	- 3,793,985
Developer Contribution 6% IRR per area of new build	£/m2	28
Developer Contribution 12% IRR per area of new build	£/m2	28

Table 25 Summary of Financial Analysis for White Rock and Yalberton

Overall, the White Rock and Yalberton site is the largest of the strategic sites and this is shown in the lower NPV (higher level of gap funding required). The increased costs are largely because the network is longer and the heat demands are spread out across the site. Network costs could be reduced in the strategic planning of the site, by encouraging high heat demand buildings to be located as close to the centre of the site as possible within each plot. This will reduce network costs because the pipes carrying the larger heat loads, will not need to reach the outskirts of the site.

Table 24 also shows how the NPV is affected by AS contributions and reduce the gap funding required by 15% for Gas CHP NPV at 6% DF and by 30% for Biomass CHP NPV at 6% DF. Hence, the AS contribution makes a significant difference to the finances of the scheme even where there are limited numbers of existing housing to connect. In Option 7 there is more new build than there is existing buildings; resulting in only 30% of the potential AS contribution to be used to finance the DHN, because the DHN is not connected to enough existing buildings to make use of the heat. In Option 2, Castle Circus (Option 2), there is a contrary situation as there is more existing housing than there are new buildings. This maximises the AS contributions from the new buildings and builds a network capable of delivering more CO_2 savings. This illustrates the need for a wider assessment of how AS contributions from a new development outside of an SDHA could assist in the financial delivery of the DHN. This could be carried out after the SDHAs and the Torbay growth strategy have been agreed.

The gap funding required per area of new build is below the £50/m^2 benchmark for all technology options at White Rock. This is mainly because there is a significant amount of new build on this site, which all could contribute to the DHN costs. This would be before any Allowable Solutions contribution, as this payment for connection would be for the developers to achieve their 70% onsite carbon compliance.

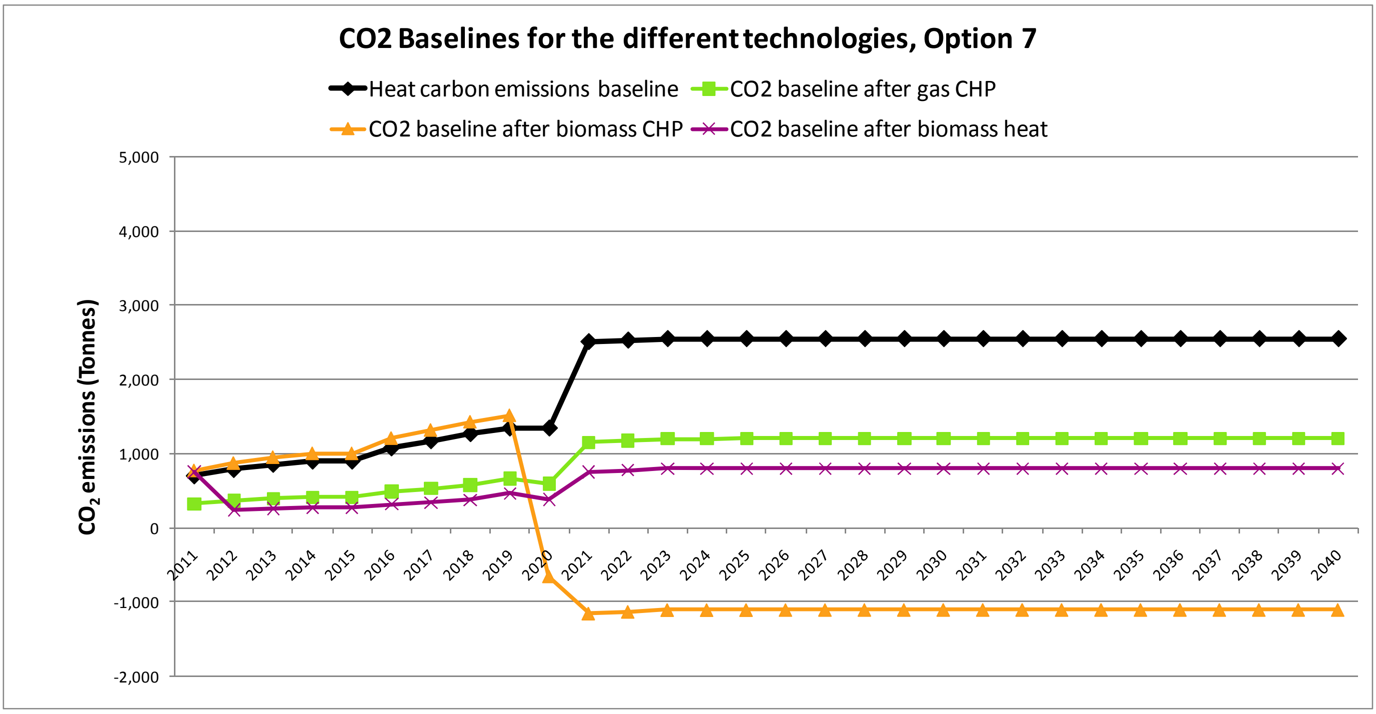

Figure 20: Option 7 White Rock and Yalberton

6.5. Strategic site 4: Paignton Town Centre

Overview

Paignton Town Centre includes three Mayor's Vision Sites in the core option, Option 8, and investigates the option of extending to a fourth. These are:

- MV 8: Crossways Shopping Centre, recently sold and renovated, with the latest plan for the site to be a food store with no residential units,
- MV 9: Station Lane, new community hub and Paignton Library, part of a Local Asset Backed Vehicle (LABV), with suggestions for it to be used for 25 holiday flats, 140m^2 office space, 280m^2 of restaurants, and a 60-bed hotel;
- MV 10: Victoria Shopping Centre and Multi Storey Car Park, 40 dwelling units if there is a change in ownership, along with retail, office, leisure and community facilities,
- MV 21: Oldway Mansion extension: Proposed to be converted as a hotel with new leisure and conference facilities, and residential.

The core of this strategic site, Option 8, also picks up the Paignton Community Hospital anchor load. Option 8 has a physical constraint to the east due to the Paignton railway line and therefore this extension (which might be considered in order to connect to the rest of MV 10: the sea front hotels and 'My Place' Sports development) has been modelled separately.

In addition, the Mayor's Vision sites (8, 9 & 10) originally had substantial residential areas allocated as part of the Action Framework Plan[68] however, due to market drivers, these proposed new residential areas have since been downsized or completely removed from the Mayor's Vision sites greatly reducing their heat demand from the initial predictions discussed at the workshop.

Heat demand profiles

There are three heat demand profiles that are modelled within this Strategic Site. This is to demonstrate the effect of extending the network towards the Oldway Mansion site, and another extension across the railway line to the Esplanade and 'My Place'.

The three options are:

Option 8: Paignton

Town centre Mayor's Vision sites 8, 9 and 10, with no crossing of the railway line. Option 8 includes connection to the Paignton Community Hospital.

Option 9: Paignton extd Oldway

Option 8 with extension to the Oldway Mansion site, and Oldway Primary school with further opportunities to connect to surrounding existing residential.

Option 10: Paignton extd Esplanade

Option 8 with extension to the seafront areas including 'My Place' and the remainder of MV 10.

The EOP shows that there are additional heat demand opportunities further south along the sea front to connect to the existing residential, and also the wide area, west of the railway, and south of MV9 which also has a reasonable residential heat density. Therefore, in addition to the options modelled in this assessment, Paignton has further opportunities for extensions.

[68] The New English Riviera Action Framework Plan, LDA Design, January 2008

		Paignton	Paignton extd Oldway	Paignton extd Esplanade
Option		**8**	**9**	**10**
No. of new resi (final)	No.	34	184	81
Area of new resi (final)	m2	2,040	11,040	4,860
No. of existing resi	No.	693	857	1,153
Area of new Non-resi (final)	m2	5,620	10,072	17,260
Area of existing Non-resi	m2	1,943	4,373	1,943
Total R+NR heat load at energy centre	MWh/year	11,762	15,849	21,024
Available existing housing CO2	tonnes CO2	2,169	2,743	3,794
Total Potential Income from AS	£	155,366	155,366	370,138
District Heating CAPEX	£	3,714,499	5,095,036	6,501,327

Table 26: Heat Demand data for Paignton [NB. R= Resi; NR= Non-resi]

Table 26 shows the mix of uses connected for the three different options. This shows that, in Option 8, there are only 34 new homes being proposed which is considerably less than the initial proposals for Paignton in the Action Framework Plan[69]. As discussed before, a small number of new residential limits the potential AS contribution when connecting to existing homes in this site Even for the extension options to Oldway and the Esplanade, there is a slight increase in new homes, but there are still a much higher percentage of existing homes.

The extension options also increase the non-residential buildings, existing and new build, which greatly increases the heat demand for the overall site. The key non-residential buildings are the conversion to Oldway Mansion, the connection to the nearby Oldway School, 'My Place' new development and connection to the surrounding existing hotels. Option 10, also has the highest total heat demand for all the different options in Torbay.

This is good in terms of a higher demand for heat being available, however there are large heat loads at the two extremities of the site (Oldway and 'My Place') which would require large heat pipework to extend to these extremities. Therefore, there are suitable heat demands available in Paignton, however the layout of the network may require further consideration before it could be categorised as a SDHA. For example, a smaller scheme could be proposed with the energy centre at Oldway, with connection to existing housing immediately surrounding the site. This could be suitable as the site is in a residential area of medium

[69] The New English Riviera Action Framework Plan, LDA Design, January 2008

residential heat density. Alternatively, the energy centre could be located in the central MV sites 8 or 9, with a large extension to Oldway which then is able to continue past Oldway into the existing housing areas as financial capital becomes available. This is an attractive option because ‘closed’ heat networks, which have ‘dead end’ pipe work, are less attractive than ‘open’ ones which lead the network into areas for possible future connection.

Summary of CO_2 savings

The table below shows the financial analysis for Strategic Site 4.

		Paignton	Paignton extd Oldway	Paignton extd Esplanade	Paignton extd Esplanade
				(excl railway costs)	*(incl railway costs)*
Option		**8**	**9**	***10a***	***10b***
Gas CHP					
Unit Installed		1.1MW x 2	1.5MW x 2	2.0MW x 2	2.0MW x 2
Energy Centre + Plant CAPEX	£	2,426,354	3,191,266	4,234,007	4,234,007
CO_2 savings over 30 yrs	TCO_2/30yrs	14,866	50,665	63,338	63,338
CO_2 savings in 2013	TCO_2/yr	- 17	- 70	- 17	- 17
CO_2 savings in 2040	TCO_2/yr	586	2,364	3,140	3,140
Existing buildings CO_2 saved by DHN connection	TCO_2/yr	1,335	2,146	2,898	2,898
Biomass CHP					
Unit Installed		2.3MW x 1	3.1MW x 1	2.0MW x 2	2.0MW x 2
Energy Centre + Plant CAPEX	£	5,236,460	7,094,701	9,411,983	9,411,983
CO_2 savings over 30 yrs	TCO_2/30yrs	78,478	103,759	130,552	130,552
CO_2 savings in 2013	TCO_2/yr	- 17	- 70	- 17	- 17
CO_2 savings in 2040	TCO_2/yr	3,634	4,881	6,479	6,479
Existing buildings CO_2 saved by DHN connection	TCO_2/yr	3,694	4,562	6,160	6,160
Biomass Heat Only					
Unit Installed		1.1MW x 2	1.5MW x 2	2.0MW x 2	2.0MW x 2
Energy Centre + Plant CAPEX	£	2,778,374	3,782,463	5,018,242	5,018,242

CO_2 savings over 30 yrs	TCO_2/30yrs	20,189	51,502	64,315	64,315
CO_2 savings in 2013	TCO_2/yr	- 12	- 54	- 12	- 12
CO_2 savings in 2040	TCO_2/yr	814	2,403	3,191	3,191
Existing buildings CO_2 saved by DHN connection	TCO_2/yr	1,777	2,195	2,963	2,963

Table 27 Summary of CO_2 savings Analysis for Paignton

Table 27 shows that there are no savings made in the initial phases of the development, but as the network builds out, there are potentially significant savings to be made, especially in the existing buildings.

Table 27 provides a fourth option assessing sensitivity of the NPV when the cost of crossing the railway line is included. There is likely to be a payment to Network Rail incurred for crossing the railway line with a pipework. Similar crossings have cost up to £200,000 to cross the railway line, however this price can vary depending on the level of disruption that would be caused to the line. As the Mayor's Vision site 10 also spreads over both sides of the railway there could be works being carried out as part of this development which also cross the line (such as pedestrian walkways or below ground ducting) and it may be possible to reduce the cost of the heat network crossing by combining with these works.

Option 10a includes no additional cost for crossing the railway line, however Option 10b includes a £200,000 additional cost to the heat network to account for crossing the railway line. Table 27 shows that this increases the NPV by £189,000 or £131,500, for 6% and 12% discount factors. This is less than 5% of the total NPV hence is not a major proportional increase in the network costs.

Overall, the options in Paignton would require high gap funding for delivery and the gap funding to new building area ratio is significantly greater than the £50/m^2 benchmark because there is a low proportion of new buildings.

Summary of financial analysis

The table below shows the financial analysis for Strategic Site 4.

		Paignton	Paignton extd Oldway	Paignton extd Esplanade	Paignton extd Esplanade
				(excl railway costs)	*(incl railway costs)*
Option		**8**	**9**	***10a***	***10b***
Gas CHP					
Annual revenue from energy sales in 2013	£/yr	26,496	110,536	26,496	26,496
Annual revenue from energy sales in 2040	£/yr	835,580	1,480,891	1,956,785	1,956,785
Baseline 30 yr NPV @6%	£	- 1,780,529	- 3,059,763	- 3,901,291	- 4,090,996
Baseline 30yr NPV @12%	£	- 1,940,457	- 3,376,573	- 4,004,529	- 4,136,035
With AS contribution 30 yr NPV @6%	£	- 1,674,132	- 2,953,366	- 3,647,816	- 3,837,522
With AS contribution 30yr NPV @12%	£	- 1,866,002	- 3,302,118	- 3,827,151	- 3,958,657
Developer Contribution 6% IRR per area of new build	£/m2	219	140	165	173
Developer Contribution 12% IRR per area of new build	£/m2	244	156	173	179
Biomass CHP					
Annual revenue from energy sales in 2013	£/yr	26,496	110,536	26,496	26,496
Annual revenue from energy sales in 2040	£/yr	1,188,244	1,593,754	2,106,500	2,106,500
Baseline 30 yr NPV @6%	£	- 2,491,546	- 3,794,385	- 5,026,603	- 5,216,309
Baseline 30yr NPV @12%	£	- 3,285,532	- 4,683,045	- 5,812,230	- 5,943,735
With AS contribution 30 yr NPV @6%	£	- 2,385,150	- 3,687,988	- 4,773,129	- 4,962,834
With AS contribution 30yr NPV @12%	£	- 3,211,077	- 4,608,590	- 5,634,852	- 5,766,357
Developer Contribution 6% IRR per area of new build	£/m2	311	175	216	224
Developer Contribution 12% IRR per area of new build	£/m2	419	218	255	261

Biomass Heat Only					
Annual revenue from energy sales in 2013	£/yr	26,496	110,536	26,496	26,496
Annual revenue from energy sales in 2040	£/yr	730,224	1,114,011	1,470,112	1,470,112
Baseline 30 yr NPV @6%	£	- 2,159,764	- 4,080,221	- 5,160,790	- 5,350,495
Baseline 30yr NPV @12%	£	- 2,273,900	- 4,008,916	- 4,763,971	- 4,895,477
With AS contribution 30 yr NPV @6%	£	- 2,053,367	- 3,973,824	- 4,907,315	- 5,097,021
With AS contribution 30yr NPV @12%	£	- 2,199,445	- 3,934,461	- 4,586,594	- 4,718,099
Developer Contribution 6% IRR per area of new build	£/m2	268	188	222	230
Developer Contribution 12% IRR per area of new build	£/m2	287	186	207	213

Table 28 Summary of Financial Analysis for Paignton

As indicated previously, it is likely that these options could perform better if there were a higher proportion of new homes included in this strategic site. As the growth options for Torbay are consulted on, the capacities of the Mayor's Vision sites could be increased to enable more growth in built up areas instead of developing greenfield sites.

Alternatively, heat networks across Torbay could be financially, not physically, linked together, enabling networks with a high proportion of new build to help finance a heat network that serves existing buildings. For example, using Allowable Solutions from new buildings in White Rock and Yalberton sites, to help fund the heat network that delivers CO_2 savings to existing buildings in the Paignton Town centre heat network

Capabilities on project:
Building Engineering

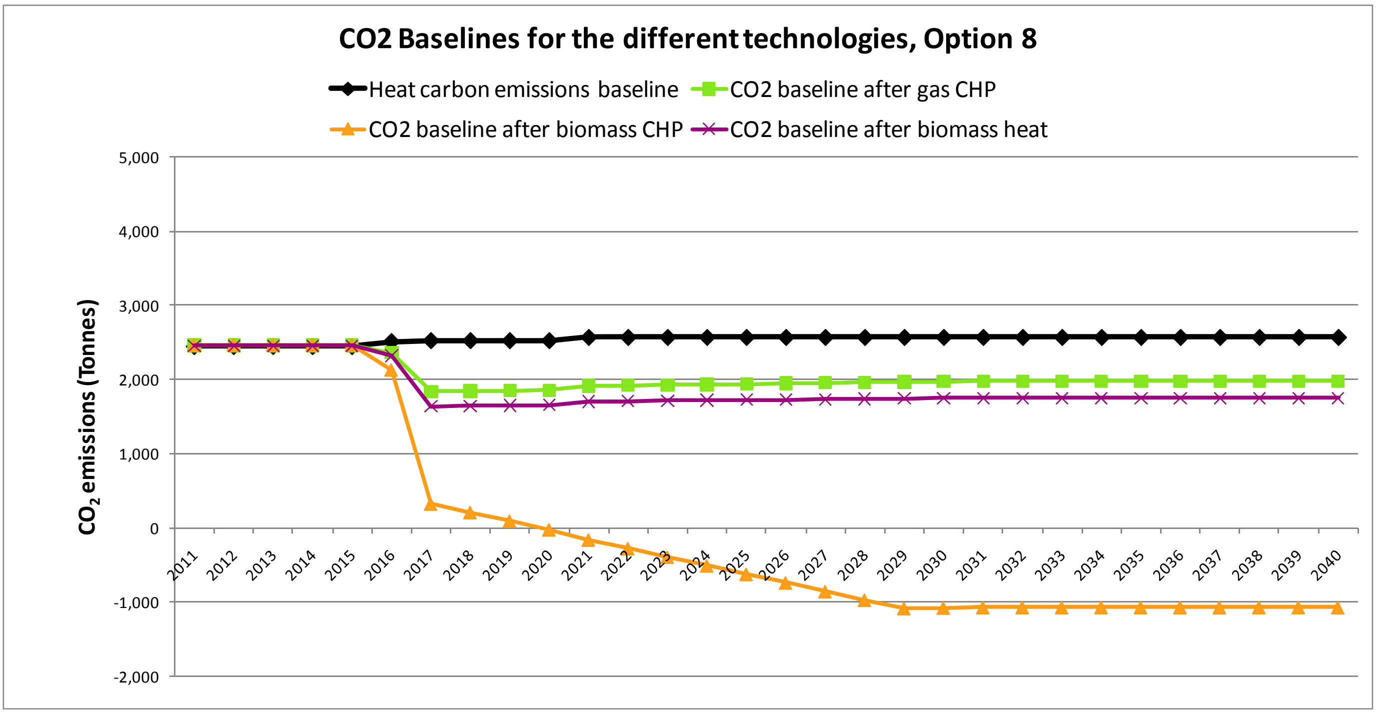

Figure 21 Option 8 CO2 savings for different technologies over 30 years

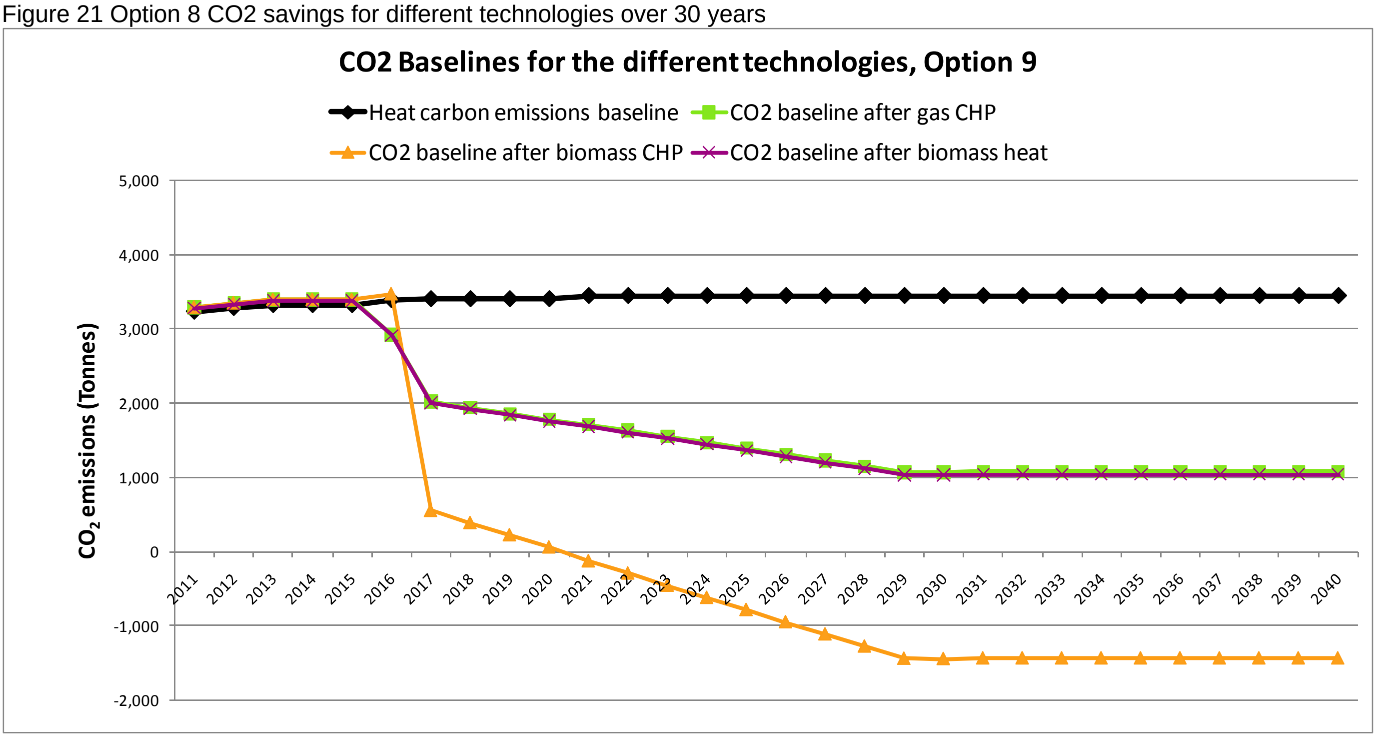

Figure 22 Option 9 CO2 savings for different technologies over 30 years

Capabilities on project:
Building Engineering

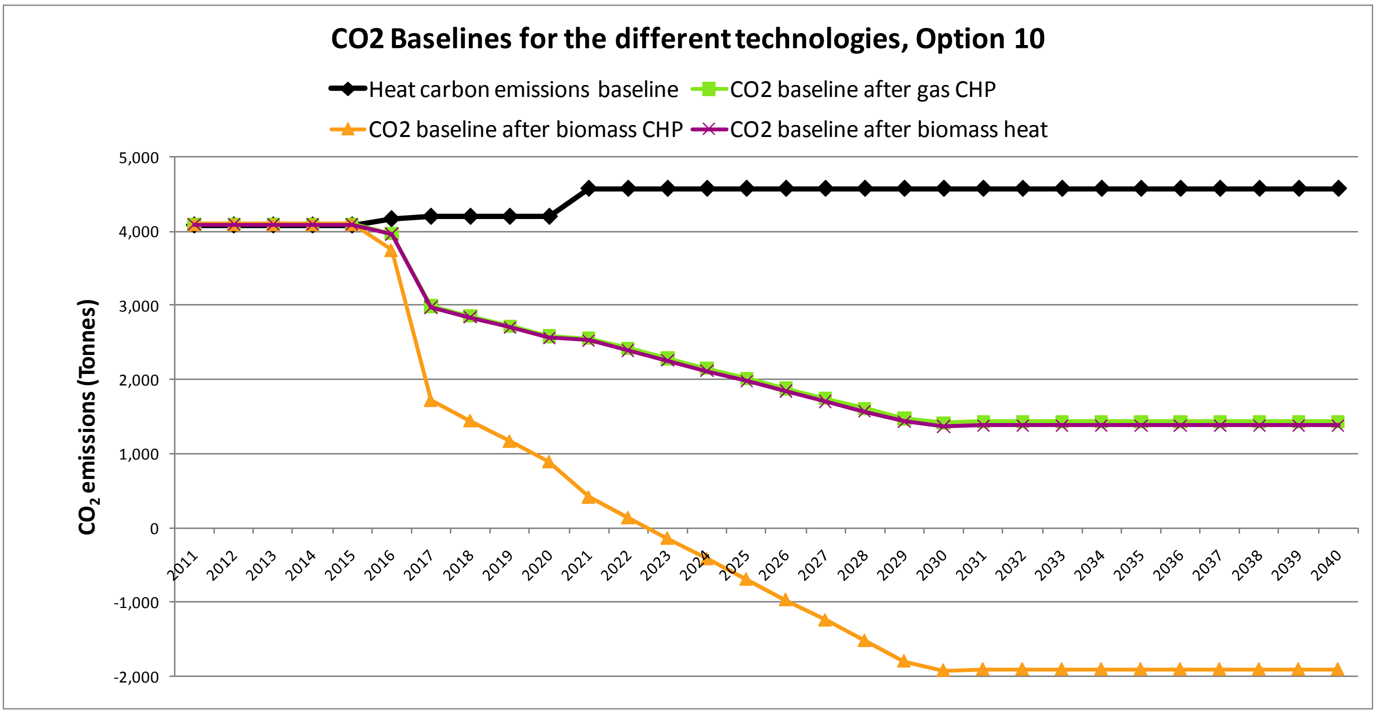

Figure 23 Option 10 CO2 savings for different technologies over 30 years

6.6. Strategic site 5: Brixham Town Centre

Overview

Brixham Town Centre consists of three Mayor's Vision (MV) sites:

- MV 15 Town Centre car park market area that is likely to be new food retail.
- MV 16: Fish Market refurbishment due to be completed this year.
- MV 17: Freshwater Quarry and Oxen Cove 300 flats, 5,000m^2 of employment space and 600m^2 of retail.

Heat demand profiles

In addition to the Mayor's Vision sites, this site looked to include the Brixham Community College and Leisure Centre to the south of the town centre. There is only one option modelled: Option 11.

		Brixham
Option		**11**
No. of new resi (final)	No.	300
Area of new resi (final)	m2	18,000
No. of existing resi	No.	394
Area of new Non-resi (final)	m2	13,166
Area of existing Non-resi	m2	4,434
Total R+NR heat load at energy centre	MWh/year	10,544
Available existing housing CO2	tonnes CO2	1,844
Total Potential Income from AS	£	1,544,136
District Heating CAPEX	£	2,471,699

Table 29: Heat Demand data for Brixham [NB. R= Resi; NR= Non-resi]

Table 29 shows that there are a similar number of new residential homes planned as the existing residential that could potentially be connected. Compared to the other strategic sites, there is a large heat demand to meet. Therefore, as the previous sites have demonstrated, this site should be suitable for a district heating network.

This site, as shown in the energy opportunities and constraints mapping in Appendix H, has the majority of the new build located at the harbourside of Brixham, and the larger non-domestic anchor loads at the other ends. These could be linked together from the central new build area in the town centre market area of Brixham, however this site is likely not to have such a high heat demand as it is largely food retail. Therefore, this option could be reassessed focusing in on the areas near Oxen Cove to deliver a smaller heat network, which, once installed, might be potentially extended to the rest of Brixham.

Table 30 gives the CO_2 savings for the site after modelling the three different technologies and shows that due to phasing, there are no CO_2 savings made by 2013, as there is insufficient heat demand until after 2016. However, once the network has been built out there are good annual CO_2 savings to be made at around 1,500TCO_2/yr for Gas CHP or biomass (heat only), and over 3,000TCO_2/yr for biomass CHP. In addition, there are good CO_2 savings to be made in the existing building stock.

The gap funding required for this scheme could be around £2m , as shown in

Table 31, and the gap funding per area of new build ratio is around the same as our £50/m^2 benchmark for developers to meet 70% onsite carbon compliance with PV. However, this could be improved by delivering a smaller network to focus on the higher heat demand areas of new residential, which will be required to meet the zero carbon compliance.

Overall, this could be a Strategic District Heating Area (SDHA) but until there is more known about the proposed new buildings in the central market area of Brixham, this is not a recommendation.

Capabilities on project:
Building Engineering

Summary of CO_2 savings

The table below shows the financial analysis for Strategic Site 5.

		Brixham
Option		**11**
Gas CHP		
Unit Installed		2.0MW x 1
Energy Centre + Plant CAPEX	£	2,209,486
CO_2 savings over 30 yrs	TCO_2/30yrs	28,260
CO_2 savings in 2013	TCO_2/yr	- 32
CO_2 savings in 2040	TCO_2/yr	1,565
Existing buildings CO_2 saved by DHN connection	TCO_2/yr	1,323
Biomass CHP		
Unit Installed		2.0MW x 1
Energy Centre + Plant CAPEX	£	4,806,490
CO_2 savings over 30 yrs	TCO_2/30yrs	55,743
CO_2 savings in 2013	TCO_2/yr	- 32
CO_2 savings in 2040	TCO_2/yr	3,239
Existing buildings CO_2 saved by DHN connection	TCO_2/yr	2,812
Biomass Heat Only		
Unit Installed		1.0MW x 2
Energy Centre + Plant CAPEX	£	2,602,817
CO_2 savings over 30 yrs	TCO_2/30yrs	29,885
CO_2 savings in 2013	TCO_2/yr	- 24
CO_2 savings in 2040	TCO_2/yr	1,590
Existing buildings CO_2 saved by DHN connection	TCO_2/yr	1,353

Table 30 Summary of CO_2 savings Analysis for Brixham

Summary of financial analysis

The table below shows the financial analysis for Strategic Site 5.

		Brixham
Option		**11**
Gas CHP		
Annual revenue from energy sales in 2013	£/yr	45,569
Annual revenue from energy sales in 2040	£/yr	977,389
Baseline 30 yr NPV @6%	£	- 1,996,833
Baseline 30yr NPV @12%	£	- 2,086,330
With AS contribution 30 yr NPV @6%	£	- 1,250,973
With AS contribution 30yr NPV @12%	£	- 1,709,864
Developer Contribution 6% IRR per area of new build	£/m2	40
Developer Contribution 12% IRR per area of new build	£/m2	55
Biomass CHP		
Annual revenue from energy sales in 2013	£/yr	45,569
Annual revenue from energy sales in 2040	£/yr	1,052,478
Baseline 30 yr NPV @6%	£	- 2,693,449
Baseline 30yr NPV @12%	£	- 2,849,501
With AS contribution 30 yr NPV @6%	£	- 1,947,589
With AS contribution 30yr NPV @12%	£	- 2,473,035
Developer Contribution 6% IRR per area of new build	£/m2	62
Developer Contribution 12% IRR per area of new build	£/m2	79
Biomass Heat Only		
Annual revenue from energy sales in 2013	£/yr	45,569
Annual revenue from energy sales in 2040	£/yr	733,299
Baseline 30 yr NPV @6%	£	- 2,517,727
Baseline 30yr NPV @12%	£	- 2,394,798
With AS contribution 30 yr NPV @6%	£	- 1,771,867
With AS contribution 30yr NPV @12%	£	- 2,018,333
Developer Contribution 6% IRR per area of new build	£/m2	57

Developer Contribution 12% IRR per area of new build	£/m2	65

Table 31 Summary of Financial Analysis for Brixham

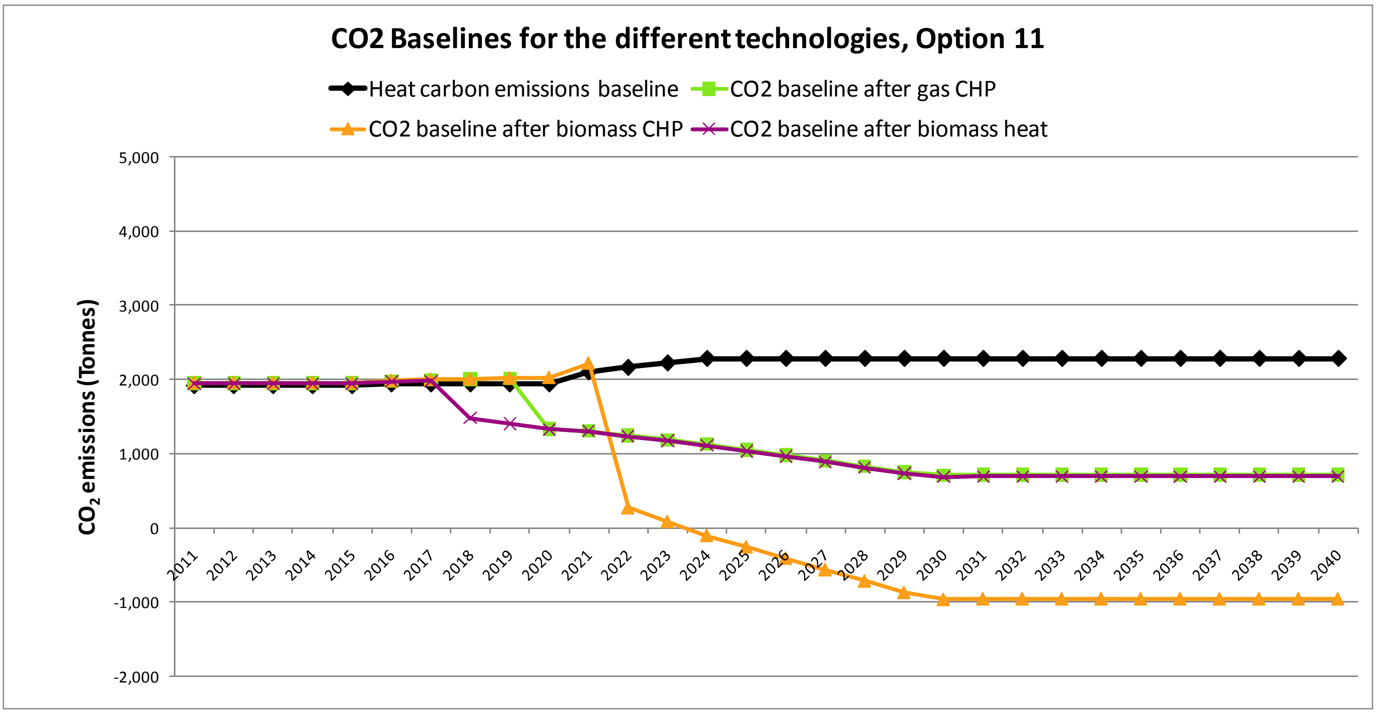

Figure 24 Option 11 Brixham

6.7. Summary

The five strategic sites are shown in the table below

	1. Torquay – Castle Circus and Union Street	2. Torquay Harbourside	3. White Rock and Yalberton	4. Paignton Town Centre	5. Brixham Town Centre
Existing buildings	760 homes 6,600 m^2 Non Resi	220 – 245 homes 770 – 1,800 m^2 Non Resi	11 homes 8,260 m^2 Non Resi	693 – 1,150 homes 1,900 – 4,370 m^2 Non Resi	390 homes 4,400 m^2 Non Resi
New buildings	159-335 homes 40-50,000 m^2 Non Resi	200-260 homes 14-20,000 m^2 Non Resi	840 homes 70,800 m^2 Non Resi	34 - 184 homes 5,600 – 17,260 m^2 Non Resi	300 homes 13,160 m^2 Non Resi
Opportunities	CESP, Town Hall Civic Hub	Area Action Plan	Greenfield, Business Park, College	CESP, Hospital, Oldway	Freshwater Quarry and Oxen Cove, harbour redevelopment
Capital cost	£4.3m (Heat network) £3.5 – 7.6m (Energy centre)	£1.3 – 1.6m (Heat network) £1.6 – 2.2m (Energy centre)	£2.980 m (Heat network) £3.0 – 5.9 m (Energy centre)	£3.7 – 6.5 m (Heat network) £2.4 – 9.4m (Energy centre)	£2.4 m (Heat network) £2.2 – 4.8 m (Energy centre)
Potential Allowable Solutions	£0.8 - 1.5m	£410,000 – 690,000	£2.983 m	£155,000 – 370,000	£1.5m
Max annual energy sales	£1.1 - 1.6m	£500,000 – 780,000	£0.7 – 1.1 m	£0.8 – 2.1m	£0.7 – 1.0m
Annual CO_2 savings	1,900 – 4,000 TCO_2/yr (existing buildings)	633 – 710 TCO_2/yr (existing buildings)	280 – 777 TCO_2 (existing buildings)	1,300 – 6,100 TCO_2 (existing buildings)	1,300 – 2,800 TCO_2 (existing buildings)
Dev. contribution 6% IRR	36 – 60 £/m^2 New build	34 – 59 £/m^2 New build	23 – 28 £/m^2 New build	140 – 311 £/m^2 New build	40 – 62 £/m^2 New build
Dev. contribution 12% IRR	49 – 70 £/m^2 New build	47 – 67 £/m^2 New build	26 – 28 £/m^2 New build	156 – 419 £/m^2 New build	55 – 79 £/m^2 New build

However, it should be noted that this analysis is based on the growth strategy at the time of this report and if this changes then it can affect the viability of the DHN scheme.

Table 32 shows the five strategic sites against the three growth options, illustrating how the viability can increase or decrease with the different growth options. For example, if a more constrained growth option is chosen, the urban strategic sites such as Castle Circus, Harbourside, Paignton and Brixham increase in their DHN viability because there is more likely to dense new build housing which could lever a heat network.

Alternatively, if the greenfield growth option is taken, and more emphasis is moved to large greenfield developments, then this increases the opportunities for DHN in strategic sites such as White Rock and Yalberton.

	1. Constrained	2. Limited Greenfield	3. Greenfield
1. Castle Circus, Torquay	✓✓	✓	✓
2. Harbourside, Torquay	✓✓	✓	✓
3. White Rock and Yalberton	-	✓	✓✓
4. Paignton	✓✓	✓	✓
5. Brixham	✓	✓	✓

Table 32 Affect of growth options on DHN Viability

Overall, this chapter demonstrates that there are three strategic sites which show good potential for a DHN:

- Castle Circus;
- Harbourside;
- White Rock and Yalberton.

Strategic sites in Brixham and Paignton have less potential, however smaller scale networks or increasing the new build heat density in the sites, could make these sites more viable.

7. Policy options

7.1. Policy context

This chapter sets out the policy recommendations which arise as a result of the analysis work undertaken throughout the project. The text assumes some familiarity with the various terms used when discussing such issues, however, should there be a need to review some of the terminology used here please visit http://www.planningportal.gov.uk/england/genpub/en/1018892037172.html where a full planning glossary can be found as well as http://www.swplanners-toolkit.co.uk/resources/glossary where a glossary relating specifically to the issues dealt with by the Climate Change Supplement to PPS1 can be found.

There is a clear framework throughout national policy for inclusion of planning policies designed to reduce CO_2 emissions and promote decentralised renewable and low carbon energy (PPS1, PPS3 and PPS22). Key drivers are the legal requirements for an 80% reduction in CO_2 emissions over 1990 levels by 2050 (with an interim target of 34% by 2020) and to generate 15% of the UK's total energy from renewable sources by 2020. The Government's strategy for delivering these hugely challenging targets are set out in the *UK Low Carbon Transition Plan*[70], published on 15th July 2009, which includes the *Renewable Energy Strategy*. These national targets alone provide sufficient justification for setting challenging energy policies in development plan documents. More detail on these and other important pieces of legislation, drivers for action and incentives can be found at http://www.swplanners-toolkit.co.uk/policy-context.

Changes to the Building Regulations in 2010 (which are now in force from 1st October 2010), 2013 and 2016 are expected to bring in increasingly tough emissions (CO_2) rate targets for residential development and for commercial development by 2019. Planning policy has an important role to play in supporting developers in achieving these requirements without duplicating requirements.

The suite of policies recommended here seeks to address these issues while providing an easily understandable and deliverable local response.

A key feature of the proposed approach is to identify the specific roles of planning policy supported by delivery from local strategic partners and other parts of the local authority, including the corporate level. The figure below describes the relationship between each of the elements that should make up a local energy strategy. This recognises that planning cannot deliver the desired levels of CO_2 reductions and energy alone; rather it needs to play a defined role within a wider strategy that encompasses other local authority departments and local strategic partners. This study can act as the starting point for these wider discussions which planners, with their emerging spatial knowledge of the opportunities, are well placed to lead in the first instance.

[70] UK Low Carbon Transition Plan, HM Government, July 2009, http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/lc_trans_plan/lc_trans_plan.aspx

Figure 25 Interrelated elements of a local energy approach

7.1.1. Energy Opportunities Plan

The Energy Opportunities Plan is presented in Chapter 5, and Appendix H, and brings together GIS layers showing existing heat densities, wind opportunity sites, public sector housing, anchor loads, potential development sites and so on. The Plan can be used as a key diagram to guide planning policies and targets, but also corporate strategy policies and targets and the investment decisions of other local authority departments and local strategic partners. It should therefore be presented in both the LDF and relevant corporate strategies. In order that it remains up to date, it may be preferable to include it in an SPD rather than DPD.

7.1.2. Planning policy

Policy can then be developed aimed at the three types of energy opportunity of interest to planners and their delivery partners:

- The first, stand alone generation, includes wind turbines.
- The second refers to community integrated generation and infrastructure such as district heating and combined heat and power (CHP). Essentially we are talking not just about renewable and low carbon generation, but also infrastructure. It is delivery of these opportunities that are particularly dependent upon a wider local authority delivery approach.
- The third relates to building or development integrated CO_2 reductions and generation.

This broader approach is important if opportunities for delivery are to be maximised and will involve the following, which fall outside the scope of this commission:

- A clear statement of the relationship between planning, development and Torbay public/private partnership in a Supplementary Planning Document (SPD).

- Engagement with and buy-in from the Local Strategic Partnership and from other local authority departments

7.1.3. Strategic partnerships and strategies

The evidence base could be used as a starting point for work to support a wider reduction target and/or trajectory that contributes towards national and regional targets. Due to the overarching nature of these targets it is likely that the most appropriate place for it is in a corporate strategy that applies to the local authority as a whole and its strategic partners rather than just planning, such as a Sustainable Community Strategy. The local driver for this could be delivery of National Indicator (NI) 186 (per capita CO_2 emissions reduction) and NI185 (local authority CO_2 emissions reductions) as well as the forthcoming new NI on renewable energy.

A similar approach can be taken to renewable and low carbon energy generation by locating an area wide, renewable and low carbon energy generation target in the corporate strategy with reference to it in DPDs. These are not requirements of the PPS nor this study and to be effective will require sufficiently robust links between planning and the corporate structure.

Refer to Chapter 8 Delivery for further details of potential delivery mechanisms and partnerships.

7.2. Torbay spatial growth options

This chapter discusses the three main spatial growth options for Torbay, as set out in the Regulation 25 Draft Core Strategy[71]:

- Option 1: Constrained development approach: Increasing capacity on Mayor’s Vision sites and other urban development to avoid greenfield development.
- Option 2: Urban focus and limited greenfield development: allowing some new greenfield development, to avoid “town cramming”, but still some increased capacity on the Mayor’s Vision sites.
- Option 3: Greenfield approaches: On top of the existing capacity expected for the Mayor’s Vision and allocated SHLAA sites, and meeting the remaining target with greenfield sites.

The Draft Core Strategy addresses the social and economic issues related to increasing densities in the city centres, and this report discusses the energy related issues for the different growth options. In Chapter 6.7, the growth options are discussed alongside the five strategic sites and the effect that the different growth options could have on the viability of a DHN on those sites.

7.2.1. Option 1: Constrained development

The constrained development approach increases the yield on the Mayor’s Vision sites by 2,500 units resulting in high densities and high rise buildings.

Firstly, high rise and high density developments will have reduced heat demands, from better energy efficiency in building fabric, as there are a high proportion of party walls/floors, thus reducing heat losses.

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[71] Torbay Local Development Framework (LDF) Core Strategy, Development Plan document (DPD), Regulation 25 Consultation (LDD2 September 2009)

Once energy efficiency has been maximised, the carbon compliance targets could be difficult to meet from micro generation technologies because there is generally insufficient roofspace/dwellings to install solar panels, and they are typically in dense urban environments which suffer from wind turbulence issues, making micro wind turbine installations unsuitable. In some cases, where there is unshaded façade on a tall building, building integrated PV may be suitable on the façade of the building (installed at 90deg to the horizontal) however this would be a building specific solution depending on orientation and local shading. Ground source heat pumps are also unlikely to be feasible due to the necessary land take required for boreholes. It should also be noted, than under the new 2010 Building Regulations, the carbon emissions factor for grid electricity has increased from 0.422kgCO_2/kWh in 2006, to 0.517 kgCO_2/kWh and this will decrease the short term benefits of using heat pumps (air or ground) to contribute to carbon savings. Broadly, if a COP of greater than 3.2 can be achieved then the heat pumps solution could save carbon. However, the recent EST field trials[72] stated that only 13% of all the 83 sites trialled achieved system efficiencies (COP's) of greater than 3.0.

High rise buildings are suitable for low carbon heat networks, as there is a high heat density, e.g. heat is not required to be transported long distances from where the heat is generated to reach the heat demand. This makes the scheme more viable. As a rule of thumb, generally a development with more than 500 units, new build or existing, could be suitable for a heat network, however, less dwellings and increased non-residential heat demands can also be viable.

However, in dense urban environments, large heat and power generation plant can have related air quality issues, (increased NOx emissions compared to a standard gas boiler installation), and noise / vibration issues. These issues can be overcome by carrying out air quality assessments, to assess the impacts of increased NOx emissions on the local air quality; and designing the plant room with sufficient space for noise and vibration attenuation.

7.2.2. Option 2: Urban focus and limited greenfield development:

This approach attempts to balance the need to avoid "town cramming" in the town centres, and the need to avoid excessive greenfield development. It would increase the yield on the Mayor's Vision sites by 1,000units resulting in higher densities but not as extreme as proposed in Option 1, and overall, it would see 10,700 new homes in built up areas, and the remaining 5,500 homes built on Greenfield sites.

Under this option, the possible locations for new development beyond the existing urban area include:

- Scotts Meadow, Torquay (230 dwellings): this site is located north of the railway line close to The Willows shopping centre.
- Edginswell, Torquay (750 dwellings): this is a mixed use site to the south of the railway line as it enters Torbay.
- Yalberton Road, Paignton (850 dwellings): this is a mixed use site to the west of Paignton, and Brixham Road, north of South Devon College and Torbay Business Park.
- Totnes Road, Paignton (2,000 dwellings): this site would cover both sides of the Totnes road, as it leaves Paignton.

[72] Getting Warmer: a field trial of heat pumps, EST, September 2010

- West of A3022 (White Rock), Paignton (270 dwellings): this site is to the west of Paignton, and Brixham Road, south of South Devon College and Torbay Business Park.
- Small sites on outskirts of built up areas, such as Preston Down Road, Paignton (200 dwellings), located on the north east side of Paignton.

These new developments on the outskirts of the town are likely to be developed at a lower density than in the urban area to deliver more family sized homes. A lower density development could make it easier to meet more of the carbon compliance target on site by microgeneration technologies such as PV and SHW, and possibly heat pumps if COP's greater than 3 can be achieved, as discussed earlier.

The larger greenfield sites such as Edginswell, Yalberton and Totnes Road could also meet their carbon compliance targets by using a central energy centre and district heating network (which could be a combination of technologies). This could also introduce an element of future-proofing to the site as it enables potential retrofit of central plant to use different fuels or technologies as they become more affordable, and available. For example, when grid electricity begins to decarbonise and it is no longer more carbon effective to generate electricity locally using gas CHP engines, the fuel could be converted to biomass or energy from waste, with minimal disruption to the residents.

This option of a central energy centre would be taking a strategic approach to sustainable development and would enable longer term reductions in Torbay's carbon emissions.

7.2.3. Option 3: Greenfield approaches

This option takes the existing projected capacity of the SHLAA and Mayor's Vision sites, which are estimated to deliver 8,300 dwellings, and aims to deliver the remaining 6,700 dwelling target in Greenfield sites. This is further split into three sub-options:

Option 3a: Mixed Greenfield Approach: This option uses a range of sites, similar to those identified in Option 2, however increased yield on sites such as Totnes Road;

Option 3b: Single Urban Extension: Focussing on one single urban extension to the west of Brixham Road, Paignton, combining the Totnes Road, Yalberton and west of A 3022 sites.

Option 3c: Northern Torbay Approach: This option aims to move development away from the A 3022, Western Corridor which is already considered heavily congested and instead, brings the focus of new development to a mixture of sites across the north of Torbay.

In terms of energy opportunities, all three of these sub-options could meet the carbon compliance targets in similar ways. After maximising energy efficiency in the new buildings, a central energy centre could be utilised in the large sites to deliver a strategic solution to meeting carbon compliance. This would be particularly suited for a site such as the single urban extension, west of Paignton, which would include a new community centre, and a low carbon network could make development in this site more attractive to developers as they would be able to achieve their carbon compliance targets more cost effectively than using on-site microgeneration methods.

Capabilities on project:
Building Engineering

7.2.4. Optimum growth option for sustainable energy opportunities

Whilst it is an over-simplification to suggest that a particular type of growth option is 'better' in sustainable energy terms than another, it is possible to state a general principle in this context. However, it should be borne in mind that the reality is different growth options enable different sustainable energy opportunities to be implemented more or less efficiently.

In terms of DHNs; a higher density option will increase viability as costs of installing infrastructure (the major capital outlay for such systems) will be less per unit of heat load connected. Therefore, a dense urban development with high heat density is favourable (as heat loads are closer together less pipework is required to connect them) as is a new greenfield development where the optimum heat density can be designed into the scheme and installation of pipework can be coordinated with other infrastructure works reducing cost. So, where a high density approach is desired, strategic plans should bring together key anchor loads and ensure a compatible internal heating design for connection to a DHN.

In terms of solar and heat pump microgeneration technologies, lower density schemes can provide more opportunities for unshaded roof area for PVs and solar thermal installations, and open land for laying ground pipes for heat pumps. In such cases, including underfloor heating in new homes to maximise heat pump and solar hot water heating solutions and ensuring that south facing roofs are maximised on all properties are examples of design principles which can assist the delivery of these technologies.

Naturally there will be an element of compromise required when considering the aims of new development, but, on balance, and when considering sustainable energy in isolation, higher density developments are generally preferred, whether urban or greenfield. Where a lower density approach is required and DHNs are not viable, the plans should consider how microgeneration technologies might be incorporated.

7.3. Planning policy approach

The following approach represents the application of national policy to the specific Torbay context. Broadly, the PPS1 Supplement on Planning and Climate Change requires the following:

- Along with criteria based policies, identify suitable sites for decentralised and renewable or low carbon (DRLC) energy and supporting infrastructure.
- Expect a proportion of energy supply for new development to be secured from DRLC energy. This can involve:
  - Setting a target percentage of the energy to be used in new developments to come from DRLC energy where viable.
  - Bringing forward development area or site-specific targets, where opportunities allow higher percentages.
  - Setting thresholds and development types to which the target will be applied and ensuring a clear rationale and proper testing for the targets.
  - Utilising existing and fostering new opportunities to supply development. For example, co-locating potential heat customers and suppliers, requiring development to connect to an identified system or to be able to in the future, setting

out how proposed development should contribute to securing the DRLC energy system from which it could benefit, and facilitate connection.

- Anticipate levels of building sustainability ahead of the Building Regulations on specific sites where opportunities exist or development would otherwise be unacceptable.

It is clear that the PPS adopts a non-prescriptive approach which enables local planning authorities to develop policy responses that suit the particular characteristics of their area.

7.4. Policy options

This chapter puts forward policy options regarding the reduction of carbon associated with energy use in the Torbay LPA area. The policies presented here are simply options and both inclusion of the policies and the specific wording should be reviewed by the Torbay Spatial Planning Team. The policy options proposed will also need to be reviewed if and when the approach to local authority delivery is agreed by the LPA and their partners. The review will need to consider:

- The nature of the local authority delivery mechanism and the role of planning policy in supporting this; and
- The extent to which existence of this mechanism influences the viability and feasibility of the policies set, and discussion around the need for more explicit criteria.

The policy options presented are split into two principal themes:

- Those which are applied to development within Strategic District Heating Areas (SDHA)
- All other development

The Energy Opportunities Plan identifies the areas suggested as being designated SDHAs within Torbay.

7.4.1. Policy impact on viability

The creation of an energy strategy that imposes significant additional cost on the development of new dwellings in the area is likely to exacerbate issues of site viability and impact upon the delivery of development in the area as a whole. Consequently, an approach that seeks to deliver maximum gain in terms of carbon reduction for minimum cost is considered expedient. Therefore, the energy study approach has focused on the opportunities provided by the development of district heat networks across Torbay rather than asking developers to make all their carbon savings on a site by site basis.

Instead of on-site CO_2 targets, we have focused particularly on identifying suitable sites for decentralised renewable and low carbon energy and drafting policies that require development to connect to the district heating networks.

This approach requires that rather than pay for compliance on an individual building basis, a developer will be required (conditional on viability) to contribute to the cost of the provision on the DHN infrastructure. The level of contribution will be based on the cost of associated energy infrastructure.

Capabilities on project:
Building Engineering

7.4.2. Policy types

We have also considered a number of other policy types which may be beneficial to and appropriate for Torbay by drawing on the information presented in the South West Planners Toolkit[73]. The toolkit (developed by Regen SW) seeks to assist planners in the development of consistent and robust policy surrounding climate change. These recommendations have been tested in this chapter to forward specific recommendations for Torbay.

The toolkit presents nine policy options for sustainable energy and we have considered them all in our recommendations. The following table outlines each of the suggested policies and where they are addressed in this chapter. If they are not addressed, a rationale for their removal has been provided.

South west Toolkit Policy	Order in document/ Rationale for not Including
SE1: Area-wide energy/carbon target for new development	*Not included* – Due to expected advances in Building Regulation requirements a specific carbon reduction target across the LPA-area is not thought to be an efficient mechanism to be applied through the planning system. Instead planning can influence and enable strategic delivery strategies and set requirements for strategic sites where there are evident opportunities for carbon reductions in excess of proposed Building Regulations. Emerging advice from Government (in the Low Carbon Planning PPS in consultation) suggests area-wide advances on Building Regulations can be used until 2013 where viability evidence exists, but due to the proposed Core Strategy timetable, this is not thought to be worthwhile for a limited amount of time.
SE2: Energy/carbon targets for strategic sites	Policy 3: Strategic Sites
SE3: Stand-alone renewable energy sites	Policy 4: Potential areas for renewable stand-alone energy
SE4: Area-wide renewable energy targets	Policy 5: Renewable Energy
SE5: Sustainable building standards	Policy 6: Code for Sustainable Homes and BREEAM Targets
SE6: Inform site allocation for sustainable energy maximisation	Policy 1: Delivering an Energy opportunities plan
SE7: Sustainable energy infrastructure plan	*Not included* - This could be a key delivery mechanism for Torbay, but the exact form and administration of a carbon buyout fund / community energy fund will need to be decided through the delivery strategy. The fund could potentially source funding from ‘Allowable Solutions’ or from ‘buy-out’ clauses attached to targets for specific developments. There may also be options to connect the fund with CIL.
SE8: District Heating Networks	Policy 2: Strategic District Heating Areas (SDHA)

[73] South West Planners Toolkit, 2010, http://www.swplanners-toolkit.co.uk/

SE9: Local Development Orders	*Not included* – This is considered as something that can be applied as a delivery strategy or in sites specific guidance, but which is not suitable for the Core Strategy unless specific sites can be identified at this stage.

Table 33 How the South West Toolkit is applied in this chapter

This report provides the evidence base required to support several of the proposed policies, subject to the further work required that is set out in Chapter 10. The remaining policy options would require further work in order to develop robust evidence base material.

Capabilities on project:
Building Engineering

7.5. Policy options directly supported by this study

7.5.1. Policy Option 1: Delivering an Energy Opportunities Plan

Policy option development context

The various options for decentralised renewable and low carbon energy opportunities across Torbay have been compiled to create an Energy Opportunities Plan (EOP). The EOP acts as the key spatial map for energy projects throughout Torbay and can be used to support site allocations as well as the policies, targets, and delivery mechanisms described here and can also establish where money raised through a Carbon Buyout Fund/Community Energy Fund might be spent. The housing minister's recent announcement that LPAs will likely play a role in the co-ordination and delivery of 'Allowable Solutions' outside the site boundary only emphasises this point. Torbay Council and its various community partners should use the EOP to help make decisions related to renewable and low carbon energy and sustainability strategies.

The main opportunities for renewable and low carbon energy identified are in the form of district heating networks and, in a few locations, wind energy generation and hydro potential. Areas where district heating are more likely to be implemented need to be identified and co-ordinated based on various development's phasing. As indicated on the EOP, suitable areas for wind turbines include south west of Paignton, and off the Brixham shore.

Policy Option

1. Delivering the Energy Opportunity Plan

Decentralised, low carbon and renewable energy is a priority for the Council. Planning applications for new development in Torbay will need to demonstrate how they contribute to delivery of the 'Energy Opportunities Plan'

7.5.2. Policy Option 2: Strategic District Heating Areas (SDHAs)

Policy Option development context

PPS1 Supplement on Planning and Climate Change and PPS22 (Renewable energy) expects that a proportion of energy supply for new development be sourced from decentralised renewable and low carbon (DRLC) energy and supportive infrastructure. Co-locating existing heat customers and suppliers; requiring new developments to connect or have the ability to connect to a heat network; and proposing how developments should contribute to a DRLC are all expected under this national policy.

Manchester's draft Core Strategy already contains precedent policy related to DRLC developments. Their draft Core Strategy states:

> *Policy Approach En 2 – Within Manchester it is considered that the following strategic areas will have a major role to play in achieving an increase in the level of decentralised, renewable and low carbon energy available:*
>
> - *Regional Centre, which also includes the Oxford Corridor and Sport city*
> - *District Centres*
> - *Inner Areas*
> - *Strategic Housing sites*

- *Strategic employment sites*

The City Council will work with all relevant stakeholders, which may include residents, private sector partners, utilities companies, neighbouring authorities and other public sector bodies, as appropriate, to bring forward more detailed proposals for decentralised low and zero carbon energy infrastructure in these areas.

Where investment or development is being undertaken into or adjacent to a public building, full consideration shall be given to the potential role that the public building can have in providing an anchor load with a decentralised energy network.

Bristol's draft Core Policy (2009) also recommends the use of district heating. Their policy states:

The use of combined heat and power (CHP), combined cooling, heat and power (CCHP) and district heating will be encouraged. Development will be expected to incorporate, where feasible, low carbon energy generation and distribution by these means. Within Heat Priority Areas, development will be expected to incorporate infrastructure for district heating, and will be expected to connect to existing systems where available.

The purpose of such policies is to prioritise the adoption of DRLC technologies where opportunities are greatest. The policy may go further to designate certain areas as district heating networks and cover specific policies that optimise and protect heat networks' operation. This may be set out in a supplementary planning document (SPD) requiring developers to adhere to financial or other contribution to a heat network.

In addition, the policy will need to set out that; where appropriate, applicants may be required to provide land, buildings and/or equipment for an energy centre. It may also be of value to include in the policy a requirement that the masterplans put forward by applicants are arranged so as not to significantly reduce the viability of the DHN particularly in green field type developments.

Heat network policies can provide many benefits, including:

- Providing developers with a ready-made solution to meet future requirements under Building Regulations for zero carbon developments;
- Encouraging a network would facilitate connection of future and existing buildings to the network;
- Providing an impetus for ESCos, as it guarantees them future heat loads and customers;
- Helping to reduce the area's CO2 emissions and improve its financial performance.

Policy Option:
2. District Heating Priority Areas

The Council will support the delivery of district heating in these areas and will work with all relevant stakeholders, which may include residents, private sector partners, utilities companies, neighbouring authorities and other public sector bodies, as appropriate, to bring forward more detailed proposals for district heating in these areas.

Development within the priority area should install the secondary elements of a district heating network (i.e. from the wider network to properties), unless it can be shown not to be viable or feasible. Should development come forward prior to a district heating network being in place, developers should provide a containerised energy centre to provide temporary supply. Where appropriate, applicants may be required to provide land, buildings and/or equipment for an energy centre to serve proposed or multiple developments.

New residential and commercial development should be designed to maximise the opportunities to accommodate a district heating solution, considering: density; mix of use; layout; and phasing.

Where applicants demonstrate that connection to a district heating network is not feasible or viable they can contribute financially to a Carbon Buyout Fund / Community Energy Fund

7.5.3. Policy Option 3 – Strategic Sites

Policy option development context

PPS1 Supplement encourages setting specific policy and targets for strategic sites where greater opportunities exist to reduce CO_2. The strategic sites in the study area have been considered in detail in previous chapters which demonstrate the level of carbon reduction that is achievable on each site through the use of energy efficiency and connection to a district heating network. The financial analysis of some of the strategic sites indicates that a DHN is not currently viable. Therefore, it may be more appropriate to set targets for these sites which are lower than the level of carbon saving which would have been achieved had a DHN been viable, but, still ahead of Building Regulations. Torbay should also seek opportunities to set higher targets on other significant sites that come forward where significant potential exists. The strategic site analysis along with general advice given in this report should help to guide the Council in deciding whether a development typology is likely to be capable of achieving carbon reductions in excess of Building Regulations. A simple typology table is provided in Appendix J. Where specific targets cannot be set for sites, an energy strategy should be required to be submitted with the planning application that considers potential achievable carbon reductions. For sites where adjacent development is also occurring, the feasibility of community energy schemes should be considered on a wider scale.

Policy Option:
3. Strategic Sites: Energy Strategies
Within Torbay, the following strategic areas are thought to play a major role in achieving an increase in decentralised, low carbon and renewable energy:

- Castle Circus and Union Street
- Harbourside and Victoria Parade
- White Rock and Yalberton (Land west of Brixham Road, Paignton)
- Paignton Town Centre
- Brixham

An energy strategy, including phasing requirements, should be developed for the entire site and surrounding area. This will guide the development of low carbon infrastructure in a coordinated way, and ensure that individual developments on the site can be taken forward in a carbon and cost-efficient manner. All energy strategies should include feasibility assessment for district heating and CHP.

Strategic Sites: Carbon Reduction Targets

It may be possible to set targets ahead of Building Regulations for some of the strategic sites, which come forward in Torbay; However the specific level of carbon savings beyond buildings regulations will be affected by the technology used in the district heating system.
If the use of district heating system achieves the same savings as required by Building Regulations, setting targets in advance of that, may be too onerous on developers

7.5.4. Policy Option 4: Potential areas for stand-alone renewable energy

Policy option development context
Within a national context, both Planning Policy Statement 1 (PPS1) and PPS22 support the local adoption of wind power.
The land to the south west of Paignton in the Yalberton area has potential to support wind energy, as this has the largest unconstrained wind area on the EOP and is currently undeveloped. The bay and port area around Brixham also has to deliver some potential for wind energy. There are also some sites that could support micro-hydro schemes.

The incorporation of suitable stand-alone renewable energies should be encouraged by the Council and the EOP can be used as a tool to assist selection of sites. Wind turbines can help contribute to the renewable energy targets. As growth, especially within the strategic areas, is desired, it is likely to be necessary to implement policies that view the deployment of stand-alone technologies favourably. Installation of renewables should always be sensitive to South Devon Area of Outstanding Natural Beauty (AONB)'s policies.

Policy Option:
4. Potential Areas for Stand-Alone Renewable Energy

The Council will favourably consider applications for development which the Energy Opportunities Plan (EOP) highlights as potential locations for stand-alone renewable energy.

The Council will look favourably on the addition of new wind turbines at the medium or large scale as part of any redevelopment of industrial parks, commercial areas or public realm located a suitable distance from residential areas as to not have adverse impacts. The location of wind turbines in these areas should not be to the detriment of local biodiversity, and should consider the South Devon AONB. Applications would be encouraged from community groups and individuals in areas with the ability to support wind energy.

Similarly, policies supporting hydro power that do not adversely impact on local biodiversity and are considerate of the South Devon AONB are recommended

7.6. Policy options requiring further evidence base

7.6.1. Policy Option 5: Renewable energy

Policy option development context
The binding national renewable energy target of 15% of total energy to be generated from renewable sources by 2020 can be delivered through a combination of renewable electricity, heat, and transport fuel. The Government's July 2009 Renewable Energy Strategy indicates that for electricity and heat that 30% of total electricity from renewables and 12% of total heat is a realistic target. Planning has a key role to play in the achievement of these targets.

Via the UK's Renewable Obligation, the former south west RSS set a target of 20% renewable electricity by 2020 based on an evidence base that considered the overall potential of the Region. The analysis of Torbay has identified a range of opportunities to produce renewable electricity, including some wind energy, micro-hydro, combined heat and power and micro-generation.

The national 12% goal for renewable heat generation is most likely to be supplied in conjunction with developments that are new or regenerative in nature. Because much of the Torbay area is located in an urban built area, many opportunities exist for district heating systems. The incorporation of district heating in Torbay should significantly contribute toward a 12% target for renewable heat.

Therefore, it may be beneficial to develop a policy to which includes a target of 'installed capacity' for renewable electricity and heat. It could be possible to set this target using the evidence base which supported the RSS, however, it is our opinion that a more detailed study of Torbay's renewable energy capacity be undertaken in order to provide a more robust set of evidence. This could allow a target level of installed capacity to be set with confidence which would span the entire Torbay area.

The sample wording below is based on the levels set out in the RSS and is provided to demonstrate the sort of approach which might be taken.

Capabilities on project:
Building Engineering

Policy Option:
5. Renewable Energy

Torbay demonstrates potential for a number of renewable energy types and the deployment of renewable energy will support environmental, social and economic aims in Torbay.

Applications for low carbon and renewable energy installations should generally be supported in the area. Torbay is seeking new renewable energy generation capacity to deliver an appropriate contribution towards the UK Government's binding renewable energy target. Therefore:

The equivalent of at least 12% of the area's heat demand per annum should be generated through low carbon and renewable resources by 2020. Torbay demonstrates significant potential for inclusion of district heating. The equivalent of at least 20% of the area's electricity demand per annum should be generated through low carbon and renewable resources by 2020. Particular opportunities to contribute towards the targets include Combined Heat and Power, wind energy and micro-generation

For more information regarding the development of this kind of policy, please refer to the following section of the South west Toolkit: http://www.regensw.co.uk/climate-change-pps/objectives/se-policy-objectives/se4

7.6.2. Policy 6 – Code for sustainable homes and BREEAM targets

Policy option development context
This report includes an evidence base for the need for carbon reduction in Torbay and the introduction of sustainable building standards may help in delivering carbon reductions in new development across all sectors and in major non-domestic refurbishments. The UK's two main assessment frameworks are the Code for Sustainable Homes (for dwellings) and BREEAM (for non-domestic buildings). Both of these assign a rating to buildings based on the performance in a range of categories including energy. Both the Code and BREEAM rate buildings at a variety of levels depending on their overall performance against a range of issues in each category and it might be possible to create a policy which requires performance at a stated level (such as Code Level 4 or BREEAM Excellent for example) for all development across Torbay.

Whilst guidance on overall viability and cost related to the Code and BREEAM is given in Chapter 4.7 of this report and indicative costs of the application of various levels of performance provided, a wider evidence base should be developed to support any policy in this area particularly before any district-wide application of Code for Sustainable Homes and BREEAM levels. This is because sustainable building assessments, and BREEAM in particular, are heavily influenced by the location and conditions of each specific site. This means that setting a target which affects all sites in Torbay may have a significantly different level of impact depending on which site is being considered. A policy which set specific targets for each strategic or major site in Torbay may therefore be more appropriate. It would also be worth considering creating an evidence base around the water issues covered by the assessment methodologies before putting policy into place.

Should a policy focused on carbon be more desirable due to issues of viability, a further possibility is to create a policy which requires development to achieve standards set out only the relevant parts of the Code and BREEAM. The South West Toolkit provides other case studies of where Code and BREEAM policies have been included in other areas and gives guidance on developing an evidence base for this kind of policy http://www.regensw.co.uk/climate-change-pps/objectives/se-policy-objectives/se5.

In any case, individual applications should assess the viability of meeting the standards proposed on a site-by-site basis where the policy applies. Where it can be demonstrated that the Code levels cannot be met through an open-book viability analysis, developers could instead contribute to a compensation fund to reduce impacts elsewhere.

The changes to Building Regulations on the pathway to zero carbon are currently proposed, but may change in response to the new Government or for other reasons. Application of a Code for Sustainable Homes/BREEAM targets would ensure all new development has a 'backstop' requirement for carbon reductions in the absence of Building Regulation changes.
Dover District Council has adopted policies in the Core Strategy that require delivery of district-wide and BREEAM levels. Dover District Council's policies include a provision to fund off-site reductions in carbon or water use where targets cannot be met on-site. The Dover policies are as follows:

> *New residential development permitted after the adoption of the Strategy should meet Code for Sustainable Homes level 3 (or any future national equivalent), at least Code level 4 from 1 April 2013 and at least Code level 5 from 1 April 2016.*
>
> *New non-residential development over 1,000 square metres gross floorspace permitted after adoption of the Strategy should meet BREEAM very good standard (or any future national equivalent). Where it can be demonstrated that a development is unable to meet these standards, permission will only be granted if the applicant makes provision for compensatory energy and water savings elsewhere in the District.*

Capabilities on project:
Building Engineering

Policy Option:
6. Code for sustainable homes and BREEAM targets

Note: This policy should only be applied once a full evidence base against all sustainability aspects, particularly water, has been developed. Also this policy could be applied across all of Torbay or could support a variety of performance levels for different sites as indicated by the result of evidence base development.

New residential developments in Torbay's administrative area are required to meet full 'Code for Sustainable Homes' standards or equivalent. These requirements will not come into effect until successive updates to Part L of the Building Regulations become mandatory:

Code level 3 or above, will be required for all new homes once updates to Part L come into effect from 1 October 2010. Code level 4 or above, will be required for all new homes once updates to Part L come into effect (currently scheduled for 2013).

All new non-residential developments in Torbay over 1000m² gross floor area should aim to achieve the BREEAM "Very Good" standard or equivalent, with immediate effect (relevant versions of BREEAM are available covering all types of non-residential development).

If this policy option is to be applied it should require submission of final Code certificates and post-construction BREEAM certificates, as appropriate.

7.7. Monitoring and review

An Excel model, which provides insight on how altering renewable and low carbon energy strategies will impact on carbon reduction targets, has been provided to the Council as part of the study. This should be regularly updated to help to show progress against low carbon planning ambitions.

Key to delivering an effective area-based renewable and low carbon energy strategy is successfully drawing on all of the available opportunities. Alongside the opportunities for a local delivery vehicle are shorter-term Local Area Agreements (LAA) and National Indicators.

The Renewable Energy Strategy proposes introducing a renewable energy indicator, but until this time several can be used to deliver energy projects:

- NI 185 – Percentage CO_2 reduction from local authority operations.
- NI 186 – Per capita CO_2 emissions in the local authority area.
- NI 187 – Tackling fuel poverty – percentage of people receiving income based benefits living in homes with a low and high energy efficiency rating.

The CAA and National Indicators are under review by the new Government and may be subject to change.

Appendix K provides guidance for Development Management officers specifically around the measures they might expect of developers addressing energy efficiency and Low and Zero Carbon technologies (LZCs).

8. Delivery

8.1. Introduction

To be effective, policies and targets need to have a strategy for delivery and a collaborative approach between the Council, Local Strategic Partnerships, Torbay Development Agency, utilities, private developers, other stakeholders and the community. This strategy should set out:

- What the objectives of the policy or targets are
- An appropriate mechanism for delivery
- Who is responsible for their delivery
- Recommended next steps.

This chapter describes the mechanisms available to Torbay Council to deliver the principal opportunities for decentralised renewable and low carbon energy opportunities identified on the Energy Opportunities Plan (EOP). These mechanisms should be considered in addition to the planning policy recommendations. It is not intended to be an exhaustive list, nor does it reach definitive conclusions about which mechanisms are most suited to Torbay. Rather it seeks to clarify the importance of considering delivery at the same time as planning policy and provide guidance on what opportunities exist and where further work is required. Making clear recommendations on what approach will be suitable for Torbay will require a more detailed study involving discussions across the Council and with partners.

Table 34 sets out some of the mechanisms and partners required to deliver change in Torbay.

Delivery Mechanisms	Potential Partners
Corporate Policy and Targets	Torbay Council
Site Specific policy	Torbay Strategic Partnership
Partnership for Renewables	South West Regional Development Agency
Powers of Wellbeing	Carbon Trust and EST
Prudential Borrowing	Torbay Development Agency
Bond Financing	Home / Building Owners
Local Asset Backed Vehicles / Accelerated	Finance Institutions
Development Zones	ESCo
Allowable Solutions Fund / Community Energy Fund	Energy Developers
CIL and s106	Housebuilders / Developers / RSLs
Building Regulations	Community Organisations and Operatives
Conditions to Local Authority Land Sales	Utility Providers
SALIX Finance	

Table 34 Overview of delivery mechanisms and partners for energy opportunities in Torbay

This chapter outlines mechanisms which might be used to support the implementation of the strategic policies set out in Chapter 7. The chapter is structured as follows:

1. Existing development – Effective ways to retrofit existing building, including delivery mechanisms and funding that can facilitate it
2. New development – Programmes and funding options available to the LPA, an outline of the housing market and its potential appetite for carbon efficient building, and the role of local delivery vehicles in addressing viability in new development
3. Strategic Community-Wide Interventions – How private investment and local partners can help implement renewable and low carbon energies
4. Delivery Factors for Strategic Sites – Opportunities for each of the five strategic sites, agreed by Torbay Council, to deliver renewable and low carbon energies on-site

8.2. Existing development

8.2.1. Delivering energy efficiency in existing buildings

A significant portion of CO_2 emissions in the Torbay LPA area in the future will come from existing buildings, and hence the Council should seek to improve existing buildings where possible. However, a concentrated funding and improvement programme would have to be introduced to trigger the completion of higher cost elements of retrofit. The Council has a role in working with partner organisations to distribute and focus funding.

Heat loss can often be more easily and cost effectively addressed than other efficiency measures, leading to immediate CO_2 savings. Home improvement measures such as loft, cavity and solid wall insulation, double glazing and boiler replacement should be heavily promoted across the LPA area, as these are the least efficient areas on a per home basis. Social marketing campaigns that have a clearly defined message, promote both financial and other benefits, and identify a target audience already interested in energy efficiency are likely to increase the success of home retrofit programmes[74]; such campaigns have been shown to be more effective than the more usual awareness raising or standard marketing campaigns.

8.2.2. Delivering on-site renewable and low carbon energy technologies

Delivery of renewable and low carbon technologies within existing buildings and communities cannot easily be required by planning, but can be encouraged by the Council. The Council should seek to engage communities and, through the use of social marketing techniques, increase the likelihood of retrofit micro-generation. The introduction of the feed-in-tariff[75] and other funding sources available to homeowners and businesses to assist with the capital cost of installation, retrofit, particularly of electricity generating renewables, is likely to increase. It is also important, however, to stress non-financial benefits including issues of comfort, noise, health and safety. There is an opportunity for Torbay Council and its partners to act as catalysts in leading by example by installing efficiency measures and micro-generation technologies in buildings under their ownership or management.

[74] Build It Green, Community-Based Social Marketing to Inform Homeowner Participation in California Energy-Efficiency Home Improvement Programs. Available: http://www.builditgreen.org/_files/DevCom/Greenpost/CBSM_Report.pdf

[75] The Feed-In Tariff came into action in April 2010 for micro-generation installations not exceeding 5 megawatts . The tariff will pay generators a guaranteed price for electricity generated and exported to the grid over a period of 20 years (25 for solar PV).

8.2.3. Available delivery mechanisms

In addition to central Government grants and subsidised energy efficiency offered by energy companies, Local Authorities have access to low interest loans and have the powers to deliver energy opportunities in the existing stock using the Wellbeing Power and Community Sustainable Energy Programme (CSEP).

There are funding sources already available to homeowners and businesses to assist with the capital cost of installing CO_2 reduction solutions. These include Warm Front, Carbon Emissions Reduction Target (CERT), the Big Lottery Fund, the Energy Saving Trust and Low Carbon Communities Challenge.

The three part approach suggested below offers a potentially effective way to co-ordinate the various funding streams and to prioritise areas for installation of micro-generation technologies and energy efficiency improvements. The initiative could be financed using a combination of Salix and Community Energy Savings Programme (CESP) and could be co-ordinated through the Council and/or Torbay Development Agency, possibly in partnership with the private sector and energy companies for finance and with installation companies for delivery:

- *Discount provision* – available finance could be used to bulk buy technologies, enabling them be sold on at a discount to households and businesses.
- *Householder or business hire purchase* – appropriate technologies could be leased to householders and businesses. Rental costs could be charged as a proportion of the generation income received by the beneficiary. After a period of time, ownership would transfer to the householder or business.
- *Householder or business rental* – a third model could be for the Council or partnership to retain ownership of the technologies and to rent roof or other suitable space. Again, rental costs could be set as a proportion of generation income. As with the hire purchase option, this approach would give benefits of renewable and low carbon energy to communities without the up-front expense. The advantage of this option would be the retention of control over phasing and technology choice, and greater flexibility to respond to changes in technology and demand.

Option	Potential Partners	Potential Delivery Mechanism
Increased energy efficiency Increased micro generation	• Local authority • Torbay Development Agency • Energy companies • Community groups • Private installation companies	• Provision of discounted CO_2 reduction solutions • Hire purchase of CO_2 reduction solutions • Rental of space for CO_2 reduction solutions • Awareness and education campaign for householders and businesses, possibly utilising social marketing principles. • Salix Finance • Community Sustainable Energy Programme • Warm Front

		• Carbon Emissions Reduction Target • Big Lottery Fund • Energy Saving Trust • Low Carbon Communities Challenge

Table 35 Delivery options for existing development

8.3. New development

8.3.1. Delivering CO_2 reductions in new development

Building Regulations are likely to be the primary drivers for higher energy performance standards and renewable and low carbon energy generation in the majority of new developments. Within the strategic sites discussed below, should more stringent policies prove feasible, Torbay Council's role should be to outline more stringent policy or targets to facilitate renewable and low carbon energy adoption and coordinate strategic site interventions where appropriate.

A variety of options exist which can deliver impacts ahead of Building Regulation requirements. One option includes applying conditions to sales of the Council's own land requiring higher environmental standards or installation of energy technologies. Partnerships for Renewables, an organisation set up by the Carbon Trust to develop, construct, and operate renewable energy projects on public land, is a further option to be explored.

Another opportunity is both a planning and a delivery mechanism. That is to prioritise delivery of energy opportunities through the use of funds raised through a Community Infrastructure Levy (CIL). Unlike Section 106 contributions, these can be used 'to support the development of an 'area' rather than to support the specific development for which planning permission is being sought. Therefore, contributions collected through CIL from development in one part of the charging authority can be spent anywhere in that authority area. This flexibility will enable the Council, as the 'charging authority', to fund energy infrastructure identified in the Energy Opportunities Plan. (EOP).

It is our understanding that CIL money can be spent on infrastructure projects (the definition of infrastructure includes renewable and low carbon energy technologies) delivered by the public or private sectors or partnership between the two. Therefore, a local authority led delivery vehicle, partnership or joint venture could be established to manage and co-ordinate delivery of energy infrastructure to support new development and to help enable developers meet the requirements of planning and Building Regulations, including future Allowable Solutions. Although CIL is an optional charge for local authorities we would recommend adopting it in Torbay in order to deliver energy infrastructure. Should CIL not come into force it may be possible to set up a local tariff, similar to that in Milton Keynes.[76] As part of the CIL, Torbay can also establish a carbon buyout fund, which allows developers the ability to financially support renewable and low carbon energy within the community should installing renewable and low carbon energy on-site prove too difficult.

76 Milton Keynes Partnership Infrastructure Tariff http://www.miltonkeynespartnership.info/about_MKP/business_plans_infrastructure_tariff.php

8.3.2. Delivering 'Allowable Solutions'

As previously discussed, future development (post 2016 for domestic and post 2019 for non-domestic) will need to make use of Allowable Solutions to achieve carbon reductions required by Building Regulations.

The UK Minister of Housing announced in July 2010[77] that the Government would implement a community energy fund, which would allow developers to make payments to the Local Planning Authority (LPA) as part of the Allowable Solutions approach. It is expected that Local Authorities will be responsible for administering the fund. This provides Torbay Council with the ability to determine how funds can best be used to meet renewable energy targets across the LPA area in a way that suits local circumstances.

The EOP can be used to identify possible locations for use of the fund. For example, White Rock and Yalberton could support a district heating solution, linking the business park or college into proposed residential development. Since most of the strategic sites and the larger SHLAA sites sit within a district heating opportunity area, each should be prioritised for action. The Strategic Sites are discussed in more detail below; however, further feasibility work will need to be undertaken to understand the extent of the opportunities. This will need to consider practical issues such as development phasing, cost, and market potential and delivery strategies. The EOP in Appendix H shows the location of the strategic sites in relation to feasible district heating areas and should be used to assist the Council in identifying the location and phasing of district heating.

Similarly, wind opportunities exist that can be related to new development. and therefore constitute 'Allowable Solutions'. In locations not prioritised by the Council for district heating, developers could be required to pay for or contribute (through the proposed carbon buyout fund) towards a wind turbine off-site in one of the wind opportunity areas. Further work will need to be undertaken to establish the extent of the opportunity, considering issues such as land ownership. Alternatively, if no tariff or buyout fund is in place a Merchant Wind arrangement could be entered into between the developer and energy company.

Potentially, Allowable Solutions or a local carbon buyout fund will be charged at £100/tonne of CO_2[78], resulting in significant availability of funding. A recent speech by Rt Hon John Denham[79] suggests that an annual pot of £1bn will result from the zero carbon homes policy by 2020.

It should be noted that this scale of contribution will only offset CO_2 increases from new development. The Council will need to consider these opportunities alongside those for the existing stock and strategic community-wide interventions. Torbay Council should develop a plan to deliver Allowable Solutions in the LPA area, to ensure funding available from new development is directed towards the best solutions in a coordinated manner.

[77] CLG News story published 27th July 2010, http://www.communities.gov.uk/newsstories/newsroom/16527871
[78] Impact Assessment of the Zero Carbon Homes Consultation, CLG, December 2008
[79] The Green Councils of the Future, 26th November 2009

8.3.3. The role of a local delivery vehicle in addressing viability in new development

A 'carbon buyout fund' (operated through CIL or other tariff mechanism) offers a useful way of providing continuity in delivery mechanisms between proposed planning policies requiring energy performance standards ahead of Building Regulations prior to 2016 and the likely Allowable Solutions post 2016. Linked to this is the important issue of viability. Specifically in relation to new development, a local delivery vehicle (company, partnership or joint venture) set up to deliver projects funded through the fund could provide a useful opportunity for reducing the financial burden on developers, thereby improving viability, while increasing the level of low and zero carbon energy delivered.

While this option will require further work beyond the scope of this study, one of the objectives of a delivery vehicle could be to ensure synergy between delivery of its energy projects and phasing of new private sector development. Under such a scenario the vehicle could enter into an agreement with the developer whereby it commits to installing a district heating network. The responsibility and therefore financial burden for the developer would be limited to installing the secondary network, making space available for an energy centre and possibly payment of a connection fee, again operated through the carbon buyout fund. Where phasing synergy cannot be secured the secondary network could be powered by a containerised temporary energy centre.

The Council should carry out feasibility work to assess the potential for setting up a local delivery vehicle to deliver district heating networks across the Bay. This will need the involvement and buy-in from a wide range of stakeholders.

Option	Potential Partners	Potential Delivery Mechanism
Higher energy and sustainability standards Wind energy District heating networks	• Local authority • Torbay Development Agency • Energy companies • Community groups • Private installation companies • Homes and Communities Agency	• Conditions attached to local authority owned land sales • Community Infrastructure Levy or local carbon buyout fund • 'Allowable solutions' or off-site opportunities • Local delivery vehicle (company, partnership or joint venture) • Salix Finance • Low Carbon Communities Challenge • Merchant wind

Table 36 Delivery options for new development

Capabilities on project:
Building Engineering

8.4. Strategic community-wide interventions

Local authority-led delivery is likely to be crucial to increasing installed capacity and maximising delivery of energy opportunities, especially for district heating since the private sector is traditionally poor at delivering infrastructure. Opportunities are set out below and will need to be supported by planning policies.

Planning policy and decision-making should support the market development of renewable and low carbon energy, where it doesn't conflict with other planning criteria. Broadly speaking, there are three areas where planning can influence strategic community-wide decentralised renewable and low carbon energy:

- Providing an overarching supporting policy, along with a set of criteria policies to guide development;
- Identification of suitable sites and opportunity areas; and
- Providing policies designed to support delivery mechanisms, such as a requirement for new development to connect to a district heating network.

8.4.1. Delivering decentralised renewable and low carbon energy through private investment

Market opportunities will be delivered with little or no requirement for intervention by the public sector beyond supportive planning policies. However, the Council and its partners can maximise the likelihood of delivery by the market in a number of ways:

- Development of stand-alone wind power is a possibility in some areas of Torbay. The Council should seek to positively support development of wind energy. However, as a broad rule of thumb commercial wind developers are interested in opportunities of above 5MW. There are some areas that show promising signs of supporting this level of wind energy – particularly south west of Paignton in White Rock and Yalberton.
- As with new development, the proposed 'Allowable Solutions' will place emphasis on the Council to identify and support delivery of strategic and community scale solutions. There is potential, therefore, to use delivery of energy opportunities across Torbay as a driver for housing delivery. In other words, where key large-scale opportunities driven by new development have been identified then the value of these energy opportunities to a developer, in terms of potential income from energy sales combined with Renewables Obligation Certificates (ROCs), feed-in-tariff or future renewable heat incentive could actually drive the delivery of more homes rather than acting as a break on development.

8.4.2. Delivering renewable and low carbon energy through local partners

There are three principal reasons why reliance on delivery of energy opportunities through market mechanisms alone may be insufficient to achieve maximum delivery:

1. Where opportunities extend beyond the boundaries of an individual site or development. This is particularly an issue for CHP or district heating schemes where viability is determined by a combination of scale, mix of use and density. Individual sites, even Torbay's larger strategic ones, may not be able to support a network without extending it into existing developments or connecting to an anchor load, such as a hospital or civic building. The additional cost and practical challenges of delivering a scheme that crosses new and existing development, areas of multiple land ownership and other infrastructure such as roads, rivers or railways is unlikely to attract commercial developers. It is, therefore, unlikely that an individual planning application will be forthcoming.

2. Where there is lack of experience or confidence in the technology. District heating is a well established type of infrastructure in many parts of Europe. In the UK; however, there are a relatively small number of examples of large scale DHNs meaning that schemes still require local community confidence to ensure successful delivery. Existing examples include Aberdeen City Council, Sheffield District Energy Network and Southampton Community Heating Scheme[80].
3. Where schemes are of insufficient size to attract a commercial developer. The link to Allowable Solutions for new development described earlier may offer one solution but this may still leave some opportunities unrealised.

Where market delivery isn't forthcoming Torbay Council can lead delivery of energy infrastructure, potentially with support from the private sector, investors or communities. Communities may want to join together to deliver energy infrastructure, investing in capital cost and receiving income from selling energy, though further work will need to be undertaken to understand the nature of Torbay's communities.

There are a few groups within Torbay that partnering with might prove beneficial. Torbay Coast and Countryside Trust is a local, independent charity dedicated to protecting Torbay's natural capital. With respect to renewable energy, they have installed a number of renewable energies in differing capacities on their properties, and plan to produce wood pellets for renewable heating solutions through the processing of 5,000 tonnes of wood per year[81]. Devon Sustainable Energy Network is another group, consisting of a partnership of organisations working towards the promotion and use of sustainable energy. Transition Torbay is a small group, created with the goal of working towards climate change and peak oil solutions. Torbay Development Agency is composed of public/private partnerships, created to ensure Torbay's regeneration and future sustainability through community and business support. These four community groups might be able to help the Council establish renewable and low carbon energy in Torbay.

8.4.3. Medium and large scale wind

Very few wind opportunity areas identified in the EOP are likely to be attractive to commercial developers. Project finance options include the issuing of bonds to residents and businesses. Returns on investments would be based on energy sales, ROCs and the feed-in-tariff. These kinds of delivery approaches will be challenging. Therefore, to ensure sufficient expertise and resource is devoted to making local authority-led delivery initiative a success it is recommended that a local authority-led delivery vehicle, such as an ESCo, partnership or joint venture, be considered. The types of ESCo are discussed in more detail below.

South Devon College sits close to a wind opportunity area on Shopdown Copse, which presents a further opportunity for linking up with other programmes or similar initiatives. Where school focussed communities are identified, through further work, community-led delivery could provide an alternative to local authority-led delivery.

Cooperatives are a common delivery mechanism in parts of Continental Europe and a few examples exist across the UK, including Baywind, the first UK wind cooperative. Baywind issues shares to fund development of turbines with investors receiving

[80] CHPA UK case studies http://www.chpa.co.uk/case-studies_19.html
[81] Torbay Coast and Countryside Trust, 'Wood Fuel', Available: http://www.environmenttorbay.org.uk/

a stake in the project and annual financial returns. Importantly, this community ownership can help to boost support for a wind proposal. The local authority can play a useful role as a partner and in raising awareness of the potential for community ownership. Community ownership or investment could bring particular benefits for delivering more controversial schemes; large wind being an obvious example in such a heavily constrained LPA area.

For all potential wind sites the Council and its partners should identify delivery opportunities, considering available financial mechanisms, publicly owned land, community involvement and ownership and the role of schools.

8.4.4. District heating

District heating networks can have the heat they distribute generated from a variety of sources but the types that we consider as part of this study are: biomass (heat only), biomass combined heat and power (biomass CHP) and gas powered combined heat and power (CHP).

There are opportunities across Torbay for the introduction of heat networks and the strategic sites where this has been examined were identified at a stakeholder workshop as part of this study. A strategic approach will be necessary to successfully manage and co-ordinate delivery. The local authority would be ideally placed to plan, deliver and operate part or all of a district heating network through establishment of a delivery vehicle.

The following would need to be considered:

- Financing – the different elements of a network can be treated differently. The operating costs of the insulated pipes that move heat between the energy centre and customers are relatively low. The main cost is installing the pipeline at the start. The pipe work, therefore, could be competitively tendered by a local authority-led vehicle and, since the Council may have access to low interest loans and repayments over a long time period using prudential borrowing, repayments can be kept to a minimum. Repayments could be serviced by energy sales and income from the:
    - Renewable heat incentive (RHI): applicable for biomass (heat only) and/or ;
    - ROCs, applicable for CHP and Biomass heat only.

  It needs to be recognised, however, that the ability of the public sector to raise finances is likely to be severely hampered for the foreseeable future by the recent economic crisis. Alternative sources of funding may need to be considered, including: bond financing; local asset-backed vehicles; and accelerated development zones or tax increment financing. In the December 2009 Pre Budget Report the Government committed to examining tax increment financing and the scope for local authorities to borrow against future CIL revenues and the renewable heat incentive and feed-in-tariff revenue streams. This could provide crucial finances to support investment.

  Energy centres tend to have lower upfront costs. The expense comes with ongoing operation and maintenance, a shorter life span (around 15 years) and exposure to fluctuations in energy prices, whether gas or biomass fuel. While ownership of the sites and buildings may be retained by the local authority, the plant itself could be operated by a private sector ESCo. To simplify things further for the Council, the billing and customer service elements could be contracted out to a third party.

- Delivery of networks as part of new development could also be undertaken by a local authority-led delivery vehicle or partnership, leaving the secondary network to be installed by the developer. The developer could then be charged a connection fee to the primary network. An initial district heating network could be installed to connect existing Council facilities, where new and existing development connects later. This model has been used successfully by the Council in Woking.
- Planning - the PPS1 Supplement presents opportunities at the local level in the form of a Local Development Order (LDO), which can be applied by local authorities to extend permitted development rights across whole local authority areas or to grant permission for certain types of development. Should the Council agree to lead installation of a district heating network then it is recommended that they explore the option of establishing an LDO in order to add certainty to the development process and potentially speed up delivery.
- Phasing – installing a district heating network is a major capital investment. The cost depends on the number of buildings to be connected, how close together they are and how much heat they require. In order to minimise risk, a general strategy for developing a scheme would be to secure the connection of a large anchor load within close proximity to the generating plant. Existing anchor loads are identified on the energy opportunities plan. Further work will need to prioritise sites based on the following suggested considerations:
    - Opportunities for incremental delivery, such as to the installation of pipes to coincide with other works requiring roads to be excavated.
    - Phasing of and opportunities from strategic sites. Sites that include new anchor loads as part of the development will make ideal candidates, such as Castle Circus (civic buildings anchor load), White Rock and Yalberton (commercial development/college anchor loads).
    - Opportunities for connecting existing anchor loads. For example, possibilities to connect to the hospital in Paignton. The local authority is likely to need to work with the NHS, utilities and other partners to assess opportunities for connecting the hospital to surrounding communities.
    - Areas of hard to treat homes and buildings, such as those with solid walls (a significant proportion) or conservation areas.

8.4.5. Creating a biomass supply chain

For DHN’s that use biomass as the fuel source, either for biomass (heat only) or biomass CHP, a biomass supply chain ensures the supply of locally sourced biomass. There are opportunities to establish a biomass supply chain, coordinating both forestry and agricultural waste and growth of bio-crops locally. The limited supply of biomass within Torbay LPA area means that the Council will need to explore sub- or area-wide opportunities with partners in neighbouring rural authorities. Key issues are:

- Biomass supply chains
- Management of sewage – Torbay sewage is currently processed at Churston in the Brokenbury Quarry

- Management of waste – Torbay waste is transported outside the LPA area to a landfill site at Heathfield, Newton Abbot, which is within Teignbridge District.

Option	Potential Partners	Potential Delivery Mechanism
Wind energy District heating and CHP Biomass supply chain	• Local authority • Torbay Development Agency • Regional and sub-regional bodies • Energy companies • Homes and Communities Agency • Partnerships for Renewables • NHS • Developers • Community groups	• Community Infrastructure Levy or local carbon buyout fund • ‘Allowable solutions’ or off-site opportunities • Local authority led delivery company, partnerships and joint ventures • Merchant wind • Region-wide or Sub-Region-wide development and coordination of biomass supply chains • ROCs and feed-in-tariff and possibly renewable heat incentive in 2011 • District heating priority areas • Wind priority areas • Cooperatives and community involvement • EDF Renewable Energy Fund • Carbon Emissions Reduction Target • Building Schools for the Future

Table 37 Delivery options for strategic community-wide local authority and community interventions

8.5. Delivery factors for Strategic Sites

To understand the potential for renewable and low carbon energies in Torbay, the following chapters discuss each of the five Council-designated strategic sites. A general overview provides a description of the site and the likely schedule for site developments to be delivered based on information provided by Torbay Council Strategic Planning Team. Given the timing and size of development, the potential to deliver renewable and low carbon energy on-site is broken down into five potential ‘delivery mechanisms’:

- Strategic masterplan – a masterplan for developing a large area is suggested
- Large site catalyst – A large development can either single-handedly deliver renewable and low carbon energy, or significantly contribute to its adoption on-site
- Co-ordination based – there are no large catalysts on-site. Therefore, a number of small sites will need to co-ordinate with each other to deliver renewable and low carbon energy on-site.
- Independent Provider – An external party, such as an ESCo, or wind energy company provides the impetus for delivery of renewable and low carbon energy

- Strategic intervention – The development is at a late stage of planning (e.g., planning permission has already been granted) and the planning department will be required to 'strategically intervene.'

Each site description concludes with a list of potential delivery partners. This chapter looks to provide an overview of some of the most promising sites for renewable energy delivery in Torbay.

8.6. Strategic site 1: Castle Circus and Union Street, Torquay

Overview

This strategic site contains two Mayor's Vision sites. Castle Circus is a development with the potential to deliver 3,120m^2 of business and 190m^2 of retail space. This site is part of the "Castle Circus Regeneration Project" and contains the Town Hall, which is currently undergoing a refurbishment. Tor Hill House across the street is mainly offices with some retail and is owned by the Council.

The Union Street project is also part of the Mayor's Vision project, and is thought to be integral for a strong urban link between the downtown and harbourside. The goal is for Union Street to complement the Castle Circus regeneration project by increasing the retail offer with the potential for a supermarket or department store to anchor the redevelopment. There are also a number of SHLAA sites included within this strategic site. Overall, there is an opportunity for 335 residential units, 8,000m^2 of employment space, and 18,000m^2 of retail space.

Delivery timing

These plans are at varying stages of delivery. We understand that work on Tor Hill House is nearing completion. The Town Hall refurbishment is scheduled to be undertaken between 2011 and 2012, while the business hub plans are detailed and are thought to be delivered in the next few years. The redevelopment of Union Street is currently undergoing a feasibility analysis, and construction is not likely to begin until the 2020s due to the land assembly issues, as much of the land is currently owned by multiple parties; financing and flood alleviation work required.

Delivery mechanism – Strategic intervention and coordination of sites

Because the timing of the project is already far along the planning stage, a strategic intervention will be required initially to ensure immediate development incorporates the required infrastructure to support a district heating network, such as the ability to connect to a potential DHN network in the future. If this can be accomplished, the Town Hall and Tor Hill House sites represent potential components in an area-wide heat network. The office and retail space mixed uses demand different amounts of energy at different times of the day. This is known as load sharing, and provides a more consistent energy demand as it reduces large fluctuations in energy demand. With the Union Street project likely to be completed later, its additional retail and residential energy demand could contribute in a later phase to the load sharing. Coordination of sites and the respective planning applications will be required here to ensure these schemes connect to / provide district heating infrastructure. The Council should explore options to ensure district heating infrastructure is provided in these schemes and connected to a wider area.

Capabilities on project:
Building Engineering

Delivery partners

Potential partners in the successful delivery of this project include: Torbay Council, Torbay Development Agency, Torbay Town Centres Company, English Riviera Tourism, Federation of Small Businesses, Chamber of Commerce, and any anchor stores.

8.7. Strategic site 2: Torquay Harbourside

Overview

The second strategic site is the Torquay Harbourside and Victoria Parade. The Harbourside is another Mayor's Vision site, and the SHLAA indicates the Terrace Car Park has the potential to be redeveloped to accommodate 95 residential units, 2,000m^2 of employment space. The former Royal Garage site has a scheme in place to provide 12 dwelling units, hotel, cinema, restaurants, and some retail.

The SHLAA notes the Marina Car Park (part of Mayor's Vision site 6) has the potential to accommodate 20 residential units, and MV6 indicates the potential for a hotel, 1,500m^2 of retail, and 1,500m^2 of entertainment and leisure. Within the same Mayor's Vision site, the Cary Parade amusement arcade has the capacity for 20 residential units, and redevelopment of the Palm Court Hotel to provide 100-bed hotel, new commercial units, and residential apartments.

The final Mayor's Vision site, Victoria Parade, has the potential to deliver between 50 and 95 dwelling units, and as much as 1,824m^2 of retail.

Delivery timing

With three separate Mayor's Vision sites in the area, phasing is an important component for any on-site renewable and low carbon energy schemes. Pending planning permission, The Royal Garage site is likely to be delivered by 2013. Subject to final negotiations with respect to Section 106, the planning application for regeneration of the Palm Court Hotel has been delegated for approval. A planning application for the Princess and Royal Terrace Gardens expected within the next six months. Victoria Parade Public Realm enhancement scheme has been planned and will likely be delivered incrementally over the next five to ten years, and is subject to participation from private landowners.

Delivery mechanism – Coordination of sites

With many hotels and leisure activities in the area, each represents a significant anchor load, but perhaps would not justify installation of CHP on their own. The key to developing a heat network will be to ensure the first properties coming to market establish the basis of a district heating network, thereby providing momentum for other developments to connect in. The Royal Garage and Palm Court Hotel sites are likely to be delivered first; however, if the planning phase is too far along, focusing on the Princess and Royal Terrace Gardens site might be more feasible. Since the Victoria Parade site does not have a notable anchor site, to achieve the required critical mass necessary to deliver an efficient energy network, co-ordinating many smaller sites may be required. The Council should take a coordination role in ensuring an area-wide network is established in this area.

Delivery partners

Potential partners in the successful delivery of this project include: Torbay Council, Torbay Development Agency, Terrace Car Park, Torquay Harbour, Victoria Parade, Torbay Town Centres Company, English Riviera Tourism, Federation of Small Businesses, Chamber of Commerce, Torbay Hotel, Imperial Hotel, and any anchor stores.

8.8. Strategic site 3: White Rock and Yalberton

Overview

Of the five strategic sites, this site is promising in its ability to deliver a sustainable energy strategy largely due to the minimal existing development and hence the greater opportunities to influence future developments. The land to the west of Brixham Road is the focus of the new development and we understand that this area is in the process of undergoing a masterplan.

Potential Development of the Site

It is our understanding that Parkbay Garden Centre and Yannons Farm sites have recently been granted planning permission. Parkbay Garden Centre has the potential to deliver 95 residential developments, while Yannons Farm (Land off Brixham Road, behind Torbay Garden Centre) has been planned for a 220 dwelling unit development, approximately 5,600m^2 of employment space, a local centre and public open space. This development may also benefit from the additional Jackson's Lane (south west corner) which has been indicated to accommodate an additional 50-100 dwelling units. The residential development on this site should provide the impetus to develop new employment space.

There has also been some interest in land between Waddeton Road and Brixham Road. This land may provide a mixed use development with hotel and/or employment uses, community centre, and 50-100 unit accommodations for South Devon College students. Land south east of the existing business park is indicated to be a mixed use development and land between Shopdown Copse and Torbay Business Park may be used as a mix of industrial, manufacturing, distribution, research and development, and office uses.

Delivery timing

This land is part of Torbay's Core Strategy preferred growth options. If it is selected as the preferred option, its delivery is likely to be completed in phases over the next few years.

Delivery mechanism - Masterplanning

The delivery of renewable and low carbon energy in the area will most likely take form in the strategic masterplanning stage of development. This will ensure that on-site low carbon energy generation is maximised. With the planning and development of a large site, there is an opportunity to deliver a layout and the required infrastructure for an effective heat network. The existing South Devon College represents an existing heat load, and a potential site for an energy centre.

The south west area of Paignton also shows promise for wind energy. Should wind turbines be selected as a preferred renewable energy, they will require a minimum separation distance from residential developments (600m is recommended for

2.5MW turbines, but buffers decrease with turbine size). Despite the required separation distance, there is an opportunity to include wind energy in the commercial areas of the development where this requirement is not as stringent as in residential areas. Other opportunities for wind generation also exist on adjacent open land. The bordering Area of Outstanding Natural Beauty will also have to be considered as it will have a visual impact and noise issues in the area. A full environmental assessment will be required to test the ecological implications of installing wind turbines.

Delivery partners

Delivery partners for the formation and delivery of the masterplan include: Cavanna Homes, Deeley Freed, Abacus Projects Ltd., Jacksons, Bookham site land owners and tenants, South Devon College, John Britton, PCL Planning, and Eatonfield.

8.9. Strategic site 4: Paignton Town Centre

Overview

Paignton Town Centre includes a number of Mayor's Vision sites: Oldway Mansion (Project 21), Crossways Shopping Centre (Project 8), Station Lane (Project 9), and part of Victoria Shopping Centre and Multi Storey Car Park (Project 10). The latter three sites had substantial residential areas allocated as part of the Action Framework Plan[82] however due to market drivers, these proposed new residential areas have since been downsized or completely removed from the Mayor's Vision sites. Oldway Mansion site is proposed to be converted as a hotel with new leisure and conference facilities. The SHLAA (T742) within the Oldway Mansion site has also identified capacity for 150 dwelling units. Crossways Shopping Centre site was recently sold and renovated, with the latest plan for the site to be a food store with no residential units. Station Lane is the site of the new community hub and Paignton Library, with the rest of the site potentially going to be part of the Torbay Local Asset Backed Vehicle (LABV), with suggestions for it to be used for 25 holiday flats, 140m^2 office space, 280m^2 of restaurants, and a 60-bed hotel. The site is focused on developing the parcel of land adjacent to the railway line, behind the library. Victoria Square (Project 10) is now thought to be able to deliver 40 dwelling units if there is a change in ownership, along with retail, office, leisure and community facilities.

Delivery timing

The ability to influence development to consider renewable and low carbon energy will be more achievable on some sites than on others:

1. It has been indicated that the selected developer of the Oldway Mansion site is likely to submit a planning application within six months making this a critical point in the planning process for influencing the scheme.
2. The Crossways Shopping Centre site has recently been sold; therefore, development of this site does not seem likely before 2020.
3. The Station Lane development is thought to be delivered within the next five years;
4. The Victoria Park site is likely to be a longer term development. Victoria Park's delivery timeframe is likely to be five to ten years from now.

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[82] The New English Riviera Action Framework Plan, LDA Design, January 2008

Delivery mechanism – Catalyst site and masterplanning

As the Oldway Mansion site will be the first to be developed, should it adopt a renewable and low carbon energy strategy, it is likely to have a positive cascading effect on the other Mayor's Vision sites in the area. With a planning application expected within the next six months, pushing to include a renewable and low carbon energy strategy might be beneficial. There is also potential for any heat network installed at Oldway Mansion, to establish a connection with the hospital. While desirable, extending across to the esplanade sea front with the existing hotels is not likely to be viable due to the length of pipework required and the costs for crossing the railway line.

Should intervening with Oldway Mansion fail, there will still be sufficient time to influence the remaining sites. Station Lane is the site likely to come on-line next, and masterplanning the site to facilitate the use of renewables will be important. Crossway Shopping Centre and Victoria Parade are more long-term projects and incorporating renewables should be expected.

Delivery partners

Delivery partners for this strategic site include: Torbay Town Centres Company, Chambers of Trade, Hoteliers, Torbay Development Agency, Project managers for each of the Mayor's Vision sites, Torbay Council, Network Rail, and private company landowners.

8.10. Strategic site 5: Brixham Town Centre

Overview

Brixham Town Centre consists of four Mayor's Vision (MV) sites. MV project 15 is most likely to be a food retail development. MV project 16 is due to be completed this year and consists of refurbishment and expansion of the fish market. MV Project 17 includes two harbourside car parks, and a new harbour breakwater. Freshwater Quarry is over 4.5 hectares and Oxen Cove is 5.5 hectares. These sites may accommodate up to 300 flats, 5,000m^2 of employment space and 600m^2 of retail. MV project 18 in Brixham Northern Arm is hoped to be developed to improve protection of the fish market, facilitate unloading of fish in all weather conditions, and provide calm water for waterborne leisure activities. Its development is contingent on MV project 17 being completed.

There is also potential for installation of wind turbine(s) in the port at Breakwater Beach. Alternatively, there is potential for a wind turbine at the end of the Brixham Northern Arm (MV Project 18).

Delivery timing

MV 15 is likely to have many planning concerns which need to be addressed, including: heritage impacts, pollution, and traffic. MV 16 will be completed this year. MV 17 is a long-term vision to be delivered after 2020. As MV 18 is dependent on the development of MV 17, it too will only be developed after 2020.

Delivery mechanism – Catalyst Site and Independent Provider

If planning intervention can require a low carbon and/or renewable network on the MV15 site, it will likely be a catalyst for sustainable energy in the area. It will be ten plus years before MV 17 and 18 are developed. For these sites, Freshwater Quarry and Oxen Cove represent the catalyst properties, though it will likely be unable to extend to the Brixham town centre and Admirals Swimming Pool. Implementing a sustainable energy policy in Torbay is likely the most effective way to include low carbon and/or renewable energy on these sites.

The potential wind turbine(s) off Brixham Breakwater can be treated as a stand-alone project and it is likely that an external entity (e.g., wind company/co-operative) will be required for its successful delivery. The Council can stimulate external investment in wind energy through strong policy that signals their support for the technology, and expedites the planning approval process. More details of delivery options are included in Chapter 8 'Delivery'.

Delivery partners

Delivery partners for these MV sites include: Torbay Town Centres Company, Brixham 21, Brixham Town Council, Chambers of Trade, Brixham Harbour, MDL, Astra Zeneca, Torbay Development Agency, Dalverton Court residents, and private developers.

8.11. Delivery partners

It is clear that a planned approach is necessary, with targets complemented by spatial and infrastructure planning. The implications of this for the Council are significant. We are no longer simply talking about a set of planning policies; rather success depends on coordination between planners, other local authority departments (including the corporate level) and local strategic partners.

An exciting opportunity is the possibility of setting up a delivery vehicle coordinated by the Council or Torbay Development Agency. The skills needed to do this are likely to need to be developed. This does not need to be an insurmountable barrier and there are a growing number of local authorities engaging in similar activities both in energy and other areas. The key to success is likely to be leadership: from senior local authority management or, at least initially, from committed individuals in planning or other departments.

Delivery vehicle models range from fully public, through partnerships between public, private and community sectors to fully private. Broadly speaking, the greater the involvement of third parties the lower the risk to the authority but, importantly also, the less control the authority will have. Whichever route is chosen, the delivery vehicle should be put in place as early on in the development process as possible, so that its technical and financial requirements can be fed through into negotiations with potential customers.

Capabilities on project:
Building Engineering

	Private Sector Led ESCo	Public Sector Led ESCo
Advantages	▪ Private sector capital ▪ Transfer of risk ▪ Commercial and technical expertise	▪ Lower interest rates on available capital can be secured through Prudential Borrowing ▪ Transfer of risk on a District heating network through construction contracts ▪ More control over strategic direction ▪ No profit needed ▪ Incremental expansion more likely ▪ Low set-up costs (internal accounting only)
Disadvantages	▪ Loss of control ▪ Most profit retained by private sector ▪ Incremental expansion more difficult ▪ High set-up costs	▪ Greater risk ▪ Less access to private capital and expertise, though expertise can be obtained through outsourcing and specific recruitment

Table 38 Advantages and disadvantages of ESCo/delivery vehicle models

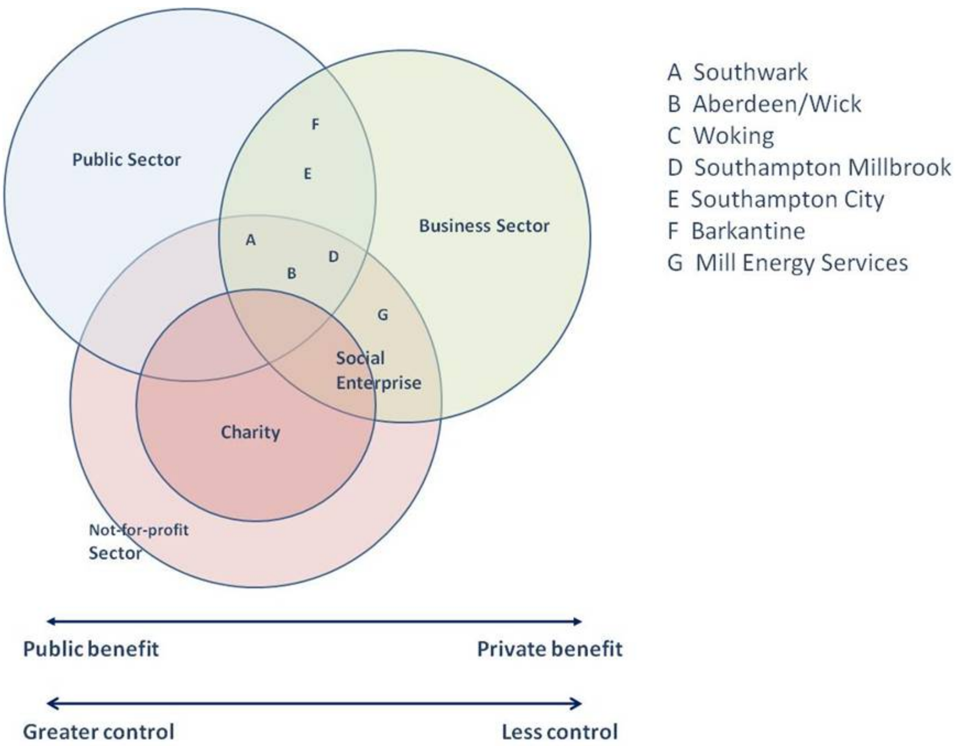

Figure 26 Spectrum of ESCo/delivery vehicle (Source: Making ESCos Work)

Capabilities on project:
Building Engineering

8.12. Recommendations and next steps

There are a wide range of delivery mechanisms that can be employed to support planning for energy. Not all will be suitable for Torbay and a mix is likely to be needed to encompass all of the energy opportunities. This report provides the context for making those decisions. Further work, discussions and advice will be needed to make them happen. As initial actions, a number of next steps are set out in Chapter 9.

9. Next steps

9.1. Introduction

This section sets out some key next steps which the Council should consider undertaking for developing and implementing the policies suggested in this report. The items listed are intended as an aide memoire and should be further developed as part of producing an action plan which clearly describes the route from here to implementation of the policies and beyond.

The actions are divided into a number of topic headings in order to make reviewing them easier. Some of the actions might fit into more than one topic area but are only included once to avoid repetition. The areas covered are:

- Corporate and strategic actions
- Policy actions & monitoring
- Priority projects and technology specific actions
- Delivery vehicles and funding
- Further evidence base work

9.2. Corporate & strategic actions

In order to create a robust environment for the development and implementation of policies aimed at delivering a sustainable energy future for Torbay, the Council, along with its strategic partners, must take a leadership role and be seen to be doing so. This means actively pursuing the objectives of planning policy within its own corporate estate, increasing skills within the Council to deal with the implementation of the policies and taking strategic actions to lay the foundations for their successful delivery.

9.2.1. Corporate Actions

A series of leadership and skills actions are suggested here which, once implemented, will allow the Council to demonstrate support for the policies it has set out by ensuring that:

- the necessary political and stakeholder buy-in to support the policies is secured as a priority;
- buildings within their own estate connect to district heating networks wherever feasible;
- their own land is made available for energy centres and district heating infrastructure where necessary;
- strategic funding from internal or external sources is fully explored;
- skills are developed across the Council and its partners which will help deliver sustainable development;
- they set out a clear framework giving relative certainty by prioritising strategic sites, council and public sector property and assets, and;
- oversized energy generation is considered on new development sites and in public sector and council owned schemes.

Clearly, there is a need to review, revise and possibly develop new corporate policy that can be used to support and drive forward these next steps. A sensible way to bring together each of these actions would be to develop an action plan with a set of clear objectives described as key milestones. The achievement of each milestone should move the Council closer to the final implementation of robustly supported policy.

Capabilities on project:
Building Engineering

9.2.2. Strategic actions

The strategic actions involve the Council engaging with its strategic partners in order to:

- develop wider opportunities for energy generation by working with other local authorities;
- ensure that initiatives in energy efficiency priority areas focus on home improvement measures;
- develop a micro-generation retrofit strategy, and;
- explore opportunities for biomass, biofuels and biogas with partners in neighbouring authorities.

9.3. Policy actions

The report highlights a number of key policies which will need to be developed to fully support the implementation of the SDHAs, the strategic sites, taking forward stand alone opportunities for LZCs and so on. These are described in detail in Chapter 7 and the actions required to further support the policies suggested, either directly or indirectly, and realise the opportunities highlighted in the Energy Opportunities Plans are set out below:

- A set of priority district heating schemes should be drawn up by the Council and its partners, the areas in which they sit be designated as Strategic District Heating Areas (SDHAs – as indicated in Section 5.2) and further feasibility work carried out.
- Support the designation of strategic sites by continuing to test the feasibility and viability of district heating networks on such sites as they come forward and setting appropriate targets for connection where potentially viable or other targets so long as any alternatives will not be an undue burden.
- Should the Council agree to lead installation of a district heating network, then, it is recommended that they explore the option of establishing a Local Development Order to add certainty to the development process and potentially expedite delivery.
- For all potential wind sites, the Council and its partners should identify delivery opportunities, considering available financial mechanisms, publicly owned land and community involvement and ownership.
- The Council and its partners should undertake further work to explore the role for the local authority and Torbay Development Agency in linking housing development to energy supply delivery.

The final two policy options require additional evidence base work before they are ready to be developed and implemented. The next steps for these options are described in Further Evidence Base Work below.

In order for developers to have confidence, there is a need for the Council to produce guidance around the policies. One way of doing this would be to produce a Supplementary Planning Document. It may be worth the Council exploring the development of such a document in co-operation with a public/private partnership ESCo. The SPD would ideally address:

- Provision of guidance on how development should be designed so as to enable it to connect to and accommodate district heating networks;
- Assessing feasibility and viability of connections including some guidance on the likely maximum financially viable distance from a DHN;

- The inclusion of a statement of what applicants should expect from the public/private partnership ESCo and/or other partners, and;
- Identify Allowable Solutions, S.106 and/or CIL spending priorities.

Whatever policy options are taken forward, they must be accompanied by a robust methodology for monitoring and reviewing their implementation and effectiveness in the same way as any other planning policy. It is therefore expected that the Council will extend any existing practices they have for monitoring in this area to new policies taken forward for sustainable energy. As the scope of this study did not include an examination of these processes, some key features of a robust monitoring system are set out here along with sources of other guidance.

Monitoring activity should include;

- establishing a formal data-gathering system - this could be linked to existing development control databases as well as the DECC Renewable Energy Planning Database[83];
- closely liaising with Development Management colleagues to ensure that sufficient information is being captured to demonstrate the effectiveness of policies;
- the planning team endeavouring to liaise with external parties, such as developers, to understand policy impact on issues such as viability;
- nominating a single officer to take responsibility for the management of the data providing a single point of contact within the authority This officer should also be the main point of contact for the provision of data to REPD;
- consistency with national reporting by ensuring data collected for specific projects includes installed capacity for renewable energy developments or installations granted planning permission and completed renewable energy developments or installations;
- reporting of only on-shore renewable energy developments or installations. This does not include any developments or installations permitted by a general development order;
- reporting of installed capacity in megawatts and in line with the current DECC RESTATS classifications.

Ultimately, the Council must implement a level of monitoring which it feels provides them with the required level of confidence that policy is being effectively applied, is resulting in the desired outcomes and is not having adverse unforeseen consequences.

Further information on monitoring can be found in the South West Planners Toolkit[84].

[83] https://restats.decc.gov.uk/cms/welcome-to-the-restats-web-site
[84] http://www.regensw.co.uk/climate-change-pps/monitoring-and-reviewing

Capabilities on project:
Building Engineering

9.4. Priority projects and technology specific actions

9.4.1. Priority projects

As part of the study, specific sites have been examined and in order to maximise the potential for some of these sites to assist in implementing policy objectives, priority actions should be undertaken. These have been identified as:

- Castle Circus & Union Street
    - a strategic intervention will be required to ensure the current development work incorporates the required infrastructure to support a district heating network, such as the ability to connect to a potential DHN network in the future. It is likely that some work will need to be done to clarify the exact nature of the infrastructure which might be required.
- Torquay Harbourside
    - the first properties coming to market within this site should be encouraged to establish the basis of a district heating network, thereby providing momentum for other developments to connect. The Royal Garage and Palm Court Hotel sites are likely to be delivered first; however, if they are already too far progresses to incorporate DHN infrastructure, focusing on the Princess and Royal Terrace Gardens site might be more feasible.

9.4.2. Wind opportunity actions

Wind power can contribute to the Torbay energy strategy in one of three ways:

- By locating wind turbines within the boundary of strategic new development sites, to contribute to on-site carbon compliance targets. The analysis has found that the only potential site for such an approach is Shopdown Copse as part of the White Rock site and this should be investigated.
- Government has indicated[85] that one of the allowable solutions for 2016 could be for off-site wind turbines to be connected to a development site. This could potentially be relevant for White Rock if Shopdown Copse falls outside of the final strategic site boundary
- The Government has also indicated that another possible allowable solution for developers to offset residual carbon emissions from new development, after 2016, could be for developers to transfer share ownership in new wind turbines to householders. The Council / TDA could, as an ESCo, potentially build wind turbines on one or more of the sites indicated, with the aim of then selling shares in those to developers to make it easier for them to meet their zero carbon requirements[86].

Should the Council wish to encourage the development of wind resource in the area, landowners of the areas identified in the EOPs should be approached to ascertain their appetite for involvement in a scheme. Also, the possibility of setting up an ESCo with strategic partners should also be explored.

9.4.3. Hydropower opportunity actions

The next step for the potential hydropower sites as identified in the Environment Agency (EA) report 'Mapping Hydropower Opportunities and Sensitivities' is to contact the EA [enquiries@environment-agency.gov.uk] to request the sites are reviewed by

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[85] In its consultation on a definition for zero carbon homes and non-domestic buildings, issued December 2008

[86] Although, in theory, these wind farm sites wouldn't need to be within Torbay.

their local area team. The local area team ‘ground-truths’ the national database and provides an indication of suitability based on local wildlife and species issues and the measured flow rates on the waterway. This provides further guidance on whether the sites are suitable.

9.5. Delivery vehicles and funding

- The Council and its partners need to establish an appropriate form of delivery vehicle or vehicles to pursue the key energy efficiency and supply opportunities.
- Funding mechanisms should be identified and applied first to priority schemes, co-ordinated through the appropriate delivery vehicle. In terms of funding to develop wind sites, or carrying out more detailed analysis; as a charity the Friends of South Devon College may be able to access utility “green energy funds” such as that run by EDF which could be put toward wind resource at Shopdown Copse. For the other sites, a typical approach would be for the landowners to engage with utility companies and specialist wind developers about whether they would be interested in developing the sites. Such companies may be prepared to absorb or share development costs in return for having the option to develop the site.
- Communities are likely to play a crucial role in the delivery of energy infrastructure. However, to be successful further work will be needed to explore how communities function within Torbay.

9.6. Further evidence base work

In terms of work specifically highlighted by this report, there are several elements which are required to support the policies suggested. These include:

9.6.1. Developing evidence for a renewable energy installed capacity policy

Policy Option 5 Renewable Energy is set out in Chapter 7 however the level of installed capacity in this suggested policy is currently based only on evidence developed at a regional and national level. Whilst this may be sufficient to support the implementation of a policy, it is likely to present a risk if challenged. A more detailed study of Torbay’s renewable energy capacity should be undertaken in order to provide a more robust set of evidence.

9.6.2. Developing evidence for a BREEAM / Code for sustainable homes target

It would be possible to create a policy which required a specific Code Level or BREEAM rating requirement for all new developments in Torbay, or for a strategic site or to set a certain level of performance under specific issues within the assessment. Whilst a policy based around sustainable building standards could be applied at different scales, these assessments, and BREEAM in particular, are heavily influenced by the location and conditions of each specific site. This means that setting a target which affects all sites in the area may have a significantly different level of impact depending on which site is being considered.

In order to support a policy in this area, further work should be carried out to examine the appropriateness of an area wide target and targets for specific strategic sites as well as whether targets aimed at achieving certain performance levels for specific issues in the assessments would be beneficial.

It may also be worthwhile this work engaging with developers to understand with more clarity the potential impact of a range of performance levels so that and targets can be robustly defended if challenged.

9.6.3. Renewable Heat Incentive (RHI)

With the change in Government in 2010, the future of the RHI is somewhat uncertain but it appears that it will be implemented in some form in the near future. Currently the value of the RHI for heat generators is not known and we have made an assumption about this value for the analysis. If the actual value is significantly different to our assumption, then this could have a large impact on financial viability (either positive or negative). Therefore, we recommend the financial models for the SDHAs should be re-run once the details of the RHI are known.

9.6.4. Allowable solutions

Within the next 12 months the issue of allowable solutions will continue to develop and currently ambiguous issues should clarify into a coherent and consistent approach. It is advisable therefore for the Council to revisit the findings of this report to ensure that they are robust in the light of the more fully developed context.

Some of the key issues to be investigated when final definitions of allowable solutions are made public will be:

- Does the definition of zero carbon remain at 70% on site carbon compliance?
- Is the cost per tonne of CO_2 set at around £1100/TCO_2, as used in this study?
- Are the allowable solutions still designed to cover the CO_2 emitted from the homes over 30 years?
- What are the agreed mechanisms for using the allowable solutions fund to deliver low carbon energy infrastructure?

9.7. Conclusion

Considering Torbay purely on its merits as a location for the implementation of sustainable energy installations, it would be fair to say that local authorities benefitting from a more diverse set of landscapes would also enjoy a wider variety of opportunities. Specifically, Torbay has very limited rural landscape suitable for developing the types of large scale renewable energy installations that are relatively common in the South West (e.g. larger wind turbines and wind farms). However, the largely urban nature of Torbay does present a number of clear sustainable energy opportunities. Principally these revolve around the future development plans and growth options for the area in terms of delivering district heating networks as well as encouraging the use of high energy efficiency standards in new buildings. It is very unlikely though that these opportunities will come forward without the provision of the policies outlined in this study and strong ongoing support from the Council. The Council should see the measures indicated in the study as key opportunities for the following reasons:

- They will help the Council meet its obligations in delivering CO_2 reductions in line with national policy;
- The provision of policies which support the development of viable routes to compliance with future legislative CO_2 reduction targets (i.e. future Building Regulations) are likely to prove attractive to developers;

- They, in association with taking corporate action, will demonstrate the Council's commitment to a low carbon future and their willingness to lead;
- They can encourage the development of low carbon skills and industry in Torbay and the surrounding areas, and;
- They provide strategic opportunities to develop relationships with both private and other public sector organisations.

Clearly, the Council recognises the need for new development within Torbay in order to deliver the additional domestic and commercial building stock required to move the area forward. In order to realise the benefits indicated above and to successfully bring forward the major schemes tested as part of this study, it will be necessary for the Council to be proactive in engaging with developers, land owners, landlords and so on such that timely intervention can encourage uptake and support new planning policy by putting in place effective delivery mechanisms.

However, national CO_2 emissions reduction targets cannot be met through new development alone. Therefore, these major schemes should be seen as part of the answer to addressing a key challenge facing all local authorities of how to reduce CO_2 emissions from existing building stock and thus make significant in-roads to meeting targets. The Council should develop the plans for the schemes examined here such that they take the fullest advantage of their ability to act as a catalyst for delivering emissions reductions within the existing community through the extension of DHNs into in to existing developed areas.

So, it can be seen that the policies and development opportunities discussed and examined as part of this study will be key to the Council meeting its obligations, but there is a clear need for the Council to being acting immediately to develop policy, engage with others and take corporate action in order to realise its ambitions for a low carbon future for Torbay.

Glossary

Term	Acronym	Meaning	For more information
A			
Aggregate method		Proposed method of taking into account the cost effectiveness of different techniques used together or in isolation to comply with Part L for differing types of non-domestic building.	http://www.communities.gov.uk/publications/planningandbuilding/partlconsultation
Air permeability (or Air Tightness)		Air Permeability (m3/hr/m2) is a measure of how leaky a building is. E.g. what volume of air (m3) is lost through gaps in the building construction per hour per m2 of building floor area.	
Air source heat pumps (ASHP)	ASHP	A heat pump technology that absorb heat from the outside air, which can then be used to warm water for radiators or underfloor heating systems, or to warm the air in your building. There are two main types: An air-to-water system uses the heat to warm water. Heat pumps heat water to a lower temperature than a standard boiler system would, so they are more suitable for underfloor heating systems than radiator systems. An air-to-air system produces warm air which is circulated by fans. The efficiency of air source heat pump systems is measured by a coefficient of performance (CoP) - the amount of heat they produce compared to the amount of electricity needed to run them. A typical CoP for an air source heat pump is around 2.5. Ground- and Air- source heat pumps are not completely ‘renewable’ as they require electricity to drive their pumps or compressors.	1. http://www.energysavingtrust.org.uk/Generate-your-own-energy/Air-source-heat-pumps 2. http://www.carbontrust.co.uk/cut-carbon-reduce-costs/products-services/technology-advice/renewables/Pages/Air-source-heat-pumps.aspx
Allowable solutions		Used in the Definition of Zero Carbon Homes and Non-Domestic Buildings consultation to describe a range of solutions that can deal with the remaining building emissions, after maximising solutions that are on the site of the development.	http://www.communities.gov.uk/publications/planningandbuilding/zerocarbondefinition
Anaerobic Digestion		A process in which organic matter broken down by bacteria in the absence of air, produce a gas (methane) and a solid (digestate) product. The by-products, for example biogas, can be used in a furnace, gas engine, turbine or gas-powered vehicles,	http://www.carbontrust.co.uk/cut-carbon-reduce-costs/products-services/technology-advice/renewables/Pages

Term	Acronym	Meaning	For more information
		and digestates can be re-used on farms as a fertiliser.	/Anaerobic-Digestion.aspx
Anchor 'Heat' Loads	AHLs	A pre-existing heat load that could be connected to a district heating network. The benefit of heat loads which exist before the DHN are that they can use heat from the DHN immediately it is available, providing an early income stream for the operators of the network and making it more financially attractive.	
Area of Outstanding Natural Beauty	AONB	An area with statutory national landscape designation, the primary purpose of which is to conserve and enhance natural beauty. AONB are designated by the Countryside Agency.	http://www.aonb.org.uk/
B			
Baseload		When examining the annual heat required by a building, this term is applied to the lowest level of consistent heat demand throughout the year. Typically, this might be for domestic hot water as this is required all year round whereas space heating for example will only be required during colder periods. The baseload is a useful concept when considering heat generating systems (such as DHNs) as it gives an indication of the minimum income that will be generated at the lowest demand period of the year.	
Baywind Cooperative		This is the first UK wind cooperative formed in 1996 based on a Scandinavian model. The first two Baywind projects enabled a community in Cumbria to invest in local wind turbines.	http://www.baywind.co.uk/baywind_aboutus.asp
BERR	BERR	Government Department of Business, Enterprise and Regulatory Reform	http://www.berr.gov.uk/
Biogas		A useful gas produced from anaerobic digestion. See anaerobic digestion.	
Biomass		Living matter within an environmental area, for example plant material, vegetation, or agricultural waste used as a fuel or energy source. This is a 'carbon neutral' energy source because CO2 is absorbed during the life of the crop, which is then released during combustion.	
Biomass		A CHP system that uses biomass as fuel. See	

Term	Acronym	Meaning	For more information
Combined Heat and Power (CHP)		Combined Heat and Power (CHP).	
Biomass heating		A biomass heating systems generally burns wood pellets, chips or logs to power central heating. Systems can operate using combustion to heat water (the heating medium) or air for space heating.	1. http://www.energysavingtrust.org.uk/Generate-your-own-energy/Wood-fuelled-heating 2. http://www.carbontrust.co.uk/cut-carbon-reduce-costs/products-services/technology-advice/renewables/Pages/Biomass.aspx
Blue infrastructure		A network of multifunctional marine and water spaces in urban areas, the countryside in and around towns, and the wider countryside.	
BREEAM (BRE Environmental Assessment Method)		A voluntary scheme from the Building Research Establishment (BRE) that aims to quantify and reduce the environmental burdens of buildings by rewarding those designs that take positive steps to minimise their environmental impacts.	1. http://www.bre.co.uk/ 2. http://www.breeam.org/
C			
Carbon Buyout Fund		A fund established to support the installation of sustainable energy infrastructure (such as District Heating Networks to existing housing) the principle investment for which comes from Allowable Solutions payments made by developers to deal with carbon emissions which cannot be readily dealt with directly on their development site. The fund may form part of a Community Infrastructure Levy.	
Carbon Dioxide	CO2	One of the Greenhouse Gases (GHG), which cause climate change. It is the most significant due to its extreme proliferation caused by the burning of fossil fuels, but not the most potent in terms of impact per unit.	

Term	Acronym	Meaning	For more information
Carbon Emissions Reduction Target	CERT	A capital funding scheme which the domestic energy suppliers are obliged, by the Government, to make available for energy saving measures and the installation of energy saving products.	1. http://www.decc.gov.uk/en/content/cms/what_we_do/consumers/saving_energy/cert/cert.aspx 2. http://www.energysavingtrust.org.uk/Easy-ways-to-stop-wasting-energy/Energy-saving-grants-and-offers/Carbon-cuts-get-serious-with-CERT
CIBSE	CIBSE	Chartered Institution of Building Services Engineers	http://www.cibse.org
CIBSE TM 46 (Technical Memorandum 46) Energy benchmarks		This publication provides energy benchmarks for a range of different classifications of commercial and public building types. These energy benchmarks can be multiplied by floor area data to provide an approximate energy use for commercial, industrial and public buildings of different type and size.	http://www.cibse.org/index.cfm?go=publications.view&item=404
Climate change		The process by which human activities, most specifically the burning of fossil fuels, is believed to be altering Earth's climate, leading to unpredictable and extreme weather conditions.	
Climate Change Act 2008		The world's first legally binding long-term framework to cut carbon emissions. It also creates a framework for building the UK's ability to adapt to climate change. It sets a legally binding target for the UK to reduce its carbon emissions by 805 by 2050. It also requires the UK Government to set five yearly carbon reduction targets.	1. http://www.defra.gov.uk/environment/climate/legislation/index.htm 2. http://www.decc.gov.uk/en/content/cms/legislation/cc_act_08/cc_act_08.aspx
Climate Change Levy	CCL	Introduced in April 2001, the CCL adds approximately 15% to typical energy bills of UK businesses. The CCL is applied to electricity, gas, coal and Liquid Petroleum Gas (LPG), but is not applied to any domestic supplies.	1. http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?_nfpb=true&_pageLabel=pageExcise_ShowContent&id=HMCE_PROD_009791&propertyType=

Term	Acronym	Meaning	For more information
			document 2. http://www.carbontrust.co.uk/policy-legislation/energy-intensive-industries/pages/climate-change-levy.aspx
CO2 equivalent		A measure of Global Warming Potential (GWP) that takes into account all the Greenhouse Gases (GHG). Carbon dioxide equivalency is a quantity that describes, for a given mixture and amount of greenhouse gas, the amount of CO2 that would have the same Global Warming Potential (GWP), when measured over a specified timescale (generally, 100 years).	
Code for Sustainable Homes	CfSH	A national mandatory environmental assessment standard for all new homes launched in December 2006 by BRE.	1. http://www.planningportal.gov.uk/uploads/code_for_sust_homes.pdf 2. http://www.breeam.org/page.jsp?id=86
Coefficient of Performance	COP	This is performance factor related to the efficiency of a technology, and is commonly used when describing the efficiency of heat pump technologies. For example, a Heat Pump with a COP = 3 converts 1kW electricity to 3kW heat.	
Combined Heat and Power/Combined Cooling Heat and Power	CHP / CCHP	The simultaneous generation of usable heat and power (usually electricity) in a single process, thereby reducing wasted heat and putting to use heat that would normally be wasted to the atmosphere, rivers or seas. CHP is an efficient form of decentralised energy supply providing heating and electricity at the same time. CHP's overall fuel efficiency can be around 70-90% of the input fuel, depending on heat load; compared to typical fossil fuel power stations which are only up to around 40-50% efficient.	http://www.carbontrust.co.uk/emerging-technologies/technology-directory/pages/combined-heat-power.aspx
Communities and Local Government	CLG	The successor department to the Office of the Deputy Prime Minister (ODPM). It is an expanded department with the remit to promote community cohesion and	http://www.communities.gov.uk/corporate/

Term	Acronym	Meaning	For more information
		equality, as well as responsibility for housing, urban regeneration, planning and local government.	
Community Infrastructure Levy	CIL	A proposed levy, which can be charged by Local Authorities, on most types of new development in their area. CIL charges will be based on simple formulae which relate the cost of the charge to the size and character of the development. CIL will be a valuable top-up for local communities who wish to see additional facilities in their area such as roads, public transport, open space or health centres, though it won't replace the need for mainstream public funding.	1. http://www.communities.gov.uk/planningandbuilding/planning/planningpolicyimplementation/reformplanningsystem/planningbill/communityinfrastructurelevy/ 2. http://www.pas.gov.uk/pas/core/page.do?pageId=122677
Community Sustainable Energy Programme	CSEP	An open grants programme run by BRE as an award partner of the Big Lottery Fund (BIG). The grants are available to community-based organisations for the installation of microgeneration technologies, such as solar panels or biomass boilers and energy efficiency measures including loft and cavity wall insulation.	1. http://www.communitysustainable.org.uk/
Connection charges		A one-off payment paid in addition to usage charges for gas and electricity by an energy supplier. Connection charges cover costs like cost of labour, materials, and any special expenses required to carry out the connection to the customer's requirements.	
CRC Energy Efficiency Scheme (CRC), (formerly known as the Carbon Reduction Commitment).	CRC	A mandatory carbon trading scheme designed to encourage larger organisations to manage energy consumption and emissions. The scheme, starting in April 2010, is designed to create a shift in awareness, behaviour and infrastructure. It will be administered by the Environment Agency. The scheme will affect approximately 20,000 organisations, with around 5,000 of these required to participate in the scheme. Participating companies will be ranked in a league table for their sector, depending on their performance in reducing carbon emissions. They will also receive either a financial penalty or reward depending on where they are ranked in the table.	1. http://www.carbontrust.co.uk/policy-legislation/Business-Public-Sector/Pages/carbon-reduction-commitment.aspx 2. http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/crc/crc.aspx

Term	Acronym	Meaning	For more information
D			
Decentralised and renewable or low carbon energy	DRLC	Decentralised renewable energy or decentralised low carbon energy or a combination of decentralised renewable energy and decentralised low carbon energy. These include, but are not exclusive to: wind turbines, biomass boilers, Biomass CHP, hydro and gas-CHP.	
Decentralised energy supply		Energy supply from local renewable and low carbon sources (i.e. on-site and near-site, but not remote off-site) usually on a relatively small scale. Decentralised energy is a broad term used to denote a diverse range of technologies, including micro-renewables, which can locally serve an individual building, development or wider community and includes heating and cooling energy.	
Department of Energy and Climate Change	DECC	The Department of Energy and Climate Change (DECC) was created in October 2008, to bring together: - energy policy (previously with BERR, which is now BIS - the Department for Business, Innovation and Skills), and - climate change mitigation policy (previously with Defra - the Department for Environment, Food and Rural Affairs)	1. http://www.decc.gov.uk/
Development Plan Documents	DPDs	Prepared by local planning authorities, these documents outline the key development goals of the local development framework. Development Plan Documents include the core strategy and, where needed, area action plans. There will also be an adopted proposals map which illustrates the spatial extent of policies that must be prepared and maintained to accompany all DPDs. All DPDs must be subject to rigorous procedures of community involvement, consultation and independent examination, and adopted after receipt of the inspector's binding report. Once adopted, development control decisions must be made in accordance with them unless material considerations indicate otherwise. DPDs form an essential part of the Local Development Framework.	

Term	Acronym	Meaning	For more information
Display Energy Certificate	DEC	Mandatory certificates for buildings with a total useful floor area over 1,000m2, occupied by public authorities or by institutions providing public services to a large number of persons and therefore frequently visited by those persons. The DEC must be on prominent public display and has a validity of one year. DECs show the actual energy usage of a building, the Operational Rating (OR), and help the public see the energy efficiency of a building.	http://www.communities.gov.uk/planningandbuilding/theenvironment/energyperformance/publiccommercialbuildings/displayenergycertificates/
District Cooling Network		A system where a centralised cooling plant (using any one of a range of technologies) provides coolth to surrounding buildings in the area by means of a network of pipes.	
District Energy System		A system where a centralised heat and/or power generating plant (using any one of a range of technologies) provides heat and/or power to surrounding buildings in the area by means of a network.	
District heating network	DHN	A system where a centralised heat generating plant (using any one of a range of technologies) provides heat to surrounding buildings in the area by means of a network of pipes.	
District heating network (DHN) Infrastructure		The pipework which connects the central energy plant to the buildings using the heat.	
Domestic Hot Water	DHW	Hot water used for kitchens and showers rather than for heating spaces within buildings.	
E			
Energy Act 2008		Along with the Planning Act 2008 and Climate Change Act 2008, the Energy Act 2008 ensures that UK legislation underpins long-term energy and climate change strategy. The Act includes: - Carbon Capture & Storage (CCS) - Renewables - feed-in tariffs - smart metering - Renewable Heat Incentive.	http://www.decc.gov.uk/en/content/cms/legislation/energy_act_08/energy_act_08.aspx
Energy Crops		See Biomass Fuel	

Term	Acronym	Meaning	For more information
Energy Efficiency		Energy efficiency in this context means design measures which reduce the base energy demand from a building. This could be issues such as; ensuring high levels of insulation and air tightness to reduce heat loss and therefore heating demand, reducing solar gain (perhaps through reduced glazing, use of solar control glass, solar shading etc), using exposed thermal mass to increase the buildings ability to maintain stable internal temperatures and so on. Energy efficiency should always be considered and included in the design of a building before considering DRLC.	
Energy from Waste	EfW	The conversion of waste into a useable form of energy, often heat or electricity.	http://www.r-e-a.net/power/biomass-bioenergy/energy-from-waste
Energy infrastructure fund		Similar to the Community Infrastructure Levy, this is a fund which would be paid into by developers helping to deliver energy infrastructure projects.	
Energy Opportunities Plan	EOP	A map, produced using GIS, which maps a range of features related to the opportunity to provide sustainable energy. These features might include existing heat demand, significant existing heat loads, clusters of social housing, publicly owned buildings, producers of waste heat etc. The use of the map is to assist in identifying opportunities by enabling the spatial relationship between features to be observed.	
Energy Performance Certificate	EPC	Launched by Communities and Local Government, the certificates will give home buyers and sellers A to G ratings for their home's energy efficiency and carbon emissions.	http://www.communities.gov.uk/planningandbuilding/theenvironment/energyperformance/homes/energyperformancecertificates/
Energy Service Company	ESCo	A commercial entity which typically operates and maintains the plant associated with a district heating network. It would also normally bill the network’s customers.	

Term	Acronym	Meaning	For more information
Energy Statement		Reports that are increasingly required by local authorities to support planning applications, responding to the relevant policies on renewable energy and sustainable design and construction.	
Evidence Base		The information and data gathered by local authorities to justify the "soundness" of the policy approach set out in Local Development Documents, including physical, economic, and social characteristics of an area. An ESCO might be involved in a large scheme particularly where shared technologies are an option, especially site-wide heat networks. ESCOs typically focus on system operation and sometimes procurement, and rarely contribute the bulk of financing. Where an ESCO and/or other third party are financing the energy strategy, their investment will effectively be paid back over time through the heat and/or electricity prices paid by the consumers and, typically, a standing charge to building owners/occupiers to cover operating, maintenance and financing costs.	http://www.planningportal.gov.uk/england/government/policy/policydocuments/englandppgpps/791ppps1
F			
Feed in Tariffs	FITs	A scheme to incentivise renewable electricity installations up to a maximum capacity of 5 MW. The impact of FITs will significantly increase revenue for small-scale generators of renewable electricity, such as photovoltaic systems or small wind turbines. The FITs may also make it easier to obtain finance for such projects as it provides a guaranteed price for the electricity generated.	http://www.decc.gov.uk/en/content/cms/consultations/elec_financial/elec_financial.aspx
Flood plain		Generally low-lying areas adjacent to a watercourse, tidal lengths of a river or the sea, where water flows in times of flood or would flow but for the presence of flood defences.	
Flood Risk Assessment	FRA	An assessment of the likelihood of flooding in a particular area so that development needs and mitigation measures can be carefully considered.	http://www.environment-agency.gov.uk/research/planning/93498.aspx
Fossil fuels		Carbon-rich fuel (coal, oil and natural gas) formed	

Term	Acronym	Meaning	For more information
		from the remains of ancient animals and plants.	
G			
Geographic Information System	GIS	Any of a range of software packages used for undertaking statistical analysis and representing the results visually so that relationships of physical location can be observed.	
Global learning rates		A method of mathematically representing increasing international production volumes and the associated reducing costs of technologies.	
Global warming potential	GWP	A measure of how much a given mass of greenhouse gas is estimated to contribute to global warming. It is a relative scale which compares the gas in question to that of the same mass of carbon dioxide (whose GWP is by convention equal to 1).	
Green Infrastructure		A network of multi-functional green space, both new and existing, both rural and urban, which supports the natural and ecological processes and is integral to the health and quality of life of sustainable communities'	
Greenhouse Gases	GHG	Naturally occurring examples include water vapour, carbon dioxide, methane, nitrous oxide and ozone. Some human activities increase these gases, including fossil fuel combustion within motor vehicles and some power stations.	
Ground source heat pumps	GSHP	A heat pump technology using stored thermal energy in the ground to heat or cool the building. Beneath the Earth's surface the ground will have a relatively stable temperature throughout the year. This will be approximately the same as the average mean annual air temperature in the particular location. There are two main types: Open Loop uses a submersible pump removing the ground water for example from chalk cracks and aquifers. Closed Loop uses water or antifreeze solution circulated through plastic pipes buried beneath the earth's surface. Closed loops can be installed in three ways: horizontally, vertically or as an underwater coil. These systems are usually used to warm water for radiators or underfloor heating systems. It can also be used to pre-heat water before it goes into a more	1. http://www.energysavingtrust.org.uk/Generate-your-own-energy/Ground-source-heat-pumps 2. http://www.carbontrust.co.uk/cut-carbon-reduce-costs/products-services/technology-advice/renewables/Pages/Ground-source-heat-pumps.aspx

Term	Acronym	Meaning	For more information
		conventional boiler. Ground- and Air- source heat pumps are not completely 'renewable' as they require electricity to drive their pumps or compressors.	
Groundwater		An important part of the natural water cycle present underground, within strata known as aquifers.	
H			
Heat and Energy Saving Strategy	HES	The Government's Heat and Energy Saving Strategy sets out an aim for emissions from existing buildings to be approaching zero carbon by 2050. The policies set out aimed to reduce annual emissions by up to 44 million tonnes of CO2 in 2020 – the equivalent of a 30% reduction in emissions from households compared to 2006 – making a significant contribution to meeting the UK carbon budgets.	http://hes.decc.gov.uk/
Heat demand density		A key parameter for planning district heating networks showing the density of the heat demand in a particular area.	
Heat density mapping		A visual representation of the heat demand in a given area.	
Heat Load		In this context (I.e. the Climate Change PPS), a heat load is a requirement from a building for heat which would be used to heat the space, heat hot water (for uses such as showering) or for a particular process which is carried on in the premises.	
Heat main backbone		The principle pipework distribution spine of a district heating network.	
Homes and	HCA	The national housing and regeneration delivery	http://www.homesandco

Term	Acronym	Meaning	For more information
Communities Agency		agency for England.	mmunities.co.uk/
Hydroelectricity		A technology generating electricity from running water, usually a small stream. Small or "micro" hydroelectricity systems can produce enough electricity for lighting and electrical appliances in an average home. Hydroelectricity systems are also called hydro power systems or just hydro systems.	1. http://www.energysavingtrust.org.uk/Generate-your-own-energy/Hydroelectricity 2. http://www.carbontrust.co.uk/cut-carbon-reduce-costs/products-services/technology-advice/renewables/Pages/Small-scale-hydro-electric-power.aspx
I			
Incineration		The controlled burning of waste. Energy may also be recovered in the form of heat (see Energy from Waste).	
Installed capacity		The maximum rated output of a generator, prime mover, or other electric power production equipment under specific conditions designated by the manufacturer. Installed capacity is commonly expressed in megawatts (MW) and is usually indicated on a nameplate physically attached to the unit.	
Internal Rate of Return	IRR	A measure of the return on investment taking into account both the size and timing of cash flows. Alternatively, the interest rate which, when used as the discount rate for a series of cash flows, gives a net present value of zero.	
J			
K			
L			
Landfill gas		The gas generated in any landfill site accepting biodegradable material. It consists of a mixture of gases, mainly methane and carbon dioxide.	

Term	Acronym	Meaning	For more information
Local Development Framework	LDF	A collection of local development documents produced by the local planning authority which collectively form the spatial planning strategy for its area. The core strategy within the LDF sets out the vision, strategic objectives and delivery strategy for achieving these. The LDF as a whole is the spatial expression of the sustainable community strategy (SCS) for the area. Each LDF includes one or more statutory development plan documents, which are used by planning authorities to control development and determine planning applications. These can include area action plans (AAPs) or supplementary development documents (SSDs), which set more detailed planning requirements. The aim of the new LDF system is to allow local planning authorities to respond to changing local circumstances. It also provides a greater emphasis on community consultation and engagement in the planning process, when compared with the previous system.	
Local Development Orders	LDO	An order made by a local planning authority extending permitted development rights for certain forms of development, with regard to a relevant Local Development Document.	
Local Strategic Partnership	LSP	An overall partnership of people that brings together organisations from the public, private, community and voluntary sector within a local authority area, with the objective of improving people's quality of life.	http://www.communities.gov.uk/localgovernment/performanceframeworkpartnerships/localstrategicpartnerships/
Low & Zero Carbon	LZC	Energy generation technologies, such as biomass, wind, solar etc. See Renewable and Low Carbon Energy.	
M			
Marine Energy		Two main sources, waves (originating from solar energy) and tides (resulting from the gravitational pull of the moon and sun). Wave and tidal energy devices convert the oceans' movement into electricity that is carried to shore using undersea cables and connected to the electricity grid.	1. http://www.carbontrust.co.uk/emerging-technologies/technology-directory/marine/Pages/Marine.aspx

Term	Acronym	Meaning	For more information
			2. http://www.bwea.com/marine/index.html
Merchant Wind arrangement		This is an arrangement in which wind turbine operators develop brown field sites for wind turbine electricity generation and then supply the land owners with power at reduced rates.	
Micro-generation		This refers to the use of on-site technologies to generate heat and/or electricity from low or zero carbon sources.	
Municipal Solid Waste	MSW	Household waste and any other waste collected by a waste collection authority such as municipal parks and gardens waste and waste resulting from the clearance of fly-tipped materials.	
N			
National Core Output Indicators	NCOIs	Set out in LDF good practice guide (July 2008), NCOIs aim to provide a consistent data source for a particular region in order to inform and develop spatial planning performance at the regional level. The indicators are	http://www.communities.gov.uk/publications/planningandbuilding/localdevelopmentframework
National Indicator 185: Percentage CO2 reduction from local authority operations	NI185	The aim of this National Indicator (NI) is to measure the progress of local authorities in reducing CO2 emissions from the relevant buildings and transport used to deliver their functions and to encourage them to demonstrate leadership on tackling climate change.	http://www.defra.gov.uk/corporate/about/what/localgovindicators/ni185.htm
National Indicator 186: Per capita reduction in CO2 emissions in the local authority area	NI186	This National Indicator (NI) relies on centrally produced statistics to measure end user CO2 emissions in the Local Area from: - Business and Public Sector, - Domestic housing, and - Road transport.	http://www.defra.gov.uk/corporate/about/what/localgovindicators/ni186.htm

Term	Acronym	Meaning	For more information
National Indicator 188: Planning to adapt to climate change	NI188	This National Indicator (NI) is a process-based indicator that aims to embed the management of climate risks and opportunities across the local authority and partners' services, plans and estates and to take appropriate adaptive actions. The indicator has been developed in consultation with the GO, UKCIP, LGA, EA and the Audit Commission.	www.defra.gov.uk/corporate/about/what/localgovindicators/ni188.htm
Net Present Value	NPV	NPV is a time series of cash flows, both incoming and outgoing, and is defined as the sum of the present values (PVs) of the individual cash flows.	
O			
Off gas areas	OGAs	Refers to areas of buildings which are not on the mains gas network.	
On-site		In this context, on-site means any measures taken by a developer within the boundary of a site required to comply with Part L of the Building Regulations.	
Output areas	OAs	Properly called Super Output Areas, these are a set of non-varying national geographies which divide the country into small areas. They are used for collecting, aggregating and reporting statistics. See Super Output Areas.	
P			
Part L		The Approved Document of the Building Regulations which deals with the conservation of fuel and power.	http://www.planningportal.gov.uk/wales/professionals/buildingregs/technicalguidance/bcconsfppartl/bcconsfppartlappdoc/
Photovoltaics	PV	Renewable system converting sunlight into electricity, which can be used to power (or partially power) electrical equipment and appliances.	1. http://www.energysavingtrust.org.uk/Generate-your-own-energy/Solar-electricity 2. http://www.carbontrust.co.uk/cut-carbon-reduce-costs/products-services/technology-advice/renewables/Pages/Solar-electricity-photovoltaics.aspx

Term	Acronym	Meaning	For more information
Planning Act 2008		This Act introduces a new stream-lined system for decisions on applications to build nationally significant infrastructure projects (NSIPs), such as major energy generation, railways, ports, major roads, airports and water and waste infrastructure. The act also introduces the Community Infrastructure Levy (CIL).	http://www.communities.gov.uk/planningandbuilding/planning/planningpolicyimplementation/reformplanningsystem/planningbill/
Planning Obligations and Agreements		Legal agreements between a planning authority and a developer, or undertakings offered unilaterally by a developer, that ensure that certain extra works related to a development are undertaken. For example, the provision of highways. Sometimes called "Section 106" agreements.	
Planning Policy Statement (PPS)	PPS	Issued by central government to replace the existing Planning Policy Guidance notes in order to provide greater clarity and to remove from national policy advice on practical implementation, which is better expressed as guidance rather than policy.	
Planning Policy Statement 1: Delivering Sustainable Development	PPS1	Planning Policy Statement 1 (PPS1) sets out the Government's overarching planning policies on the delivery of sustainable development through the planning system.	http://www.planningportal.gov.uk/england/government/policy/policydocuments/englandppgpps/791ppps1
Planning Policy Statement 22: Renewable Energy	PPS22	Planning Policy Statement 22 (PPS22) sets out the Government's policies for renewable energy, which planning authorities should have regard to when preparing local development documents and when taking planning decisions.	http://www.planningportal.gov.uk/england/government/policy/policydocuments/englandppgpps/7922ppps22
Planning Policy Statement 25: Development and Flood Risk	PPS25	Planning Policy Statement 25 (PPS25) sets out Government policy on development and flood risk. Its aims are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas of highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe, without increasing flood risk elsewhere, and, where possible, reducing flood risk overall.	http://www.planningportal.gov.uk/england/government/policy/policydocuments/englandppgpps/7925ppps25
Planning Policy Statement 3: Housing	PPS3	Planning Policy Statement 3: Housing (PPS3) underpins the delivery of the Government's strategic housing policy objectives and our goal to ensure that everyone has the opportunity to live in a decent	http://www.planningportal.gov.uk/england/government/policy/policydocuments/englandppgpps/793

Term	Acronym	Meaning	For more information
		home, which they can afford in a community where they want to live.	ppps3
Prudential Borrowing		New regime for council borrowing which aims to give councils more freedom to decide how much they can afford to borrow.	
Q			
R			
Refuse Derived Fuel	RDF	A fuel product produced from the combustible fraction of waste.	
Regional Spatial Strategy	RSS	A strategy for how a region should look in 15 to 20 years time and possibly longer. The Regional Spatial Strategy identifies the scale and distribution of new housing in the region, indicates areas for regeneration, expansion or sub-regional planning and specifies priorities for the environment, transport, infrastructure, economic development, agriculture, minerals and waste treatment and disposal. Most former Regional Planning Guidance is now considered RSS and forms part of the development plan. Regional Spatial Strategies are prepared by Regional Planning Bodies.	
Regulated CO2 emissions		That element of a building's CO2 emissions which are controlled by Part L of the Building Regulations (space and water heating, ventilation, lighting, pumps, fans & controls).	
Renewable and low carbon energy		Includes energy for heating and cooling as well as generating electricity. Renewable energy covers those energy flows that occur naturally and repeatedly in the environment – from the wind, the fall of water, the movement of the oceans, from the sun and also from biomass. Low carbon technologies are those that can help reduce carbon emissions. Renewable and/or low carbon energy supplies include, but not exclusively, those from biomass and energy crops; CHP/CCHP (and micro-CHP); waste heat that would otherwise be generated directly or indirectly from fossil fuel; energy-from-waste; ground source heating and cooling; hydro; solar thermal and photovoltaic generation; wind generation.	

Term	Acronym	Meaning	For more information
Renewable Heat Incentive	RHI	The Energy Act 2008 allows for the setting up of a Renewable Heat Incentive (RHI), which would provide financial assistance to generators of renewable heat and to some producers of renewable heat, such as producers of biomethane. The Government aims to have this in place by April 2011. The incentive payments will be funded by a levy on suppliers of fossil fuels for heat. The proposal is that the RHI will cover a wide range of technologies including biomass, solar hot water, air and ground source heat pumps, biomass CHP, biogas produced from anaerobic digestion and injection of biomethane into the gas grid. As with FITs, the impact of the RHI is that it will make generation of renewable heat more financially viable than it is currently	http://www.decc.gov.uk/en/content/cms/consultations/elec_financial/elec_financial.aspx
Renewable Obligation Certificates	ROCs	Certificates awarded to renewable electricity generators related to their output. See Renewables Obligation (RO).	http://www.ofgem.gov.uk/Sustainability/Environment/RenewablObl/Pages/RenewablObl.aspx
Renewables Obligation	RO	The Renewables Obligation (RO) is the main current financial support scheme for renewable electricity in the UK, and is administered by Ofgem. It obliges electricity suppliers in the UK to source a proportion of their electricity from renewable supplies. They demonstrate this has been achieved by showing they have the required quantity of Renewable Obligation Certificates (ROCs), which renewable electricity generators are awarded for their output.	http://www.ofgem.gov.uk/Sustainability/Environment/RenewablObl/Pages/RenewablObl.aspx
S			
Salix finance		Salix is an independent social enterprise, a not for profit company limited by guarantee, which delivers interest free funding to accelerate investment in energy efficiency technologies across the UK public sector.	http://www.salixfinance.co.uk/home.html
Section 106 Agreement	s106	A legal agreement under section 106 of the 1990 Town & Country Planning Act. Section 106 agreements are legal agreements between a planning authority and a developer, or undertakings offered unilaterally by a developer, that ensure that certain	

Term	Acronym	Meaning	For more information
		extra works related to a development are undertaken.	
Shadow price of carbon		The cost to society of the environmental damage caused by a tonne of CO2 emitted into the atmosphere.	
Simple Payback		Simple payback is a frequently used measure which indicates how quickly an investment, in this case in DRLC, will it's capital cost through savings, income or a combination of the two. Simple payback is calculated by taking the total capital investment and dividing by the total annual savings and income less any ongoing costs such as maintenance. The resulting figure is time to recoup outlay in years.	
Site of Special Scientific Interest	SSSI	A site identified under the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000) as an area of special interest by reason of any of its flora, fauna, geological or physiographical features (basically, plants, animals, and natural features relating to the Earth's structure).	
Solar Electricity		see Photovoltaics (PV)	
Solar gain		Heat gains in a building that results from solar radiation. Also known as solar heat gain or passive solar gain.	
Solar Hot Water	SHW	This is primarily a hot-water technology. It works by absorbing energy from the sun and then heating water (using heat exchangers). It can be used to provide hot water at temperatures of 55-65ºC. An efficient solar water-heating system can meet all of a building's hot water needs during summer, but much less in winter. It will still provide good performance during cloudy conditions.	1. http://www.energysavingtrust.org.uk/Generate-your-own-energy/Solar-water-heating 2. http://www.carbontrust.co.uk/cut-carbon-reduce-costs/products-services/technology-advice/renewables/Pages/Solar-water-heating.aspx

Term	Acronym	Meaning	For more information
Solar Thermal Energy		see Solar Hot Water (SHW)	
Space Heating	SPH	Heating energy required for space heating within buildings, rather than heating water for use in kitchens and bathrooms.	
Spatial Planning		Spatial planning goes beyond traditional land use planning to bring together and integrate policies for the development and use of land with other policies and programmes which influence the nature of places and how they function. This will include policies which can impact on land use by influencing the demands on, or needs for, development, but which are not capable of being delivered solely or mainly through the granting or refusal of planning permission and which may be implemented by other means.	
Special Area of Conservation	SAC		
Standard Assessment Procedure	SAP	This is the methodology which must be used to demonstrate compliance of any new dwellings with Part L of the Building Regulations.	
Standing charges		A fixed cost paid in addition to usage charges for gas and electricity by an energy supplier. Standing charges cover costs such as meter reading, maintenance, connection to the energy network and, in the case of gas, emergency services.	
Strategic District Heating Areas	SDHA	Areas identified by Local Authorities as viable for a district heating network.	
Strategic Housing		The Housing Green Paper 'Homes for the Future: More affordable, more sustainable' calls on all local authorities to play a stronger role in addressing the housing needs of residents. It encourages councils to develop their strategic housing role by using the full range of housing and land use planning powers. They should be working with partners to meet the needs of residents by ensuring the delivery of new and affordable housing while making the best use of existing stock.	
Strategic Housing Land	SHLAA	An assessment carried out by local authorities of land availability for housing, over a 15 year period, in their	http://www.communities .gov.uk/publications/plan

Term	Acronym	Meaning	For more information
Availability Assessment		areas as outlined in Planning Policy Statement 3: Housing (PPS3).	ningandbuilding/landavail abilityassessment
Super Output Area	SOA	A Super Output Area (SOA) is a geographical area designed for the collection and publication of small area statistics. It is used on the Neighbourhood Statistics site, and has a wider application throughout national statistics. SOAs give an improved basis for comparison throughout the country because the units are more similar in size of population than, for example, electoral wards. see Output Areas	
Supplementary Planning Document (SPD)	SPD	A Local Development Document that may cover a range of issues, thematic or site specific, and provides further detail of policies and proposals in a 'parent' Development Plan Document.	http://www.planningportal.gov.uk/uploads/ldf/ldfguide.html
Supplementary Planning Guidance (SPG)	SPG	Covering a range of issues, both thematic and site specific and provides further detail of policies and proposals in a development plan.	http://www.planningportal.gov.uk/uploads/ldf/ldfguide.html
Sustainable development		A widely used definition drawn up by the World Commission on Environment and Development in 1987: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The UK government has set out four aims for sustainable development in its strategy A Better Quality of Life, a Strategy for Sustainable Development in the UK. The four aims, to be achieved simultaneously, are: -social progress which recognises the needs of everyone -effective protection of the environment -prudent use of natural resources - maintenance of high and stable levels of economic growth and employment.	1. http://www.defra.gov.uk/sustainable/government/what/index.htm 2. http://www.sd-commission.org.uk/
T			
Target Emission Rate	TER	The amount of regulated emissions (measured in kgCO2/m2/year) a new building is permitted to produce in order to comply with Part L.	

Term	Acronym	Meaning	For more information
Thermal Bridging		Thermal Bridging (W/m2K), or cold bridging, is when materials of poor thermal insulation come into contact, conducting heat through them. Thermal Bridging can typically occur in construction details around window frames and floor-wall connections.	
U			
Un-regulated CO_2 emissions		That element of a building's CO_2 emissions which are not controlled by Part L of the Building Regulations, generally, those emissions which are associated with occupant uses (cooking, computers and small power).	
U-value		The U-value (W/m2K) is the overall heat transfer coefficient for a particular material and describes how well that material, or in this case building element, conducts heat.	
V			
W			
Waste heat		Under Part L of the Building Regulations, this is defined as waste heat from industrial processes and power stations rated at more than 10MWe and with a power efficiency >35%.	http://www.planningportal.gov.uk/wales/professionals/buildingregs/technicalguidance/bcconsfppartl/bcconsfppartlappdoc/
Wave Energy		See Marine Energy	
Wind Energy (small, large scale; onshore, offshore)		Wind turbines harness the power of the wind and use it to generate electricity. Small-scale wind refers to energy generated by wind turbines that are rated less than 50kW. There are a number of designs of small-scale wind turbines – with horizontal or vertical axes. Large-scale wind farms can be either sited offshore or onshore.	1. http://www.energysavingtrust.org.uk/Generate-your-own-energy/Wind-turbines 2. http://www.carbontrust.co.uk/cut-carbon-reduce-costs/products-services/technology-advice/renewables/Pages/small-scale-wind-energy.aspx 3. http://www.bwea.com/about/index.html
Wood fuelled		see Biomass Heating	

Capabilities on project:
Building Engineering

Term	Acronym	Meaning	For more information
heating			
World Heritage Site	WHS	A cultural or natural site of outstanding universal value designated by the International Council on Monuments and Sites (ICOMOS), for example Durham Cathedral and Stonehenge.	http://www.culture.gov.uk/ukwhportal/
X			
Y			
Z			
Zero Carbon Building		Over a year, the net carbon emissions from all energy use in the building are zero. This includes energy use from unregulated appliances (cooking, washing, electronics) as well as space heating, cooling, ventilation, lighting and hot water. The UK Government has set out plans for all new homes to be zero carbon from 2016; new schools to be zero carbon from 2016; and all new non-domestic to be zero carbon from 2019.	http://www.zerocarbonhub.org/

Capabilities on project:
Building Engineering

Table of Appendices

Appendix A – Comprehensive Spending Review 2010

This appendix details the key points related to buildings, environment and climate change from the Government's Spending Review (October 2010). The review fixes spending budgets for each Government department up to 2014-15[1] and this appendix presents an edited version of a note prepared by Torbay Council summarising the outcomes of the review.

Department of Energy & Climate Change (DECC) funding

- Cut by less than many other Departments, at 5% per annum. DEFRA must save an average 8% a year.
- From 2011 to 2015, DECC will reduce resource spending by 18% in real terms, and increase capital spending by 41% in real terms. The Department's Administration budget will be reduced by 33%. This equates to an overall budget cut of 5% per year. The temporary increase in capital spend is largely to cope with nuclear decommissioning.
- The work of the Carbon Trust, Energy Saving Trust, the Coal Authority and the delivery arm of Ofgem will be reviewed.

Investment

- Green Investment Bank - A "green" investment bank will be set up using £1bn of funding (together with additional significant proceeds from the sale of Government owned assets and private sector investment). It will make its investment decisions independent from political control and will employ private sector skills and expertise. The Government aims to complete design and testing work by spring 2011. £200 million is allocated to the development of low-carbon technologies including offshore wind technology and manufacturing infrastructure at port sites.
- Regional Growth Fund - £1.4 billion is allocated to Regional Growth Fund, with an increase in 3rd year. There is potential for some of this to be spent on "green" projects.
- Carbon Capture & Storage - Up to £1 billion for one of the world's first commercial scale carbon capture and storage demonstrations on an electricity generation plant. However, the original plans had been for "up to four" such projects.
- Low carbon technologies - More than £200 million for the development of low carbon technologies including offshore wind technology and manufacturing at ports sites.

Tariffs & Schemes

- CRC Energy Efficiency Scheme. It was announced that the revenues from allowance sales totalling £1 billion a year by 2014-15 will be used to support the public finances, including spending on the environment, rather than recycled to participants. The government had intended to "recycle" the revenue raised from the sale of allowances to those organisations participating in the scheme. The level of recycled payments would be determined by the organisation's performance in an energy efficiency league table, with the best performers receiving all the money they spent on allowances plus a bonus and the worst performers receiving only some of the money back.
- Renewable Heat Incentive (RHI) is to be launched from June 2011, two months later than planned, to support households and businesses investing in renewable heat measures. £860 million of funding has been allocated from 2011 to 2015. DECC have pledged a commitment to using the RHI to drive "a more-than-tenfold increase of renewable heat over the coming decade". A key change to the scheme is that the RHI will be funded directly by government, rather than by consumers as proposed by the previous government. The DECC press release states: "The Government will not be taking forward the previous administration's plans of funding this scheme through an overly complex Renewable Heat levy".

1 http://www.hm-treasury.gov.uk/spend_index.htm

- Feed-in Tariffs (FITs). It was announced that by 2014 DECC will refocus FITs on the most cost-effective technologies saving £40 million in 2014-15, unless higher than expected deployment requires an earlier review.

Domestic energy efficiency and fuel poverty

- The Green Deal - from 2013, the Green Deal will go ahead to enable households to borrow capital to invest in energy efficiency measures and fund repayments through the savings on their energy bills. A new obligation on energy companies will replace the current CERT funding.
- Energy company obligations - From April 2011, energy suppliers will provide greater help with the financial costs of energy bills to more of the most vulnerable fuel poor households, through Social Price Support – with total support of £250 million in 2011/12 rising to £310 million in 2014/15.
- Cold weather payments - Make permanent the temporary increases to Cold Weather Payments provided in the past two winters, at a cost of £50 million a year, so that eligible households receive £25 for each seven day cold spell recorded or forecast where they live.
- Warm Front - DECC will fund a smaller, targeted Warm Front programme for the next two years with a budget of £110 million in 2011/2012 and £100 million in 2012/2013. From 2013, Warm Front will stop.
- Fuel Poverty - A review of fuel poverty targets and their definition will take place by the end of 2010.

Appendix B – CLG Carbon Compliance Tables

This Appendix includes extracts from Annex E of the Definition of Zero Carbon Homes and Non-domestic Buildings: Consultation, CLG, December 2008. There are in total of 11 examples included in the full Annex.

This Annex E provides results of modelling undertaken to demonstrate that a range of solutions could be adopted in order to meet the 70% target for onsite compliance.

The tables shown in this Appendix illustrate that for larger scale urban developments, where district heating is not used, the solution with the lowest uplift in capital cost is to use Best Practice Energy Efficiency (BPEE) and install solar photovoltaics (PV). Therefore, it can be assumed that the first choice for developers to meet carbon compliance would be through BPEE and PV.

The Annex also demonstrates that district heating fed by biomass, or biomass CHP in combination with BPEE could deliver the 70% on site compliance requirement. Whether or not gas engine Combined Heat and Power (CHP) together with BPEE could meet the 70% target would depend on the size (and hence efficiency) of unit that could be installed, and the emissions factors for grid electricity and gas that would apply in 2016 .

The tables also show that a combination of ground source heat pumps and PV could also be used to meet the onsite compliance requirement, however, heat pumps alone would not be able to meet the 45-50% reduction required after energy efficiency had been adopted, based on the assumptions used for the Annex E analysis, due to the carbon emissions arising from the grid electricity used to run the heat pumps.

The acronyms used in the tables are as follows

BPEE	EST* Best Practice Energy Efficiency
APEE	EST Advanced Practice Energy Efficiency
SHW	Solar hot water
PV	Solar photovoltaic
CHP	Gas combined heat & power
GSHP	Ground source heat pump

*EST – Energy Saving Trust

It should be noted that for the assumptions used for the Annex E of the consultation document, gas CHP plus BPEE did not meet the 70% onsite target for the urban regeneration scenario. However, this was for a relatively small scale of unit (300kWe), and the carbon savings are very sensitive to the difference between the gas and the electricity carbon emission factors (which were assumed to be 0.194 and 0.43kgCO_2/kWh respectively for the consultation analysis).

In addition, it should be noted that this modelling assumed a carbon emissions factor for grid electricity of 0.43kgCO_2/kWh which has now been increased to 0.517 kgCO_2/kWh under the 2010 Building Regulations, and this will decrease the short term benefits of using heat pumps (air or ground) to contribute to carbon savings.

Capabilities on project:
Building Engineering

Small scale – mid-terrace

Technology Combination	Target CO_2 reduction (% 2006 TER)	Carbon reduction (vs. Part L 2006)	Residual CO_2 - electricity (tpa)	Residual CO_2 -other (tpa)	Total residual CO_2 (tpa)	Capital cost premium
BPEE alone	25%	15%	1.20	1.23	2.43	£2,093
APEE alone	25%	28%	1.24	0.99	2.23	£5,738
SHW + BPEE	25%	29%	1.20	1.00	2.21	£5,364
PV + BPEE	25%	26%	1.02	1.23	2.25	£4,977
GSHP +BPEE	25%	29%	1.97	0.24	2.22	£11,457
Gas CHP (80%) with BPEE	44%	31%	0.27	1.92	2.18	£23,774
PV + BPEE	44%	44%	0.75	1.23	1.98	£7,346
PV + APEE	44%	44%	0.99	0.99	1.98	£9,112
SHW + APEE	44%	43%	1.24	0.76	2.00	£8,789
Biomass heating (80%) + BPEE	44%	67%	1.04	0.59	1.62	£13,593
Biomass heating (80%) + APEE	44%	67%	1.13	0.50	1.63	£17,181
GSHP +APEE	44%	46%	1.54	0.41	1.95	£16,501
PV + BPEE	70%	70%	0.35	1.23	1.58	£10,786
PV + APEE	70%	70%	0.59	0.99	1.58	£12,264
GSHP + PV + BPEE	70%	70%	1.34	0.24	1.58	£17,346
Biomass heating (80%) + PV + BPEE	70%	79%	0.86	0.59	1.44	£15,475
Biomass heating (80%) + PV + APEE	70%	79%	0.95	0.50	1.45	£19,019
Biomass CHP (80%) + BPEE	70%					
Biomass CHP (80%) + APEE	70%					
Gas CHP (80%)+ PV + BPEE	70%	70%	-0.34	1.92	1.58	£29,343
PV + BPEE	100%	74%	0.29	1.23	1.52	£11,439
PV + APEE	100%	87%	0.33	0.99	1.32	£14,983
GSHP + PV + BPEE	100%	88%	1.06	0.24	1.30	£20,187
Biomass heating (80%) + PV + BPEE	100%	100%	0.54	0.59	1.12	£18,444
Biomass heating (80%) + PV + APEE	100%	100%	0.62	0.50	1.12	£22,031
Biomass CHP (80%) + BPEE	100%					
Biomass CHP (80%) + APEE	100%					
Gas CHP (80%)+ PV + BPEE	100%	90%	-0.64	1.92	1.27	£32,510
Biomass heating (80%) + PV + BPEE	Zero carbon	127%	0.13	0.59	0.71	£22,651
Biomass heating (80%) + PV + APEE	Zero carbon	127%	0.22	0.50	0.72	£26,195
Biomass CHP (80%) + PV + BPEE	Zero carbon					
Biomass CHP (80%) + PV + APEE	Zero carbon					
Gas CHP (80%)+ PV + BPEE	Zero carbon	90%	-0.64	1.92	1.27	£32,510

Urban Regeneration – mid-terrace

Technology Combination	Target CO_2 reduction (% 2006 TER)	Carbon reduction (vs. Part L 2006)	Residual CO_2 - electricity (tpa)	Residual CO_2 -other (tpa)	Total residual CO_2 (tpa)	Capital cost premium
BPEE alone	25%	15%	1.20	1.23	2.43	£2,093
APEE alone	25%	28%	1.24	0.99	2.23	£5,738
SHW + BPEE	25%	29%	1.20	1.00	2.21	£5,364
PV + BPEE	25%	26%	1.02	1.23	2.25	£4,977
GSHP +BPEE	25%	39%	1.59	0.47	2.06	£8,976
Gas CHP (80%) with BPEE	44%	44%	-0.26	2.24	1.98	£6,959
PV + BPEE	44%	44%	0.75	1.23	1.98	£7,346
PV + APEE	44%	44%	0.99	0.99	1.98	£9,112
SHW + APEE	44%	43%	1.24	0.76	2.00	£8,789
Biomass heating (80%) + BPEE	44%	67%	1.04	0.59	1.62	£6,264
Biomass heating (80%) + APEE	44%	67%	1.13	0.50	1.63	£9,852
GSHP +APEE	44%	46%	1.54	0.41	1.95	£12,333
PV + BPEE	70%	70%	0.35	1.23	1.58	£10,786
PV + APEE	70%	70%	0.59	0.99	1.58	£12,264
GSHP + PV + BPEE	70%	70%	1.11	0.47	1.58	£13,411
Biomass heating (80%) + PV + BPEE	70%	79%	0.86	0.59	1.44	£8,330
Biomass heating (80%) + PV + APEE	70%	79%	0.95	0.50	1.45	£11,874
Biomass CHP (80%) + BPEE	70%	116%	0.16	0.73	0.88	£9,471
Biomass CHP (80%) + APEE	70%	103%	0.48	0.60	1.08	£13,015
Gas CHP (80%)+ PV + BPEE	70%	70%	-0.66	2.24	1.58	£10,928
PV + BPEE	100%	74%	0.29	1.23	1.52	£11,439
PV + APEE	100%	87%	0.33	0.99	1.32	£14,983
GSHP + PV + BPEE	100%	98%	0.68	0.47	1.15	£17,870
Biomass heating (80%) + PV + BPEE	100%	100%	0.54	0.59	1.12	£11,299
Biomass heating (80%) + PV + APEE	100%	100%	0.62	0.50	1.12	£14,886
Biomass CHP (80%) + BPEE	100%	116%	0.16	0.73	0.88	£9,471
Biomass CHP (80%) + APEE	100%	103%	0.48	0.60	1.08	£13,015
Gas CHP (80%)+ PV + BPEE	100%	100%	-1.12	2.24	1.12	£15,637
Biomass heating (80%) + PV + BPEE	Zero carbon	127%	0.13	0.59	0.71	£15,505
Biomass heating (80%) + PV + APEE	Zero carbon	127%	0.22	0.50	0.72	£19,049
Biomass CHP (80%) + PV + BPEE	Zero carbon	173%	-0.73	0.73	0.00	£18,499
Biomass CHP (80%) + PV + APEE	Zero carbon	162%	-0.43	0.60	0.17	£22,361
Gas CHP (80%)+ PV + BPEE	Zero carbon	103%	-1.17	2.24	1.07	£16,168

Appendix C – CO_2 emissions calculation for new developments in Torbay

This Appendix shows the calculation carried out to determine the CO_2 emissions from new developments proposed to be built after 2016. The total CO_2 emissions are then broken down into the following:

- CO_2 emissions which would be required to be dealt with on-site;
- CO_2 emissions which could be dealt with by reducing CO_2 emissions in existing homes connected to DHNs;
- Remaining CO_2 emissions to be dealt with Allowable Solutions.

Torbay has set a target of around 10,000 new dwellings to be delivered by 2026[2] (2350 of which have already been built[3]), based on the, now redundant, Regional Spatial Strategy (RSS)[4]. Therefore, a total of **7,650 new homes** are expected to be built over the 16-year period 2011-2026, which is an average of **478 homes each year**.

Based on this synopsis, **5,260 new homes are due to be built between 2016 and 2026.**

This figure can now be used to calculate the amount of CO_2 which is likely to need to be dealt with as part of the Zero Carbon Homes policy. Taking a weighted average CO_2 emissions figure for new homes of different sizes (flats, terrace and detached) post 2016 based on the April 2001 census data for Torbay KS16 tenure, the following breakdown per new home built after 2016 is derived:

Regulated CO_2 emissions	1,730	kgCO_2/yr per home
Unregulated CO_2 emissions	1,096	kgCO_2/yr per home
Total CO_2 emissions	2,826	kgCO_2/yr per home

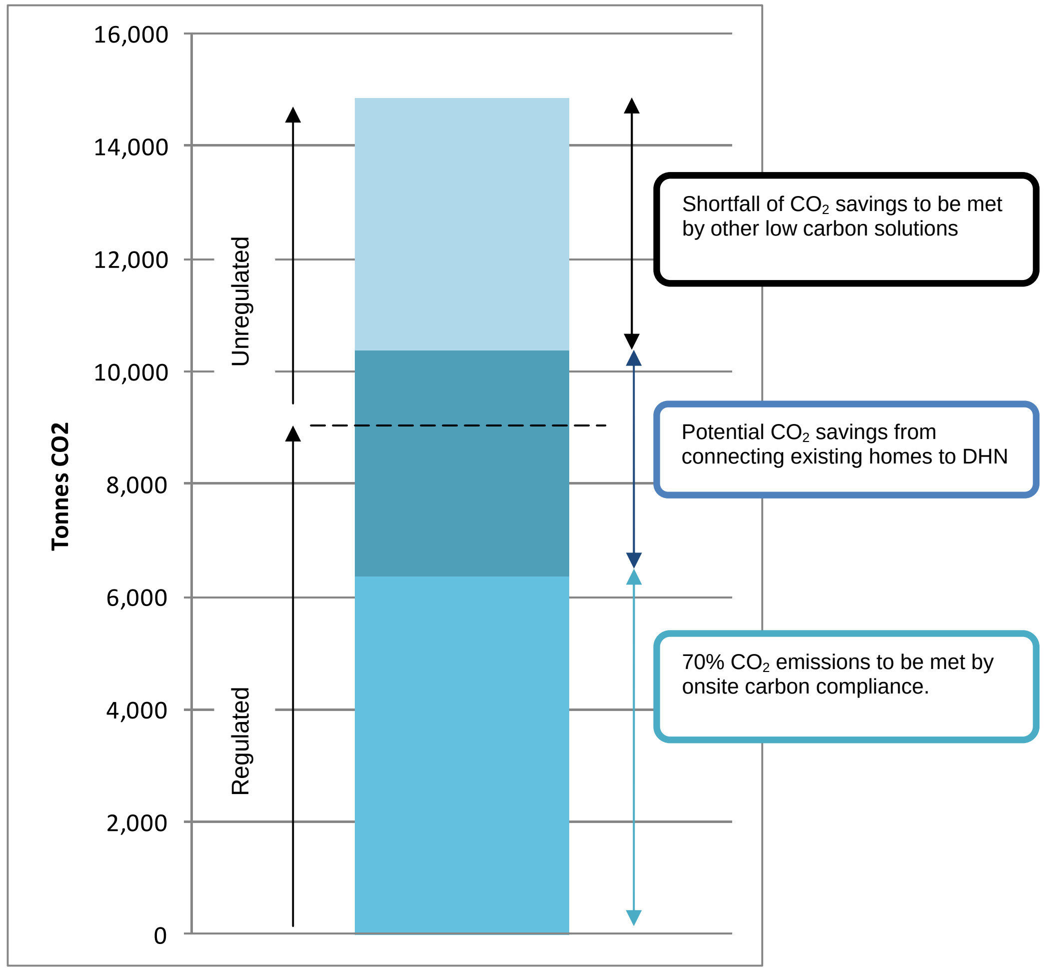
Therefore, for 5,260 new homes, a total of 14,866 tonnes of CO_2 would need to be dealt with in Torbay. As set out in Chapter 2 of the main report:

- 20-25% of the regulated emissions would be dealt with under the fabric energy efficiency standard;
- 45-50% of the regulated emissions would then be dealt with by onsite measures, such as building integrated PV or connection to a low carbon DHN; and then,
- 30% of the regulated emissions and 100% of the unregulated emissions would be required to be dealt with off-site, for example reducing CO_2 emissions in existing buildings in Torbay, or generating energy off-site.

Hence, for 5,260 new homes, 30% of the regulated emissions and 100% of the unregulated emissions equates to **8,495** tonnes of CO_2

In Torbay, this evidence base suggests that there is an opportunity to reduce CO_2 emissions in existing buildings by connecting them to DHNs, and, taking the assumption that DHN schemes in Torquay (Castle Circus and Harbourside) and White Rock connect to 75% of the existing homes within those areas, 4,006 tonnes of CO_2 could be saved.

This leaves **4,487 tonnes of CO_2 remaining** from the 5,260 new homes built after 2016, which would need to be dealt with by Allowable solutions such as wind, hydro and solar which are discussed elsewhere in this report.



[2] 'Report to Commissioning Officers Group (COG) dated 22nd June 2010. 'Abolition of Regional House Building Targets: the Implication for Torbay' Authored by David Pickhaver.3rd June 2010.

[4] Secretary of State's letter to abolish the housing target element of RSS (dated 27th May 2010)

Appendix D – GIS Data Sets

This Appendix lists the data sets used in the GIS mapping for the wind energy opportunities and constraints mapping

Constraint	Dataset	Sub Dataset	DECC Method	Comment
Non Accessible Areas	Motorway	-	N/A	No motorways across Torbay
	Primary Road	-	Yes	Assumed road width 12.5m
	A-Road	-	Yes	Assumed road width 20m
	B-Road	-	Yes	Assumed road width 12.5m
	Railway	-	Yes	Assumed railway width 12.5m
	Lakes	-	Yes	-
	Minor River	-	Yes	Assumed river width 1.25m
	Built Up Areas	-	Yes	-
	Airports	-	No	No evidence of airports constrained
	MoD Training Sites	-	No	No evidence of airports constrained
Exclusion Areas	Ancient Semi Natural Woodland	-	Yes	-
	Sites of Historic Interest	Scheduled Ancient Monuments	Yes	-
		Listed Buildings	No	No evidence to suggest LB were constrained. Total of 14 LB in Torbay
		Conservation Areas	No	No evidence
		Registered Historic Battlefields	N/A	No RHB in Torbay
		Registered Parks and Gardens	Yes	-
		World Heritage Site	N/A	No WHS in Torbay
	Road & Railway Buffer [150m]	-	Yes	-
	Urban Area Buffer [600m]	-	Yes	Regen SW used a more accurate approach using OS Address Point. 600m Company Offset AND 600m Residential Offset.
	Airports & Airfields Buffer [5km]	-	N/A	No Airports [Strategic Data] within 5km of Torbay

Constraint	Dataset	Sub Dataset	DECC Method	Comment
	Civil Air Traffic Control	-		No evidence
	MoD Constraints	-		No evidence
	Explosive Safeguarded Areas	- No		No evidence
Designated Landscapes and Nature Conservation Areas	Landscape Areas	National Parks	N/A	No National Parks in Torbay
		AONBs	Yes	
		Heritage Coast	Yes	
	Nature Conservation Areas	SPAs	N/A	No SPAs in Torbay
		SACs	Yes	
		RAMSARs	N/A	No RAMSARs in Torbay
		SSSIs	Yes	
		NNRs	Yes	

Additional Datasets NOT considered by DECC	Further Exclusions Based on Historic Interest	-	-	The extent of these additional datasets is unknown
	River Buffer [50m]	-	-	Additional constraint on river width

Additional Datasets that AECOM have access to and could be included	Local Nature Reserve	-	-	MAGIC dataset [Seven LNR in Torbay]
	RSPB Reserve	-	-	MAGIC dataset [Single RSPB Reserve in Torbay]
	National Grid	Gas Pipe Line	-	Pipe line located to the northern boundary of Torbay
		Electrical Transmission Line	-	No National Grid ETL in Torbay

Additional Datasets provided by the Client	Built Environment	BE5 - Conservation Areas	Yes	No impact on wind energy resource [likely to be already included within REGEN SW wind energy assessment.]
		BE8 - Historic Parks & Gardens	Yes	Already accounted for in REGEN SW dataset
		BE9 - Scheduled Monuments	Yes	Already accounted for in REGEN SW dataset
	Landscape	L1 - AONB	Yes	Already accounted for in REGEN SW

Constraint	Dataset	Sub Dataset	DECC Method	Comment
	Designations			dataset
		L2 - Area of Great Landscape Value	No	Note - Conflict with Wind Energy Resource
		L3 - Coastal Protection Area	No	Note - Conflict with Wind Energy Resource
		L4 - Countryside Zone	No	Note - Conflict with Wind Energy Resource
		L5 - Urban Landscape Protection Areas	No	No impact on wind energy resource
	Nature Conservation	NC1 - International Sites	Yes	Note - Conflict with Wind Energy Resource
		NC2 - National Sites	Yes	Note - Conflict with Wind Energy Resource
		NC3 - Local Sites	No	Note - Conflict with Wind Energy Resource
		NC4 - Wildlife Corridors	No	No impact on wind energy resource

Appendix E – Heat Demand Methodology

This Appendix describes the methodology used to build the heat demands across Torbay and within the specific Strategic Sites. This is broken down into the following building types:

- Existing residential;
- Existing non-Residential;
- Future residential;
- Future non-Residential.

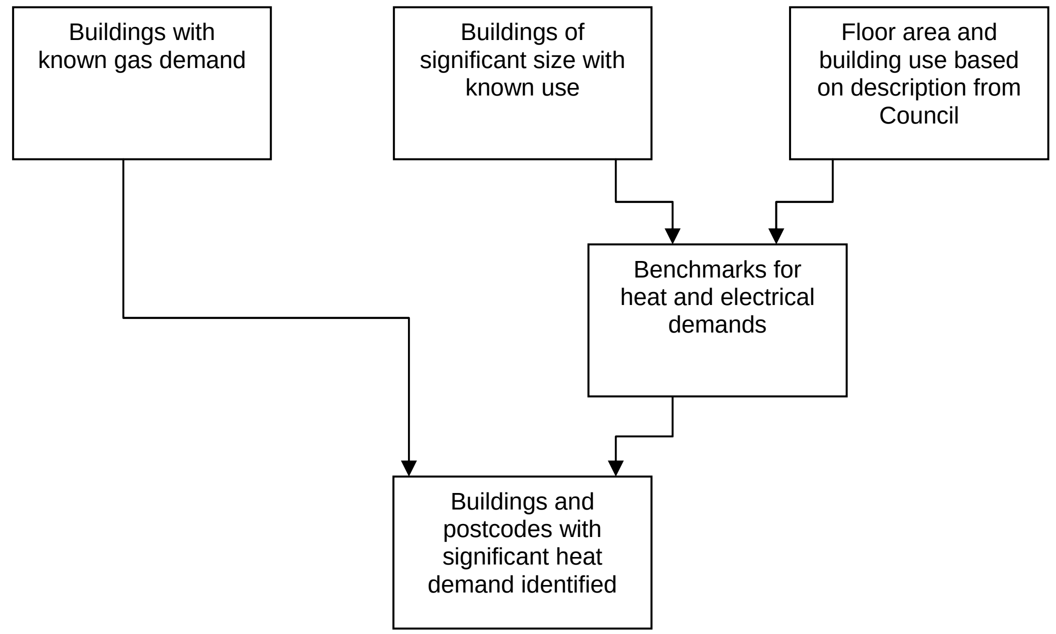
Existing residential
The South West Heat Map[5] GIS data layer for Torbay was used to find the heat demands for the existing residential buildings. This was assumed to be the most accurate method of estimated the heat demands.

The SW Heat Map provides annual heat demand at address point level enabling accurate total heat demands to be reached for specific boundaries. For residential properties, heat demand is estimated using a set of constant values developed by the project team, using the English House Condition Survey and the Expenditure and Food Survey. This contains a distinct annual heat demand value for each combination of housing tenure, age, built form and size (number of bedrooms). The data sets used for the residential address point heat data is shown in the table below.

Dataset	Use in SW Heat map
Residata	Classification of residential address types
CIBSE Guide F	Floorspace heat demand benchmarks
English House Condition Survey	As input to calculation of residential benchmarks
Expenditure and Food Survey	As input to calculation of residential benchmarks
DECC Small Area Energy Consumption Statistics	Validation at SW – Regional level

Existing non-Residential
The SW Heat Map was not used for estimating the heat demands of existing non-residential buildings because it was considered that the uses within the non-residential buildings are too varied and difficult to predict in such a high level study. Therefore non-residential heat demands are not included in the heat density data layer shown in the EOP's.

Instead, this non-residential heat demand was found on a building by building basis, using actual metered data or benchmarks based on actual building use and area. This was considered more accurate than the SW Heat Map methodology which uses a national VOA database and applies TM 46 benchmarks based on type of building. This can lead to inaccuracies in estimating heat demand, such as a Leisure Park being classified as a swimming pool, when there is no swimming pool in the building.



Buildings with Known Heat Demand

- Data supplied by Torbay Council, or a contact within a specific building, provided the gas and electrical consumption of all of the Council-owned buildings, education buildings and leisure centres. Gas consumption was converted to heat demand based on an assumed 85% efficiency. Buildings with heat demand greater than 300MWh/yr were deemed suitable for inclusion on the heat density EOP.
- ERIC (Estates Return Information Collection) database6 provided energy use for the healthcare buildings.

Buildings of Significant Size with Known Use

- Data supplied by Torbay Council provided details of hotels and residential care homes, including number of beds. Their floor areas (m^2) were inferred from the number of bedrooms, and then relevant benchmarks used to calculated heat demand. A cut off of 100-beds and 40-beds were used for hotels and residential care homes respectively to be included on the EOPs.

CIBSE TM46 Energy Benchmarks

- CIBSE TM 46 benchmarks, degree-day adjusted for Torbay, were applied in order to estimate heat and electricity demand for each building identified above according to its primary use and based on its total floor area

[5] The South West Heat Map, produced by The Centre for Sustainable Energy and Geofutures Ltd. 30 July 2010. www.southwestheatmap.co.uk

[6] Hospital Estates and Facilities Statistics http://www.hefs.ic.nhs.uk/

Future residential development

Torbay Council schedule

- A schedule of proposed residential development based on the SHLAA report[7] has been provided by Torbay Council that gives the number of dwellings planned in each year for each parcel of new development.

Mayors Vision

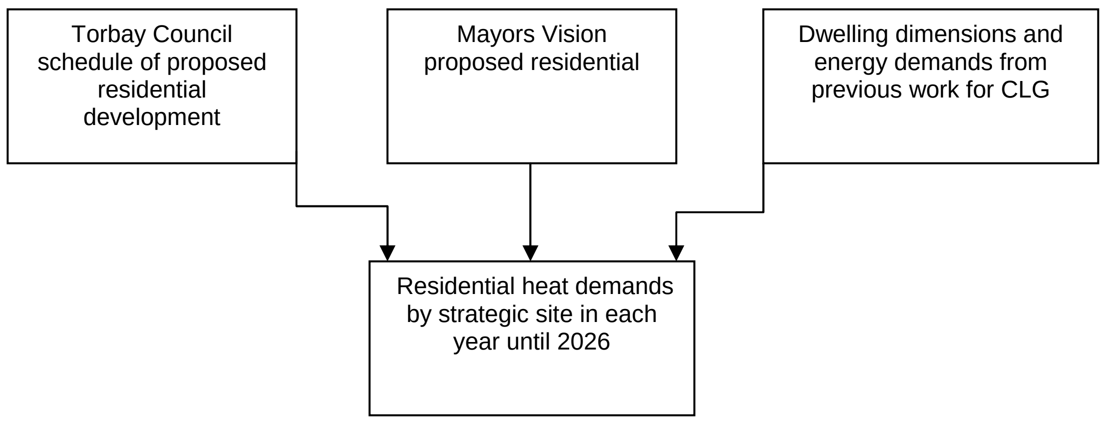
- Based on the LDA Design report[8] and updated figures from Torbay Council.

Dwelling dimensions and heat demands

- The above proportions are applied to the Council's schedule of future housing development and heating and electrical demands for each house type (based on AECOM's previous work for Communities and Local Government on Zero Carbon Homes) are used to establish energy demands for new development parcels, taking into account future changes to Building Regulations.
- Energy efficiency backstops are increased in 2013 from current 2006 levels to a current 'best practice' level. This level would yield a 10% carbon emission reduction measured against current 2006 Part L1A (i.e. 10% against the 44% reduction expected in 2013)

Heat and electrical demands

- Residential heat and electrical demands are then summed into Strategic Sites, and later added to the estimated future energy demands of proposed non-residential development



Future non-residential development

Schedule of proposed non-residential development

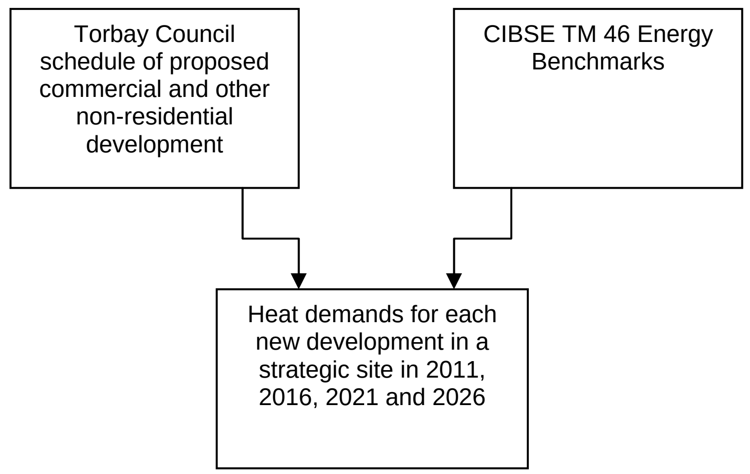
- A schedule of proposed commercial and other non-residential development was provided by Torbay Council.
- This schedule identifies the estimated time for each development completion (short, medium or long term), its relevant planning class, floor area and location. This provided five-yearly "snapshots" of change in heat demand as development progresses ending in 2026 (in line with the RSS) for developments within 2011-2015, 2016-2020 and 2021-2026.

CIBSE TM46 Energy Benchmarks

- The relevant TM 46 Energy Benchmarks were aggregated in order to give reasonable estimates of heat demands for each of the proposed planning classes. For example, energy demands for development under planning class A1 (Shops) were based on the mean average of TM 46 Benchmarks for General Retail, Large Non-Food Shop, Small Food Store and Large Food Store.

Heat and electrical demands for each new development parcel

- The total heat demand from future non-residential development in each year for each strategic site could then be summed and added to the heat demand from planned future residential development in the same format.



[7] Torbay Council Strategic Housing Land Availability assessment, Volumes 1 and 2, Final Report September 2008
[8] The New English Riviera, Action Framework Plan, January 2008

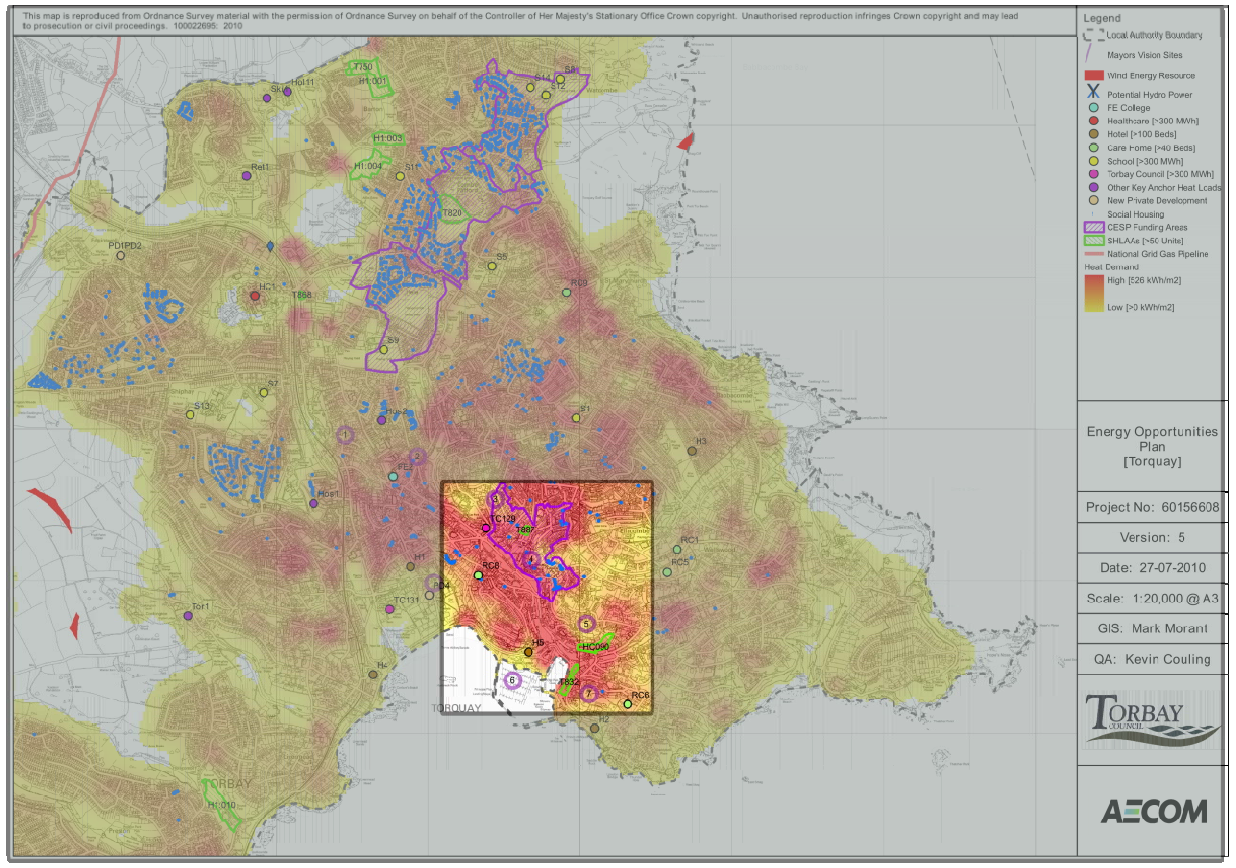
Capabilities on project:
Building Engineering

Appendix F – Identifying Strategic Heat Areas

The initial heat mapping highlighted key areas of Torbay which have high heat densities. In total, eight areas were identified and presented to Torbay Council in the workshop on 29th July 2010. These areas were:

1. Castle Circus & Union St
2. Harbourside & Victoria Pde
3. Yalberton Ind & Paignton College
4. Paignton Hosp & Crossways
5. Great Parks
6. White Rock & Torbay Business Pk
7. Brixham Town centre
8. Brixham breakwater

Torquay



Two sites were identified in Torquay; Castle Circus and Harbourside.

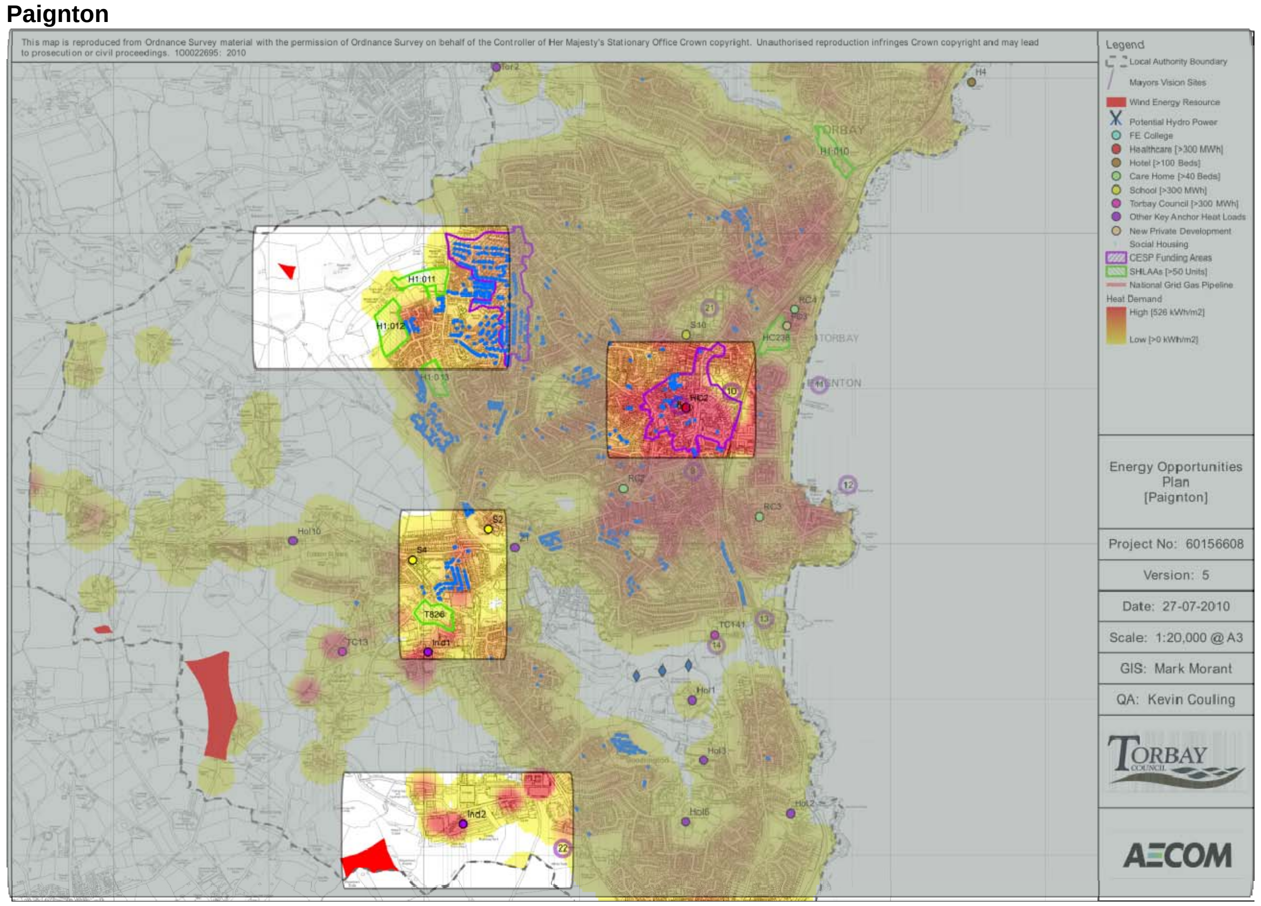
1. Castle Circus & Union St
Key Characteristics

- Dense SHLAA site
- Council Town Hall
- MV sites 3 and 4: Castle Circus (Civic Hub) and Union Street (retail)
- CESP Area

2. Harbourside & Victoria Pde
Key Characteristics

- 2No Dense SHLAA sites
- MV sites 5,6 and 7: Harbourside, Victoria Parade and Princess Gardens

Paignton



This shows the four areas of interest in the central Paignton area

Capabilities on project:
Building Engineering

1. Yalberton Ind & Paignton College

Key Characteristics

- Industrial Estate (Yalberton)
- College (Paignton community)
- Council building (Aspen Way Depot)
- Large SHLAA
- Social Housing cluster

2. Paignton Hospital & Crossways
Key Characteristics

- CESP Area
- Paignton Community Hospital
- Crossways Mixed Use new development
- MV 8 and 10

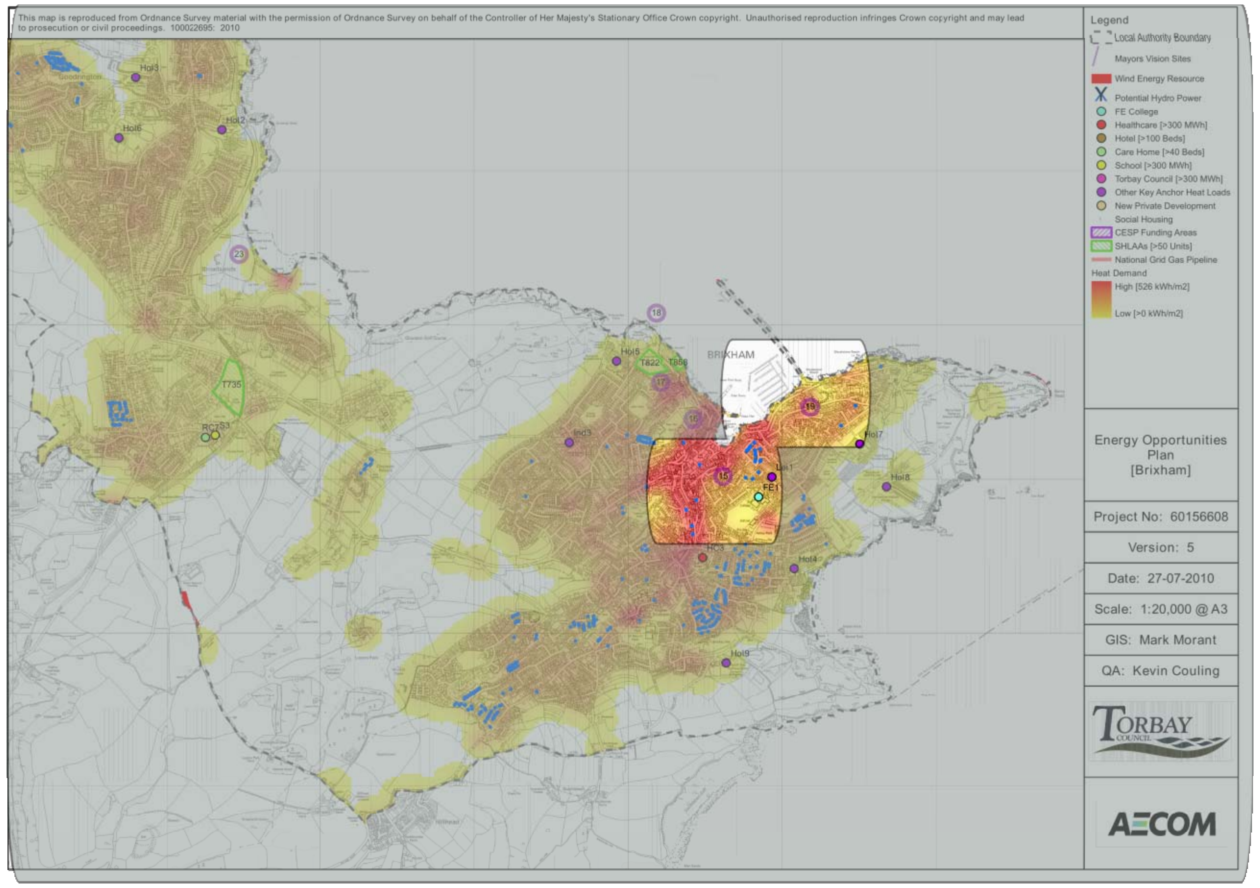
3. Great Parks
Key Characteristics

- Three large SHLAA sites
- Small area of unconstrained Wind
- Social Housing

4. White Rock & Torbay Business Park
Key Characteristics

- Technology Business Park
- South Devon College Innovation centre
- MV22 (White Rock)
- Area of unconstrained Wind

Brixham



This shows the extent of the Brixham town centre which was considered for further investigation

1. Brixham Centre
Key Characteristics

- Mixed Use MV15 for Brixham Market centre
- Brixham Community College
- Brixham Community Hospital
- Leisure Centre and Community Swimming pool

2. Brixham breakwater
Key Characteristics

- Wind Opportunity

Appendix G – Building key

This Appendix provides a build key for those specific buildings, SHLAA or Mayors Vision projects which have been included in the opportunities and constraints mapping.

Colour Key

Existing Buildings	
TC	Torbay Council Owned buildings
S	Schools (primary or secondary)
H	Hotels
HC	Health Care buildings
RC	Residential Care buildings
Tor, Hol, Ind	Misc buildings with potentially large heat demand. E.g. Tourism, leisure buildings, holiday parks, Industrial parks.
FE	Further Education buildings
New Buildings	
MV	Mayors Vision sites
PD	Private Development (new)
T	SHLAA site

Torquay

Development Ref.	Development Name
TC131	Torre Abbey
TC129	Torquay Town Hall
S9	Torquay Community College
S8	Mayfield School
S7	Torquay Girls Grammar School
S5	Cuthbert Mayne School
S14	Watcombe CP School
S13	Sherwell Valley Primary School
S12	Combe Pafford School
S11	Barton Primary School
S1	Westlands Upper School
H5	Torbay Hotel, Torbay Road (at Torquay Harbour)
H4	Grand Hotel, Torquay seafront
H3	Palace Hotel, near Babbacombe
H2	Barcelo Imperial Hotel, Parkhill Rd
H1	Torquay Leisure Hotels, Belgrave Road (Derwent, Victoria, Carlton & Toorak)
HC1	TORBAY DISTRICT GENERAL HOSPITAL
RC9	Margaret Clitherow House
RC8	Wallis Court
RC7	Three Corners Nursing Home
RC6	Sundial Lodge
RC5	The Warberries Nursing Home
RC1	Mount Tryon Nursing Home
Hol11	Parkdean Holidays
Hos1	Rowcroft Hospice
Hos2	Mount Stuart Hospital
Ret1	The Willows
Ski1	Alpine Ski Club
Tor1	Cockington Country Park
FE2	South Devon College
MV1	Torquay Central Station and Gateway
MV2	Brunswick Square Car Park
MV3	Castle Circus
MV4	Union Street Retail
	Union Street Retail Plan B
MV5	The Harbourside (Terrace Car Park) & the former Royal Garage
MV6	Princess & Royal Terrace Gardens, Pavilion, Pavilion Car Park, Cary Green and the Strand
	Marina Car Park Plan B
MV7	Victoria Parade
MV20	International Riviera Conference Centre, Torquay
PD1	Edginswell phases 1,2,3
PD2	Edginswell phases 4,5

Capabilities on project:
Building Engineering

PD4	Premier Inn, Seafront, Existing plus Extension (83+60=143)
PD5	New Palm Court Hotel
T887	Land R/O Market Street, Torquay
T832	Victoria Parade
HC090	The Terrace Car Park

Paignton

Development Ref.	Development Name
TC141	TORBAY LEISURE CENTRE
TC13	Aspen Way Depot
S4	Paignton Com College Borough Road
S2	Paignton Com. College Waterleat Road
S10	Oldway Primary School
HC2	PAIGNTON HOSPITAL
RC4	Cornerways Residential Home
RC3	Belle Vue Nursing Home
RC2	Primley Court Nursing Home
Z1	Paington Zoo
Hol1	Hoburne Holiday Park
Hol2	Waterside Holiday Park
Hol3	Marine Park Holiday Centre
Hol6	Beverley Holidays
Hol10	Devon Hills Holiday Village
Ind1	Yalberton Industrial Estate
Ind2	Torbay Business Park
Tor2	Occombe Farm
MV8	Crossways Shopping Centre
MV9	Station Lane
MV10	Victoria Shopping Centre and Multi Storey Car Park
MV11	Paignton Coastal Park
MV12	12. Paignton Harbour fish works & multi storey car park
MV21	Oldway Mansion, Paignton
MV22	White Rock Incubator
PD3	Travel lodge, marine Drive, Paignton

PD6	Parkbay Garden Centre
PD7	Yannons Farm
PD8	Jackson's Lane
PD9	Yalberton (employment land)
PD10	Waddeton Close
PD11	Shopdown Copse

Brixham

Development Ref.	Development Name
TC24	Brixham Town Hall
S3	Churston Grammar School
HC3	BRIXHAM HOSPITAL
Hol4	Riviera Bay Holiday Centre
Hol5	Brixham Holiday Park
Hol7	Wall Park Holiday Centre
Hol8	Landscove Holiday Park
Hol9	South Bay Holiday Park
Lei1	Brixham Leisure Centre
Lei2	Admiral Swimming Pool
Ind3	Northfield Foundry Ltd
FE1	Brixham Community college
MV13	Quay West/ Goodrington
MV14	Clennon Valley Health and Sports Facilities
MV15	Brixham Town Centre mixed use and creative industries hub
MV16	Fish Market
MV17	Freshwater and Oxen Cove Development
MV18	Brixham Northern Arm
MV19	Breakwater Hard Development
MV23	Broadsands Watersports Centre
T858	Freshwater Car Park

Appendix H – Energy Opportunities and Constraints Mapping

This Appendix presents the output from the various GIS mapping exercises undertaken as part of the study and the Energy Opportunities Plans (EOPs) developed. The EOPs bring together the results of the GIS mapping and highlight unconstrained areas of Torbay which could be used for low carbon energy solutions. For example, potential areas of wind resource are only highlighted where they are not constrained by their proximity to residential buildings, air fields, sites of ecological importance, and all other constraints as detailed in the methodology9. In addition, GIS mapping displaying the heat demand across Torbay along with a range of other features (such as anchor loads, clusters of social housing and so on) has been carried out to enable the assessment of potential for District Heating Networks (DHNs) as part of the study. A range of other potential resource and features (such as biomass resource and hydropower) which will form part of the evidence base to support policy has been mapped.

The following GIS mapping has been undertaken as part of this study and are presented in this Appendix:

- Existing heat demand
- Key potential anchor heat loads
- Large scale wind
- Small Scale wind
- Offshore wind
- Hydropower
- Biomass resource

Large-scale wind mapping

The wind constraints assessment for Torbay used a GIS mapping tool to provide up-to-date information on the spatial relationship between potential sites for large scale on- and off-shore wind energy developments (circa 2 MW wind turbines) and constraints which may restrict such developments. Overall, none of the site identified would appear to be large enough to accommodate a commercial scale wind farm, but rather single large turbines, or clusters of smaller turbines.

Below is a summary of the process of identifying technical feasibility:

1. Review national data sets for indications of whether the technology is feasible in the area (e.g. SW RDA study)
2. For the chosen area, spatially map the constraints (e.g. residential buildings, roads, air fields)
3. With the remaining area, assess the capacity which exists (e.g. is there sufficient wind speed in the unconstrained area)
4. If there is sufficient resource (i.e. wind speed), estimate the potential load that could be accommodated on the site, assuming maximum utilisation is possible.

The mapping was carried out using GIS datasets from Regen SW and additional data sets to enhance the Regen SW study. The following additional data sets were included on the maps:

- Local Nature Reserve (LNR) – there are four LNRs in Torbay.
- National Grid Pipelines – there is one pipeline to the north of Torbay.

[9] Renewable and Low-carbon Energy Capacity Methodology (January 2010) http://www.sqw.co.uk/file_download/246 published by DECC

- Listed buildings
- Torbay's Adopted Local Plan designations
- Bat Flight Paths outlined in South Hams SAC - planning guidance (May 2010).

In addition, electrical transmission lines are also shown on the EOP's where relevant.

The assessment covers the following geographic constraints: residential property; transport infrastructure; environmental and cultural heritage; and telecommunication links. Once identified, any areas constrained by any of the above were removed from the overall study area to leave unconstrained, potential sites for large scale wind energy development(s).

A comprehensive list of all the GIS datasets used in the assessment are given in Appendix D.

For small scale wind, a similar approach is used, however a secondary filter is undertaken based on topographic constraints and average annual wind speed.

Existing wind constraints

Noise and residential amenity

Residents of dwellings in close proximity to wind turbines may potentially be affected by mechanical and aerodynamic noise from wind turbines. There are established guidelines as to the maximum acceptable noise levels to prevent any undue impact on residential amenity. For individual sites, the potential noise impacts on nearby residential properties would be modelled in detail, using industry software. However, for this level of strategic assessment, it is appropriate to use a "rule of thumb" for a minimum separation distance from dwellings. Wardell Armstrong have assumed a separation buffer of 600m, based on the use of wind turbines of 2.5MW capacity.

Transport infrastructure

The PPS 22 companion guide states that "Although a wind turbine erected in accordance with best engineering practice should be a stable structure, it may be advisable to achieve a set-back from roads and railways of at least fall over distance, so as to achieve maximum safety." For non-trunk roads we have assumed a separation buffer of topple distance plus 10% which is slightly more conservative than PPS 22.

Environmental and cultural heritage

Existing environmental and cultural heritage features were identified as area of constraint and included: Sites of Special Scientific Interest, Local Nature Reserves, Special Protection Areas, Areas of Outstanding Natural Beauty, archaeological sites which included listed buildings, and conservation areas.

Aviation, radar and telecommunication links

Potential interference with National Air Traffic Service (NATS) en route radar for civilian aircraft was assessed using the NATS GIS dataset. There were no evidence of airports constrained within the wind constraints study area.

Any potential interference with point-to-point radio telecommunications links (e.g. as used by mobile phone operators) can only be assessed through consultation with Ofcom and relevant operators as part of a more detailed assessment of specific sites.

Wind constraints not included

The following constraints have not been considered as part of the wind mapping:

- Feasibility of grid connection

- Potential impacts on birds and bats and other ecology
- Impact on telecommunications, or military or civilian radar
- Shadow flicker
- Visual impact and landscape sensitivity

These constraints and issues can only be considered as part of a more detailed analysis for specific sites and through consultation with statutory consultees such as the MoD and Ofcom.

Small-scale wind mapping

Small scale wind is a sub-category of onshore wind and is typically less than 100 kW with hub heights around 15-20m. The majority of small scale wind installations are ground-based developments, but they can also be integrated into the building on roofs. They are typically installed on-site and supply the on-site demand first before spilling the excess to the grid and therefore they are by definition located in or next to built-up areas. This means that they can extend the deployment of wind capacity into areas where large developments are likely to be significantly constrained. At the same time, the number of small wind installations is in practice a function of the number of buildings or sites and not deployable on a per km^2 basis

The Regen SW datasets were used for assessing the small scale wind capacity in Torbay, which are based on the DECC SQW methodology. This uses the NOABL wind database and applies a factor to the windspeed based on the categorisation of the DEFRA Rural Definition dataset (based on LSOA dataset). In Torbay, all of the LSOA's are categorised as 'Urban' and this brings the NOABLE windspeeds for the different areas to below the viable cut off point, which is 4.5m/s for small-scale wind. Urban and built-up areas typically do not perform well with wind turbines due to the additional turbulence in the wind flow, which is cause by the buildings, hence monitoring of wind speeds at a particular site is vital to establish if the actual wind speeds are achievable.

The Census OA dataset, which is slightly more detailed, attributes some of the outer areas of Torbay as 'Rural' and 'Sub-Urban' areas. The analysis carried out in this Sustainable Energy Assessment shows the Census OA dataset in order to illustrate more variety in the land classifications in Torbay, and indicate areas of higher potential for small scale wind.

Hydro mapping

The Environment Agency report on Hydro opportunities[10] in the SW identifies a couple of sites within Torbay that each have a capacity of less than 10kW. This EA dataset considers the potential for low head hydropower on lowland rivers, where there were existing barriers, such as weirs. It does not include all at the potential for medium or high head hydropower. These have been included in the energy opportunities mapping.

In addition, there are preliminary proposals to install a hydro scheme near Brokenbury, which is a private project and not included in the EOP. The Brokenbury scheme is being currently researched by South West Water (SWW). The system would utilise the energy potential from the inlet pumping station (50m deep), and effluent head height between the STW and the outfall at Sharkham Point. The initial estimates of energy potential here are much greater than those predicted using the Environment Agency report, and is more in the region of 100-250kW. It is likely that this scheme could generate electricity that could be utilised on the SWW site. Therefore this would not be a community energy scheme, but could still contribute to reducing Torbay's CO_2 emissions.

[10] 'Mapping Hydropower Opportunities and Sensitivities in England and Wales: Technical Report' Final Report, February 2010, Environment Agency.

Key for EOP's

The EOP's use a series of symbols and colours to effectively communicate the different aspects of the information, including labelling each key anchor loads on the 1:20,000 EOP's with a unique reference number. The full list of codes are included in the Appendix, and a summary of the key symbols is provided here:

Key	Description	Symbol
Local Authority Boundary	Torbay Local Authority Boundary. Torbay is bounded by Teignmouth to the north, and South Hams to the west and south.	
Mayor's Vision Site	Mayor's vision sites as set out in the Action Framework Plan[11]	
Wind Energy Resource	Unconstrained areas which could be potential wind energy sites, provided wind analysis demonstrates there are high wind speeds on the site.	
Potential Hydro Power	Site for potential hydro power, as identified in the EA report.	
Existing Residential Heat Density	The heat density colour shading across the EOP's represents existing residential heat demand only. This heat demand is based on National Statistics data sets of residential gas consumption in LSOA's and address point GIS data layers from the SW Heat Map. Non-residential heat demand is shown from the identification of individual anchor buildings, and is based on real consumption data where possible.	
Known Buildings or potential new buildings	Specific buildings which could be potential anchor loads in Torbay including Council buildings, Healthcare, Hotels and new developments. Colours as described in Building Key of Appendix G.	
CESP Funding Area	CESP funding has been available to homes below the fuel poverty line to suport them in insulating their homes and becoming more energy efficient. CESP funding is currently under threat from Government spending cuts, however this data layer can still illustrate some of the areas of hard-to-treat homes in Torbay and therefore are still a priority area for the Local Authority to address.	

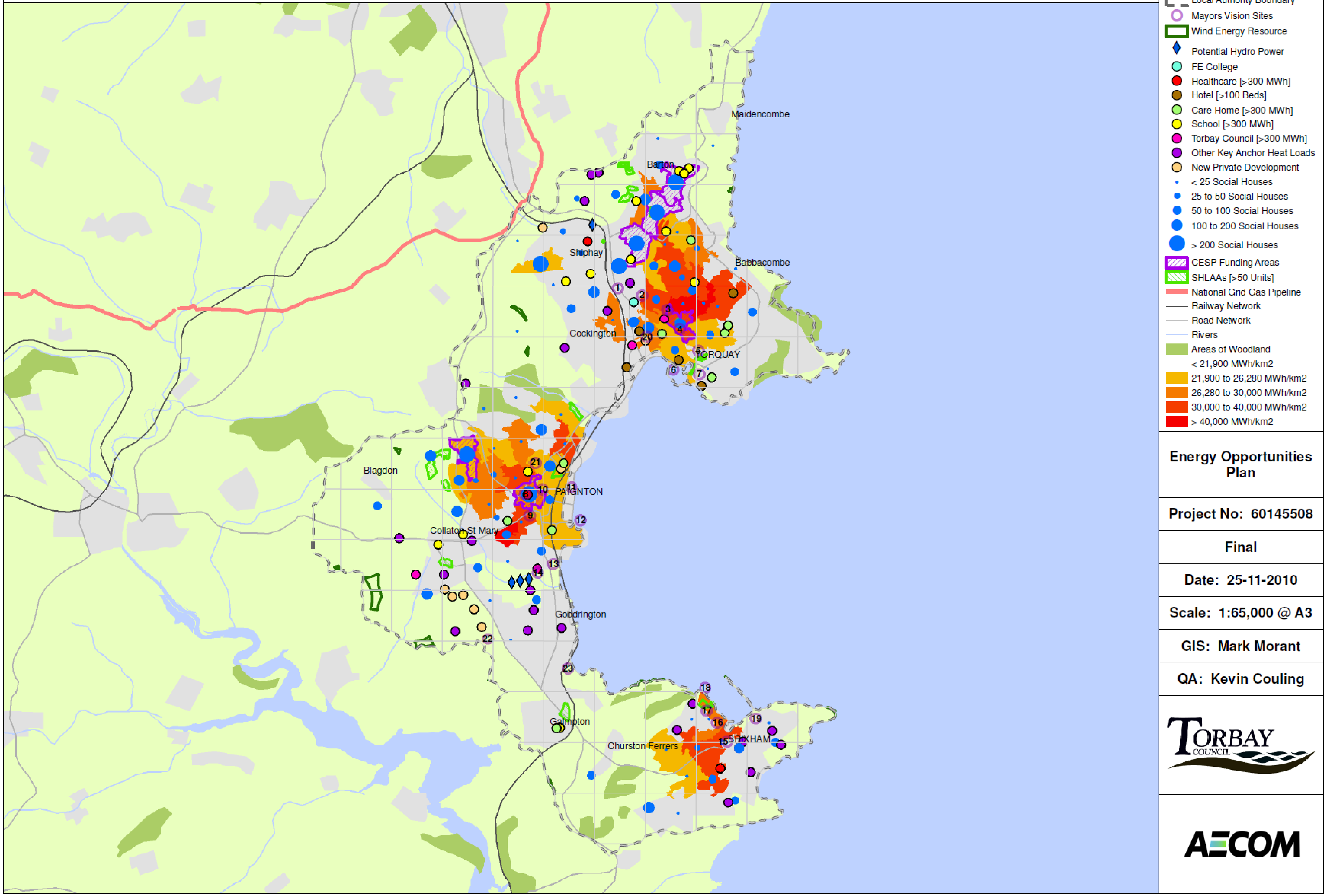
[11] 'The New English Riviera' Action Framework Plan, LDA Design (January 2008)

Energy Opportunities and Constraints Maps

There are 12 maps included in this Appendix which accompany Chapter 5. This Appendix should be read alongside the commentary presented in Chapter 5. The 12 maps are:

1. EOP Torbay Overall: This shows the overall energy opportunities map for Torbay at a high level (1:65,000). The energy opportunities shown include onshore wind resource, hydro and areas of high residential heat density. This can be used to place the opportunities in relation to each other across Torbay. The following maps split Torbay into the three core areas, Torquay, Paignton and Brixham at a more detailed scale of 1:20,000 to enable a more details assessment of areas of high heat demand.
2. EOP Torquay: This EOP shows the most northern parts of Torbay, around Torquay and north towards Teignmouth.
3. EOP Paignton: This EOP shows the central area of Torbay around Paignton.
4. EOP Brixham: This EOP shows the most southern part of Torbay around Brixham and Berry head.
5. Onshore Wind constraints map: Using the principal constraints to wind energy, as set out in the DECC methodology and the Regen SW data sets, this EOP sets the unconstrained areas of Torbay that could be suitable for wind energy at a high level of 1:65,000.
6. Onshore Wind constraints map highlighting areas Torbay's Adopted Local Plan designations: This EOP (1:65,000) shows the unconstrained areas from EOP 5 and overlays the local plan designations to allow further discussion on the appropriateness of the unconstrained wind energy areas.
7. Onshore Wind constraints map highlight Bat Flight Paths: Similarly, this EOP (1:65,000) shows the unconstrained areas from EOP 5 and overlays the Bat Flyways and Corridor from the South Hams report to demonstrate how they interact with the possible wind energy sites.
8. Offshore Wind constraints map: This is a 1:6,000 constraints map focussed in on the offshore wind potential at the end of the Brixham Breakwater.
9. Small Scale Wind constraints map: This constraints map (1:65,000) shows both the land classification (Urban, Sub-urban, or Rural) and average wind speeds from the national NOABL database. From these two layers of information a more accurate average wind speed is deduced, and hence areas suitable for small scale wind are highlighted.
10. Biomass EOP Food Waste: This EOP (1:65,000) shows the total amount of food waste available in tonnes of wet waste per $1km^2$. This has been summed from two sub sets: Municipal Solid Waste (food waste) and Commercial and public sector food waste.
11. Biomass EOP Agricultural Waste: This EOP (1:65,000) shows the total amount of agricultural waste available in tonnes of wet waste per $1km^2$. There are four sub data sets assessed as part of the Regen SW study including Cattle, Dairy, Pig and Poultry slurry. However only Poultry is shown to have a resource in Torbay.
12. Biomass EOP Timber Waste: This EOP (1:65,000) shows the total amount of timber waste available in oven dried tonnes per $1km^2$. This EOP is made up of five sub-sets covering Demolition (treated waste wood); Municipal Solid Waste (MSW) waste wood; Arboriculture waste wood; Industrial and construction (clean waste wood) and Forestry.

Capabilities on project:
Building Engineering



Capabilities on project:
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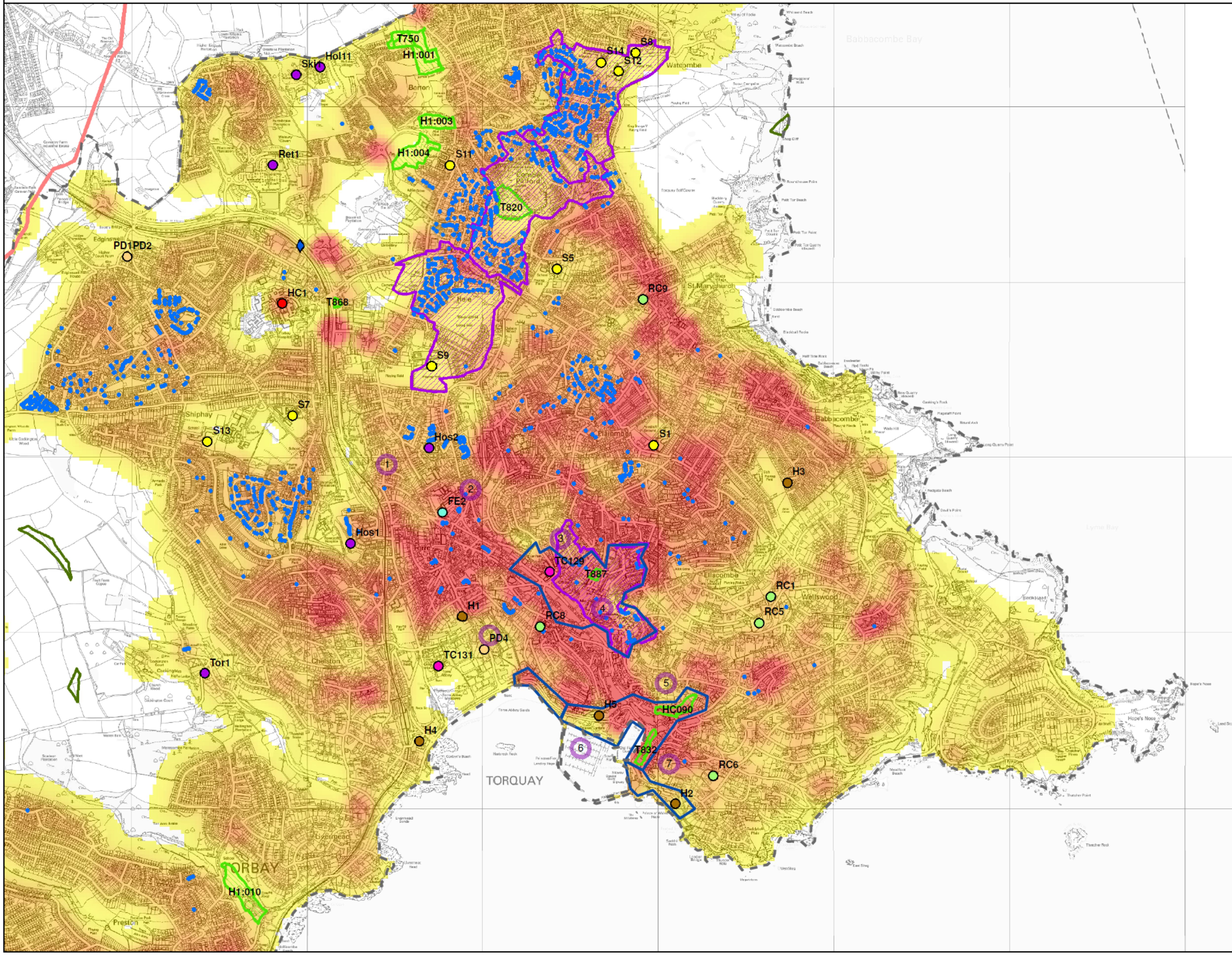


Legend

- Local Authority Boundary
- Strategic Sites
- Mayors Vision Sites
- Wind Energy Resource
- Potential Hydro Power
- FE College
- Healthcare [>300 MWh]
- Hotel [>100 Beds]
- Care Home [>40 Beds]
- School [>300 MWh]
- Torbay Council [>300 MWh]
- Other Key Anchor Heat Loads
- New Private Development
- Social Housing
- CESP Funding Areas
- SHLAAs [>50 Units]
- National Grid Gas Pipeline

Heat Demand

- High [526 kWh/m2]
- Low [>0 kWh/m2]

Energy Opportunities Plan [Torquay]

Project No: 60156608

Final

Date: 22-10-2010

Scale: 1:20,000 @ A3

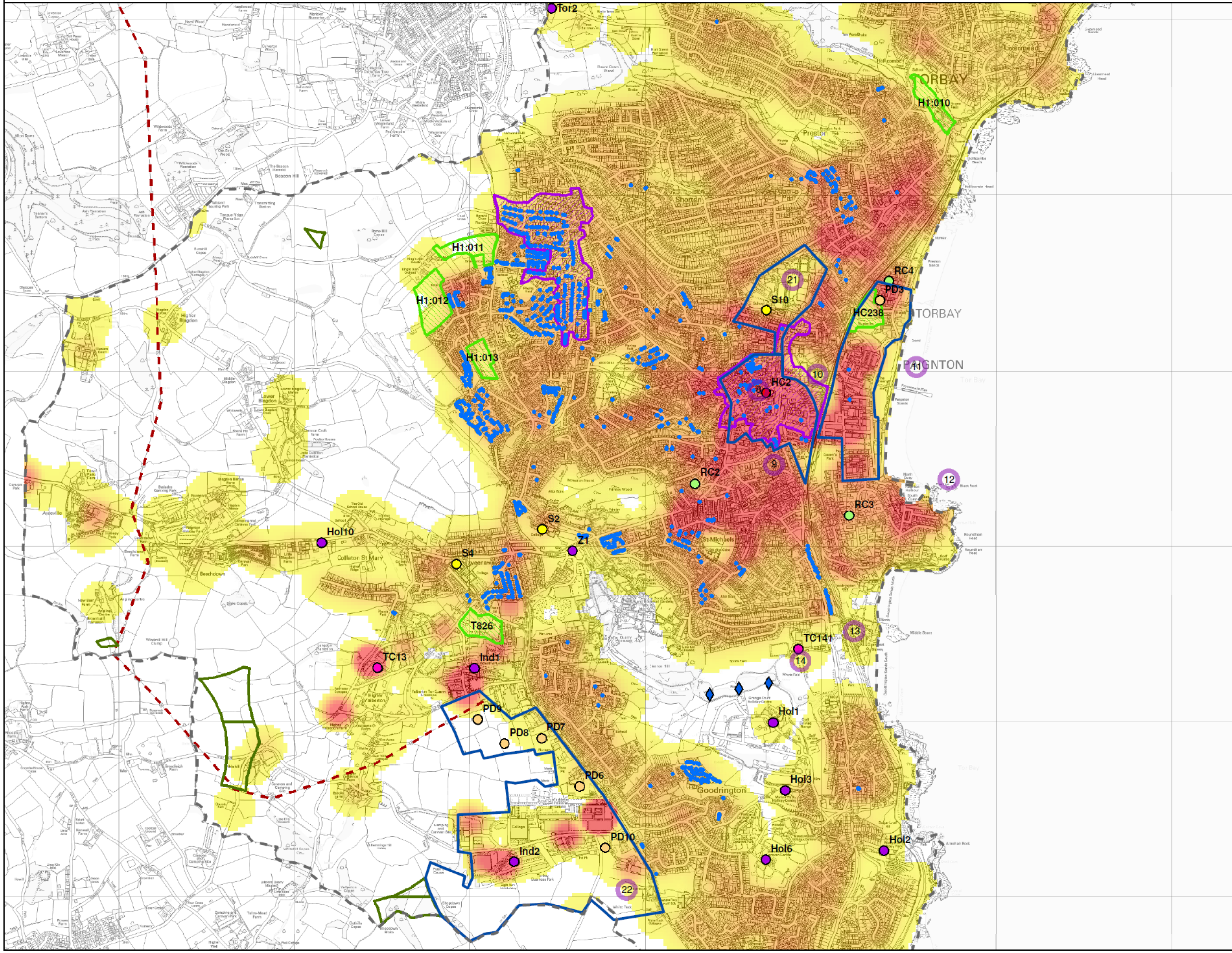
GIS: Mark Morant

QA: Kevin Couling

TORBAY COUNCIL

AECOM

Capabilities on project:
Building Engineering



Legend

- Local Authority Boundary
- Strategic Sites
- Mayors Vision Sites
- Wind Energy Resource
- Potential Hydro Power
- FE College
- Healthcare [>300 MWh]
- Hotel [>100 Beds]
- Care Home [>40 Beds]
- School [>300 MWh]
- Torbay Council [>300 MWh]
- Other Key Anchor Heat Loads
- New Private Development
- Social Housing
- CESP Funding Areas
- SHLAAs [>50 Units]
- National Grid Gas Pipeline
- Electrical Transmission Line

Heat Demand

- High [526 kWh/m2]
- Low [>0 kWh/m2]

Energy Opportunities Plan [Paignton]

Project No: 60156608

Final

Date: 25-11-2010

Scale: 1:20,000 @ A3

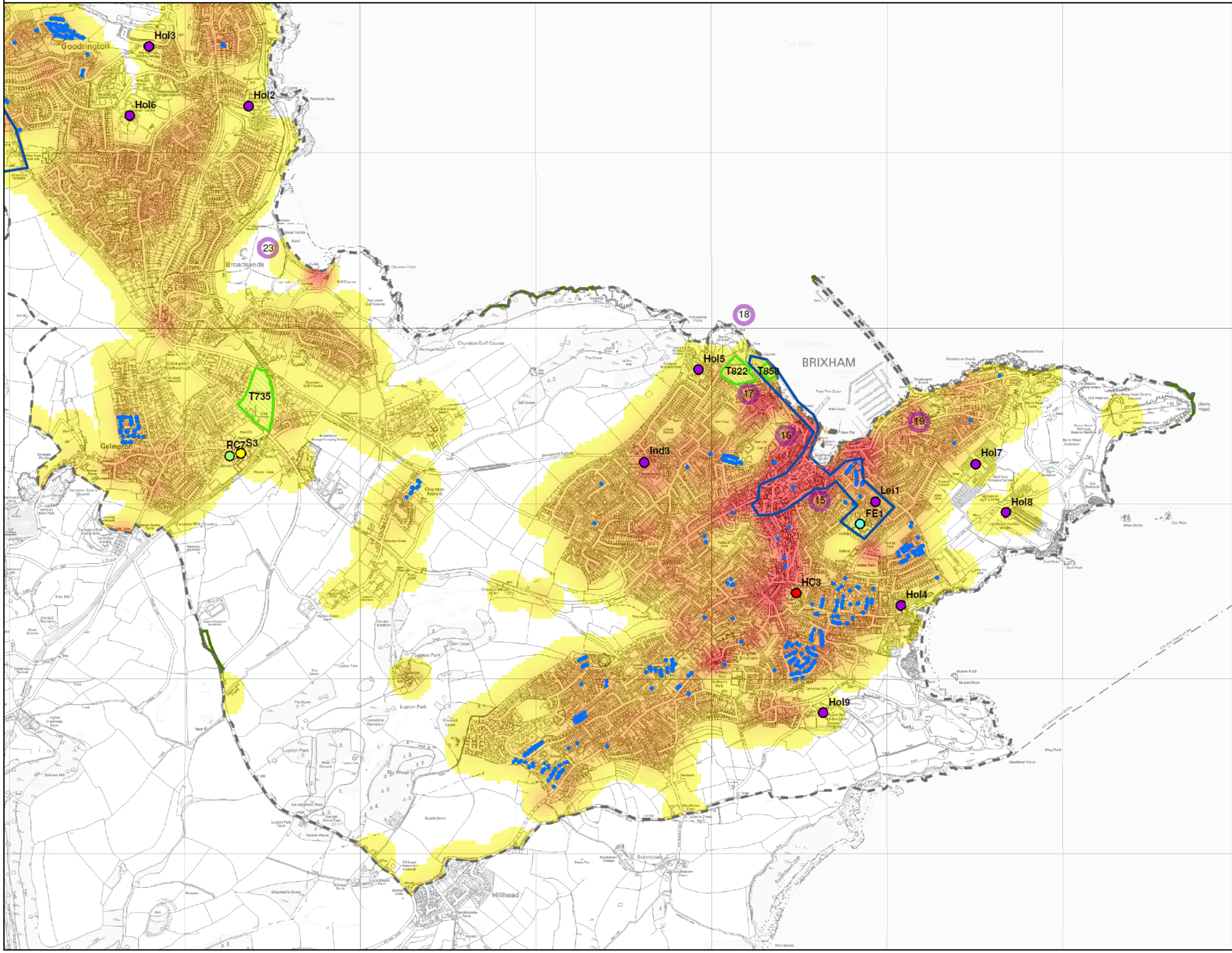
GIS: Mark Morant

QA: Kevin Couling

TORBAY COUNCIL

AECOM

Capabilities on project:
Building Engineering



Legend

- Local Authority Boundary
- Strategic Sites
- Mayors Vision Sites
- Wind Energy Resource
- Potential Hydro Power
- FE College
- Healthcare [>300 MWh]
- Hotel [>100 Beds]
- Care Home [>40 Beds]
- School [>300 MWh]
- Torbay Council [>300 MWh]
- Other Key Anchor Heat Loads
- New Private Development
- Social Housing
- CESP Funding Areas
- SHLAAs [>50 Units]
- National Grid Gas Pipeline

Heat Demand

- High [526 kWh/m2]
- Low [>0 kWh/m2]

Energy Opportunities Plan [Brixham]

Project No: 60156608

Final

Date: 22-10-2010

Scale: 1:20,000 @ A3

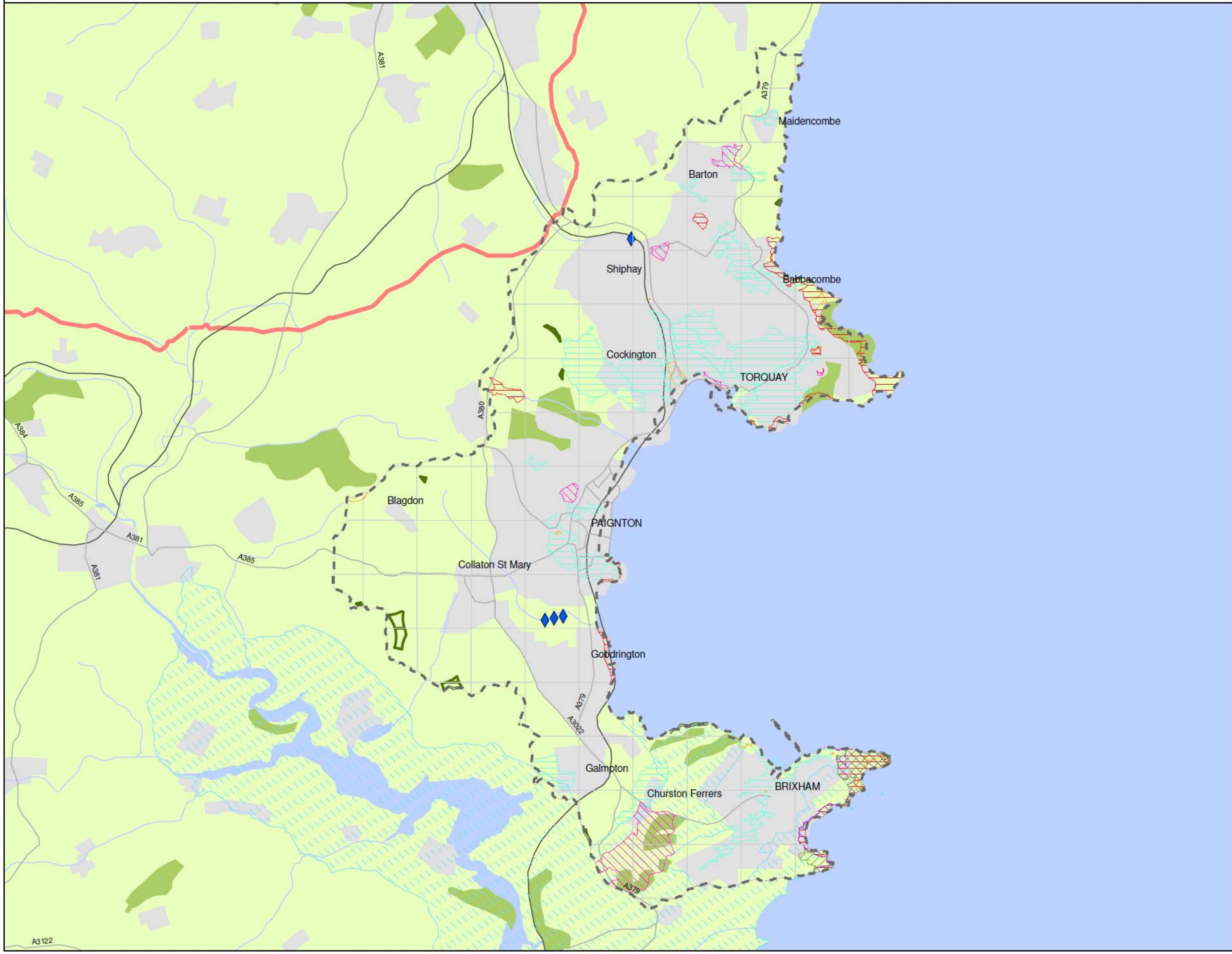
GIS: Mark Morant

QA: Kevin Couling

TORBAY COUNCIL

AECOM

Capabilities on project:
Building Engineering



Legend

- Local Authority Boundary
- NNR
- SAC
- SSSI
- SAM
- Registered Parks and Gardens
- Heritage Coast
- Conservation Area
- AONB
- Wind Energy Resource
- Potential Hydro Power
- Road Network
- Railway Network
- National Grid [Gas]
- Rivers
- Areas of Woodland
- Areas of Open Water
- Urban Areas

Onshore Wind & Potential Hydro Power Energy Resource Plan [Constraints]

Project No: 60156608

Final

Date: 22-10-2010

Scale: 1:65,000 @ A3

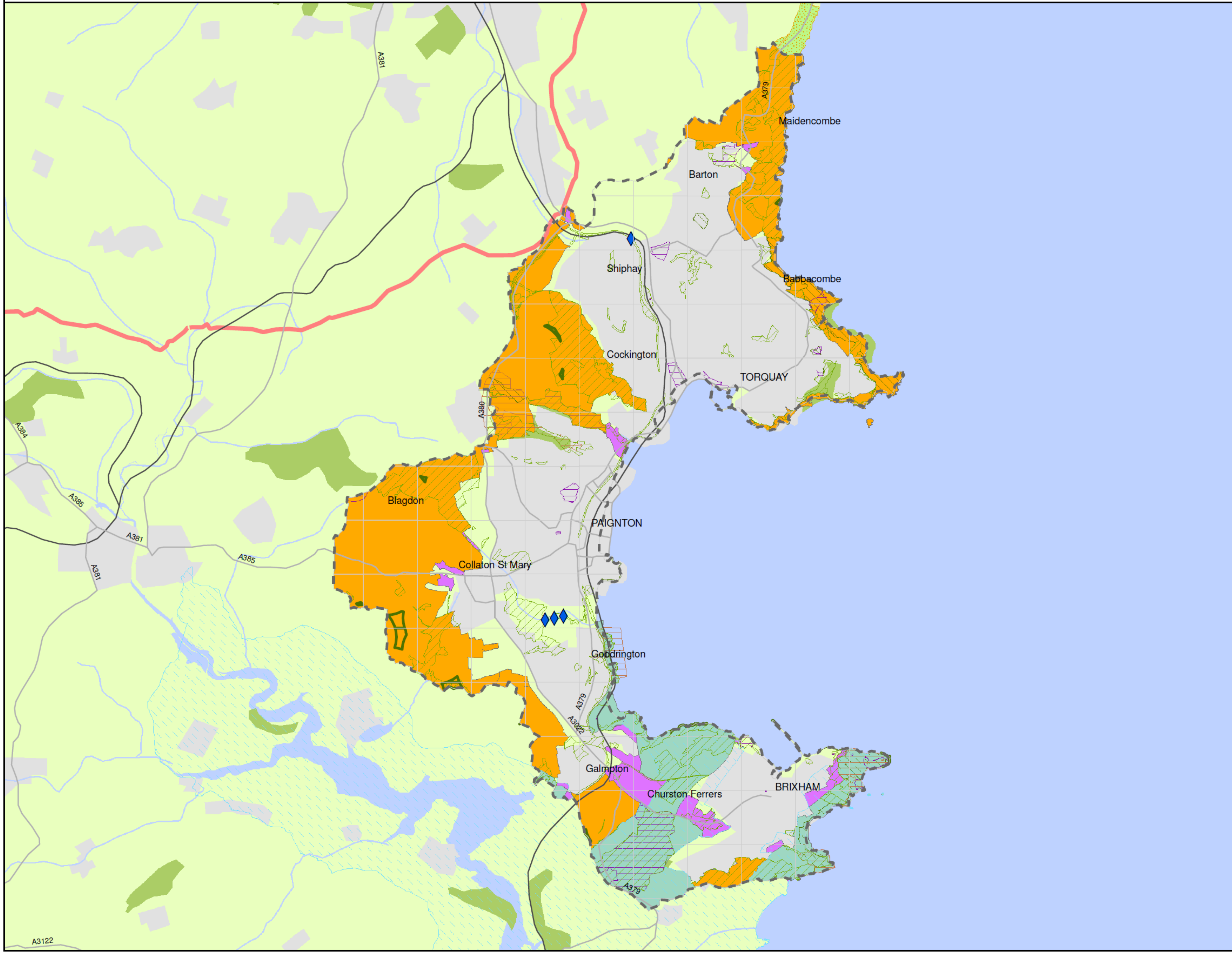
GIS: Mark Morant

QA: Kevin Couling

TORBAY COUNCIL

AECOM

Capabilities on project:
Building Engineering



Legend

- Local Authority Boundary
- Wind Energy Resource
- Potential Hydro Power
- Road Network
- Railway Network
- National Grid [Gas]
- NC3 [Locally Important]
- Local Nature Reserve
- RSPB Reserve
- AONB
- Heritage Constraints
- Environmental Constraints
- Area of Great Landscape Value
- Coastal Protection Area
- Countryside Zone
- Rivers
- Areas of Woodland
- Areas of Open Water
- Urban Areas

Onshore Wind & Potential Hydro Power Energy Resource Plan [Additional Constraints]

Project No: 60156608

Final

Date: 22-10-2010

Scale: 1:65,000 @ A3

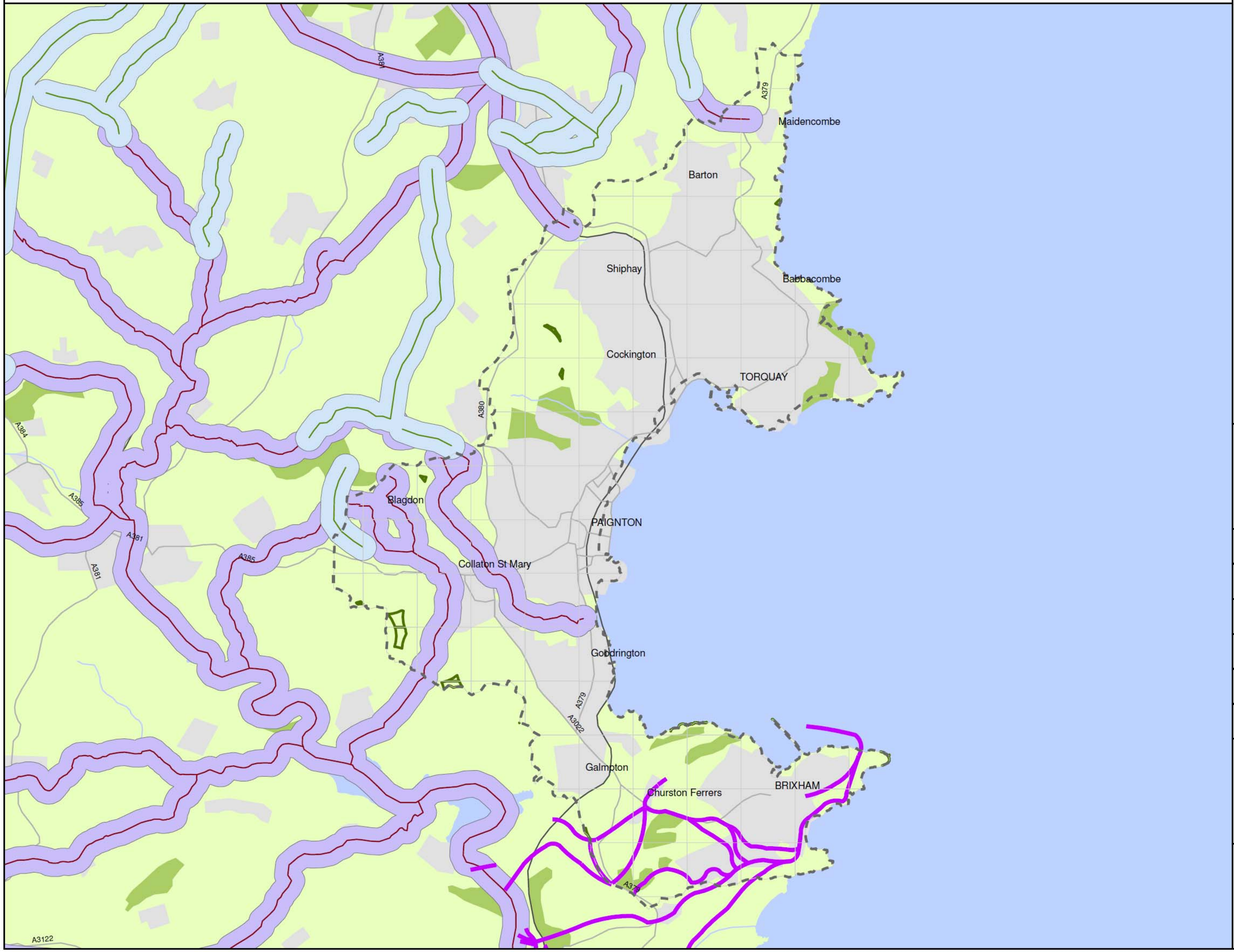
GIS: Mark Morant

QA: Kevin Couling

TORBAY COUNCIL

AECOM

Capabilities on project:
Building Engineering



Legend

- Local Authority Boundary
- Wind Energy Resource
- Radio Tracking
- Bat Flyaways
- Bat Flyways [250m Buffer]
- Bat Corridor Line
- Bat Corridor Line [250m Buffer]
- Road Network
- Railway Network
- Rivers
- Areas of Woodland
- Areas of Open Water
- Urban Areas

Onshore Wind Power Energy Resource Plan [Bat Constraints]

Project No: 60156608

Final

Date: 22-10-2010

Scale: 1:65,000 @ A3

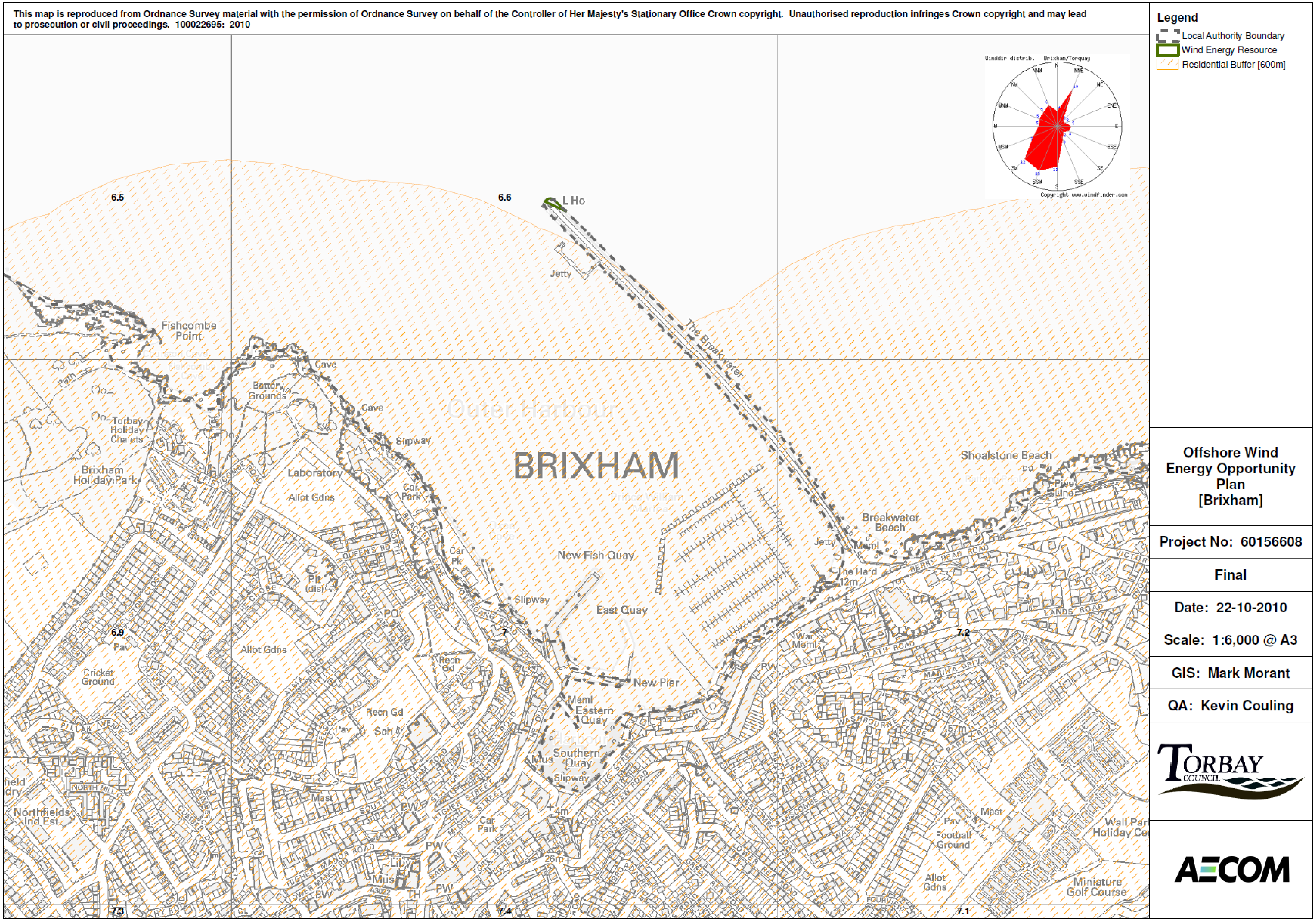
GIS: Mark Morant

QA: Kevin Couling

TORBAY COUNCIL

AECOM

Capabilities on project:
Building Engineering



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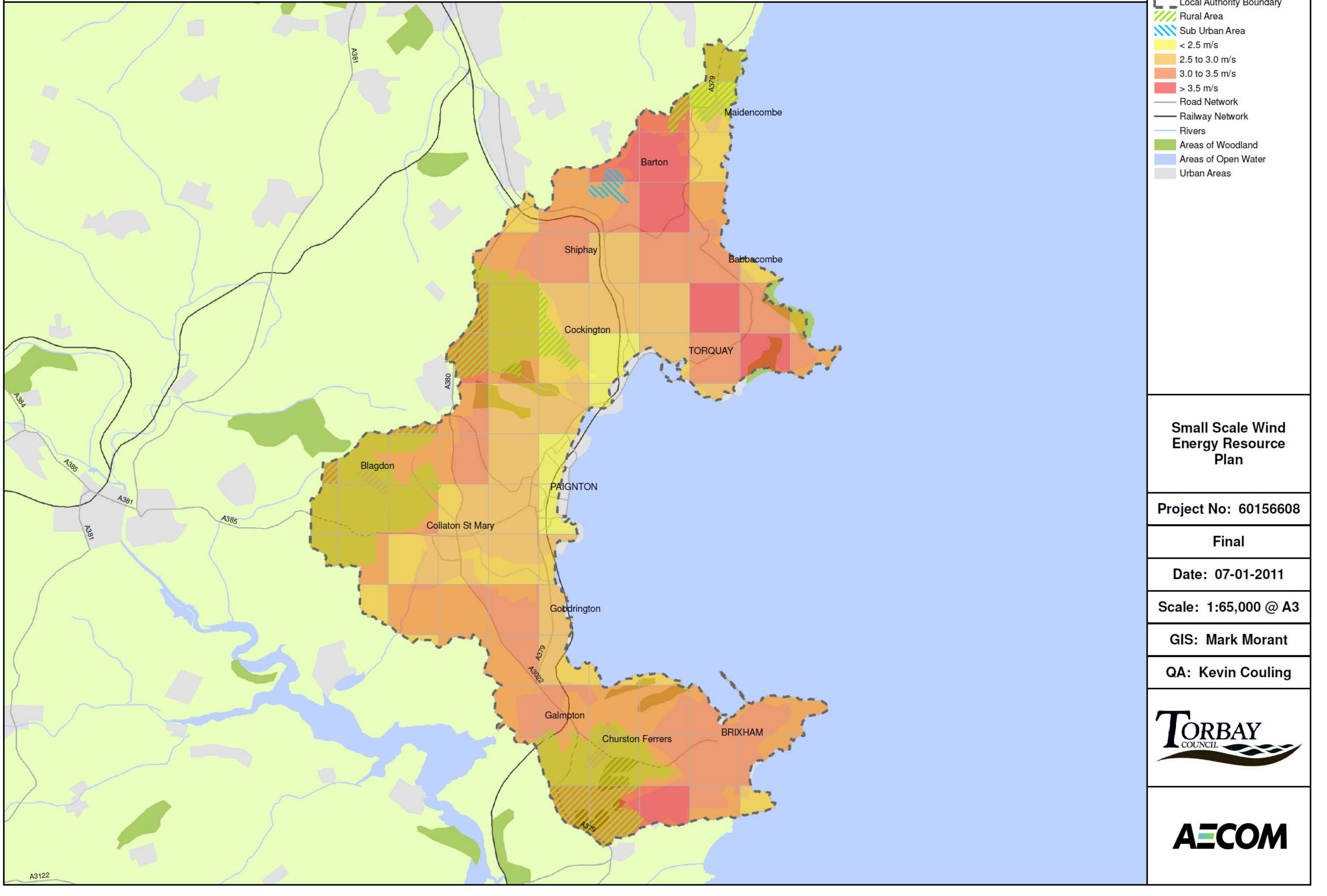

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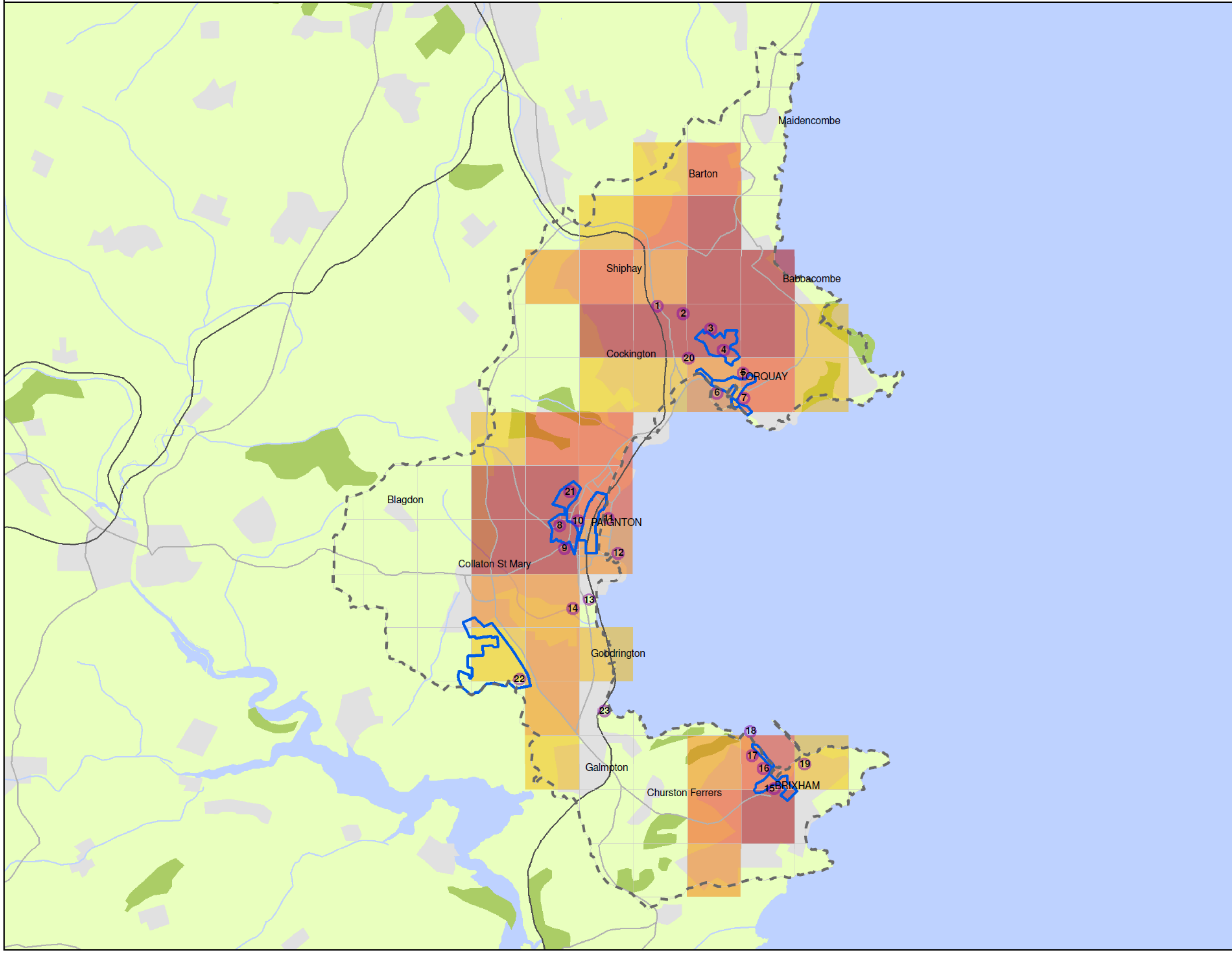


Legend

- Local Authority Boundary
- Mayors Vision Sites
- Strategic Sites
- Railway Network
- Road Network

Food Waste

- < 100 m3 CH4
- 100 to 200 m3 CH4
- 200 to 300 m3 CH4
- 300 to 400 m3 CH4
- > 400 m3 CH4
- Rivers
- Areas of Woodland

Biomass Energy Opportunities Plan [Food Waste]

Project No: 60145508

Final

Date: 29-11-2010

Scale: 1:65,000 @ A3

GIS: Mark Morant

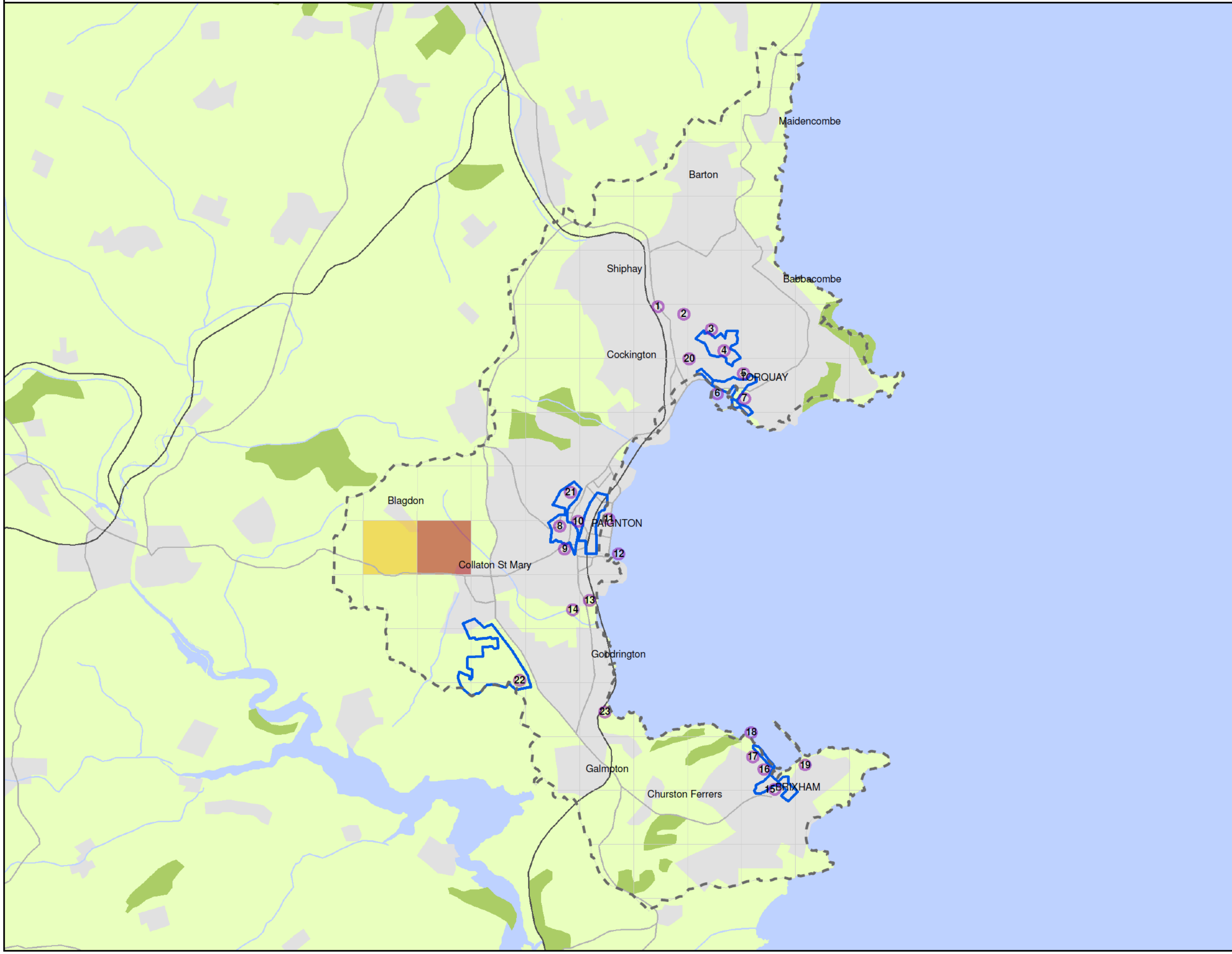
QA: Kevin Couling

TORBAY COUNCIL

AECOM

Capabilities on project:
Building Engineering

Capabilities on project:
Building Engineering



Legend

- Local Authority Boundary
- Mayors Vision Sites
- Strategic Sites
- Railway Network
- Road Network

Agricultural Waste

- < 5 m3 CH4
- 5 to 10 m3 CH4
- 10 to 25 m3 CH4
- 25 to 50 m3 CH4
- > 50 m3 CH4
- Rivers
- Areas of Woodland

Biomass Energy Opportunities Plan [Agricultural Waste]

Project No: 60145508

Final

Date: 29-11-2010

Scale: 1:65,000 @ A3

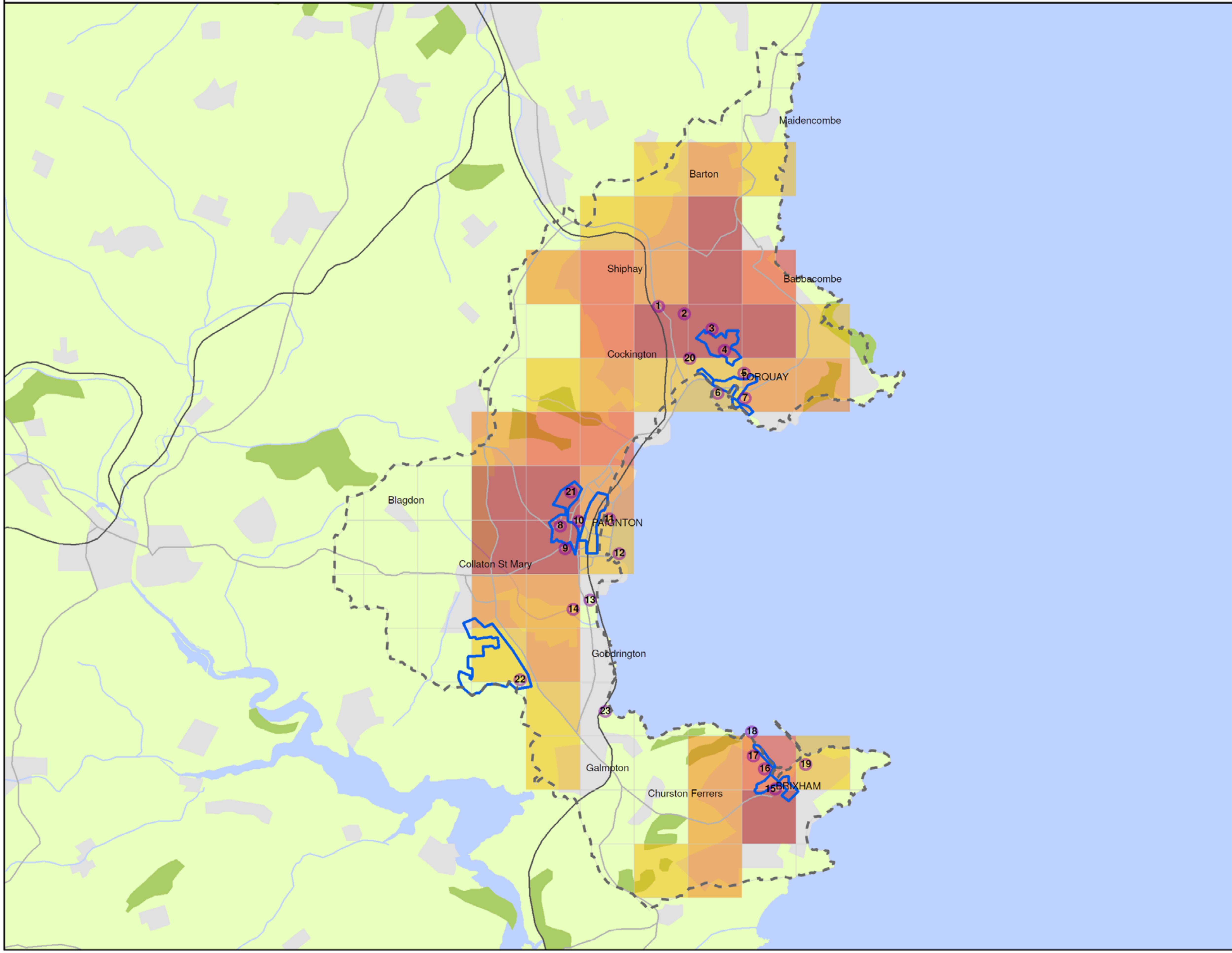
GIS: Mark Morant

QA: Kevin Couling

TORBAY COUNCIL

AECOM

Capabilities on project:
Building Engineering



Legend

- Local Authority Boundary
- Mayors Vision Sites
- Strategic Sites
- Railway Network
- Road Network

Timber

- < 50 Oven Dried Tonnes
- 50 to 100 Oven Dried Tonnes
- 100 to 150 Oven Dried Tonnes
- 150 to 200 Oven Dried Tonnes
- > 200 Oven Dried Tonnes
- Rivers
- Areas of Woodland

Biomass Energy Opportunities Plan [Timber]

Project No: 60145508

Final

Date: 26-11-2010

Scale: 1:65,000 @ A3

GIS: Mark Morant

QA: Kevin Couling

TORBAY COUNCIL

AECOM

Appendix I – Assumptions for financial modelling

This Appendix provides the assumptions used in the energy and financial modelling of the viability of DHN in the Strategic Sites. Three different technologies were considered: Gas CHP; Biomass CHP and Biomass (heat only).

Energy and carbon baseline

Energy consumption from heat use in terms of a given fuel type can be converted to carbon emissions by using the following carbon conversions, taken from the Building Regulations Part L[12]:

Fuel	CO_2 emissions $kgCO_2$/kWh delivered
Gas	0.198
Electricity (grid)	0.517
Electricity (grid displaced)	0.529
Biomass Fuel	0.028

Determining strategic sites

Benchmark Cost of Carbon Emission Compliance for Dwellings

In order to assess the viability of setting targets on strategic sites we first benchmarked the cost of compliance without any district heating. Without strategic targets it would be up to individual developers to decide how to meet the legal maximum standard for carbon emissions set out in Part L1A of the Building Regulations.

As the criteria of future amendments to Part L1A of the Building Regulations have not yet been decided, we made the following assumptions[13]:

- Energy efficiency backstops are increased in 2013 from current 2006 levels to a current 'best practice' level. This level would yield a 10% carbon emission reduction measured against current 2006 Part L1A (i.e. 10% against the 44% reduction expected in 2013)
- The overall permitted carbon emissions cap (Target Emission Rate, TER) is tightened by 25% in 2010 and 44% in 2013.
- The 2016 zero carbon definition leaves the on-site carbon compliance level as is forecast for 2013 (44% reduction on 2006 TER)
- Allowable solutions are used to reduce the residual carbon emissions from the carbon compliance level of 44% to net annual zero carbon.

We estimated that the benchmark route to compliance, based on experience in modelling, will be photovoltaic panels. Therefore we have benchmarked the on-site compliance cost to a combination of current best practice energy efficiency and PV panels.

Costing of district heating options

The cost of a district heating scheme can be divided into the:

- energy centre
    - o energy centre building
    - o LZC plant (i.e. gas CHP unit)
    - o thermal storage
    - o gas back-up boilers
- district heating network
    - o m ain backbone transferring heat from the energy centre
    - o district branches transferring heat from the backbone to development areas
    - o street branches transferring heat from the district branches to separate streets
- dwellings costs
    - o local connection to the street level district heating network
    - o a heat exchanger to take heat from the network
    - o a heat meter

We used a combination of previous quotations and modelling to arrive at a cost for the above as outlined the below.

The Energy Centre

For gas CHP and biomass heating, energy centre sizes were calculated from benchmark sizes, which are based on previous projects that AECOM has been involved with. For biomass CHP, plant sizes are estimated from existing plants in Europe. The cost of the energy centre building was estimated using a benchmark cost of £1,000/m^2 based on previous project experience. The cost of LZC plant and back-up gas boilers was based on benchmarks used in a recent report by AECOM and POYRY[14]. The above capital costs are summarised in the table below. The capital cost thermal storage was based on previous costings provided by ESCo for AECOM at £90k/MW of peak heating demand.

	Min Size (MW_{th})	Heat efficiency	Electrical efficiency	Capex/kW_e	Maintenance p/kWh_{th}	Lifespan Years
Gas boiler	0.1	85%		£60/KW_{th}		
Gas CHP	0.4	45%	30%	£864	1	15
Gas CHP	0.9	42%	32%	£864	1	15
Gas CHP	1.2	40%	35%	£657	1	15
Gas CHP	2.2	42%	38%	£657	1	15
Biomass CHP	1	50%	20%	4000	2	20
Biomass CHP	6	63%	17%	3500	2	20
Biomass CHP	29.6	63%	17%	3500	2	20
Biomass	All	80%		718/KW_{th}	0.5	20

The District Heating Network (DHN)

We estimated the length and diameter of the district heating branches for each development parcel and output area from a model. The model, which is based on previous heat main layouts, includes the following variables:

- housing mix, i.e. number flats, terrace, semi detached and detached dwellings
- density of housing

[12] Approved Document L2A, Conservation of fuel and power in new buildings other than dwellings, 2010 edition, Office of the Deputy Prime Minister.

[13] Definition of Zero Carbon Homes and Non-Domestic Buildings – *Consultation*, Communities and Local Government - Dec 2008

[14] The Potential and Costs of District Heating Networks, DECC, April 2009

- the area of the overall development parcel
- the peak load of each building
- the fraction of soft dig available (i.e. 100% on new build sites)

The overall mix of accommodation was taken from the from April 2001 census data for Torbay KS16:

- Flats (approx 27%)
- Terrace houses (approx 25%)
- Semi detached houses (approx 23%)
- Detached houses (approx 25%)

For the purpose of estimating heat demands of new developments, it was assumed that the new homes built were 100% flats in the urban areas, except for the White Rock and Yalberton greenfield strategic site, which followed the same mix as the April 2001 census data.

The floor area of new build houses was taken from the Definition of Zero Carbon Homes consultation modelling that AECOM completed for CLG.

Peak space heat loads for existing housing were used from SW Heat Map, and for new housing approximated the peak heating to 60W/m^2. For residential domestic hot water we approximated the diversified peak heat demand to 2.5kW per dwelling. We estimated new build non-residential peak loads to be 80W/m^2 of floor area.

The term 'heat main' refers to a pair of buried pre-insulated pipes, one of which carries hot water (flow) from the energy centre, the other (return) carries cooler water back to the energy centre. Between the pipes, heat loads are connected in parallel, as with radiators in a domestic central heating system.

District heat main costs are taken from previous AECOM models and take account of the cost of the pipe itself (as quoted by Logstor) and the civil cost adjusted for the fraction of soft dig. This adjustment is intended to take account of the difference between removing and re-instating roads vs. new build soft dig.

The backbone diameter was based on the peak heat demand figures outlined above and a 30ºC difference between flow and return temperature, and a maximum flow rate of 1.5 m/s.

Dwelling Costs

An allowance per dwelling connection was included for connection to the heat main including; a small spur of heat main to reach the street main, the heat exchanger and heat meter.

The cost for a new build dwelling was assumed to be £1,800 based on the following figure, taken from work AECOM completed for CLG.

Connection to dwelling	£400
Heat exchanger	£1,200
Heat meter	£200
Installation	£500
Total connection cost	£2,300

For existing owner occupied dwellings the assumption around uptake rate (see next section) relies on the householder paying for connection to the value of a new condensing gas boiler. Therefore, the total connection cost would be £1,500. A larger heat exchanger is assumed in line with the higher peak heat load for an existing dwelling. Cost data is taken from figures used in a previous study by AECOM and POYRY[15].

Connection to dwelling	£400
Heat exchanger	£1,600
Heat meter	£700
Contribution from householder:	-£1200
Total connection cost	£1,500

For existing social dwellings the avoided gas boiler was not deducted from the cost of connection as in most cases the dwellings will not immediately need to have their boilers replaced. This is thought to be a conservative assumption with regards to capital cost, as some dwellings may need new boilers at present to meet Decent Homes Standard. A larger heat exchanger is assumed in line with the higher peak heat load for an existing dwelling. Cost data is as above.

Connection to dwelling	£400
Heat exchanger	£1,600
Heat meter	£700
Total connection cost	£2,700

Cash flow modelling

The cashflow modelling exercise informs the viability of a strategic option with regard to financial performance. We made general assumptions about district heating performance and economics and specific assumptions around each LZC energy technology. These are set out below.

General assumptions

Timeframe

A 30 year timeframe was modelled as this should represent a conservative district heating infrastructure lifespan.

Uptake rate

We assumed that all new buildings connect to the district heating system as they are built and that this would be required by policy.

For existing non residential buildings and social dwellings we assumed connection occurs at a date chosen for the specific option. For owner occupied dwellings we assumed that connection only occurs in dwellings that require a new boiler, to a maximum of 75% of the total number of dwellings. We estimated that domestic boilers require replacement every 15 years, giving an uptake rate of 6.7% per year.

15 The Potential and Costs of District Heating Networks – DECC – April 2009

District Heating Network Build Out

District networks and street networks, and the backbone for new build residential is assumed to be built out as required. The backbone for existing buildings is assumed to be built out to the final length at the start year for existing building connection. This follows the assumption that the first buildings connected may not be adjacent.

Heat Load at the Energy Centre and Lead Boiler Sizing

We calculated the heat load at the energy centre with an assumed distribution efficiency of 94%. We sized the lead LZC boiler plant to meet 90% of the annual heat load operating at a 50% capacity factor i.e. 50% of its maximum possible annual output.

Energy Costs and Sale Prices

The cost and selling price of fuels was taken from figures used in a previous study by AECOM and POYRY[16], which were supplied by DECC. The selling price of heat to domestic customers is based on a survey of duel fuel online tariffs with no standing charges. The selling price of heat to non-domestic customers is based on the commercial gas cost and an assumed gas boiler efficiency of 85%. These are given in the table below:

	Cost p/kWh	Note
Gas cost to commercial customer	2	From DECC
Electricity cost to commercial customer	8.48	From DECC
Wood chip cost to commercial customer	2	From DECC
Wholesale electricity price	5	From DECC
Heat cost to residential customer	5.25	From survey of online tariffs
Heat cost to commercial customer	3.2	From commercial gas cost
CCL on gas to commercial customer	0.16	

Incentives and additional payments

We assumed that a standing charge for heat to domestic customers was £100/ dwelling/year in line with an annual boiler service charge. Incentives considered are the Renewables Obligation (RO), the Feed in Tariff (FIT) and the Renewable Heat Incentive (RHI). The value of one ROC was taken at £43 / MWh[17], double ROCs were assumed to be allowed for biomass CHP[18], which assumes it is fuelled by biomass only.

The value of Climate Change Levy exemption certificates was taken at £4.70 / MWh[19].

[16] The Potential and Costs of District Heating Networks – DECC – April 2009
[17] http://www.berr.gov.uk/energy/sources/renewables/policy/renewables-obligation/microgeneration/page39851.html
[18] http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/explained/microgen/strategy/green_cert/green_cert.aspx

A one-off charge of £500 has been assumed to be charged to the developer on connection to the district heating system in lieu of the charge that would be made by an utility for gas connection.

Capital Cost Assumptions

We assumed that the capital cost for the energy centre building, thermal storage and gas boilers to meet initial peak demands would be incurred in year zero. The capital cost for heat mains are assumed to be incurred as the heat mains are built out, see above. For lead LZC plant capital costs we assumed that the plant would be installed when there was sufficient heat load to operate the plant at a 30% capacity factor. For energy from waste the plant is assumed to be installed over year zero and one.

Operating Cost Assumptions

We have assumed that the operating costs of an energy centre are as follows:

Lead LZC energy unit O&M	taken from the AECOM and POYRY report[20]
Pumping electricity	1kW/1MWh of delivered heat at commercial electricity rates
Fuel for the Lead LZC energy unit	as per specific technology
Fuel for the backup gas boilers	at commercial gas rates
Meter Reading	At fixed cost of £60k per year per customer
Insurance	at 1% of network capital cost
Design costs	£50K

Discount Factors

We have used two different discount factors (DF) to compare different 30-year Net Present Values (NPVs):

- 6%: this represents a discount factor which is more likely to be acceptable to the public sector who may take a longer view on projects than private investors;
- 12%: this represents a discount factor which is more likely to be acceptable to private sector investment.

Revenue Assumptions

Heat is assumed to be sold to the connected buildings at rates stated above.

Electricity from CHP options is assumed to be sold at wholesale rates (i.e. no private wire).

Gas CHP

We calculated that total installed capacity of gas CHP as described above, assuming that 90% of the total annual load is met at a 50% capacity factor. Because it may take a prohibitive amount of time for sufficient buildings to connect to the system to run this capacity of

[19] http://www.ofgem.gov.uk/Sustainability/Environment/cclrenexem/Pages/CCLRenewablesExemption.aspx
[20] The Potential and Costs of District Heating Networks – DECC – April 2009

Appendix J – LZC Technologies for Development Typologies

CHP effectively, we assumed a number of smaller installations. We assumed two installations where the total capacity required was greater than 2MWth, assuming that installing units less than 1MWth would not be preferable. Each unit was assumed to be installed, as outlined above, when the heat load has built sufficiently.

<u>Biomass CHP</u>

This Appendix provides a summary table for the different LZC technologies covered in this Sustainable Energy Assessment and indicates which technologies would be more appropriate for a variety of development typologies according to size, type of development and other considerations. This is presented in a summary table which can be used across Torbay.

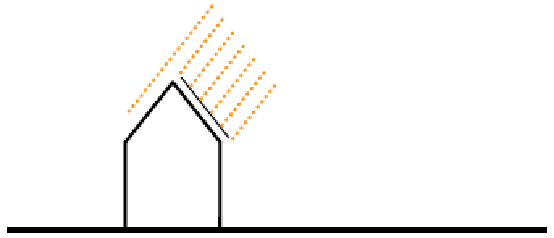
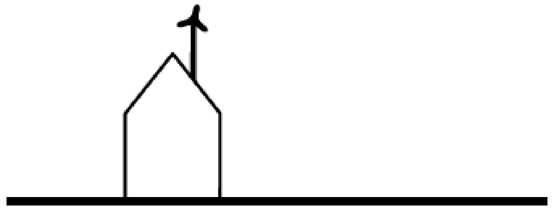
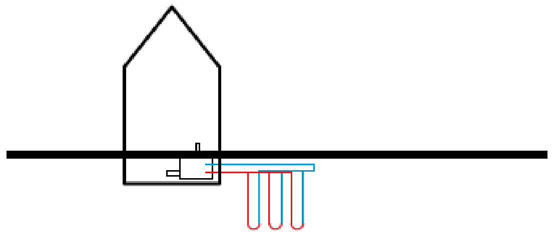
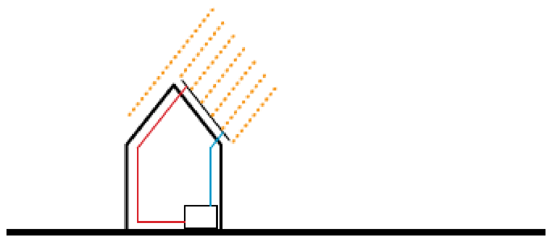
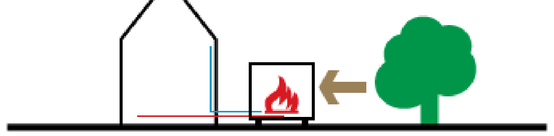
This Appendix also provides a typology example which is particularly relevant in Torbay, which is the refurbishment and conversion of derelict Hotels to residential accommodation. This Appendix provides high-level guidance on technologies to consider for such examples.

Biomass CHP total installed capacity was calculated as for other technologies described above. We assumed two installations where the total capacity required was greater than 3.4MWth, assuming that installing units less than 2MWth would not be preferable. Each unit was assumed to be installed, as outlined above, when the heat load has built sufficiently.

<u>Biomass (Heat only)</u>

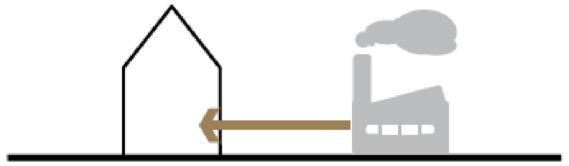
Biomass boilers were assumed to be installed in two instalments as above, or one instalment if the size would be below 250kW.

Capabilities on project:
Building Engineering

	DESCRIPTION:	SOURCE:	SCALE:	LANDTAKE / ENERGY:	ENERGY TYPE:
 PHOTOVOLTAICS	PANELS CONVERT LIGHT ENERGY TO ELECTRICITY. THEY CAN BE POSITIONED ON A SOUTH-FACING ROOF OR AS STAND-ALONE INSTALLATIONS.	SUN	BUILDING INTEGRATED	4M X 9M PANEL AREA = 1 HOUSE (4m, 9m)	ELECTRIC
 MICRO-WIND	SMALL-SCALE WIND TURBINES CAN SUPPLY ELECTRICITY DIRECTLY TO HOMES OR CONNECT TO THE GRID. CAREFUL SITING IS NEEDED TO ENSURE TURBULENCE FROM STRUCTURES DOESN'T AFFECT EFFICIENCY.	WIND	BUILDING INTEGRATED	1 X 5KW RATING = 1 HOUSE (5kw)	ELECTRIC
 GROUND SOURCE	GROUND SOURCE HEAT PUMPS USE THE LATENT HEAT IN THE GROUND TO INCREASE THE EFFICIENCY OF ELECTRIC HEATING. PIPEWORK CAN BE LAID HORIZONTALLY OR VERTICALLY IN THE GROUND.	GROUND	BUILDING & OPEN SPACE	10M X 10M AREA = 1 HOUSE (10m, 10m)	HOTWATER, HEATING
 SOLAR HOT WATER	SOLAR THERMAL PANELS USE HEAT FROM THE SUN TO HEAT WATER FOR USE INSIDE THE HOME. THEY SHOULD BE PLACED ON A SOUTH FACING ROOF AND ANGLED TO HARNESS THE SUN PATH.	SUN	BUILDING INTEGRATED	4M X 9M PANEL AREA = 1 HOUSE (2m, 2m)	HOTWATER
 BIOMASS HEATING	BIOMASS OR ORGANIC MATERIAL SUCH AS WOOD PELLETS CAN BE UTILISED AS A RENEWABLE RESOURCE TO PROVIDE HEATING. CAN BE USED IN COMMUNAL HEATING SYSTEMS OR INDIVIDUAL BUILDING SYSTEMS.	BIOMASS	BUILDING INTEGRATED	SMALL WOOD STOVE = 1 HOUSE	HOTWATER, HEATING

Capabilities on project:
Building Engineering

CHP

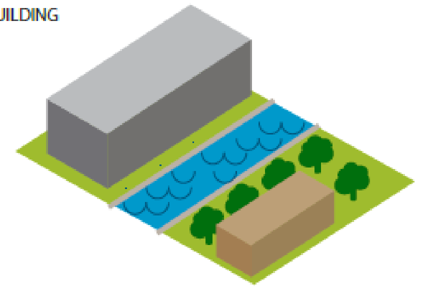


COMBINED HEAT AND POWER PLANTS PRODUCE ELECTRICITY WHILE CAPTURING PROCESS HEAT TO DISTRIBUTE TO HOMES VIA A HEAT NETWORK. MINIMUM HOUSE NUMBERS, MIX AND DENSITY ARE NEEDED

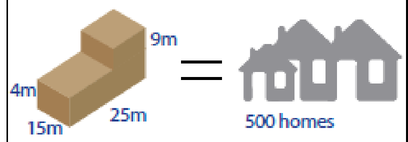
BIOMASS

GAS

NEW SITE BUILDING



1 GAS CHP = 500 HOUSES

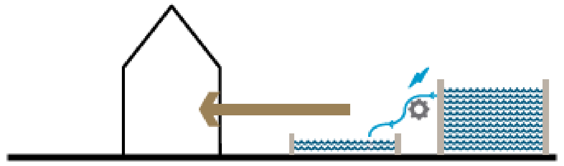


HOTWATER

HEATING

ELECTRIC

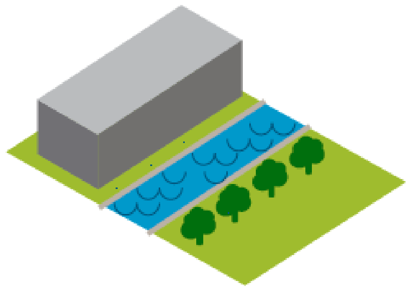
HYDRO-POWER



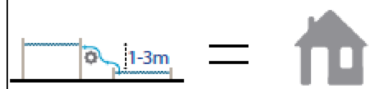
SMALL SCALE HYDRO-POWER CAN BE USED ON RIVERS OF STREAMS NEARBY TO SUPPLY ELECTRICITY TO DEVELOP-MENTS. SUFFICIENT CHANGE IN HEIGHT AND WATER FLOW IS NEEDED.

WATER

RIVER OR STREAM

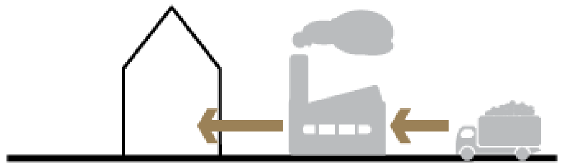


3KW RATED HYDRO = 1 HOUSE



ELECTRIC

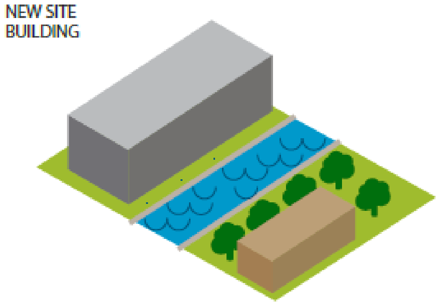
ENERGY FROM WASTE



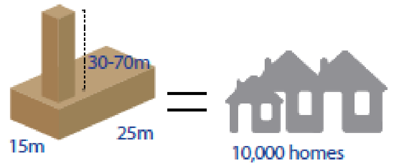
CERTAIN TYPES OF WASTE CAN BE UTILISED TO GENERATE BOTH ELECTRICITY AND HEAT. HEAT CAN BE DISTRIBUTED THROUGH ASITE-WIDE HEAT NETWORK.

WASTE

NEW SITE BUILDING



1 TREATMENT FACILITY = 10,000 HOUSES

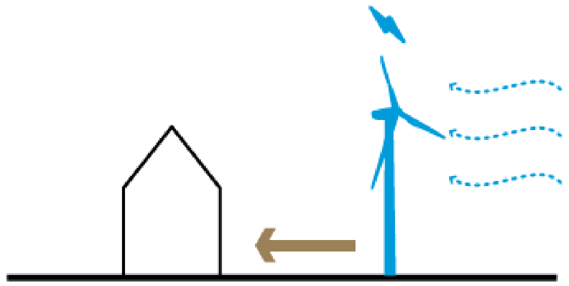


HOTWATER

HEATING

ELECTRIC

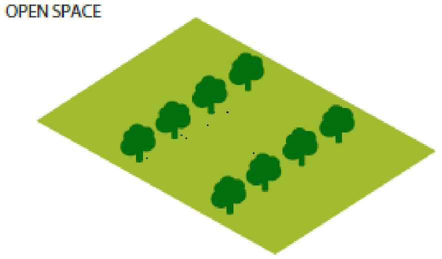
LARGE SCALE WIND



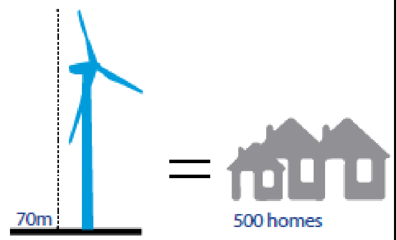
LARGE WIND TURBINES HARNESS THE WIND TO PRODUCE ELECTRICITY. CAN BE DIRECTLY CONNECTED TO DEVELOP-MENT OR TO THE GRID. BUFFER DISTANCES NEEDED FROM HOUSES AND SENSITIVE HABITAT.

WIND

OPEN SPACE



1MW RATING = 500 HOUSES



ELECTRIC

Appendix K – Supporting implementation

Introduction

This Appendix provides guidance for Development Management officers specifically around the measures they might expect of developers addressing energy efficiency and Low and Zero Carbon technologies (LZCs). By providing this information and signposting to sources of additional guidance, it is anticipated that the capacity of the Council as a whole to implement their planning objectives will be enhanced. It may also be worthwhile looking at existing training packages which are aimed at building the capacity of the Council to develop and implement planning policy around sustainable energy.

Development Management officers should be encouraged to read the full report to understand the context of the guidance given here and the background to the likely direction of planning policy within Torbay.

Energy efficiency in new buildings

In assessing the heat demand of future developments, the report and subsequent policy recommendations make assumptions on the level of fabric energy efficiency that is designed into the building as this will affect the space heating demands.

As discussed in Chapter 2, the debate on how far can we take the building fabric energy efficiency has been consulted on thoroughly and a new Standard for Fabric Energy Efficiency was recommended in a report dated November 2009[21] by the Zero Carbon Hub Task Group. This standard focuses on the fabric of the building, to secure long lasting benefit for home owners and occupiers, and to make sure that energy efficiency plays a proportionate part in the ultimate delivery of zero carbon homes and buildings. The research considered not only the potential energy savings from the measures but also the buildability at mainstream delivery scale; occupant health and wellbeing and desirability of the homes.

Although this research is targeted at new homes only, similar principles can be applied to new non-domestic buildings and Torbay Council should seek to refer to latest guidance related to non-domestic as it is published over the next 3-5 years.

This chapter seeks to highlight the key findings from the new Standard, to enable Torbay Council to assess if new developments have maximised the energy efficiency opportunities, without being unreasonably onerous on the developer.

The levels of energy efficiency tested

A selection of design specifications were developed as part of the Standard based on four well known energy efficiency standards. These were AECB Silver Standard, EST Best Practice Energy Efficiency (BPEE) Standard, EST Advanced Practice Energy Efficiency (APEE) Standard and Passivhaus, as illustrated in Figure 1.

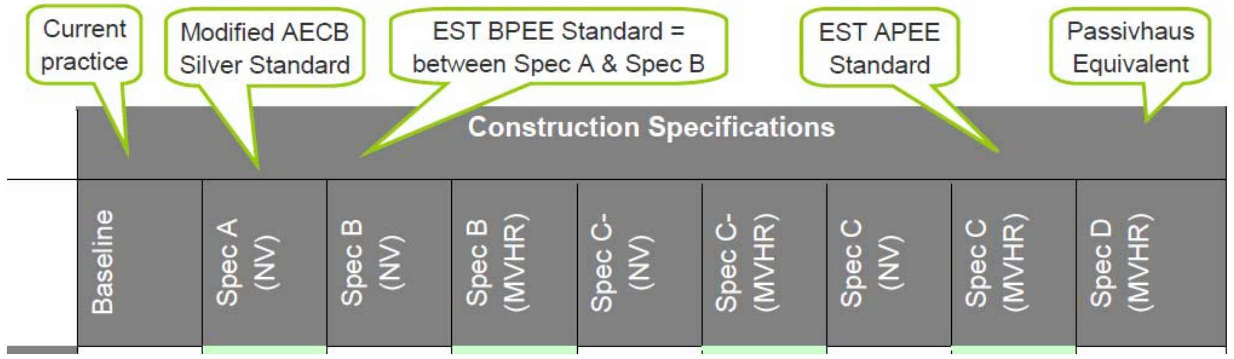


Figure 1: The construction specifications compared to current industry recognised standards (source: ZCH Defining a Fabric Energy Efficiency Standard)

Each of these standards set out the specifications for the different construction elements covering:

- U-values (W/m^{2}K)
    - Wall
    - Floor
    - Roof
    - Windows
    - Doors
- Air Permeability (m^3/hr/m^2)
- Thermal Bridging (W/m^{2}K)
- Ventilation: Either Natural Ventilation with extract fans or Mechanical Ventilation with Heat Recovery (MVHR).

The Standard also provides examples of how the different specifications can be met by different construction sections illustrating that there were many different ways of achieving the specification with different construction details.

The recommended levels of energy efficiency

The recommended standard is a measurement of space heating demand (kWh/m^2/yr), rather than requiring a certain specification. This aims to allow design flexibility and to take account of the building form. For example a flat with BPEE will have a lower space heating demand per m^2 than a detached house with BPEE. This is due to the increase area of exposed wall and hence heat losses from the building. To take this into account, the standard specifies that a lower target for the energy efficiency standard is set for flats, than detached houses, as illustrated in Figure 2.

[21] Defining A Fabric Energy Efficiency Standard, November 2009, http://www.zerocarbonhub.org/resourcefiles/ZCH-Defining-A-Fabric-Energy-Efficiency-Standard-Task-Group-Recommendations.pdf

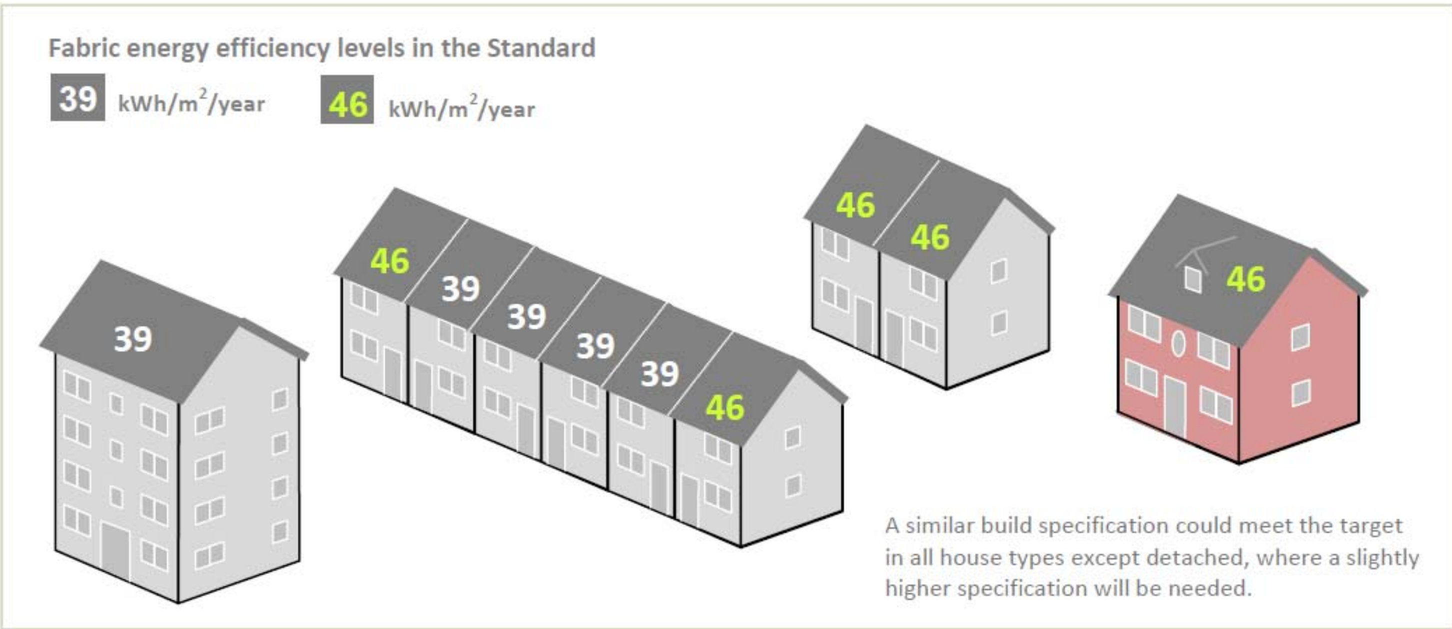


Figure 2 Target energy demand levels for main dwelling types.

These energy efficiency levels were tested using the different specifications on different types of buildings as shown in Figure 3.

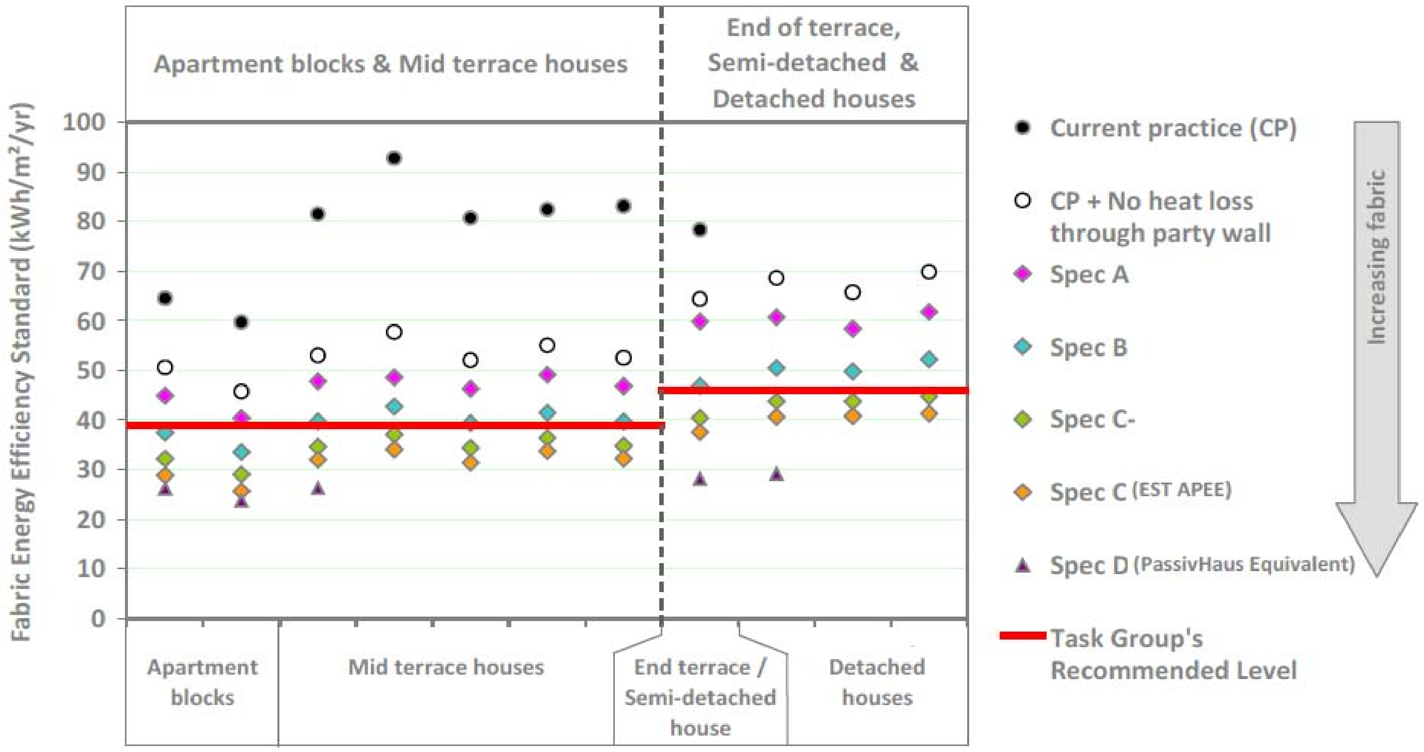


Figure 3: Recommended level compared to the different construction specifications tested

Other Energy efficiency measures

In addition to the fabric of the building, energy efficiency in building design can be demonstrated in the following key principles:

- Reducing solar gains: this is important in buildings with high internal heat gains such as offices, as it can reduce their cooling demand in the summer.
- Building layout and massing: choice of use of rooms within the buildings can have an impact on energy use, and rooms with a high internal heat gains should be located away from areas with high solar gains. For example, locating rooms, such as a data centre with high density of equipment, or lecture theatre with a high density of people, away from south facing areas.
- Lighting Controls: This can not only reduce electricity usage but also reduce internal heat gains and subsequent cooling demand.
- Energy efficient lifts: with a high density growth option in Torbay, there could be more tall buildings which require lifts. Lift design should be encouraged to be as low energy as possible.
- Energy efficient appliances: As unregulated emissions are included in the definition of a zero carbon building, attention should be paid to the small power and fixed appliances in a building such as the washing machines, fridges, computing equipment etc.
- Metering and Monitoring: Designing for metering and monitoring of building energy can help reduce energy in the future and should be encouraged on all new buildings.

Energy efficiency can also be practiced in occupant behaviour and building energy management, and these can be influenced by engaging with the building occupants and owners themselves rather than the developers of the building.

Low and Zero carbon Technologies

This chapter provides a summary of the different Low and Zero Carbon (LZC) technologies which were considered in this study and how they relate to the Energy Opportunities Plans developed as an output of the work. Appendix J summarises these LZCs in terms of typologies for different development sizes and types. This typology table can then be used to provide early-stage assessment of which technologies could be suitable for a proposed development.

Solar Photovoltaics (PV)

Solar PV has high capital cost but can create a revenue stream using the Feed-in-tariff (FIT). This is increasing the uptake of the technology particularly as it is easy to retrofit and integrate into new buildings. It is technically feasible in most south facing, un-shaded locations and has few specific constraints. It is therefore not mapped on the EOP, but is considered as an important element in the overall strategy for Torbay.

Large installations of solar PV, typically at ground level, are called Solar PV Farms, or Parks. Such installations have been implemented across Germany, Spain and other countries in continental Europe, and now, with the introduction of Feed-in-tariffs, have become more attractive in the UK. General principles for site selection that would be used to identify sites in Torbay are:

- Land that has not been designated with national environmental importance e.g. AONB's;
- Land which is not currently utilised for food crops;
- Unshaded from the south e.g. on a south facing sloped land, or flat land with no tall obstructions to the south of the site including trees;
- Large areas. Typically, a solar farm would be between 20-50 acres for a profitable scheme;
- Areas of low visual impact;

- Access to site for delivering equipment.

Solar Hot Water (SHW)

It is currently understood that Solar Hot Water (SHW) will benefit from any Renewable Heat Incentive (RHI) scheme which may be forthcoming which will bring down the costs of this technology. SHW is relatively easy to retrofit, and integrate into new buildings and is technically feasible in most south facing, un-shaded locations. This technology has no specific constraints and is therefore not mapped on the EOP.

Hydro

The Environment Agency report on Hydro opportunities[22] in the SW identifies only a couple of sites within Torbay, each with a capacity of less than 10kW. These have been included in the energy mapping exercise. In addition, there are preliminary proposals to install a hydro scheme near Brokenbury, which is a private project and not included in the EOP.

Wind

Wind turbines are assessed at three scales:

- Micro and building integrated
- Small
- Medium to large

Micro and building integrated turbines have minimal spatial constraints as these can be installed in more buildings with little issues of noise or sightlines. The main constraint for small scale wind is the area in which it is to be installed i.e. urban, suburban and rural. This is due to the affects of obstacles (such as buildings and trees) which affect both wind speed and turbulence both of which greatly affect the output of the turbine. Finally, medium to large scale wind is typically constrained by factors such as occupied buildings, roads, airfields and so on.

Wind also benefits from the FiT for system sizes less than 5MW.

Biomass

The biomass study from Regen SW was expected to be issued at the end of July 2010, however this was significantly delayed and was only issued in November 2010. Despite this delay, results of the study are provided for Torbay in this report. The EOPs for biomass indicate resources of food waste, agricultural waste and woody biomass.

Biomass technology can be utilised in most developments with sufficient heat load, access and fuel storage. Access and fuel storage space must be assessed in each individual case and therefore biomass is only considered where there is sufficient heat load. Further investigation would need to be carried out in any case where biomass was recommended to assess suitability for vehicular access and fuel storage.

Large-scale biomass boilers can also provide heat to a district heating network. This could be an efficient solution to space and delivery issues as there is one central energy centre for a district. This energy centre could house additional top-up gas boilers for peak demands. In this study, a biomass heat option is modelled for the strategic sites with good heat demands to assess financial viability.

[22] Mapping Hydropower Opportunities and Sensitivities in England and Wales: Technical Report - Final Report, February 2010, Environment Agency.

Heat pumps (air source heat pumps, ground source heat pumps)

The SQW DECC Methodology includes heat pumps (air and ground source) under micro generation because heat pumps are typically installed as part of a building development, and therefore the constraints mapping is related to the building constraints rather any at a higher level.

Ground source heat pumps (GSHP) extract the heat stored in the ground to provide space and water heating, using electricity in the process to power the pump. Generally, GSHP is more suitable for suburban and rural areas where there is more space to install boreholes. They are particularly suitable and economically viable in areas with no mains gas supply.

Air source heat pumps (ASHP) are generally installed on a building by building basis and there are no existing schemes of community ASHP. The constraints to technical feasibility for ASHP's are building related and therefore cannot be mapped at any higher level.

Sea water-source heat pumps (sea-WSHP) may be suitable for developments along the coast and there are examples across the UK of successful schemes for example the Bristol Harbour Project[23]. Sea water is used as the heat source, and is mainly used for medium to large heat pump installations. At a depth of 25-50 metres, the sea temperature is typically constant (5-8°C), and ice formation is generally not an issue (freezing point -1°C to -2°C). Both direct expansion systems and brine systems can be used. It is important to use corrosion-resistant heat exchangers and pumps and to minimise organic fouling in sea water pipelines, heat exchangers and evaporators, etc.[24] Constraints for sea-WSHP are to be located adjacent to accessible coast and therefore could be feasible for a range of coast side developments in Torbay. In order to deliver a strategic and effective system, the sea-WSHP could be integrated into a wider district heat network. This would maximise the utilisation of such a system and avoid ad hoc installations across Torbay. For this study, an example of a sea-WSHP is included for the coast-side strategic sites Brixham and Harbourside.

Combined Heat and Power (CHP) District Heating (Gas, Biomass, Energy from Waste)

District heating to utilise waste heat from electricity generation is widely recognised as a low carbon technology. This technology is called Combined Heat and Power (CHP) and can utilise different fuel sources such as natural gas, biomass, fuel cell and waste incineration.

CHP is technically feasible for areas with a constant and high heat demand which minimises the CHP running at part load. The financial viability of a CHP scheme is increased in areas with a high heat density, i.e. ensuring that the heat demands are in close proximity to the energy centre. Therefore, in the Sustainable Energy Assessment for Torbay, CHP district heating networks (DHN) are only assessed for areas of sufficient heat density, based on detailed heat mapping. This heat mapping ensures that existing and future heat demands are spatially mapped over time, to more accurately assess whether a CHP DHN could be viable.

Incinerating waste to generate heat and power (Energy from Waste or EfW) has also been successfully demonstrated across the UK, for example the Veolia scheme in Sheffield. In Torbay, the council confirmed that currently all municipal solid waste (MSW) is taken out of the district for recycling and landfill, and that there are advanced plans to develop a sub-regional Energy from waste plant outside of Torbay which, if commissioned, will take all future residual MSW up until 2039. Therefore EfW is not assessed as part of this Sustainable Energy Assessment.

[23] http://www.buildingdesign-news.co.uk/2010/19-Cooltherm-Cooling-system-Chiller-installation-System-cooling-Water-chillers-News-100510.asp
[24] http://www.heatpumpcentre.org/en/aboutheatpumps/heatsources/Sidor/default.aspx

Marine Energy (Wave, Tidal, Tidal Current)

The study carried out by South West RDA[25] shows that there is limited potential for marine energy in the Torbay area. In addition, the SW RDA Marine Energy Brochure illustrates there is <20kW/m capacity in the area and there are no identified tidal resources nearby.

Figure 4 Map from SW RDA Marine Energy Study

Further guidance

For further guidance, reference should be made to the South West Planners Toolkit where there are a series of pages specifically aimed at Development Management officers: http://www.regensw.co.uk/climate-change-pps/development-management; the toolkit provides advice on the following topics:

- Information in applications
- Assessing applications
- Feasibility
- Viability
- Planning conditions and enforcement
- Monitoring and reviewing

Plus a series of checklist to help officers understand key elements which should be included in an application.

[25] http://www.renewables-atlas.info/

Capabilities on project:
Building Engineering