4. Energy

Overview

4.1 The Council commissioned the University of Exeter to undertake a renewable energy study for the borough in 2014[1]. This study provides some useful insights into the current energy demand and carbon emissions in the Borough. Using sub-national energy statistics to 2011[2], the following findings are worth noting:

a. Approximately half of all energy used was for transport, of which a fifth (10% of the Brentwood total) was due to road transport on the M25;

b. A third of energy used was for the domestic sector, with the remaining 18% of energy use in the commercial and industrial sectors;

c. Within the commercial and industrial sector the main fuel used was electricity (44%), followed by gas (36%) and petroleum products (17% - which is likely to be entirely due to the industrial sector).

d. Within the domestic sector approximately three quarters of energy use was gas, with almost all of the remainder electricity – there was a very small amount of oil use in homes.

e. Excluding energy use to the M25, the breakdown of energy use is 20% in the commercial and industrial sector; 37% in the domestic sector and 43% in the transport sector.

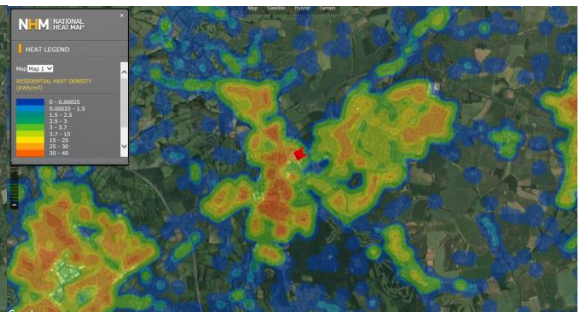
4.2 As an overview of the domestic, commercial and industrial energy use, the National Heat Map, [3] provides a set of electronic maps showing heat demand from buildings. Figure 4.1 provides selected topic maps for Brentwood Borough, which indicates when comparing the proportion of dwellings at a LLSOA level, that high energy consumption is lowest where there are generally high proportions of terraced housing and flats. The majority of flats are located within the town of Brentwood. Brentwood has similar proportions of semi-detached houses and flats compared to the national average, though a much greater proportion of

[1] University of Exeter – Renewable Energy Study for Brentwood Borough Council April 2014 – D Lash & A D S Norton
[2] https://www.gov.uk/goverment/organisations/department-of-energy-climate-change/series/sub-national-energy-consumption (accessed 09/10/13)
[3] http://tools.decc.gov.uk/nationalheatmap/ (accessed 21/02/16)

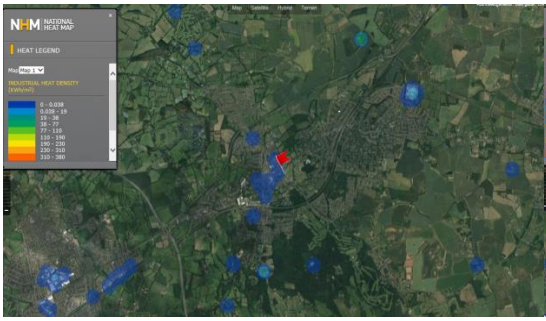
detached houses at the expense of terraced houses. This pattern of house types is likely to related to its historical economic base and proximity to London[4].

Figure 4.1: Heat Maps

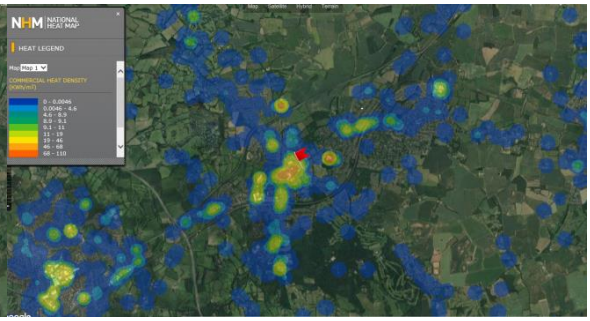
Brentwood Urban– No Energy Info



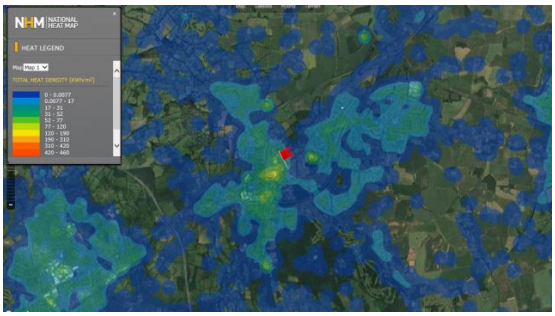
Brentwood Urban Residential Heat Density



Brentwood Urban – Industrial Heat



Brentwood Urban – Commercial Heat



Brentwood Urban – Total Heat Density

4.3 Statistical information from the Department for Business, Energy and Industrial Strategy (BEIS)[5], indicates that the Brentwood Borough has relatively high levels of domestic gas and electricity consumption. Over the period 2010 -2015, Brentwood had the highest level of domestic customer mean gas consumption in the County and was also significantly higher than the England and East of England averages for the same period. Electricity usage for Brentwood ranks about 4th in the County and also significantly higher than the England and East of England averages for the period 2010-2015. Further information is detailed below in Figure 4.2 One of the

[4] Information reproduced from the University of Exeter study – also see pp10-13 for further analysis
[5] BEIS Sub-national consumption statistics

reasons for the higher domestic energy use in Brentwood is generally that homes in the Borough are 13% larger than homes in England on average. Domestic emissions are sensitive to the weather, though over time have fallen mainly due to the impact of improved energy efficiency. [6]

Figure 4.2: Average Domestic Electricity and Gas Use (2010-2015)

Area	Average Domestic Electricity Consumption Per Household (kWh) 2010-2015	Average Domestic Gas Sales Per Meter (kWh) 2010-2015
Brentwood Borough	4,627	17,034.50
Essex Average	4,420	14,679.50
East of England	4,281	14,099
England	3,998	13,901

4.4 While this is a brief snapshot of Brentwood now, it is predicted that the energy landscape in the UK over the next 10 to 20 years will change significantly to a lower carbon system. Potential macro drivers of change include:

a. technological innovation and investment to convert energy more efficiently, with a possible move to more locally produced or decentralised energy;

b. domestic security and managing fluctuating fuel prices and disruptions to fuel supplies;

c. a flexible range of reliable supplies to respond to energy peaks and demands;

d. responding to the challenges of climate change and reducing the use of carbon-rich fuels;

e. affordable energy supply to both suppliers and end customers

f. societal change, including adaptation to new technology and use of energy.[7]

[6] Information taken from P.8 University of Exeter – Renewable Energy Study for Brentwood Borough Council April 2014 – D Lash & A D S Norton

[7] Insights from Innovate UK - https://innovateuk.blog.gov.uk/2018/03/06/predictions-the-future-of-energy/ and https://www.edfenergy.com/future-energy/uk-energy

Existing Infrastructure, Gaps and Projects

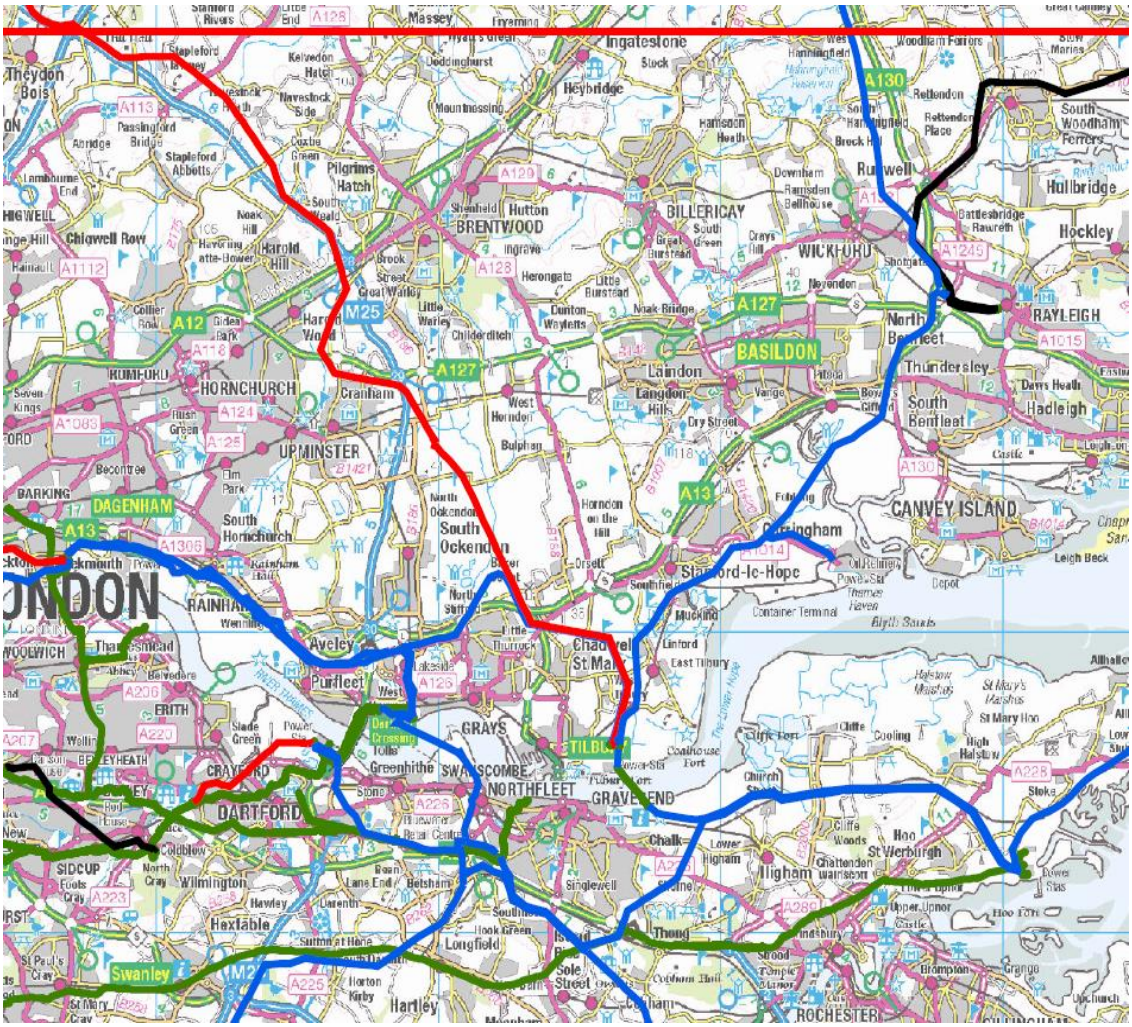
Electricity Transmission and Distribution – Existing Infrastructure

4.5 National Grid owns and operates the high voltage electricity transmission system in England and Wales providing electricity supplies from generating stations to local distribution companies. To facilitate competition in the supply and generation of electricity, National Grid must offer a connection to any proposed generator, major industry or distribution network operator who wishes to generate electricity or requires a high voltage electricity supply.

4.6 Often proposals for new electricity projects involve transmission reinforcements remote from the generating site, such as new overhead lines or new development and substations. If there are significant demand increases across a local distribution electricity network area, then the local network distribution operator may seek reinforcements at an existing sub-station or a new grid supply point. In addition, National Grid may undertake development works at its existing substations to meet changing patterns of generation and supply. UK Power Networks owns and operates the local electricity distribution network within the Brentwood Borough Council administrative area.

4.7 The electricity transmission network carries large qualities of electricity across long distances through cables and overhead lines. The electricity transmission network carries high voltages of electricity at up to 400kV, which is more than 1,600 times the average domestic supply. Figure 4.3 below provides information (indicated in red) on the National Grid Overhead High Voltage cable route, as it applies to part of the South Essex area. It can be noted that there is one main route which are of relevance to the Brentwood area, namely: ZB Route - 275kV two circuit route from Waltham Cross Substation in Epping Forest to Warley substation in Havering (route to the west of the Borough).

Figure 4.3 National Grid Overhead High Voltage Cables



4.8 UK Power Networks owns and operates the local electricity distribution network within the Brentwood area. The electricity distribution network takes energy from the wires of the electricity transmission network and converts it into lower voltage so that it can be safely delivered to homes and businesses. In general terms, the boosted 275,000V electricity transmission is reduced to 132,000V for the local Distribution Network Operator (DNO) and then reduced again to commercial and household use (ranging from 33,000V to 230V). Substations are where electricity lines are connected and switched and where voltage is changed by transformers. The range of typical substations is outlined below :

a. National Grid – large substations where 400kV and 275kV lines are switched and electricity transformed down to 132,000V;

b. Sealing End Compounds – where an overhead line joins onto an underground cable;

c. Intermediate Substations – smaller than National Grid sub stations and transform electricity between 132,000V, 33,000V and 11,000V;

d. Final Distribution Substations – transform the electricity from usually 11,000V to 230V for domestic usage.

4.9 The UK Power Network Regional Development Plan (Barking, Warley and West Thurrock) reviews the UKPN Grid Supply Points (GSP) which supply the London Borough's of Barking & Dagenham, Havering and the Essex boroughs of Thurrock and Brentwood. The combined area has approximately 201,000 customers and is generally a dense urban part of Outer London and Essex.

4.10 The area is supported from two National Grid infeeds (Warley and Tilbury) to the UK Power Networks 132kV system. There are two main Grid substations (Shenfield and Basildon) connected to nine primary substations across the Brentwood and surrounding area. These are detailed below in Figure 4.4 (small red triangles) . Figure 4.5 (below) also provides a more thematic overview.

Figure 4.4: Primary sub-stations

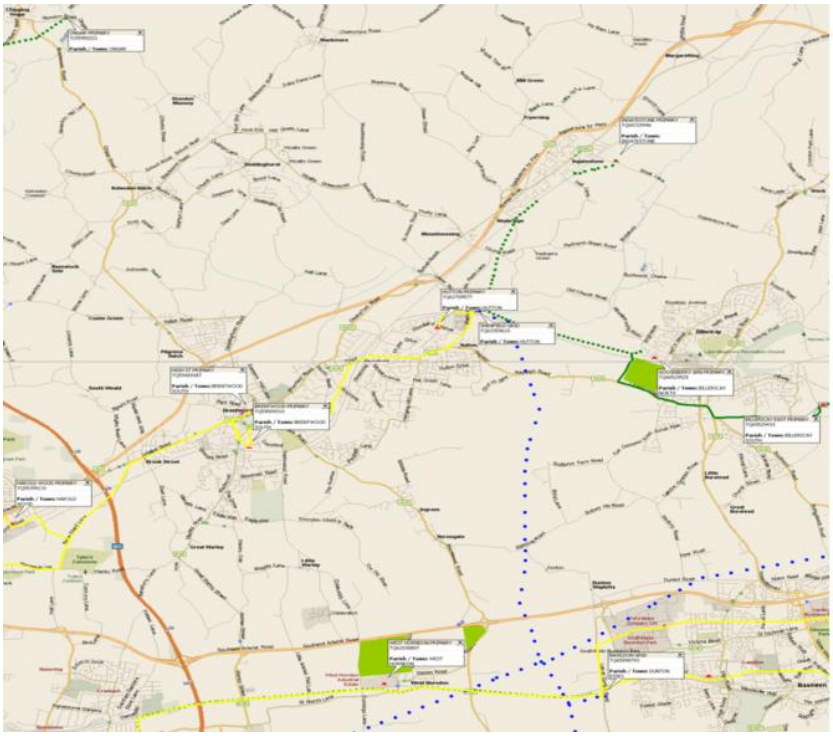
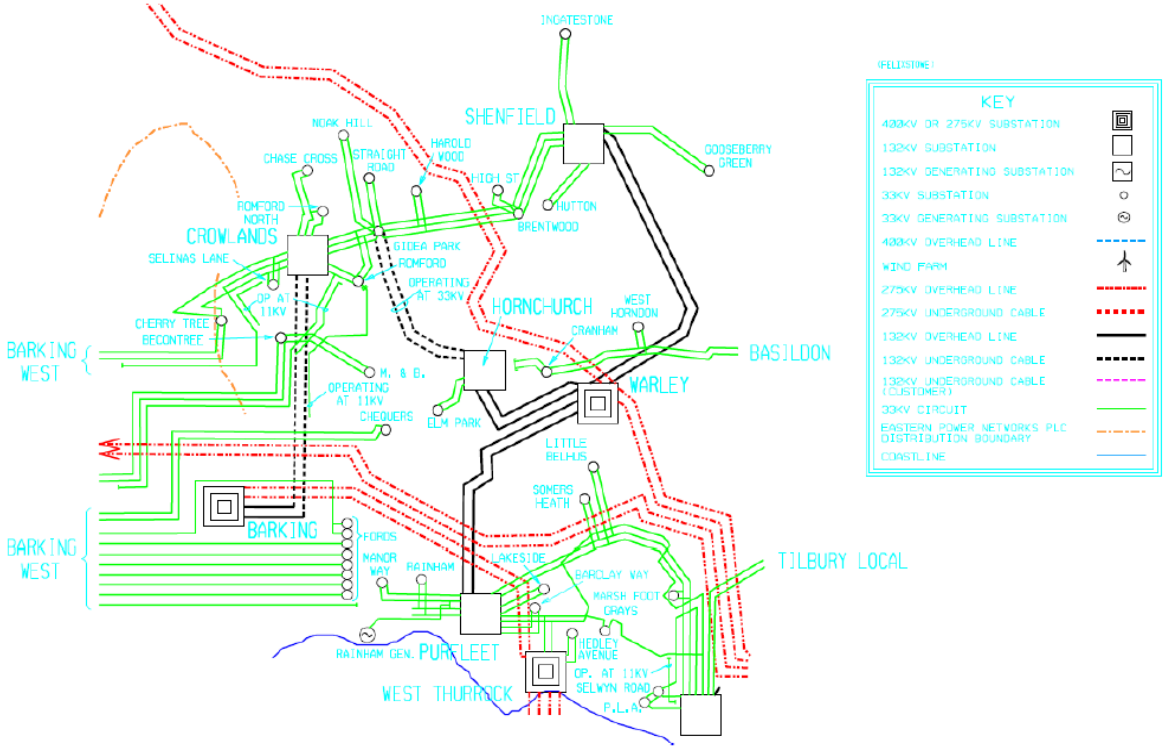


Figure 4.5: UKPN Electricity Distribution Network



4.11 The winter demand figures for 2016/17 are detailed in Figure 4.6 and whilst these are representative the readings can fluctuate year on year by up to 10% due to the length and intensity of the winter cold spell that occurs8. This table highlights sufficient capacity compared to demand for the period indicated.

Figure 4.6: Substation Operating Capacity and Winter 2017/17 Demand

[8] Information and table supplied by UKPN.

Substation	Operating Voltage	Winter Capacity 2017	Winter Demand 2016/17
		(MVA)	(MVA)
Brentwood Primary	33/11kV	24	15.3
Gooseberry Green Primary	33/11kV	15	11.2
Harold Wood primary	33/11kV	23	11.6
High Street Primary	33/11kV	19	14.6
Hutton Primary	33/11kV	19	14.8
Ingatestone Primary	33/11kV	13	8.8
Langdon Primary	33/11kV	24	8.2
Ongar Primary	33/11kV	20	18.1
West Horndon Primary	33/11kV	6	6
Basildon Grid	132/33kV	114	48
Shenfield Grid	132/33kV	114	88
Warley Exit Point National Grid	400/132kV	560	265
Tibury Exit Point National Grid	400/132kV	144	120

Electricity Transmission and Distribution – Gaps in Existing Provision

4.12 Much of the Borough's electricity network and substations were originally built during the 1950's and early 1960's and whilst a substantial amount of work has been done in the last 10 years to address asset 'health' issues there remains a challenge to update and replace the network to deliver a network suitably appropriate for this area.

4.13 The UKPN Regional Development Plan (RDP) recognises that the potential commercial electricity users within the Thames Gateway area and London financial districts with nearby data centre requirements demands high electricity volume / usage. The RDP also recognises, that the overall area is also identified for substantial housing development.

Electricity Transmission and Distribution – Potential Projects or Plans

4.14 Looking ahead for the remainder of the OFGEM ED1 review period there are plans to replace a 33/11kV transformer at High Street Primary and possibly at West Horndon Primary as well. The replacements will provide coincidental reinforcement as new transformers sizes will be larger than those being replaced. The 33kV switchgear at Shenfield Grid is under review for replacement, though this will improve reliability rather than provide additional network capacity. The 11kV switchgear at Hutton primary is also still in the plan to be

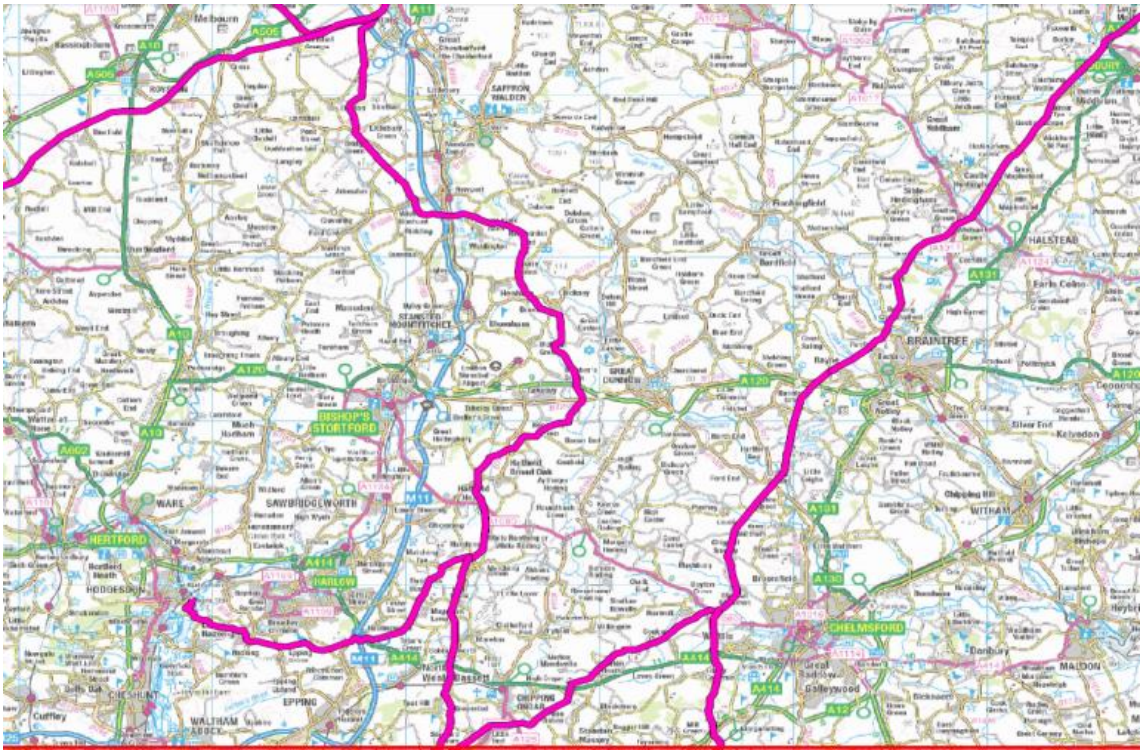
replaced. The Grid substation at Basildon has recently undergone a major refurbishment with new transformers and some new switchgear, increasing the capacity at the rite substantially. At the UK Power Networks / National Grid (NG) interface there are ongoing discussions to review the connection of the NG assets at Tilbury. Information with the site promotor for Dunton Hills Garden Village, has indicated that the pylon infrastructure across this potential development site is nearing the end of its life and may need replacement.

Gas Transmission and Distribution – Existing Infrastructure

4.15 National Grid has a duty to develop and maintain an efficient and economical transmission system for the conveyance of gas and respond to requests for new gas supplies in certain circumstances. In the UK, gas leaves the transmission system and enters the distribution networks at high pressure. It is then transported through a number of reducing pressure tiers until it is finally delivered to consumers.

4.16 The national transmission high pressure gas pipelines which are of relevance to the Brentwood Borough are detailed below in Figure 4.7 and are namely pipeline FM18 – Stapleford Tawney to Tilbury Thames North (36'' diameter pipeline running from the north west of the Borough (running south of South Weald and then onwards running near Great Warley and onwards and FM05 – Braintree to Horndon (36'' diameter pipeline running from the north east of the Borough - north of Ingatestone, east of Hutton and then onwards south through the eastern edge of the proposed Dunton Hills Garden Village to near Horndon.

Figure 4.7: National Transmission High Pressure Gas Pipelines



4.17 The Borough also has a series of gas distribution apparatus within the administrative area of Brentwood Borough. This includes Low Pressure (LP) and Medium Pressure (MP) Gas Pipes and associated equipment and six High pressure (HP) (above 2 bar gas pipelines) and associated equipment. The exact details on this gas distribution apparatus has not been collected for the IDP to date but would be a useful inclusion.

Gas Transmission and Distribution – Gaps in Existing Provision and Projects / Plans

4.18 The National Grid Gas Ten Year Statement (2015) sets out the impact of changing customer requirements, future energy scenarios, legislative changes, asset health on the future operation and development of the National Transmission System. The thematic map for the Eastern Area and North Thames indicates no major gaps in provision with no new or upgraded NTS pipelines currently planned. This information is detailed below in Figure 4.8. No information on works planned for distribution pipelines was available at the time of print.

Figure 4.8: National Transmission System (NTS)

Figure A1.8
Eastern (EA) – NTS

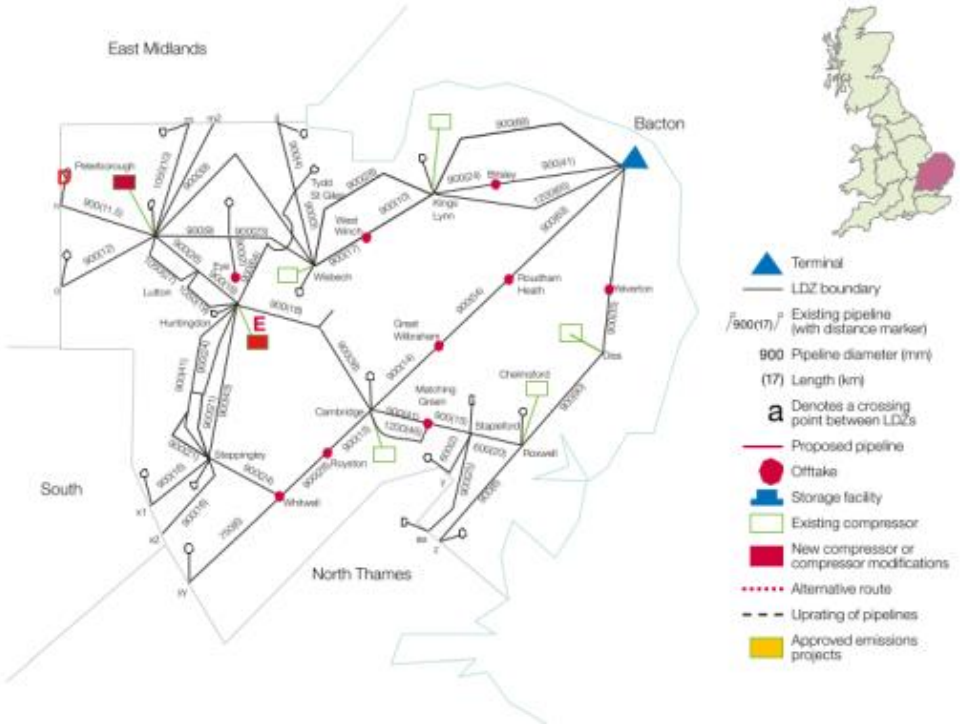
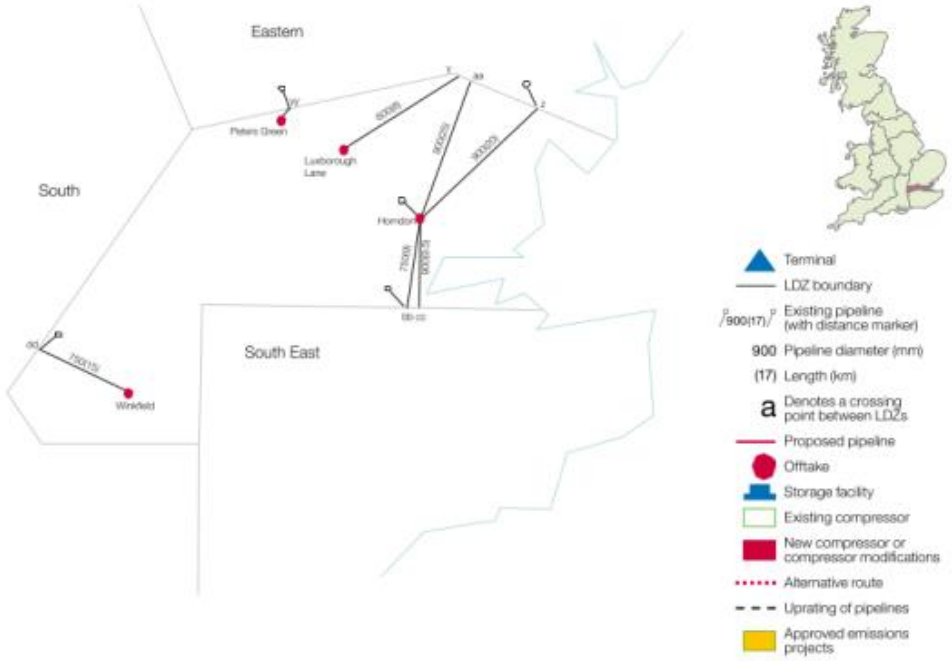


Figure A1.9
North Thames (NT) – NTS



Renewable and Low Energy – Existing Infrastructure

4.19 There is currently one major renewable energy unit within Brentwood Borough at Dunton Hills Farm and consists of a single 500kw wind turbine. Figure 4.8 details the current renewable energy planning permissions within Brentwood Borough.[9]

Figure 4.8: Renewable Energy Permissions

Location	Type of Development	Forecast Energy Generation	Potential Housing Supply (Estimate Only)	Status
Dunton Hills Farm Tilbury Road West Horndon Essex CM13 3LT	Installation of a single 500kw wind turbine.	500kw	300	Decision notice 11th Feb 2014. Now built.
Orchard Farm Little Warley Hall Lane West Horndon Little Warley Essex CM13 3EN	Installation and operation of a ground mounted solar PV system with a capacity of up to 250kW	250kw	62	Decision notice 5th Aug 2013 Conditions not discharged.
Hawthorn Cottage 2 Old Church Road Mountnessing Essex CM13 1UP	Installation and operation of a solar array with a capacity of up to 4kW on agricultural land at Hawthorn Cottage	4 kw	1	Decision notice 7th April 2015. Conditions not discharged.

Renewable and Low Energy – Gaps in Provision

4.20 For a small Borough with limited renewable energy projects it is difficult to forecast gaps in current provision. However, when considering renewable energy potential this was analysed for Brentwood in the University of Exeter study based predominately on a capacity study undertaken for the East of England by AECOM in 2011.[10] The methodology of the study is based upon a sequential constraint approach in which constraints are progressively introduced to reduce the naturally available resource to those that are constrained by planning and regulation. The scope from the original assessment included district heating

[9] Planning permissions were last reviewed in 2017 and a further review should be undertaken shortly.
[10] http://www.sustainabilityeast.org.uk/index.php?option=com_content&view&id=113ltemid=92 (*accessed originally on 18/10/13)*

(DH) and combined heat and power (CHP), large scale onshore wind, hydro energy, biomass covering a range of fuels, energy from waste (EfW) and microgeneration technologies including small scale wind, solar, and heat pumps. The output from this assessment has was extracted in the University of Exeter Study for the Brentwood Borough area.

4.21 Some of the key non-sites specific findings from this analysis are noted below:

- There is unlikely to be major heat density areas in the Borough suitable for retrofit only district heating schemes – new development may therefore play an important role in heat network development.
- District heating is a viable and zero carbon energy solution for new development – evidence from the Carbon Trust indicates that district heating can be viable on sites with as few as 200 homes (estimate of over 60% of energy generated could be applied to major developments and CHP schemes).
- In general, it is assumed that most homes that are currently using oil or solid fuel could switch to biomass boilers – there is broadly a match between the technical capacity to deliver biomass from managed local woodlands and domestic demand but commercial and industrial demand this may result in the Borough becoming a net importer of biomass (could account for almost 27% of energy generated).
- Commercial scale wind turbines (2.5 MW) could generate significant energy generation and carbon reduction – 5 commercial turbines could deliver 30% of energy generated.
- Standalone PV developments could generate approximate 7% of energy generated with heat pumps and solar technologies at about 8.5% each.

Low Energy Options – Potential Projects and Plans

4.22 Outside of any policy and site requirements set out in the Local Plan, there are no major proposals for renewable or low energy projects and associated infrastructure within the Borough.

Implications of Growth

Electricity

4.23 Feedback on behalf of the National Grid has highlighted that the ZB high voltage overhead line cross a small part of Brentwood Enterprise Park (ref 101A) proposed allocation. National Grid prefers that buildings are not built directly beneath its overhead lines. This is for two reasons, the amenity of potential occupiers of properties in the vicinity of lines and because National Grid needs quick and easy access to carry out maintenance of its

equipment to ensure that it can be returned to service and be available as part of the national transmission system. Such access can be difficult to obtain without inconveniencing and disturbing occupiers and residents, particularly where properties are in close proximity to overhead lines.

4.24 National Grid seeks to encourage high quality and well-planned development in the vicinity of its high voltage overhead lines. Land beneath and adjacent to the overhead line route should be used to make a positive contribution to the development of the site and can for example be used for nature conservation, open space, landscaping areas or used as a parking court. The relocation of existing overhead lines will only be considered by National Grid as part of nationally important projects and appropriate safety clearances between overhead lines, the ground and built structures must not be infringed.

4.25 Feedback from UKPN indicates that the proposed level of housing that most will accommodated without the need for reinforcement of major substations and individual developments will be connected with local reinforcement and network extensions. This does assume that properties will still be heated by gas fired central heating and not direct acting or storage heaters. The introduction and effect of Electric Vehicles (EV's) has not been considered on the distribution network at the current time. The Dunton Hills proposed settlement is well located near to Langdon and West Horndon Primary substations and therefore no major reinforcement is envisaged . Network extensions are likely to be needed from the Langdon Primary substation that is located at the Basildon Grid site.

4.26 There will also be a need to consider electricity load requirements associated with future electronic domestic and commercial vehicle re-charging, although some of the extra demand may be countered by off-peak programming.

Gas

4.27 Feedback on behalf of National Grid has indicated that a high-power gas transmission pipeline runs across a small southern section of Land East of Nags Head Lane (ref R06) allocation; within the extreme eastern boundary of Dunton Hills Garden Village (ref R01) proposed allocation area and within the eastern edge of the proposed Brentwood Enterprise Park allocation (ref E10). National Grid requests that any High Pressure Major Accident Hazard Pipelines (MAHP) are taken into account when site options are developed in more detail. These pipelines form an essential part of the national gas transmission system and National Grid's approach is always to seek to retain existing transmission pipelines in situ. National Grid may also have a Deed of Easement for each asset which prevents the erection of permanent/ temporary buildings, or structures, changes to existing ground levels, storage of materials etc.

4.28 Further information will be required on investment required in lower pressure gas pipelines and associated equipment.

Low Energy Options

4.29 There are opportunities to explore the delivery of renewable energy infrastructure, including district heating schemes linked to new strategic developments. Strategic level sites which may be considered suitable for district or localised heating schemes include:

a. Dunton Hills Garden Village

b. Brentwood Enterprise Park

c. West Horndon Industrial Estate sites

d. Officer's Meadow and linked sites

e. Ford and Council Depot

Financial Considerations

4.30 Electricity - UKPN has a programme of infrastructure improvements outlined in previous sections, with much of the information commercially sensitive. There is further detailed information required on whether substation reinforcements are necessary as part of the Dunton Hills Garden Village development. It is also understood that there may be an opportunity to either upgrade or underground ageing pylon infrastructure across parts of the Dunton Hills site, but this needs to be formally confirmed, as well as costs and liabilities.

4.31 Gas – no major financial considerations indicated at this stage although localised pipelines may need to be extended and reinforced linked to development sites.

4.32 Low Energy and Renewables – detailed information on district heating cost options will be project specific and need to be subject to feasibility analysis and comprehensive project / cost planning. Research undertaken in 2010 on the cost per dwelling of district heating schemes with combined heat and power units suggested a cost of circa £3,500 to £8,000 per dwelling (depending upon dwelling type). Smaller scale Combined Heat and Power (CHP) Schemes have a potential capital costs of circa £8,000 per house (depending upon scale of project). Research has also recently been undertaken by AECOM and the Energy technologies Institute on reducing the capital costs of district heat network infrastructure.

4.33 Site Development – there are site layout costs associated with easements and development restrictions in relation to allocation sites E10, R06, and R01.

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