AECOM

# Camborne, Pool, Illogan and Redruth Sustainable Energy Strategy

**Camborne, Pool, Illogan and Redruth Area Action Plan 2006 – 2026**

Cornwall Council LDF Evidence Base Document

September 2009

CORNWALL DEVELOPMENT COMPANY

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CORNWALL COUNCIL

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| Rev No | Comments | Prepared by | Approved by | Date |
|---|---|---|---|---|
| | Draft for comment | EE,JT,KC | SQW | 16/07/09 |
| 1 | Final | KC | SQW | 05/09/09 |
| 2 | Final Version 2 | JT | | 13/10/09 |

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Job No Reference Date Created **Error! Reference source not found.**



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## 1.1 Introduction

Cornwall Council (the Council or CC), in developing an Area Action Plan for the Camborne, Pool, Illogan and Redruth (CPIR) area, wished to explore how to assist new development to meet the national Building Regulations timetable. They also wished to explore the viability of setting energy or carbon targets and policy requirements that exceed, or come into effect faster than the proposed changes in national Building Regulations.

AECOM was commissioned by the Council to undertake work to establish a sufficiently robust evidence base to support the development of policies which met this stated objective. The work included a detailed technical analysis of the current and future energy demands of the CPIR area, the identification of strategic opportunities where implementing such policies might be possible, the testing of the financial viability of these opportunities and the production of guidance with respect to suitable policy to support their implementation. This report sets out the approach, procedure and findings of the CPIR Energy Strategy Study carried out by AECOM.

## 1.2 Background

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, also have a responsibility to deal with climate change through measures of mitigation and adaptation. For the Council there is a clear framework throughout national policy aimed at mitigating the effects of climate change. It provides for the 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 challenging targets are set out in the *UK Low Carbon Transition Plan*[1], 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. It is probable that the *Low Carbon Transition Plan* will, over the CPIR plan period, result in increasingly demanding targets.

## 1.3 Outcomes

There are three principal outcomes from the study. Firstly, it is expected that by establishing the policies suggested by the report the Council can effectively set targets ahead of Building Regulations within Strategic District Heating Areas (SDHAs). By identifying and enabling these SDHAs (principally, this will be by provision of District Heating Networks - DHNs), costs associated with achieving high levels of carbon compliance, especially after 2016, will be reduced. As a result, it is hoped that CPIR could become more attractive in itself to developers and possibly more attractive than areas without such progressive policies.

Secondly, and perhaps as more of a beneficial consequence than as a direct result of the policies, the Council should be able to make in-roads to the difficult territory of addressing emissions from existing housing stock.

Finally, movement toward these principles may allow the Council to explore the revenue and regeneration potential of decentralised energy production.

## 1.4 Approach

A summary of the approach taken is as follows:

- An exercise to understand the baseline energy demand within the CPIR area was undertaken to establish a starting point for further analysis.
- A series of heat maps were created, based on the baselining work, which provide a spatial representation of the demand for heat in the CPIR area. Along with assumptions made regarding the energy demands of proposed new development, the maps facilitated the identification of several strategic opportunities for the use of community energy to serve selected clusters of existing and future development. These areas have been characterised as Strategic District Heating Areas (SDHAs). A number of these maps form the Energy Opportunities Plan.
- A financial analysis comparing the costs associated with the implementation of a District Heating Network (DHN) within the SDHA with other methods of complying with $CO_2$ targets was then carried out for each SDHA and for a number of suitable technologies.
- An assessment for the potential of large scale wind power in the CPIR area
- Policy recommendations were then developed.

## 1.5 Results

A brief summary of the results of each stage are provided below.

*Baselining*

The following table sets out the aggregated energy totals for the entire CPIR area. The existing development figure is based on estimated current demand and future development is based on predicted demand in 2026 (i.e. all development included) with no DHNs in place.

| CPIR area energy and carbon baselines | | | |
|---|---|---|---|
| Year | Heat (MWh) | Electricity (MWh) | $CO_2$ (Tonnes) |
| 2009 | 381,085 | 159,927 | 128,643 |
| 2026 | 397,488 | 179,995 | 148,482 |

*Mapping*

The results of this element of the project are a series of maps which, when taken as a whole, effectively form the Energy Opportunities Plan.

The plan is a key part of the evidence base and spatially represents the various opportunities to establish district scale energy generation in the CPIR area by highlighting the Strategic District Heating Areas and associated points of interest (such as anchor loads and so on).

*SDHAs*

A number of SDHAs were identified as a result of the analysis undertaken. These are shown in the table below.

| SDHA Name |
|---|
| Camborne West SDHA |
| Camborne Central SDHA |
| Pool Community pilot ESCO |
| Pool EfW SDHA |
| Redruth SDHA |

The majority of the SDHAs have been modelled as 'core' and 'extended' options each of which include a mixture of new residential and non-residential development and existing heat loads including significant anchor loads (such as; colleges and occasionally existing dwellings). The exception to this is the Pool Community ESCo scheme which is only modelled as a core option to

[1] The plan can be found at http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx

reflect the existing proposals being progressed by the Council, plus additional development proposals emerging in the area. Note that this option takes in the same development parcels and existing development as the Pool EfW Core option.

*Wind power assessment*

The analysis showed that, based on the assumptions used, there were a total of 11 unconstrained areas. All of these sites have an annual average wind speed over 6.5 m/s at 45m above ground level. Only two of these are directly within the CPIR action plan area and are small sites, and the remainder are outside of, but in close proximity to, the study area. The main constraints within the CPIR area are due to the separation distances required from roads, the railway and existing dwellings. Removing the buffers around any new build development parcels did not show up any additional unconstrained areas.

## 1.6 Financial analysis of SDHAs

The financial analysis of a number of technologies in each of the SDHAs was carried out. A summary of the results of the financial analysis is shown in the table below. All schemes that have an IRR of 6% or higher are potentially financially viable, as this is a typical rate of return for public/private projects (such as PFI). Most of the schemes shown achieve this with one or more technology options, assuming the use of an allowable solutions fund. Biomass heating performs more favourably than gas CHP due to the assumed value of the Renewable Heat Incentive. Energy from Waste (EfW) performs most favourably, due to the revenue from gate fees.

*Table: summary of financial analysis of technology options for SDHAs*

| Estimated Carbon Savings from SDHA Options | Carbon Saving (tonnes) | Carbon Saving (% of 2026 baseline) | IRR |
|---|---|---|---|
| Option 2a Camborne West - core option | | | |
| Gas CHP | 1,610 | 1% | 3% |
| Biomass Heat | 1,273 | 1% | 7% |
| Option 2b Camborne West - extended option | | | |
| Gas CHP | 1,744 | 1% | 2% |
| Biomass Heat | 1,722 | 1% | 7% |
| Option 3a Camborne Central - core option | | | |
| Gas CHP | 1,492 | 1% | 1% |
| Biomass Heat | 1,192 | 1% | 5% |
| Option 3b Camborne Central - extended option | | | |
| Gas CHP | 3,754 | 3% | 3% |
| Biomass Heat | 3,018 | 2% | 6% |
| Option 4a Pool Community Pilot ESCo - lower RSS housing figure | | | |
| Gas CHP | 6,102 | 4% | 2% |
| Biomass Heat | 4,032 | 3% | 5% |
| Biomass CHP | 9,215 | 6% | 5% |
| Option 4a Pool Community Pilot ESCo - higher RSS housing figure | | | |
| Gas CHP | 7,119 | 5% | 3% |
| Biomass Heat | 4,703 | 3% | 6% |
| Biomass CHP | 10,752 | 7% | 5% |
| Option 5a Pool EfW - core option - lower RSS housing figure | | | |
| Energy from Waste | 6,910 | 5% | 13% |
| Option 5a Pool EfW - core option - higher RSS housing figure | | | |
| Energy from Waste | 8,890 | 6% | 14% |
| Option 5b Pool EfW - extended option - lower RSS housing figure | | | |
| Energy from Waste | 13,505 | 9% | 13% |
| Option 5b Pool EfW - extended option - higher RSS housing figure | | | |
| Energy from Waste | 16,154 | 11% | 13% |
| Option 6a Redruth - core option | | | |
| Gas CHP | 2,292 | 2% | 2% |
| Biomass Heat | 1,822 | 1% | 7% |
| Option 6b Redruth - extended option | | | |
| Gas CHP | 5,649 | 4% | 4% |
| Biomass Heat | 3,811 | 3% | 6% |
| Biomass CHP | 8,412 | 6% | 6% |

## 1.7 Policy recommendations and actions

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). We have avoided suggesting targets for on-site $CO_2$ reduction or energy generation for three reasons:

- It should be assumed that Part L will make such policies redundant over time;
- Requiring developers to show percentage reductions in emissions or energy generation places a significant burden on both applicant and development manager to understand and make decisions based on technically complex calculations; and
- District scale solutions are particularly appropriate to CPIR and will bring significant $CO_2$ savings without placing undue burden on applicants.

Instead of on-site $CO_2$ targets, we have focused particularly on identifying suitable sites for district scale solutions and drafting policies that require development to connect to the strategic heat main and other district heating networks. Our policy recommendations cover the following:

*1. Policy designating SDHAs*

In preparing for the delivery of the DHNs the Council will need to develop a policy which designates areas indicated by the Energy Opportunities Plan as being viable as Strategic District Heating Areas.

*2. Policy requiring connection to DHNs and associated requirements*

The Council will need to develop a policy requiring all new development within SDHAs to connect to the DHN where viable or feasible. 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.

*3. Policy informing dwelling density, layout & mix*

A further policy will be required to ensure that, in particular, the masterplans put forward by applicants are arranged so as not to significantly reduce the viability of the DHN.

*4. Policy supporting S.106/CIL or CPIR-wide allowable solutions*

This policy will support the concept of a CPIR-wide fund which will gather together contributions from developers in order to fund the connection of existing buildings to the DHN or the implementation of other allowable solutions.

*5. Development of a supplementary planning document*

The report also highlights that further work will need to be carried out in order to support the policies suggested by providing clear guidance. The key work here will be around the production of a Supplementary Planning Document. Cornwall Council in co-operation with the public/private partnership ESCo will need to develop a Supplementary Planning Document that includes the Energy Opportunities Plan. The SPD will need to:

- Deliver development that is able to connect to and accommodate district heating networks,
- Assess feasibility and viability of connections including clarifying issues around maximum financially viable distance from a DHN,
- Include a statement of what applicants should expect from the public/private partnership ESCo and/or other partners
- Identify Allowable Solutions, S.106 and/or CIL spending priorities.

## 1.8 Corporate action

From a corporate perspective the Council should be seen to be supporting the policy it has set out for developers by ensuring that;

- 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;
- other strategic funding from internal or external sources is fully explored, and;
- the link between establishing district heat networks and the County's waste strategy is developed.

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.

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.

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 a 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.

## 1.9 Action with wider stakeholders

The wider actions which will be required to generate a robust environment for the delivery of the SDHAs revolve around engaging with strategic partners. These partners will have varying levels of roles to play but each will be essential if the most successful delivery is to be achieved.We recommend that the following parties are engaged as a key element of the next steps;

- Hospitals – as these present significant potential for anchor loads they should be brought on board as soon as possible
- Registered Social Landlords - the aim here should be to gain their commitment to connect to district heating networks as part of their development, upgrade and refurbishment programmes, where this is feasible and viable.
- Waste companies – any company dealing with suitable waste streams will need to be engaged as part of the wider discussion around aligning waste and energy policy
- Network Rail – The use of the railway as a possible route for the provision of a strategic heat main across CPIR should be explored with Network Rail at the earliest opportunity as this presents a significant possibility to reduce the cost of installing such a significant element of infrastructure.

There may also be other parties who should be involved and for a more detailed consideration of these we recommend that the Council liaise with internal stakeholders to identify who they might be. A further essential piece of work is to engage with one or more organisations as part of a public / private Energy Supply Company (ESCo) to gain their assistance in developing a suitable Supplementary Planning Document.

## 1.10 Other actions

*Wind energy*

We suggest that actions for Cornwall Council (CC) and/or the Cornwall Development Company (CDC) are as follows:

- To discuss with RAF St Mawgan (which is the parent for RAF Portreath) whether the radar station remains operational and whether they would have any interest in pursuing wind development on their land. This may require a formal consultation to be lodged with the MoD, which provides a central contact point for all queries regarding potential wind farm sites.
- To discuss with Duchy College whether they would be interested in exploring the feasibility of a wind turbine on their site, potentially in partnership with CDC.

*Further evidence base work*

Further work to support the evidence base for policies includes allowing for updating the analysis as details emerge for the following:

- Costs of compliance with the 2010 edition of Part L
- Renewable Heat Incentive (RHI)
- Allowable solutions

# 2 Introduction

Cornwall Council, in developing an Area Action Plan for the Camborne, Pool, Illogan and Redruth (CPIR) area, wished to explore how to assist new development to meet the national Building Regulations' timetable. They also wanted to assess the viability of setting energy / carbon targets and policy requirements that exceed, or come into effect faster than the proposed changes in national Building Regulations.

This report sets out the approach, methodology and results of a range of detailed analysis work carried out by AECOM for Cornwall Council in order to establish the viability of such targets and policies. This report will be part of the evidence base for the Area Action Plan.

## 2.1 Background

In achieving this, the study has examined a range of strategic opportunities to deliver district heating networks within the CPIR area and has prepared a financial appraisal

The climate change supplement to PPS1 (Planning and Climate Change) is clear in stating that local authorities may set $CO_2$ performance targets in advance of Building Regulations, where they are supported by an appropriate and robust evidence base which demonstrates that compliance with the targets will not amount to an undue burden on those applying for permission to develop.

A key issue with such an approach is that complying with any targets which are sufficiently advanced as to have a real impact may carry an additional capital cost for developers. In order to demonstrate that these costs do not form an undue burden, it is necessary to model a series of scenarios which can establish costs with and without the targets being in place as well as calculating the level of carbon performance of a range of compliance solutions.

## 2.2 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 CPIR study area;
- Establish an energy baseline over time for future development;
- Preparing energy mapping of the CPIR area;
- Identify opportunities in CPIR for renewable, zero and low carbon development;
- Develop benchmarking to allow opportunities to be assessed for viability;
- Present details SDHA analysis;
- Identify required planning policy and Council actions to support delivery of the SDHAs and;
- Set out 'Next Steps' in the process of delivery.

In addition to the above, a workshop was held on the $24^{th}$ June, 2009, where the various opportunities identified by the team were tested with key stakeholders (see appendix 4). This led to various suggestions and additional opportunities that were factored into the final analysis.

The outcomes for the project are not as easily defined as the deliverables, however, it is expected that by establishing the policies suggested by the report the Council can set targets ahead of Building Regulations within Strategic District Heating Areas (SDHAs). By identifying and enabling these SDHAs (principally, this will be by provision of District Heating Networks - DHNs), costs associated with achieving high levels of carbon compliance, especially after 2016, will be reduced. The net result is anticipated as making CPIR more attractive in itself to developers and possibly more attractive than areas without such progressive policies.

There is a further desirable outcome of the project which is perhaps more subtle than the overarching objective stated above but nonetheless should be considered of equal importance.

One of the most significant challenges to reducing our (UK) emissions from buildings is how to address the issue of the existing building stock and in particular existing dwellings. 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).

The consequence of the approach being taken by UK Government to emissions in new dwellings will result in only a proportion of the total emissions savings required being made using methods directly associated with the dwellings being constructed and the remainder being dealt with in other ways. These remaining emissions are to be dealt with by one or more 'allowable solutions'.

The idea of allowing the remaining emissions to be dealt with other than on the site of the building with which they are associated is one of the key fundamental methods of addressing emissions in existing building stock.

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 a lower carbon intensity than individual homes with their own boilers.

**Glossary**

PPS1: PPS1 sets out the Government's overarching planning policies on the delivery of sustainable development through the planning system. See www.planningportal.gov.uk for more information.

$CO_2$: Carbon Dioxide - the most significant of a group of gases which cause climate change due to its extreme proliferation through the use of fossil fuels rather than its absolute ability to affect the climate per unit.

SDHAs: Strategic District Heating Areas. These areas are those where we have been able to demonstrate that a district heating network is a viable option.

Cont…

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 implementation 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 policies suggested.

Finally, movement toward these principles may allow the Council to explore the revenue and regeneration potential of decentralised energy production.

## 2.3 How to read this report

The report is set out in line with the process undertaken during the study and therefore follows the logical procedure, starting from establishing baselines through to providing clear advice on the way forward for strategic DHN opportunities.

We appreciate that the focus of this report is largely technical and that not all of those reading it may be wholly familiar with some of terms and references used. To make the report more digestible, we have provided, where necessary, box-outs which give explanations of key points, words, abbreviations etc as well as highlighting where more detail on a particular topic might be found.

An item which is included in these box-outs is emphasised by being coloured blue in the body of the text on the occasion of its first appearance. Where an item is also included in the text of a later section, it appears in blue text to indicate its definition is included earlier in the document.

## 2.4 Overview of approach

The process map below gives an overview of the approach used for assessing the financial viability of Strategic District Heating Areas. More detail on each step is provided in sections 3 and 4.

**Glossary Cont…**

Heat Density Mapping: A visual representation of the heat demand in a given area.

GIS: Geographic Information System. Any one 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.

DHN: District Heating Network. This term is generally given to a system where a centralised heat raising plant (using any one of a range of technologies) provides heat to surrounding buildings in the area by means of a network of pipes.

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.

Micro-generation: This refers to the use of on-site technologies to generate heat or / and electricity from low or zero carbon sources.

Part L: The Approved Document of the Building Regulations which deals with the conservation of fuel and power, see: http://www.planningportal.gov.uk/wales/government/en/4000000000563.html for more information.

IRR: Internal Rate of Return - 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

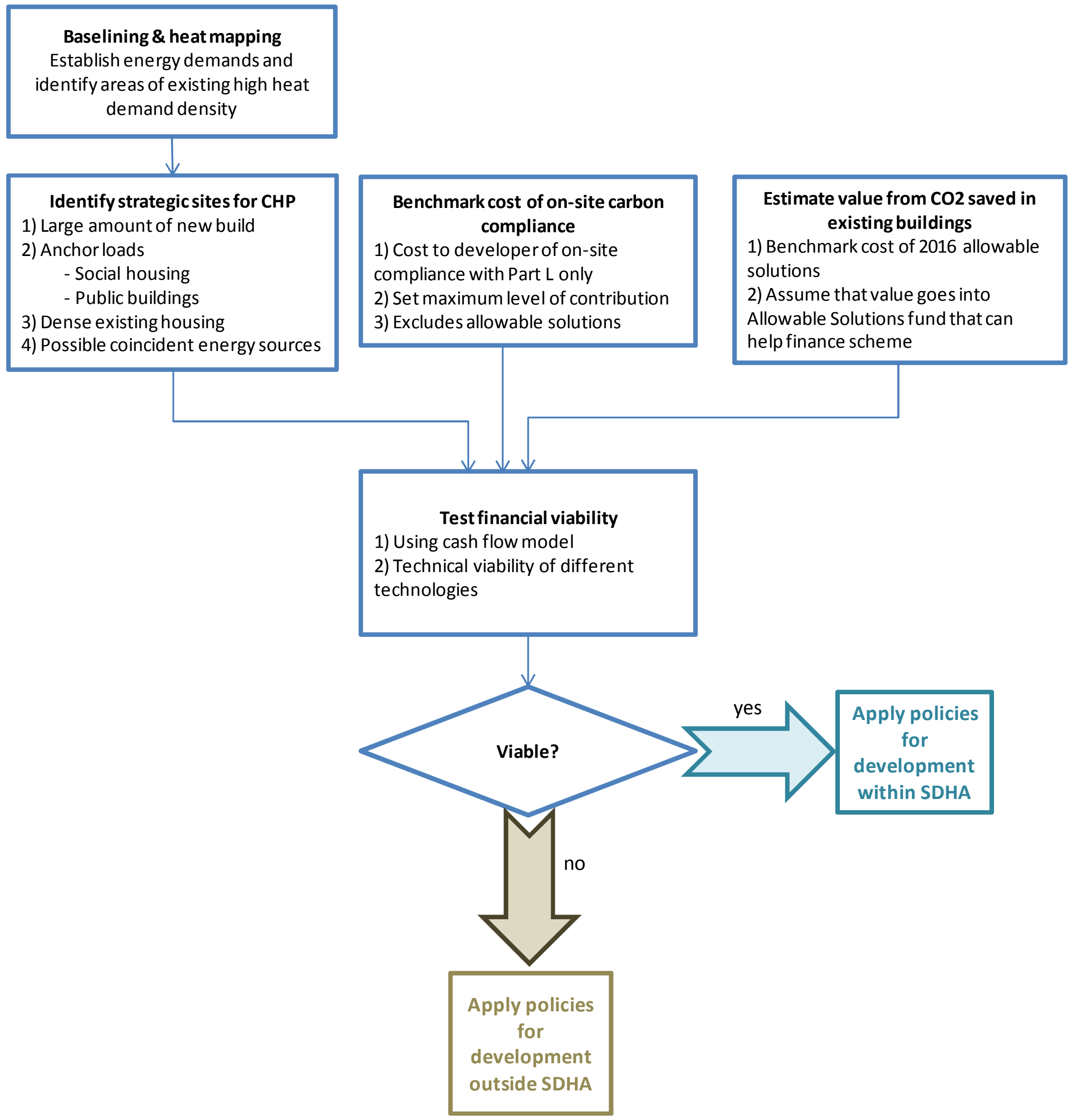



Figure 1: CPIR Energy Strategy Study process map for assessing viability of SDHAs

*Heat mapping*

Heat density mapping, based on various data sets relating to existing residential and non-residential development, has provided a spatial representation of the demand for heat in the CPIR area. Along with assumptions made as to the energy demands of proposed new development, this has facilitated the identification of several strategic opportunities for the use of community energy to serve selected clusters of existing and future development.

The heat mapping exercise utilised GIS techniques to create these spatial representations of the heat demand within the CPIR study area.

*Identify strategic district heating areas (SDHAs)*

By analysing the heat density mapping, we identified areas more likely to yield sufficiently dense load to make a DHN financially viable. This identification of a specific area where a sufficiently dense level of heat demand can be predicted or observed led us to focus on these areas as key strategic opportunities to promote the delivery of DHNs. We have characterised these sites as Strategic District Heating Areas (SDHAs). These SDHAs may include all forms of heat load identified; new and existing residential stock, new non-residential development and specific existing non-residential loads.

Whilst the SDHAs are likely to form a key plank in any approach to delivering low carbon energy within the CPIR area, the use of other solutions 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.

*Benchmark on-site carbon compliance cost*

The cost of complying with the $CO_2$ demands of Part L 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 in the CPIR area to deal with their residual carbon emissions in order to meet the future zero carbon requirements of the Building Regulations; i.e. the connection of these buildings to the DHN could form an Allowable Solution. Therefore, we have assumed that additional capital investment would be available for a strategic site to help fund the DHN infrastructure. The value of this is set by the level of carbon to be saved from the connection of the buildings to the DHN.

*Test financial viability*

The previous three steps are brought together to establish whether a particular area can 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 $CO_2$ obligations for a lower cost than would otherwise be the case. Should this seen to be viable, the area can be deemed as being a potential Strategic District Heating Area and relevant policies can be applied.

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 funding available but other measures may include: increasing capital funding, reducing the required IRR, or accessing low cost grants or loans.

Where no viable solution exists for connection to a DHN, it is proposed 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 CPIR fund. The level of contribution is suggested as being equal to the financial value of the carbon difference between the level achieved on-site and the level which would have been achieved if the development had connected to the DHN.

# 3 Baselining and benchmarking

## 3.1 Overview

A significant amount of the future energy demand from buildings will arise from that building stock which already exists and it is therefore essential to take account of this existing demand when assessing the likely future picture for any particular area.

There are also good practical and financial reasons for wanting to establish a picture of existing energy demand, in order to identify, for example: potential opportunities for: co-location of energy generation plant near to existing loads, connection of existing dense housing stock and so on. These issues are discussed in more detail below.

For the purposes of the CPIR Energy Strategy study, energy demand has been divided into four principal 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 1 with the results of that analysis presented later in this section. Below are brief commentaries on each of the energy demand groups and relevant issues.

*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.

Although this is often the case, 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.

It is for this reason that, despite its impact, existing residential is seen as a significant challenge in reducing the overall carbon emissions associated with buildings in the UK. Our work has shown, however, that the inclusion of a proportion of the existing housing stock within CPIR will aid the financial viability of some of the options examined as part of the report.

*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 provide 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).

*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 which increases financial viability of any DHN and secondly a range of issues are made more straightforward by the housing being new, namely:

- Much simpler installation of the DHN infrastructure
- Initial install 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.

*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 1, 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[2] 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.

## 3.2 Energy baseline versus heat baseline

The purpose of understanding the overall energy demand of the CPIR area, both in terms of existing and future development, is to enable the identification of strategic opportunities for the provision of low or zero carbon heat through use of DHNs in a particular area. The reason that (in this context) heat is more relevant than electricity is that heat can only be distributed locally and thus requires an awareness of the spatial relationship of potential loads for any system installed.

Electricity, on the other hand, can be distributed via the national grid and is therefore far less reliant on its co-location with loads associated with a particular development[3].

The study has calculated both heat and electricity baselines but has focused on the spatial distribution of heat loads for this reason.

## 3.3 Heat density

The density of heat 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 DHN as the closer together individual buildings to be connected are, the less infrastructure needs to be provided.

[2] Using absorption cooling

[3] This is true in all cases except those where an isolated private wire arrangement is adopted. This is where the distribution cables for a particular development do not connect to the national grid and are operated privately.

**Glossary**

Existing Residential – This refers to any dwelling, whether privately owned, rented or social housing which exists within CPIR at the time of this study

NI186: National Indicator 186 is the per capita $CO_2$ emissions for a given Local Authority area

Existing Non-Residential: Any building which is not a dwelling that exists within CPIR at the time of this study

Anchor Loads: A heat load which pre-exists the DHN which could connect and potentially provide an early income to the DHN project by purchasing heat.

Future Non-Residential: This refers to any non-dwelling which is included in the Council's forward projections for development within the CPIR area

SAP Modelling: Standard Assessment Procedure. This is the methodology which must be used to demonstrate compliance of any new dwellings with Part L of the Building Regulations

BERR: Government Department of Business, Enterprise and Regulatory Reform

Baseload: Term applied to the pre-existing load for a given area or to be met by any system under consideration

ESCo: Energy Supply Company – a commercial entity which typically operates and maintains the plant associated with a DHN. They would also normally bill any user of the DHN

Future Residential: This refers to any dwelling which is included in the Council's forward projections for development within the CPIR area

Cont…

**Glossary cont…**

Financially Viable: In this instance financial viability has been judged to be achieved where a commercially acceptable Internal Rate of Return can be seen on the DHN over a 30year investment period

DHN Infrastructure: The pipework which connects the central energy plant to the buildings using the heat

CIBSE: Chartered Institution of Building Services Engineers

TM46: Technical Memorandum 46 published by CIBSE provides a range of energy consumption benchmarks for non-domestic buildings

Regulated $CO_2$ Emissions: 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)

LZCs: Low & Zero Carbon energy generation technologies, such as; biomass, wind, solar etc.

Cont…

## 3.4 $CO_2$ baseline

As part of the work, we established $CO_2$ baselines which allowed a comparison of two scenarios examined during the study.

The first is a Business As Usual (BAU) scenario which supposes that the current existing emissions baseline will change over time driven by the following:

- The take up of energy efficiency measures in the existing residential stock,
- The development of new residential stock and,
- The delivery of new non-residential development.

The second scenario is that which takes account of the possibility of delivering strategic district heating networks (DHN) in the CPIR area which provide energy to new developments (both residential and non-residential) and existing residential stock. This model takes account of all the factors considered in the BAU scenario but also reflects:

- The connection of a proportion of new residential and non-residential development to a DHN
- The differing affects of using various technologies to support the DHN

*Source data*

In the majority of instances, the $CO_2$ baseline uses the same base data as that utilised to establish energy demands. There is, however, a difference in terms of non-domestic development as this element of the baseline model has been derived from $CO_2$ data taken from 2006 Local Authority consumption statistics from BERR energy trends.

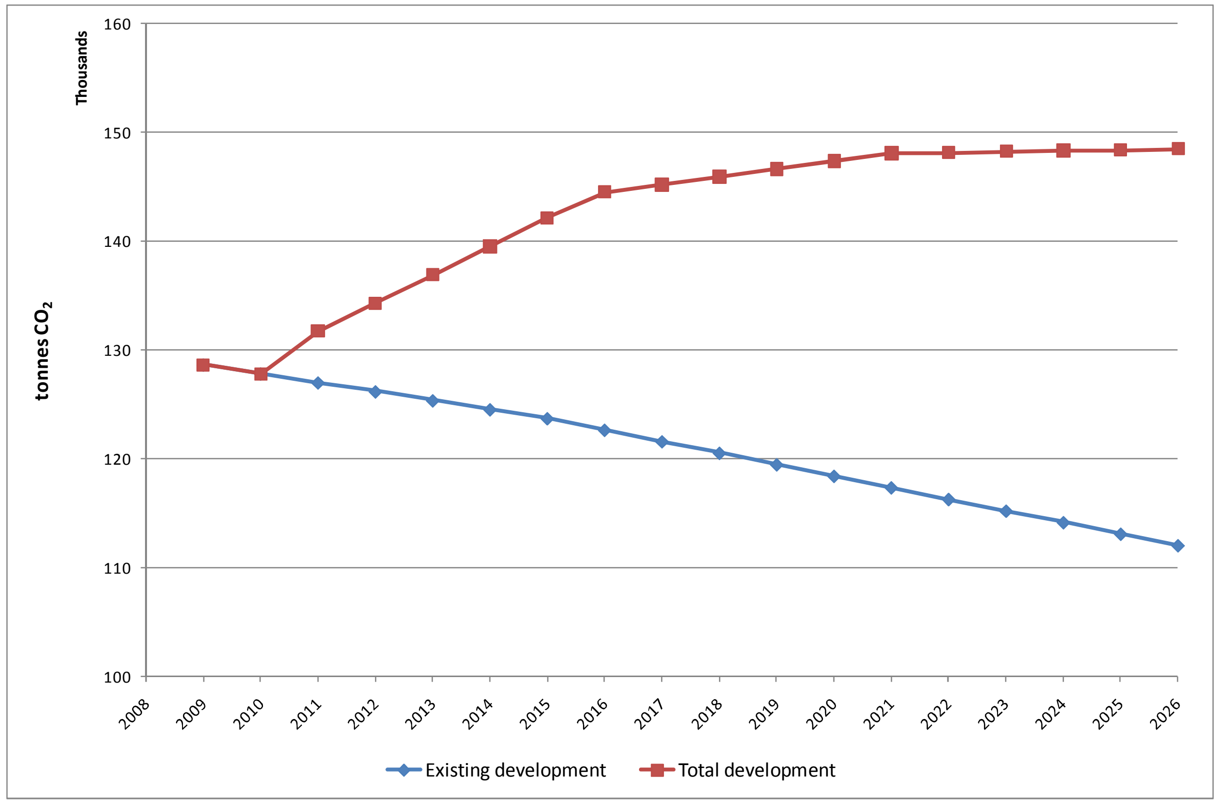



Figure 2: Business as Usual $CO_2$ emissions

## 3.5 CPIR energy demand baseline

The following table sets out the aggregated energy totals for the entire CPIR area. The existing development figure is based on estimated current demand and future development is based on predicted demand in 2026 (i.e. all development included) with no DHNs in place.

Existing energy demands of non-domestic buildings are based on data from BERR while energy demands of domestic buildings are based on our analysis of residential energy use (as detailed in the main methodology).

Carbon baselines for 2009 and 2026 are estimates of carbon dioxide emissions from the operation of buildings only. These figures do not include emissions from activities such as transport and construction.

Table 1: Total CPIR energy and carbon baselines

| CPIR area energy and carbon baselines | | | |
|---|---|---|---|
| Year | Heat (MWh) | Electricity (MWh) | $CO_2$ (Tonnes) |
| 2009 | 381,085 | 159,927 | 128,643 |
| 2026 | 397,488 | 179,995 | 148,482 |

## 3.6 Benchmarking the cost of compliance with Building Regulations Part L

In delivering new building, developers must comply with Part L of the Building Regulations which governs 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.

Connection to a DHN will also carry an associated cost. However, connection is likely to afford a $CO_2$ performance better than that currently required by Part L for any building and this is likely to remain the case until 2016 for domestic buildings and 2019 for non-domestic buildings[4].

As, by its nature, a DHN is not solely associated with a single building, it would be unreasonable to expect that any one building should shoulder the burden of the cost for its provision. It follows then, that some mechanism must be found to spread the burden and thereby only apply reasonable costs to each building.

A further question is thus raised in terms of how to establish a level of contribution required from each building which is both fair and will, hopefully, result in the financial viability of the opportunity. It seems reasonable therefore to use, as a starting point, the costs which the developer would have had to pay for Part L compliance if a DHN were not available.

***Residential Development***

Without strategic planning policies it would be up to individual developers to decide how to meet the legal maximum carbon emissions rates set out in Part L1A of the Building Regulations.

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 carbon 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 carbon reduction in excess of the requirements of Building Regulations.

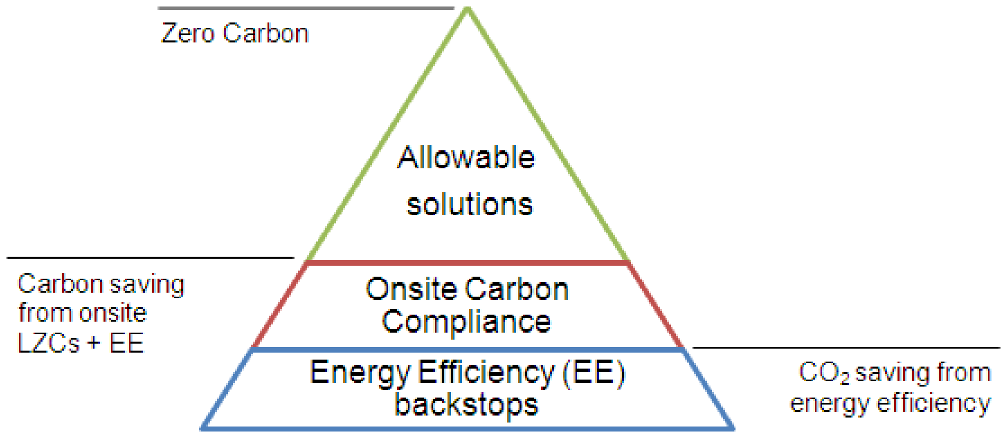



Figure 3: The Government's proposed tiered approach to reducing carbon emissions[5]

As the criteria of future amendments to Part L1A of the Building Regulations have not yet been decided, we have the following assumptions during the study:

Table 2: Key assumptions used in cost of compliance calculations

| Area | Assumption | Notes |
|---|---|---|
| Energy Efficiency | Backstops increased in 2013 from current 2006 levels to a current 'best practice' level | This level would yield a 10% carbon emission reduction (i.e. 10% against the 44% reduction expected in 2013)[6] |
| On-site carbon cap (TER) | overall permitted on-site carbon emissions cap tightened by 25% in 2010 and 44% in 2013[7] | |
| 2016 zero carbon definition | leaves the on-site carbon compliance level as is forecast for 2013 (44% reduction on 2006 TER)[footnote as above] | |
| Allowable solutions contribution | used to reduce the residual carbon emissions from the carbon compliance level of 44% to net annual zero carbon. | |

**Note – at the time of carrying out the analysis, the on-site carbon compliance requirement for zero carbon homes had yet to be finalised, and the Government consultation document set out three options of 44%, 70% and 100% reduction in regulated $CO_2$ emissions. We chose the 44% option as our assumption for what the definition would be, as this was a conservative approach to the level of contributions which might be expected from a developer to an allowable solutions fund. The UK Government has since confirmed (after our analysis was completed) that the level of compliance in 2016 will be 70% below 2006 TER[8].** We have recommended further modelling work to correct this point (refer to Section 8) and anticipate that the higher $CO_2$ target will result in a greater level of contribution from developers and increased viability of the various opportunities put forward.

We estimated that the most cost effective general route to Part L compliance where no DHN was available, based on previous modelling, would be PV. Although PV is currently relatively expensive we have used global learning rates[9] to estimate the fall in costs over time due to higher global manufacture volumes. Therefore we have benchmarked the on-site compliance cost to a combination of current best practice energy efficiency and PV panels. Figure 4 shows the total cost of on-site carbon compliance made up of:

- energy efficiency backstop improvement in 2013
- PV required to meet increased carbon compliance levels, i.e. 25% after 2010 and 44% after 2013

**Glossary cont…**

Allowable Solutions: Refer to Section 3.6 for details

TER: Target Emission Rate. The amount of regulated emissions (measured in $kgCO_2/m^2/year$) a new building is permitted to produce in order to comply with Part L.

PV: Photovoltaic systems capture the sun's energy and convert the sunlight into electricity, which can be used to power (or partially power) electrical equipment and appliances.

Global Learning Rates: A method of mathematically representing increasing international production volumes and the associated reducing costs of technologies.

Cont…

[4] 2016 and 2019 are the stated years in which Part L will require new buildings to be 'zero carbon' for domestic and non-domestic development respectively.
[5] Taken from the consultation on a Definition of Zero Carbon New Homes and Non-domestic Buildings, CLG, December, 2008

[6] 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.
[7] This is our 'best assumption' based on information available at the time of the study.
[8] A Written Ministerial Statement was made which clarifies the 70% level. This can be found at; http://www.publications.parliament.uk/pa/cm200809/cmhansrd/cm090716/wmstext/90716m0002.htm
[9] 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

**Glossary cont…**

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. Refer to http://www.communities.gov.uk/publications/planningandbuilding/partlconsultation for details.

Shadow Price of Carbon: This represents the cost to society of the environmental damage caused by a tonne of $CO_2$ emitted into the atmosphere.

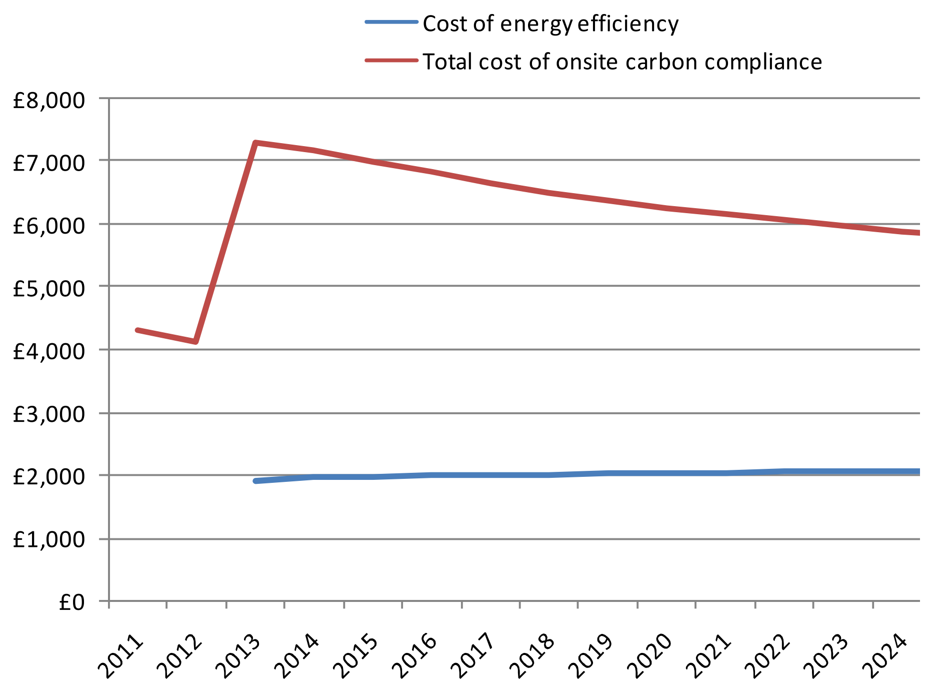



Figure 4: The total cost to developer is represented by carbon compliance

From Figure 4 we have estimated that a reasonable level to charge developers for connection to the DHN would be £4,000. This should cover all district heating connection costs including the dwellings heat exchanger and heat meter. This heat exchanger is provided instead of a conventional boiler, meaning that this is an avoided cost for the developer meaning that the net cost to the developer is approximately £2,800. The developer would still be required to comply with the minimum energy efficiency backstops set out in Part L1A.

The connection and energy efficiency cost to the developer is shown in Figure 5 below, and this should be compared with the cost of on-site compliance.

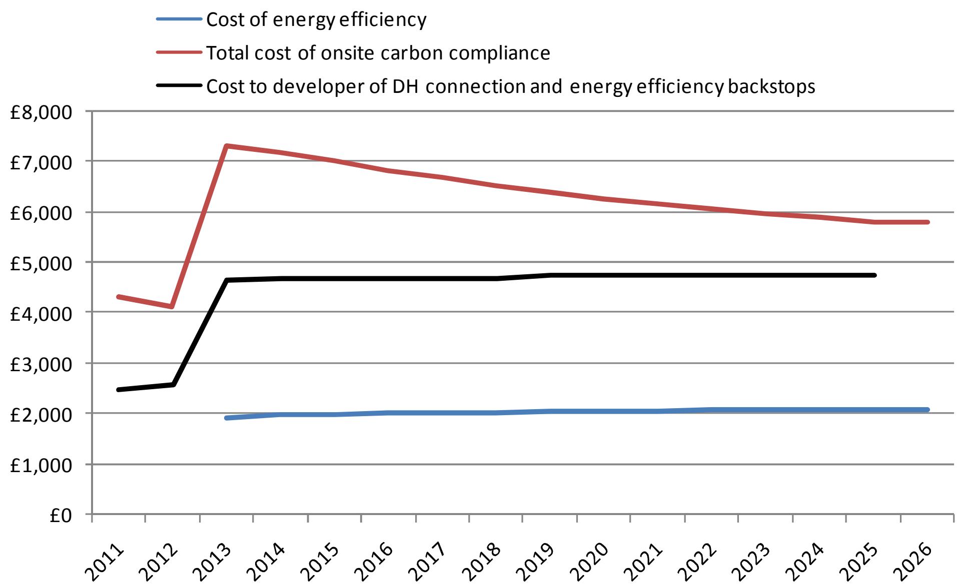



Figure 5: Comparison of developer costs – on-site compliance versus DHN connection

The cost levied to developers should also be fair with regards to dwelling type. In this study we have derived the weighted average floor area for all dwellings and established a cost per $m^2$ so that the cost of connection can be varied according to dwelling size. We calculated a cost of approximately **£50/m²** based on an average floor area of 77$m^2$.This calculation is shown in Table 3. The net additional build cost to developers would be £37/$m^2$ including the avoided cost of installing a gas boiler.

Table 3: Calculation of development mix weight average floor area

| Development mix | Floor area $m^2$ |
|---|---|
| 10% | 101 |
| 40% | 76 |
| 42% | 76 |
| 8% | 60 |
| **Weighted average** | 77$m^2$ |

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.

***Non Residential Development***

Non residential development will have to comply with Building Regulations Part L2A. The criteria of future amendments to Part L2A of the Building Regulations have been based on the following assumptions:

Table 4: Assumptions made in assessing non-residential cost of compliance

| Aspect | Assumption |
|---|---|
| Energy efficiency backstops | No energy efficiency backstops increase[10] |
| Overall permitted on-site carbon emissions cap | Tightened by 25% in 2010 based on the aggregate method[11] |
| 2013 and 2016 revision | On-site carbon compliance level remains at 25%[12] |
| Allowable solutions | Used to reduce the residual carbon emissions from the carbon compliance level of 25% to zero regulated carbon. |

To benchmark the cost of compliance for CPIR 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 CPIR. This yielded a figure of approximately £20/$m^2$ and is shown in Table 5. Unlike the case of 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.

[10] Proposals for amending Part L and Part F of the Building Regulations, *Consultation,* Communities and Local Government (CLG), June, 2009

[11] Ibid, CLG, June 2009

[12] This is our 'best assumption' based on information available at the time of the study.

Table 5: Calculation of development mix weighted average cost of compliance[13]

| Building type | Floor area m² | Total floor area m² | Aggregate method cost of compliance | Approximate CPIR floor area | Compliance cost per $m^2$ floor area |
|---|---|---|---|---|---|
| Hotel | 362 | 1,087 | £21,053 | 12,300 | £19 |
| Office[14] (deep, AC) | 2,500 | 12,500 | £358,703 | 17,588 | £29 |
| Office (shallow, AC) | 720 | 2,160 | £89,812 | 17,588 | £42 |
| Office (shallow, heated) | 720 | 2,160 | £56,939 | 17,588 | £26 |
| Retail | 250 | 250 | £12,049 | 18,000 | £48 |
| Warehouse[15] (no RL) | 600 | 600 | £1,306 | 32,295 | £2 |
| Warehouse (with RL) | 600 | 600 | £4,303 | 32,295 | £7 |
| | | | | **Weighted average:** | **£21/$m^2$** |

## 3.7 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 selection of allowable solutions proposed would allow credit for carbon emissions where heat is exported from the site to nearby existing buildings via a DHN.

*Using allowable solutions funds*

This approach provides the potential to raise funds from developers in CPIR (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 8,266 tonnes for residential development alone) and applying the forecast shadow price of carbon, we arrive at the revenue which might be generated via this route. We have estimated this figure to be in the region of £8.92M. 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 Section 6. To arrive at this figure the carbon savings have been assumed to be sold to developers at a rate 10% less than the forecast shadow price of carbon[16] for any given year. This is calculated as revenue within the cashflow modelling and is set at £27.6/tonne for 2011 rising in real terms at 2% per annum[17]. We have also assumed 30 years of residential emissions would need to be covered by an allowable solution payment[18].

These funds, subject to further Government clarification, might be used to connect existing dwellings to SDHA networks, as long as the resulting carbon savings were equal to or greater than the carbon savings required by the new build developers.

The study has not considered the above CPIR 'Allowable Solutions Fund' in detail, but has taken account of the potential value of carbon savings made within SDHAs by the connection of existing housing to DHNs. The total potential CPIR-wide carbon emission saving from connecting existing dwellings to DHNs is estimated to be in the region of 7,500 tonnes. This figure is based on only connecting existing dwellings in areas with a heat density of over 3,000kW/$km^2$ whether or not they fall within one of the defined SDHAs. We can see then that there might be a shortfall between what is needed by developers and what could be offered by this solution of around 800 tonnes $CO_2$. However, the DHNs will also make savings in existing non-residential development that could also contribute to meeting allowable solutions, which could address this shortfall. If additional carbon savings are required, then the Council and CDC could consider investing in a wind farm development on some of the potential wind sites also identified as part of this stud. This would provide developers with an additional mechanism for dealing residual carbon emissions[19].

The relative cost of carbon 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 carbon 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.

The following graph sets out both the potential year on year and cumulative revenue which might be generated towards a central fund from allowable solutions contributions from new housing. This illustrates the likely revenue for investment in other solutions, such as; connecting existing housing to a DHN, wind power opportunities and so on, which might be used to meet overall $CO_2$ targets.

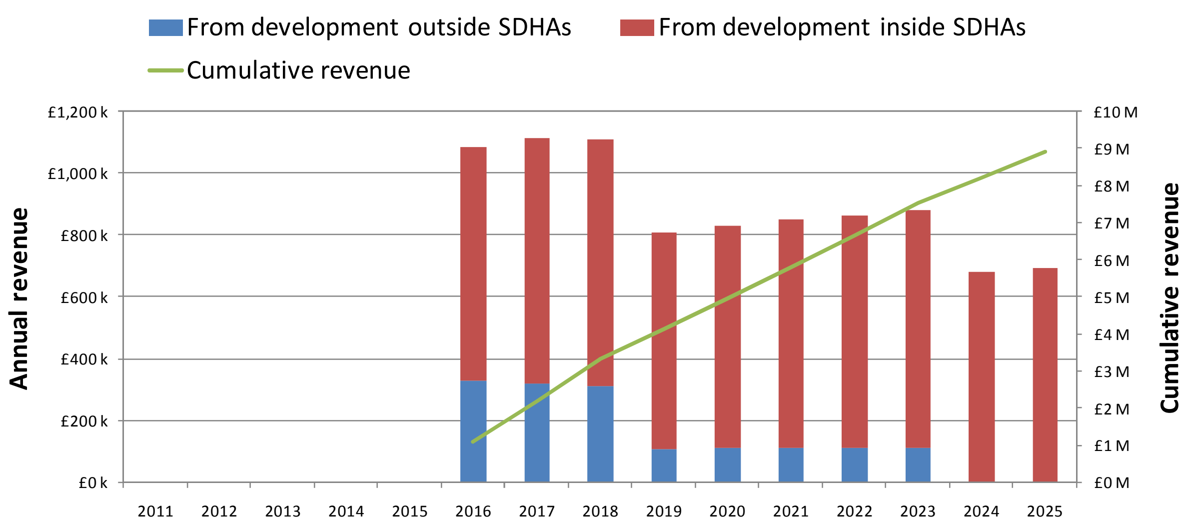



Figure 6: Annual and cumulative revenue to proposed Allowable Solutions Fund

[13] Taken from ibid, CLG, June, 2009
[14] Deep refers to deep plan, shallow refers to shallow plan, AC stands for air-conditioned
[15] RL stands for rooflight
[16] Ibid, CLG December 2008
[17] Defra, http://www.defra.gov.uk/environment/climatechange/research/carboncost/step2.htm
[18] Our assumption of a year timeframe has now been confirmed by a Written Ministerial Statement. See: http://www.publications.parliament.uk/pa/cm200809/cmhansrd/cm090716/wmstext/90716m0002.htm
[19] Assuming that this option remains on the list of allowable solutions, to be confirmed by Government by the end of 2009

# 4 Heat & wind mapping

## 4.1 Heat mapping

The mapping exercise takes the results of the analyses 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.

*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 CPIR area.

Table 6: Data used for heat mapping exercise

| Data | Notes |
|---|---|
| Heat demand from existing housing stock | These demands are mapped as Output Areas and are coloured according to their heat density |
| Identification of Social Housing clusters | The load from social housing is included in the coloured output areas but their number and 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 |
| Locations of proposed Energy from Waste sites | Locations identified by reference to CC GIS datasets provided during the study |

It should be noted that research into the viability of DHNs carried out for DECC[20] indicated that residential areas with a heat density of less than 3000kW/km$^2$ were likely to be less viable and therefore our existing heat demand map does not display Output Areas with a heat density below this threshold.

*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, it was decided (in discussion with the Council) that the period to be assessed was from the present until 2026 as this matched with the client's projections in terms of planned development.

Although the analysis examined every year over the period, heat maps have only been produced for specific 'snapshot' years, being; 2011, 2016, 2021 and 2026.

The future heat demand maps are organised by development parcel. They follow a similar principle to that established for existing residential in that a coloured gradient is used to indicate the predicted heat density of each of the development parcels. The modelling does not seek to indicate that all of these development parcels will be or are suitable to be developed, but that they are included for modelling purposes and assessment.

[20] The Potential and Costs of District Heating Networks, by Poyry and Faber Maunsell, A report to the Department of Energy and Climate Change (DECC), April, 2009

When examining the maps, it is worth noting that the Council's current projections for the delivery of new non-domestic development sees all of the planned buildings being delivered by 2013.

## 4.2 Identifying 'Strategic District heating Areas' (SDHAs)

By analysing the heat mapping, areas can be identified which are likely to yield sufficiently dense load to make a DHN financially viable. This identification of a specific area where a sufficiently dense level of heat demand can be predicted or observed led us to focus on these areas as key strategic opportunities to promote the delivery of DHNs. We have characterised these sites as Strategic District Heating Areas (SDHAs). These SDHAs may include all forms of heat load identified; new and existing residential stock, new non-residential development and specific existing non-residential loads.

At this stage, the identification of SDHAs is informed primarily by the following criteria:

- The density of existing and future heat demand;
- The presence of possible existing anchor loads, and;
- The presence of significant amounts of existing social housing.

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. Within these schemes we have identified both a core option and an extended option. The idea of this is to distinguish a core scheme that might be delivered with lower strategic investment in infrastructure from an extended scheme that, with such investment (i.e. in the heat main backbone), might extend the scheme's reach to other parcels which can then fall under proposed SDHA planning policy.

Whilst the cores of each of the opportunities identified have not changed significantly since their presentation earlier in the project, (at the stakeholder workshop on 24th June), they have been renamed to be given more descriptive titles than the previous 'Option 1, 2 , etc'. To avoid confusion, the previous and current references are given below:

Table 7: Table of previous and current option names

| Previous Option | New Name |
|---|---|
| Option 2 | Camborne West SDHA |
| Option 3 | Camborne Central SDHA |
| Option 4 | Pool Community Pilot ESCO |
| Option 5 | Pool EfW SDHA |
| Option 6 | Redruth SDHA |

Note that Option 1 is the Wind Opportunities option which is discussed later in this section

Strategic heat mains

The mapping carried out as part of the study has also highlighted the opportunity to develop a strategic heat main which links significant portions of the CPIR area.

Currently, two strategic possibilities to reduce the cost of installation present themselves: the proposed east west link road and the existing railway line. These two strategic links are illustrated on the map below. These options are discussed in more detail in Section 6.2 and should be investigated further as set out in Section 8.

**Glossary**

Output Areas: 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.

Heat main backbone: The principle pipework distribution spine of a district heating network.

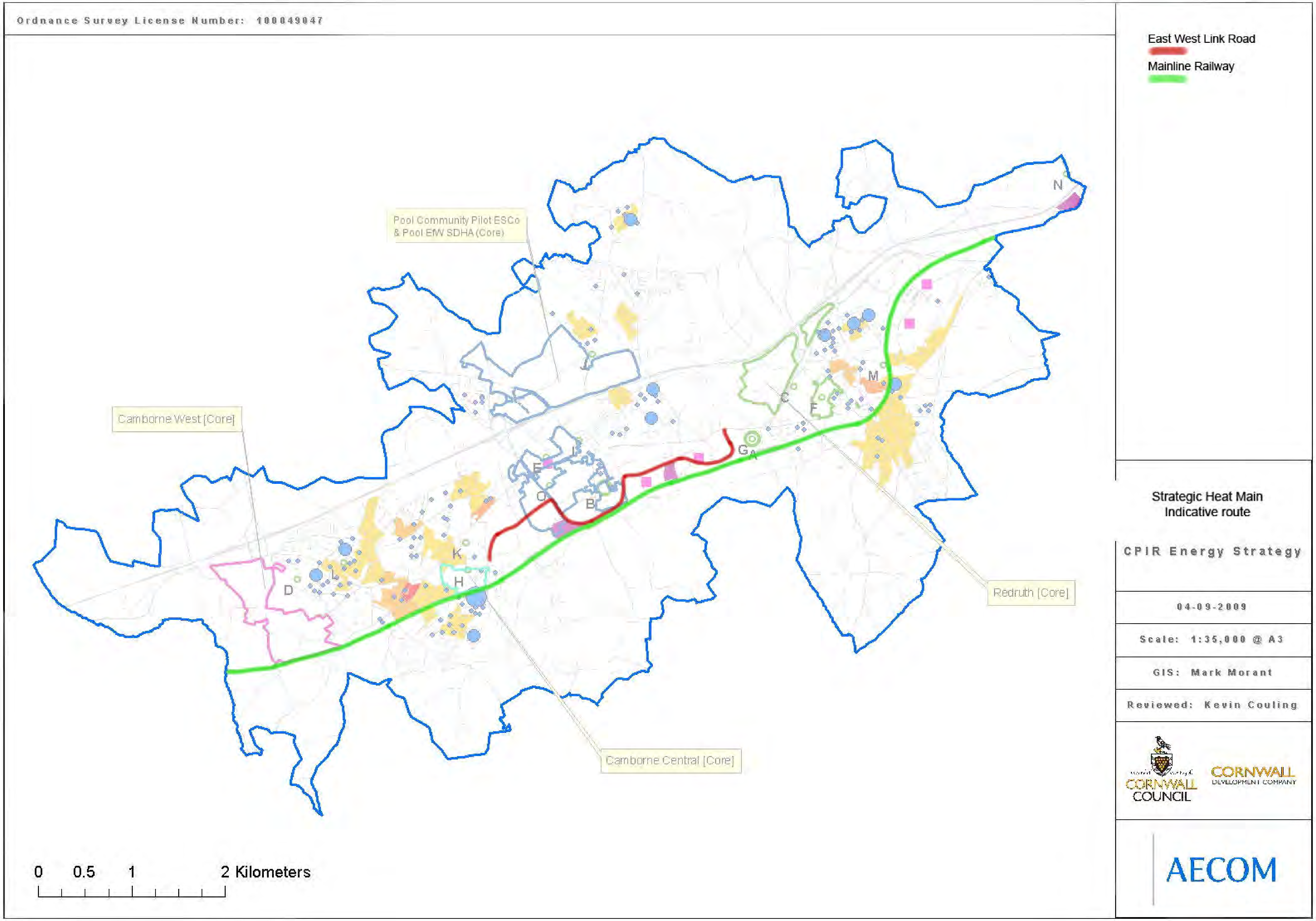



Figure 7: Strategic Heat Main indicative routes

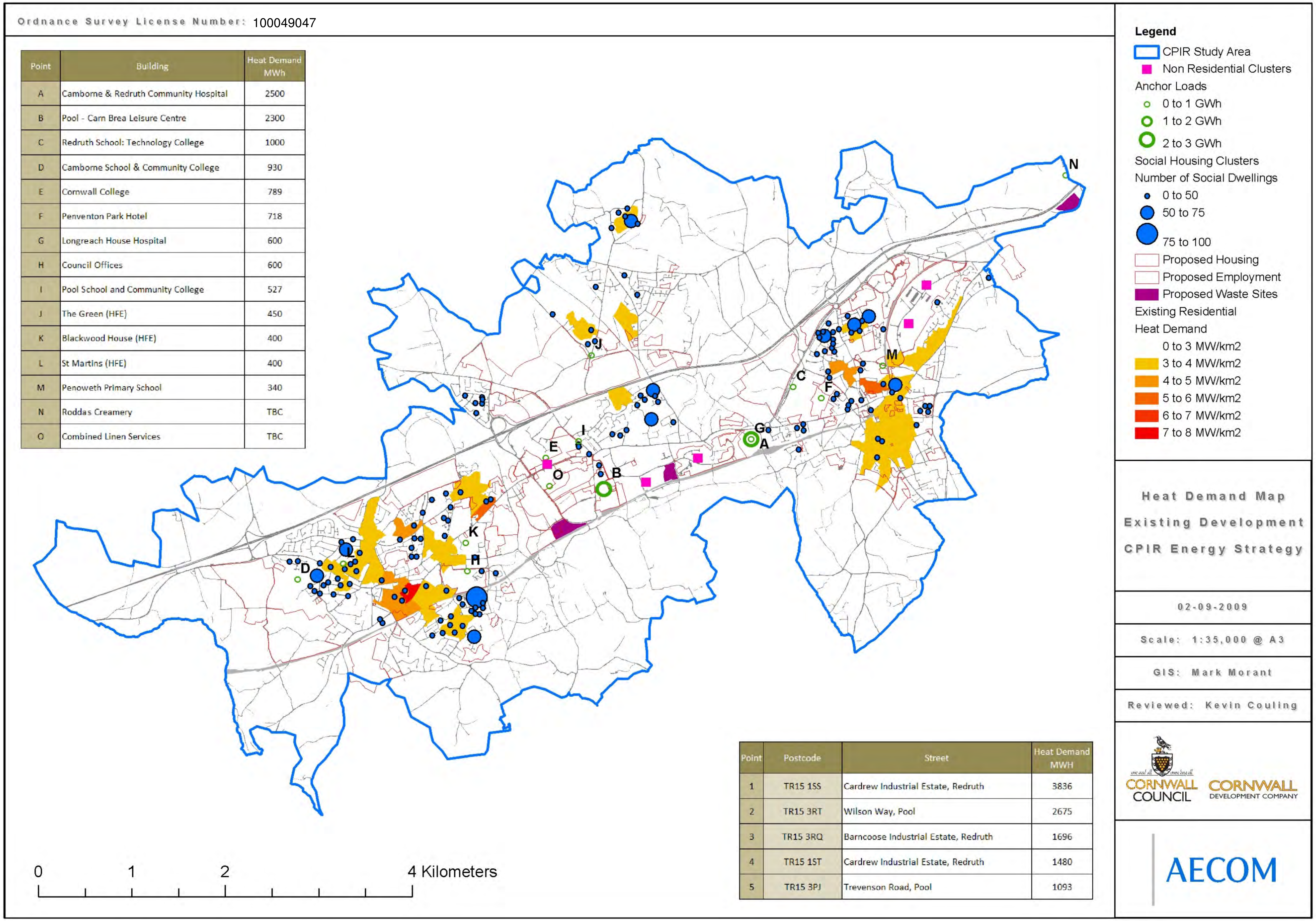
## 4.3 Energy Opportunities Plan (EOP)

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.

The maps which form the EOP, and are shown on the next pages, are:

- Heat Demand Map: Existing Development
- Heat Demand Map: Proposed Development 2011
- Heat Demand Map: Proposed Development 2016
- Heat Demand Map: Proposed Development 2021
- Heat Demand Map: Proposed Development 2026
- Energy Opportunities: Core Options Overview
- Camborne West: Core and Extended
- Camborne Central: Core and Extended
- Pool Community Pilot ESCo
- Pool Energy from Waste: Core and Extended
- Redruth: Core and Extended

The purpose and use of the EOP is discussed in more detail in Section 6.




| Point | Building | Heat Demand MWh |
|---|---|---|
| A | Camborne & Redruth Community Hospital | 2500 |
| B | Pool - Carn Brea Leisure Centre | 2300 |
| C | Redruth School: Technology College | 1000 |
| D | Camborne School & Community College | 930 |
| E | Cornwall College | 789 |
| F | Penventon Park Hotel | 718 |
| G | Longreach House Hospital | 600 |
| H | Council Offices | 600 |
| I | Pool School and Community College | 527 |
| J | The Green (HFE) | 450 |
| K | Blackwood House (HFE) | 400 |
| L | St Martins (HFE) | 400 |
| M | Penoweth Primary School | 340 |
| N | Roddas Creamery | TBC |
| O | Combined Linen Services | TBC |

| Point | Postcode | Street | Heat Demand MWH |
|---|---|---|---|
| 1 | TR15 1SS | Cardrew Industrial Estate, Redruth | 3836 |
| 2 | TR15 3RT | Wilson Way, Pool | 2675 |
| 3 | TR15 3RQ | Barncoose Industrial Estate, Redruth | 1696 |
| 4 | TR15 1ST | Cardrew Industrial Estate, Redruth | 1480 |
| 5 | TR15 3PJ | Trevenson Road, Pool | 1093 |

Figure 8: Heat Demand Map: Existing Development

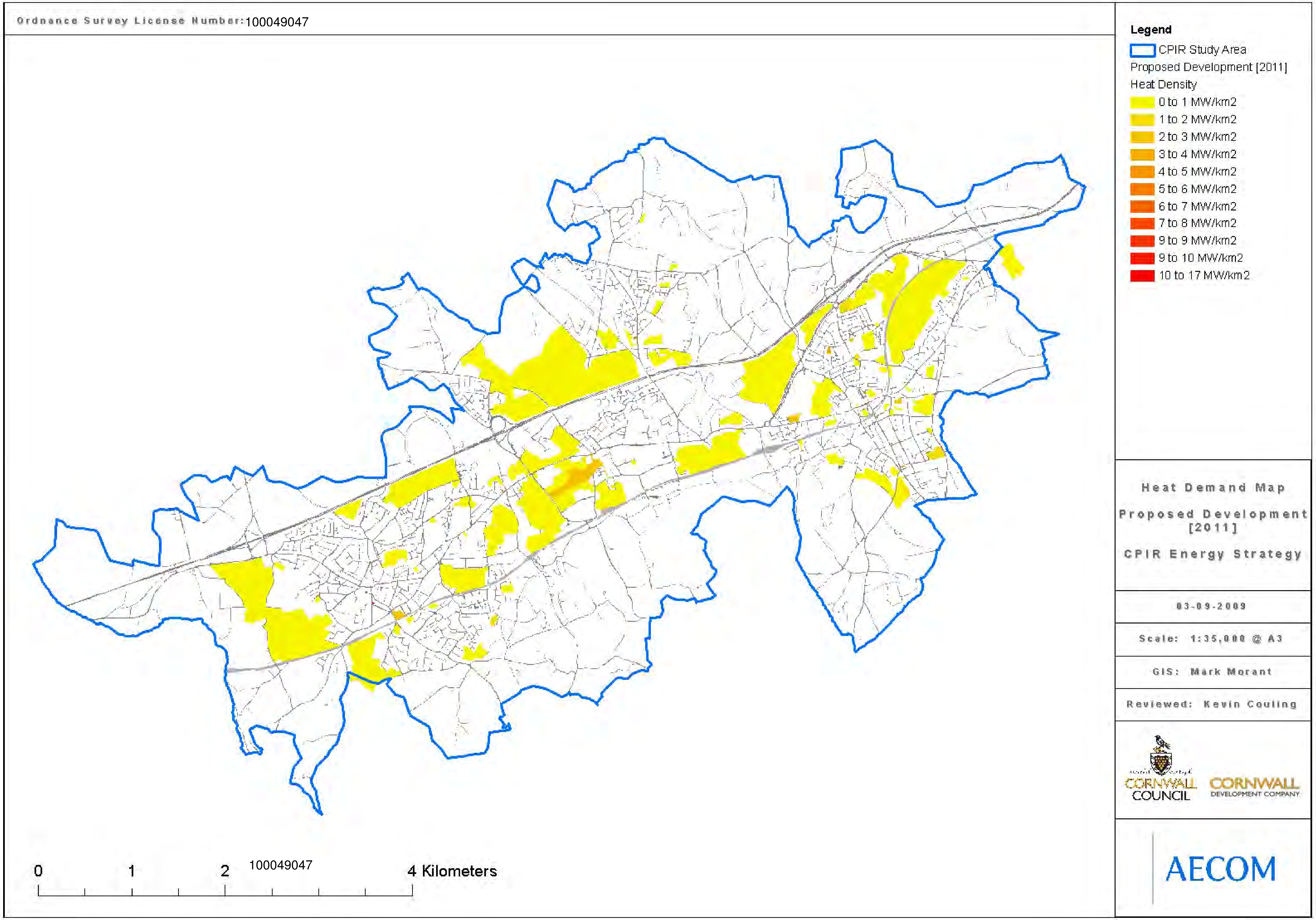



Figure 9: Heat demand map - Proposed development 2011

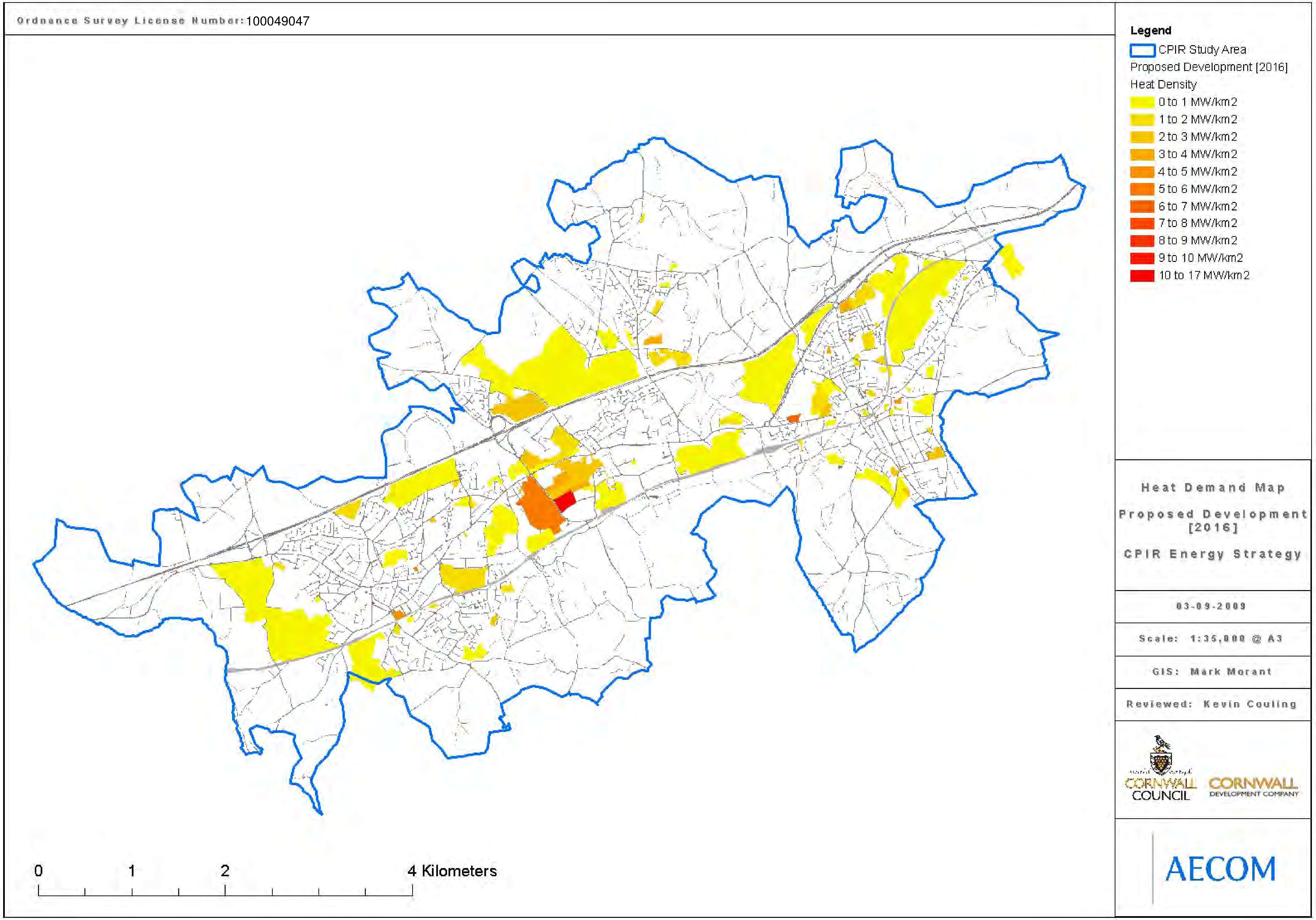



Figure 10: Heat demand map - Proposed development 2016

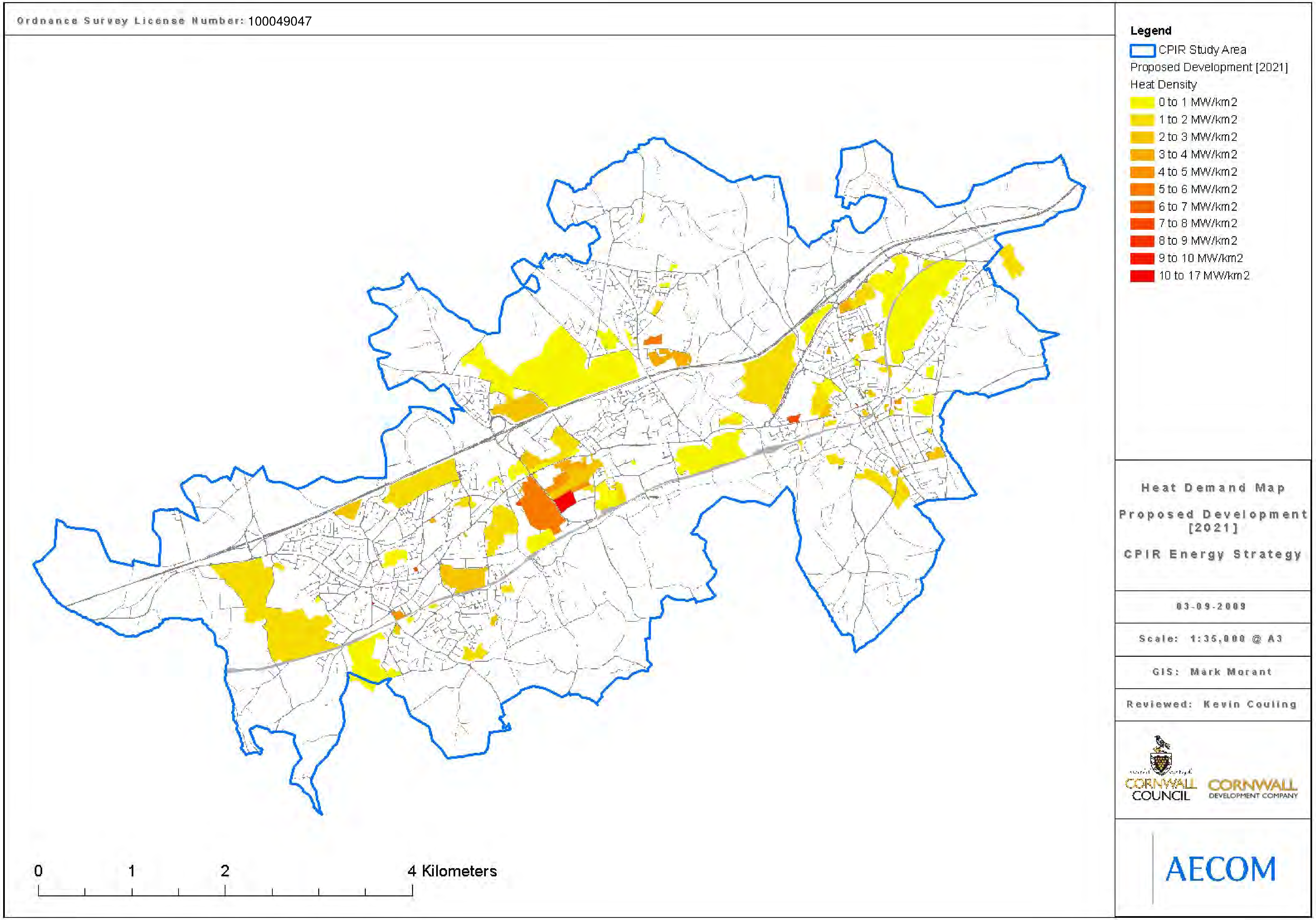



Figure 11: Heat demand map - Proposed development 2021