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Utilities Infrastructure Capacity Study

For the Black Country

On behalf of **The Black Country Local Authorities**

Dudley Metropolitan Borough Council | Sandwell Metropolitan Borough Council | Walsall Council | City of Wolverhampton Council

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Acronyms

- AI - Artificial intelligence
- AONB - Areas of Outstanding Natural Beauty
- AQMA - Air Quality Management Area
- BCCS - Black Country Core Strategy
- BGS - British Geological Survey
- DER - Distributed Energy Resources
- DNO – Distribution Network Operator
- Dph - Dwellings per hectare
- EDNA - Economic Development Needs Assessment
- ESCo - Energy Services Company
- EV - Electric vehicle
- FTTC - Fibre to the Cabinet
- FTTP - Fibre to the Premises
- GIS - Geographical Information System
- HIU - Hydraulic Interface Unit
- HP - High Pressure
- IDNO – Independent Distribution Network Operator
- IGT – Independent Gas Transporter
- IP - Intermediate Pressure
- LEP - Local Enterprise Partnership
- LNRs - Local Nature Reserves
- LZC - Low and zero carbon
- MP - Medium Pressure
- NNR - National Nature Reserves
- NPPF - National Planning Policy Framework
- NPPG - National Planning Practice Guidance
- NSIPs - Nationally Significant Infrastructure Projects

- OFGEM - Office of Gas and Electricity Markets
- OS - Ordnance Survey
- RAG - Red-amber-green
- RHI - Renewable Heat Incentive
- SAC - Special Areas of Conservation
- SEP - Strategic Economic Plan
- SHLAAs - Strategic Housing Land Availability Assessments
- SHMA - Strategic Housing Market Assessment
- SPA - Special Protection Areas
- SSSI - Site of Special Scientific Interest
- UIC - Utilities Infrastructure Capacity
- ULEV – Ultra Low Emissions Vehicle
- WPD - Western Power Distribution

Executive Summary

Introduction

A Utilities Infrastructure Capacity Study has been undertaken for Dudley, Sandwell, Walsall and Wolverhampton Councils (the Black Country Authorities) to support the preparation of a new Black Country Plan to 2038.

The study assesses the capacity of existing electricity, gas and telecommunications (broadband) infrastructure to support future housing and employment growth within the new Plan period, reviews optimal locations for new development based on utilities capacity, and identifies where potential abnormal costs and/or technical constraints may arise.

It provides further evidence for the new Black Country Plan preparation process relating to utilities infrastructure that will enable growth. It also provides recommendations for planning policies related to energy and sustainability.

Study Findings

A baseline for the potential utilities needs for growth was defined based on evidence within the Strategic Housing Land Availability Assessments (SHLAAs) for the Black Country Authorities, including the four strategic centres (Wolverhampton, Walsall, West Bromwich and Brierley Hill) and committed employment sites identified in the Economic Development Needs Assessment (EDNA) to 2026 and potential employment sites to 2038 as defined by the Black Country Authorities.

The assessment showed that there is provision for power and fibre across the region sufficient to support all existing planned housing and commercial growth in the Black Country economic geography, and potential in most locations to support potential growth arising from the new Black Country Plan.

Overall, electricity grid capacity across the Black Country represents a generally positive picture relating to spare capacity. In both Sandwell and Dudley there are minor localised constraints for the SHLAA sites, and potentially moderate constraints for employment sites depending on the nature of the employment uses. There are, however, constraints relating to power for potential employment sites close to the Rushall substation in Walsall. Employment uses that would place a heavy demand on the supply available in this location (e.g. data centres and advanced manufacturing) should be avoided unless sufficient capacity can be made available within the network; less energy intensive employment uses (e.g. office space or storage and distribution) may be more suitable in the first instance.

With regards to gas provision it has been highlighted that there may be capacity issues within the Sandwell area in the future.

There are likely to be no potential abnormal costs and/or technical constraints associated with prospective housing and commercial growth in the sub-region, with the exception of potential employment sites close to the Rushall substation. This area could benefit from further, more detailed assessment if employment allocations are likely to be made in this area. Both Western Power Distribution (WPD) and Cadent, the electricity and gas providers (respectively) within the region, would be able to deliver the required infrastructure to support growth as part of their future asset plans.

Future Growth

The power capacity within the sub-region offers excellent opportunities to underpin future housing and economic growth. In particular, the power infrastructure co-located with existing employment land uses shows that the Black Country can become a centre for the UK's Industrial Strategy. This

includes opportunities for industries looking for high power capacity requirements such as advanced manufacturing or uses such as data centres.

It should be noted, though, that successful economic growth will take power capacity which in turn will reduce the available capacity for residential growth. The relationship between commercial power use and residential growth will need monitoring.

In addition, new power demands, including electric vehicle (EV) power consumption, will need to be planned for. This is especially important when siting centralised EV charging infrastructure to ensure unplanned power consumption does not impact planned growth.

Within the Local Plan preparation process, these opportunities provide the evidence to justify the retention and renewal of policies related to the provision of distributed energy resources (DER)[1] such as micro generation[2], and the need for new growth to consider the implementation of active power network management, known as smart grids[3].

[1] Distributed energy resource (DER) systems are small-scale power generation or storage technologies used to provide an alternative to or an enhancement of the traditional electric power system.

[2] Small scale systems that generate electricity and/or heat, usually for domestic dwellings.

[3] A smart grid is an electricity network allowing devices to communicate between suppliers to consumers, allowing them to manage demand, protect the distribution network, save energy and reduce costs.

1 Introduction

1.1 Introduction

1.1.1 Peter Brett Associates LLP, now part of Stantec, (PBA) has been appointed by Dudley, Sandwell, Walsall and Wolverhampton Councils (the Black Country Authorities) to prepare a Utilities Infrastructure Capacity (UIC) Study for the Black Country. The Study supports the preparation of a new Black Country Plan to 2038.

1.1.2 It assesses the capacity of existing electricity, gas and telecommunications (broadband) infrastructure to support future housing and employment growth within the new Plan period, optimal locations for new development based on utilities capacity, and identifies where potential abnormal costs and/or technical constraints are likely to arise.

1.2 Background

1.2.1 The existing Black Country Core Strategy (BCCS) was adopted in 2011[4]. An Infrastructure and Deliverability Study was produced in 2009[5] to support preparation of the BCCS, which has since underpinned allocations in the Black Country Authorities' Local Plans up to 2026. The BCCS is now being reviewed by the Black Country Authorities to meet the new challenges and opportunities for the period up to 2038, including the expectation for significant levels of new housing and employment growth.

1.2.2 A new Black Country Plan to 2038 is currently being prepared[6] and it is envisaged that a draft-for-consultation document will be produced in 2020. Unlike the BCCS, the new Plan will be identify and allocate a number of housing and employment sites across the Black Country, including in areas which have not previously been considered for development.

1.2.3 A UIC Study provides further evidence for the new Black Country Plan preparation process relating to utilities infrastructure that will enable growth.

1.3 Growth in the Black Country

1.3.1 The continuous urban area of Wolverhampton, Walsall, Sandwell and Dudley is largely developed with minimal greenfield land. The industrial past of the area means that there are areas of ground contamination, hidden mine workings, and abandoned areas which could pose a risk to future spatial planning.

1.3.2 Around the urban area lies the West Midlands green belt, most of which is located within Walsall and Dudley. This green belt consists largely of agricultural land, woodland, nature reserves, and sports and recreational facilities.

1.3.3 Using the national standard method, over the Plan period 2018-38, the Black Country authorities have a cumulative local housing need for 3,752 homes per annum or 75,040 homes in total. Existing committed sites and windfall allowances for the urban area can meet around two thirds of this housing need.

1.3.4 Employment growth in the Black Country has also been forecast with the largest sectors for growth being retail and wholesale. The future scenarios range from an increase in jobs of

[4] Black Country Core Strategy, February 2011.

[5] Black Country Joint Core Strategy, Stage 2: Infrastructure and Deliverability Study, November 2009, Mott MacDonald.

[6] The latest information on the new Black Country Plan can be found here: https://blackcountrycorestrategy.dudley.gov.uk/bccs/

between 0.7% and 21.4%, with Wolverhampton expected to see the highest employment growth. It is estimated that there could be a need for up to 300 hectares of land for industrial use beyond that currently allocated[7].

1.4 Policy Context

National Policy

1.4.1 This Study has been prepared having due regard to relevant sections of the National Planning Policy Framework (NPPF) 2019[8], National Planning Practice Guidance (NPPG)[9], as well as the Government's Industrial Strategy 2017[10], Clean Growth Strategy 2017[11], The Road to Zero 2018[12] and recent policy announcements related to the electrification of heating in new homes. These are summarised below.

1.4.2 In June 2019, the UK Government amended the Climate Change Act to set an ambitious and legally binding target for the country to be net zero carbon by 2050[13]. In line with the objectives and provisions of the Climate Change Act, the NPPF 2019 requires the planning system to take a proactive approach to mitigating and adapting to climate change.

1.4.3 Paragraph 8 of the NPPF sets out the overarching objectives of the planning system in achieving sustainable development and net gains. Paragraph 8c sets out the environmental objective, which addresses "… mitigating and adapting to climate change, including moving to a low carbon economy". The balance is set in favour of sustainable development, and plans should be prepared with this objective in mind (paragraph 16a refers). Paragraph 20 identifies how strategic policies should be used to identify a strategy for development and refers to the need to address planning measures to tackle climate change mitigation and adaptation.

1.4.4 The availability and capacity of infrastructure and services should also be considered, whilst the planning system should support the transition to a low carbon future through supporting renewable and low carbon energy and associated infrastructure. The availability and capacity of infrastructure and services should also be considered, whilst the planning system should support the transition to a low carbon future through supporting renewable and low carbon energy and associated infrastructure.

1.4.5 The NPPF is supported by NPPG. Guidance includes plan-making in terms of the duty and role of the planning documents, effective cooperation, the evidence base, how it will be examined and reviewed, and plan delivery. As well as this, the NPPG provides guidance related to developing renewable and low carbon energy targets, and how to identify suitable mitigation and adaptation measures.

1.4.6 The Industrial Strategy aims to boost productivity and increase the earning power of people throughout the UK. The strategy sets out five foundations of productivity that are based around ideas, people, infrastructure, the business environment and places. One of the challenges identifies in the strategy is the rapidly changing way in which we generate and use

[7] Black Country Economic Development Needs Assessment, May 2017.

[8] National Planning Policy Framework, February 2019.

[9] National Planning Practice Guidance, May 2019, available here: https://www.gov.uk/government/collections/planning-practice-guidance

[10] The UK's Industrial Strategy, 2017, available here: https://www.gov.uk/government/topical-events/the-uks-industrial-strategy

[11] The Clean Growth Strategy, October 2017, HM Government.

[12] The Road to Zero, July 2018, HM Government.

[13] The Climate Change Act 2008 (2050 Target Amendment) Order 2019.

energy. The four Grand Challenges presented in the strategy are focused on the global trends of artificial intelligence (AI), an aging society, the future of mobility and clean growth.

1.4.7 The Clean Growth Strategy sets out actions to put clean growth at the centre of modern industry. Policies and proposals that aim to accelerate clean growth are set out within the strategy. Some of the key ideas that the policies and proposals focus on are accelerating clean growth, accelerating the shift to low carbon transport, delivering clean, smart and flexible power, and enhancing the benefits and value of our natural resources.

1.4.8 The Government's Road to Zero strategy sets out the way in which the UK will be at the forefront of zero emission vehicle manufacture and design. The key target is for all new cars and vans to be effectively zero emission by 2040, with almost every car and van being zero emission by 2050. This will require a major transition in transport and supporting infrastructure.

1.4.9 There has been a recent steer from the Government towards the electrification of heating for new development. This appeared in the recent Spring Statement 2019, where Her Majesty's Treasury announced the introduction of "a Future Homes Standard, mandating the end of fossil fuel heating systems in all new houses from 2025"[14]. Despite this not being confirmed in regulation, there has been a clear movement towards electric-only heating for new homes.

1.4.10 The Department for Digital, Culture Media & Sport has produced a document on delivering gigabit-capable connections in new builds. The document sets out a target to make gigabit-capable networks available to 15 million premises by 2025, and nationwide by 2033. This is required in order to start and grow digital business. This will also provide people with access to high quality, reliable digital connections. The proposals within the document also aim to ensure a digital divide does not occur.

Local and Regional Policy

1.4.11 The Black Country Core Strategy was adopted in 2011 by the four Black Country councils. It sets out a vision for the area up to 2026, identifying the Black Country as a strategic location at the heart of the Midlands. Part of the vision is to create sustainable communities that are cohesive, healthy, and prosperous. One of the challenges to be addressed, as outlined in the Strategy, is facing up to climate change and providing development that minimises its impacts and provides mitigation and adaption. Prudent use of energy and the use of renewable and low carbon technologies will be incorporated into development design. The Strategy is currently under review and the Black Country Plan is estimated to be adopted in 2021.

1.4.12 Dudley Borough Development Strategy builds on the Core Strategy and forms part of Dudley Council's Local Plan. It was adopted in February 2017 and guides development up to 2026 in the area with allocations and local planning policies. Area action plans for Brierley Hill, Dudley, Halesowen, and Stourbridge are also included in the Local Plan. Within these Action Plans, visions, objectives, and spatial strategies for the town centres.

1.4.13 The Site Allocation and Delivery Development Plan Document forms part of the Sandwell Local Plan. It will identify sufficient sites and areas to meet the boroughs housing and employment needs. It also aims to protect the historic, built, and green environment of the area. Area action plans for West Bromwich, Smethwick, and Tipton are also included in the Local Plan. The Action Plans provide a land use framework for development and will assist the delivery of growth and investment.

1.4.14 The Walsall Local Plan contains the Site Allocation Document that will identify the sites to meet the current and future needs of Walsall. The other accompanying document to the Local

[14] Spring Statement 2019: Philip Hammonds speech, online, available at: https://www.gov.uk/government/speeches/spring-statement-2019-philip-hammonds-speech

Plan is the Walsall Town Centre Area Action Plan. This document is the long-term plan of allocated sites for development of shops, leisure facilities, and offices, as well as other aspects of a town centre such as transport and the environment.

1.4.15 The City of Wolverhampton's Local Plan consists of a Unitary Development Plan, parts of which required updating and have been replaced through subsequent adoption of the Black Country Core Strategy and Area Action Plans. The Area Action Plans cover the city centre of Wolverhampton, Bilston Corridor and the Stafford Road corridor. These Action Plans guide development in the specific areas. The City of Wolverhampton Council declared a Climate Emergency in July 2019, which included a commitment to become a zero carbon City by 2028.

1.5 Purpose and Scope of Study

1.5.1 The purpose of this Study is to provide evidence on utility infrastructure capacity to support the preparation of the new Black Country Plan to 2038. The specific utilities covered by the study are electricity, gas and telecommunications / broadband.

1.5.2 The scope is as follows:

- The Study assesses the capacity of existing utilities infrastructure to support future housing and employment growth within the new Plan period. The Authorities' suitable and developable housing sites within their Strategic Housing Land Availability Assessments (SHLAAs[15]), including four strategic centres (Wolverhampton, Walsall, West Bromwich and Brierley Hill), and committed and potential employment sites form the baseline for this capacity assessment;

- Following assessment of committed sites, the Study considers the capacity for the existing utilities infrastructure to support any further growth and identifies the relative constraints applying to different locations based on utilities capacity only, including locations in the green belt;

- Where sufficient utilities (particularly electricity) capacity exists, the Study identifies strategic opportunities for growth related to the Fourth Industrial Revolution, i.e. energy-intensive industries such as data centres and advanced manufacturing;

- The Study identifies where abnormal utilities infrastructure upgrades are likely to be required to support growth within the new Plan period which the statutory providers will need to accommodate for in their asset management plans, including consideration of Nationally Significant Infrastructure Projects (NSIPs) where necessary;

- The Study provides a high-level assessment of low and zero carbon (LZC) energy potential in the Black Country as it relates to utilities infrastructure capacity. It provides a review of the potential for LZC technologies based on the Black Country's geography, with a focus on wind energy[16], and the limitations on such developments; and

- The Study provides, in a separate briefing note, recommendations for planning policies related to energy and sustainability based on the utilities analysis, with specific reference to current BCCS Policy ENV 7 which requires 10% of energy demands on major developments to be met through on-site renewable energy generation.

[15] Defined as *"An assessment of land availability identifies a future supply of land which is suitable, available and achievable for housing and economic development uses over the plan period . . . However, the assessment does not in itself determine whether a site should be allocated for development."* (https://www.gov.uk/guidance/housing-and-economic-land-availability-assessment)

[16] In accordance with footnote 49 of paragraph 154(b) of the National Planning Policy Framework 2019.

2 Method

2.1 Introduction

2.1.1 This section describes the approach to collating the primary data used within this Study, the method adopted for the analyses, and the key assumptions made within the analyses.

2.2 Primary Data

2.2.1 The primary data used within this Study is as follows:

- 2018 data for each local authority showing the location and housing capacity of committed sites to 2026, including the four strategic centres of Wolverhampton, Walsall, West Bromwich and Brierley Hill;
- Economic Development Needs Assessment (EDNA) data for all local authorities showing committed employment sites to 2026 and potential employment sites to 2038 as defined by the Black Country Authorities;
- Electrical network and substation capacity (33kV, 66kV and 132kV) for the study area based on Western Power Distribution's (WPD) network capacity map (dated 12 May 2019);
- Gas network capacity for the study area for High Pressure (HP), Intermediate Pressure (IP) and Medium Pressure (MP) pipelines based on data received from Cadent Gas on 24 May 2019 and 1 July 2019; and
- Broadband coverage and upload/download speeds for the study area using BT Openreach's online fibre broadband checker[17] and Ofcom's mobile and broadband checker[18] (dated June and July 2019).

2.3 Method

2.3.1 The method adopted for the utility infrastructure capacity analyses, the strategic growth areas review and the LZC energy assessment are summarised below:

Electricity Capacity Analysis

Residential

- The SHLAA sites and substations within the Study area boundary were plotted in Geographical Information System (GIS) software[19], and the SHLAA sites were assessed against their nearest primary substation. It was assumed that these sites would be built out between 2019 and 2026 (the end year for the existing Black Country Core Strategy);
- The electrical demand of the SHLAA sites were estimated (based on 5.5kVA per dwelling[20]), summed and compared to the spare capacity of the nearest substations; and
- The analysis compared the total substation capacity, potential housing electricity demand based on the SHLAA data, and whether the substations are under or over capacity

[17] BT Openreach, Fibre Checker, online, available at: https://www.openreach.com/fibre-broadband/

[18] Ofcom, Mobile and Broadband Checker, online, available at: https://checker.ofcom.org.uk/broadband-coverage

[19] Esri ArcPro version 2.1.0

[20] Figure based on a typical home with electric heating but no EV charging.

considering the demand of the SHLAA sites. The results were displayed in a graphic created in GIS software.

Employment

- The EDNA data provided by the Black Country Authorities showed the total site area (hectares) for committed employment sites in the urban area, which were identified for either B1 (offices), B2 (general industrial) or B8 (storage or distribution) use classes. It was assumed that these sites would be built out between 2019 and 2026 (the end year for the existing Black Country Core Strategy). In addition to committed sites, potential employment sites for B1, B2 or B8 use to 2038, as defined by the Black Country Authorities, were also included. A 60% developable area was assumed for each of the employment sites[21];
- The employment sites and substations were plotted within the GIS software, and the employment sites linked to the closest substation;
- As the use class for each site is not confirmed, an average electricity demand of 52W/m^2 was assumed[22] to calculate the estimated electricity demand of each employment site;
- The estimated electricity demand of the employment sites was compared to the spare capacity of the nearest substations; and
- The analysis compared the total substation capacity, potential employment demand based on committed and potential sites, and whether the substations are under or over capacity considering the additional demand of the employment sites. The results were displayed in a graphic created in GIS software.

2.3.2 It is noted that the is a current consultation on *'Electric vehicle chargepoints [sic] in residential and non-residential buildings'*[23] that intends to change the Building Regulations to require every new residential property with an associated car parking space to have an electric vehicle charge point. The impact of this strategy of electricity infrastructure capacity is a national issue for which large-scale solutions will need to be developed within the Plan period. As such, the electricity demand associated with electric vehicles charging has not be included within this analysis.

Gas Capacity Analysis

Residential

- Cadent Gas provided an estimate of the number of homes that could potentially be supported on their gas network for the study area considering HP, IP and MP pipelines;
- The SHLAA data was plotted on a graphic, the number of houses for each local authority summed, and compared to the capacity data provided by Cadent Gas; and
- The analysis compared potential gas capacity (number of homes that can be supplied) compared to the number of homes identified in the SHLAA data. The results were displayed in a graphic created in GIS software.

[21] As defined by the Black Country Authorities.

[22] This is an average of the typical electricity demand of B1, B2 and B8 use classes based on BSRIA Rules of Thumb 2011 and PBA's industry experience.

[23] Open consultation, *Electric vehicle chargepoints in residential and non-residential buildings,* July 2019, online, available at: https://www.gov.uk/government/consultations/electric-vehicle-chargepoints-in-residential-and-non-residential-buildings (accessed 20/08/2019)

Employment

- Cadent Gas do not release capacity data for their network and have only provided an estimate of the number of additional homes that could potentially be supported. Therefore, it is not possible to provide a quantitative assessment of the capacity of the gas network to support employment sites. As such, a qualitative assessment is provided relating back to the information provided by Cadent.

Telecommunications / Broadband Capacity Analysis

Residential and Employment

- A concentration map was created in GIS software to identify areas where high concentrations of residential growth are expected based on the SHLAA data. 'Proxy' postcodes were identified for these key residential growth areas. Proxy postcodes were also identified for the employment sites and, where necessary, additional proxy postcodes were identified to allow for fuller coverage of the study area;

- These proxy postcodes were inputted into BT Openreach's online fibre broadband checker to identify whether each area is enabled for Fibre to the Premises (FTTP) or Fibre to the Cabinet (FTTC) broadband;

- These proxy postcodes were also inputted into OfCom's mobile and broadband checker to obtain the highest available download speeds for Standard (less than 30 megabits per second, Mbps), Superfast (30 – 300Mbps) and Ultrafast (greater than 300Mbps) broadband for each specific proxy; and

- The broadband information for the proxy postcodes covering the study area were inputted into GIS software to produce two graphics: one depicting the upload speeds and one depicting download speeds, with coverage provided for identified residential and employment sites.

RAG Assessment

2.3.3 The results of the utility infrastructure capacity analysis for gas, electricity and telecommunications / broadband have been summarised on a simple RAG (red-amber-green) graphic whereby:

- Green indicates utilities capacity should not impact on growth, beyond upgrades that are typically expected for new developments;

- Orange indicates that utilities capacity may impact growth; and

- Red indicates that utilities capacity is likely to impact growth.

Strategic Growth Areas Review

2.3.4 Following the utilities capacity analysis for committed residential sites, a review of the capacity for utilities infrastructure to support any additional future growth was undertaken. Following the Spring Statement 2019, which stated that all new homes should be electric-only by 2025, this review considered electricity demand only.

- The electricity capacity of each substation was calculated with any demand already taken by the committed SHLAA sites deducted;

- The number of additional homes that could be supported with this spare capacity for each local authority area was estimated (based on 5.5kVA per dwelling[24]) and summed for each local authority area; and

- An estimate of the footprint area that would be required to accommodate these additional homes per local authority area was made, assuming 40 dwellings per hectare (dph) and a 60% developable area[25] for each site, and a comparison to available green belt area undertaken; and

- Strategic opportunities for growth related to the Fourth Industrial Revolution (i.e. energy-intensive employment uses) where high electricity capacity exists were considered.

LZC Energy Potential Review

- Data on existing and planned LZC projects was collected from BEIS' Renewable Energy Planning Database and plotted geographically within GIS software to create a graphic;

- A qualitive review of the potential for deploying a selection of LZC energy technologies in the Black Country was undertaken and an overview of their key constraints provided; and

- An overarching constraints graphic for deploying wind turbines in the Black Country was created in GIS software, considering proximity to sensitive land uses such as existing developed land and infrastructure, historic sites, ecological sites and other protected sites (the full method for this analysis is presented in **Appendix A**).

2.4 Assumptions and Limitations

2.4.1 This high level analysis is presented for the purposes of this strategic study. Furthermore, the assessment provides only a snapshot-in-time of utilities capacity, based on when data was collected from the utilities companies. The key assumptions and limitations of the method are presented in **Appendix B**.

[24] Figure based on a typical home with electric heating.

[25] As defined by the Black Country Authorities.

3 Existing Utilities Capacity Analysis

3.1 Introduction

3.1.1 This section assesses the capacity of existing utilities infrastructure to support future housing and employment growth within the new Plan period. As a baseline, it considers each Authorities' allocated housing sites to 2026 within their SHLAAs, including the four strategic centres, and committed (EDNA) and potential employment sites as defined by the Black Country Authorities.

3.2 Electricity

3.2.1 Electricity capacity was analysed across the four Black Country Authorities, with consideration given to electrical network and substation (33kV, 66kV and 132kV) infrastructure present within the geographical area. Residential and employment development have been considered separately (see supporting graphics in **Appendix C**).

3.2.2 The 'Potential Residential Electricity Capacity Analysis' graphic (**Appendix C**) shows that the electricity infrastructure in Wolverhampton has capacity to support all SHLAA sites. It is estimated that the electricity demand of the SHLAAs in this area equates to circa 66 MVA, whilst available capacity is circa 362 MVA. For Dudley, overall the electricity infrastructure has capacity to support the SHLAA sites (circa 72 MVA demand with circa 120 MVA capacity). However, there are likely to be minor localised capacity constraints for SHLAA sites around the Lye substation.

3.2.3 The electricity infrastructure has capacity to support SHLAA sites in Walsall, where there is an estimated SHLAA electricity demand of 14 MVA compared to capacity of circa 72 MVA in the closest substations to the development sites. For Sandwell, overall the electricity infrastructure has capacity to support the SHLAA sites (circa 87 MVA demand with circa 233 MVA capacity). However, there is likely to be minor localised capacity constraints for SHLAA sites around the Smethwick substation.

3.2.4 It is expected that these minor localised capacity constraints would be managed through WPD forward asset management plans, in advance of future growth.

3.2.5 For employment uses, the 'Potential Employment Electricity Capacity Analysis' graphic (**Appendix C**) shows a major constraint for employment sites close to the Rushall substation in Walsall. There are also moderate constraints for employment sites near the Bustleholm substation in Sandwell and the Halesowen substation in Dudley.

3.2.6 The nature of commercial growth in these areas would therefore need further consideration.

3.2.7 For the purposes of the RAG assessment, each authority has been categorised based on a combination of the residential and employment electricity capacity analyses above. Wolverhampton is categorised green (should not impact growth) as no major constraints have been identified. Both Sandwell and Dudley have been categorised as amber (may impact on growth) as there are minor localised constraints for the SHLAA sites. Walsall has been categorised as red (likely to impact on growth) given the major constraint for employment sites close to the Rushall substation in Walsall for existing commitments.

3.2.8 It should be noted that successful economic growth will take power capacity which in turn will reduce the available capacity for residential growth. The relationship between commercial power use and residential growth will need monitoring.

3.2.9 Residential growth is likely to have a greater electrical demand due to the need to provide electric heating and power for electric vehicle (EV) charging. Future commercial and industrial

growth will need to be planned considering the potential for high energy users to meet the needs of the UK Industrial Strategy.

3.3 Gas

3.3.1 Gas capacity was analysed across the four Black Country Authorities, with consideration given to HP (above 7 bar), IP (2 – 7 bar) and MP (75 mbar – 2 bar) pipelines present within the geographical area.

3.3.2 The IP network is currently only available in Wolverhampton, with a capacity of 101,000 dwellings equivalent. The MP network is available across the four Authorities with a total capacity of 106,000 dwellings equivalent, based on direct connections to HP pipelines. The results of the analysis are displayed in a graphic (**Appendix D**) showing the potential gas capacity (in dwelling equivalent) in each Authority alongside the number of dwellings identified in the SHLAA data.

3.3.3 The Wolverhampton SHLAA data confirms that 9,430 dwellings are planned in this area. Wolverhampton has two different types of strategic gas pipeline infrastructure: IP and MP. The IP pipelines in Wolverhampton have potential to provide an equivalent of 101,000 dwellings gas capacity, however this capacity is not currently available for use. Therefore, Wolverhampton must rely on provision of the MP pipelines, which currently have capacity of 11,000 dwellings equivalent. As such, there appears to be sufficient capacity to serve the 9,430 dwellings, with spare capacity equivalent to 1,570 dwellings. Wolverhampton has therefore been categorised as green in the RAG assessment in **Figure 1** (i.e. gas capacity should not impact on growth).

3.3.4 The Dudley SHLAA data confirms there that 13,071 dwellings are planned in this area. Dudley has two different types of strategic gas pipeline infrastructure: HP and MP, with no IP pipeline available. These pipelines have capacity for 80,000 dwellings equivalent, meaning there is enough existing gas capacity to provide to the committed SHLAA dwellings, with spare capacity equivalent to 66,929 dwellings. Dudley has therefore been categorised as green in the RAG assessment.

3.3.5 The Walsall SHLAA data confirms that 3,103 dwellings are planned in this area. Walsall has two different types of strategic gas pipeline infrastructure: HP and MP. These pipelines have capacity for 10,000 dwellings equivalent, meaning there is enough existing gas capacity to provide the committed SHLAA dwellings, with spare capacity equivalent to 6,897 homes. Walsall has therefore been categorised as green in the RAG assessment.

3.3.6 The Sandwell SHLAA data confirms that 17,713 dwellings are planned in this area. Sandwell also has two different types of strategic gas pipeline infrastructure: HP and MP. These gas pipelines currently have capacity of 5,000 dwellings equivalent, meaning there is currently insufficient capacity to provide for the committed SHLAA dwellings without reinforcement, with a shortfall of 12,713. Sandwell has therefore been categorised as red in the RAG assessment (likely to impact on growth).

3.3.7 In terms of gas capacity to support employment sites, Dudley and Walsall both have considerable spare capacity and are likely to be able to support some degree of employment uses without widespread upgrades. Though it has some spare capacity, Wolverhampton's gas infrastructure may require reinforcement to supply committed and potential employment sites. Sandwell does not have sufficient capacity to serve the committed SHLAA sites, so will not be able to serve the employment sites without grid reinforcements.

3.3.8 Cadent Gas is responsible for upgrading their gas network to meet the overarching growth needs of the Black Country. It is recommended that continued engagement with Cadent Gas is undertaken through the Local Plan making process to ensure local growth is defined in their future gas asset planning.

3.3.9 In addition, the Black Country Authorities could consider developing further local energy efficiency strategies to reduce heating demands for existing users. This could include further investments into social housing within the area to reduce the use of gas.

3.4 Telecommunications / Broadband

3.4.1 Telecommunications (broadband) coverage and capacity were analysed across the Authorities of the Black Country, taking into consideration both committed residential and commercial sites. The results have been displayed in two graphics showing the highest broadband download and upload capacities available (supporting graphics provided in **Appendix E**).

3.4.2 For download capacities, the analysis shows a higher concentration of 600 – 1000Mbps to the north-east of Walsall, reflecting the availability of Ultrafast broadband speeds (greater than 300Mbps). Overall, the Walsall area is predominantly offering Superfast (30 – 300Mbps) to Ultrafast broadband. To the north-east of Sandwell, the broadband download availability extends from 300 – 400Mbps, thus offering Ultrafast capacity. The south-east of Sandwell offers Standard (less than 30Mbps) to Superfast broadband speeds, ranging from 0 – 200 Mbps.

3.4.3 Dudley has Ultrafast broadband speeds covering a large geographical area, particularly the northern half of the area, whilst the remaining areas have broadband speeds ranging from 0 – 100 Mbps. The Wolverhampton area offers Ultrafast broadband speeds of 300 – 400 Mbps to the south-west, whilst speeds in the remaining areas range from 100 – 200 Mbps.

3.4.4 Broadband download speeds are important for users that transfer data from the internet to the user's computer or device. They are particularly important for residential areas where inhabitants download or stream films, music and other documents. From a planning perspective, download and upload speeds are important in allowing home working and therefore promoting economic development and more sustainable patterns of transport and more flexible, healthy lifestyles. High download speeds are also important for employment sites where businesses require high download capacity to download many documents quickly.

3.4.5 For upload capacities, the analysis shows that the entire geographical area of the Black Country offers upload speeds of between 0 – 100 Mbps, with the exception of a concentration of high upload speeds to the north-east of the Walsall area. These high upload speeds correlate with the high download speeds shown in **Appendix E**.

3.4.6 Upload speeds are important for users that transfer data from the user's computer or device to the internet. Generally speaking, higher upload speeds are required by businesses and commercial uses more so than residential areas and private users. Business applications that require good upload speeds include: hard-drive backups, in-house web hosting, attachments on out-going email, cloud applications (i.e. Google Docs, Dropbox, iCloud), voice-over internet protocol (IP) telephone services, and Skype and Facetime applications.

3.4.7 Overall, the highest upload and download speeds were concentrated close to Aldridge in Walsall. Within this area (i.e. Hayward Industrial Estate, Westgate Trading Estate, Lion Industrial Park and Middlemore Business Park) there are several IT, consulting and trading estate companies that are likely to require higher download and upload speeds. It is likely that the high speeds seen in this area are due to recent upgrades in the fibre broadband network, and the presence of both BT Openreach and Virgin Media fibre broadband (within a 5 mile radius of Aldridge)[26].

[26] Broadband in Aldridge, online, https://www.broadbandexposed.co.uk/

3.4.8 The Black Country Local Enterprise Partnership (LEP)[27] has a remit to create enabling conditions that will flourish enterprise and foster greater economic prosperity across the Black Country area. One of the LEP's priority propositions set out in their Strategic Economic Plan (SEP) is entitled 'Connected Black Country'. This key proposition involves a programme of investment in broadband and transport in order to support growth through a facilitated movement of goods and people.

3.4.9 The LEP's Black Country Broadband Project aims to extend availability of high-speed fibre broadband to 99.4% of homes and businesses across the study area, including addressing any 'white spots'[28]. As part of this, the LEP aims to foster development of skills in digital technology, including higher level skills such as programmers and code writers. According to the LEP, the Black Country already has the highest rate of Superfast broadband connectivity in the country.

3.4.10 New residential and commercial development, especially in undeveloped areas such as the green belt, may act as a catalyst to bring high value Superfast and Ultrafast broadband into "white spots" allowing existing communities to benefit from new growth.

3.4.11 Given the broadband upload and download capabilities outlined above, and the ambitions of the LEP's Black Country Broadband Project, all four Authorities have been categorised as green (should not impact on growth) in the summary RAG assessment in **Figure 1**.

[27] Black Country LEP, online, available at: https://www.blackcountrylep.co.uk/

[28] White spots are areas without fixed broadband connections.

4 Strategic Growth Areas Review

4.1 Introduction

4.1.1 Following the utilities capacity assessment for committed sites (**Section 3**), this section considers the capacity for utilities infrastructure to support any additional future growth that is not currently committed in SHLAAs and the EDNA.

4.1.2 In undertaking this assessment of potential additional growth, which will be beyond 2026, it is important to consider the *nature* of growth. Two factors have been considered in this study:

- Residential growth is likely to have a greater electrical demand due to the need to provide electric heating and power for electric vehicle (EV) charging; and
- Future commercial and industrial growth will need to be planned considering the potential for high energy users to meet the needs of the UK Industrial Strategy.

4.2 UK Industrial Strategy

4.2.1 The UK Government's Industrial Strategy (2017) aims to boost productivity and increase the earning power of people throughout the UK.

4.2.2 It seeks to capitalise on the current digital and technological revolution known as the Fourth Industrial Revolution. The revolution will disrupt every sector and, due to the pace and breadth of innovation, the outcomes are difficult to predict.

4.2.3 The UK Industrial Strategy focuses on four key themes, described as Grand Challenges:

- Putting the UK at the forefront of the artificial intelligence (AI) and data revolution;
- Maximising the advantages for UK industry from the global shift to clean growth;
- Becoming a world leader in shaping the future of mobility; and
- Harnessing the power of innovation to help meet the needs of an ageing society.

4.2.4 The breadth and depth of the Grand Challenges creates significant overlap between each challenge area, not least the impact of how big data drives innovation, as represented in **Figure 2**.

4.2.5 Energy infrastructure underpins all aspects of these Grand Challenges, from powering data transfer, providing for clean growth, enabling mobility and providing security for our ageing society.

4.2.6 Economic geographies that can act on delivering and enabling energy infrastructure will be able to capitalise on the economic opportunities of the Industrial Strategy.

4.2.7 This is considered further below, in terms of how it relates to both future residential and employment growth.

4.3 Impact of New Sector Demands on Power Infrastructure

4.3.1 The Black Country will need to transition energy demand from petroleum and gas to electricity over the next few decades. This will have a marked impact on power demands and infrastructure.

4.3.2 An example of these risks to the Black Country's economy can be seen in the disconnect between existing electrical power provision compared with car ownership and the future need for power infrastructure to provide energy for vehicles.

4.3.3 Currently the locations of petroleum refuelling infrastructure in the Black Country are defined by traffic flow (or footfall) and the potential value of retail convenience.

4.3.4 This infrastructure has no relationship with electricity capacity or access to bulk power supply. This creates a large disparity in that the existing road network and fuel facilities are currently not ready to provide EV charging infrastructure.

4.3.5 A large proportion of car owners also do not have access to off-street parking and therefore the potential for private charging infrastructure. This alone suggests major investment is needed in either centralising charging facilities to have direct access to grid electricity or for a major investment into distributed charging facilities (i.e. every car has access to a charging point).

4.3.6 The capacity to provide a charging point for every vehicle that does not have off-street parking has obvious engineering challenges but importantly major social equality implications. The current public EV charging infrastructure offers a price of electricity that is significantly greater than the cost of domestic electricity (i.e. the cost of charging at home).

4.3.7 As such, car owners who do not have access to off-street parking are unable to charge their EVs using normal, relatively low cost, domestic electricity tariffs. They must instead use the public EV charging infrastructure, which currently costs up to three times more than domestic rates. This is in addition to having to pay 'membership' charges to the various charging schemes currently provided within the Black Country area.

4.3.8 This inequality in access to 'cheap' electricity for those without domestic connection points has the potential to limit the travelling ability of the labour force, with associated negative impacts on growth and the environment.

4.3.9 More vulnerable members of the community, such as the elderly, may also have difficulty using complicated payment systems and mobile applications, thereby further exacerbating inequalities.

4.3.10 The impact of charging infrastructure must, therefore, be considered beyond simply the infrastructure provision of charging points.

4.3.11 Currently, the regional energy providers do not have a fixed approach regarding how these new demands will affect the future network investment plans.

4.3.12 This is a critical risk to growth for the Black Country Authorities.

4.4 Future Residential Growth

4.4.1 As highlighted in **Section 3**, regional grid capacity across the Black Country represents a generally positive picture relating to spare capacity, as defined at the time of this study.

4.4.2 To express the potential geographic extent of new development beyond 2026, based on the remaining capacity, potential aggregated development footprints have been calculated based on the energy demand of new homes built to 40 dph and a net developable area of 60%.

4.4.3 Based on the remaining power capacity (taking into consideration all proposed SHLAA development) the network and substations within each Authority have been expressed in **Table 1** below. At this stage, it has been assumed that all heating will be delivered through

electricity. This analysis is based on spare electricity capacity only as a potential influencer of growth.

4.4.4 The analysis presented in **Table 1** shows a simple geographic representation relating to distance to substations and green belt. The data shows there is potential additional capacity for new homes in all Black Country Authorities. For Dudley and Walsall there is more available green belt than power capacity.

Table 1: Potential area for new housing growth base on grid capacity

Black Country Authority	Housing growth area potential based on available grid capacity (approx. hectares)	Available green belt (approx. hectares)
Wolverhampton	3136	799
Dudley	633	1,759
Sandwell	1,571	822
Walsall	613	3,942

4.4.5 This simple comparison suggests there is a disparity between green belt provision and available grid capacity. The urban areas of Wolverhampton and Sandwell have good electrical provision which is greater in terms of growth potential than available greenbelt. Brownfield development or increasing densities in this area is therefore key to using this spare capacity.

4.4.6 This analysis does not include the provision of EV charging infrastructure within new development, which is currently required through the Black County Air Quality Supplementary Planning Document and may in future be required under Building Regulations subject to the results of a current Government consultation. If all new homes require EV charging points, this could place limits on deliverable housing growth. However, this is a national issue for which large-scale solutions will need to be developed within the Plan period, including the use of V2G[29], smart grids, smart charging and battery storage, to smooth demand and reduce the need to increase grid capacity. As noted in **Section 2.2**, the electricity capacity analysis has not considered demand associated with electric vehicle charging.

4.4.7 Alternative approaches to EV charging infrastructure could also be considered to reduce the 'cost' burden to new development, including spatial planning for centralised charging or electric charging forecourts similar to petrol stations.

4.4.8 As noted previously, the geographic relationship between the power infrastructure and planning authority boundaries are not actually aligned. In reality, WPD would create new connections between potential growth areas and where new power infrastructure is needed. Future dialogue with WPD to enable this will be important. It is therefore recommended that WPD are engaged through growth steering groups to ensure future capacity and infrastructure are aligned to needs.

[29] 'Vehicle to grid' technology, also referred to as 'V2G' enables energy stored in electric vehicles to be fed back into the national electricity network (or 'grid') to help supply energy at times of peak demand.

4.4.9 It should also be noted that successful economic growth will take power capacity which in turn will reduce the available capacity for residential growth. The relationship between commercial power use and residential growth will need monitoring.

4.5 Future Employment Growth

4.5.1 Technological advances and the Government's Clean Growth and Industrial Strategies are changing the nature of employment and the associated energy demands of employment uses. Furthermore, with the onset of the Fourth Industrial Revolution, there has been proliferation of energy-intensive industries such as data centres, EV charging and advanced manufacturing.

4.5.2 These industries are looking for locations where there is both good power infrastructure and an employment work force.

4.5.3 Employment growth will have an incremental impact on power capacity and should be considered as a metric of good growth. The better the economy, the greater the draw-down on power consumption. This is the basis of the Industrial Strategy Clean Growth Grand Challenge.

4.5.4 The analysis completed in **Section 3** shows available grid capacity in geographies located near to existing employment areas within the region. In particular, the Boundary Industrial Estate and Wolverhampton Business Park are co-located next to the Bushbury 132kV primary substation, which has circa 90MVA spare capacity (other substations have capacity in this area, including the I54 substation). Such locations offer significant opportunities for industries looking for power capacity for advanced manufacturing or uses such as data centres.

4.5.5 This evidence underpins the potential for good economic growth in the region.

4.6 Funding and Delivery Mechanisms for Power and Gas Infrastructure

4.6.1 Throughout the UK, the various electricity Distribution Network Operators (DNOs) are privately owned. This means that, generally, the investment in upgrading the network to meet increased demand is done on a reactive basis.

4.6.2 At some stage, there will be need for a significant financial expenditure (e.g. for a new grid substation and supporting circuits which would likely cost in the £millions), but this would need financial scrutiny and commitment from various end-users to justify this level of risk.

4.6.3 Additionally, as highly regulated businesses, the DNOs are not allowed to forward-fund assets in a particular area as there needs to be a competitive opportunity for other parties (Independent Distribution Network Operators – IDNOs) to supply new developments or future areas of growth.

4.6.4 The same principle applies to the National Grid gas distribution network and the competitive opportunities to Independent Gas Transporters (IGTs) for supplies to new developments. More information can be found on the competition for energy supply connections on the OFGEM website[30].

4.6.5 Both WPD's and National Grid's ability to provide infrastructure in advance of growth is limited by rules set out by OFGEM and within the UK Electricity Act 1989 and Gas Act 1986.

4.6.6 This study has shown that the potential gaps in utility infrastructure are likely to be localised in nature, rather than at the more regional scale (132kV power network and HP gas systems).

[30] https://www.ofgem.gov.uk/

4.6.7 Closing the gap between growth and infrastructure delivery at this local level may require investment that falls outside the ability for statutory undertakers to deliver. Where the private sector cannot close this gap public sector funding will be critical.

4.6.8 For example, forward funding energy infrastructure linked to strategic growth will require access to central funding routes such as the Housing Infrastructure Funding (HIF). The role of the local authority will be to establish the business case to Government to obtain HIF money to close the gap.

4.6.9 New utility capacity for 'new demands' such as EVs (as noted in **Future Growth**) is currently being considered separately by Government.

4.6.10 For example, to support innovation and encourage growth, the National Industrial Strategy presents several policy proposals which will have a direct impact on utility demands. For instance, it plans to end the sale of new conventional petrol and diesel cars by 2040, spend £1 billion on supporting ultra-low emission vehicles (ULEV), and to develop "one of the best electric vehicle charging networks in the world". Furthermore, it plans to further encourage the roll-out of low carbon heating, build and extend heat networks across the country, whilst phasing out high fossil fuel heating in new and existing homes currently off the gas grid.

5 Low and Zero Carbon Energy

5.1 Introduction

5.1.1 To help increase the supply of LZC energy, paragraph 151 of the NPPF 2019 states that plans should provide a positive strategy for energy from these sources, that maximises the potential for suitable development, whilst ensuring that adverse impacts are addressed satisfactorily. Suitable areas for LZC energy sources and supporting infrastructure should be identified, where this would help secure their development.

5.1.2 In the case of wind energy development, footnote 49 of paragraph 154(b) states that proposed wind energy development involving one or more turbines should not be considered acceptable unless it is in an area identified as suitable for wind energy development in the development plan and, following consultation, it can be demonstrated that the planning impacts identified by the affected local community have been fully addressed and the proposal has their backing.

5.1.3 This section provides a high-level assessment of LZC energy potential in the Black Country. Firstly, it provides an estimate of existing low carbon energy generation capacity and potential additional capacity that could be realised through approved applications or projects under construction. It also provides a review of the potential for LZC technologies based on the Black Country's geography, with a focus on wind energy, and the limitations of such developments, with reference to current BCCS Policy ENV 7, which requires 10% of energy demands on major developments to be met through on-site renewable energy generation.

5.2 Existing and Planned Generation

5.2.1 In order to provide a high-level summary of existing and planned LZC projects across the Black Country, a review of the Department for Business, Energy & Industrial Strategy (BEIS) Renewable Energy Planning Database[31] has been undertaken. The database tracks the progress of LZC energy projects (including those that could also be used for combined heat and power, CHP) across the UK from inception, through planning, construction and operation to commissioning.

5.2.2 According to BEIS, there are a total of 16 recorded projects in the region. These are summarised below and shown in **Figure 3**.

Operational

5.2.3 There are 7 operational LZC energy projects in the Black Country with a total installed capacity of 60.3 MW. These comprise:

- 2 landfill gas projects (Edwin Richards Landfill Scheme and Highfields South Landfill Gas) with a combined installed capacity of 2.8 MW;
- 2 energy-from-waste (EfW) projects (Dudley EfW and Wolverhampton EfW) with a combined installed capacity of 15.4 MW;
- 2 advanced conversion technology projects (Oldbury and Cradley Heath) with a combined installed capacity of 50.1 MW; and
- 1 solar photovoltaic farm (DPD Distribution Centre) with an installed capacity of 1 MW.

[31] BEIS Renewable Energy Planning Data, Public Database – March 2019, online, available at: https://www.gov.uk/government/collections/renewable-energy-planning-data (accessed 20/06/2019).

5.2.4 The average installed capacity of operational LZC projects is 8.6 MW. The operational advanced conversion technology project located at Cradley Heath accounts for 66% of the total operational capacity in the region.

5.2.5 This pattern of LZC energy development is typical of an urban geography, such as the Black Country, with limited capacity for ground-mounted technology (such as large-scale solar farms).

5.2.6 There is also a large operational solar PV array at Barnhurst Sewage Treatment Works and the Robert Hopkins EfW plant in West Bromwich (capacity unknown), which are not included in BEIS' database. For completeness, the location of these facilities is shown in **Figure 3**.

Under Construction

5.2.7 There is 1 EfW project under construction (Wednesbury) that will have an installed capacity of 4.2 MW.

Planning Permission Granted

5.2.8 There are 3 projects with planning permission granted and awaiting construction. Two of these are advanced conversion technology projects (BHEG Walsall and Bloomfield) that will have a combined installed capacity of 32 MW. The other is a battery project (Anchor Lane Energy Centre) that will have a capacity of 4 MW.

Regional Comparison

5.2.9 **Table 2** below compares the LZC energy generation capacity of the Black Country with the two neighbouring areas of Birmingham City, which is a similarly sized predominantly urban area, and Staffordshire, which is a larger rural area immediately adjacent.

Table 2: Regional comparison of planning application approvals for LZC projects

LZC energy project status	Black Country Authorities	Birmingham City Council	Staffordshire County Council
Operational, under construction or planning permission granted	Quantity: 11 Capacity (MW): 100.5	Quantity: 7 Capacity (MW): 76.2	Quantity: 4 Capacity (MW): 26.8

5.2.10 The analysis shows that the Black Country has a greater number and generation capacity of LZC energy projects that are operational, under construction or with planning permission granted than compared to the neighbouring areas of Birmingham and Staffordshire.

5.3 Potential for LZC Technologies

5.3.1 Defining LZC energy capacity within a region is complicated and must consider competing variables such as:

- Environmental constraints – e.g. suitable geology for ground source heat pumps or the presence of protected ecological species;
- Resource constraints – e.g. the availability and reliability of biomass fuel supplies or wind resources;

- Social constraints – e.g. visual or health impacts of placing combustion-based technologies near housing; and
- Infrastructure constraints – e.g. impacts on aviation from wind turbines or the availability of suitable transport infrastructure to import fuel, plant or equipment.

5.3.2 **APPENDIX F** identifies some of the overarching considerations associated with delivering LZC energy projects in the Black Country for a selection of technologies. This indicates there are likely to be opportunities for a range of technologies in the area that could be deployed to meet 10% of energy demands for major developments (as is currently required by BCCS Policy ENV 7), however this must be subject to further analysis on a site-by-site basis.

5.3.3 Energy storage technologies (including V2G) are likely to have an important future role in managing supply, storing power and providing supply at times of peak demand. The technology is currently expensive, and the energy storage markets are largely untested, however this risk is likely to diminish over the next five to ten years.

5.3.4 The WPD data for potential grid export shows there is good capacity to export renewable energy at a local level. This would support future policy associated with micro generation in new developments to support targets greater than 10%.

5.3.5 In setting targets for micro generation and distributed energy resources (DER), there will be benefit in considering requiring new development to assess the potential for active network management and DER. This would support the adoption of smart grid technology to deliver clean growth. The Black Country Authorities may also consider the use of existing public sector land for the use of DER.

5.3.6 To support the Black Country Authorities in complying with footnote 49 of paragraph 154(b) of the NPPF 2019, an overarching constraints graphic for deploying wind turbines in the Black Country has been created. This considers the potential for large-scale wind turbines only (circa 2 MW with a typical height of 125 m). It considers proximity to sensitive land uses such as: existing developed land and infrastructure, historic sites, ecological sites and other protected sites (the full list of constraints considered is presented in **Appendix A**). The sites have also been screened for sensitivity by the Black Country Authorities using their local knowledge.

5.3.7 The constraints graphic is provided in **Figure 4** below. This shows that the vast majority of the Black Country is constrained and unsuitable for wind development, based on the above sensitive land uses (red shading). Only small pockets of land have been identified as potential locations for wind turbines, subject to further site-specific investigation (green shading). These sites are located predominantly in the eastern and northern areas of Walsall and isolated areas to the east of Sandwell.

5.3.8 These considerations are not exhaustive, and any LZC energy projects (including micro- and medium-scale wind projects) must be reviewed in detail on a case-by-case basis to consider local constraints and how to address any planning impacts on the local community.

5.4 District Heating

5.4.1 District heating is a means of providing heating and / or cooling to multiple buildings via a district heating network. A recent Black Country Energy Strategy[32] identified potential district heating and energy opportunities in the area, possibly linking to EfW facilities. It states that both Wolverhampton and Dudley have incinerators that revert to their control in 2023, and these are potentially the basis for a district heating and local electricity supply service.

[32] Powering Growth: Black Country Energy Strategy (Final Report), February 2018, AECOM

5.4.2 Studies in Sandwell are ongoing into a different district heating scheme, and there is a plan for a privately funded EfW scheme in Sandwell. Sandwell Council is likely to seek grant funding from the Heat Networks Delivery Unit (HNDU) towards the cost of Detailed Project Development for two district heating schemes, one in West Bromwich and one in Smethwick.

5.4.3 New developments in Walsall could also take advantage of growing use of heat pumps based on the rivers and canals in the Borough.

Each of these potential schemes will require investment and ongoing commitment from the whole energy community (including the local authorities) to achieve success, particularly in encouraging connections to take place.

6 Conclusions and Recommendations

6.1 Introduction

6.1.1 A Utilities Infrastructure Capacity Study has been undertaken for Dudley, Sandwell, Walsall and Wolverhampton Councils (the Black Country Authorities) to support the preparation of a new Black Country Plan to 2038.

6.1.2 The study assesses the capacity of existing electricity, gas and telecommunications (broadband) infrastructure to support future housing and employment growth within the new Plan period, and reviews optimal locations for new development based on utilities capacity.

6.1.3 It provides further evidence for the new Black Country Plan preparation process relating to utilities infrastructure that will enable growth.

6.2 Study Findings

6.2.1 The potential utilities needs for growth were defined based on the evidence within the Strategic Housing Land Availability Assessments (SHLAAs), including the four strategic centres (Wolverhampton, Walsall, West Bromwich and Brierley Hill) and committed employment sites identified in the Economic Development Needs Assessment (EDNA) to 2026 and potential employment sites to 2038 as defined by the Black Country Authorities.

6.2.2 The assessment showed that there is provision for power and fibre across the region that will support both housing and commercial growth in the Black Country economic geography.

6.2.3 Overall, electricity grid capacity across the Black Country represents a generally positive picture relating to spare capacity. In both Sandwell and Dudley there are minor localised constraints for the SHLAA sites, and potentially moderate constraints for employment sites depending on the nature of the employment uses. There are though constraints relating to power for potential employment sites close to the Rushall substation in Walsall. The nature of employment use therefore should be considered.

6.2.4 With regards to gas provision it has been highlighted that there may be capacity issues within the Sandwell area in the future.

6.2.5 Both Western Power Distribution (WPD) and Cadent, the electricity and gas providers (respectively) within the region, would deliver the required infrastructure to support growth as part of their future asset plants.

6.3 Future Growth

6.3.1 The power capacity within the region offers excellent opportunities to underpin future housing and economic growth. In particular, the power infrastructure co-located with existing employment land uses shows that the Black Country can offer a location to be a centre for the UK's Industrial Strategy. This includes opportunities for industries looking for high power capacity requirements such as advanced manufacturing or uses such as data centres.

6.3.2 It should be noted, though, that successful economic growth will take power capacity which in turn will reduce the available capacity for residential growth. The relationship between commercial power use and residential growth will need monitoring.

6.3.3 In addition, new power demands, including electric vehicle (EV) power consumption, will need to be planned for. This is especially important when siting centralised EV charging infrastructure to ensure unplanned power consumption does not impact planned growth.

6.3.4 Within the Local Plan process, these opportunities provide the evidence to support continuation of policies related to the provision of distributed energy resources (DER) such as micro generation, and the need for new growth to consider the implementation of active power network management, known as smart grids, including battery storage.

6.4 Recommendations

6.4.1 Within the study, several recommendations have been drawn-out to support the evolution of Local Plan making and the new Black Country Plan as it relates to utilities infrastructure. These recommendations are based on opportunities for the Black Country Authorities to capitalise on the value of utilities infrastructure to both support economic growth and to potentially direct public sector investments.

- **Recommendation 1**: The Black Country Authorities should continue engagement with WPD, Cadent Gas and the broadband providers within the region to ensure these utilities companies are accommodating growth within their asset planning;

- **Recommendation 2**: In setting targets for micro generation and distributed energy resources, there will be benefit in considering requiring new development to assess the potential for active network management and distributed energy resources (including the use of smart meters). This would support the adoption of smart grid technology to deliver clean growth;

- **Recommendation 3**: Continued investments into energy efficiency programmes is recommended. This is especially important for social housing in control of the Authorities and will support reductions in the use of energy, which will in turn free capacity for future growth;

- **Recommendation 4**: Potential spatial planning for the delivery of centralised EV charging infrastructure or EV charging forecourts should be considered. In addition, the Authorities' own land portfolios could be considered to enable future provision of EV charging;

- **Recommendation 5**: The Black Country Authorities can support the delivery of distributed energy resources to create additional power capacity within the region through the use of their land portfolios. This offers potential revenue streams for the authorities whilst enabling utility capacity in the region; and

- **Recommendation 6**: The Black Country Authorities should explore the use of Housing Infrastructure Funding (HIF funding) to unlock housing delivery by supporting utilities infrastructure upgrades where localised constraints are identified.

7 Figures

Figure 1: Summary RAG assessment of utilities infrastructure capacity for electricity, gas and broadband

N

Local Authority

Utilities

Broadband

Electricity Gas

Impact on Growth

No Impact on Growth

May Impact on Growth

Likely Impact on Growth

City of Wolverhampton

Walsall

Sandwell

Dudley

pba peterbrett now part of Stantec	Client: Sandwell Metropolitan Borough Council	**BLACK COUNTRY AUTHORITIES UIC** RAG Assessment	0 5 10 km World Topographic Map: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community Contains Ordnance Survey data © Crown copyright and database right [2019]	1:105,000 @ A3 / Date: 03/09/2019 Drawn: HG / Checked: MD Figure 04 / Rev A

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Figure 2: Complexity in building a Local Industrial Strategy

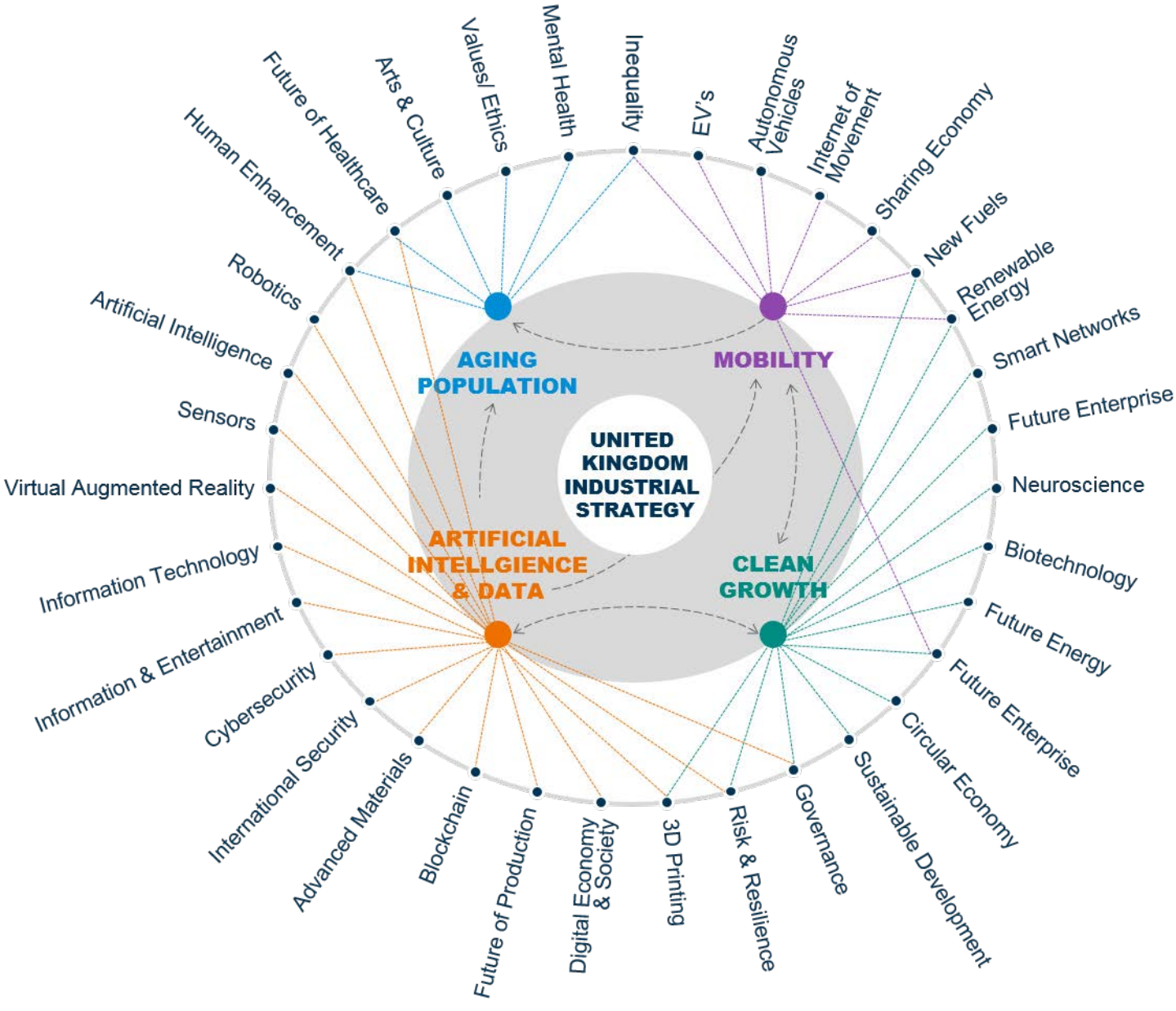
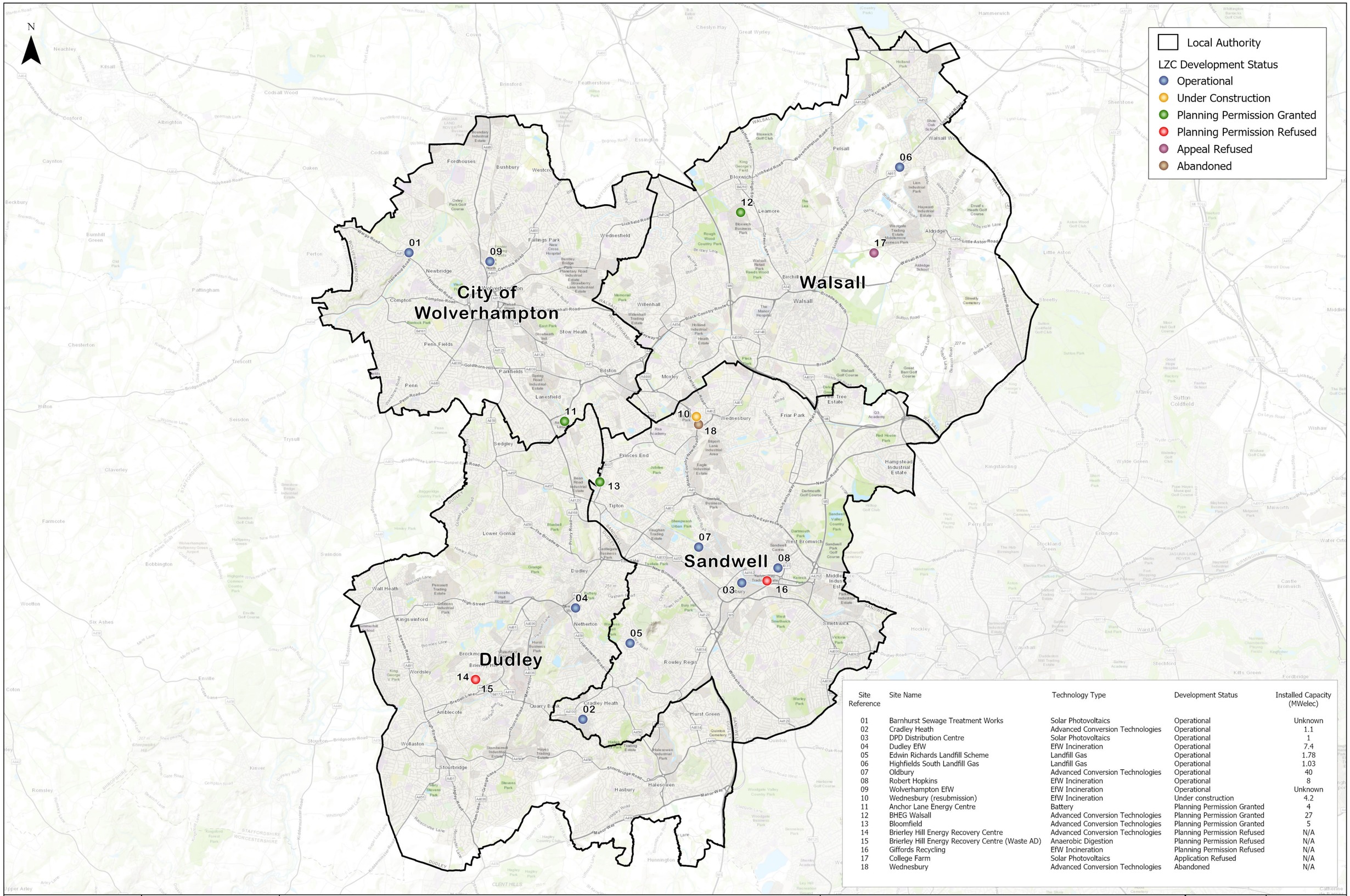

UNITED KINGDOM INDUSTRIAL STRATEGY
AGING POPULATION
MOBILITY
ARTIFICIAL INTELLGIENCE & DATA
CLEAN GROWTH
Values/ Ethics
Mental Health
Inequality
EV's
Autonomous Vehicles
Internet of Movement
Sharing Economy
New Fuels
Renewable Energy
Smart Networks
Future Enterprise
Neuroscience
Biotechnology
Future Energy
Future Enterprise
Circular Economy
Sustainable Development
Governance
Risk & Resilience
3D Printing
Digital Economy & Society
Future of Production
Blockchain
Advanced Materials
International Security
Cybersecurity
Information & Entertainment
Information Technology
Virtual Augmented Reality
Sensors
Artificial Intelligence
Robotics
Human Enhancement
Future of Healthcare
Arts & Culture

Figure 3: Existing and planned LZC energy generation in the Black Country



Site Reference	Site Name	Technology Type	Development Status	Installed Capacity (MWelec)
01	Barnhurst Sewage Treatment Works	Solar Photovoltaics	Operational	Unknown
02	Cradley Heath	Advanced Conversion Technologies	Operational	1.1
03	DPD Distribution Centre	Solar Photovoltaics	Operational	1
04	Dudley EfW	EfW Incineration	Operational	7.4
05	Edwin Richards Landfill Scheme	Landfill Gas	Operational	1.78
06	Highfields South Landfill Gas	Landfill Gas	Operational	1.03
07	Oldbury	Advanced Conversion Technologies	Operational	40
08	Robert Hopkins	EfW Incineration	Operational	8
09	Wolverhampton EfW	EfW Incineration	Operational	Unknown
10	Wednesbury (resubmission)	EfW Incineration	Under construction	4.2
11	Anchor Lane Energy Centre	Battery	Planning Permission Granted	4
12	BHEG Walsall	Advanced Conversion Technologies	Planning Permission Granted	27
13	Bloomfield	Advanced Conversion Technologies	Planning Permission Granted	5
14	Brierley Hill Energy Recovery Centre	Advanced Conversion Technologies	Planning Permission Refused	N/A
15	Brierley Hill Energy Recovery Centre (Waste AD)	Anaerobic Digestion	Planning Permission Refused	N/A
16	Giffords Recycling	EfW Incineration	Planning Permission Refused	N/A
17	College Farm	Solar Photovoltaics	Application Refused	N/A
18	Wednesbury	Advanced Conversion Technologies	Abandoned	N/A

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Existing and Planned LZC Energy Generation in the Black Country

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Figure 4: Wind power constraints graphic for the Black Country

N

Local Authority
Site Specific Investigation Required
Constrained

City of Wolverhampton

Walsall

Sandwell

Dudley

Considered Constraints:
- o Ancient Woodland
- o Areas of Outstanding Natural Beauty (AONB)
- o Battlefields
- o Country Parks
- o Electrical infrastructure
- o Flood Zones
- o Gas infrastructure
- o Historic Parks and Gardens
- o Listed Building
- o Local Nature Reserve (LNR)
- o National Parks
- o National Nature Reserve (NNR)
- o Developed Land Use Area
- o Rail Links
- o RAMSAR
- o Road Infrastructure
- o Special Areas of Conservation (SAC)
- o Schedule monuments
- o Special Protection Area (SPA)
- o Sites of Special Scientific Interest (SSSI)
- o World Heritage sites

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Wind Power Constraints Graphic for the Black Country

0 5 10 km

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Appendix A Wind Power Constraints Method

A.1.1 To support the Black Country Authorities in complying with footnote 49 of paragraph 154(b) of the NPPF 2019, an overarching constraints graphic for deploying wind turbines in the Black Country was created. This considers the potential for large-scale wind turbines only (circa 2 MW with a typical height of 125 metres).

A.1.2 A grid of hexagons (each 100 metres in height and 115 metres in width) was created and overlaid on an ordnance survey (OS) base map of the Black Country in GIS software. Where any of these hexagons interacted with the constraints layers listed below, they were considered "constrained" and unsuitable for wind power development. This is a geographical analytics technique for screening infrastructure delivery. The sites have also been screened for sensitivity by the Black Country Authorities using their local knowledge.

- World Heritage sites;
- Scheduled monuments;
- Historic parks and gardens;
- Battlefields;
- Sites of Special Scientific Interest (SSSIs);
- Special Protection Areas (SPAs);
- Special Areas of Conservation (SACs);
- Ramsar sites;
- National Parks;
- National Nature Reserves (NNRs);
- Local Nature Reserves (LNRs);
- Country Parks;
- Areas of Outstanding Natural Beauty (AONBs);
- Ancient Woodland;
- Flood Zones;
- OS meridian (developed land use area) urban areas (400 metre buffer used[33]);
- OS open map rail (150 metre buffer used);
- Listed buildings (50 metre buffer used[34]);

[33] The 400 metre buffer is a typical value related primarily to noise impacts.

[34] It should be noted that listed buildings are also included within the developed land use area buffer (400 metre).

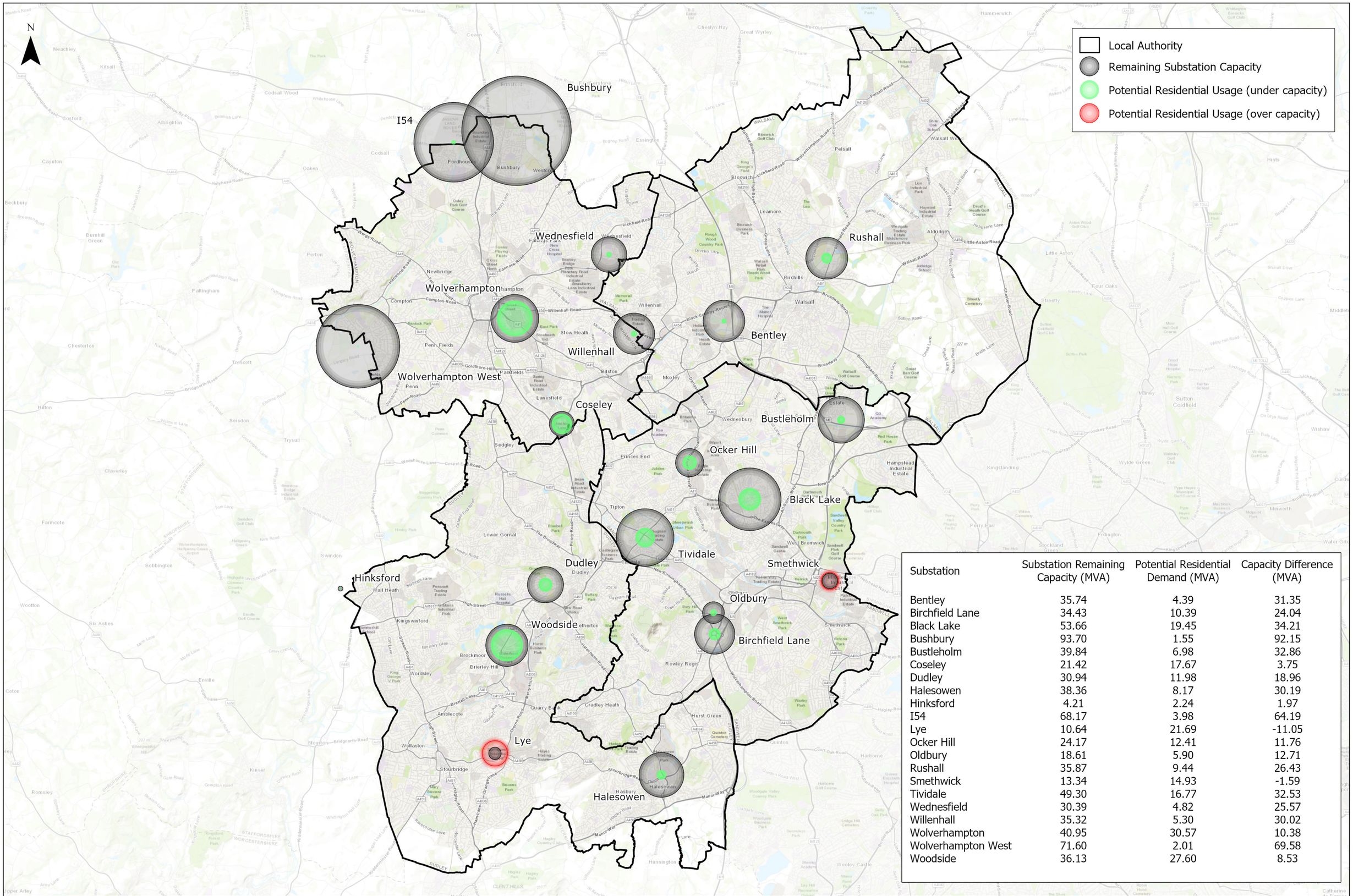
- Electrical infrastructure (overhead lines, towers, substation sites) (150 metre buffer used); and
- Gas infrastructure (high and intermediate pressure assets) (150 metre buffer used).

Appendix B Key Assumptions and Limitations

B.1.1 The key assumptions and limitations of the method presented in **Section 2** are as follows:

- The study considers strategic-level utilities assets (33kV, 66kV and 132kV for electricity and HP, IP and MP for gas). Further detailed analysis of local network capacity for individual sites would be required;
- The assessment provides only a snapshot-in-time of utilities capacity, based on when data was collected from the utilities companies. However, utilities capacity in a given network is constantly changing as connection requests and new connections are made. Connection requests will be necessary for individual development sites to confirm network capacities and any upgrades required;
- Within the electricity analysis, the SHLAA and employment sites have been linked to the closest substation. Actual connection logistics must be confirmed on a site-by-site basis;
- The analysis is based on benchmark data and therefore provides broad estimates of utilities demands only. Actual demands will vary on a building-by-building basis and are influenced by technological and policy changes over time;
- Electricity demand on employment sites has been based on an average of B1 (offices), B2 (general industrial) or B8 (storage or distribution) use classes demands using benchmark data. However, the energy demands of commercial buildings is constantly changing over time due to technological and policy changes, and can differ significantly between the commercial building types;
- The impact of new technologies, such as Electric Vehicles (EVs), will need to be considered for any future development site;
- A 60% developable area has been assumed for the employment sites, as defined by the Black Country Authorities;
- The strategic growth review (**Section 4**) considers electricity demands only in line with the Spring Statement 2019, which states that all new homes should be electric only by 2025. However, strategic assessment of gas capacity may still be required;
- The strategic growth review (**Section 4**) assumes 40 dph and a net developable area of 60% for future strategic sites, as defined by the Black Country Authorities;
- The wind power constraints review (**Section 5**) is a broad analysis based on the criteria presented in **Appendix A**. Any LZC energy projects (including wind) must be reviewed in detail to consider local constraints and how to address any planning impacts on the local community; and
- The assessment excludes any utilities assets and capacity outside the Black Country study area. However, utilities are generally not constrained by political boundaries and therefore real-life capacities in a given area may vary.

Appendix C Electricity Capacity Supporting Graphics



Substation	Substation Remaining Capacity (MVA)	Potential Residential Demand (MVA)	Capacity Difference (MVA)
Bentley	35.74	4.39	31.35
Birchfield Lane	34.43	10.39	24.04
Black Lake	53.66	19.45	34.21
Bushbury	93.70	1.55	92.15
Bustleholm	39.84	6.98	32.86
Coseley	21.42	17.67	3.75
Dudley	30.94	11.98	18.96
Halesowen	38.36	8.17	30.19
Hinksford	4.21	2.24	1.97
I54	68.17	3.98	64.19
Lye	10.64	21.69	-11.05
Ocker Hill	24.17	12.41	11.76
Oldbury	18.61	5.90	12.71
Rushall	35.87	9.44	26.43
Smethwick	13.34	14.93	-1.59
Tividale	49.30	16.77	32.53
Wednesfield	30.39	4.82	25.57
Willenhall	35.32	5.30	30.02
Wolverhampton	40.95	30.57	10.38
Wolverhampton West	71.60	2.01	69.58
Woodside	36.13	27.60	8.53

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Potential Residential Electricity Capacity Analysis

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N

Local Authority
Remaining Substation Capacity
Potential Employment Usage (under capacity)
Potential Employment Usage (over capacity)

Wednesfield
Rushall
Wolverhampton
Bentley
Willenhall
Bustleholm
Black Lake
Tividale
Dudley
Halesowen

Substation	Substation Remaining Capacity (MVA)	Potential Employment Demand (MVA)	Capacity Difference (MVA)
Bentley	35.74	8.24	27.49
Black Lake	53.66	2.07	51.59
Bustleholm	39.84	45.19	-5.35
Dudley	30.93	4.40	26.53
Halesowen	38.36	83.26	-44.89
Rushall	35.87	107.90	-72.03
Tividale	49.29	3.49	45.80
Wednesfield	30.39	4.01	26.37
Willenhall	35.32	2.38	32.93
Wolverhampton	40.95	1.27	39.66

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Potential Employment Electricity Capacity Analysis

0 5 10 km

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Appendix D Gas Capacity Supporting Graphics

N

Local Authority
Potential Gas Capacity
Potential Gas Usage (under capacity)
Potential GAS Usage (over capacity)

Gas Infrastructure
Intermediate Pressure Gas
High Pressure Gas

City of Wolverhampton
Walsall
Sandwell
Dudley

Local Authority	Gas Capacity (Dwelling Equivalent)	Residential Dwelling Demand	Capacity Difference
City of Wolverhampton	11,000	9,430	1,570
Dudley	80,000	13,071	66,929
Sandwell	5,000	17,713	-12,713
Walsall	10,000	3,103	6,897

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Potential Residential Gas Capacity Analysis

0 5 10 km

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Appendix E Telecommunications Capacity Supporting Graphics

N

Local Authority

Indicative Broadband Download Speed (Mbps)

- 0 - 100
- 100 - 200
- 200 - 300
- 300 - 400
- 400 - 500
- 500 - 600
- 600 - 700
- 700 - 800
- 800 - 900
- 900 - 1000

Full coverage not achieved due to data availability

City of Wolverhampton

Walsall

Sandwell

Dudley

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BLACK COUNTRY AUTHORITIES UIC

Indicative Broadband Download Speed

0 5 10 km

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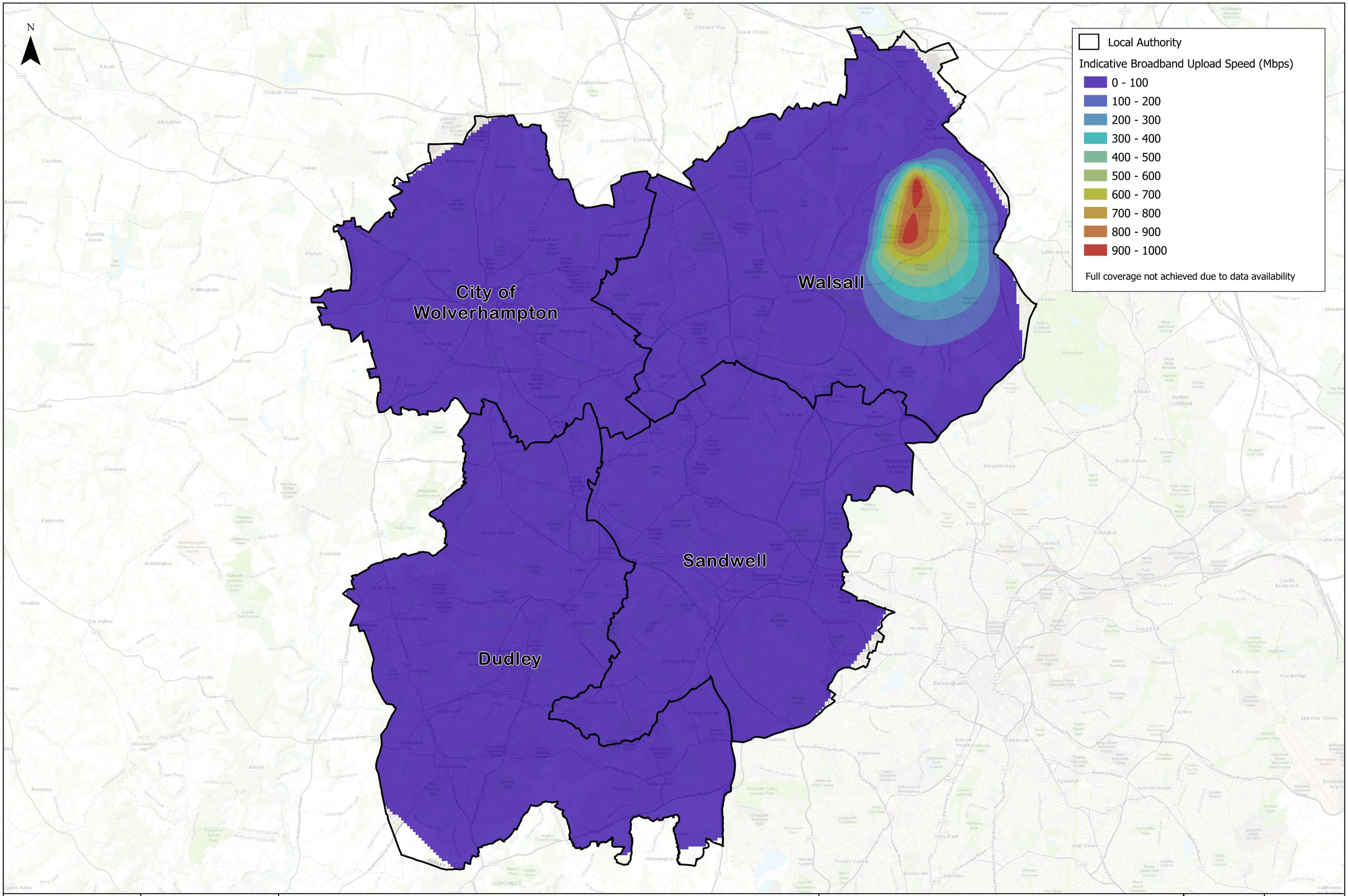

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BLACK COUNTRY AUTHORITIES UIC

Indicative Broadband Upload Speed

0 5 10 km

World Topographic Map: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User CommunityContains Ordnance Survey data © Crown copyright and database right [2019]© Openreach [2019] © OfCom [2019]

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Appendix F Low and Zero Carbon Energy Feasibility Review

F.1 Introduction

F.1.1 This Appendix identifies some of the overarching considerations associated with delivering LZC energy projects in the Black Country, for a selection of technologies. The variables affecting their suitability include:

- Environmental constraints – e.g. suitable geology for ground source heat pumps or the presence of protected ecological species;
- Resource constraints – e.g. the availability and reliability of biomass fuel supplies or wind resources;
- Social constraints – e.g. visual or health impacts of placing combustion-based technologies near housing; and
- Infrastructure constraints – e.g. impacts on aviation from wind turbines or the availability of suitable transport infrastructure to import fuel, plant or equipment.

F.1.2 These considerations are not exhaustive, and any LZC energy projects must be reviewed in detail to consider local constraints and how to address any planning impacts on the local community.

F.2 Photovoltaic solar panels

F.2.1 Photovoltaic (PV) solar panels offset grid electricity and therefore provide a carbon saving. Payback periods for PV can be commercially attractive due to the Feed-in Tariff (FiT) and a significantly increased supply base. It should be noted that the FiT is expected to decrease going forward (refer to www.fitariffs.co.uk for conditions and current tariffs).

F.2.2 Sunshine is intermittent and often unreliable in England, which can significantly impact PV performance. PV also only operates in daylight hours, so cannot generate electricity continuously. PV is generally most efficient when it is positioned as south-facing at a pitch of 30-35º from horizonal, and in areas free from shading.

F.2.3 For large (MW-scale) ground-mounted PV arrays, significant land area is required. The landscape and visual impacts of such arrays must be considered, especially in areas of sensitivity, such as Areas of Outstanding Natural Beauty (AONBs) or other conservation areas.

F.2.4 When mounted on buildings, PV arrays are connected to the electrical system via inverters. The electricity generated by PV can be used on site and, when not required, can be exported to the National Grid. This process requires no user intervention.

F.2.5 Where suitable roof space is available, PV could be an effective LZC technology to install on both residential and commercial buildings. PV is often the preferred method of renewable energy generation within residential-led or mixed-use developments due to its affordability and feasibility.

F.3 Air source heat pumps

F.3.1 Air source heat pumps absorb heat from the outside air, which can then be used to heat radiators, underfloor heating systems, or warm air convectors and hot water in buildings. Heat pumps have some environmental impact as they need electricity to run the fans for air extraction and compressors (typically in excess of 2 kW).

F.3.2 Air source heat pumps require the installation of external condensers, which are usually mounted on roofs or rear/side walls of buildings. They also feature moving parts (an electrically driven fan) and therefore make noise when they operate. As such, external condensers should be carefully positioned to reduce potential noise and visual impacts.

F.3.3 Air source heat pumps are generally installed on individual homes, apartment blocks or commercial buildings. More recently, multiple systems have been installed in energy centres, supplying heat to multiple buildings via district heat networks.

F.3.4 As air source heat pumps require electricity to operate, widespread use would have an impact on electrical loads and grid reinforcements.

F.3.5 The existing Renewable Heat Incentive (RHI) Scheme will cease in March 2021, therefore schemes must be registered before this date in order to be eligible. At this stage there are no announcements as to its replacement.

F.4 Ground source heat pumps

F.4.1 Ground source heat pumps draw heat energy from the ground, concentrate it and then release it into a property. Some heat pumps can reverse this process in the summer, thereby providing cooling in buildings.

F.4.2 Ground source heat pumps can be either ‘open loop’ or ‘closed loop’. Closed loop systems are typical in the UK and consist of laying a series of coiled pipes in shallow trenches (horizontal collector loops) – which requires considerable land area - or down boreholes (vertical collector loops). In open loop systems, groundwater is abstracted at ambient temperature from the ground, passed through a heat pump before being reinjected back into the ground or discharged at the surface. Open loop systems have the advantage of limited underground infrastructure but require an environmental permit to extract and discharge water.

F.4.3 In order for systems to operate effectively, buildings must achieve a high standard of fabric energy efficiency and, where appropriate, an underfloor heating system (wet system) could be incorporated to optimise system performance.

F.4.4 The efficiency and cost-effectiveness of a ground source heat pump system is affected by underlying ground conditions and the thermal conductivity of the geology.

F.4.5 British Geological Survey (BGS) online mapping for superficial deposits indicate that the Black Country is covered by superficial deposits of Till – Diamicton to the north and east, and patches of Alluvium – Clay, Silt and Sand, Glacial Sand and Gravel, and River Terrace Deposits (undifferentiated) – Sand and Gravel. The bedrock geology from BGS indicate that the Black Country largely consists of Warwickshire Group - Siltstone and Sandstone with Subordinate Mudstone, Mudstone, Siltstone, Sandstone, Coal, Ironstone and Ferricrete, and Triassic Rocks (undifferentiated) - Sandstone and Conglomerate, Interbedded. The coal industry has largely shaped the landscape of the Black Country.

F.4.6 However, the thermal conductivity and suitability for ground source heat pumps must be analysed on a site-by-site basis.

F.4.7 Space for the installation of collector loops is a key consideration. Horizontal collector loop systems can be installed within private garden and localised areas of green open space to provide heat to individual or small collections of buildings. More space would be required for larger horizontal collector systems or a network of vertical boreholes serving larger collections of buildings.

F.5 Water source heat pumps

F.5.1 Water source heat pumps work on a similar principle to ground source heat pumps. Instead of taking advantage of the heat in the ground, they take advantage of the relatively consistent temperatures found in a body of water.

F.5.2 A series of flexible pipework is submerged in a body of water, like a lake, river or stream. A heat pump pushes working fluid through the network of piping, and this fluid absorbs the heat from the surrounding water as it goes.

F.5.3 This working fluid is then compressed by an electric compressor, in a similar fashion to the other types of heat pump, which raises the temperature. A heat exchanger can then be used to remove the heat entirely from this working fluid, providing a building with hot water that can be used for space heating (in radiators or under floor heating). It can also be plumbed into a building's hot water system, where a boiler can just provide the small amount of additional heat needed to bring it up to the required temperature, so it can be used for showers and baths.

F.5.4 Once the heat has been removed from the working fluid via the heat exchanger, it is once again pumped back through the pipework, thereby completing a continuous cycle.

F.5.5 Smaller systems can be used to supply individual or small collections of buildings. Larger systems could be deployed to supply larger developments. The availability of suitable watercourses to supply a water source heat pump system is a key consideration, as well as the assessment of ecological impacts. An environmental permit is required to extract and discharge water.

F.6 Solar water heating (or solar thermal)

F.6.1 Solar water heating systems could be used to offset a portion of the hot water demand in both domestic and non-residential buildings. In well-designed buildings, solar water heating can reduce the fuel consumption associated with hot water by circa 60-70% and the associated carbon emissions.

F.6.2 As with PV, solar water heating systems rely on solar energy and therefore the most effective heat production occurs during the daytime and sunny periods, and efficiencies are greatly reduced in winter. Therefore, their output for the 'whole year' is relatively low.

F.6.3 Solar thermal technologies are considered suitable for application at building-scale only.

F.6.4 In order to accommodate solar water heating systems, buildings must be designed to allow space for hot water cylinders and flow/return pipework. As with PV, solar water heating operates most efficiently when installed on south-facing (or almost south-facing) roof space.

F.6.5 Use of solar thermal technologies is also subject to detailed visual impact appraisal and structural engineering assessments. Generally, solar thermal systems are not compatible with heat network technologies.

F.7 Hydropower

F.7.1 Hydropower is a form of renewable energy that uses the water stored, for example in dams and flowing in rivers, to create electricity in hydropower plants. Because the source of hydroelectric power is water, hydropower plants are usually located on or near a water course. The volume of the water flow and the change in elevation (or fall) from one point to another determine the amount of available energy in moving water.

F.7.2 In Black Country, canals are the main watercourses that run through the region and consist of the Dudley Canal and Birmingham Canal Navigation. The River Stour also runs to the south of the Black Country.

F.7.3 The suitability of these water courses for hydroelectricity supply must be assessed on a site-by-site basis. This includes an assessment of ecological sensitivity (fish passes may be required) and impacts on flood risk (equipment could create potential blockages and increase flood risk in sensitive locations).

F.8 Wind Energy

F.8.1 Wind turbines use large blades to catch the wind. When the wind blows, the blades are forced round, driving a turbine which generates electricity. These stronger the wind, the more electricity is produced.

F.8.2 Most onshore wind turbines have a capacity of 2 – 3 MW, which can produce over 6 million kWh of electricity per year[35].

F.8.3 There are also domestic-sized wind turbines that fall under two categories:

- Pole mounted: these are free standing and are erected in a suitably exposed position, with generation capacity of about 5 to 6 kW; and
- Building mounted: these are smaller than mast mounted systems and can be installed on the roof of a home where there is a suitable wind resource. Often these are around 1 kW to 2 kW in size.[36]

F.8.4 Wind is a well-established energy source. The expertise and skills to undertake a range of wind turbine installations is extensive and the good supply base for wind energy means there is strong market competition. With this experience and knowledge behind wind energy generation, the financial risks are relatively low.

F.8.5 There are numerous constraints for deploying wind turbines within a geographical region such as the Black Country, including:

- Landscape and visual impacts (including flicker), which are especially important in close proximity to residential and other sensitive uses such as amenity space and historical sites;
- The local wind regime and turbulence from surrounding land uses (e.g. high-rise buildings);
- Noise from blade rotation;

[35] How do wind turbines work?, Good Energy, online, available at: https://www.goodenergy.co.uk/how-do-wind-turbines-work/.

[36] Wind turbines, Energy Savings Trust, online, available at: https://www.energysavingtrust.org.uk/renewable-energy/electricity/wind-turbines

- Potential impacts on aviation, for example when situated close to Birmingham Airport;
- Ecological impacts, such as impacts on migratory birds and bat movements; and
- Space for turbines and supporting infrastructure.

F.8.6 **Figure 4** provides a preliminary constraints graphic for the delivery of wind turbines in the Black Country based on key constraints such as existing developed land and infrastructure, historic sites, ecological sites and other protected sites. However, detailed feasibility analysis must be undertaken for wind turbine installation on a site-by-site basis.

F.9 Biomass

F.9.1 Biomass can be used as a fuel source for heat, power and CHP applications. Energy is typically derived from burning biomass in biomass boilers. Other potential technologies include gasification and pyrolysis.

F.9.2 Biomass plants can be scaled to meet the needs of development and to reflect the availability of biomass in the area. Large biomass plants can be used to supply heat (and power) to multiple buildings via a heat network. Smaller systems can be used to heat a single building.

F.9.3 The lifecycle costs of biomass systems are typically greater than tradition fossil fuel heating systems. However, incentive schemes such as the Renewable Heat Incentive (RHI) can reduce the costs and provide financial returns. The existing RHI Scheme will cease in March 2021, therefore schemes must be registered before this date in order to be eligible. At this stage there are no announcements as to its replacement.

F.9.4 As a solid fuel, biomass often requires transportation over significant distances. However, the carbon intensity of biomass can still be less than traditional fossil fuels (oil and gas), even including the emissions associated with intercontinental transportation.

F.9.5 The use of biomass technologies is subject to the availability of long-term contracts to support security of supply and sufficient generation. In addition, biomass is a bulky product that requires significant space within a development for infrastructure (including storage and delivery space).

F.9.6 All Black Country Authorities have strategies to reduce air pollution in their area. The whole of Sandwell is Designated as an Air Quality Management Area (AQMA), whilst Wolverhampton, Dudley and Walsall all have air quality action plans. The air quality impacts of using biomass fuels in the Black Country should also be considered on a site-by-site basis before any such systems are deployed.

F.10 District energy

F.10.1 Heating and / or cooling can be provided to multiple buildings from a central energy centre via a district heating and / or cooling network. The energy centre can use a variety of fuels and this therefore enables the use of low and zero carbon energy sources. The role of district heating and cooling as a means of achieving carbon reduction targets for land development projects is increasingly being considered in the UK.

F.10.2 There are three basic elements in a district heating system:

- Production – An energy centre containing the heat sources;
- Delivery – A Hydraulic Interface Unit (HIU) for each end-user; and

- Distribution – An insulated pipe network connecting the energy centre with the end-users' HIUs.

F.10.3 The energy centre houses the heating plant, which can include a range of technologies and fuels such as gas boilers, biomass boilers and CHP. Heat can also be derived from a waste heat source, such as crematoria or an EfW facility. Hot water from the energy centre is pumped through the pipe network to the individual buildings. In each building, heat is conveyed via the HIU to the central heating system and to the hot water taps. Sometimes an Energy Services Company (ESCo) is established to manage the distribution and sale of heat.

F.10.4 When considering a district heating approach, it is important to consider the balance between building energy-efficient buildings (with a very low heat demand) and establishing a utility that is dependent on selling high volumes of heat in order to be viable.

F.10.5 District heating is most resource-efficient in developments with high baseload heat demands. Typically, this means residential developments of very high densities or other heat-intensive uses such as industrial manufacturing, hospitals, swimming pools or schools. Modern, energy-efficient and low-density developments built to national energy efficiency standards usually have a very limited heat demand.

F.10.6 Heat losses from distribution pipes are also an important environmental consideration (heat losses tend to be higher in low density developments with longer heat main runs).

F.10.7 Establishing a district heating network requires major capital investment, but the costs vary considerably depending on the project. A major driver of the high costs of district heating is the network of hot pipes – this is quoted as up to £510 per metre[37]. This is another reason why district heating is best suited to high density developments with shorter heat main runs.

F.10.8 Heat network viability is established through the relationship of capital infrastructure costs and returns from heat sales (including standing charges and a price per kWh of heat). District heat networks are not regulated by the Office of Gas and Electricity Markets (OFGEM). Therefore, there is a risk of end-users experiencing higher prices compared to a standard gas boiler approach, in order for the developer to recover the high capital costs of installation. However, it is the intention of the emerging Heat Trust to establish a framework to protect consumers connected to heat networks.

F.10.9 Delivery of heat networks in the Black Country must be assessed on a site-by-site basis to ensure it is a cost and resource-efficient approach for supplying heating. Other planning impacts, such as the visual impact of any emissions stacks and space allowance for the energy centre and utility corridors must also be considered.

Energy Storage

7.1.1 Electricity batteries allow for storage of energy generated from renewable or low carbon systems, such as solar PV systems or wind turbines. For a homeowner, a solar PV system could generate electricity during the day and stored in an electricity battery for use in the evening. The capacity of a typical home battery storage system could be up to 16 kWh, but there are also 'stackable' bespoke systems if more capacity is required[38].

Energy storage technologies have a potential role in managing supply, storing power and providing supply at times of peak demand. The technology is currently expensive, and the energy storage markets are largely untested, however this risk is likely to diminish over the next five to ten years.

[37] DECC (2015) Assessment of the costs, performance, and characteristics of UK heat networks.

[38] Energy Savings Trust, *Energy Storage,* online, available at: https://www.energysavingtrust.org.uk/renewable-energy/energy-storage (accessed 20/08/2019).