Basildon Borough Council

Basildon Borough Renewable and Low Carbon Energy Constraints and Opportunities Assessment

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Creating Opportunity

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1. INTRODUCTION

1.1 There is a statutory duty on local planning authorities (LPAs) to include policies in their Local Plan designed to tackle climate change and its impacts under Section 19 (1A) of the *Planning and Compulsory Purchase Act 2004*[1]. Policies must be designed to secure development and the use of land in the LPA area to contribute to the mitigation of, and adaptation to, climate change.

1.2 Increasing the use of renewable and low carbon energy technologies will work towards making sure that the UK continues to have a secure energy supply. It will aid in the reduction of greenhouse gas emissions to slow down climate change and also stimulate investment in new jobs and businesses.

1.3 The *National Planning Policy Framework (NPPF)*[2] states that "Renewable energy covers energy flows that occur naturally and repeatedly in the environment. Low-carbon technologies are those that can help reduce emissions (compared to conventional use of fossil fuels)".

1.4 There are a variety of forms of renewable and low carbon energy resources. This assessment seeks to identify what resources are available and where they could be utilised within the Basildon Borough.

1.5 Section 2 details the purpose of this assessment and looks at types of renewable and low carbon energy that will be considered. Section 3 looks at the policy background relating to renewable and low carbon energy in planning.

1.6 Section 4 of this assessment gives a brief overview of the study area of the Basildon Borough. Section 5 reviews the existing energy consumption and emissions within Basildon Borough.

1.7 Section 6 looks at the existing renewable and low carbon technology within the Basildon Borough. Section 7 provides the methodology to be used in this assessment.

1.8 Section 8 explains the findings of the assessment and Section 9 sets out the conclusions.

[1] Planning and Compulsory Purchase Act 2004:http://www.legislation.gov.uk/ukpga/2004/5/contents
[2] Annex 2: Glossary, p 55, National Planning Policy Framework, March 2012

2. PURPOSE

2.1 The *NPPF* (Paragraph 97)[3] states: "To help increase the use and supply of renewable and low-carbon energy, local planning authorities should recognise the responsibility on all communities to contribute to energy generation from renewable or low-carbon sources. They should:

- have a positive strategy to promote energy from renewable and low-carbon sources;
- design their policies to maximise renewable and low-carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts;
- consider identifying suitable areas for renewable and low-carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources;
- support community-led initiatives for renewable and low-carbon energy, including developments outside such areas being taken forward through neighbourhood planning; and
- identify opportunities where development can draw its energy supply from decentralised, renewable or low-carbon energy supply systems and for co-locating potential heat customers and suppliers."

2.2 The *NPPF* (paragraph 99)[4] also states that: "Local Plans should take account of climate change over the longer term, including factors such as flood risk, coastal change, water supply and changes to biodiversity and landscape. New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure".

2.3 This document seeks to assess the opportunities and constraints for renewable and low carbon energy within the Basildon Borough. A review of suitable sources will be undertaken and with those identified an assessment of whether they are technically accessible will be carried out. Once the appropriate sources have been identified an analysis on potential constraints will follow. The aim will then be to identify potential locations for proposed renewable and low carbon energy generation, informing the preparation of associated Local Plan policies.

[3] Para 97, Section 10, pp 22-23, National Planning Policy Framework, March 2012
[4] Para 99, Section 10, p 23, National Planning Policy Framework, March 2012

2.4 The following types of renewable and low carbon energy will be considered as part of this assessment:

- Large scale onshore wind energy - turbines are used to convert energy contained within wind into electricity. Commercial-scale, free standing turbines have the potential to generate significant amounts of renewable energy.

- Large scale solar arrays - ground-mounted solar PV panels are used to generate electricity. Sites are often surrounded by security fencing, and may have security lighting and CCTV. They will also include the infrastructure to connect to the grid, which can also be prominent. They can cover large areas of land which are usually in rural locations.

- Biomass (plant biomass including energy generation from managed woodland and industrial waste wood) – biomass can either be used directly via combustion to produce heat, or indirectly after converting it to various forms of biofuel.

- Energy from waste (including municipal solid waste, commercial and industrial waste arisings and animal biomass: dry organic waste (poultry litter) - a number of treatment processes and technologies used to generate a usable form of energy which can be in the form of electricity, heating and/or cooling, or conversion of the waste into a fuel for future use.

- Microgeneration - Solar photovoltaic (PV) uses energy from the sun to create electricity. Solar water heating (SWH) uses energy from the sun to work alongside a conventional water heater. Ground source heat pumps (GSHP) transfer heat from the ground into a building to provide space heating and, in some cases, to pre-heat domestic hot water. Air source heat pumps (ASHP) absorb heat from the outside air. This heat can then be used to heat radiators, underfloor heating systems, warm air convectors and hot water.

- District Heating (DH) and Combined Heat and Power (CHP) - Electricity generated by gas CHP can be used directly in a nearby site or exported to the local electricity grid. Heat generated by gas CHP can be transported for use in other buildings via water carried in a network of well insulated buried pipes, known as District Heating (DH).

2.5 It should be noted that there are a number of renewables that are outside the scope of this study for varying reasons:

- Strategies for offshore wind generation are determined at a national level and are beyond the direct influence of regional organisations.

- There are no sites within the Basildon Borough for co-firing using oil and gas.

- Whilst transportation potentially has a large role to play in reducing regional CO2 emissions it is outside the scope of this study.

- A review of potential from emerging technologies including geothermal energy generation and fuel cells are outside of the capacity of this study.

- An assessment of the impact of demand reduction measures (such as energy efficiency or passive solar design) are also outside the scope of the study.

2.6 There are also some renewable and low carbon generators that have not been considered due to lack of resource in the East of England:

- The potential for Hydro Energy was assessed in the *East of England Renewable and Low Carbon Energy Capacity Study* and large-scale hydro (e.g. large dams) were not considered due to the limited height in river levels. Small-scale hydro power (under 20MW) could be considered, however the study also found very little potential in the region as a whole. Therefore it is not considered a viable resource to consider as part of this assessment.

- The use of agricultural arisings (straw) for plant biomass was reviewed in the *East of England Renewable and Low Carbon Energy Capacity Study*. The study found that following consultation with steering group members, Natural England and reviewed literature it was apparent that this theoretical resource is mostly used up by local farmers as fertilisers or bedding material for animals. Consequently there are no large resources of un-used waste straw in the region. Difficulties in obtaining straw and the limited resource available due to competing uses have also been reported, therefore it is considered that there is currently very little resource in the region and this type of biomass would not support renewable energy generation.

- The *East of England Renewable and Low Carbon Energy Capacity Study* reviewed the use of energy crops within the region and it was found that there is limited availability of energy crops in the area. This was due most likely to the amount of water required for their growth and the East of England being one of the driest regions. Therefore it is considered that there is insufficient resources in the region for this type of biomass to support renewable energy generation.

- Wet organic waste (comprising slurry from cattle and pig farms and waste from food and drinks manufacturing) was not identified by the *East of England Renewable and Low Carbon Energy Capacity Study* as a sufficient resource for the County, therefore it is unlikely to provide a valuable resource for the Borough which is predominantly urban and suburban in character.

- There is currently one active landfill site in Pitsea which is due to cease use at the end of December 2015. There is no future landfill gas production resource assumed in the Basildon Borough.

- There are four sewage treatment works within the Basildon Borough. The *East of England Renewable and Low Carbon Energy Capacity Study*, has assumed that there will be little change to the capacity for energy generation from sewage gas, therefore sewage gas production has not been considered as part of this assessment.

- Small wind and micro wind microgeneration in Essex would generate a very small resource according to the *East of England Renewable and Low Carbon Energy Capacity Study*, therefore they have not been assessed further as part of this study.

3. POLICY BACKGROUND

3.1 There are a number of International, European and National policies in place which aim to reduce the impacts of climate change and encourage the use of renewable and low carbon energy. Some of these important policies are detailed further below.

International and European policy

3.2 The *Kyoto Protocol*[5] is an international agreement setting targets for industrialised countries to cut their greenhouse gas emissions. The *Kyoto Protocol* emerged from the *UN Framework Convention on Climate Change (UNFCCC)*, which was signed by nearly all nations at the 1992 Earth Summit meeting in Kyoto. The treaty was finalised in 1997 and became a legally binding agreement in February 2005. The UK agreed to reduce emissions of six greenhouse gases by 12.5% below 1990 levels by the period 2008-2012.

3.3 The *Doha Climate Change Conference*[6] in 2012 led to the adoption of an amendment to the *Kyoto Protocol* during the second commitment period, from 2013 to 2020. Parties have committed to reduce greenhouse gas emissions by at least 18 per cent below 1990 levels.

3.4 In April 2009, the European Union adopted the *Directive on Renewable Energy (2009/28/EC)*[7], which set targets for all Member States that the EU will reach a 20% share of energy from renewable sources by 2020. The UK's binding target is to meet 15% of its energy consumption from renewable sources by 2020. On the 24 October 2014, European Leaders agreed to a clear set of climate and energy targets for 2030 in European Council. These include:

- reducing domestic greenhouse gas emissions by at least 40% by 2030 compared to 1990 levels;
- increase the share of renewable energy to at least 27% of the EU's energy consumption by 2030
- an indicative target of at least 27% for improved energy efficiency at EU level in 2030.

National policy

3.5 The *Climate Change Act 2008*[8] establishes a legally binding target to reduce the UK's greenhouse gas emissions by at least 80% in 2050 from 1990 levels.

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[5] Kyoto Protocol: http://kyotoprotocol.com/
[6] Doha Climate Change Conference: http://europa.eu/rapid/press-release_MEMO-13-956_en.htm
[7] Directive on Renewable Energy: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32009L0028
[8] Climate Change Act 2008: http://www.legislation.gov.uk/ukpga/2008/27/contents

3.6 The *2009 UK Renewable Energy Strategy*[9] (RES) provides a series of measures to meet the legally-binding target set in the Renewable Energy Directive. The RES envisages that more than 30% of UK electricity should be generated from renewable sources.

3.7 The *Planning and Energy Act 2008*[10] is also relevant in that it enables LPA's to set requirements for energy use and energy efficiency in local plans. As detailed earlier Local Policies Section 19 (1A) of the *Planning and Compulsory Purchase Act 2004*[11] requires LPA's to include in their Local Plans "policies designed to secure that the development and use of land in the LPA's contribute to the mitigation of, and adaptation to, climate change". This will be a consideration when a Local Plan is examined along with the other guidance.

Local policies

3.8 LPAs are responsible for renewable and low carbon energy development of 50 megawatts or less installed capacity (under the *Town and Country Planning Act 1990*[12]). Renewable and low carbon development over 50 megawatts capacity will be considered by the Secretary of State for Energy, under the *Planning Act 2008*[13], and the LPA will be a statutory consultee.

3.9 Some forms of renewable and low carbon energy, especially Microgeneration, is often permitted development[14] and may not require an application for planning permission.

3.10 Local and neighbourhood plans are the key to delivering development that has the backing of local communities. When drawing up a Local Plan LPA's should consider what the local potential is for renewable and low carbon energy generation. Communities can make use of neighbourhood planning through Neighbourhood Development Plans (NDPs) and Neighbourhood Development Orders (NDOs) which can be used to guide local development including the use of renewable and low carbon energy.

NPPF and PPG

3.11 The *Planning Practice Guidance (PPG)* and the *NPPF* (as detailed in the above section) provide essential guidance on planning for renewable and low carbon energy.

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[9] 2009 UK Renewable Energy Strategy: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228866/7686.pdf
[10] Planning and Energy Act 2008: http://www.legislation.gov.uk/ukpga/2008/21/contents
[11] Planning and Compulsory Purchase Act 2004: http://www.legislation.gov.uk/ukpga/2004/5/contents
[12] Town and Country Planning Act 1990: http://www.legislation.gov.uk/ukpga/1990/8/contents
[13]Planning Act 2008: https://www.gov.uk/government/policies/providing-regulation-and-licensing-of-energy-industries-and-infrastructure/supporting-pages/planning-and-consents-for-national-energy-infrastructure
[14] Permitted Development (Part 14): http://www.legislation.gov.uk/uksi/2015/596/contents/made

3.12 The *PPG*[15] states that "In shaping local criteria for inclusion in Local Plans and considering planning applications in the meantime, it is important to be clear that:

- the need for renewable or low carbon energy does not automatically override environmental protections;
- cumulative impacts require particular attention, especially the increasing impact that wind turbines and large scale solar arrays can have on landscape and local amenity as the number of turbines and solar arrays in an area increases;
- local topography is an important factor in assessing whether wind turbines and large scale solar arrays could have a damaging effect on landscape and recognise that the impact can be as great in predominately flat landscapes as in hilly or mountainous areas;
- great care should be taken to ensure heritage assets are conserved in a manner appropriate to their significance, including the impact of proposals on views important to their setting;
- proposals in National Parks and Areas of Outstanding Natural Beauty, and in areas close to them where there could be an adverse impact on the protected area, will need careful consideration; and
- protecting local amenity is an important consideration which should be given proper weight in planning decisions."

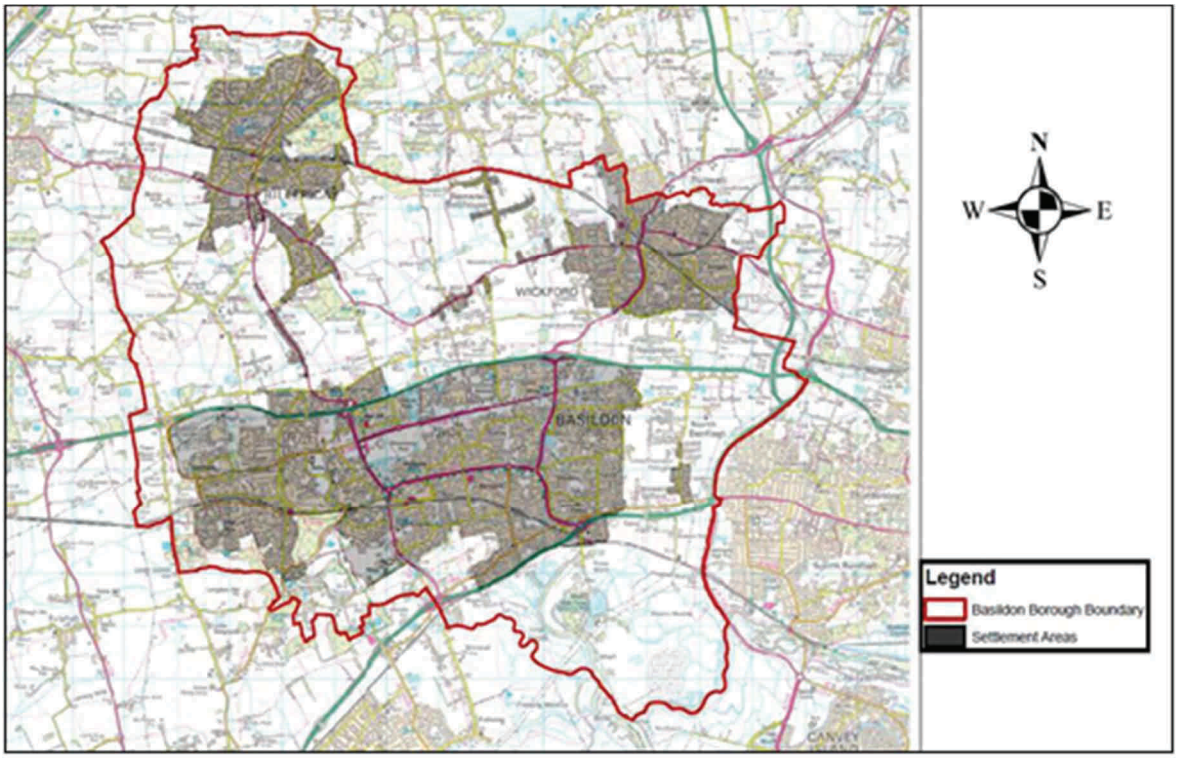
[15] PPG: http://planningguidance.planningportal.gov.uk/blog/guidance/renewable-and-low-carbon-energy/developing-a-strategy-for-renewable-and-low-carbon-energy/

4. STUDY AREA

4.1 In 2011 the census recorded there to be approximately 74,000 dwellings accommodating 174,497 people within the Basildon Borough.

4.2 The Basildon Borough consists of three main towns which are Basildon to the south of the Borough, Wickford to the north east and Billericay to the north west. Figure 1 below shows a map of the study area.

Map of Basildon Borough



(©Crown copyright and database rights 2014 Ordnance Survey 100018871)
Figure 1: Map of the Basildon Borough

4.3 The former New Town area of Basildon also contains Pitsea to the east and Laindon to the west. Each of these settlements, along with Billericay and Wickford are located around a town centre.

4.4 There are other smaller serviced settlements in the Borough; these are Bowers Gifford that lies to the east of Pitsea, Ramsden Bellhouse to the north of the Borough between Billericay and Wickford, and Crays Hill, which is to the south of Ramsden Bellhouse in the centre of the Borough. The Borough also has two unserviced settlements, which are Little Burstead and Noak Hill. Little Burstead is to the south of Billericay and Noak Hill is a ribbon development to the south of Billericay.

4.5 There are a number of strategic roads within the Borough. The A127 runs east to west through the centre of the Borough and forms a key route through the main employment areas, connecting to the A130. The A130 runs north to south

-along the eastern boundary of the Borough and connects to the A13, which runs along the southern edge of the Borough and links to the A12, south of Chelmsford City.

4.6 There are five railway stations located within the Borough at Pitsea, Laindon, Basildon, Billericay and Wickford.

5. EXISTING ENERGY CONSUMPTION AND EMISSIONS IN BASILDON

Energy demand

5.1 Data on energy demand and emissions of carbon dioxide for the Borough of Basildon were accessed from the *Department for Energy and Climate Change (DECC*), the data used was from 2012[16]. The data shows that gas (1,301 GWh - 40%) had the highest energy consumption levels in Basildon, followed by petroleum products (1,101 GWh - 34%) then electricity (792.1 GWh - 25%) (See Figure 2).

Basildon Energy Consumption by Type for Basildon in 2012

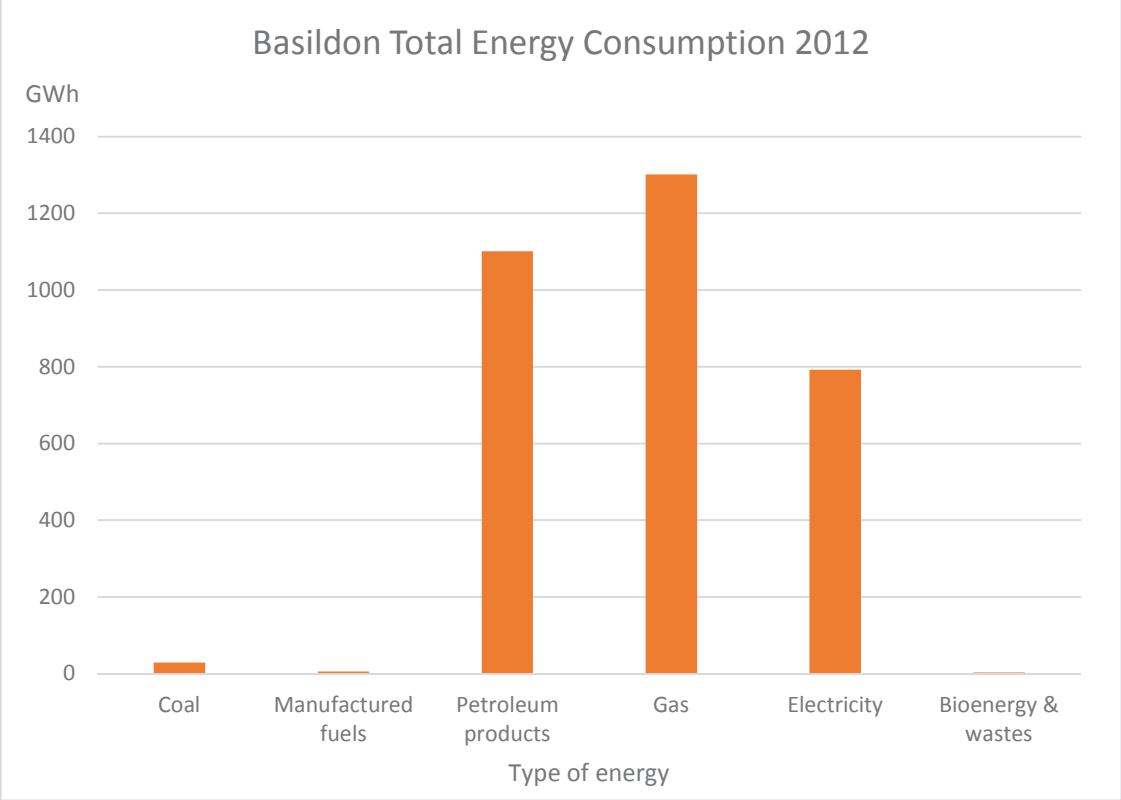


Figure 2: Energy consumption by type for Basildon in 2012

5.2 For comparison purposes the Borough's electricity use is 90.41MW and gas use is 148.52MW. This is calculated by converting GWh to MWh (times the figure by 1,000) and then dividing the resulting figure by the number of hours in a year (8760). Megawatt (MW) is the rate at which power is being consumed or produced by a circuit at any given moment in time and by looking at Basildon Borough's existing consumption in MW it will be possible to compare it to the potential outputs from each renewable and low carbon energy type in MW to see how much each type could benefit the Borough.

[16] Department for Energy and Climate Change: https://www.gov.uk/government/statistical-data-sets/total-final-energy-consumption-at-regional-and-local-authority-level-2005-to-2010

5.3 The breakdown on energy use per sector is domestic at 39%, industrial and commercial and transport both at 31% (shown in Figure 3).

Basildon Energy Consumption by Sector for Basildon in 2012

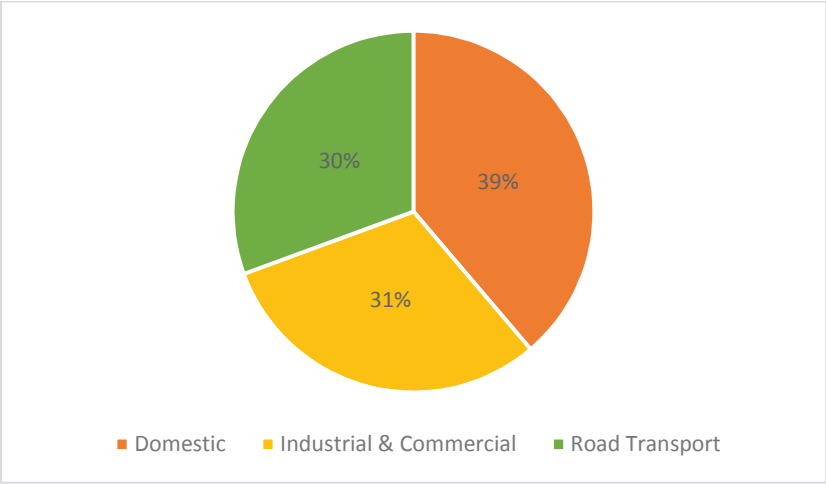


Figure 3: Energy consumption by sector for Basildon in 2012

5.4 In 2012 gas for the domestic sector was used most within Basildon (921.4 GWh), followed by, electricity and gas for industrial and commercial use (472.2 GWh and 379.6 GWh respectively) and electricity for the domestic sector (319.9 GWh) being the fourth most used fuel (shown in Figure 4).

Basildon Energy Consumption by Sector and Fuel for Basildon in 2012

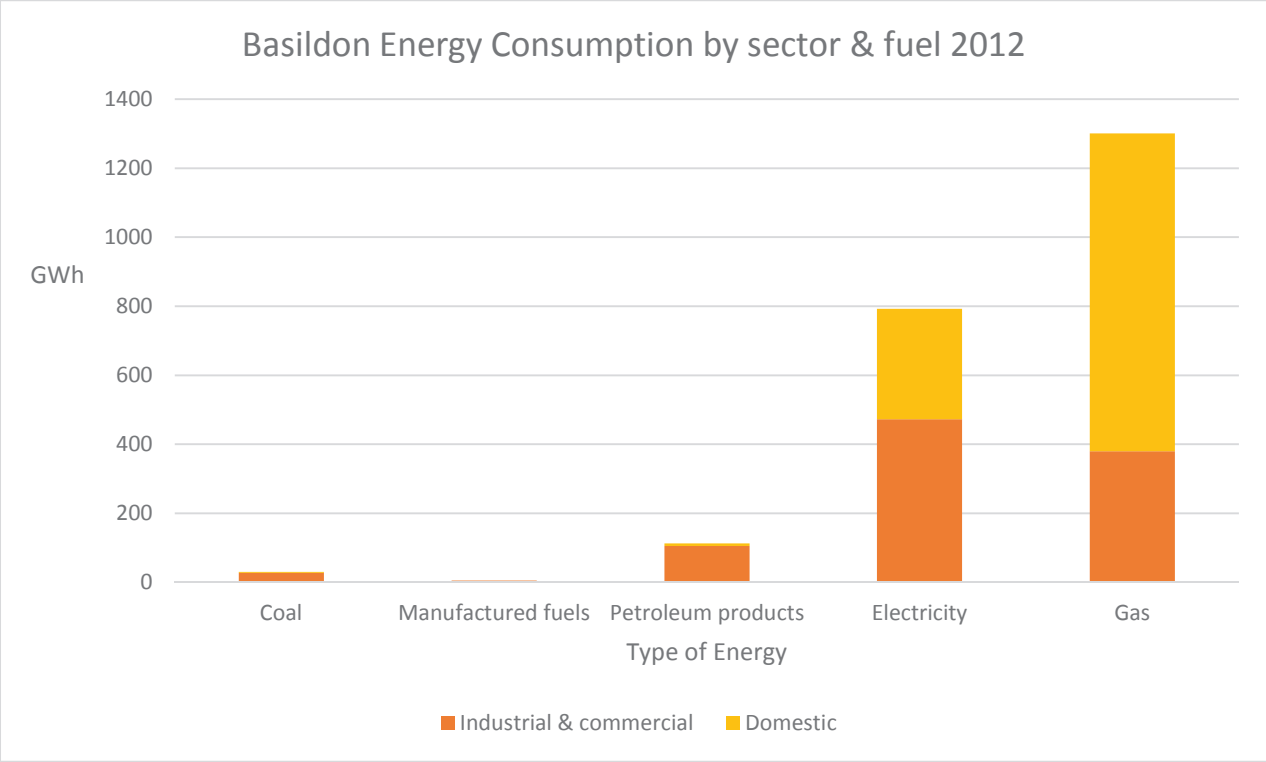


Figure 4: Energy consumption by sector and fuel for Basildon in 2012

Domestic consumption

5.5 The majority of homes in Basildon are heated by gas central heating which coincides with the above data. The full breakdown of types of domestic heating systems in Basildon is shown in Table 1 below.

Types of Central Heating in Basildon in 2011

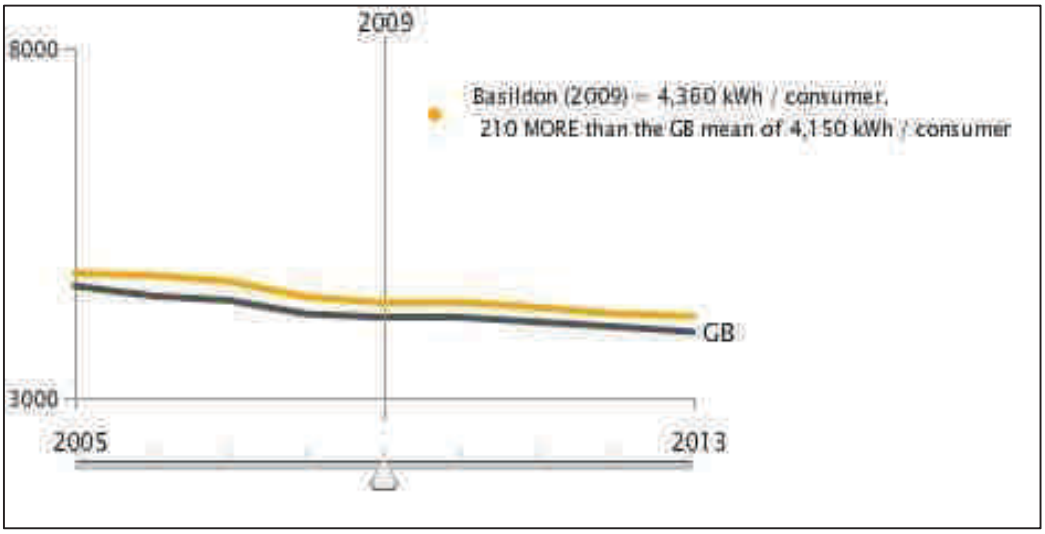
	Basildon Households	Proportion
No Central Heating	859	1.20%
Gas Central Heating	62,593	86%
Electric (Including Storage Heaters) Central Heating	5,731	7.90%
Oil Central Heating	238	0.33%
Solid Fuel (For Example Wood, Coal) Central Heating	154	0.21%
Other Central Heating	1,082	1.49%
Two or More Types of Central Heating	2089	2.87%
All Household Spaces With At Least One Usual Resident	7,2746	100%

(Source: 2011 Census[17])

Table 1: Types of central heating in Basildon in 2011

5.6 The average domestic electricity and gas usage is shown below (Figure 5 and Figure 6) having been obtained from the *DECC* website[18]. Basildon had higher than the Great Britain (GB) average of electricity usage but lower than the GB average of gas usage.

Average domestic electricity usage in Basildon and Great Britain 2005-2013



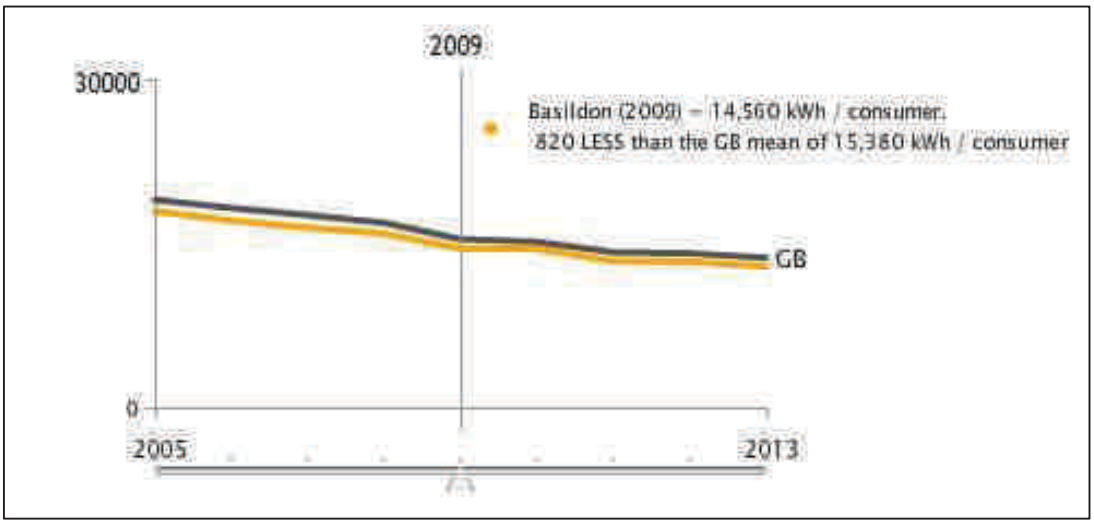
(Source: DECC)

Figure 5: Average domestic electricity usage in Basildon compared to Great Britain 2005-2013

[17] 2011 Census data: http://www.neighbourhood.statistics.gov.uk/dissemination/LeadTableView.do?a=7&b=6275014&c=basildon&d=13&g=6422170&i=1001x1003x1006&k=heating&o=230&m=0&r=1&s=1438600738479&enc=1&domainId=61&dsFamilyId=2510

[18] DECC: http://tools.decc.gov.uk/en/content/cms/statistics/local_auth/interactive/domestic_ge/index.html

Average domestic gas usage in Basildon and Great Britain 2005-2013



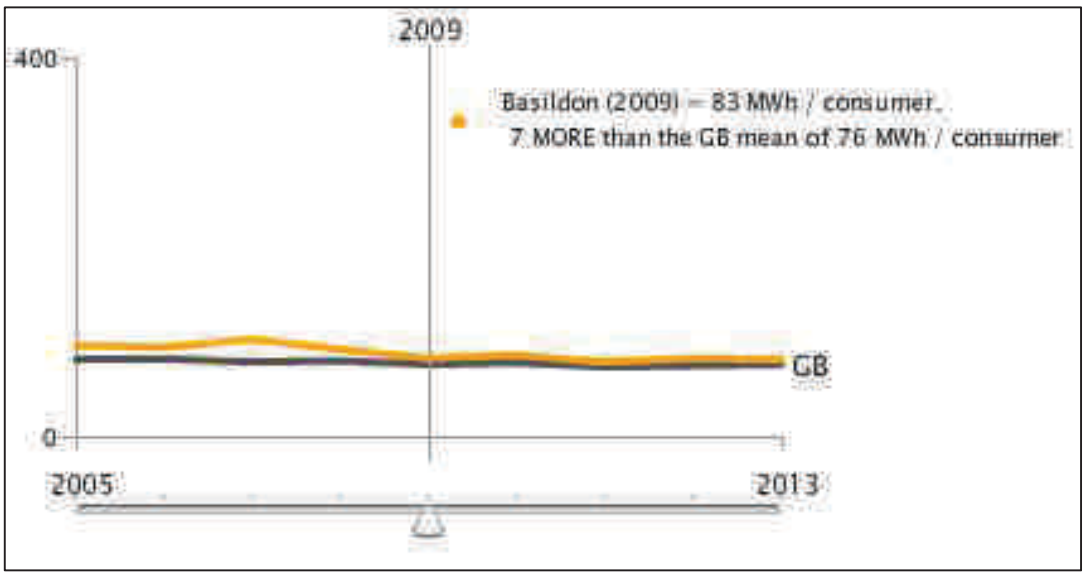
(Source: DECC)

Figure 6: Average domestic gas usage in Basildon compared to Great Britain 2005-2013

Non-domestic use

5.7 Electricity usage for non-domestic use in Basildon was slightly higher than the GB average and the gas usage was slightly lower which mirrors the domestic statistics as shown in Figure 7 and Figure 8 below

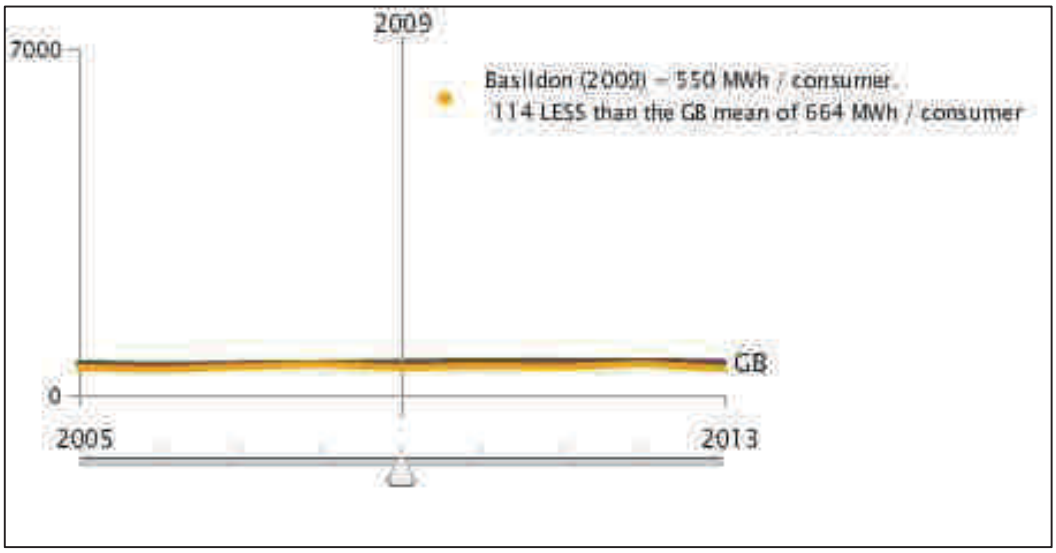
Average non-domestic electricity usage in Basildon and Great Britain 2005-2013



(Source: DECC)

Figure 7: Average non-domestic electricity usage in Basildon compared to Great Britain 2005-2013

Average non-domestic gas usage in Basildon and Great Britain 2005-2013



(Source: DECC)

Figure 8: Average non-domestic gas usage in Basildon compared to Great Britain 2005-2013

Average Energy Consumption

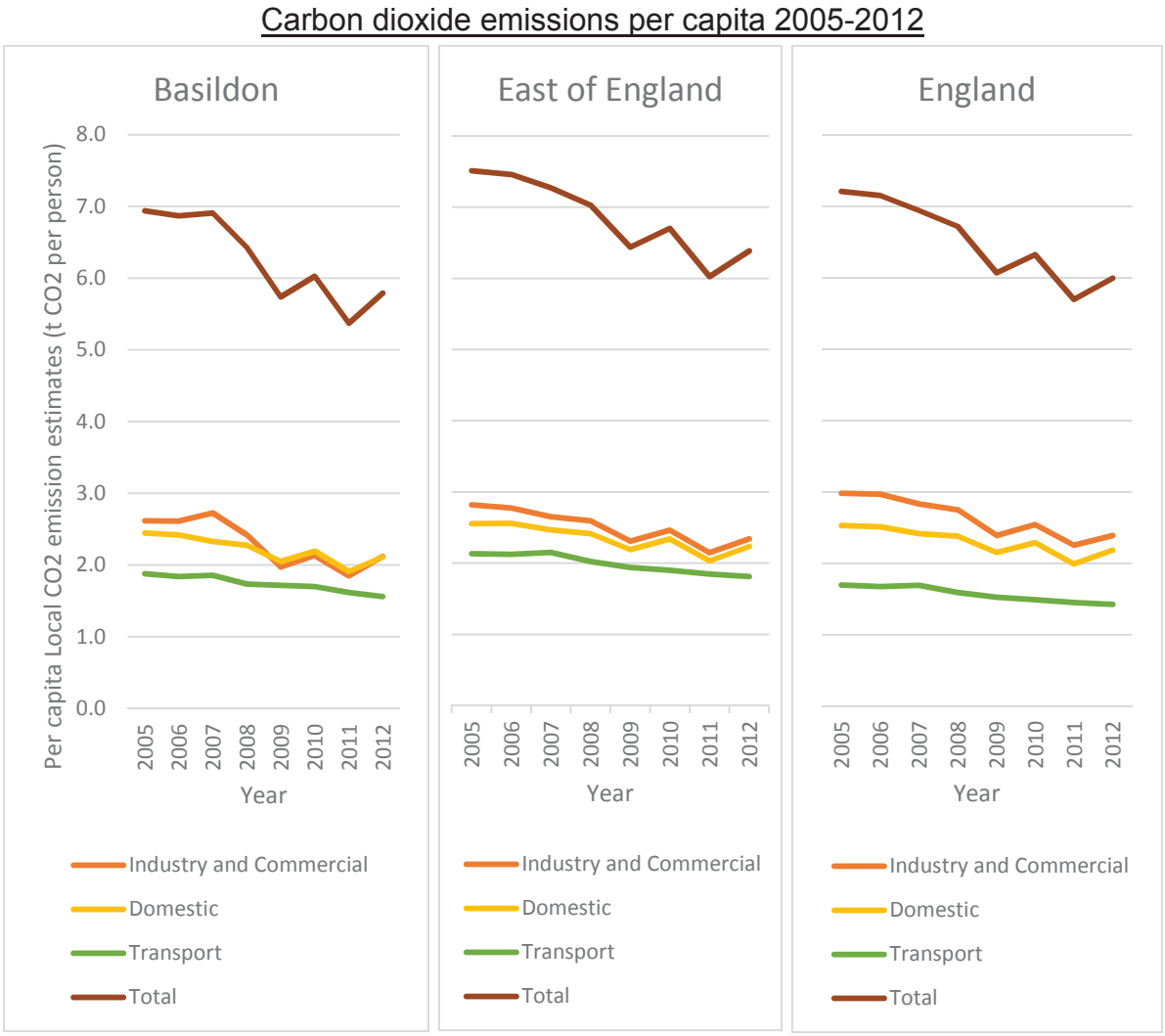
5.8 In summary, the DECC data shows that in 2012 gas had the highest energy consumption levels in Basildon, followed by petroleum products then electricity. When specifically looking at domestic consumption gas was the most used followed by electricity.

5.9 The gas usage in the Borough is 148.52MW and the electricity usage is 90.41MW. These figures will be used to work out how effective the potential renewable and low carbon energy generation could be at providing the necessary energy required for the Borough.

Energy emissions

5.10 Carbon dioxide emitted within the Borough is a combination of the total energy used together with the carbon intensity of each fuel. Figure 9 below used information from the DECC[19] and shows that the total carbon dioxide emissions in Basildon have fallen over the period following similar trends at regional and national levels. The breakdown of those emissions in Basildon is relatively different with industrial and commercial and domestic emissions dropping over time with a couple of noticeable increases in recent years. The data also shows that emissions are currently increasing. Transport emissions in Basildon and the East of England are quite similar, however England as a whole is slightly lower.

[19] DECC: https://www.gov.uk/government/.../20140624_Subset_Datatables.xlsx



(Source: DECC)

Figure 9: Carbon dioxide emissions per capita for Basildon, East of England and England from 2005 to 2012 (broken down into the industrial and commercial, domestic and transport sectors)

6. EXISTING USE OF RENEWABLE AND LOW CARBON TECHNOLOGY IN THE BASILDON AREA

6.1 There are a number of renewable and low carbon energy schemes that have been approved within the Basildon Borough to date. These include:

- a number of schemes for individual wind turbines over 15m in height;
- two schemes for large scale solar arrays;
- an anaerobic digestion facility fuelled partly by agricultural crops and poultry manure;
- a CHP plant at a supermarket; and
- a biodiesel CHP building as part of a new housing scheme.

6.2 There has also been numerous applications for microgeneration and many more presumed to have been carried out under permitted developed. Between June 2010 and December 2014, the number of domestic solar photovoltaic installations in the Borough increased from 3 to 1,133, this is 308 less than the national average[20].

6.3 There is also a number of existing facilities that currently make use of renewable energy including Pitsea Methane Conversion Plant (a Landfill Gas scheme accredited for the Renewable Obligation, with an installed generating capacity of 12 MW) and a material recovery facility/mechanical biological treatment for anaerobic digestion and combined heat and power (CHP) at Marsh Farm which uses biomass technology with a capacity of 4.4MW.

[20] DECC: http://tools.decc.gov.uk/en/content/cms/statistics/local_auth/interactive/domestic_solar/index.html

7. METHODOLOGY

7.1 This assessment is concerned with both the resource potential and renewable energy generation potential within the Basildon Borough.

7.2 The *Renewable and Low-carbon Energy Capacity Methodology for the English Regions* (January 2010)[21] produced by the *Department for Energy and Climate Change* (DECC) sets out an opportunities and constraints approach to evaluating the potential for such provision.

7.3 This approach sets out four stages to the evaluation of such potential within an area, and will be applied at a borough level in the sequence shown below (Figure 10).

7.4 The *East of England Renewable and Low Carbon Energy Capacity Study* (April 2011)[22] was also used to develop further the methodology used in this assessment and it will be detailed where applicable.

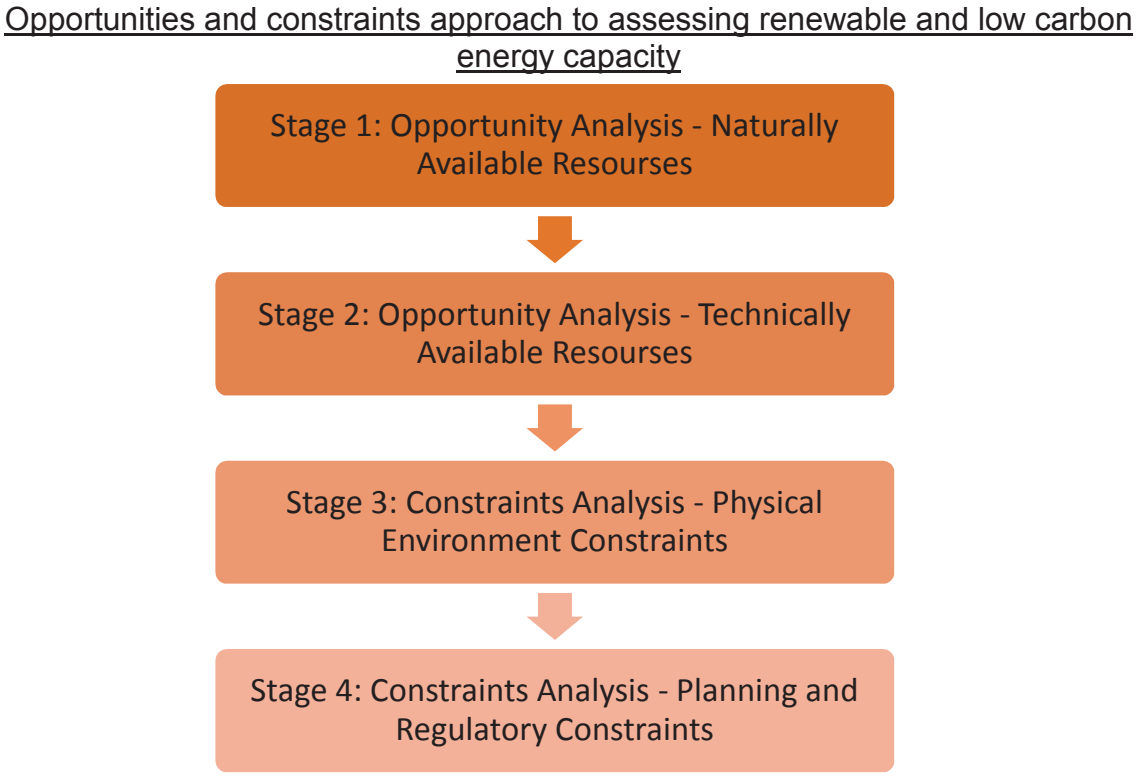


Figure 10: Opportunities and constraints approach to assessing renewable and low carbon energy capacity

7.5 Table 2 below details the methodology for how the constraints and opportunities for renewable and low carbon energy will be assessed.

[21] Renewable and Low-carbon Energy Capacity Methodology for the English Regions (January 2010): https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/226175/renewable_and_low_carbon_energy_capacity_methodology_jan2010.pdf

[22] East of England Renewable and Low Carbon Energy Capacity Study (April 2011): https://www.scambs.gov.uk/sites/default/files/documents/1667-east-england-renewable-capacity-report.pdf

Opportunities and constraints methodology

Stage 1: Opportunity Analysis – Naturally Available Resources	This stage will seek to identify the availability of natural resources to supply energy in the first instance in the Basildon Borough. Resources that are not available within the Borough have been screened out at this stage.
Stage 2: Opportunity Analysis – Technically Accessible Resources	Suitable locations where there is sufficient natural resources and accessible resources through technologies available will be sought. Different types and scales of technology will be considered from micro-generation up to the maximum size which a local planning authority can consider under its powers.
Stage 3: Constraints Analysis – Physical Environment Constraints	This stage seeks to identify any fundamental environmental constraints that would prevent the provision of renewable and low carbon energy infrastructure and facilities. Suitability of locations and potential future developments which could present an opportunity for provision associated with growth will be considered. The capacity of the UK Power Network to accommodate new connections should be considered at this stage, as this is a potential barrier to new sources of supply (details in relation to this are covered in Appendix A).
Stage 4: Constraints Analysis – Planning and Regulatory Constraints	This stage will consider those planning and regulatory constraints which would normally prevent the provision of renewable and low carbon energy infrastructure and services. It will look to identify the criteria that would need to be considered when assessing applications. Regulations related to pollution and environmental protection meanwhile may make renewable infrastructure unsuitable in some locations.

Table 2: Opportunities and constraints methodology

7.6 This assessment follows the *DECC* methodology where possible, using the same assumptions and data sources. However where the methodology is sparse, or where a more appropriate assessment procedure is possible then alternative processes have been used and will be detailed accordingly.

7.7 The resources that will be assessed and the required methods to be used will be detailed under the following categories within each stage:

- A: Large scale onshore wind energy
- B: Large scale solar arrays

- C: Biomass (plant biomass including energy generation from managed woodland and industrial waste wood)
- D: Energy from waste (including municipal solid waste, commercial and industrial waste arisings and animal biomass: dry organic waste (poultry litter)
- E: Microgeneration (including solar thermal, solar PV and heat pumps)
- F: District Heating (DH) and Combined Heat and Power (CHP)

Stages 1 and 2 – A: Large scale onshore wind energy

7.8 The resource potential and the deployment opportunities relating primarily to the wind speeds available within the area should initially be assessed. The *DECC* methodology details that wind speeds of 5 m/s and above at 45m above ground levels are potentially sufficient for wind turbine installations.

7.9 The standard average turbine size of 2.5 MW installed capacity should then be applied to identify the typical size (dimensions - tip height: 135m, rotor diameter: 100m, hub height: 85m).

7.10 The density of turbines per site should then be assessed. It is assumed that it is possible to locate 4 large turbines, 10 medium and 50 small turbines per km^2. (5x rotor diameter spacing). This also equates to one large turbine per 155m radius, one medium turbine per 92m radius and one small turbines per 46m radius. It should be noted that this is a maximum density calculation which does not take into account site shape and minimum site size. For the purposes of the calculation of technical potential, it has been assumed that where land is suitable for a range of turbine sizes, the largest turbine size should be used.

Stages 3 and 4 – A: Large scale onshore wind energy

7.11 Non-accessible areas where wind turbines cannot be installed due to physical environment constraints should be assessed (e.g. roads, rivers etc.).

7.12 Areas where wind developments are unlikely to be permitted should be reviewed, including sites of historic interest and International and National landscape and nature conservation designations.

7.13 Additional exclusion areas relating to MOD sites and radar issues should then be reviewed.

7.14 Once the wind turbine capacity for the Borough has been identified a realistic 10% of that figure should be considered as realistic to be taken forward.

7.15 A full list of the constraints along with an explanation as to why and how they should be applied is set out in Appendix B.

Stages 1 and 2 – B: Large scale solar arrays

7.16 Large scale solar arrays are not included in the *DECC* methodology. The *East of England Renewable and Low Carbon Energy Capacity Study* developed a way of assessing the potential for large scale solar arrays and the suggested methodology will be used in this study along with any further logical criteria.

7.17 The available resource of solar energy should be identified. A minimum requirement of1150 kWh/m^2 is considered sufficient for a solar array to operate viably.

7.18 A PV panel power density of 1 kWp per 7m^2 of panel should then be assumed. To allow for access and banked arrays, around 25% of the available ground area is covered resulting in an effective density of 1 kWp per 30m^2.

Stages 3 and 4 – B: Large scale solar arrays

7.19 The *East of England Renewable and Low Carbon Energy Capacity Study* uses the energy crops land availability assessment methodology. A number of constraints should therefore be excluded:

- Permanent pasture/grassland (non-agricultural land and agricultural land grades 4 and 5)
- Local, national and international nature conservation designations (RAMSAR, SSSI, SAC, SPA, Local Nature Reserves)
- Roads, railways, rivers, tracks, open space and buildings
- Ancient and managed woodland (due to shading potential)
- Historic designations (scheduled monuments, conservation areas)
- Competing land use demands– Assumed 10% of land has potential due to competing land use demands – i.e. for growing crops etc.

7.20 The Government has recently announced that Feed in Tariffs (FiTs) will be reduced for solar energy. Sites more than 5MW in size will also not be eligible for the FiT, and therefore both these factors should be a consideration of whether a scheme would be viable.

Stages 1 and 2 – C: Biomass (plant biomass - including energy generation from managed woodland and industrial wood waste)

7.21 This assessment looks at the inventory of the biomass feedstock that can be produced and its availability for energy purposes, it does not quantify the total capacity for installed capacity. The *DECC* methodology details how to assess the capacity for each type of plant biomass.

7.22 Direct combustion is seen as the most viable approach to convert plant biomass to useful energy from both economic and carbon perspectives. Both fuels looked at in this section are suitable for both electricity and heat generation in plants of varying sizes.

Managed woodland

7.23 Managed woodland for the East of England region can be identified through the *Forestry Commission*. Forecasts are provided for potential woodfuel resource within the region between 2017 and 2021.

7.24 Once the potential is identified it is possible to calculate the amount of energy that could be generated by applying a benchmark of 6,000 odt (over dry tonnes)/year per 1MW for electricity to convert the amount of the total biomass feedstock to installed capacity.

Industrial waste wood

7.25 For the purpose of this study waste wood is defined as wood that has been used for another purpose prior to entering the waste stream, therefore is it generally considered as post-consumer or post industrial waste.

7.26 Sawmill co-product can be regionally assessed through the *Forestry Commission*. Construction wood waste can be found through national level data.

7.27 The fuel requirement is the same as for managed woodland.

Stages 3 and 4 – C: Biomass (plant biomass - including energy generation from managed woodland and industrial wood waste)

Managed woodland

7.28 In order to identify the managed woodland resource that would be practicable available it is necessary to apply exclusions such as woodfuel that is uneconomic to harvest or woodfuel that could go to alternative markets.

Industrial waste wood

7.29 The constraints applied for industrial waste wood is to assume 50% loss of resource to competing uses.

Stages 1 and 2 – D: Energy from waste (including municipal solid waste, commercial and industrial waste arisings and animal biomass: dry organic waste (poultry litter)

7.30 The *DECC* methodology details how to assess the capacity for each method of generating energy from waste. Direct combustion is currently the primary method of waste to energy conversion in the UK.

Municipal solid waste (MSW)

7.31 MSW refers to household waste. MSW would be used in CHP plant, to generate both renewable heat and electricity.

7.32 Information should be obtained from local waste management plans on the amount of MSW generated (tonnes).

7.33 A benchmark of 10,000 tonnes of MSW required for 1 MW capacity per annum is then used to ascertain the output.

Commercial and Industrial waste arisings (C&IW)

7.34 Commercial waste is waste from premises used wholly or mainly for the purposes of a trade or business or for the purpose of sport, recreation, education or entertainment but not including household, agricultural or industrial waste. Industrial waste is waste arising from the provision of public services and industrial activities, but excluding construction and demolition material.

7.35 C&IW data at a local authority level is not available. County or Regional wide data would need to be used to establish the Basildon Borough resource. *The East of England Renewable and Low Carbon Energy Capacity Study* detailed how to assess the capacity of C&IW resource once the information is sourced from the County or Regional data. 10,000 tonnes of C&I would represent 1 MW of installed CHP capacity.

Dry organic waste

7.36 Dry organic waste consists of energy generation from poultry litter.

7.37 Anaerobic Digestion is considered as the conversion process for generating bio-methane for energy production. The fuel from poultry litter is used solely for electricity generation.

7.38 The number of broilers (table chicken) need to be identified and the assumption of each bird producing 43.2g of poultry litter per year can then be applied and 11,000 tonnes of poultry litter represents 1MWe of installed electrical capacity.

Stages 3 and 4 – D: Energy from waste (including municipal solid waste, commercial and industrial waste arisings and animal biomass: dry organic waste (poultry litter)

7.39 There are no constraints under stages 3 and 4 for municipal solid waste, commercial and industrial waste arisings and dry organic waste.

Stages 1 and 2 – Microgeneration (including solar energy (water heating and photovoltaics) and ground and air source heat pumps)

7.40 Microgeneration tends to refer to renewable energy systems which are integrated into buildings to largely serve on-site energy demand.

7.41 The methodology for calculating the potential for microgeneration is based mainly on the *DECC* methodology but additional constraints are added to reduce the potential to levels which are representative of economic viability given the cost of technology and future reduced costs of FiTs.

Solar energy (solar water heating and solar photovoltaics)

7.42 Solar water heating (SWH) depends on three site-specific factors: (1) available roof space (to install the system), (2) orientation and exposure of the roof (to be able to capture enough solar radiation), and (3) hot water demand on-site (SWH is typically sized to supply 50% of the hot water demand). SWH systems are suitable for most domestic buildings and this assessment focuses on the residential building stock.

7.43 Table 3 below details the criteria for assessing the potential for SWH.

Solar water heating potential (thermal) methodology

Constraint type	Details
Existing buildings potential	25% of all dwellings
New development potential	50% of all dwellings
System capacity	2 kW domestic No / limited potential (commercial/industrial)
Realistic uptake	Existing domestic – 10% of potential New build – 25% of potential

(Source: East of England Renewable and Low Carbon Energy Capacity Study)

Table 3: Solar water heating potential (thermal) methodology

7.44 Solar photovoltaics (PV) depends only on two of the above site-specific factors: (1) available roof space (to install the system) and (2) orientation and exposure of the roof (to be able to capture enough solar radiation). Solar PV systems are

equally suitable for domestic and non-domestic buildings. Domestic buildings tend to have pitched roofs and therefore orientation is a strong factor, unlike commercial and industrial buildings, which often have flat roofs. The capacity assessment explores all building stock in the Borough (See Table 4 below).

Solar photovoltaics potential methodology

Constraint type	Details
Existing buildings potential	25% of all dwellings 40% of all commercial properties 80% of all industrial properties
New development potential	50% of all dwellings
System capacity	2 kW domestic 5 kW commercial 10 kW industrial
Realistic uptake	Existing domestic – 10% of potential Existing commercial / industrial – 25% of potential New build – 25% of potential

(Source: East of England Renewable and Low Carbon Energy Capacity Study)

Table 4: Solar photovoltaics potential methodology

7.45 Deployment of either solar technology requires suitable space for installation. A building may have either or both technologies installed, however the total capacity of the system(s) will not vary considerably, i.e. a large system of either technology or two systems, one of each technology. Therefore, the assessment uses a single set of parameters for both categories to avoid double counting.

Heat pumps (air and ground source)

7.46 Ground source heat pumps (GSHP) extract the heat stored in the ground to provide space and water heating. They use electricity in the process. There are two broad subcategories: (1) open loop systems typically pump warmer water up from an aquifer returning it at a lower temperature; these systems tend to be larger and more suitable for commercial buildings; and (2) closed loop systems, where liquid circulates through a closed tube put in the ground, which absorbs the ground heat. The ground component of closed loop systems can be installed horizontally in trenches or vertically in boreholes.

7.47 Air source heat pumps (ASHP) extract the ambient heat in the air to provide space and water heating. They use electricity in the process. As the outside air temperature varies considerable during the year, their energy and carbon efficiency varies as well and is lower overall compared with GHSP. Their advantage however is in their low space requirement and can be installed in most locations, including urban areas, where they are the alternative to GHSP.

7.48 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.

7.49 Table 5 below details the criteria for assessing the amount of potential heat pumps that could be installed.

Heat pumps potential methodology

Constraint type	Details
Existing buildings potential	100% of post 1980 dwellings off gas grid 25% of commercial off gas grid 25% of industrial off gas grid
New development potential	50% of all dwellings
System capacity	5 kW domestic 100 kW commercial
Realistic uptake	Existing domestic – 20% of potential New build – 25% of potential

(Source: East of England Renewable and Low Carbon Energy Capacity Study)

Table 5: Heat pumps potential methodology

Stages 3 and 4 – Microgeneration (including solar energy (water heating and photovoltaics) and ground and air source heat pumps)

7.50 There are no constraints under stages 3 and 4 for solar energy and heat pumps.

Stages 1 and 2 – District Heating (DH) and Combined Heat and Power (CHP)

7.51 The guidance for calculating the potential for District Heating (DH) and Combined Heat and Power (CHP) is based mainly on the information within the *DECC* methodology. However, the assessment was produced before the *DECC UK CHP Development Map*, and the map shows areas of heat density within the UK.

7.52 CHP is the simultaneous generation of usable heat and power (usually electricity) in a single process. CHP systems are highly efficient, making use of the heat which would otherwise be wasted when generating electrical or mechanical power. Whilst they are an expensive and complicated technology, when installed efficiently they can be extremely viable. DH (also known as Community Heating) is the system for distributing heat from a centralised location (such as a CHP plant) for residential and commercial heating requirements. Multiple users are connected through a piped network to the main plant.

7.53 DH can be retrofitted for existing heat customers or installed in new developments. Retrofit heat networks are most suited to areas with at least one large anchor load (e.g. a major hospital) which is located in an area with a high heat density (e.g. and number of high rise apartments). Anchor loads should be identified to establish potential for DH and CHP schemes and these can be found using the *DECC UK CHP Development Map*[23].

Stages 3 and 4 – District Heating (DH) and Combined Heat and Power (CHP)

7.54 The viability of CHP or DH is dependent not only on the availability of heat, but the density of that heat demand. This is because the cost of pipe required to transport heat is very high, which also means that the plant used for generating the low carbon energy is likely to need to be close to its demand.

7.55 Heat density is defined as the annual heat demand divided by the number of hours in a year (8760), which is then divided by area in km^2. Higher density urban areas would have a higher heat demand per km^2 and hence would be expected to have lower DH costs and greater potential for a cost-effective scheme. Generally if heat density exceeds 3,000 kW/km^2, the heat density is considered to be high, which means that economically speaking DH will likely suit a high proportion of flats rather than houses.

7.56 The heat density of an area would need to be reviewed to assess whether CHP and DH schemes would be viable, the *DECC UK CHP Development Map* also shows areas of heat density and should be reviewed accordingly.

[23] UK CHP Development Map: http://chptools.decc.gov.uk/developmentmap/

8. THE FINDINGS

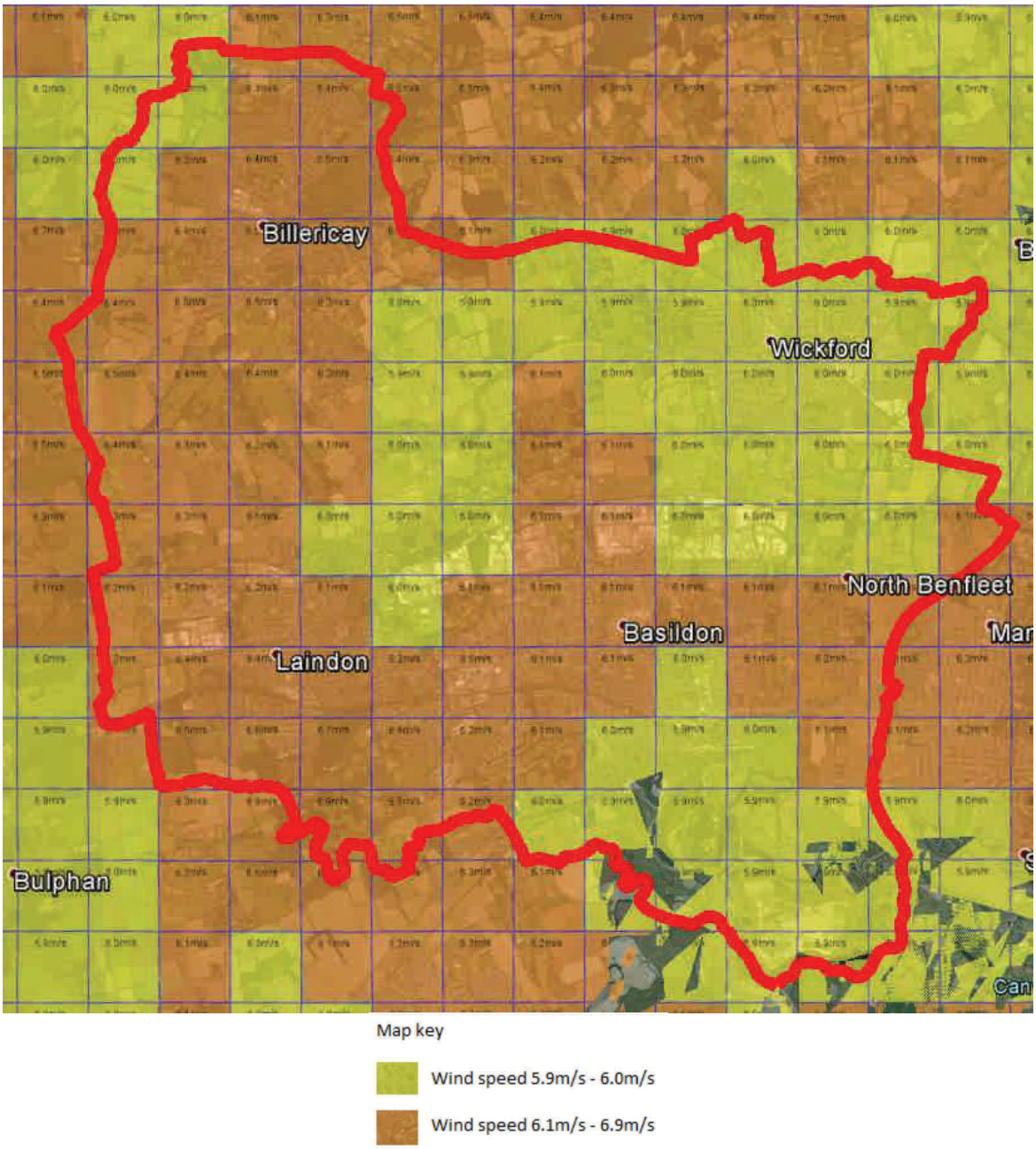
8.1 The results from this assessment will always be an approximation of the likely level of resource and not the exact resource potential, as this will vary depending on the amount of renewable energy resource available, and the ability for it to be extracted using the technologies available. Calculations in this report should be used as an indicator of the order of magnitude of a resource, and how this might compare with other resources and baseline energy demands.

8.2 The results will be detailed under the section headings A to F as set out in the methodology.

A: Large scale onshore wind energy

8.3 The initial criteria set by the methodology was to identify whether the wind speeds in Basildon were in excess of 5m/s measured at 45m above ground level. The whole of the Basildon Borough met this criteria and Figure 11 below shows the varying wind speeds, with yellow areas measuring up to 6m/s (generally 5.9m/s upwards) and the orange areas measuring 6m/s and above. The entire Borough is therefore considered to have a suitable wind resource.

Wind speed mapping in the Basildon Borough at 45m above ground level



(Source: Google Earth and Rensmart NOABL UK[24])
Figure 11: Wind speed mapping at 45m above ground level

8.4 The methodology suggests that capacity is reviewed next, whereas it would appear more important to initially consider a number of likely constraints on the location of wind turbine developments due to physical and environmental restrictions. Therefore a constraint analysis has been carried out to estimate the practical available resource.

The constraints reviewed included physical environment constraints such as roads and railways, and areas where development is unlikely to be permitted including Ancient Woodlands and built up areas (with necessary buffers).

[24] *Google Earth and Rensmart NOABL UK:* http://www.rensmart.com/DataServices/GoogleEarthMaps

8.5 Figure 12 below shows all the constraints applied within the Basildon Borough. A full list of the constraints applied are detailed in Appendix B. The remaining white spaces show the unconstrained areas where large scale wind turbines may be appropriate.

Map of the Basildon Borough showing large scale wind turbine constraints

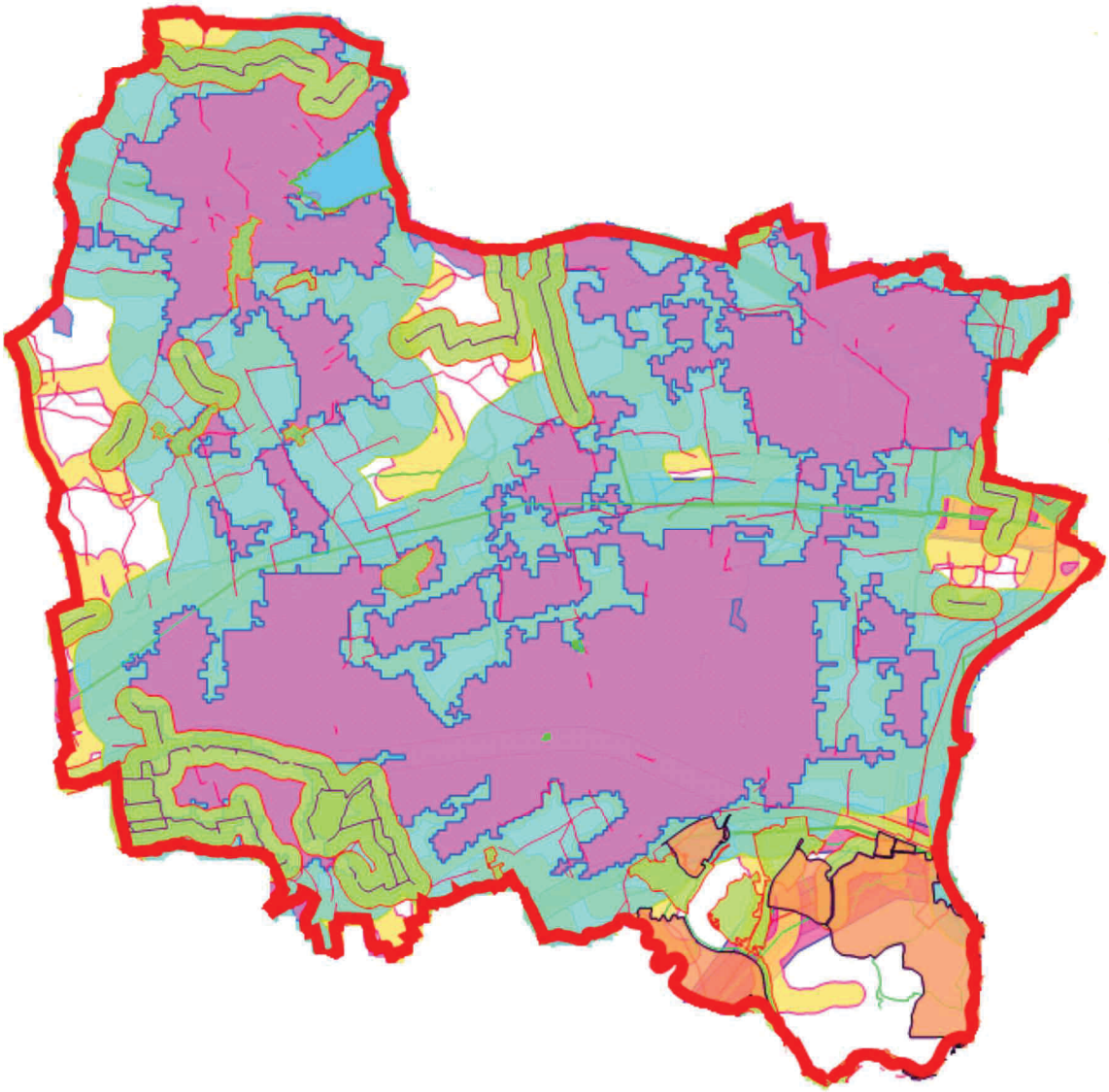


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Figure 12: Map of the Basildon Borough showing large scale wind turbine constraints

8.6 It is worth noting that there are also other issues where consideration will need to be given to schemes on a case by case basis. The most significant is the Green Belt policy which has the overarching aim of maintaining land as permanently open. Most forms of development are considered to be inappropriate in the Green Belt. However, some development may be possible where harm to the purpose of including land within the Green Belt is significantly outweighed by the benefits that a wind turbine development would

offer. An appraisal of the relative benefits of a wind turbine development within the Green Belt is beyond the scope of this study, and would need to be subject to consideration as part of any planning application. Details of matters of consideration for wind turbines are given in Appendix B in Table 10.

8.7 The next stage was to identify the remaining space once all the constraints had been applied. Figure 13 below shows the thirteen leftover areas where the wind turbine constraint criteria is met. Some areas do have minor constraints located within, i.e a public right of way or waterway, however these could still accommodate a turbine if the location of a turbine(s) avoided the constraint, or otherwise provided suitable mitigation.

Map of Basildon Borough showing remaining areas following constraints analysis

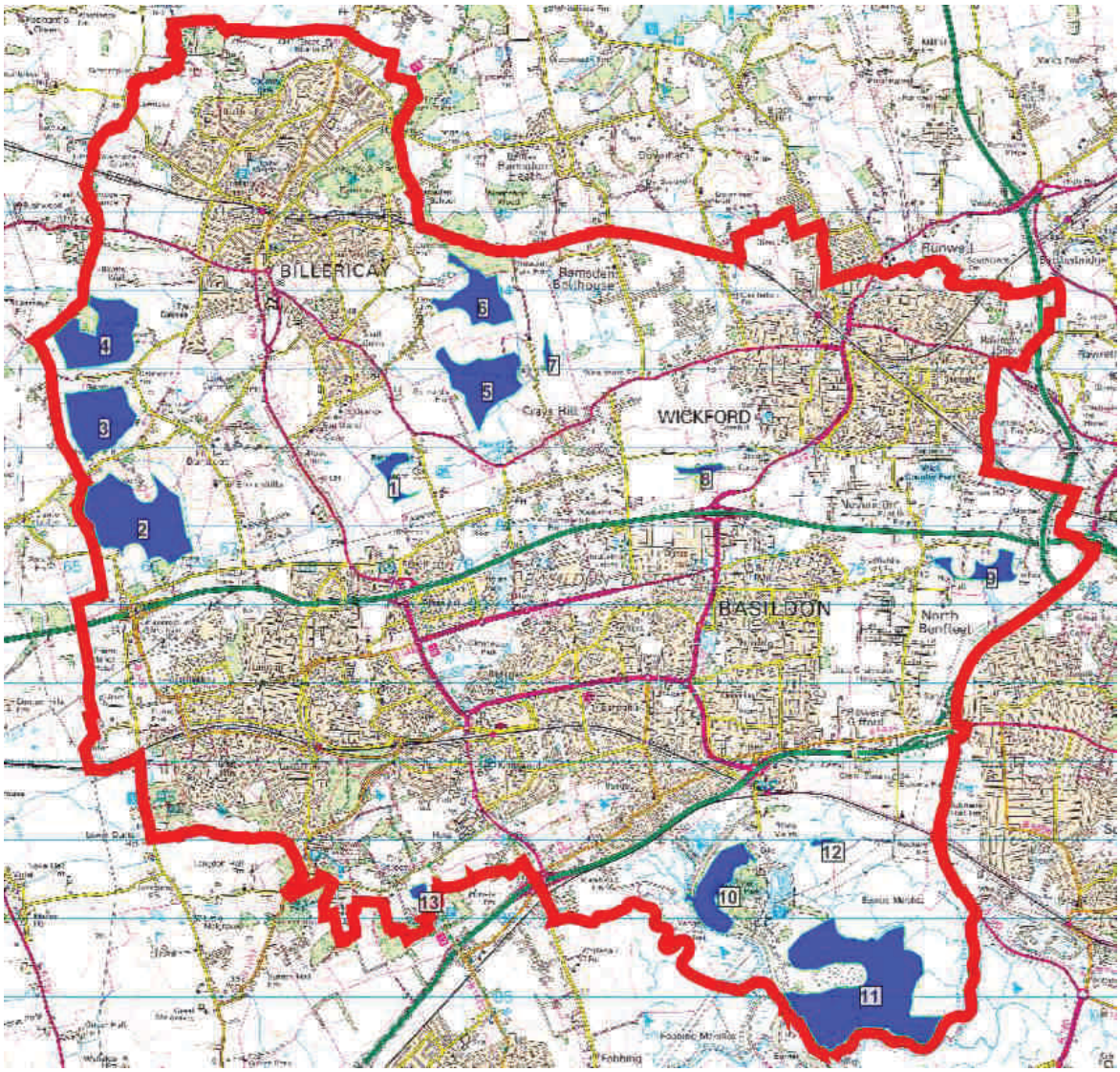

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Figure 13: Map of Basildon Borough showing remaining areas following constraints analysis

8.8 It is then necessary to consider the capacity of each of the 13 sites to see if any of them would be of an appropriate size to accommodate large scale wind

turbines. Table 6 below shows the criteria for small, medium and large scale turbines to be able identify where they could be accommodated considering rota diameter and topple distance.

Typical scales of wind turbines

Scale	Typical Turbine Installed Capacity	Typical Turbine Height (to blade tip)	Topple distance (Height of turbine plus 10%)
Micro	6kW	15m	16.5m
Small	500kW	15-40m	46m
Medium	900kW	40-80m	92m
Large	2.5MW	80-135m	155m

Table 6: Typical scales of wind turbines

8.9 Based on the topple distance the relevant radius buffer could be applied to work out the capacity for each site, these are illustrated for the thirteen sites in Appendix C.

8.10 Table 7 below shows a summary of the capacity detailing the maximum potential for where large, medium and small scale turbines could be accommodated. The largest potential for energy has been assumed first in each case, i.e if a large scale turbine can be accommodated this will be preferred over two medium scale turbines. It should be noted that it is highly unlikely that the maximum amount of turbines would be located on a potential site, however it is necessary to consider the maximum potential of electricity that could be generated from large scale onshore wind turbines to attain a potential energy generation figure.

Typical number of wind turbines per site

Site number	Location	Maximum number and type of turbines	Maximum amount of renewable energy potential
1	Land between Barleylands Road and Noak Hill	1 medium and 5 small turbines	3.4MW
2	Land west of Little Burstead	8 large, 2 medium and 20 small turbines	31.8MW
3	Land west of Great Burstead	5 large, 1 medium and 10 small turbines	18.4MW
4	Land west of Tye Common	4 large, 4 medium and 13 small turbine	20.1MW
5	Land north of Crays Hill and east of South Green	4 large, 1 medium, 17 small turbines	19.4MW
6	Land east of Outwood Farm Road, Billericay	2 large, 3 medium and 10 small turbines	12.7MW
7	Land adjacent Crays Hall Farm	3 small turbines	1.5MW

8	Land north of Nevendon interchange	3 small turbines	1.5MW
9	Land at Bonvilles Farm	5 small and 3 medium turbines	4.2MW
10	Land adjacent Wat Tyler Country Park	1 large, 3 medium and 11 small turbines	12.5MW
11	Vange marshes	16 large, 3 medium and 22 small turbines	53.7MW
12	Pitsea marshes	1 small turbine	0.5MW
13	Land south of Dry Street	1 medium turbine	0.9MW
Total			180.6MW

Table 7: Typical number of wind turbines per site

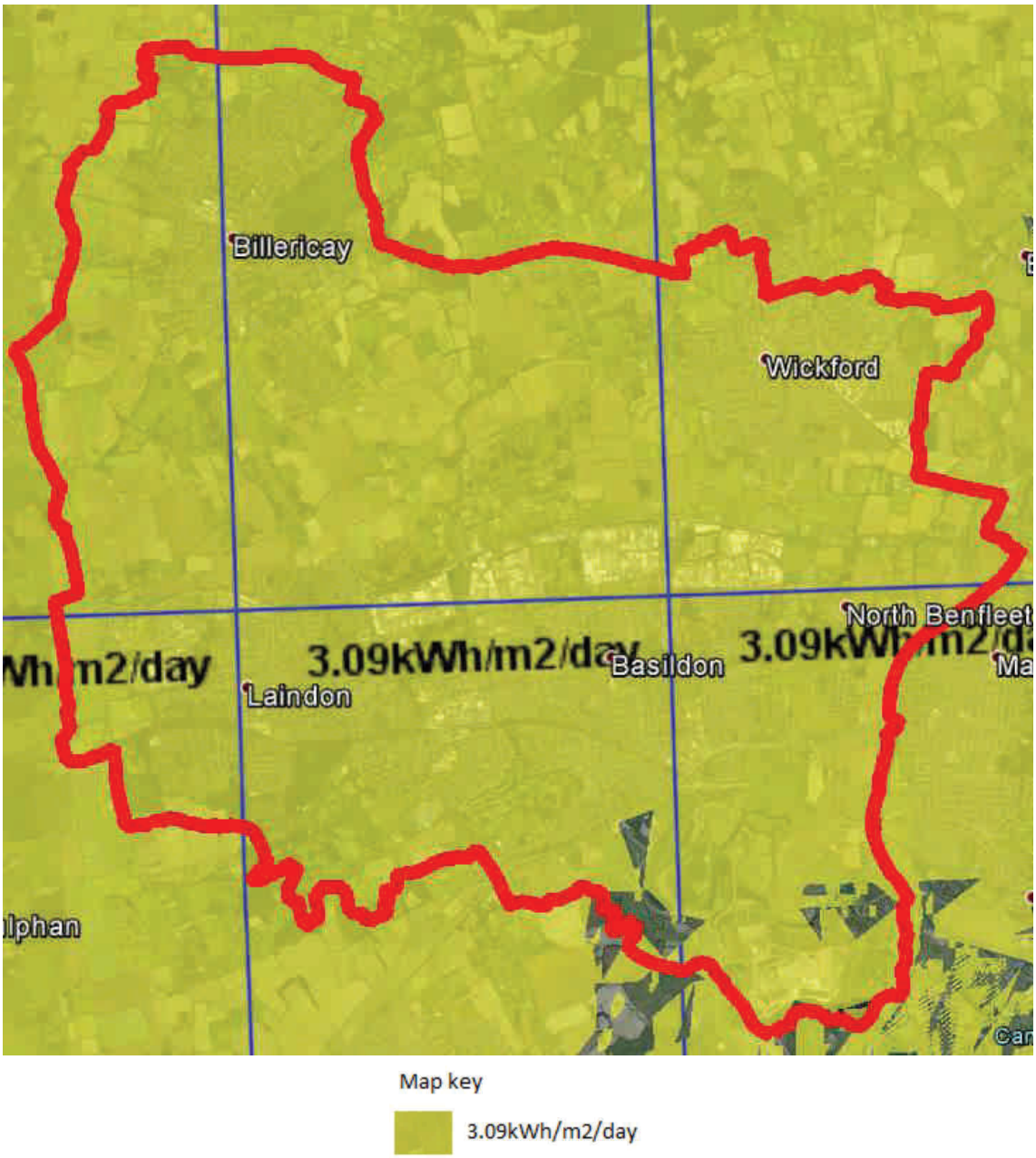
8.11 The resulting energy generation from wind turbines within the Borough could amount to 180.6MW if the uptake was 100%. However a realistic uptake is considered to be 10% which would amount to 18.06MW. Given that the Borough needs 90.41MW, the 18.06MW that wind turbines could provide would meet 20% of the Borough's electricity needs.

8.12 It is also worth noting that wind turbines can adversely affect a number of MOD operations. These effects are not limited to specific geographical areas. The methodology detailed in section 7 requires for these areas to be checked to establish suitability. It is not currently possible to view MOD sites and radar issues as highlighted in the methodology, however the Government is looking to provide this information. In the meantime developers and LPAs should consult with the MOD if a proposed turbine is 11 metres to blade tip or taller, and/or has a rotor diameter of 2 metres or more.

B: Large scale solar arrays

8.13 The first requirement for large scale solar arrays was to determine if a sufficient amount of solar irradiation is available to make the proposal viable. In Basildon the solar irradiation levels are 3.09kWh/m^2/day (which is approximately equal to 1,130kWh/m^2 a year) this is shown Figure 14 and this is in line with the suggested figure of 1,150 kWh/m^2 a year.

PVGIS UK Solar Map

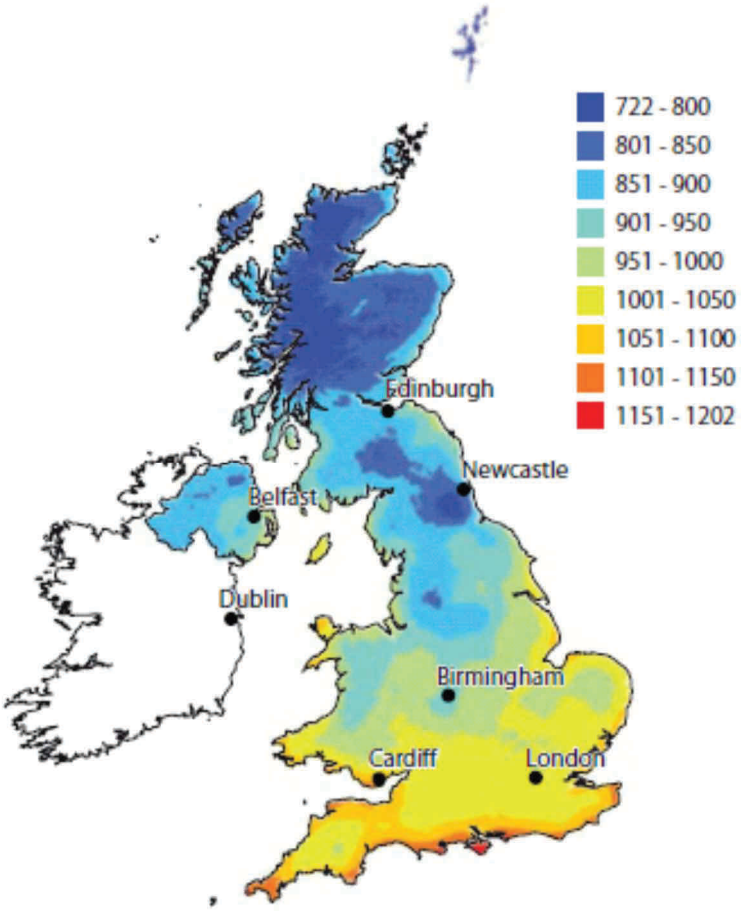


(Source: Google Earth and Rensmart NOABL UK[25])
Figure 14: Solar mapping (3.09kWh/m2/day equates to approximately 1,100kWh/m2 a year)

8.14 There is no current publicised specification for the amount of solar irradiation required, although Figure 15 below shows that the south has a higher than average amount of irradiation in comparison to other parts of the UK, therefore it would be considered that the radiation levels are high enough to make solar panels viable.

[25] *Google Earth and Rensmart NOABL UK:* http://www.rensmart.com/DataServices/GoogleEarthMaps

UK Solar irradiation map



(Source: Map data courtesy of the Met Office ©[26])

Figure 15: UK Solar irradiation map. Yearly total of global irradiation in kWh/m². Averaging period: 1997-2003.

8.15 The constraints identified in section 7 were then applied to the Basildon Borough. The map below (Figure 16) shows the Basildon Borough with the constraints applied, a list of the constraints are detailed in paragraph 7.19.

[26] Met Office map: https://www.bre.co.uk/filelibrary/pdf/other_pdfs/KN5524_Planning_Guidance_reduced.pdf

Map of Basildon Borough showing constraints analysis for large scale solar arrays

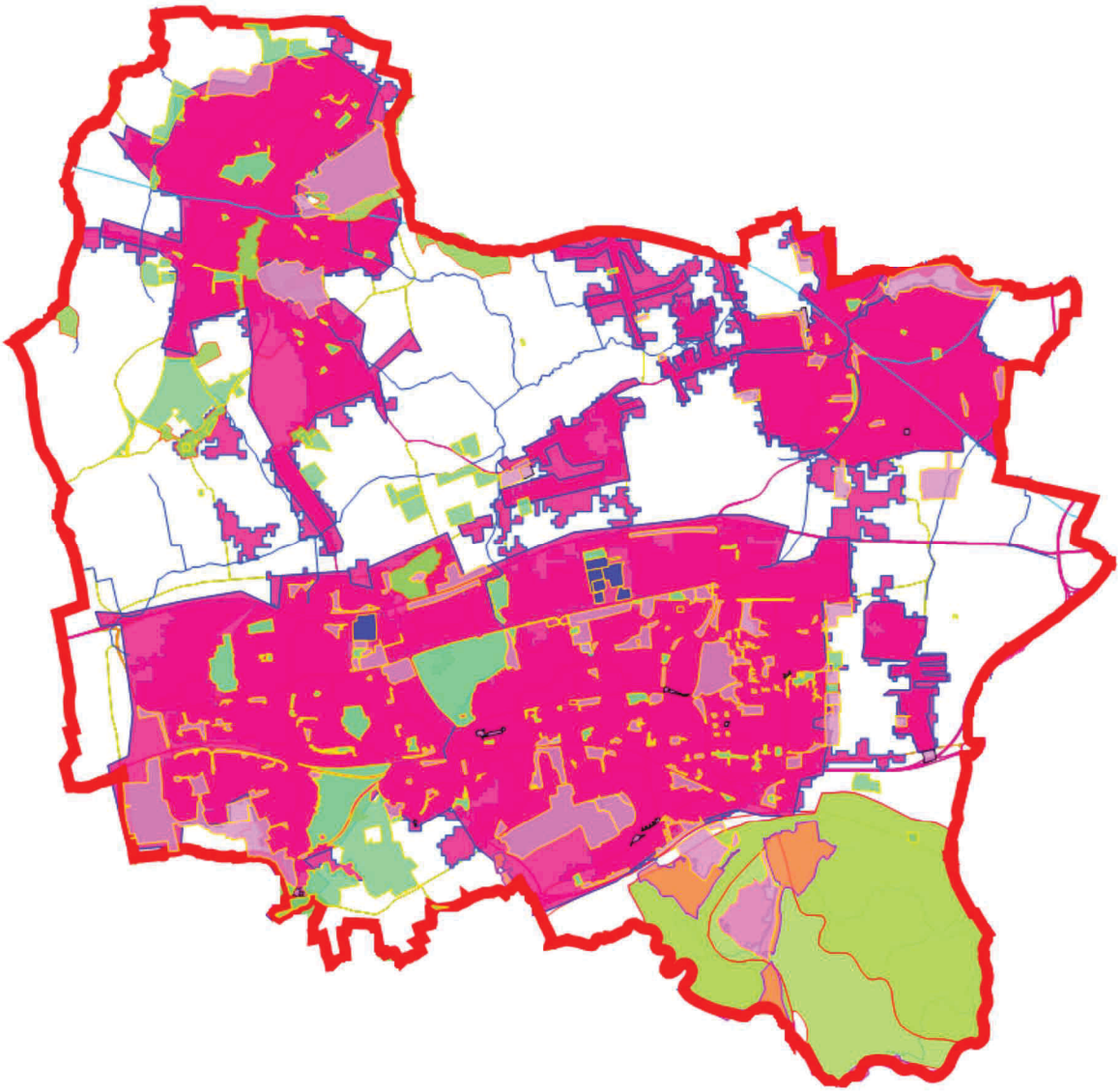


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Figure 16: Map of Basildon Borough showing constraints analysis for large scale solar arrays

8.16 The next step was to review the remaining areas which would be considered suitable for large scale solar arrays. The map below (Figure 17) shows the resulting 92 areas that were created by applying the constraints and plotting the locations that were left into individual areas where roads, rivers, etc. did not enter into an area.

Map of Basildon Borough remaining areas suitable for large scale solar arrays following the constraints analysis

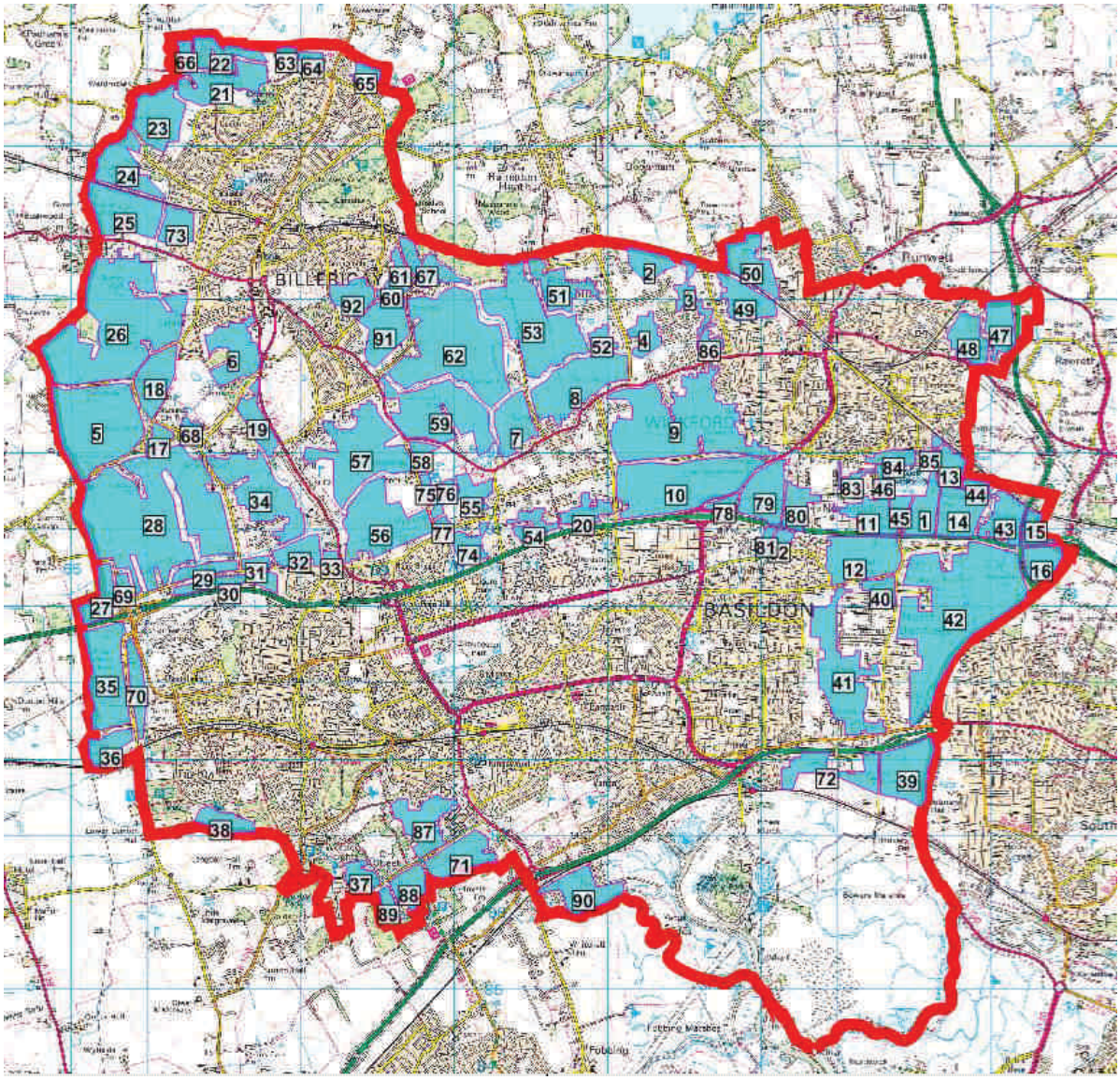

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Figure 17: Map of Basildon Borough remaining areas suitable for large scale solar arrays following the constraints analysis

8.17 The estimated potential for electricity generation from the 92 sites from large scale solar arrays was found to be approximately 1019.1MW. This was calculated by using the methodology described in section 7. This is clearly a significant resource and 10% of this is then thought to be what could actually be delivered within the Borough which equates to 102MW. The breakdown of each individual site detailing the size and electricity generation potential is detailed in Appendix D.

8.18 In light of the amount of electricity (90.41MW) that the Borough requires, large scale solar arrays could provide 102MW which equates to over 113% of the Borough's need.

Biomass

8.19 The *East of England Renewable and Low Carbon Energy Capacity Study* identified the resources available in the East of England. The results found that there could be as much as 260,000 tonnes of woodfuel available from managed woodlands between 2017 and 2021 (this includes both Forestry Commission woodland and also private sector woodland over 2ha in size). Unmanaged woodland has not been included in the assessment as there are significant barriers to its use such as maintenance and collection.

8.20 This figure is an estimated upper limit and constraints would need to be considered including practicalities of fuel recovery, the economic viability of the resource and potential distribution of larger sized wood to other market areas.

8.21 An estimate of the likely remaining amount of managed woodland suitable for biomass use as woodfuel from the *East of England Renewable and Low Carbon Energy Capacity Study* is therefore considered to be 67,000 oven dried tonnes (odt) per year consisting of fellings and thinnings from woodland and smaller scale stemwood. This would support 27MWe and 54MWth (MW thermal) of CHP capacity and an additional 204 MWth of boiler capacity. The annual generation is 847 GWh of heat and 190 GWh of electricity.

8.22 The electricity generated by biomass would equate to 21.69MW for Essex which would be 24% of Basildon's. However once the woodfuel from managed woodland is divided between Counties and then Boroughs it is unlikely to provide a substantial amount of resource for Basildon.

8.23 The *East of England Renewable and Low Carbon Energy Capacity Study* also identified the capacity for fuel from waste wood. The available resource of primary processing co-products was estimated as 24,577 odt per annum. Primary processing co-products are understood to represent wood waste from sawmills. The wood waste stream available from construction and demolition was estimated at 231,200 tonnes per year.

8.24 Therefore the total currently available (in 2011) sustainable resource from industrial wood waste is estimated to be 255,777 tonnes per year. The industrial wood waste resource in 2020 has been calculated by assuming that the quantity of industrial wood waste identified above increases by 1% per year between 2011 and 2020. This would equate to 279,740 tonnes in 2020.

8.25 The uptake in 2020 has been calculated by reducing the amount of biomass available for combustion in CHP by 50% to account for competing uses such as chipboard manufacture. Therefore the anticipated amount of industrial wood waste available for combustion up to 2020 is 139,870 tonnes. This equates to

approximately 47 MWth and 23 MWe, corresponding to 204 GWh of renewable heat and 163 GWh of renewable electricity.

Energy from waste (EfW)

Municipal solid waste (MSW)

8.26 The amount of MWS generated in Basildon between April 2011 and March 2012 is detailed in the Essex County Council and Southend-on-Sea Borough Council Waste Local Plan Capacity Gap Report 2013 Update[27] as 74,738 tonnes.

8.27 MSW availability for energy from waste is then considered as 25% of total MSW generation to allow for inert materials and recycling equalling 18,685 tonnes.

8.28 MSW could then be used in CHP plant, to generate both renewable heat and electricity.

8.29 18,685 tonnes would represent an installed capacity of 1.8MW. Of this a capacity factor of 90% has been assumed for the annual electrical output and 50% for the annual heat output based on AECOMs experience of conducting feasibility studies for CHP schemes as reported in the *East of England Renewable and Low Carbon Energy Capacity Study*.

8.30 This would generate 1.6MW of electricity when 90% capacity factor is assume which would be equivalent to 1.78% of the Borough's need.

Commercial and Industrial waste (C&IW)

8.31 The Essex County Council and Southend-on-Sea Borough Council Waste Local Plan Capacity Gap Report 2013 Update identified that a projection of 1,365,000 tonnes of C&IW is likely to be generated per annum in the Essex County area. It is considered that 80% of the total C&I waste stream is collected in a format that can be used for EfW and from that 25% is assumed as the total of C&IW generation to allow for inert materials and recycling equalling 273,000 tonnes.

8.32 This total is for the whole of Essex therefore it is necessary to apportion the amount likely to be generated for use in Basildon. The 2011 census states that there is 174,497 people in Basildon, in the Essex there is 1,724,950. Basildon therefore represents approximately 10% of Essex's population and this equates to approximately 27,300 tonnes of C&IW.

[27] https://www.essex.gov.uk/Environment%20Planning/Planning/Minerals-Waste-Planning-Team/Planning-Policy/Documents/Waste%20Capacity%20Gap%20Report%202013%20update%20-%20July%202013.pdf

8.33 C&IW could then be used in CHP plant, to generate both renewable heat and electricity.

8.34 27,300 tonnes would represent an installed capacity of approximately 2.7MW. Of this a capacity factor of 90% has been assumed for the annual electrical output and 50% for the annual heat output based on AECOMs experience of conducting feasibility studies for CHP schemes as reported in the *East of England Renewable and Low Carbon Energy Capacity Study*.

8.35 This would generate 2.43MW of electricity when 90% capacity factor is assume which would be equivalent to 2.69% of the Borough's need.

Dry organic waste

8.36 The local authority data on the *Department of Environment, Food and Rural Affairs* website[28] (Defra) details that Basildon had 3,063 poultry chickens in 2013. This equates to approximately 132 tonnes of poultry litter which represents 0.012MW of installed electricity capacity.

8.37 The *East of England Renewable and Low Carbon Energy Capacity Study* states how 90% of this would be the likely energy generation from installed plant working out as 0.001MW. This would not therefore make a significant contribution towards meeting the Borough's energy needs.

Microgeneration

Solar water heating (SWH)

8.38 The predicted increase in the number of dwellings within the Borough is set out in the *Strategic Housing Market Assessment 2015.* Based on the 2011 Census figures of an existing 74,032 dwellings, it has been calculated that by 2021 there will be approximately 79,332 dwellings within the Borough which is an increase of 5,300 dwellings.

8.39 Table 8 below details the outcomes of SWH potential based on the methodology detailed in section 7. The potential energy from SWH is 5MW.

SWH potential in the Basildon Borough

Constraint type	Details	Results
Existing buildings potential	25% of all dwellings	18,508 dwellings
New development potential	50% of all dwellings	2,650 dwellings
System capacity	2 kW domestic	42.3MW

[28] Department of Environment, Food and Rural Affairs website: https://www.gov.uk/government/statistical-data-sets/structure-of-the-agricultural-industry-in-england-and-the-uk-at-june

	No / limited potential (commercial/industrial)	
Realistic uptake	Existing domestic – 10% of potential New build – 25% of potential	10% of existing = 1,851 dwellings 25% of potential = 663 dwellings Total = 2,514 dwellings equal to 5MW

Table 8: SWH potential in the Basildon Borough

Solar photovoltaics (PV)

8.40 The statistics relating to dwellings in the Borough is detailed in section 8.37 above. The number of existing commercial and industrial buildings in the Borough have been calculated using the Basildon Borough GIS data. There are approximately 4,500 commercial buildings and 1,300 industrial buildings. Table 9 below details the results using the methodology detailed in section 7. The potential energy from solar PV is 9.9MW.

Solar PV potential in the Basildon Borough

Constraint type	Details	Results
Existing buildings potential	25% of all dwellings 40% of all commercial properties 80% of all industrial properties	18,508 dwellings 1,800 commercial buildings 1,040 industrial buildings
New development potential	50% of all dwellings	2,650 dwellings
System capacity	2 kW domestic 5 kW commercial 10 kW industrial	42.3MW domestic 9MW commercial 10.4MW industrial
Realistic uptake	Existing domestic – 10% of potential Existing commercial / industrial – 25% of potential New build – 25% of potential	1,851 dwellings = 3.7MW 450 commercial buildings = 2.3MW. 260 industrial buildings = 2.6MW 663 new build dwellings = 1.3MW Total = 9.9MW

Table 9: Solar PV potential in the Basildon Borough

Heat pumps (air and ground)

8.41 It was not possible to identify the necessary statistics to calculate the potential uptake for heat pumps within the Basildon Borough using the *DECC* methodology or the East of England methodology. Therefore the results from

the *East of England Renewable and Low carbon Energy Capacity Study* have been used.

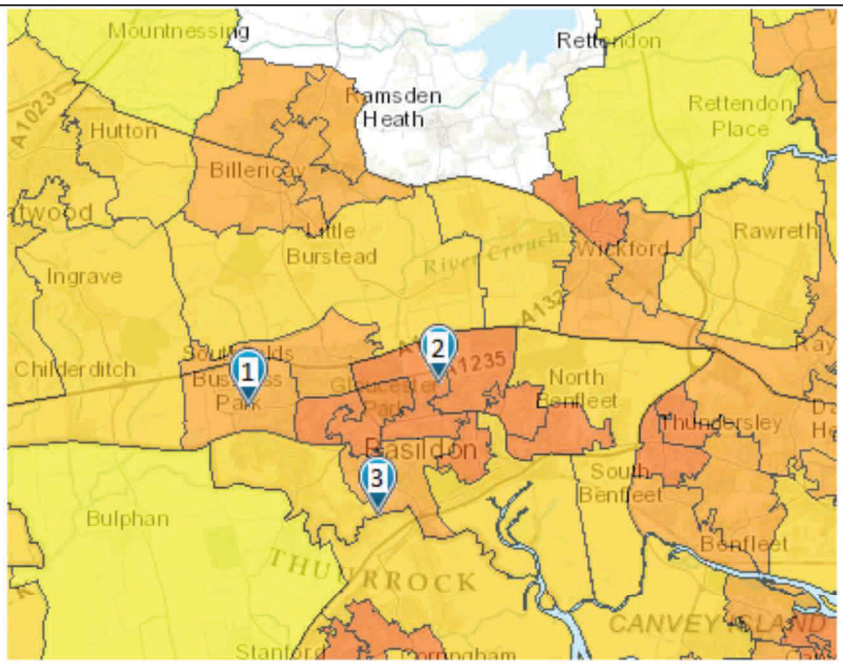
8.42 The study found that there was a potential uptake of 211MW in Essex. Based on the apportioning technique used in section 8.31, Basildon makes up approximately 10% of the Essex population, therefore 21.1MW could be considered as the total resource potential from heat pumps within the Borough.

8.43 The combined energy generation from microgeneration could be 36MW which would work out as 39.82% of the Borough's need.

District Heating (DH) and Combined Heat and Power (CHP)

8.44 Three anchor loads were identified using the *DECC UK CHP Development Map and* Figure 18 below shows the locations within the Basildon Borough. These anchor loads would be considered as suitable locations for CHP and could reduce risk for investment in district heating networks.

Map of anchor loads within the Basildon Borough



	Operator	Total KW
1	Ford Motor Company Ltd	5,551 KW
2	Elyo UK Industrial	8,659 KW
3	Basildon & Thurrock University Hospitals NHS Trust	5,120 KW
	Total heat load for all large heat load sites	**19,329 KW**

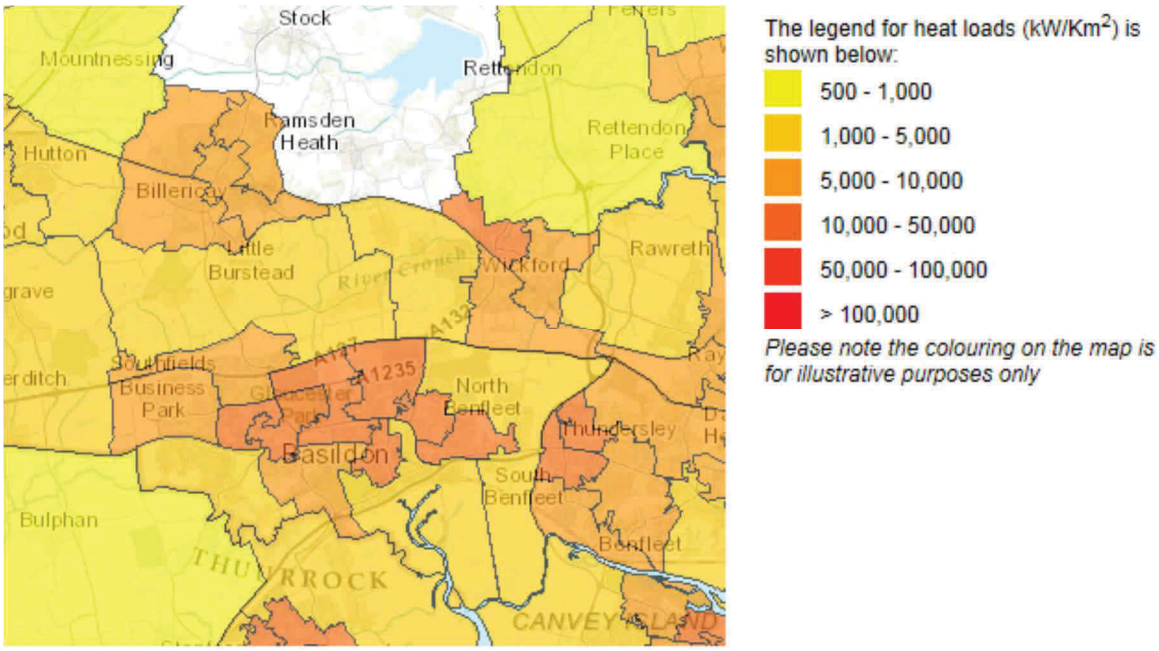
(Source: DECC UK CHP Development Map[29])

Figure 18: Map of anchor loads within the Basildon Borough

[29] DECC UK CHP Development Map: http://chptools.decc.gov.uk/developmentmap/

8.45 Figure 19 below shows the heat density within the Basildon Borough. The areas that are orange (5,000 – 10,000 KW/Km^2) or red (10,000 – 50,000 KW/Km^2) are considered to be most suitable for CHP and DH schemes.

Map of heat density within the Basildon Borough



(Source: DECC UK CHP Development Map [30])

Figure 19: Map of heat density within the Basildon Borough

8.46 There are a range of timing, planning, financial and technical hurdles to overcome. On-site assessments would still need to be undertaken to fully investigate the viability of schemes as other factors such as the site uses may vary (i.e. residential only or missed use). The barriers that could affect viability include:

- Lack of scale, diversity and security of load to create a viable network. A strategic approach to the planning and phasing of district heating infrastructure and plant is crucial for success;
- Phasing and timing issues, including lack of committed and secure base-loads to attract investment in required infrastructure. Uncertainty around timing and delivery of networks, preventing developers from committing to solutions outside the red line boundary of their own site;
- Varying local authority capacity and commitment to lead and enable delivery. Even where loads can be aggregated there may be reluctance for the private or public sector to invest unless loads can be guaranteed;
- Lack of evidence base required for decision making at a community scale.

[30] DECC UK CHP Development Map: http://chptools.decc.gov.uk/developmentmap/

9. CONCLUSIONS

Large scale onshore wind energy

9.1 The maps in section 7 clearly show that there is capacity within the Basildon Borough for large scale onshore wind turbines subject to necessary physical, environmental, and technical constraints being overcome. This is in line with the findings of the *East of England Renewable and Low Carbon Energy Capacity Study* which also found that Essex is a suitable location for large scale onshore wind energy.

9.2 The amount of electricity that could be generated by wind turbines was found to be 18.06MW which is 20% of the Borough's electricity needs.

9.3 Renewable energy from wind turbines within the Basildon Borough could be a significant resource providing the constraints are carefully reviewed along with other factors including landscape impact and the impact on visual and residential amenity.

9.4 Whilst some broad locations and the assessment criteria for onshore wind turbines have been identified in this assessment, there is national legislation in place to ensure that sites suitable for wind turbines are identified in either a local plan or neighbourhood plan and that communities are consulted on the proposal prior to planning permission being sought. This to ensure that the communities affected by the proposals have a chance to express their views, it is then up to the LPA to make a decision accordingly.

Large scale solar arrays

9.5 The assessment for the capacity of large scale solar arrays, as set out in section 8, shows that there is capacity within the Basildon Borough to generate a substantial amount of renewable electricity from large scale solar PV. The assessment found that there is capacity for 102MW of electricity generation which equates to 113% which is in excess of the Borough's electricity needs.

9.6 The amount of solar radiation is sufficient for the panels to be effective and providing the solar panels are located appropriately i.e south facing and not overshadowed and also that landscape impacts are assessed and mitigated then there is potential for large scale solar array schemes within the Basildon Borough.

9.7 Any large scale solar arrays are subject to planning permission and the constraints identified within this assessment along with landscaping considerations and impacts on visual and residential amenity should be considered on a case by case basis.

Biomass

9.8 The *East of England Renewable and Low Carbon Energy Capacity Study* carried out an exercise to ascertain whether sufficient feedstock resource is available to support biomass. The results for the East of England found that whilst the resources for biomass (including agricultural arisings, energy crops, managed woodland and industrial wood waste) could be a substantial amount, once the physical, technical and financial availability are considered the resource is severely limited.

9.9 Whilst this method of renewable energy generation is not necessarily feasible within the Basildon Borough at the present time, it is an important method of providing renewable energy and the use of plant biomass within the Borough in the future could be considered and any further schemes that come forward should be assessed on a case by case basis.

Energy from waste

9.10 The *East of England Renewable and Low Carbon Energy Capacity Study* looks at the resource potential from waste for MSW, C&IW and dry organic waste. The potential for using dry organic waste within the Basildon Borough was not considered as a sufficient amount to warrant its use for energy generation. However using MSW and C&IW would generate a moderate amount.

9.11 In total (from MSW and C&IW) 4.03MW of electricity could be generated which would be 4.46% of the Borough's electricity need, whilst this isn't a substantial amount it would provide a sufficient proportion of electricity to make energy from waste worth considering. Any planning applications that are submitted should be reviewed on a case by case basis.

Microgeneration

9.12 The *East of England Renewable and Low Carbon Energy Capacity Study* identifies the potential for microgeneration within Essex. The methods available include heat pumps (air and ground) and solar water heating and photovoltaics.

9.13 The results which are detailed in section 8 show that there are opportunities within the Borough for microgeneration to be installed subject to compliance with the permitted development criteria or where this is not possible then subject to proposals being acceptable under national and local planning legislation.

9.14 The methods of microgeneration reviewed would provide a substantial amount of renewable energy if installed within the Basildon Borough totalling 36MW which is equivalent to 39.82% of the Brough's electricity needs.. However it is

worth noting that the uptake for microgeneration may decline following changes to the FiT as the amount is due to be reduced.

District Heating (DH) and Combined Heat and Power (CHP)

9.15 The levels of heat demand in the Basildon Borough were detailed in section 8 and three areas with anchor loads were identified as well as a number of areas with a high level of heat density.

9.16 Whilst it would appear that there is potential for CHP and DH within the Borough, all potential DH and CHP schemes should be assessed on a case by case basis to ensure that local conditions (number, size, type of heat users, delivery mechanism and financing) are taken into account and that viability is considered in any case.

9.17 Due to the complexity of CHP and DH schemes it is not possible to make assumptions on the potential energy generation from them as part of this study. Any planning applications submitted would need to be carefully reviewed and assessed for their viability as well as planning matters including impacts to landscape and visual and residential amenity.

Overall potential for energy from renewable and low carbon sources

9.18 There is significant potential to generate a large amount of renewable and low carbon energy within the Basildon Borough. If all the methods reviewed as part of this study were combined and utilised then 181.78MW of electricity could be generated which equals a substantial 201% of the Borough's electricity needs based on the 2012 statistics.

9.19 This assessment has shown that large scale solar arrays could provide the most electricity for the Borough followed by microgeneration and wind turbines.

9.20 By promoting the use of renewable and low carbon energy generation methods at commercial and domestic scale (in appropriate locations) the Borough could reduce greenhouse gas emissions and contribute to the UK having a continuous and secure energy supply.

9.21 Given the potential for substantial electricity generation through renewable and low carbon energy in the Borough and the positive benefits it would bring not only to the Borough but to the UK as a whole, it would be appropriate to set targets within the emerging Local Plan for new developments and conversions to existing buildings to incorporate renewable and low carbon energy generation. It is suggested that the Merton Rule is applied at a rate of 10-20% CO2 emissions arising from each development site. This would require on-site renewable /low carbon energy provision at 10-20% of the sites total energy consumption.

9.22 The Merton Rule was a ground breaking planning policy developed by Merton Council. The policy required new developments to generate at least 10% of their energy needs from on-site renewable energy equipment, in order to help reduce annual carbon dioxide (CO2) emissions in the built environment. The rule applied to all types of buildings, not just homes. Merton Council developed the rule and adopted it in 2003. Since then the Mayor of London and many councils implemented it, and it became part of national planning guidance. This type of planning policy would encourage renewable and low carbon energy generation contributing to the UK's target reductions as well as the benefits detailed above.

Other considerations

Connection to the grid

9.23 *UK Power Networks* data (shown in Appendix A) maps the capacity for electricity to connect to the existing national grid. Some areas of the Basildon Borough have an existing high demand and may therefore be more suitable for decentralised renewable and low carbon energy schemes. *UK Power Networks* would need to be consulted on any planning application for renewable and low carbon energy where a connection to the grid is required to ensure that capacity is not a technical issue.

Visual impact

9.24 The methodology from the *DECC* website on assessing the capacity for renewable energy development does not specifically look at the impact of some types of technologies may have on landscape. It would be necessary to assess the likely landscape and visual impacts of individual proposals as part of the planning application process.

10. GLOSSARY OF TERMS

Relevant Abbreviation	Term	Definition
	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, and digestates can be re-used on farms as a fertiliser.
	Anchor loads	A pre-existing heat load that could be connected to a district heating network (DH).
AONB	Area of Outstanding Natural Beauty	Area of Outstanding Natural Beauty (AONB): is a landscape whose distinctive character and natural beauty are so outstanding that it is in the nation's interest to safeguard them. Created by the legislation of the National Parks and Access to the Countryside Act of 1949.
-ASHP	Air Source Heat Pump	An air source heat pump (ASHP) is a system which transfers heat from outside to inside a building, or vice versa. Under the principles of vapour compression refrigeration, an ASHP uses a refrigerant system involving a compressor and a condenser to absorb heat at one place and release it at another.
	Ancient Woodland	Ancient woodland is an area that has been wooded continuously since at least 1600 AD. Ancient woodlands are of prime ecological and landscape importance. Many rare and threatened species are associated with this habitat. Furthermore relatively undisturbed woodland often contains features of historical, archaeological and landscape importance.

Relevant Abbreviation	Term	Definition
		Ancient woodland is listed under Section 41 of the Natural Environment and Rural Communities Act 2006, as being of principal importance for the purpose of conserving biodiversity in England.
	Basildon	When "Basildon" is mentioned in text, it refers only to the area of the Basildon New Town including Laindon and Pitsea and not the whole Borough.
	Biomass (animal and plant)	Biomass is biological material derived from living, or recently living organisms. In the context of biomass for energy this is often used to mean plant based material, but biomass can equally apply to both animal and vegetable derived material.
	Climate Change	Climate change is a large-scale, long-term shift in the planet's weather patterns or average temperatures.
	Climate Change Act 2008	The Climate Change Act 2008 makes the UK the first country in the world to have a 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. The act sets out the target for 2050: the net UK carbon account for the year 2050 should be at least 80% lower than the 1990 baseline.
	Co-firing	Co-firing is the process of replacing part of the fossil fuel supplied to a power station or boiler with a 'carbon lean', renewable alternative.
CHP	Combined Heat and Power	Combined Heat and Power (CHP) is the simultaneous generation of usable heat and power (usually electricity) in a single process. The heat generated

Relevant Abbreviation	Term	Definition
		during this process is supplied to an appropriately matched heat demand that would otherwise be met by a conventional boiler. CHP systems are highly efficient, making use of the heat which would otherwise be wasted when generating electrical or mechanical power. This allows heat requirements to be met that would otherwise require additional fuel to be burnt. A CHP plant can be run on fossil or renewable fuels.
	Conservation Area	Areas of Towns or Villages which have special architectural or historic interest and deserve to receive careful protection are designated as Conservation Areas. Conservation areas give broader protection than listing individual buildings: all the features listed or otherwise, within the area, are recognised as part of its character.
	Decentralised Energy	Electricity production at or near the point of use.
	Density	The intensity of development within a given area, usually measured for housing in terms of the number of dwellings per hectare.
DCLG	Department Communities and Local Government	The central Government department with responsibility for Planning.
DECC	Department of Energy and Climate Change	The Government department responsible for energy and climate change.
DEFRA	Department of Environment, Food and Rural Affairs	The Government department responsible for environmental protection, food production and standards, agriculture, fisheries and rural communities

Relevant Abbreviation	Term	Definition
	Designated Heritage Asset	A World Heritage Site, Scheduled Monument, Listed Building, Protected Wreck Site, Registered Park and Garden, Registered Battlefield or Conservation Area designated under the relevant legislation.
	Directive on Renewable Energy 2009/28/EC	The European Union directive which mandates levels of renewable energy use within the European Union.
DH	District Heating	A low-carbon system for distributing heat, which is generated in a local centralised location for residential and commercial heating requirements.
	Energy Efficiency	Using less energy to provide the same service.
EfW	Energy from Waste	Energy-from-waste (EfW) is the process of generating energy in the form of electricity and/or heat from the primary treatment of waste.
	Evidence Base	The collection of information and studies which a Local Planning Authority will use to draw up suitable planning policies for its area.
FiT	Feed in Tariff	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.
	Geothermal energy	Energy obtained by tapping underground reservoirs of heat, usually near volcanoes or other hot spots on the surface of the Earth.

Relevant Abbreviation	Term	Definition
	Green Belt	A restrictive land use designation around major built up areas that have existed since 1947 to restrict urban growth and safeguard the countryside for agriculture, forestry and recreation. They are protected by the national and local policies.
GSHP	Ground source Heat Pump	A Ground Source Heat Pump (GSHP) is a central building heating and/or cooling system that takes advantage of the relatively constant year-round ground temperature to pump heat to or from the ground.
	Hydro energy	Hydroelectric energy is energy derived from the movement of water. Water has mass. It falls and flows downward due to gravity. When it moves, it has kinetic energy which can be harnessed.
	Kyoto Protocol	The Kyoto Protocol, also known as the Kyoto Accord, is an international treaty among industrialized nations that sets mandatory limits on greenhouse gas emissions.
	Listed Building	Buildings designated to be of 'special architectural or historic interest' by the Secretary of State under the Listed Buildings and Conservation Areas Act 1991.
LNR	Local Nature Reserve	Local Nature Reserves are for both people and wildlife. They offer people special opportunities to study or learn about nature or simply to enjoy it. To qualify for LNR status, a site must be of importance for wildlife, geology, education or public enjoyment.
	Local Plan	Policy Plan for the Borough setting out detailed planning policies, proposals and Policies Maps for use when determining planning applications and

Relevant Abbreviation	Term	Definition
		spatially guiding strategic development.
LPA	Local Planning Authority	The local authority responsible for planning matters in its area. Essex County Council and Basildon Borough Council are both Local Planning Authorities for different planning matters in Basildon Borough.
LoWS	Local Wildlife Sites	Local Wildlife Sites previously known as Sites of Importance for Nature Conservation (SINC) or County Wildlife Sites (CoWS) are areas of land with significant wildlife value. Local Wildlife Sites support both locally and nationally threatened wildlife, and many sites will contain habitats and species that are priorities under the Essex or UK Biodiversity Action Plans that sets out strategies for the conservation of much of our most vulnerable wildlife.
	Low Carbon Energy	Low-carbon technologies are those that can help reduce carbon emissions.
	Merton Rule	The Merton Rule was a ground breaking planning policy, developed by Merton Council, which required new developments to generate at least 10% of their energy needs from on-site renewable energy equipment, in order to help reduce annual carbon dioxide (CO_2) emissions in the built environment. The rule applied to all types of buildings, not just homes. Merton Council developed the rule and adopted it in 2003. Since then the Mayor of London and many councils implemented it, and it became part of national planning guidance.
	Microgeneration	This refers to the use of on-site technologies to generate heat and/or

Relevant Abbreviation	Term	Definition
		electricity from low or zero carbon sources.
	National Parks	An area of countryside, or occasionally sea or fresh water, protected by the state for the enjoyment of the general public or the preservation of wildlife.
NPPF	National Planning Policy Framework	Sets out the Government's economic, environmental and social planning policies for England. It was published March 2012.
NDO	Neighbourhood Development Order	Communities can use NDOs to permit the development they want to see - in full or in outline – without the need for planning applications.
NDP	Neighbourhood Development Plan	Neighbourhood forums and parish councils can use new neighbourhood planning powers to establish general planning policies for the development and use of land in a neighbourhood.
	Neighbourhood Planning	Introduced by the Localism Act (2011) to allow local communities to shape new development in their area, through the building of homes, jobs and community facilities.
	Open space	All open space of public value, including not just land, but also areas of water (such as rivers, canals, lakes and reservoirs) which offer important opportunities for sport and recreation and can act as a visual amenity.
	Passive solar design	Passive solar design refers to the use of the sun's energy for the heating and cooling of living spaces. In this approach, the building itself or some element of it takes advantage of natural energy characteristics in

Relevant Abbreviation	Term	Definition
		materials and air created by exposure to the sun.
	Planning Act 2008	An Act to establish the Infrastructure Planning Commission and make provision about its functions.
	Planning and Compulsory Purchase Act 2004	The primary legislation for the development plan process.
	Planning and energy Act 2009	An Act to enable local planning authorities to set requirements for energy use and energy efficiency in local plans.
PD	Permitted development	Minor development or changes of use that can be made to a house or building within the need for planning permission.
PPG	Planning Practice Guidance	Planning guidance to support the NPPF.
	Ramsar Site	Ramsar sites are wetlands of international importance, designated under the Ramsar Convention. The Ramsar Convention is an international agreement signed in Ramsar, Iran, in 1971, which provides for the conservation and good use of wetlands.
	Renewable Energy	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.
RES	2009 UK Renewable Energy Strategy	The strategy which sets out how the UK will reach our goal of 15% of energy from renewables by 2020.
	Scheduled Monument	'Scheduling' is shorthand for the process through which nationally important sites and monuments are

Relevant Abbreviation	Term	Definition
		given legal protection by being placed on a list, or 'schedule'. A schedule has been kept since 1882 of monuments whose preservation is given priority over other land uses.
Solar PV	Solar photovoltaics	Renewable system converting sunlight into electricity, which can be used to power (or partially power) electrical equipment and appliances.
SWH	Solar Water Heating	This is primarily a hot-water technology. It works by absorbing energy from the sun and then heating water (using heat exchangers).
SAC	Special Area of Conservation	SACs are areas which have been given special protection under the European Union's Habitats Directive. They provide increased protection to a variety of animals, plants and habitats and are a vital part of global efforts to conserve the world's biodiversity.
SPA	Special Protection Areas	SPAs are areas which have been identified as being of national and international importance for the breeding, feeding, wintering or the migration of rare and vulnerable species of birds found within European Union countries. They are European designated sites, classified under the 'Birds Directive 1979'.
SSSI	Special Site of Scientific Interest	SSSI's are the country's very best wildlife and geographical sites. There are over 4,000 Sites of Special Scientific Interest in England, covering around 7% of the land area. More than 70% of these sites by area are internationally important for their wildlife, and are also designated as Special Areas of Conservation, Special Protection Areas or Ramsar sites

Relevant Abbreviation	Term	Definition
	Town and Country Planning Act 1990	Legislation which regulates the development of land in England and Wales.

11. APPENDICES

Appendix A – Electricity Grid Capacity

Figure 20 below shows the locations of substations which serves the Basildon Borough. There is one located to the east of Basildon just outside the Borough area shown as a blue area. The orange outer circle highlights which areas are within 3km of the substation. A further orange area is shown to the south where another substation is sited relatively close to the Borough boundary.

Map of the Basildon Borough showing electricity substations

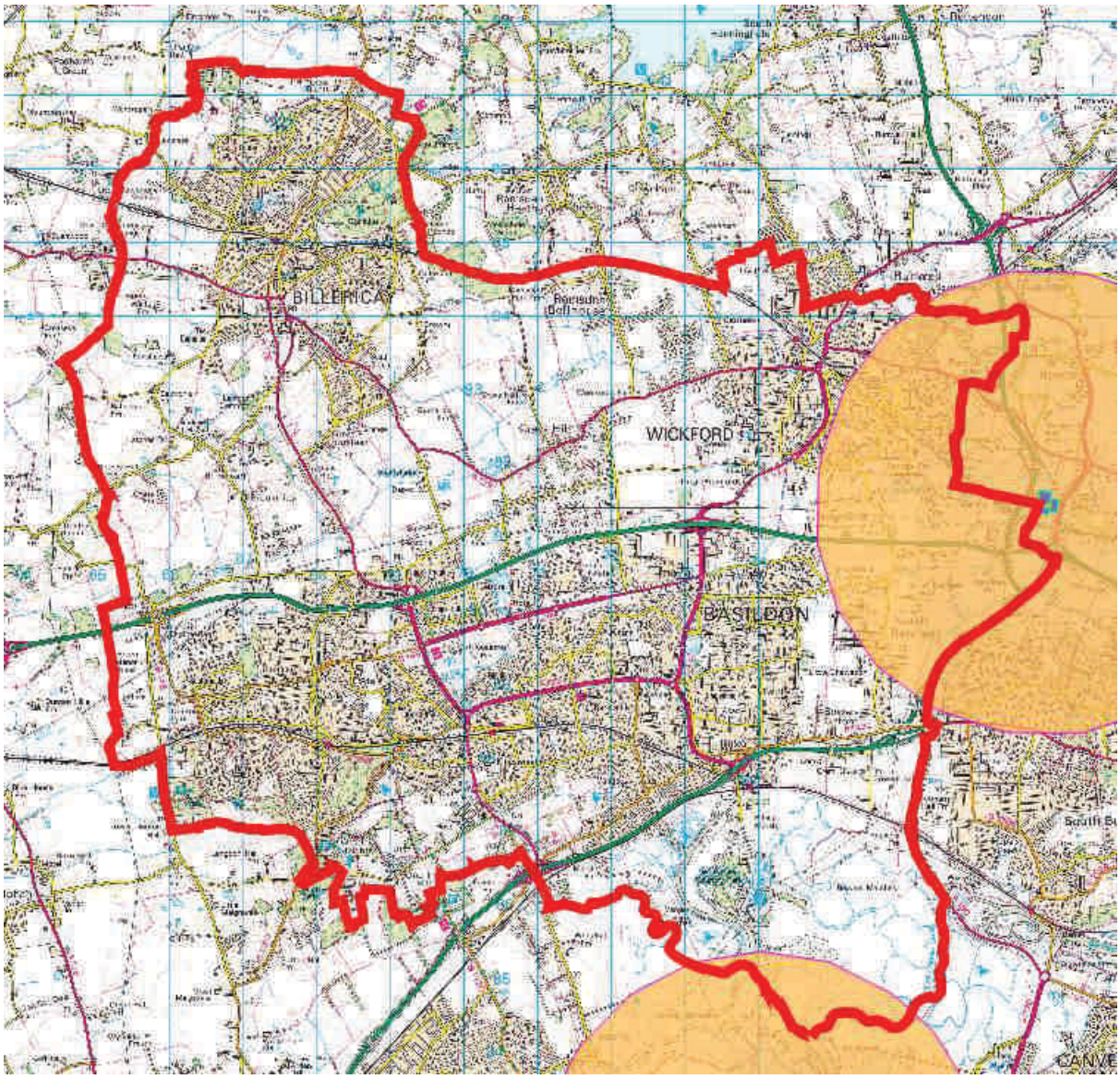


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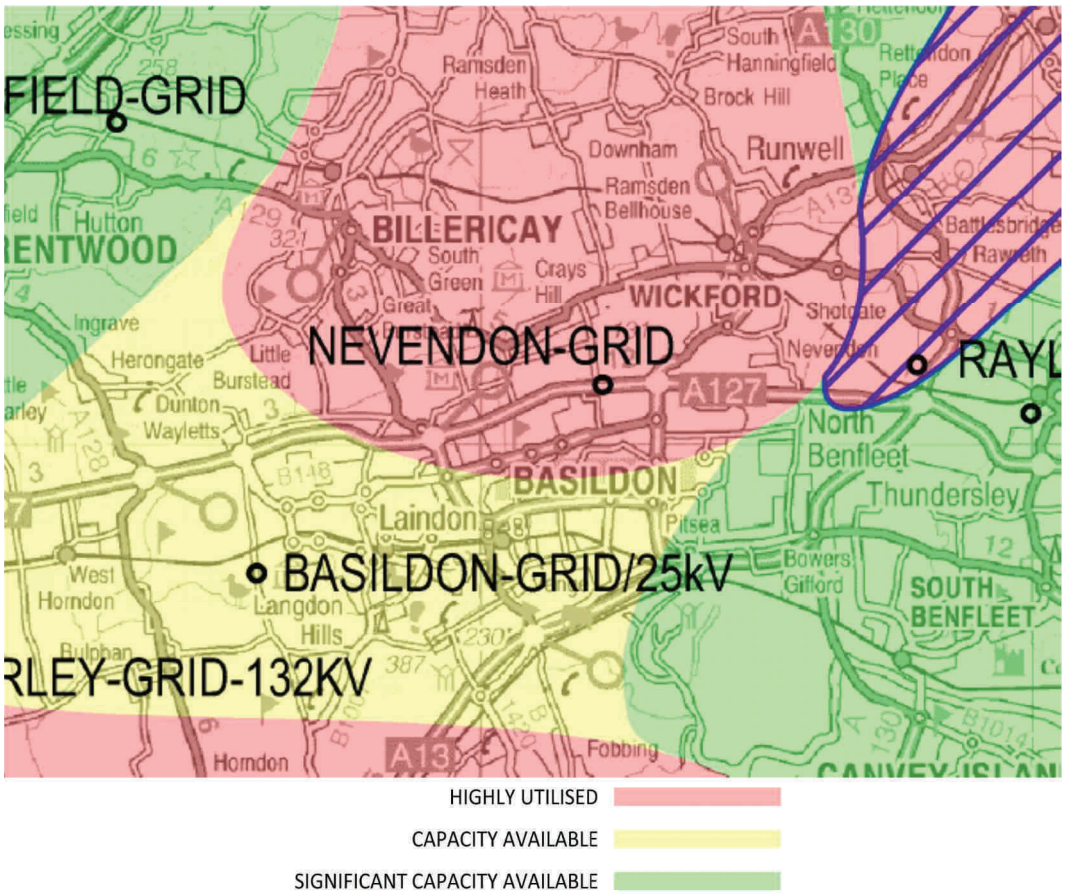
Figure 20: Map of the Basildon Borough showing electricity substations

Figure 21 below details where the UK Power Network have indicated the capacity for the electrical network to accept connection of new generation equipment.

Indicative map of new electricity capacity (Source: UK Power Networks[31])



(Source: UK Power Networks – December 2014)

Figure 21: Indicative map of the capability of the high voltage electrical network to accept connection of new generation equipment

It is usually possible to connect generation equipment to the electricity distribution network at all voltages, but a number of factors can restrict the capabilities including:

a) The amount of new generation that can be connected relative to the existing load/demand to the system;
b) The proposed location and size of the generator;
c) The nature of the existing equipment and circuit ratings; and
d) The amount of existing generation equipment already connected or which UKPN are committed to connect.

The map above (Figure 21) identifies where there may be some issues with connecting renewable and low carbon energy generators to the electricity grid. North of the borough, shown in red, is detailed as highly utilised and this would need to be considered when looking at suitable renewables. The yellow area should allow for capacity and the green area should have significant capacity available.

A study of the electricity distribution network in the East of England[32] considered the impact of potential renewable energy generation on the grid. The study concluded that whilst the design of the network may act as a barrier, this cannot be defined on a

[31] UK Power Networks: http://www.ukpowernetworks.co.uk/internet/en/connections/documents/HQ-2000-4702-M.141205.pdf
[32] Power Infrastructure Study, East of England Development Agency, 2009

simple basis or mapped, but will need to be assessed on a case by case basis. The network is changing and it is considered that it will continue to evolve in the future to allow incorporation of renewable electricity generators, notwithstanding certain site restrictions.

Appendix B – Constraints for Assessing Wind Turbine Capacity

The *East of England Renewable and Low Carbon Energy Capacity Study* created a table of the natural and physical constraints based on the DECC methodology which should be considered when assessing the potential for large scale onshore wind turbines. This has been adapted further as part of this study and the constraints considered are detailed below in Table 10. Table 11 looks at the issues that were considered but not included in the assessment for wind turbines

Constraints for the location of large scale onshore wind turbines

Constraint	Details	Included in DECC Statistics	Included in East of England Study	Included in Basildon Borough study
Natural resource – wind speed	Areas identified suitable for wind turbines with speeds above 5 m/s at 45m height	Yes	Yes	Yes
Roads	Roads (A,B and Motorways) excluded and a 150m buffer adjacent to roads	Yes	Yes	Yes
Railways	Railways excluded and 150m buffer adjacent to railway	Yes	Yes	Yes
Waterways	Inland waterways (rivers, canals, lakes and reservoirs) excluded	Yes	Yes	Yes
Built-up areas	Built-up areas excluded	Yes	Yes	Yes
Built-up areas buffer	Buffer zone of 600m around built-up areas. Most existing studies apply a buffer zone around built up areas to act as a proxy for safety (topple distance) and noise impacts, mainly to residential properties. The extent of the buffer varies from 400 to 600m. In practice, the minimum distance required between a wind farm and residential properties is site-specific, dependant on the proposed turbine and ambient background noise. There is no definitive guidance on this issue and therefore a rule of thumb has been used based on expert opinion (from wind farm noise specialists) which suggests that the minimum buffer distance that is required for a 2.5MW turbine (to take account of safety and noise constraints) is 600m.	Yes	Yes	Yes

Constraint	Details	Included in DECC Statistics	Included in East of England Study	Included in Basildon Borough study
Overhead power lines	High Voltage overhead power lines and 300m buffer excluded based on National Grid's current policy that "consideration should be given to reducing the minimum layback of wind turbines from overhead power lines to three rotor diameters"[33]	No	Yes	Yes
Public rights of way (PROW)	PROW excluded	Yes	Yes	Yes
Airports	Airports excluded	Yes	Yes	No – no airports within Basildon
Airports / Airfields buffer	5 km buffer zone around airports	Yes	Yes	Yes. However none within 5km.
Current MOD sites	MOD sites excluded. No buffers proposed due to lack of additional information from the MOD apart from airfields	Yes	Yes	No data available
Zero deployment of wind turbines assumed within National Parks	This constraint has been previously discussed with Natural England. Feedback is required as to the level of constraint (currently "consideration")	Yes	Yes	None within Basildon Borough
Zero deployment of wind turbines assumed within National Parks – 2k buffer	This constraint has been previously discussed with Natural England. Feedback is required as to the level of constraint (currently "consideration")	Yes	Yes	N/A
Zero deployment of wind turbines assumed within	This constraint was applied in response to consultation with Natural England.	Yes	Yes	None within

[33] National Grid – internal use only, Review of the Potential Effects of Wind Turbine Wakes on Overhead Transmission Lines, TR (E) 453 Issue 1 – May 2009.

Constraint	Details	Included in DECC Statistics	Included in East of England Study	Included in Basildon Borough study
50m of areas designated as National Trails				Basildon Borough
Zero deployment of wind turbines on areas designated as Heritage Coast	This constraint was applied in response to consultation with Natural England.	Yes	Yes	None within Basildon Borough
Zero deployment of wind turbines assumed within areas with international and national nature conservation designations (including SPAs, SACs, RAMSARs, SSSIs)[34]	This constraint was applied in response to consultation with Natural England.	Yes	Yes	Yes where applicable within the Basildon Borough
Zero deployment of wind turbines in areas defined as ancient woodland	This constraint was applied in response to consultation with Natural England.	Yes	Yes	Yes
Zero deployment of wind turbines in areas defined as sites of historic interest – scheduled ancient monuments and conservation areas. This excludes listed buildings which would be examined on a case by case basis.	This constraint has been previously discussed with Natural England. Feedback is required as to the level of constraint (currently "consideration")	Yes	Yes	Yes
Sensitivity to birds	Lower turbine density assumed in areas of high sensitivity to birds (assumed to be 2.25 MW/km2) Lower turbine density in	Yes	Yes	Yes

[34] The Conservation of Habitats and Species Regulations 2010, UK Statutory Instrument, April 2010

Constraint	Details	Included in DECC Statistics	Included in East of England Study	Included in Basildon Borough study
	areas of medium sensitivity to birds (assumed to be 4.5 MW/km2) These constraints are applied in response to consultation with Natural England.			
Bridleways	The British Horse Society recommends that a distance of at least 200m, but preferable 4 tip heights (equivalent to 540m in this case) should be maintained from bridleways.[35] This study assumes a 200m buffer zone.	Yes	Yes	Yes
Zero deployment of wind turbines assumed in areas where the average annual wind speeds is below 5 m/s at 45m height above ground level.	Discussion with wind farm developers has suggested that this is the minimum wind speed considered viable for commercial scale wind energy generation.	No	Yes	Yes

(Source: East of England Renewable and Low Carbon Capacity Study)

Table 10: Constraints for the location of large scale onshore wind turbines

[35] The British Horse Society Advisory Statement on Wind Farms AROW20s08/1

Issues considered but not included in the assessment of large scale wind turbines

Constraints excluded from assessment	Justification for not applying constraint
Green Belt	Planning decisions on wind farm applications where the Green Belt has been a material consideration have varied depending on whether exceptional circumstances were demonstrated. It is not clear where Green Belt policy will present a constraint on wind energy development, and this will need to be assessed on a case by case basis.
Local nature conservation designations (local nature reserves)	These have not been included as a constraint in accordance with national planning policy.
Electromagnetic links, such as radio links and microwave links	These have not been included as a constraint due to: (i) lack of accurate data on the location and physical characteristics of links; (ii) any buffer zones that should be maintained from links will be variable depending on negotiations with telecoms operators, who should be consulted during the planning of specific wind turbine sites.
Air traffic control and radars (CAA and MoD) coverage zones	These areas were not constrained since there are already a number of wind farms located within these areas and a mitigating solution is likely to be found in the short to medium term to prevent degradation of performance.
Precision Approach Radars coverage zones (MoD)	These areas were not constrained since there are already a number of wind farms located within these areas and a mitigating solution is likely to be found in the short to medium term to prevent degradation of performance.
Tactical training areas (MoD)	These areas were not constrained since there are already a number of wind farms located within these areas and a mitigating solution is likely to be found in the short to medium term to prevent degradation of performance.
Air defence radars (MoD)	Defence radars require clear line of sight to operate effectively. However, these areas were not constrained since there are already a number of wind farms within line of sight of these radars and a mitigating solution is likely to be found in the short to medium term to prevent degradation of performance.
Shadow Flicker	Some sources recommend that a distance of up to 10 rotor diameters from homes should be maintained to avoid shadow flicker.[36] This has not been applied as a

[36] London Renewables/London Energy Partnership, Guidance Notes for Wind Turbine Site Suitability

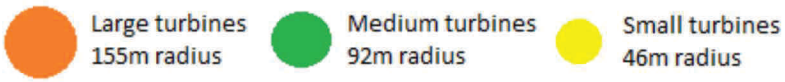
Constraints excluded from assessment	Justification for not applying constraint
	constraint in this study because it can usually be mitigated and is unlikely to affect the rate or scale of wind farm deployment.
Proximity to the electrical grid	This will be discussed in Appendix A.

(Source: East of England Renewable and Low Carbon Capacity Study)

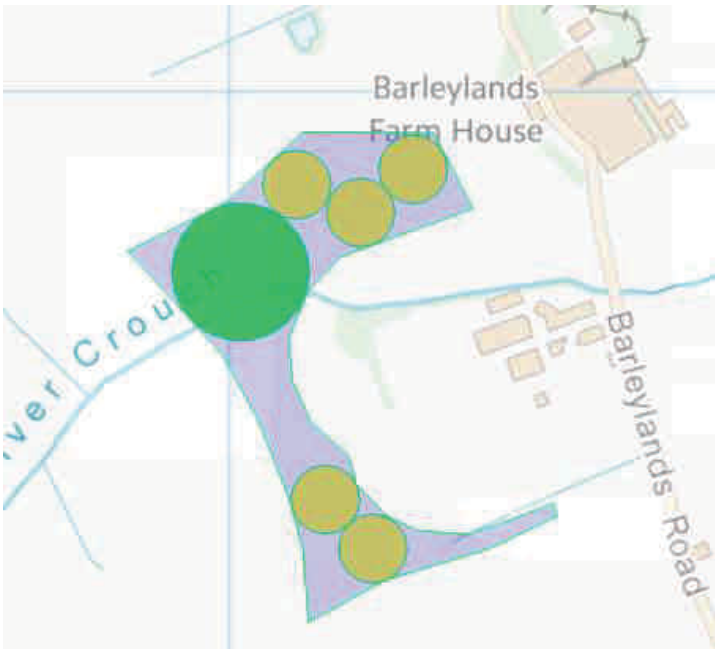
Table 11: Issues considered but not included in the assessment of large scale wind turbines

Appendix C – Location, sizes and maximum capacity of large scale onshore wind turbines

Key



Site 1: Wind turbine capacity - Land between Barleylands Road and Noak Hill



(©Crown copyright and database rights 2014 Ordnance Survey 100018871)
Figure 22: Site 1: Wind turbine capacity - Land between Barleylands Road and Noak Hill

Site 2: Wind turbine capacity - Land west of Little Burstead

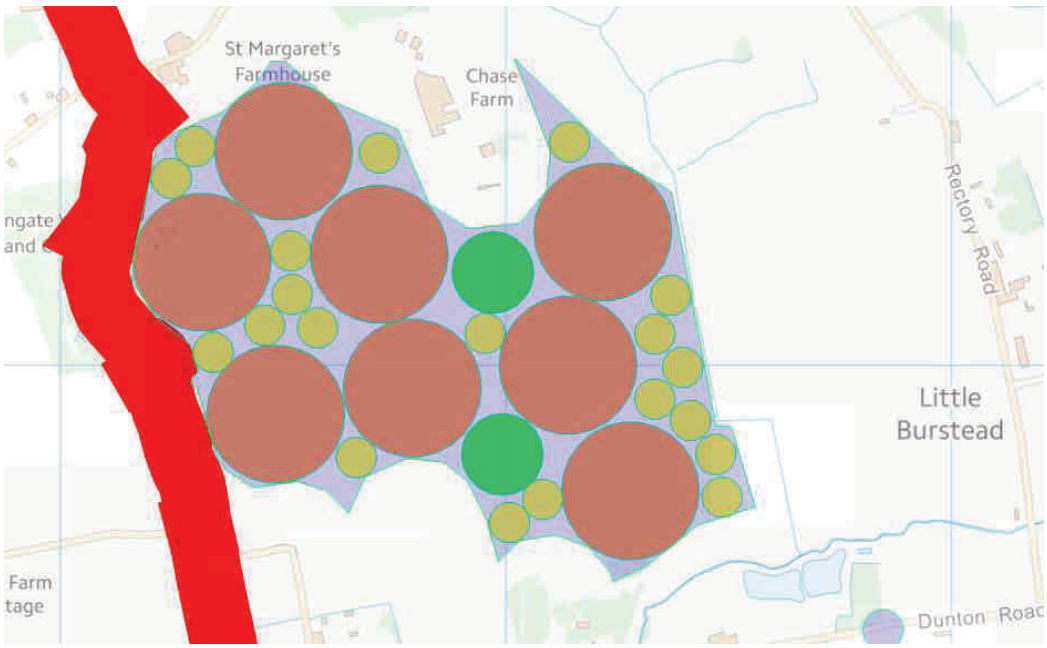


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Figure 23: Site 2: Wind turbine capacity - Land west of Little Burstead

Site 3: Wind turbine capacity - Land west of Great Burstead

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Figure 24: Site 3: Wind turbine capacity - Land west of Great Burstead

Site 4: Wind turbine capacity - Land west of Tye Common

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Figure 25: Site 4: Wind turbine capacity - Land west of Tye Common

Site 5: Wind turbine capacity - Land north of Crays Hill and east of South Green

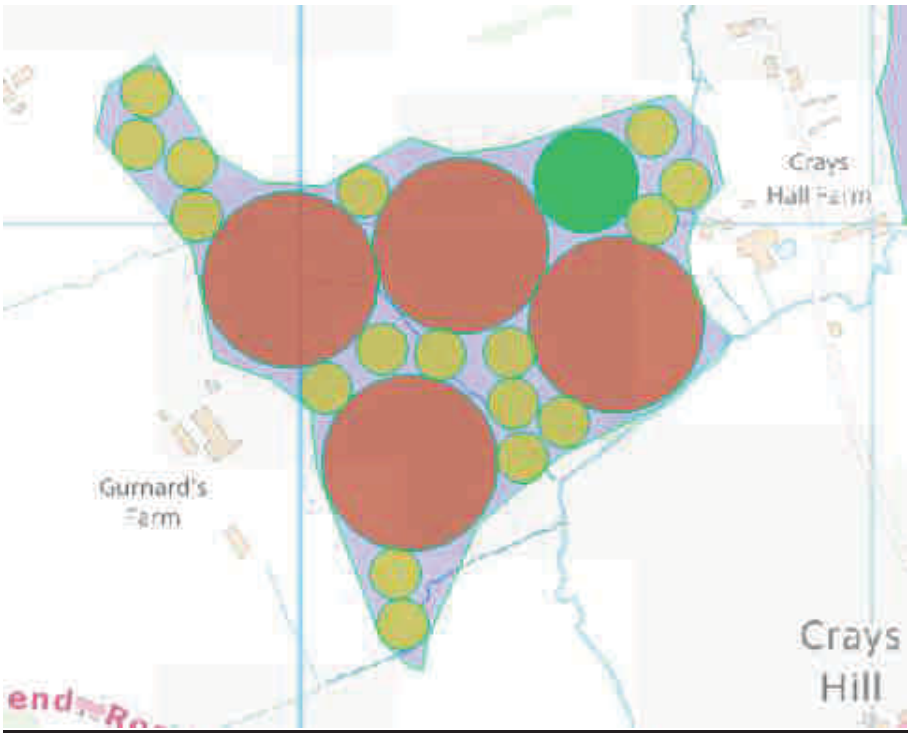

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Figure 26: Site 5: Wind turbine capacity - Land north of Crays Hill and east of South Green

Site 6: Wind turbine capacity - Land east of Outwood Farm Road, Billericay

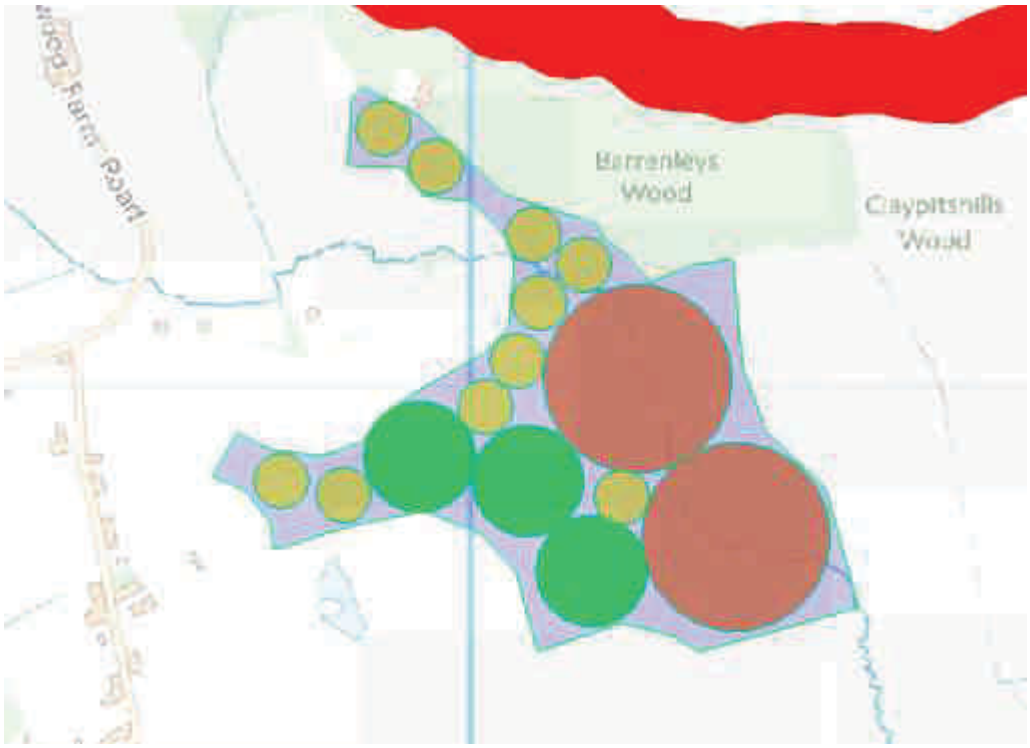

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Figure 27: Site 6: Wind turbine capacity - Land east of Outwood Farm Road, Billericay

Site 7: Wind turbine capacity - Land adjacent Crays Hall Farm

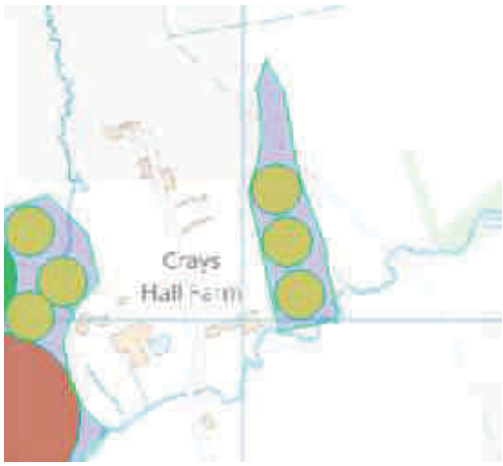

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Figure 28: Site 7: Wind turbine capacity - Land adjacent Crays Hall Farm

Site 8: Wind turbine capacity - Land north of Nevendon interchange

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Figure 29: Site 8: Wind turbine capacity - Land north of Nevendon interchange

Site 9: Wind turbine capacity - Land at Bonvilles Farm

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Figure 30: Site 9: Wind turbine capacity - Land at Bonvilles Farm

Site 10: Wind turbine capacity - Land adjacent Wat Tyler Country Park

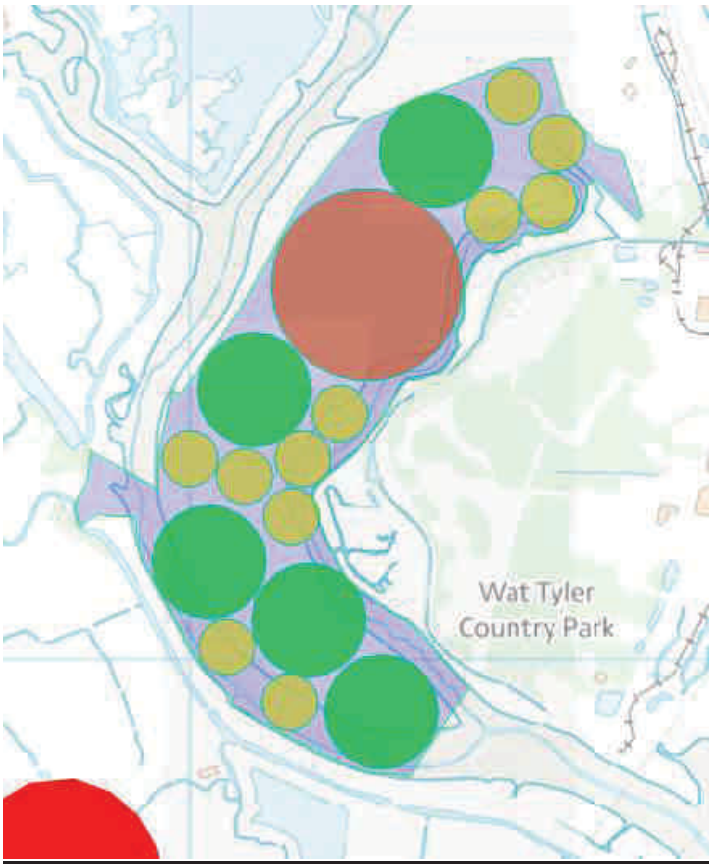

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Figure 31: Site 10: Wind turbine capacity - Land adjacent Wat Tyler Country Park

Site 11: Wind turbine capacity - Vange marshes

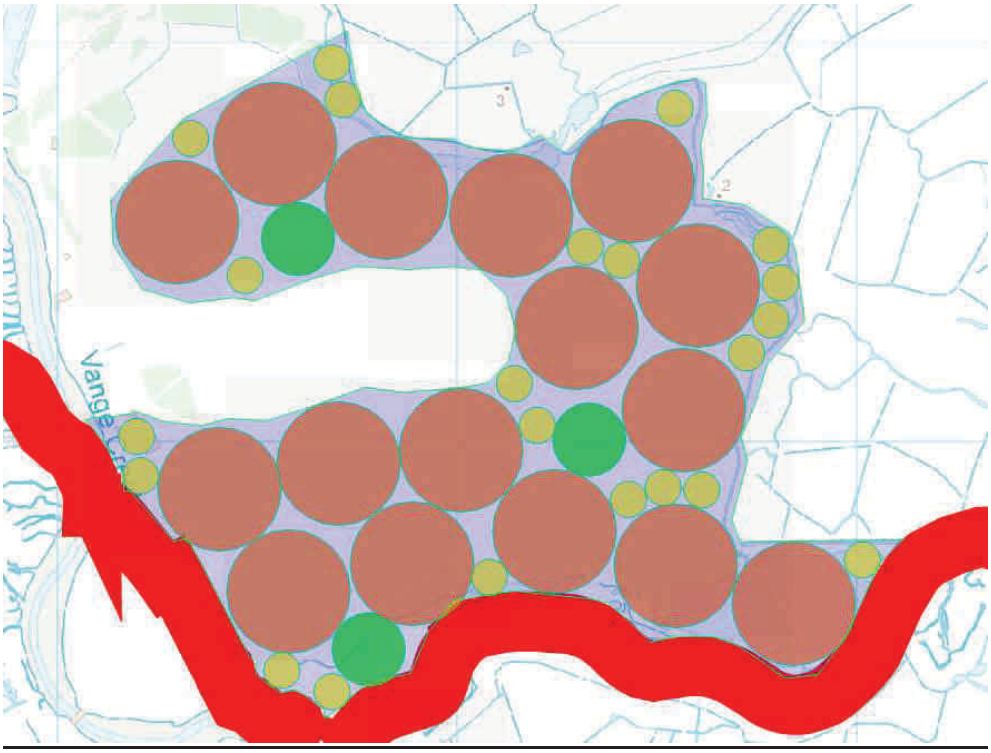

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Figure 32: Site 11: Wind turbine capacity - Vange marshes

Site 12: Wind turbine capacity - Pitsea marshes

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Figure 33: Site 12: Wind turbine capacity - Pitsea marshes

Site 13: Wind turbine capacity - Land south of Dry Street

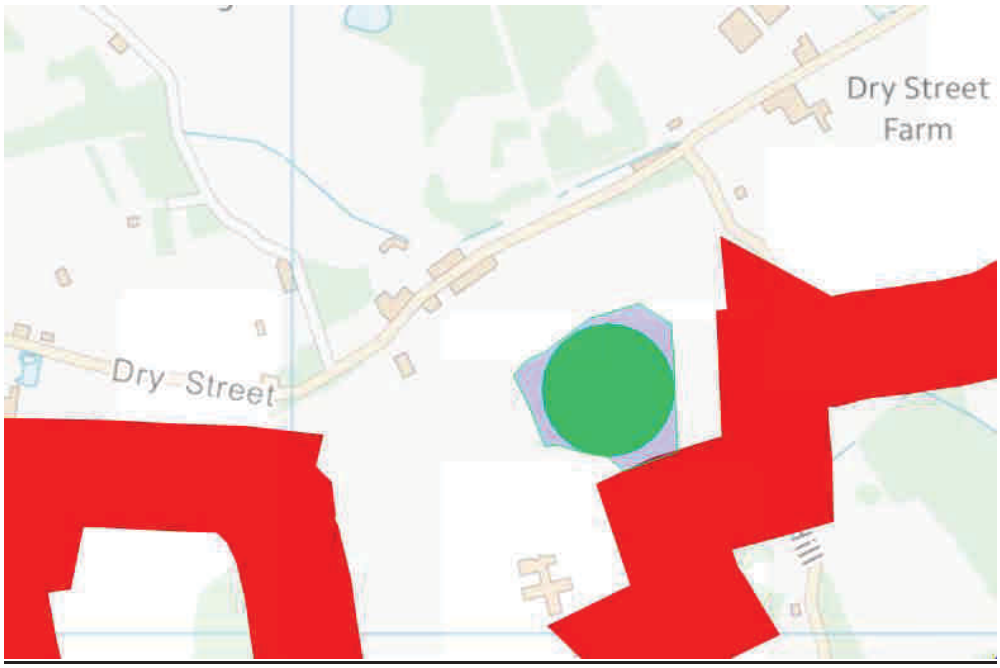

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Figure 34: Site 13: Wind turbine capacity - Land south of Dry Street

Appendix D – Potential electricity generation for large scale solar arrays in the Basildon Borough

Table 12 below provides a summary of the technical potential for electricity generation from large scale solar arrays per identified site within the Basildon Borough.

Potential electricity generation for large scale solar arrays in the Basildon Borough

Site ref	ha	m^2	MW potential	Site ref	ha	m^2	MW potential
1	23	225646	7.5	**47**	23	227598	7.6
2	17	171955	5.7	**48**	25	246148	8.2
3	14	144880	4.8	**49**	26	261121	8.7
4	15	145623	4.9	**50**	31	307053	10.2
5	105	1049156	35.0	**51**	28	276250	9.2
6	38	375862	12.5	**52**	6	62948	2.1
7	30	302639	10.1	**53**	94	936386	31.2
8	65	649018	21.6	**54**	14	144230	4.8
9	143	1425643	47.5	**55**	21	207749	6.9
10	104	1042093	34.7	**56**	70	700418	23.3
11	24	236878	7.9	**57**	83	827537	27.6
12	48	478926	16.0	**58**	7	65386	2.2
13	15	154164	5.1	**59**	77	773939	25.8
14	35	347136	11.6	**60**	7	68238	2.3
15	11	106506	3.6	**61**	6	64363	2.1
16	18	175468	5.8	**62**	139	1389307	46.3
17	8	81522	2.7	**63**	4	37241	1.2
18	33	320728	10.7	**64**	5	49604	1.7
19	24	197357	6.6	**65**	7	72055	2.4
20	21	147852	4.9	**66**	5	48461	1.6
21	37	371251	12.4	**67**	22	221681	7.4
22	23	231566	7.7	**68**	4	36441	1.2
23	40	404873	13.5	**69**	6	57255	1.9
24	36	361448	12.0	**70**	19	193440	6.4
25	46	460189	15.3	**71**	30	303966	10.1
26	177	1766639	58.9	**72**	31	312788	10.4
27	20	196617	6.6	**73**	18	178844	6.0
28	224	2238105	74.6	**74**	15	149419	5.0
29	12	122743	4.1	**75**	3	34817	1.2
30	18	184488	6.1	**76**	2	19948	0.7
31	6	55018	1.8	**77**	3	28446	0.9
32	19	186069	6.2	**78**	5	53784	1.8
33	3	33962	1.1	**79**	35	353608	11.8
34	66	660393	22.0	**80**	19	186403	6.2
35	61	606492	20.2	**81**	3	33740	1.1
36	19	186906	6.2	**82**	8	77379	2.6
37	11	107286	3.6	**83**	6	63953	2.1
38	16	160265	5.3	**84**	11	106891	3.6
39	45	452676	15.1	**85**	5	47405	1.6

Site ref	ha	m^2	MW potential	Site ref	ha	m^2	MW potential
40	11	106304	3.5	**86**	7	72638	2.4
41	76	758773	25.3	**87**	35	354334	11.8
42	190	1903954	63.5	**88**	17	171693	5.7
43	24	242100	8.1	**89**	7	73502	2.5
44	4	43780	1.5	**90**	32	322625	10.8
45	8	82655	2.8	**91**	38	375768	12.5
46	7	70174	2.3	**92**	20	203458	6.8
				Total	3069	30574036	1019.1

Table 12: Potential electricity generation for large scale solar arrays in the Basildon Borough