



A Regional Energy Strategy for the West Midlands

March 2018

Final Draft for Consultation

ENERGY CAPITAL

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Executive Summary

Between 2018 and 2030, more than £15bn will be invested in local energy projects across the three LEPs of the West Midlands, and £74bn will be spent on products and services (like cars and houses) where the quality of local energy systems will make the difference between global competitiveness and economic failure for our local industries. A further £80bn will be spent on fuel and power to drive our industry and power those same products and services.

Vision

This strategy is about influencing these financial flows to deliver a strategic vision for energy across the region by 2030 which includes:

- Reducing energy costs for our strategic industrial sectors to at least match those of our international competitors
- Reducing the incidence of fuel poverty across our region by hitting current government targets five years ahead of schedule
- Delivering the West Midlands' share of national and global carbon budgets by reducing regional carbon emissions
- Creating a regional energy infrastructure that adds £1bn to GVA by 2025 by putting the region at the leading edge of the global energy and transport systems transition.

Specific, measurable targets for each of these objectives are set out in section 5.

Innovative and selective delivery mechanisms

We will deliver these targets through highly selective investment of public and private capital, working through a framework of Energy Innovation Zones (EIZs) developed alongside this strategy.

EIZs create local partnerships which bring together the right stakeholders for each locality and are thus collectively able to manage energy investment risk efficiently (particularly when innovative technologies are being commercialised or require strategic infrastructure investment).

Unique regional ambitions and history

This idea was developed in the West Midlands and is designed to work for the particular diversity, strengths and heritage of our region. The West Midlands would simply not exist as a population and industrial centre if it were not for the world-class energy infrastructure and assets uniquely available here and matched to our industrial and innovative capabilities from 1750 onwards.

The West Midlands of today is very different from that of the 18th to 20th centuries, but energy remains critical to our key sectors and to our citizens. This energy strategy is a key element underpinning a local industrial strategy focused on the digital, health and life sciences and clean growth opportunities of the future. In particular, it targets a massive global clean growth opportunity which is aligned with national industrial strategy but which this region is particularly well-positioned to exploit.

We have specific regional issues around the quality of our housing stock; diversifying and creating new markets for our exceptional industrial and manufacturing base; and making best use of the

imagination and creativity of our innovators and academic institutions. This strategy recognises and responds to all of these issues.

Contributing to national challenges and needs

However, this strategy has also been developed against the backdrop of a fundamental transition in global energy systems which is widely recognised and which is also creating challenges and opportunities at global and national level. Effective regional leadership in energy is key to responding to these national and global challenges, so this strategy sees the West Midlands contributing constructively to changing the way energy is regulated and managed nationally, working with other devolved regions and authorities across the UK.

Financial implications and approach

Four pilot EIZs have been identified and preliminary investment cases developed for this strategy. These EIZs will act as a focus for between £270M and £490M of energy systems investment over the next 15 years, delivering the first £200M of the £1bn GVA target. The remaining £800M will be delivered through a range of initiatives including:

- Additional Energy Innovation Zones
- Strategic infrastructure support for accelerated new market development for locally sourced products such as electric vehicles and smart connected and low carbon housing
- Seeking to establish a legacy bank to cover sunk costs of stranded and legacy energy infrastructure assets and using this to reduce energy costs for innovative and competitive manufacturers
- Energy efficiency programmes for manufacturing and residential sectors
- Simplifying access and improving the transparency of energy markets for business customers
- More rigorous and targeted new build housing energy efficiency standards
- Large scale retrofit programmes for fuel poor households and energy-inefficient housing
- A focused cluster support programme including incubation of clean technology businesses and specialist support in energy to established businesses, working with regional and international partners

We propose to establish a £500M specialist regional investment fund to support these initiatives.

The strategy will be delivered through Energy Capital, established with a governance structure shown in Figure 1 (and see section 5). Individual EIZs will be controlled and run by the relevant local authorities.

Detailed delivery plans and timescales are set out in accompanying reports covering EIZs and *Energy as an Enabler of Industrial Strategy* across the region and summarised in section 7. The immediate priorities are:

1. To establish the Energy Capital executive team within the WMCA to support the Board and funding commitments made by partners
2. To follow through on the recommendations of the Regional Energy Policy Commission, particularly around working with government and regulators to detail the legal implications and requirements for EIZs

- To work with regional and wider partners to develop a cross-sectoral and place-based growth deal for the West Midlands new energy economy. This will act as the initial focus for securing the investment funding required.

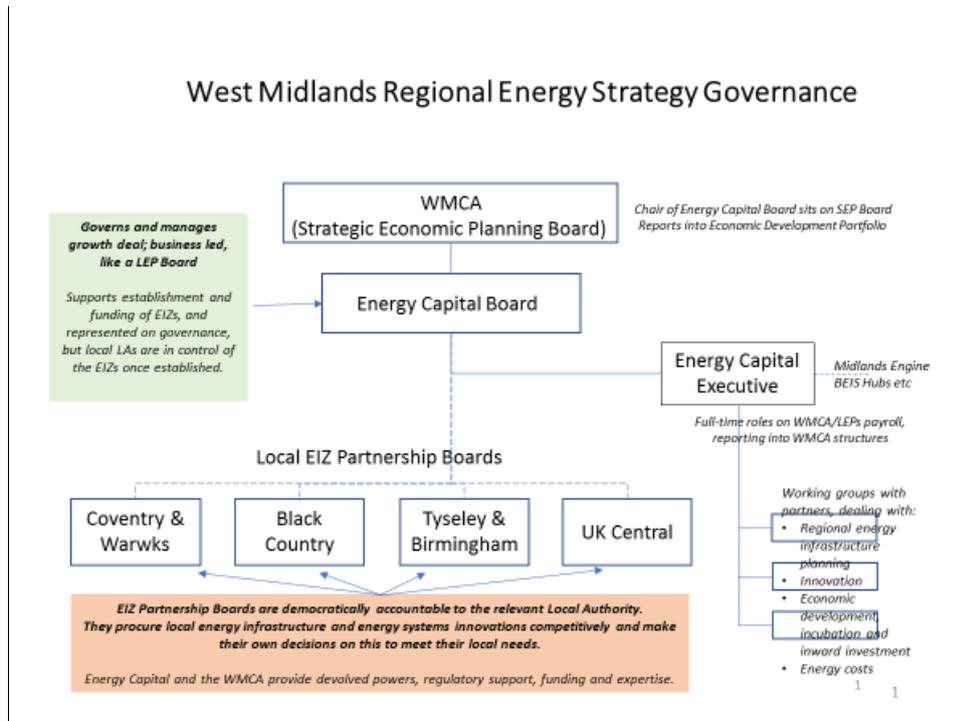


Figure 1 West Midlands Regional Energy Strategy governance

This strategy document is being made available in final draft form in March 2018 for consultation with key stakeholders. The intention is that it will be formally adopted by the various regional authorities during Spring and Summer 2018.

Please provide any feedback or comments to enquiries@energycapital.org.uk by 5pm on 21 May (see Appendix III).

1. Introduction

This report is a consolidation of more than a year's work across the West Midlands to bring together existing energy mapping and strategy work, fill in gaps and develop a strategic framework to support delivery of the region's ambitions and needs. It is intended as a response to BEIS's request that the three LEPs within the West Midlands Combined Authority (WMCA) produce a single high-level strategy summarising how they will work together through Energy Capital to deliver shared objectives.

Throughout the work, we have maintained a fundamental principle that the strategy will not lead to replication or duplication of existing work, initiatives or institutions. The intention is to create a strategy which builds on and supports these activities where they are already underway and makes it easier for local leaders and projects to deliver their specific local objectives around energy. This point is expanded on in some depth in later sections.

In particular, Energy Capital itself inherited a strong partnership from the Birmingham Green Commission led by Councillor Lisa Trickett and the work of its energy group, chaired by Professor Martin Freer. The strategy has been made possible by the willingness of this group to combine with the strong sense of purpose coming from the Black Country LEP, where energy is championed by Tom Westley, and the vision of Coventry and Warwickshire, who are engaging creatively with the energy challenge as their traditional core transport and manufacturing businesses see new global opportunities rapidly opening in front of them.

The report should be read in conjunction with other key documents produced alongside or as part of the regional energy strategy, specifically:

- Powering Growth: Black Country Energy Strategy Final Report (Aecom, February 2018)
- Business Cases for Energy Innovation Zones in the West Midlands (Arup, March 2018)
- Powering West Midlands Growth: A Regional Approach to Clean Energy Innovation (Regional Policy Commission on Energy, March 2018)
- Energy as an Enabler: Linkages between regional energy strategy, productivity and growth (Black Country LEP and Matthew Rhodes, March 2018)
- Distributed generation and demand study. Technology growth scenarios to 2030, regen for WPD (January 2018)ⁱ

Several sections of this report draw heavily on the work done for these reports and the reports themselves, and the work of all their authors and the conversations and events surrounding their preparation is much appreciated and recognised. Links to all these documents and others relevant to the strategy are provided in appendices I and II and in the references at the end.

The project has been governed by a steering group consisting of a representative from each of the three LEPs. Figure 2 below shows how the various workstreams came together. The red diamonds indicate consultation events with stakeholders. A full list of participants in the main stakeholder engagement event on 6 March is provided as Appendix IV – Attendees at the stakeholder engagement event.

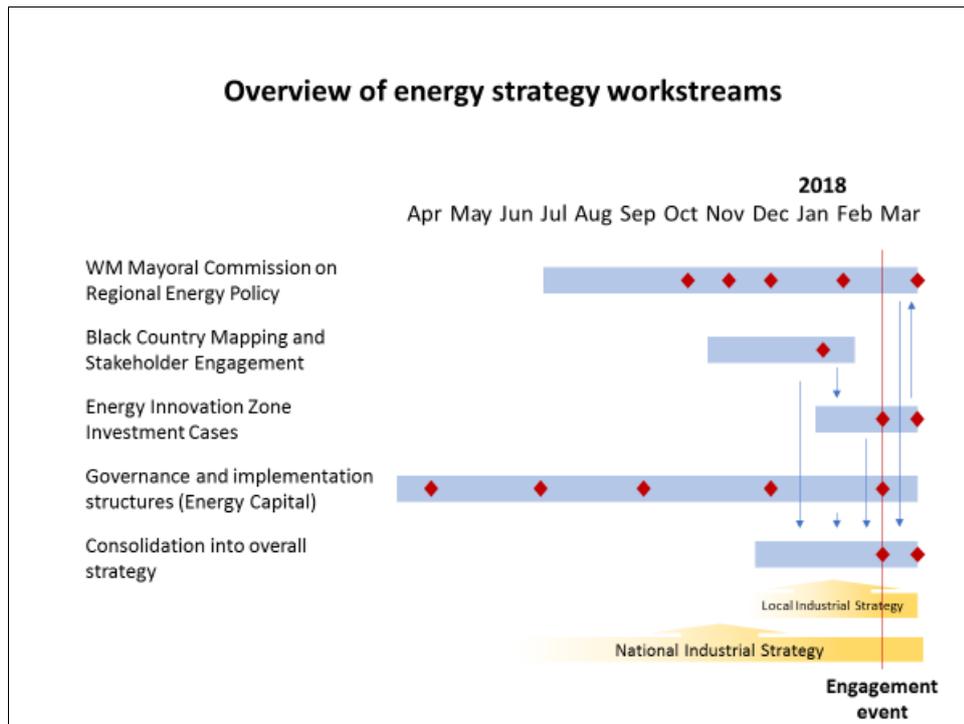


Figure 2 Overview of energy strategy workstreams

The report starts by summarising the specific regional context that is the West Midlands. It then discusses the economic opportunities in energy seen from this perspective and the challenges and constraints faced by the region in seeking to maximise economic outcomes from investments in energy systems. These sections set the scene for the regional energy strategy itself, which is summarised in section 5. Section 6 puts this in the context of global best practice, and section 7 summarises the planned next steps.

2. The West Midlands

History, geography and political context

The population of the three LEPs which make up the West Midlands Combined Authority is just over 4 million peopleⁱⁱ, and its central location means 90% of country's population is within 4 hours drive.ⁱⁱⁱ There are 1.7 million homes in the area, and over 2 million jobs across 145,000 businesses, with a business 'birth' rate of over 20,000 new businesses a year (around twice the UK average)^{iv}.

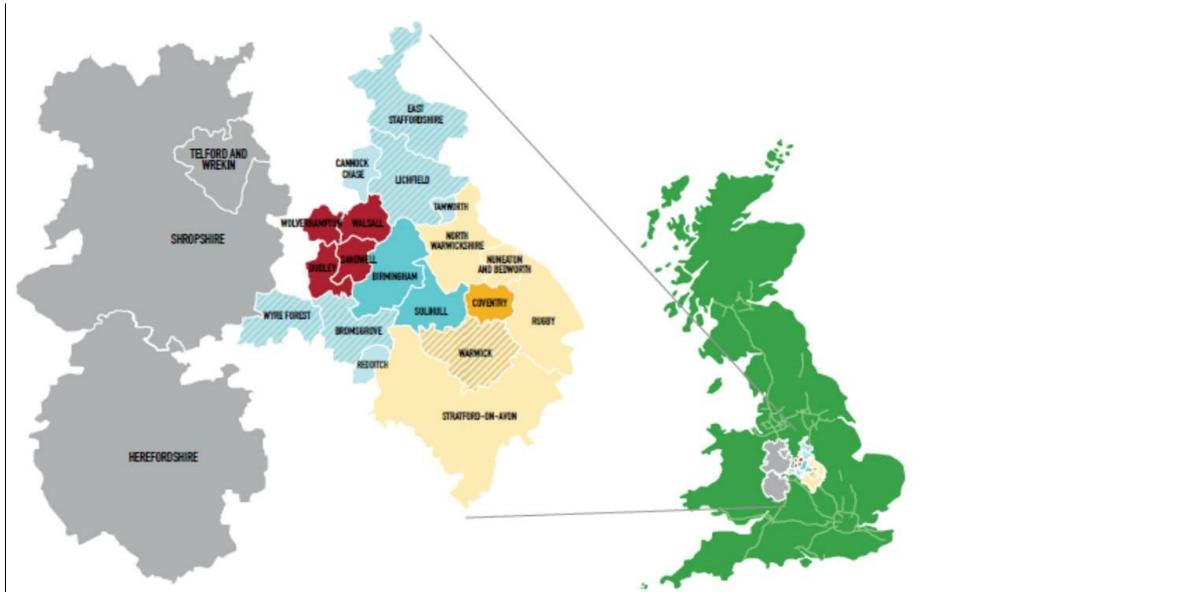


Figure 3 The West Midlands Combined Authority geography

The West Midlands is the largest regional economy outside London. The areas covered by Black Country, Coventry and Warwickshire, and Greater Birmingham and Solihull LEPs have a combined GVA of around £90 billion per year. This is larger than those of Greater Manchester, the Leeds City Region and the South East. The West Midlands LEPs have also grown their GVA faster than those regions from 2010 to 2015 (see Figure 4 below).

This density of population and industry reflects the region's history and identity, which were largely forged in the eighteenth and nineteenth centuries on the back of abundant local energy resources (particularly in the Black Country) and innovation, driven by the then prohibitive cost of skilled labour^v. Strong sub-regional identities and economies persist to this day, with an emphasis on transport and mobility in the East (where Coventry's heritage in transport and automotive grew out of over 250 companies manufacturing bicycles from 1870 onwards^{vi}) and metal processing in the West, where there are still over 240 medium-sized businesses within the LEP area focused on traditional metal forming and component production, largely for the high-technology and demanding aerospace and automotive supply chains.

The region has the highest concentration of manufacturers of any region^{vii}, and accounts for 9% of all manufacturing employment in Britain.^{viii} It is home to world class companies including Jaguar Land Rover (JLR) Aston Martin, UTC Aerospace, and Mondelez as well as much of their supply chains.

The West Midlands is Britain's largest exporter after the South East and London.^{ix} In 2016, the West Midlands exported goods worth £3.3 billion to China, more than three quarters of which were road vehicles. This represented 26% of all UK exports to that country, twice as much as the next largest region. With imports from China of £3.5 billion, the West Midlands is the only region to achieve anything close to trade balance with what is predicted to become the world's largest economy by 2030.^x The West Midlands has also secured more inward investment from China than any other region bar London - 52 projects in the past 20 years, and 30 in the past six – creating 2,500 jobs and safeguarding a further 1,500.^{xi}

Table 2-1: GVA in 2015 and growth 2010-15 for the area and comparators

Area	GVA in 2015 (£bn)	GVA growth 2010-15
London	378.4	27%
3-LEP WM SIA geography	87.5	20%
South East	85.8	18%
Leeds City Region	64.6	14%
Greater Manchester	59.6	16%

Source: ONS, Gross Value Added (GVA) for Local Enterprise Partnerships (LEPs)

Figure 4 GVA in 2015 and growth 2010-15 for West Midlands LEPs and those of other regions.^{xii}

Birmingham is Britain's second city, and its population of just over 1 million makes up around a quarter of the total West Midlands population^{xiii}. It is a dense and thriving modern city, with many of the challenges common to cities worldwide in energy poverty, legacy infrastructure, and a need for new housing which puts pressure on the surrounding rural hinterland.

There are two further cities within the region which share similar challenges (Coventry (320,000 people) and Wolverhampton (260,000 people)) and seven metropolitan local authorities in total, as well as districts of Warwickshire, Staffordshire and Worcestershire which fall within the three LEP geography. These have more rural economies. However, the region has a natural economic geography and political coherence as a whole because our existing transport systems and employment patterns mean a large part of the population of the WMCA area will commute to and from work in the city centres.

Key local stakeholders

The political geography of the West Midlands is evolving rapidly and is currently working reasonably well (evidenced for example by the GVA growth illustrated in Figure 4). The three LEPs and WMCA focus largely on specific agendas where working together at regional scale makes sense, for example around economic development, including transport, inward investment and skills; while the local authorities run public services and maintain the integrity of their respective geographical places.

All these bodies are properly democratically-accountable, and the LEP Boards (which are supervised by elected representatives) have effectively engaged committed local business interests and academic institutions, including all the region's eight universities.

Major energy-related corporates located in or close to the region include E.ON, National Grid, Calor, Cadent, JLR, Severn Trent, UTC Aerospace. These represent a significant part of the GVA attributable to energy across the region (see section 3) but a tiny fraction of the 10,000 businesses active in the energy sector across the region^{xiv}. Smaller businesses are represented on LEP Boards and sub-boards through organisations such as the Engineering Employers Federation (EEF) and Chambers of Commerce.

The West Midlands also hosts substantial national research and innovation assets in the Energy Systems Catapult and the universities of Aston, Birmingham and Warwick, which are part of the Energy Research Accelerator. Aston, Birmingham and Warwick have highly complementary research expertise in energy and have all contributed to this strategy in distinctive ways¹. Wolverhampton, Coventry and Birmingham City University further enhance regional energy capabilities, particularly around energy in buildings, smart systems and industry engagement.

¹ Aston's expertise is in bioenergy and infrastructure economics; Birmingham in thermal energy systems; Warwick in battery and storage technologies and automotive/transport/energy cross-over.

3. Economic opportunity

Energy in the West Midlands Economy

Figure 5 below shows the estimated split of annual energy spend in the West Midlands^{xv}.

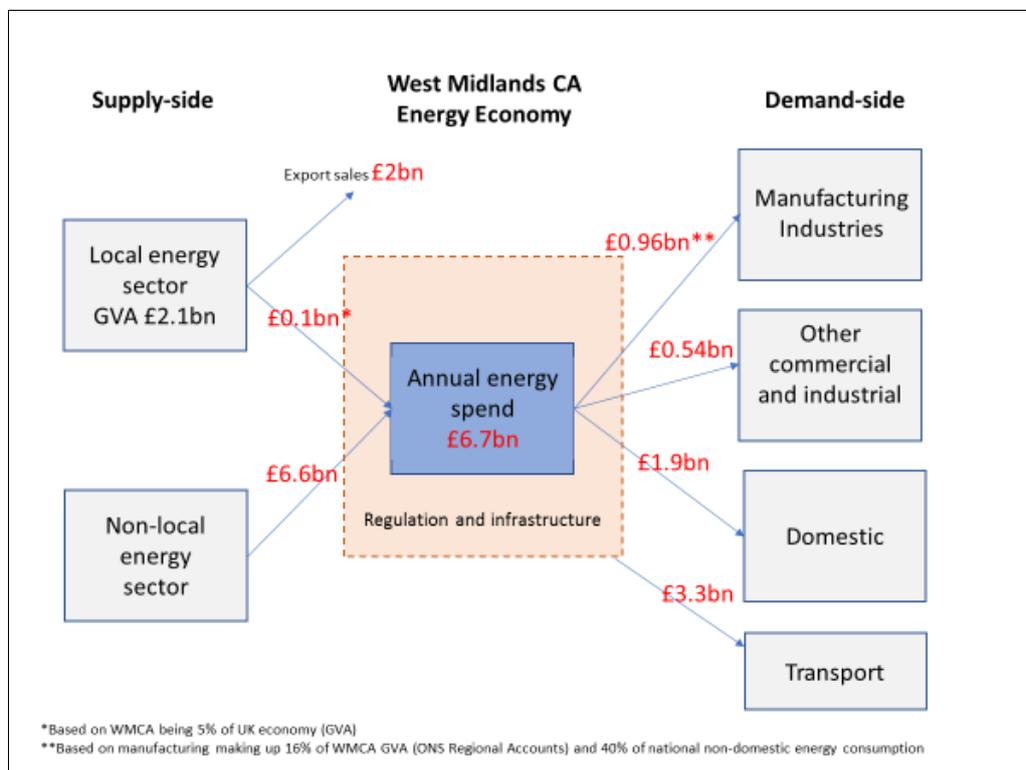


Figure 5 The West Midlands energy economy

Although the local energy sector contributes approximately £2.1bn of GVA to the regional economy, most of this is earned outside the region (it is dominated by companies like E.ON, who sell energy nationally). The more significant figure is the £6.7bn spent annually on energy by West Midlands businesses and households, and within this the £960m spent by the industrial and manufacturing sectors.

The combined manufacturing and commercial annual spend figure of £1.5bn has a direct impact on industrial profits and productivity. If the figure were £500m lower regional productivity and GVA would be up to £500m higher (for the same output)². It is thus very relevant that UK energy costs in many sectors are up to 41% higher than those of competitor economies (see Figure 6).^{xvi}

² This is true in the short-term and for mature industries with sticky customers competing primarily internationally, like most West Midlands manufacturers. It is not true if GVA measures are based on value-added production function approaches which assume any saving in energy costs will be common to competing firms and hence not impact GVA. Reality is almost certainly somewhere between these two extremes.

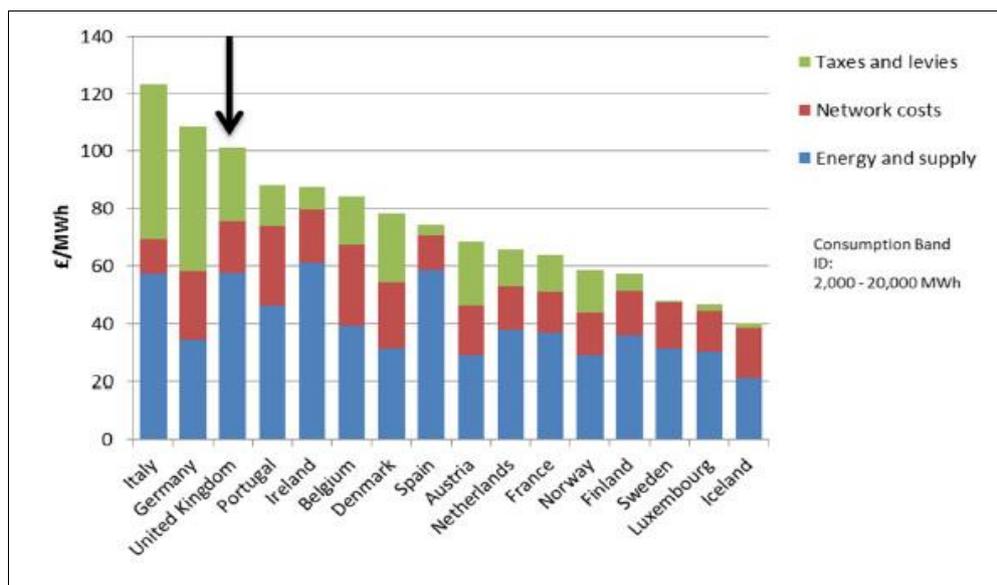


Figure 6 Commercial energy costs compared internationally^{xvii}

It is also relevant that around half of electricity costs for typical regional manufacturing companies are the apportioned costs of regional and national infrastructure investments (Figure 7). This is why Figure 5 has a shaded box labelled market regulation and infrastructure: there are considerable and increasing opportunities to influence energy costs and hence sectoral productivity simply through regulation and strategic choices.

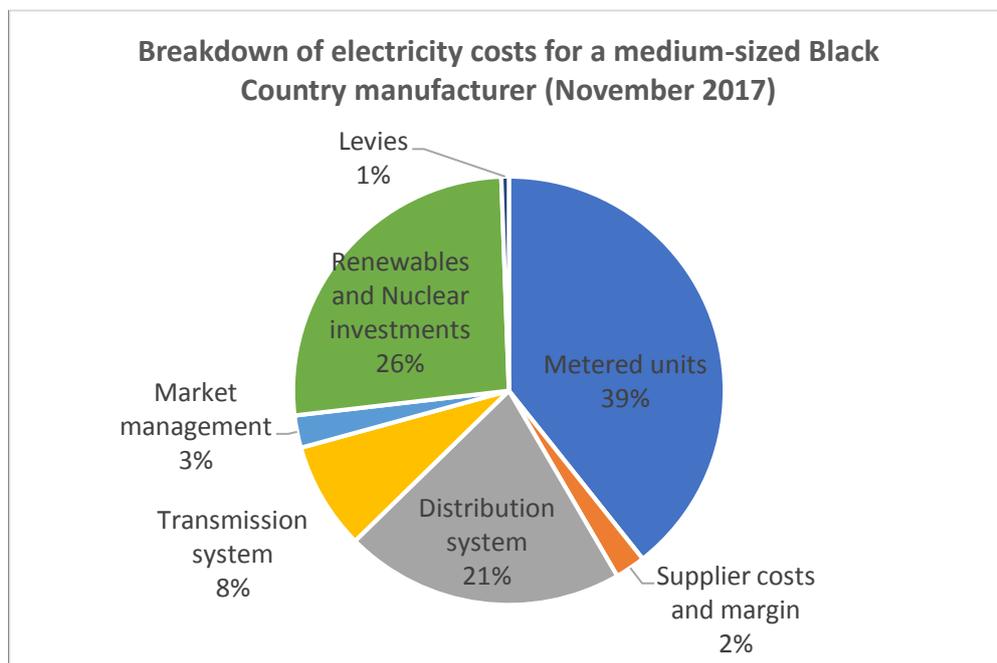


Figure 7 Split of electricity costs for a medium-sized West Midlands manufacturer^{xviii}

Because of their magnitude and impact, the way energy infrastructure costs are apportioned between sectors is treated as an industrial strategy decision in many other economies^{xix}. For example, in Germany there is quite a complex ‘privilege’ system which allocates network and renewables costs variably between industrial sectors, favouring some sectors (such as metal

processing) and penalising others (such as paper mills). Thus, although average industrial energy costs in Germany appear on face value higher than the UK (Figure 8) in practice they are significantly lower in many manufacturing sectors and even higher in other sectors (including the domestic sector³) to ensure that the overall numbers balance (see Figure 8).



Figure 8 International comparison of electricity prices

In the UK, however, we currently operate a regulated national market system which does not generally differentiate between industrial sectors, other than on size (larger businesses pay a lower share of infrastructure costs per unit of energy). This will tend to differentially handicap our more energy intense sectors (in comparison to competitor economies with industrial strategies) although a number of ad hoc dispensations have been secured over the years to compensate to a degree for this.^{xx}

The UK approach to energy market regulation has recently been extensively criticised in a high-profile report commissioned by the Secretary of State for Business, Energy and Industrial Strategy (BEIS) and written by Professor Dieter Helm^{xxi}. In it, he makes a number of relevant observations about the direction of travel of global energy systems, including the powerful point that within a relatively few years almost all energy costs will be fixed and apportioned infrastructure costs, with virtually no variable costs as the cost of fuels essentially falls to zero⁴.

³ Headline energy prices in the domestic sector do not necessarily mean higher bills for households provided housing is well-built to high energy efficiency standards. Hence the German public is, up to a point, more tolerant of higher energy tariffs than the UK public, who live in lower quality housing (on average).

⁴ This is obvious if you consider that nuclear and renewable energy systems are essentially all asset investments with free or essentially sunk fuel costs. Helm also (slightly more controversially) argues that fossil

This has profound implications for UK energy market regulation and how energy costs are managed, because it means that energy will become very like telecoms or road travel in that usage of the system once it's built will essentially be free for everyone up to local capacity limits, so you can't meaningfully base pricing directly on usage any more: you are instead entirely focused on ensuring you recover infrastructure investment costs, and you might choose to do this in a number of ways to meet industrial strategy or political objectives.

Investment flows

In the West Midlands, we invest around £1.25bn every year in our energy infrastructure (Figure 9): this is network investments such as gas pipes, heat mains, wires and substations; key energy conversion technologies such as domestic boilers; and local energy generation assets such as solar farms, district heating and waste to energy plants.^{xxii}

We also spend around £3.5bn every year in the West Midlands on our built environment^{xxiii}, which has a significant impact on our energy spend and long-term productivity in its own right and should probably therefore also be considered as energy infrastructure.

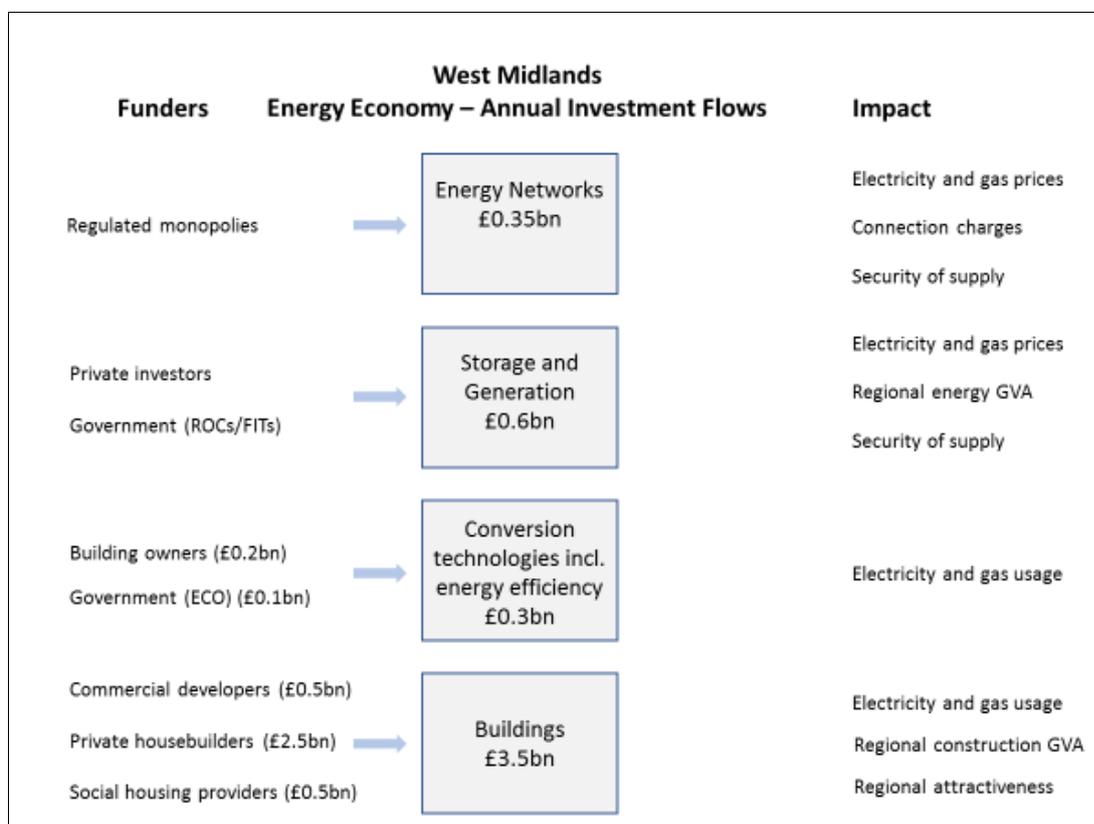


Figure 9 West Midlands annual investment flows - energy

fuel prices will fall towards zero as it becomes impossible to sell them given increasing global penalties for pollution and carbon emissions.

Economic activity

Energy and Environmental technologies currently account for £2.1bn of annual GVA in the WMCA area^{xxiv}, and is the most productive of all sectors by value. It is the only sector in which regional productivity is higher than the UK average. Coventry and Warwickshire and the Black Country are both in the top five LEPs nationally in terms of % of GVA attributable to energy and environmental technologies.

Employment estimates vary between 24,500 jobs and 60,000 jobs^{xxv} depending on definitions of geography and sector boundaries. The GVA generated is concentrated in a small number of large firms (E.ON, National Grid, Cadent, Baxi, Calor) with a long tail of smaller firms. There are also significant employers just outside current regional boundaries (Worcester Bosch, nPower) and significant economic activity and employment within the region controlled by firms with headquarters elsewhere in the UK (Western Power Distribution, British Gas).

The statistics exclude closely-related jobs which depend on energy infrastructure, such as most manufacturing, transport and automotive jobs, and energy managers within larger organisations. Engineering and infrastructure companies such as Balfour Beatty, Arup and Costain all have significant energy infrastructure divisions and presence in the region which may not appear in sectoral figures, as does Severn Trent which as well as being primarily a water company is one of the largest renewable energy generators in the UK.

Skills are an issue in energy as in many other sectors, with 36% of all vacancies across the energy and utilities sector nationally attributed to skills shortages.^{xxvi} The sector skills council for Energy and Utilities, Energy and Utility Skills, is based in the region (Solihull) as are other key sector interest groups and trade associations (e.g., the Energy and Utilities Alliance, the Sustainable Energy Association). There are also a number of specialist training providers across the region (e.g., the Energy Training Hub in Dudley) suggesting skilled energy sector people are as easy (or easier) to recruit in the West Midlands as anywhere in the country.

Energy Storage and Systems was identified as one of the four key market strengths in the recent regional Science and Innovation Audit^{xxvii}. This reflects the major academic assets in this sector across our regional universities (see section 2).

Carbon emissions and environment

The environmental challenges and opportunities for the West Midlands are similar to those facing the country as a whole. A report^{xxviii} by Sustainability West Midlands (published in 2010) found the region suffers a carbon deficit compared to the rest of the UK of around 2MtCO₂e per year on top of national targets. This is due to the high concentration of manufacturing and motorways in the region, and limited access to renewable generation such as offshore wind. This report is now eight years old, however, and it is likely the situation will have improved somewhat, as take up of renewables since 2010 has been substantial across the West Midlands and nationally, and manufacturing and transport activity has grown more slowly.

Carbon targets and plans vary significantly by local authority across the region, and while the merits of seeking to set a regional carbon target were discussed as part of this project, it was agreed that this remains primarily the responsibility of local authorities, and the region's responsibility is to

ensure the energy strategy supports local authorities in delivering their local objectives in this respect.

Transport is a major element in the regional economy, and also recognised globally as one of the hardest sectors in which to reduce CO₂ emissions. However, vehicles are largely responsible for the toxic air pollution that afflicts cities worldwide. The nitrogen oxides and particulate matter emitted by diesel vehicles in particular are key ingredients in the outdoor air pollution that causes 3.7 million premature deaths each year^{xxix}. In Britain, the government estimates that each year these emissions cause between 44,750 and 52,500 premature deaths and cost society between £25.3 billion and £29.7 billion.^{xxx} The West Midlands share of these figures will be between 5-10%, so 2,500 to 5,000 people dying prematurely in the Combined Authority area, and a cost to society of £1-£3billion.

The government has largely devolved the problem to local authorities under the Localism Act 2011 and revisions to the Environment Act 2008 and has instructed five city authorities including Birmingham to implement Clean Air Zones by 2020. These will prevent the most polluting vehicles such as old diesel buses, coaches, taxis and lorries from entering the most polluted areas at particular times of day, or charge them for doing so, and the Birmingham scheme will also cover vans.^{xxxi}

Specific regional opportunities and needs

The West Midlands sees energy as core to the region’s local industrial strategy (Figure 10). The scale of investment and potential benefit is substantial, so although this is a local strategy, it’s important to bear in mind that tackling the issues and opportunities will require a commensurately ambitious and innovative response.

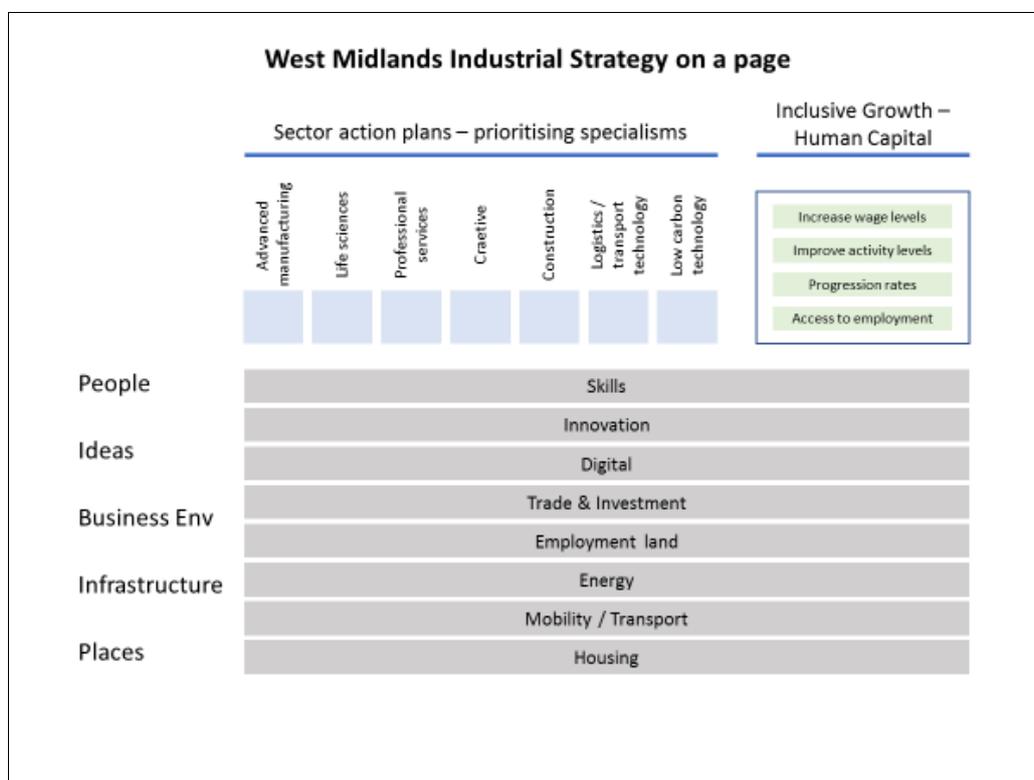


Figure 10 West Midlands Industrial Strategy Framework

A recent report produced for the WMCA by the Black Country LEP^{xxxii} estimates that a focused regional energy strategy could deliver annual GVA improvements of between £400M and £820M. This is broken down as indicated in Table 1 below.

Potential Benefits of a Focused Regional Approach to Energy as an Enabler of Industrial Strategy	Provisional GVA impact estimate (p.a.)
Accelerated roll-out of commercial developments	£100M
Speed of new market development	£120M
Competitiveness of industry	£155M-£400M ⁵
Attractiveness of the region to skilled people	£25M-200M
Total	£400M - £820M

Table 1 Summary of potential GVA benefits delivered by a West Midlands Regional Energy Strategy

Accelerated roll out of new developments refers to the electricity and gas infrastructure required to support new investment in manufacturing and commercial developments across the region. This will amount to £3-4 billion over the next decade (see Investment Flows above): the figure of £100M is the estimated GVA benefit from accelerating the timing of this investment to align it more closely with local spatial and economic development plans.

Speed of new market development is about making West Midlands energy infrastructure fit for purpose to support mass roll out of low carbon transport systems, including EVs. Again, the scale of investment runs into billions (much of it around HS2 terminals) and the strategic need is to ensure this is timed to make West Midlands markets more attractive for inward investment and new technology deployment.

Competitiveness of industry refers to the benefits of energy efficiency, smart energy systems, efficient procurement and strategic infrastructure cost allocation for energy intense manufacturing businesses in particular, to ensure they compete on a level playing field against international competitors.

These figures exclude the benefits of clean air (estimated at between £1bn and £3bn, see above) and are conservative on the potential benefits of clean energy innovation (the figure for the region offering opportunities for accelerated market development is based purely on additional local sales of low carbon vehicles by local companies).

In addition, the separate report by Arup^{xxxiii} (also see Appendix II – Pilot Energy Innovation Zones and Investment Cases) identifies up to £490m of economically-viable energy infrastructure investment to optimise economic and environmental benefits in four pilot energy innovation zones.

⁵ The higher figure assumes Helm's national recommendation to establish a legacy bank for historic energy infrastructure investment costs is adopted in the West Midlands.

Headline investment projects

The West Midlands is an ambitious region, and there are major investment and regeneration projects underway across the region: over £2 billion of investment is planned for UK Central and Solihull with the arrival of HS2; similar levels of investment are planned for Birmingham (again with HS2 and the redevelopment of Smithfield) and Coventry (housing and new manufacturing facilities for JLR) and £1.5 billion is being invested in the Black Country's Enterprise Zones.

It will be critical to get the local energy infrastructure right for these projects, and that's challenging and risky at a time of major change in global energy systems. In particular, there is a danger that the tendency of commercial investors and developers to focus exclusively on short-term profit maximisation results in energy infrastructure investment which quickly turns into stranded assets and limits the long-term economic and environmental sustainability of the surrounding local community. There is a strong regional interest in getting this right.

It's also not just the headline schemes that need appropriate energy systems. As appendix I summarises, there are clean energy opportunities across the region, including at least a dozen district energy schemes, four major waste to energy projects with contract renewals due in the next five years, and approaching £200m of solar PV investment opportunities in the Black Country alone.

Housing challenges

In addition, the West Midlands has significant housing issues and opportunities. The current expectation is that 200,000 new homes will be created in the region (net) over the next 12 years^{xxxiv}. This represents mixed public and private investment of around £20bn, and an additional electricity requirement which could vary from virtually zero to 8TWh per year^{xxxv, xxxvi}. In electrical capacity alone, 200,000 houses will need around 80MW of new base power generation and 200MW of available peak power generation (assuming no innovation in control technologies and load shifting)^{xxxvii}. This also assumes heat continues to be provided by gas and no electric vehicles, which are additional to these figures.

Energy poverty is a significant issue for the region, with rates exceeding 13.5% in several areas of Birmingham, the Black Country and Coventry^{xxxviii}. This is a consequence of poor quality (often private) housing as well as domestic energy prices and a concerted strategy to address this needs to focus on the built environment and infrastructure as well as headline domestic energy costs.

The number of households in fuel poverty across the region is around 200,000^{xxxix} which is potentially a substantive and targeted market for energy efficiency refurbishment (retrofit) using innovative models such as Energiesprong⁶ or models being developed by the Energy Systems Catapult in Birmingham. Energiesprong retrofits eliminate fuel poverty from households where they are applied and recover the costs over 30 years via (much lower) energy bills. To carry out this scale of radical low carbon retrofit on 200,000 houses would require investment of around £4 billion.

⁶ Energiesprong is currently being piloted by a consortium in the UK including Accord Housing, who are based in the Black Country, and have a manufacturing facility (LoCal Homes) in Walsall.

Electric vehicles

Electric vehicles are seen as a particular area of opportunity for the region because of the region's heritage and strategic strengths in advanced manufacturing, low carbon technologies, transport and logistics and construction. EVs represent a significant market opportunity for all these sectors.

The region's potential strength in this sector has already been recognised by the government in locating the £80M National Battery Manufacturing Development Centre in Coventry, and Jaguar Land Rover will be bringing their first electric vehicle to market in 2018. To maximise the economic and environmental benefits of this investment, the region – especially around Coventry and Solihull - plan to invest significantly in connected autonomous vehicle (CAV) development and infrastructure and various stakeholders are already discussing the creation of EV charging hubs and infrastructure (including vehicle to grid) at commercial scale.

Electricity networks and distributed generation

Western Power commissioned Regen in 2017 to carry out a comprehensive review of renewables and distributed energy technology opportunities in the region, and this provides some further useful indications of the likely investment opportunities (and uncertainties) across the region up to 2030^{xi}.

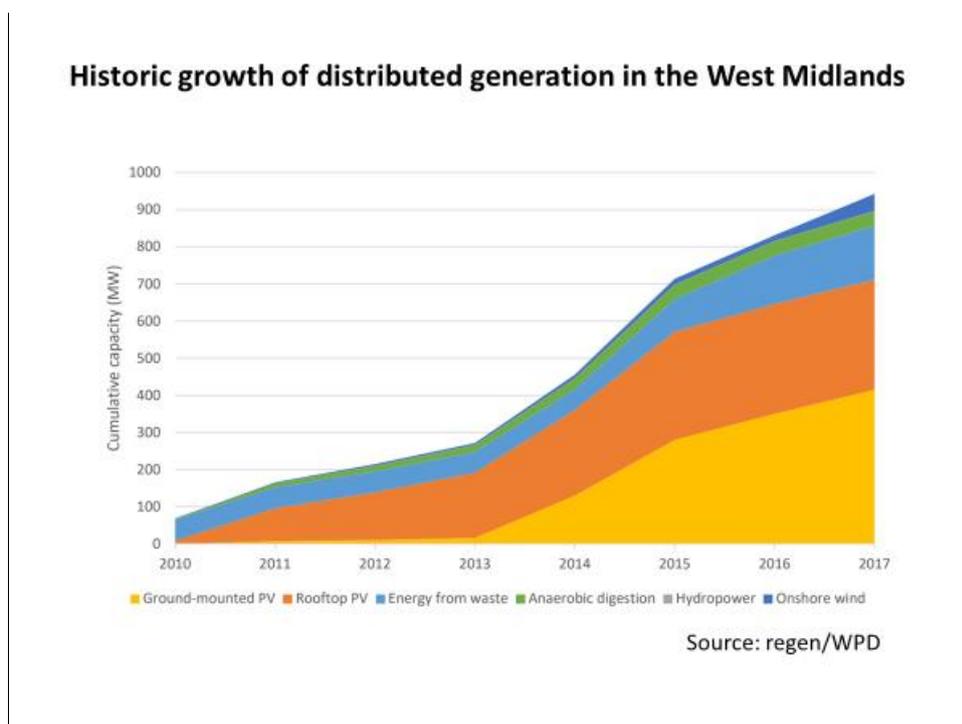


Figure 11 Historic growth of distributed generation in the West Midlands

Figure 11 shows cumulative investment of around £1billion in distributed energy technologies in the region over the past seven years, delivering more than sufficient power to support the housing growth planned for the next decade (for example).

Figure 12 (below) shows a range of projected futures for regional distributed generation investment modelled based on National Grid's Future Energy Scenarios^{xii}. This includes varying assumptions for electric vehicle (EV) take up, and broadly equates to between £400M and £2.5bn of investment opportunities in local generation alone (before heat and network investments) up to 2030.

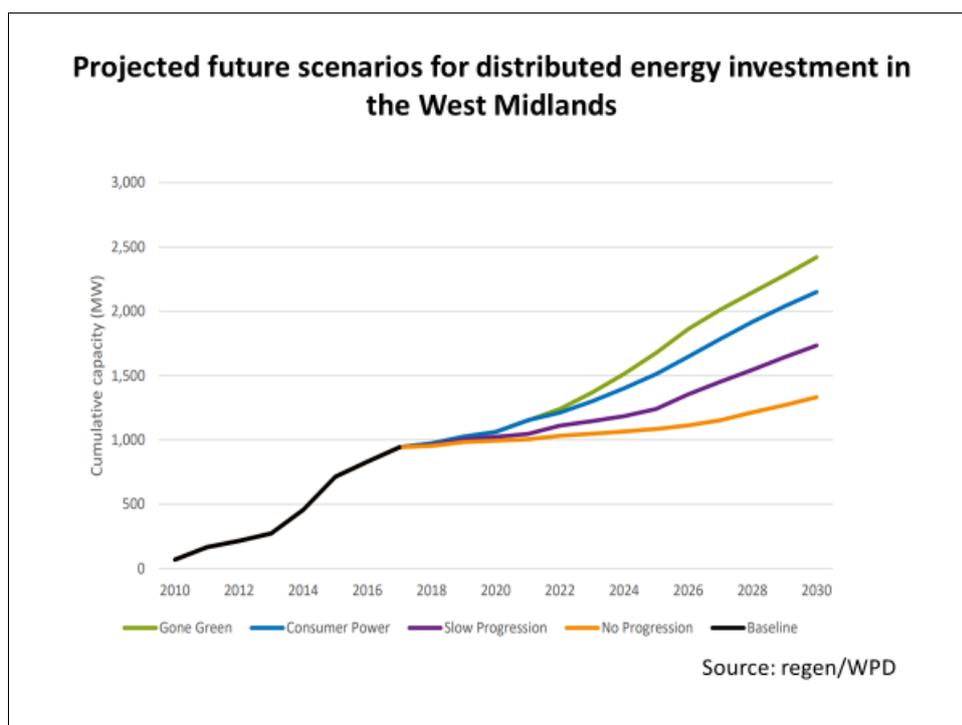


Figure 12 Projected future distributed generation investment in the West Midlands to 2030

Hydrogen

The West Midlands also has longstanding interests in the developing hydrogen economy, including companies such as Microcab, developing fuel cell powered vehicles, and plans for hydrogen re-fuelling facilities in Tyseley Energy Park alongside the existing 10MW biomass power station and joint research and development facilities in emerging biomass and hydrogen technologies run by the University of Birmingham and Fraunhofer ISI.

The University of Birmingham has the UK's only integrated and internationally-recognised research programme across all aspects of fuel cells and their fuels^{xlii} and in 2017 a hydrogen-focused network was launched (the Midlands Hydrogen and Fuel Cell Network) specifically to support commercialisation activity around hydrogen in the region. Solihull Council have been working with Ecuity, a local company, towards establishing a hydrogen hub locally, and Birmingham City Council are committed to trialling hydrogen powered buses^{xliii} and waste vehicles as part of their fleet.

Waste to energy and heat networks

There is a concentration of waste to energy facilities in the Black Country, as well as major plants in Coventry (44MWe) and Tyseley (25MWe). Currently only the Coventry plant is committed to linking into a district heating scheme as well but plans and feasibility studies have been completed for the plants in Tyseley, Dudley, Wolverhampton and Sandwell and these create the opportunity to develop commercial integrated schemes (subject to negotiation and contracts) when waste contracts come up for renewal between 2019 and 2023.

There are several private waste to energy plants in the Black Country, and some of these are now exploring local private wire arrangements with nearby manufacturers. More detail on potential waste to energy and heat network schemes is provided in appendix I.

Birmingham also has an established district energy company, BDEC, serving much of the city centre including council buildings, the International Convention Centre, Children’s Hospital and Aston University. This is in partnership with ENGIE (as is the Coventry scheme). Both Warwick and Birmingham Universities also have their own on-site gas-fired CHP⁷ networks as the main source of heat and power for their campuses.

Global markets

The global energy system is on the cusp of a major transition. For most of the past century technology and economics have only supported a largely one-size-fits all approach to energy infrastructure. Attempts to do anything more than superficially adapt energy systems infrastructure to local needs would either have imposed excessive costs or resulted in inequities in access.

However, rapid reductions in the costs of communications, IT and energy storage and generation technologies are now changing this context fundamentally.^{xliv} Figure 13 illustrates one example: a projected 60% reduction in the installed cost of battery storage to 2030^{xlv,8}.

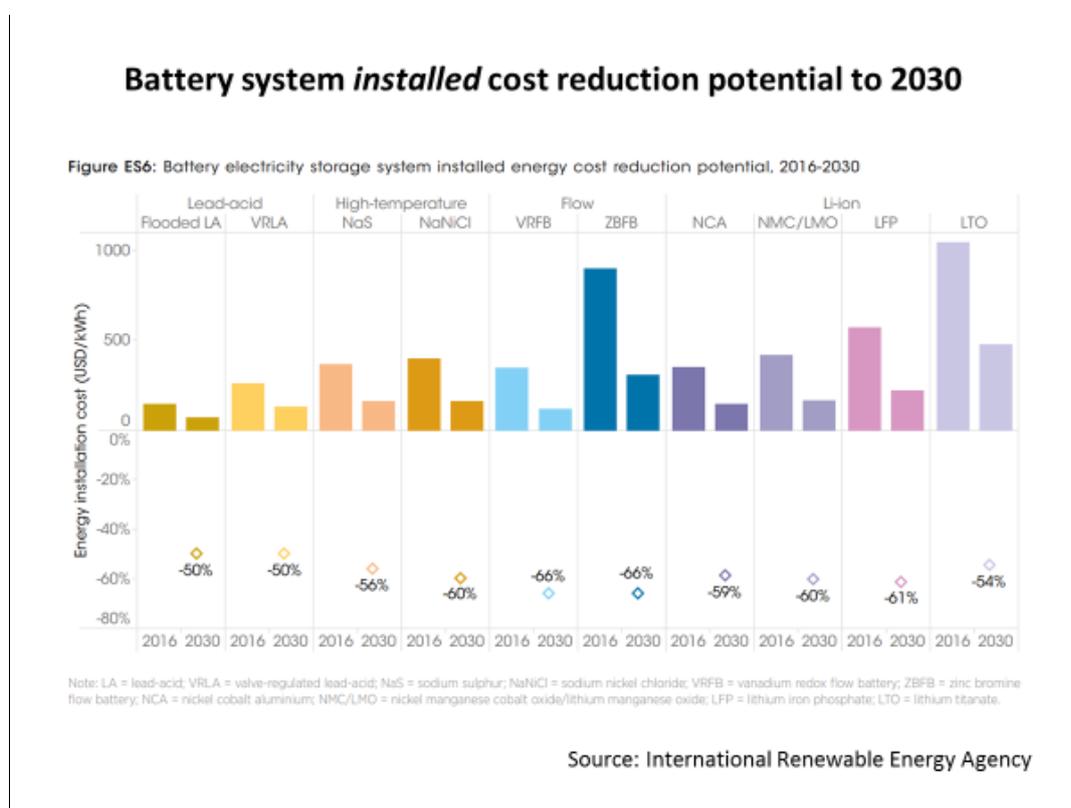


Figure 13 How costs of energy technologies can fall rapidly

Digitisation and energy storage technologies in particular make it possible to optimise energy systems at much more local levels, and to manage them in a more distributed way^{xlvi}. This in turn means national energy infrastructure, including energy market and regulatory structures, can

⁷ Combined Heat and Power

⁸ Note this is installed cost; the actual technology costs are falling much faster (for example Lithium Ion battery costs fell by 60% from 2014-17 (same source)).

accommodate much more diversity and variety (at least in principle). The benefits of such local diversity in energy systems and responsiveness to local needs now outweigh the costs.

These fundamental technical changes have been accompanied by significant global political shifts, particularly recognition of the need to address the challenges of climate change through reducing carbon emissions. The energy system is the largest emitter of carbon globally, and thus at the forefront of these political changes.

The economic opportunities associated with these shifts are potentially huge. The broad global political consensus around climate change is manifest in changing customer attitudes, varying national targets, regulatory nudges and incentives across the world, all of which create significant markets for clean energy technologies and systems.

The most recent estimates (e.g., from the World Bank, Oxford Economics, Mckinsey and IEA) of the global market opportunity for clean tech products and services suggest a market of well over \$3trn a year, with energy infrastructure investment alone accounting for between \$2,5trn and \$3trn a year between now and 2040^{xlvii}.

The challenge in taking advantage of this global market opportunity is that it will clearly require new cross-sectoral collaborations, for example between transport, energy, construction and digital sectors, and the transfer of know-how from sectors like advanced manufacturing and logistics to construction and energy. Unlike the West Midlands, few regions have economies with strengths in all these areas, especially coupled with a diversity of both research and practice-led universities to support effective cross-fertilisation and the emergence of new competencies.

Effective commercialisation of cross-sectoral innovations also requires accessible markets of sufficient scale to support rapid scale-up (for example helping new businesses cross the 'valley of death')^{xlviii}. The West Midlands is big enough – comparable in population and economy to a small country such as Finland, Denmark or Norway – to offer such a market, particularly in the energy sector where public policy unavoidably plays a major role in determining outcomes (in any political system).

For these reasons, low carbon technologies and services are justifiably identified as a key strategic sector in the West Midlands industrial strategy, and the region has a unique opportunity to benefit from the \$3trn global market opportunity currently developing.

4. Challenges and constraints

There are, however, significant challenges in any attempt to address energy strategically at regional level in the UK, despite the clear potential economic and environmental benefits of doing so summarised in section 3. This section reviews these challenges under seven broad headings, setting the agenda for the focused strategy set out in section 5.

The speed and nature of technological change and choice in energy systems

There are a wide variety of technical choices to make in any energy system, whether for an individual house, a region or a country. The economics of energy technologies in a given place are also not independent of each other⁹, so for example a district energy system may make a lot of economic sense if local housing is poorly insulated and no sense at all if the same housing is retrofitted with the latest insulation (an economic choice which makes complete sense for the householder but not for the district heat operator).

This context is further complicated when we are seeing technological change and changes in the economics of individual technologies on the scale and at the rate illustrated in Figure 13. The current world is one in which proponents of hydrogen, electric vehicles, biomass, solar, nuclear, micro-chp, district heating, smart controls, energy storage, building energy efficiency and heat pumps can all credibly claim to be offering game-changing rates of technical progress and cost reduction.

If we're not very careful, these two realities create a significant risk of very poorly informed and meaningless public debate and policy-making. This is particularly true at national and international level, and in political systems where public servants are poorly equipped^{xlix} to resist specialist lobbying by corporates and academic proponents of specific technologies. The outcome is too often far too much time wasted debating questions which are meaningless and impossible to answer in the abstract: like 'are heat pumps better than gas, or wind better than nuclear?'. Such questions can only really be answered in a defined context (i.e., for a specific geography and set of infrastructure and market regulations) and at a given moment in time.

Energy investment decisions will also always entail significant uncertainty and risk, because a high rate of innovation means the one certainty is that tomorrow's economics will not be the same as today's, so some assets will be 'stranded' and we'll look back at other decisions with the benefit of hindsight and find that if we'd make a different choice we'd have ended up with a lower cost outcome.

The challenge then, is not to identify the best technologies to deploy in any kind of general sense, but to make sure that energy investment choices and decisions are made by those best placed to manage the unavoidable uncertainty and risks that all such decisions entail.

Two further points are increasingly relevant to many energy choices:

⁹ This should probably be written more forcefully: the economics of energy technologies are typically highly dependent on other energy technologies already present and the infrastructure around them. To give a stark example, a gas boiler has no economic value at all to a property off the gas grid.

1. Energy infrastructure choices are becoming more granular and local. This point has already been made in section 3 and is the outcome of the reducing costs of storage and digital control technologies. Put another way, the proposition is that varying local energy infrastructure no longer necessarily means extra cost and risk to the national system.

The challenge this creates is that it's no longer economically optimal (or sensible) to think about a single national energy infrastructure: it's becoming in everyone's interest – especially the customers who pay for energy – to think about infrastructure choices more locally. This makes regional and local energy decision-making more challenging (because it's no longer simply about what investments should be made in generation and demand-side assets given a fixed infrastructure – the infrastructure itself is now fluid and part of the process) but is more likely to result in better outcomes and match risk to reward.

2. Energy investments (and their economics) are increasingly tied into wider (non-energy) infrastructure and policy decisions. Carbon pricing, carbon targets and environmental policy are the obvious examples of this at global, national and local level, but local waste, transport and industrial strategies will also be critical factors determining the viability and attractiveness of energy projects, as will housing and spatial plans.

This means that to manage the risks and uncertainty of energy investments effectively, decision-makers need to be able to take a broad range of interests and issues into account. This gets very difficult (and can easily lose touch with political realities and voters) once decisions are taken at regional or national level – which is why much spatial, waste and transport planning is done at local authority level.

Customer engagement in energy markets

While customers can occasionally get very engaged by energy technologies and energy investment and infrastructure choices in particular (for example, wind turbines, waste-to-energy plants or nuclear power) they are largely apathetic and disengaged when it comes to the energy market, with around 95% of customers of the larger suppliers paying more than necessary for electricity and gas, despite the best efforts of Ofgem and others to persuade customers actively to shop around and switch suppliers regularly¹.

This is a significant problem for any effort to 'do energy differently', especially if such efforts assume benefits will be delivered by active competition. Markets simply don't work if people ignore them and refuse to visit.

So it's important that any strategy include some model for customer engagement and communication, particularly if benefits depend on customers making active and informed choices.

Narrow definitions of innovation

As discussed in section 3, there are major opportunities for innovation and the emergence of new business models in energy (including potentially whole new industrial sectors, such as autonomous vehicles and connected homes). Facilitating the development of such models and such innovation is critical for the region to maximise both economic and environmental benefits. However, we need to be very careful not to constrain growth by taking too narrow an approach to innovation regionally.

By a narrow approach to innovation, we mean a tendency to define innovation solely as commercialising new technologies emerging from university-led research, coupled with an innovation agenda largely set by existing (and typically larger) industrial interests.

Both of these aspects of innovation are, of course, fundamentally important and need to be supported, but in regional energy systems and to deliver the scale of ambition of the West Midlands, it's also critically important to recognise the value of investment which is innovative in the sense of, for example:

- new applications of existing technologies at a scale beyond anything previously attempted
- new combinations of existing technologies in a systemic way, creating new business models and new customer outcomes
- incremental development (including simple cost reductions) of existing technologies
- innovative market regulation and governance, creating incentives for investors and innovators to take significant commercial risks at scale
- investment in energy infrastructure which may not be that innovative in itself, but which unlocks whole new markets for low carbon energy technologies and systems and opportunities for economic development

Innovations such as Tesla are (arguably^{li}) far more likely to arise from this kind of innovation than innovation driven by leading edge research or existing automotive or energy interests.

This particular challenge in the energy sector (particularly energy infrastructure) stems from the combination of:

- the world currently emerging from a relatively long period (several working generations) when the whole energy sector has been relatively static and slow-moving, with very limited innovation;
- a one-size-fits-all approach to national energy infrastructure that was driven by the economics and technologies of the 20th century rather than the 21st;
- a long-standing cultural problem with UK innovation policy which places too much emphasis on the simplistic 'linear' model of innovation^{lii}.

Some progress has been made in the last few years with the creation of the Catapults nationally, particularly the Energy Systems Catapult in Birmingham^{liii}, although there is still some way to go in recognising the need for (and value of) local variety and sensitivity in energy systems. Nevertheless, it will be important to take a broad perspective of innovation in the regional energy strategy.

Diversity of local ambitions

The West Midlands' scale gives it economic weight and the ability to deliver substantial and ambitious schemes and policy objectives, to national as well as local benefit. It is, however, a diverse geography (see section 2) and the workshop-style medium size manufacturing of the Black Country has very different needs and offers different opportunities and challenges to the concentration of automotive manufacturing in Coventry and Warwickshire, currently heavily dependent on a single firm (JLR).

Similarly, the highly diverse and concentrated urban population and environment of Birmingham contrasts with the rural environment and town centres of Warwickshire, North Worcestershire and

South Staffordshire, and it isn't at all clear that the same kind of energy system will benefit all these areas equally.

The challenge is to see this diversity as a strength and a virtue, in common with the people who live in the region (often commuting from rural towns to Birmingham, or vice versa for leisure and shopping) and not to develop an energy strategy which either ignore or undermines the diversity of ambitions and loyalties this variety creates.

Complexity of political institutions and public sector capacity

The diverse economic geography of the region is reflected in a complex layering of political institutions which can appear somewhat impenetrable to outsiders, although in practice it generally works very well and makes sense to those involved.

The table below summarises the political structure of the region.

Body	How many	Broad role(s)	Accountability
West Midlands Combined Authority	1	Transport; industrial strategy; housing and land; productivity and skills	Democratic and to constituent members
Local Enterprise Partnerships	3	Economic development (Innovation; creativity; growth)	Local authorities via supervisory board
Constituent Local Authorities	7	Deliver public services – all metropolitan and unitary authorities	Democratic
Non-constituent Local Authorities	11	Deliver public services – fewer voting rights on WMCA; mix of unitary, shire and district councils	Democratic

Table 2 West Midlands' political structure^{liv}

As at the end of 2017, only five of the seven constituent local authorities retained specialist energy or sustainability officers. The LEPs and combined authority had no dedicated energy officers at all, although the boards of all three LEPs include individuals with energy expertise and several local authorities retain energy project managers and specialists on a consultancy basis when required (for example, Birmingham have been working on setting up a retail energy company with a specialist team for over a year).

This limited resource is potentially a significant challenge, particularly to efficient and informed on-going discussion of local needs¹⁰. However, it has also facilitated a recognition at all levels that energy investment is an area which may well best and most efficiently be supported from the

¹⁰ Although it did not prevent all 7 constituent local authorities responding promptly and helpfully to this project.

Combined Authority and has driven the formation of the Energy Capital partnership for the region. Energy Capital has been well-supported by the public and private sector.

BEIS have recognised public sector capacity issues in energy nationally and are funding the equivalent of one specialist energy post per LEP area for the next two years. This funding will be very helpful in supporting better dialogue and knowledge transfer, but it will fall some way short of the resource necessary to deliver any meaningful strategy for the region with the scale and impact justified by the opportunities outlined in section 3 above.

Existing industrial strengths

The West Midlands has historic strengths in several sectors, but especially automotive and manufacturing. This is a weakness and risk, of course, as well as a major virtue.

Given the global consensus that new cross-sectoral business models are likely to emerge as the energy transition unfolds (and companies like Tesla and Amazon already exemplify this) it will be very important to the long-term economic success of the region that we don't only reinforce existing industrial strengths through our energy strategy.

Our approach must also support new firms and start-ups with potential to grow, and the 'silent majority' of mid-sized manufacturing firms across the region^{iv} who could grow substantially by redirecting their existing skills and competencies to new markets and opportunities opening up worldwide.

A mismatch between regulatory system design and market opportunities

There are two separate and equally fundamental issues with energy market regulation from the perspective of a region seeking to develop a coherent and meaningful energy strategy to deliver local economic, social and environmental objectives. One is the complexity of the system, and the other is a structural mismatch between regulation and where the technical and economic opportunities lie.

Historic complexity

Over the last 40 years the UK has led the world in developing a market-based regulatory model for energy. This was initially very successful, but the past 15 years have seen a progressive return to government control and increasing criticism of the complexity and outcomes delivered by the current model for customers, which are generally higher prices^{vi}.

The desire of government to get involved in energy market regulation is understandable (and probably necessary) because energy has such a significant potential impact on economic and environmental outcomes at all levels – national, regional and individual. However, the consequence of recent UK history in this sector and the rather confused mix of 'independent' regulation of privatised companies and increasingly robust government intervention (e.g., the introduction of price caps^{lvii}) is a horribly complex and opaque energy sector and slowly stirring soup of regulations which is virtually impenetrable to many insiders^{lviii}, let alone to local or regional authorities (or small and medium-sized businesses) wishing to innovate or develop coherent and ambitious strategies in this sector.

Structural mismatches

The current structure of UK energy markets is summarised in Figure 14 below. Criticism of this since 2010 has come from all sides of both academic and political debate (for comprehensive and largely opposing academic critiques see Helm^{lix}, iGov (Mitchell)^{lx}).

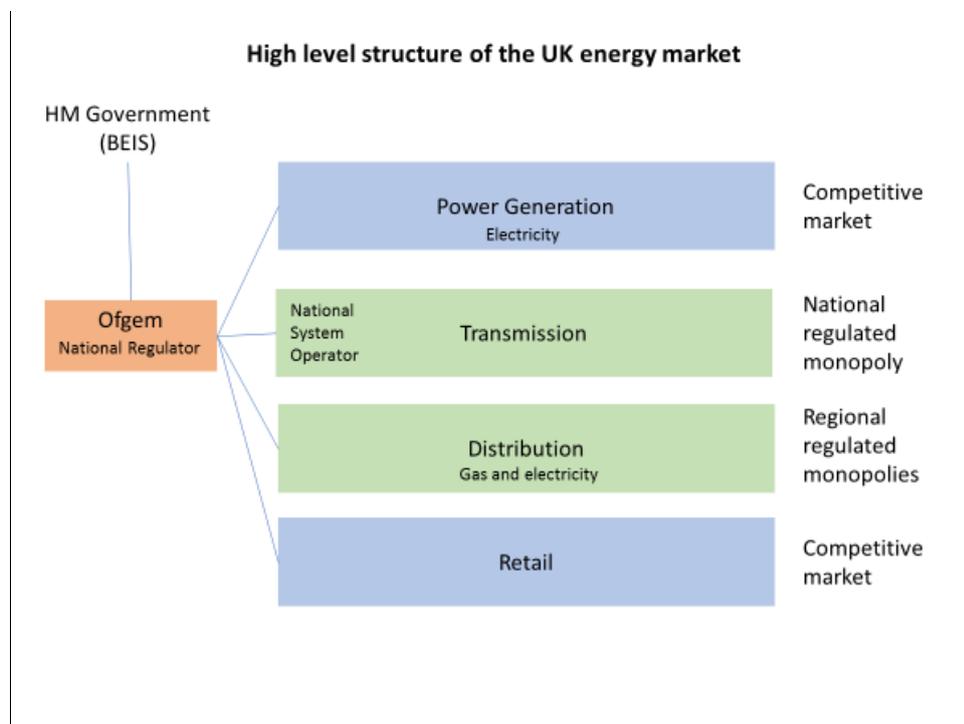


Figure 14 How the UK energy market is structured

The practical reality from a regional perspective is that this makes it challenging to take an integrated, market-based approach to energy systems and energy infrastructure planning at regional level. This is because energy markets and energy infrastructure are primarily regulated, planned and managed nationally, whereas transport, waste and spatial plans are primarily planned and regulated regionally and locally.

However, successful modern distributed energy projects and economic opportunities associated with (for example) low carbon autonomous vehicles, smart connected homes and optimised waste-to-energy systems require integration of transport, waste, spatial, digital and energy strategies. They also require local political and community consent and engagement. If energy systems investment is fundamentally regulated nationally while other key enablers of energy projects are controlled locally, progress will be limited.

This is not purely a regulatory and policy point. Regulation essentially specifies how returns on investment are allocated. If regions want or need to invest in substantial energy infrastructure to support their particular economic goals and local needs, they need to be able to offer investors returns on these investments. Constraining such returns within national regulatory frameworks inhibits and prevents this.

The essential argument in this strategy is that the greatest economic and industrial benefit can be secured by optimising the energy system as a whole, starting from inherently diverse and place-

based requirements and opportunities. Increasingly this means paying attention to distribution and generation infrastructure at a regional level (integrated with other regional infrastructure and industrial needs) in the context of an over-arching national system which supports this.

Unfortunately, the system is currently designed on the assumption that distribution and transmission infrastructure is essentially fixed, changes only slowly, and has little or no impact on competitiveness. It also assumes that the only economically-viable generation assets are national in scale. These assumptions were broadly true in 1970, 1980, and 1990 but from 2000 they became diminishingly true and they no longer hold.

The present UK system therefore assumes that the only economic benefit and industrial advantage that the energy system can offer is through competition in retailing energy and in generating energy to supply a national system. In the 21st century, these assumptions are simply wrong¹¹.

¹¹ In saying this, this strategy agrees with Dieter Helm, who develops all these points at some length in his cost of energy review.

5. Our regional energy strategy

Overview and principles

The West Midlands Combined Authority is a new organisation with a new Mayor, working to an ambitious agenda with three highly effective local enterprise partnerships and supportive constituent local authorities. This creates an opportunity to develop a distinctive and powerful regional energy strategy building on our unique history and meeting our unique regional needs (see section 3) while addressing the challenges set out in section 4.

Reflecting this background and context, the strategy is built on five core principles:

1. **Respect for diversity** and existing strengths across the region
2. **Leadership in the clean energy transition** nationally and internationally through innovation
3. **Partnership** across sectors and between our universities, businesses and communities
4. **Openness** to new thinking and transparency to support this
5. **Focus** on areas where we can make the biggest difference by working together at regional level.

In particular, we see local leadership of regional energy activity as fundamental to success¹². This means local authorities and the communities they represent. Our strategy is thus a framework for local energy leadership at scale and creating impact across the West Midlands.

These core principles are translated into four specific initiatives:

1. Development and use of **Energy Innovation Zones** to provide a simple, flexible mechanism to support integrated local energy infrastructure transition, investment and accelerated deployment of innovation. The West Midlands has led on the development of the concept of EIZs nationally^{lx}.
2. Creation of an innovative and **democratically-accountable regional energy governance structure, Energy Capital**, in partnership with national stakeholders and energy system operators. This will manage risks, help secure necessary funding and regulatory powers and provide assurance to national system operators and regulators that local activities remain within national market and regulatory frameworks.
3. Investing in **specialist resource to help secure long-term funding** at scale for targeted and appropriate local energy investments, innovation and development of an active innovative energy business cluster at scale. We propose to target raising £500M of investment funding to support commercially-viable energy investment across the region^{lxii}.
4. **Targeted support** for innovators, ambitious existing businesses and citizens in taking advantage of the economic opportunities created by the global energy transition. This will build on existing initiatives and institutions.

¹² This is a technical point as well as a political and logical one. The more localised an energy project, the more sensitive its economics tend to be to customer engagement: local people impact project development risk and costs significantly (for example for wind and waste to energy schemes) and customer behaviour is typically the key determinant of financial returns on demand side energy projects. Wayleaves for district energy pipework and other such details are all under local authority and community control and critical to efficient and profitable project delivery.

Objectives and vision

We aim to:

- Reduce energy costs for our strategic industries to enhance their competitiveness and productivity.
- Reduce the incidence of fuel poverty among households, particularly in Birmingham, Coventry and the Black Country
- Deliver the region's share of national and global carbon budgets
- Create a regional energy infrastructure which puts the West Midlands at the leading edge of the global energy and transport systems transition and make this region the most attractive market to commercialise new energy and transport system technologies in the UK.

For each of these objectives we will set ourselves measurable targets as set out in Table 3 below.

Objective	Proposed target
Energy costs for our strategic industries	Equivalent or better than costs paid by German competitors by 2023 This means delivering a typical 20-25% reduction, depending on sector.
Reduced incidence of fuel poverty across our 1.7M households (currently approximately 200,000 homes are in fuel poverty across the region)	Beat national government targets ^{13, lxiii} by at least 5 years: As many fuel poor households as practical in Band C homes by 2025 As many fuel poor households as practical in Band D homes or better by 2020
Deliver our share of national and global carbon budgets	Reduce regional carbon emissions by 26% between 2016 and 2030 ^{lxiv}
Create a regional energy infrastructure putting the region at the leading edge of the global energy and transport systems transition	£1bn GVA improvement by 2025 through EIZs and associated cluster support and technology commercialisation ^{lxv} .

Table 3 Strategic objectives and targets

Anticipated projects and pipeline - who picks the winners (and losers)?

There are over £490M of commercially-sensible innovative energy infrastructure projects in the proposed pilot EIZs alone^{lxvi} and at least the same scale of opportunity again across the wider region (Appendix I – Sub-regional mapping reports). In total, our analysis (section 3) indicates that more

¹³ In 2014, the Government put in place a new statutory fuel poverty target for England: to ensure that as many fuel poor households as reasonably practicable achieve a minimum FPEER rating of Band C by 2030, with interim targets of Band E by 2020, and Band D by 2025. Bands are ways of measuring the energy efficiency of housing: A is good and E is awful.

than £15bn of investment will be needed *as a baseline scenario* in energy infrastructure across the three LEPs between now and 2030, plus a further £74bn in energy-dependent technologies such as cars (£32bn^{lxvii}) and buildings (£42bn) over the next 12 years.

The task of this strategy is clearly to influence these investment flows to ensure our regional strategic targets are met, but given the challenges set out in section 4, who is best placed to make the key investment choices is a moot point.

A fundamental challenge in the energy sector is that who picks the winning and losing technologies is not a simple question to answer. Individual customers select energy suppliers and choose between makes of car (creating what looks like competitive markets) but the costs of delivering the energy to the customer's home or of driving the car are largely determined by local infrastructure, and the investment decisions which shaped this have been taken over decades by national and local stakeholders, including both government and private companies¹⁴.

Similarly, experts and innovators may be sure a new energy technology such as a particular type of hydrogen fuel cell is bound to succeed in the future, but if customers don't want it and the local infrastructure asset base doesn't support it economically, it probably isn't going to succeed.

So all we really know is that the answer to 'who picks the winners' in energy is not the market, not the government and not experts or innovators, but a complex combination of all of these. An effective regional strategy (and indeed market design and national system) needs to recognise and work with this reality.

In the current UK energy system, infrastructure winners and losers are currently chosen by network operators with regional monopolies regulated nationally, broadly on the assumptions that not a lot is fundamentally going to change: a one-size fits all system is the only economic option; and thus who picks winners and losers doesn't really matter. As previously discussed, almost everyone in the energy sector recognises these assumptions are now outdated, and the most economically-competitive future systems will be more sensitive to local opportunities and needs.

A more locally-sensitive process for making energy infrastructure choices and investment decisions is therefore required.

This strategy responds to this challenge in three ways.

1. It creates a framework through Energy Innovation Zones for localities to act as intelligent and strategic customers (i.e., procurement and investment bodies) for future energy infrastructure and asset investments. EIZ Partnership Boards (see below) will be made up of stakeholders relevant to the local area (often including academic experts and distribution network operators) and controlled by the local authority, representing the long-term democratically-determined interests of the area.
2. It provides support for the creation and operation of EIZs through Energy Capital, which itself provides a gateway to wider support (such as BEIS's Energy Hubs). Energy Capital will help fill gaps in expertise where necessary; it will develop large scale investment funds; and it will provide access to regulatory and specialist legal advice and support where this is

¹⁴ This is arguably one reason why customers fail to engage very much in retail energy markets: they know the real cost-determining decisions are not in their hands.

necessary and helpful (this will be provided to local authorities as well as EIZs where required). Energy Capital will also ensure regional investment and activity in the energy sector continues to conform to national market regulations and policy.

3. It sets out measurable, focused and ambitious targets which will help prioritise activity and ensure national and regional economic needs are reflected in individual EIZ and local authority objectives.

What the strategy does not do is tell localities which technologies or projects to invest in or which infrastructure choices will be best for them.

Energy Innovation Zones

Energy Innovation Zones (Figure 15) provide a flexible framework for focused energy infrastructure investment meeting local community needs. They are mechanisms for risk-managed transition to an appropriate energy infrastructure for the future. EIZs are defined areas operating with specified flexes in energy and planning regulations to encourage competitive innovation in energy infrastructure systems and meet local needs. The defined geography and local governance of an EIZ enables new energy infrastructure to be delivered integrated with transport, digital and economic development plans and in innovative ways responsive to local needs that is simply not possible through existing national energy governance structures.

Each EIZ is established and approved through the regional energy governance structure (see Figure 18) and has dedicated resourcing reporting to a local EIZ partnership board.

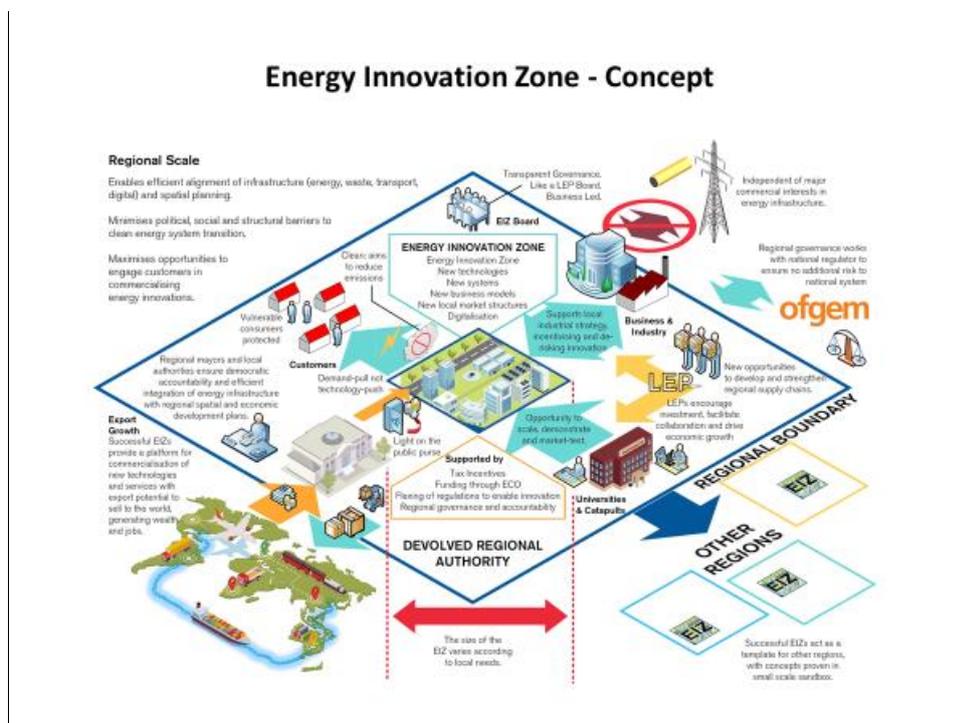


Figure 15 Energy Innovation Zones schematic (courtesy Dr Gavin DJ Harper)

Discussions to develop an appropriate framework for EIZs have been taken forward through a Regional Energy Policy Commission^{lxviii}, chaired by Sir David King and jointly funded by the

Universities of Birmingham, Warwick and the Energy Systems Catapult. The Policy Commission is sponsored by the WMCA and Mayor and supported by BEIS, Ofgem and both national and local energy system stakeholders.

Appendix II – Pilot Energy Innovation Zones and Investment Cases, provides overviews of each of the four pilot zones, and *Appendix I – Sub-regional mapping reports* summarises specific project opportunities (or references to existing sub-regional project pipelines) within these zones and beyond. The Arup report *Business Cases for Energy Innovation Zones in the West Midlands*^{lxix} sets out a range of infrastructure and project investment options for each EIZ from a baseline case (£270M investment across the four zones) to a more innovative case (£490M investment across the four zones). This investment will generate circa £200M GVA improvements by 2030 towards the overall £1 billion strategic target set out above.

Wider initiatives, including cluster development and business support

The four initial pilot EIZs are only the start. We will deliver the remaining £800M of targeted GVA benefit through a range of locally-led interventions, including identification and development of additional EIZs and building on the framework set out in the ‘Energy as an Enabler’ Report recently published by the Black Country LEP^{lxx}.

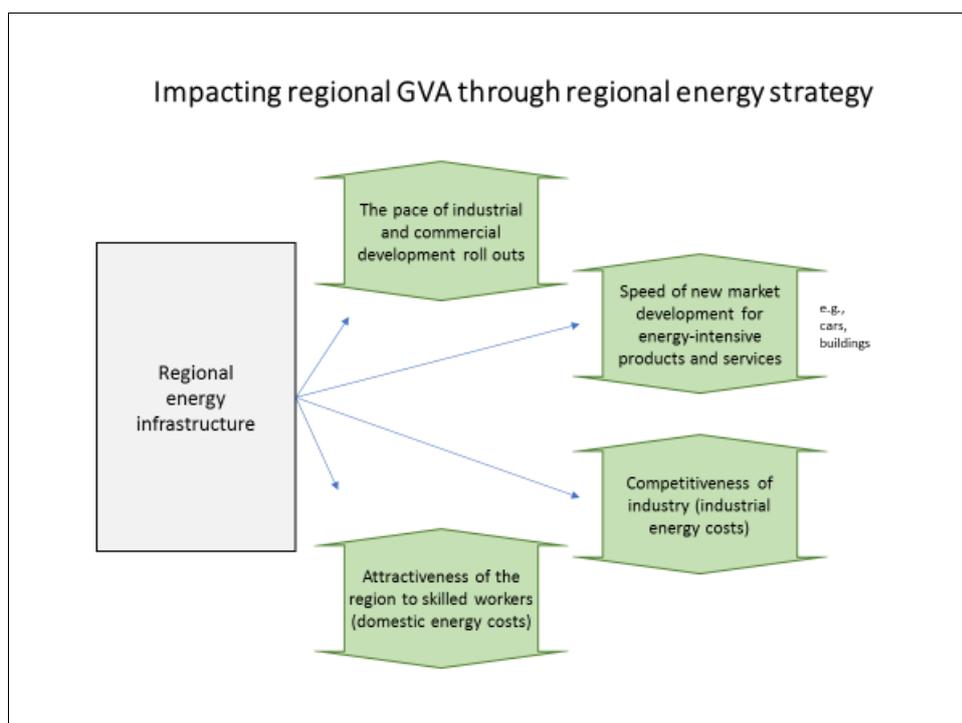


Figure 16 Impacting GVA through regional energy strategy

That report identifies four areas of opportunity (see Figure 16 and Table 1 (Section 2)) and indicative GVA benefits of £420-£800M through a variety of initiatives including:

1. Additional Energy Innovation Zones
2. Strategic infrastructure support for accelerated new market development for locally sourced products such as electric vehicles and smart connected and low carbon housing.

3. Seeking to establish a legacy bank to cover sunk costs of stranded and legacy energy infrastructure assets and using this to reduce energy costs for innovative and competitive manufacturers
4. Energy efficiency programmes for manufacturing and residential sectors
5. Simplifying access and improving the transparency of energy markets for business customers
6. More rigorous and targeted new build housing energy efficiency standards
7. Large scale retrofit programmes for fuel poor households and energy-inefficient housing

These programmes will need to be developed through appropriate partnerships, for example with the Engineering Employers Federation, the West Midlands Housing Officers Group, the West Midlands Innovation Alliance (especially the Innovative Low Carbon Working Group) and the Sustainable Housing Action Partnership. In particular, the energy strategy will work with the Growth Hub and LEPs and through existing working groups wherever possible.

Low carbon and energy technologies are also identified as a strategic sector within the regional industrial strategy (Figure 10) and there are a range of cluster support activities underway and about to be launched, for example supported by Aston University^{lxxi}, Birmingham University^{lxxii} and Climate KIC^{lxxiii} (Figure 17). Energy Capital will support these initiatives through a dedicated working group, and in particular Climate KIC are about to start a three year project to link the cluster development in Birmingham with best practice in London, Edinburgh, Valencia and Frankfurt.

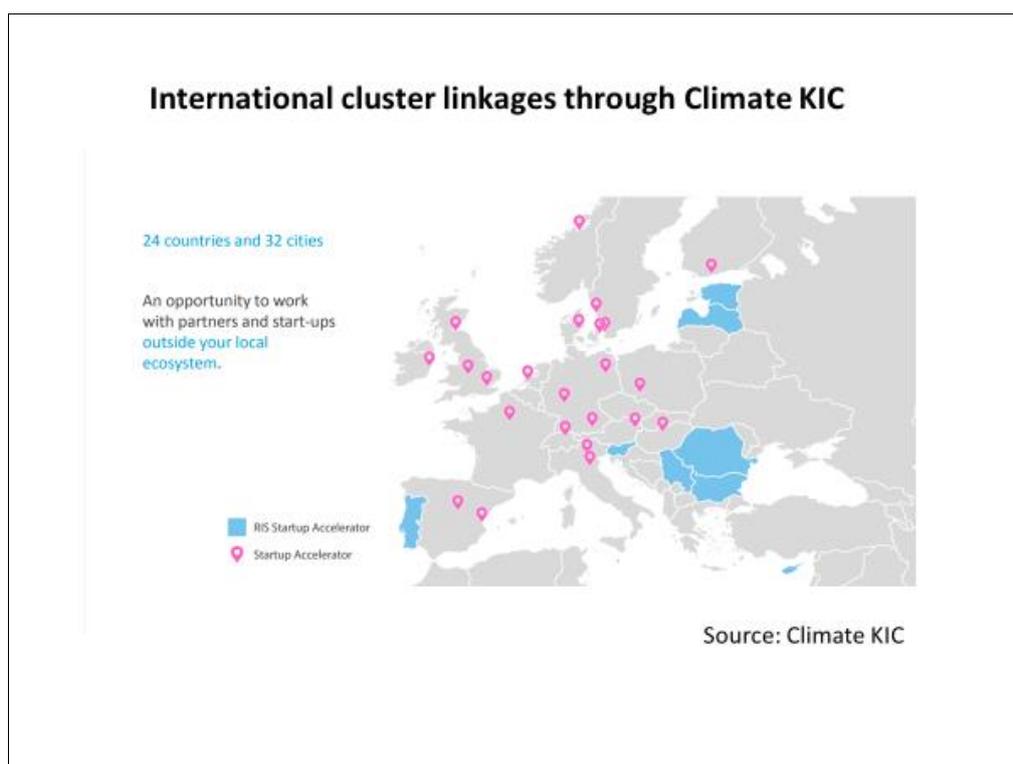


Figure 17 Access to international best practice networks via Climate KIC

Roles and responsibilities

EIZs provide a framework for local authorities to control and lead local energy investment activity within their areas, while also establishing a mechanism which enables them to manage risks and to

support appropriate partnerships and expertise alongside and distinct from their existing organisations. The EIZ structure as set out in the Regional Energy Policy Commission report^{lxxiv} is also entirely compatible with the existence of local retail energy companies, where Councils are considering this (for example in Birmingham and Wolverhampton) as retail companies will generally focus on trading within the current UK energy market structure, while EIZ partnership boards will be focused on infrastructure investment.

Formally the proposed division of responsibilities for energy is set out in Table 4.

Body	Responsibility	Accountable to
EIZ partnership board	<ul style="list-style-type: none"> • Energy infrastructure investment and strategic planning within its zone • Alignment with local plans 	Relevant local authority(ies)
Energy Capital	<ul style="list-style-type: none"> • EIZ establishment and monitoring (where regulated powers devolved) • Funding • Delivery of regional energy strategy (i.e., specified targets) • Strategic regional energy planning, where appropriate (e.g., liaison with network operators and national regulator) 	WMCA (SEP ^{lxxv} Board)
Local Authorities	<ul style="list-style-type: none"> • Effective delivery of public services, including local energy infrastructure • Publicly-owned Retail energy companies where applicable 	Electorate
LEPs	<ul style="list-style-type: none"> • Economic development within strategic sectors, including energy 	Members
WMCA	<ul style="list-style-type: none"> • Governance of Energy Capital • Devolved powers over energy as agreed with Whitehall 	Mayor and constituent members

Table 4 Roles and responsibilities for energy in the West Midlands

These arrangements are shown schematically in the organisation chart below (Figure 18).

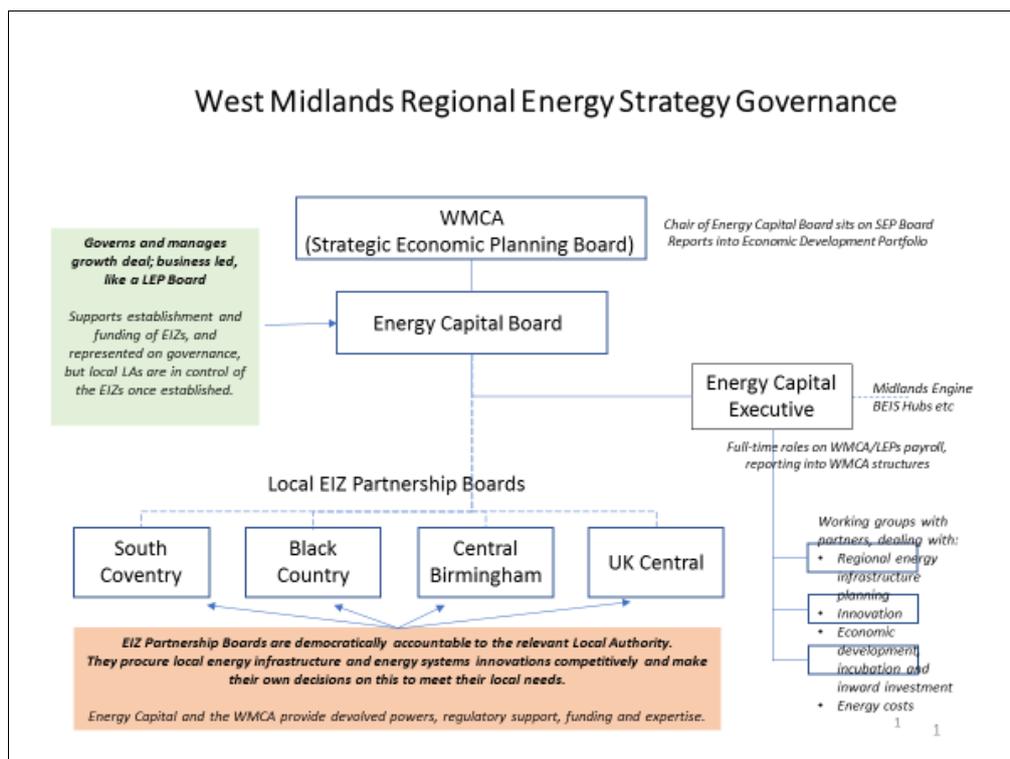


Figure 18 West Midlands Regional Energy Strategy governance

Funding, governance and resourcing

Energy Capital is accountable to the Mayor of the West Midlands through the WMCA and SEP Board. It is a partnership board consisting of key stakeholders established to ensure effective delivery of the aims of this regional energy strategy in a way that creates an efficient model for future energy systems governance across the UK¹⁵.

Energy Capital will be supported by a small executive funded by partners and located in the WMCA. The four areas of responsibility outlined in Table 4 reflect two fundamental roles:

1. To provide democratic governance and legitimacy to strategic regional energy infrastructure planning and major investment and cost allocation decisions. These decisions have a significant impact on the viability of local industrial strategy, the future economic prosperity of the region and on domestic energy bills. They often require liaison both with local authorities and national energy system stakeholders such as network operators, the regulator and major investors.
2. To deliver the agreed regional energy strategy using the framework provided by the EIZs and working groups, in particular facilitating investment and infrastructure development through identification, development, funding, support and supervision of designated EIZs.

¹⁵ In particular ensuring generation, distribution and supply of energy are managed together in an efficient way; and integrating infrastructure planning across housing, economic development, energy, transport, environmental and digital infrastructure.

The Energy Capital Board will provisionally be constituted as follows:

- Chair (from membership)
- Infrastructure providers (4)
 - National Grid
 - Cadent
 - Western Power
 - Severn Trent
- Customers (4)
 - JLR
 - EEF/Manufacturers
 - Housing
 - Environment
- Local authorities and EIZs (7)
 - 1 representative nominated by each LEP
 - 1 representative nominated by local authorities per LEP area
 - 1 representative nominated by non-LEP WMCA local authorities
- Universities/Innovation
 - 1 representative nominated by each contributing university
 - Energy Systems Catapult

The model is akin to a LEP board but specific to the energy sector.

Relationship to other regions

The West Midlands is already collaborating internationally in energy through Climate KIC – particularly the new project with Edinburgh, London, Valencia and Frankfurt - and various university partnerships with overseas institutions. While developing this energy strategy we've actively engaged and exchanged notes with Cornwall and the West of England devolved authorities as well as the GLA (all of which have similar political structures and ambitions or experiences in local energy) and we intend to maintain and expand this openness and willingness to share best practices and take it through into the strategy delivery phase.

We also welcome the new regional energy hubs being established by BEIS and look forward to supporting the staff allocated to our region. The West Midlands is part of the Midlands Engine and we envisage this being helpful, for example in contexts like MIPIM^{lxvii} (where external bodies - typically with little familiarity with UK regional geography - find it easier to relate to the various economic regions within the Midlands collectively) provided it doesn't dilute the focus and efficiency with which we can deliver.

One of the recommendations of the Regional Energy Policy Commission is that the Energy Systems Catapult help act as a conduit for transfer of best practices around innovation (which is not just what this strategy is about) so it's very helpful the Catapult is based in Birmingham. The strategy proposes the Catapult is invited to become a continuing partner in Energy Capital and represented on the Board on this basis.

6. Global best practice

This strategy has been developed over more than two years and informed by support from global consultancies^{lxxvii} and individuals from companies with global perspective and presence, as well as organisations like BEIS, who have a national view; Climate KIC, who have a European view; and the universities across the region, who have global views. We also commissioned a short piece of work by Sustainability West Midlands to understand what other LEPs nationally were doing on energy. This has enabled us to compile a good sense of best practice nationally and internationally.

Much of this work has already been collated and written up for the region as part of the King Commission Report^{lxxviii} which provides an excellent overview and commentary, so the following is a summary only. As mentioned in section 5 above, the intention is to keep a strong sense of global perspective in everything we do in the region, and continuously to adapt and refine the strategy as we progress through delivery and take on board new ideas and experiences from elsewhere.

At the same time, we and constantly aspire to do better than our competitor economies worldwide and are comfortable providing leadership where we have distinctive contributions to make. So we will seek to develop global best practice and positions of leadership ourselves.

UK examples

Cities in the UK which have made significant progress on energy include Bristol, Nottingham, Glasgow and London.

Bristol and Nottingham have both set up retail energy companies. Bristol's now has over 100,000 customers and Nottingham 50,000, and Nottingham has recently expanded its offer to Leeds under a white label scheme¹⁶. Both have also invested in energy project teams (numbering in 10s of staff) and have a reasonable pipeline of projects supported by funding from the EU and Innovate UK.

Neither have yet managed to achieve the theoretical ideal of linking substantive funding streams from a successful retail energy company into local energy infrastructure investment. This has limited the scale of their achievements to modest savings on customer bills (of the order of 10%, or £130-£190 per household) and modest capital investment projects, of the order of £1-£10M¹⁷.

Such achievements are substantial in the context of austerity and the wider challenges facing the public sector, but nevertheless fall significantly short both of what Bristol and Nottingham themselves set as targets (Bristol estimates £1 billion of investment is needed in its energy system to meet its 2050 targets) and what the West Midlands is seeking to achieve through its industrial strategy.

Nottingham is also hosting an early UK pilot of the Energiesprong^{lxxix} approach to large scale housing retrofit, which is of interest to the West Midlands because of our significant fuel poverty challenges and interest in off-site manufacturing (modern methods of construction). In practice, Energiesprong was introduced to the UK through the West Midlands' Sustainable Housing Action Partnership and

¹⁶ Much of the evidence in this section is drawn from the work of David Strahan and the West Midlands Regional Energy Policy Commission, whose report will be published in March 2018.

¹⁷ Ibid.

has been strongly supported from the West Midlands (the board is chaired by Accord Housing from West Bromwich and the off-site manufacturing is done in Walsall) so this is already a good example of best practice travelling from Holland to the UK via the West Midlands, as well as on-going knowledge sharing.

Glasgow has also made similar progress to Bristol and Nottingham with a retail energy company^{lxxx}, led by the social housing sector (which is helpful in providing access to a semi-captive customer base, thus reducing risk) and London has made useful progress in constructively challenging OFGEM around regulations which inhibit local authorities supporting infrastructure investment ahead of demand^{lxxxi}.

International examples

International examples of progress and innovation in regional energy systems were recently comprehensively reviewed by the West Midlands Regional Energy Policy Commission^{lxxxii}. Copenhagen, Munich, New York and South Australia are all mentioned as regions which have benefitted substantially from locally-controlled energy investment, but the point is made that in all these cases the municipalities have far greater statutory powers and responsibilities than their UK equivalents.

Copenhagen has a history of local investment in integrated energy infrastructure suited to its needs going back for at least a century. A city region with a population of just under 2 million, Copenhagen's local authority recently issued a bond of EUR500 million solely to finance regional energy projects.

Munich is comparable to the West Midlands in terms of population with an urban core home to 1.5 million people and a wider regional population of 2.65 million people. Interestingly, Munich operates its transport and energy systems through a single integrated municipal utility, Stadtwerke Munchen, running a liberalised local energy (and transport) system and market on an entirely commercial basis and securing revenues of EUR6.5 billion in 2016^{lxxxiii}. Munich has already secured and invested over EUR3 billion on its local energy system and plans to raise a further EUR3-4 billion shortly.

As the Regional Energy Policy Commission report notes, what all these examples show is the power of local action to accelerate clean energy deployment and innovation, and to outstrip national targets. Munich in particular is a good example (with its similar industrial heritage to the West Midlands) and is currently one of the fastest growing city regions in Germany.

7. Next steps

This strategy consolidates the findings and recommendations of several reports, including the *Regional Energy Policy Commission Report*^{lxxxiv}, the *Arup EIZ Investment Case Report*^{lxxxv} and the *Black Country Energy as an Enabler*^{lxxxvi} and *Powering Growth*^{lxxxvii} Reports.

The key next step to take forward the recommendations in all these reports is the establishment of a fully-funded delivery body for the region, which will be Energy Capital, building on the formal agreement secured in October 2017 to incorporate this within the WMCA structures.

Energy Capital will then take forward the work programmes agreed between the Mayor, the government and the LEPs to deliver the various recommendations, broadly following the timescale set out in Figure 19 below.

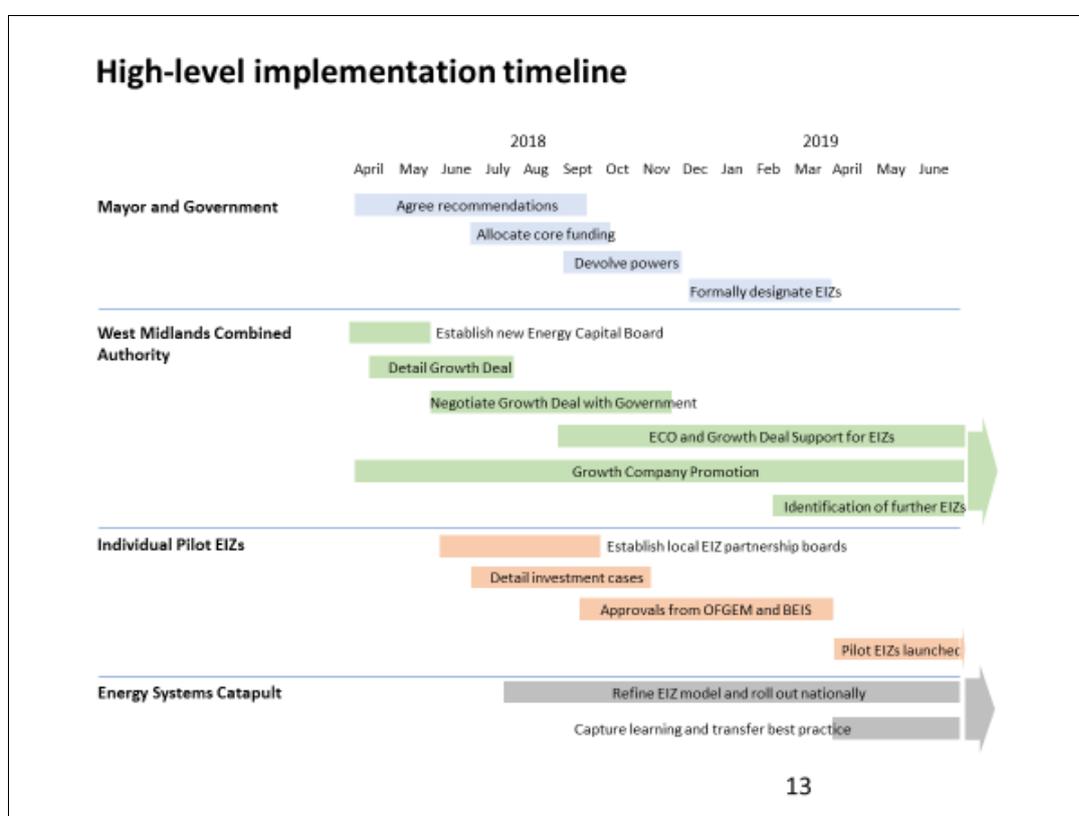


Figure 19 High level strategy implementation timeline

Within WMCA/Energy Capital responsibilities, securing substantial funding (of the order of £500M) to support investment in energy projects across the West Midlands should be a high priority. One way of doing this would be around a cross-sectoral ‘Growth Deal’ centred on the West Midlands emerging ‘new energy economy’¹⁸.

The second priority is to work with government and regulators to detail the EIZ model for the region, working with legal experts to ensure an operational level of detail. The Arup report suggests initially

¹⁸ The cross sectoral aspect is the critical automotive, construction and digital elements constantly referenced throughout this strategy and associated reports.

establishing EIZs as special purpose vehicles (SPVs) which might subsequently take on energy or other regulatory or financial powers, which seems a sensible approach to avoid delaying immediate progress.

The context and framework created by this strategy is designed to facilitate raising a sensible mix of public and private finance: broadly public investment is appropriate where significant strategic innovation risk (and consequent social reward) is present¹⁹ or there are significant social and health issues (such as fuel poverty) to be tackled; private finance should be appropriate where the risks are purely commercial.

A virtue of almost all regional energy projects is, however, that within appropriate regulatory frameworks – which EIZs should provide - most of this funding should be investable with acceptable rates of return to the right parties, albeit over relatively long timescales in some cases. This should limit the need for grant-type funding mostly to innovation and fuel poverty alleviation investment.

¹⁹ The Regional Energy Policy Commission report makes a number of suggestions on allocation of public funding to support EIZs.

Appendix I – Sub-regional mapping reports

Most of the local authorities in the West Midlands have renewables and local energy opportunity maps and studies produced over the past ten years and still hold these: the issue is not knowing what the project opportunities are, it is securing the local political consensus, stakeholder support and finance (within appropriate and predictable environments from the perspective of risk and returns) to make them happen.

This appendix summarises resources known to be available, including the additional Black Country Mapping report commissioned as part of this project to fill in the one major gap in the region.

In particular, studies of relevance to this strategy are:

Heat network studies part financed by BEIS (HNDU) for:

- Canley
- Dudley
- Sandwell (in progress)
- Solihull
- South Staffordshire
- Warwick (in progress)
- Whitley (in progress)
- Several across Birmingham and Staffordshire (see Figure 20 below)

A comprehensive utilities study for UK Central by Peter Brett Associates (in progress)

A detailed study of Coventry's energy requirements by Rolton Group (subject to NDA)

GBSLEP Low Carbon Energy Plan 2016 (Gyron LLP) and associated Master planning study

Wolverhampton Renewable Energy and Carbon Reduction Study, Amec Group^{lxxxviii}

Detailed solar feasibility study for the city of Birmingham

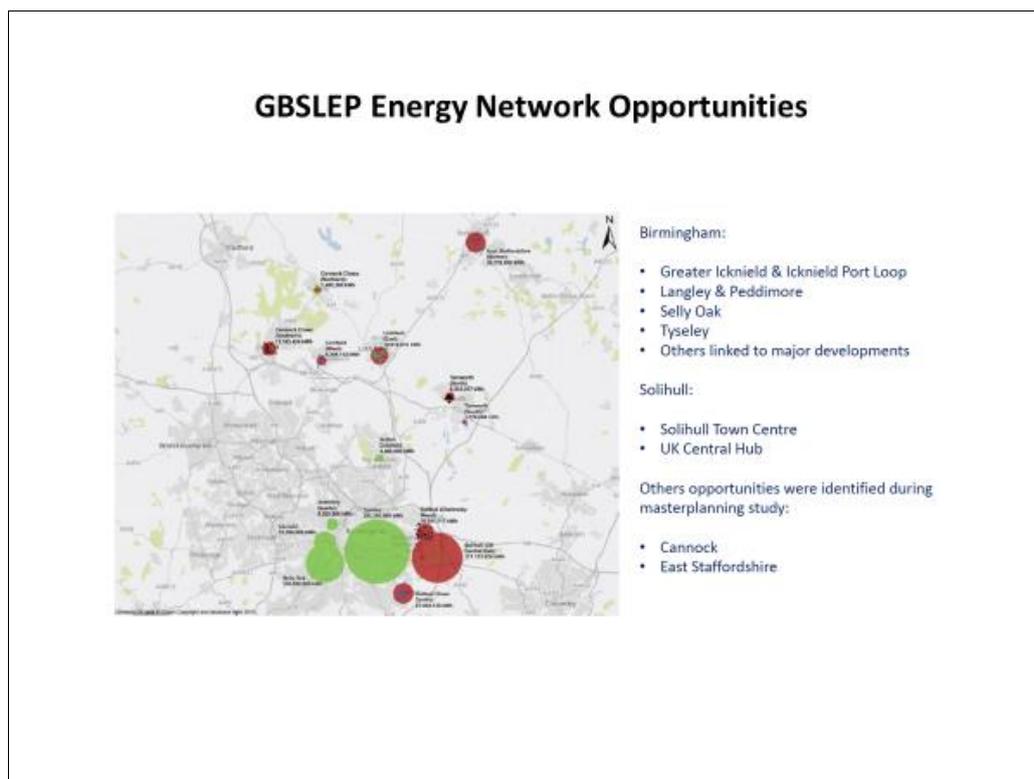


Figure 20 GBSLEP energy network opportunities

First principles renewables opportunity studies covering all technologies including wind, hydro, solar and biomass for Birmingham, Warwickshire and Coventry have also been completed in the past 10 years (by Encraft and EST respectively).

However, the Black Country as a LEP area lacked any overall ‘masterplan’-level assessment of local energy opportunities and demand, and Aecom were commissioned as part of this project to deliver this.^{lxxxix} Selected excerpts from the report are provided below to give an indication of the kind of data now available.

The report looked at:

- Energy demand patterns and magnitudes across the four metropolitan boroughs
- Energy costs for residential and commercial customers
- Technical and economic opportunities for meeting these needs using:
 - District energy schemes
 - Solar PV
 - Battery storage
 - Energy from waste
 - Other renewables/nuclear (although it concluded none of these were viable at any meaningful economic scale)

Detailed maps of demand were produced for each of the four boroughs in the LEP. These are now held at the BCLEP in GIS form and available on request to project developers.

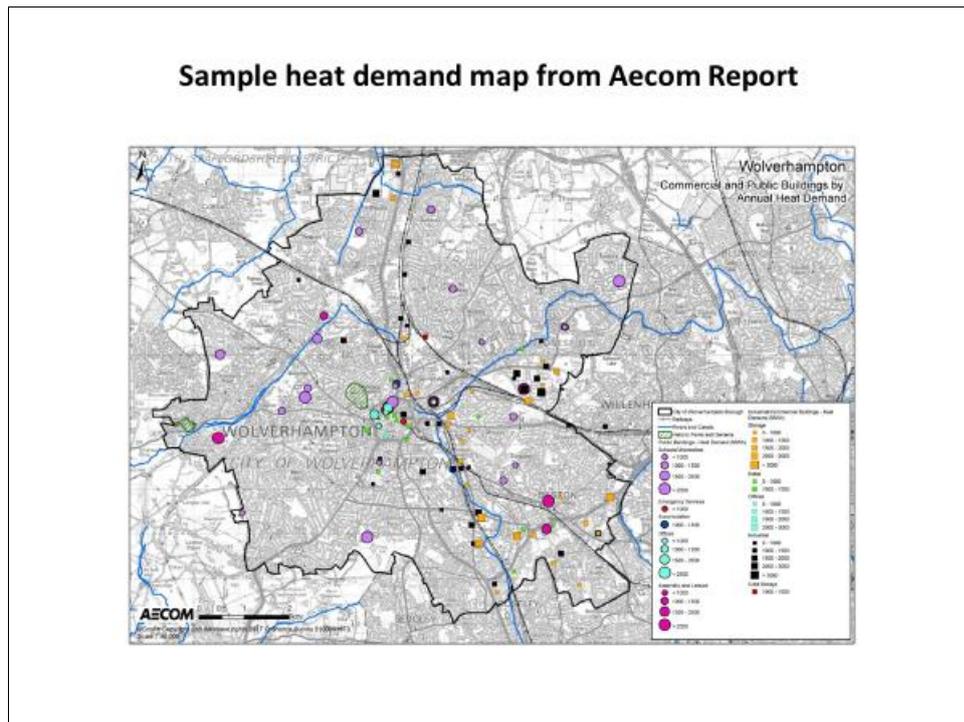


Figure 21 Sample heat and power demand map

Demand maps were used to develop high level business cases for energy from waste and district heating schemes.

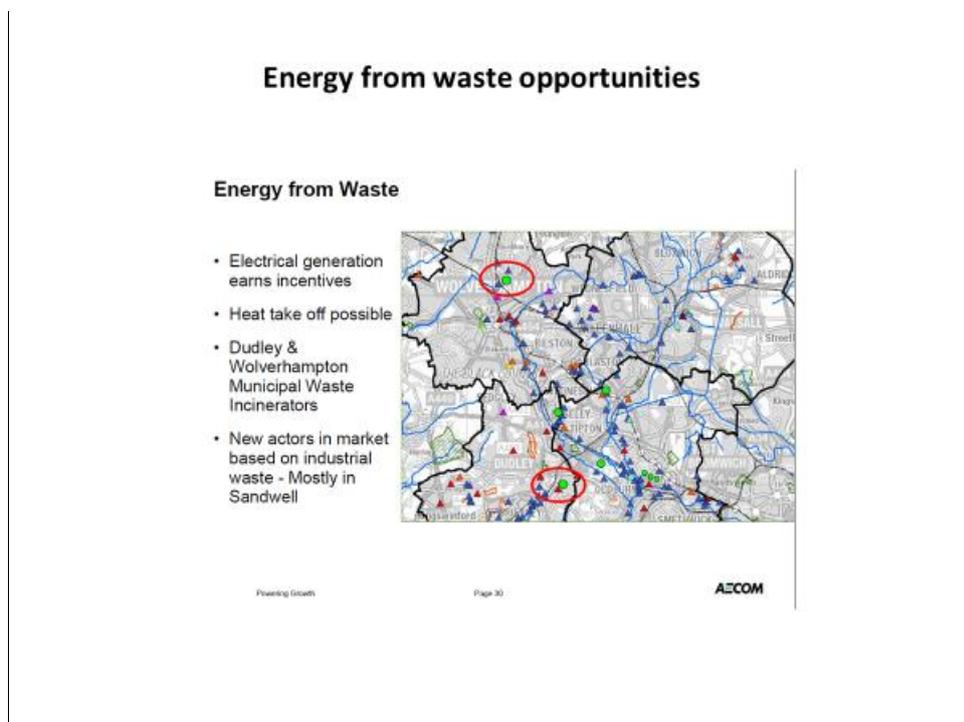


Figure 22 Energy from waste opportunities in the Black Country

Some specific private wire opportunities linked to existing energy from waste schemes were also identified as part of the project, although this also highlighted the scope for regulatory flexes to make this kind of efficiency easier to achieve.

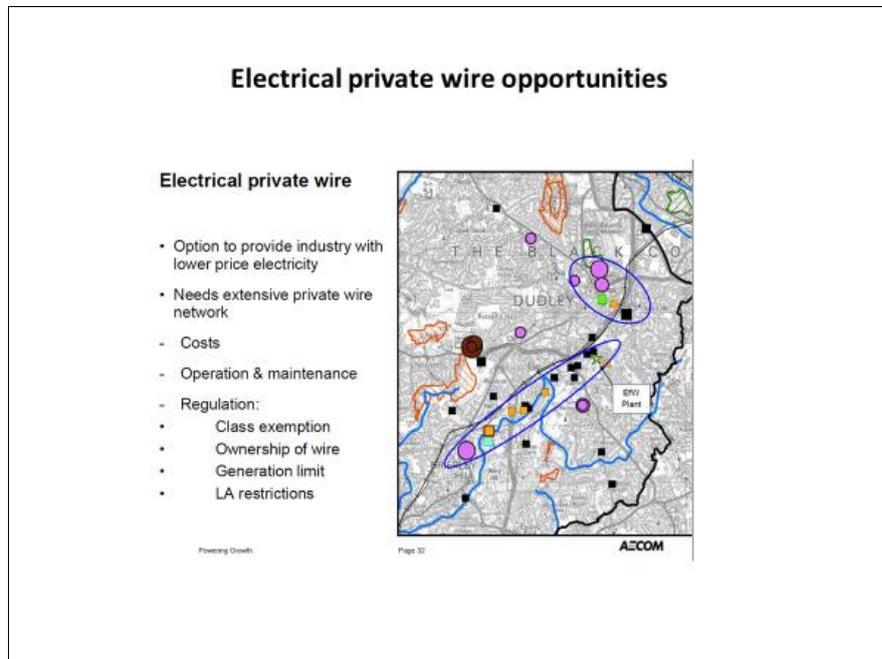


Figure 23 Private wire opportunities in the Black Country

At a high level, the report also identified the large scale solar potential of the region, which has large numbers of warehouses and factories with substantial unshaded roof space. It also noted well over £100M of planning applications had been received for battery storage within the LEP area over the past two years, probably reflecting financial opportunities arising from national Capacity Markets.

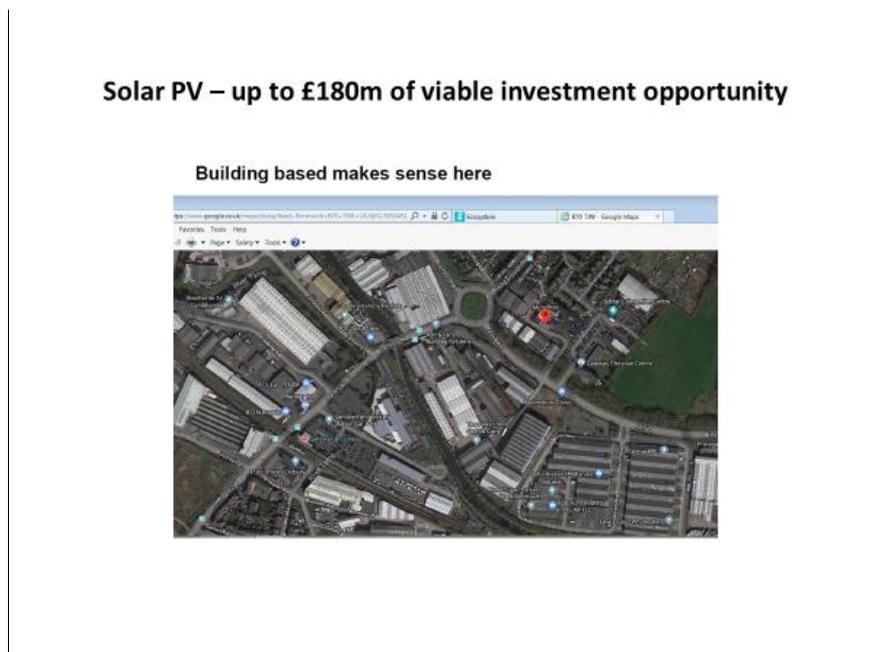


Figure 24 Typical large scale solar opportunity in the Black Country

Appendix II – Pilot Energy Innovation Zones and Investment Cases

Investment cases for the four proposed pilot energy innovation zones are set out in the separate Arup report for this project.^{xc}

For reference this appendix provides outline descriptions of the four EIZs (largely) extracted verbatim from the report of the Regional Energy Policy Commission, March 2018.

The report of the Regional Energy Policy Commission^{xci} focuses on making the overall case for energy innovation zones, while the Arup report provides an initial cost-benefit analysis of the specific zones.

The four potential EIZs described below have been proposed by local communities across the West Midlands and reflect local needs and perceptions of energy system opportunities and challenges. This is in itself a critically important feature and point of departure for EIZs: that they are driven not only by climate imperatives and technical opportunities, but also by local market and customer needs. It immediately makes them distinct to many demonstration and innovation projects in the energy sector and aligned with the general shift towards more customer-centric approaches.

Each proposed EIZ presents distinctive opportunities for energy-system innovation, and each is at a different stage of development. This should help the process of generalising from the West Midlands experience to develop a generic EIZ ‘template’ - meaning an institutional and process model - that could be rolled out nationally. The philosophy is to be inclusive and offer any community the opportunity to nominate an area as an EIZ, provided it meets defined criteria such as willingness to accept innovative low carbon solutions and special regulatory oversight. In this way EIZs should be seen and designed as a privilege for which areas compete, and a mechanism with potential significantly to accelerate energy systems transition nationally.

On the other side of the equation, innovators and government will in turn need to accept the validity, diversity and importance of particular local needs in defining the goals of a given EIZ, even where these needs may not align exactly with national priorities. In some cases it may be possible to meet these needs purely through integrating existing technologies in new ways, and require no fundamental technical or product innovation. Such EIZs may still create new markets and industries simply by providing scale; in other cases pure process or business model innovation may be sufficient. All EIZs will accelerate the transition to a low carbon, more competitive energy system in the UK.

UK Central Hub

UK Central is a well-defined and developed potential EIZ. Local institutional structures to support major investment and regeneration projects already exist; the location is one of the best current opportunities in the world to set the benchmark for the type of mixed use development that can be delivered around a multi-modal transport interchange; and there is strong stakeholder support for innovation. Significant work has already been undertaken to define future energy and utility scenarios and potential local investment incentives and value capture mechanisms.

The UK Central Hub is an economic area which includes the significant infrastructure of Birmingham Airport, the National Exhibition Centre, Jaguar Land Rover, Birmingham International Station and Birmingham Business Park. From 2026 it will also include the High Speed 2 rail station and the enormous mixed use Arden Cross development. Each of the stakeholders has ambitious growth plans that will dramatically increase the level of employment and housing in the Hub area, and support the wider West Midlands economy. In order to support this opportunity Solihull Council formed the Urban Growth Company (UGC) to concentrate public sector investment on removing infrastructure constraints.

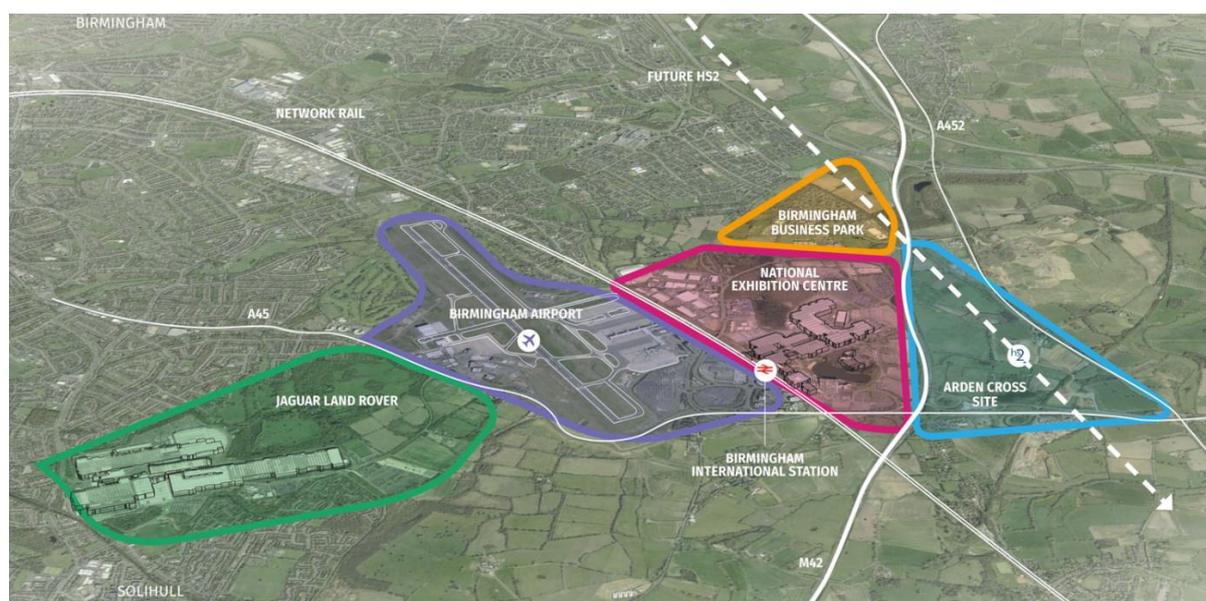


Figure 25 UK Central Hub

UGC has already done considerable work to develop infrastructure plans for the area^{xcii}, and a ‘value capture’ framework of potential funding mechanisms.^{xciii} It is now investigating potential constraints in the capacity of utilities to supply the planned developments and has commissioned Peter Brett Associates (PBA) to analyse current capacity and potential demand over the next 30 years. Initial discussions with Western Power Distribution and National Grid suggest current spare electricity grid capacity amounts to 20–25MW at the Elmdon Primary Substation, but that planned developments may need a further 80MW. This could require an additional primary substation and reinforcement of the local substations. Without this investment the growth will either stall due to power shortages,

or be delivered at a much slower rate, as the developments need to bear the additional costs of upgrading the electricity network.

Electric vehicles could present an even greater challenge to grid capacity. The Hub currently has around 40,000 car parking spaces, which could rise to over 60,000 in the next 20 years. High level estimates procured by UGC suggest that if the Hub installs lots of EV charging points it could require significant additional grid capacity. This estimate is based on private cars only, and does not include any allowance for future electric heavy goods vehicles or aircraft.

No one yet knows exactly how much impact the planned development and electric vehicles will have on electricity demand at the Hub, but it is clear that innovation in supply, control and use must be encouraged if we are to design a system in the most economic way.

One potential solution might be to find alternative funding mechanisms to build additional substation capacity ahead of demand and reserve the capacity for Hub members – similar to the approach of the Ebbsfleet Development Corporation, which is investing £30 million for new substations to supply the new garden city in Kent.^{x_{civ}} Another would be to create an Energy Innovation Zone to encourage cheaper and more innovative solutions. The Hub has many energy intensive users with large peaks and troughs in demand, and it may be possible to avoid or at least minimise capacity upgrades through innovative approaches.

The Hub also has large heating and cooling loads that could also be integrated with the electricity grid and wider systems such as waste. The scale and concentration of its electricity and thermal demand creates a huge opportunity for clean energy innovation and building efficiency that is probably unmatched in Britain over the next two decades. The Hub has [just started a Heat Network Techno-Economic Feasibility Study, which is due to report later this year.](#)

The Hub is only one of UK Central's four development zones. The others are North Solihull (Zone 2, a £1.8bn regeneration programme), Solihull Town Centre (Zone 3, a major retail, office and leisure destination), and Blythe Valley Park (Zone 4, a business park). Each has its own energy challenges and priorities. North Solihull, for example, must regenerate large amounts of 1950s/60s housing stock in Chelmsley Wood, where there are high levels of fuel poverty. Solihull Town Centre has recently completed a feasibility study that identified a low-carbon heat network opportunity that would be both technically and economically viable. Blythe Valley has the potential to develop a hydrogen hub. Each could therefore form its own EIZ, but there may also be a case for creating a single overarching EIZ to cover all four UK Central development zones.

Tyseley and Birmingham

Birmingham is also a well-developed potential EIZ, and the context is much more an established and dense urban environment, so the needs and opportunities are clearly distinct from those at UKCentral Hub, which is essentially greenfield. There is not yet a dedicated institutional structure congruent with the potential zone. There is however strong stakeholder and community engagement; a well-defined and large local market; a portfolio of energy innovation and investment projects at the Tyseley Energy Park; and 35MW of existing waste-to-energy power plants.

Birmingham city centre will undergo massive redevelopment over the next 15 years^{xv}, particularly around the HS2 Curzon Street station (£900 million), Smithfield (£600 million), Snow Hill, Typhoo Wharf and Arena Central.^{xvi} The area also suffers serious air pollution and the City Council is developing plans for a Clean Air Zone to start by 2020. This will require the construction of a substantial clean energy transport refuelling infrastructure including hydrogen and electric vehicle charging at scale.

There is little space available for vehicle recharging in the city centre. Part of the solution may be to use the industrial land available at Tyseley, 5km east of the city centre, to produce clean energy for the city centre and local communities, and power a new clean transport refueling infrastructure. Tyseley is already the site of the city's energy-from-waste (EfW) plant, which burns 350,000 tonnes of waste per year to generate 25MWe. The 16 acre industrial site next door is being developed as Tyseley Energy Park by its owners, Webster and Horsfall, and partners including the University of Birmingham, the City Council and the Local Enterprise Partnership.

Tyseley Energy Park already hosts a 10MWe biomass generating plant and private wire electricity supply, and is also the depot for a growing fleet of rent-by-the-hour electric taxis – most of the city's taxi drivers live nearby. A clean energy refueling station is being built to provide EV charging, hydrogen and CNG for the city's bus fleet, and for the refuse vehicles that supply the EfW plant.

Future plans include recycling waste heat from the EfW plant through a heat pipe to the Birmingham District Energy Scheme in the city centre, which is owned and operated by ENGIE. This route would run through areas of dense housing including many energy poor households. There may also be synergies with new transport initiatives such as the proposed tram route to the airport, and refuelling and recharging infrastructure for the city.

Key energy challenges and opportunities for an EIZ based around Tyseley and the City Centre include:

- Integrating energy and transport infrastructure developments at a time of rapid change in both sectors
- Optimising use of the city's 350,000 tonnes of waste which currently pass through Tyseley annually, ensuring neither waste nor energy market regulation inhibits delivery of sensible outcomes
- Making use of the latest clean technologies already being developed and deployed by the Universities of Birmingham and Aston at Tyseley and elsewhere
- Making best use of the city's planning powers to optimise the energy performance of new and existing buildings as more than £2 billion of construction investment flows into the city

- Ensuring the local community is fully engaged in the major changes proposed, and actively contribute to the success of the zone.

The key stakeholder group for this EIZ includes the Birmingham City Council Planning and Regeneration Team, along with key city centre development stakeholders; ENGIE; the University of Birmingham; and Webster and Horsfall. The Tyseley Energy Park already falls within the Tyseley Energy & Environmental Enterprise District, and the Council has decided it will become Birmingham's Energy and Waste nexus.

Tyseley Energy Park has the potential to become an innovative demonstrator that integrates energy vectors including electricity, heat, liquid air, hydrogen. The site will also be home to a University of Birmingham / Fraunhofer Institute shared research platform and Energy Skills Academy.

Work already completed or ongoing includes:

- Birmingham District Energy Scheme (owned by ENGIE)
- Clean Air Zone / vehicle refueling recharging studies
- Masterplans for the Tyseley site by owners Webster and Horsfall/Energy Capital
- Heat network project at feasibility part 1 stage
- City solar feasibility study completed

Black Country

As the seat of the industrial revolution in the late 18th century, the Black Country can claim to be the world’s first ‘energy innovation zone’, and this heritage perhaps explains the enthusiastic local support for the proposed EIZ. But of the four potential EIZs, the Black Country is the least developed, and so provides the greatest opportunity to demonstrate a complete model of how an EIZ can be defined, developed and implemented. There is a strong desire in the area to lead the energy transition by securing investment in modern, clean energy systems which deliver power at globally competitive costs and thus support delivery of the national industrial strategy. The EIZ is intended to provide a focus for this, specifically within the geography of the existing Enterprise Zones.

The Black Country Enterprise Zones comprise a portfolio of sites in Dudley, Wolverhampton, Darlaston and i54 - Wolverhampton North, spread over 120 hectares.^{xcvii xcviii xcix} The focus of these zones is to promote and attract advanced manufacturing in the Black Country - by offering competitive advantage to manufacturers who locate there - especially targeting aerospace, automotive and high added value engineering.

There are already major manufacturing companies located on the i54 site, including JLR, Moog, Eurofins and ISP. This enterprise zone is known as one of the most successful in the country, and total investment of more than £1.5 billion is expected across the Black Country over next 15 years.

A key competitiveness issue for the Black Country is the cost of energy, and in particular the energy used in metal processing. Manufacturers using electricity to drive their processes are keen to secure reliable and high-quality energy supplies with predictable and highly competitive pricing.

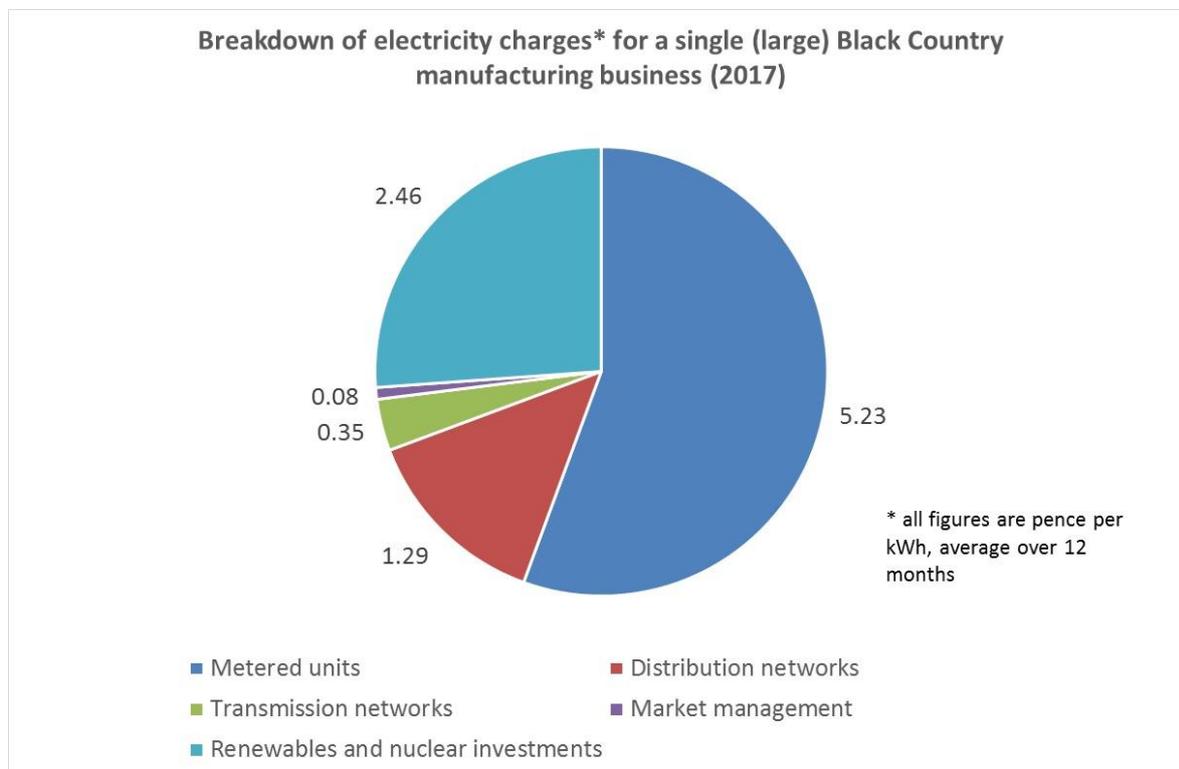


Figure 26 Breakdown of electricity charges for a large regional manufacturing business, 2017.

Figure 26 shows a breakdown of the electricity charges paid by one large Black Country manufacturer in 2017.^c Only 56% of the cost of energy for this manufacturer is made up of the payment to the energy supplier. The remaining 44% is the cost of infrastructure (distribution and transmission use of system and capacity charges) and a share of the costs of the clean energy transition in the form of renewables and nuclear investment levies (ROCs, FITs and Contracts for Difference).

This breakdown of charges compares unfavourably with the prices paid by similar industries in competitor economies, where differential energy pricing is an instrument of industrial strategy. In countries such as Germany, the Netherlands, France, Italy and Denmark^{ci}, some industries pay less towards infrastructure and energy transitions and domestic consumers pay more. The resulting contrast in electricity costs for energy intensive industries in the UK, Germany and France is shown in Figure 27 .

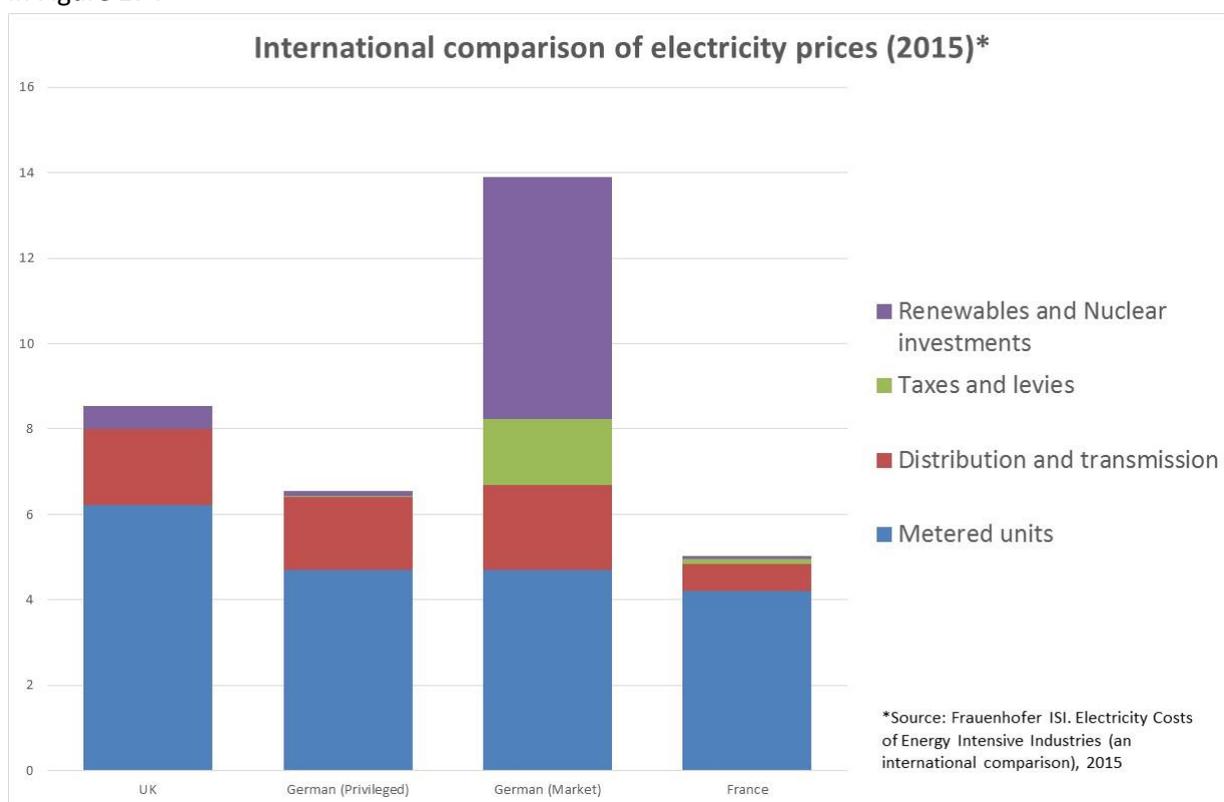


Figure 27 International comparison of electricity prices of energy intensive industries, 2015.

If a Black Country EIZ were to propose lowering industrial electricity costs through differential pricing as in Germany, it would in effect mean loading that cost onto domestic consumers, which would be politically unacceptable in a region with such high levels of fuel poverty. The prospective role of the Black Country EIZ would therefore be to reconcile these competing and legitimate concerns through clean energy innovation.

There are specific opportunities for local generation and supply in the Black Country, and in particular a cluster of waste-to-energy firms is developing close to the Darlaston sites that need to be integrated with the LEP’s plan for the region. Private sector investment in this type of activity could be encouraged through simplification of supply exemptions; support for manufacturers in

managing relationships with the DNO; local incentives for energy from waste technologies; and the public sector taking an active role in matchmaking between potential generators and industrial energy users. In addition, given the high density of similar small- and medium-sized metal processing businesses (more than 250 across the region) there is scope for the Black Country to pioneer the collective use of smart energy data in optimising energy efficiency, for example by subsidising or mandating installation of smart sub-metering in industry

Coventry and Warwickshire

Coventry and Warwickshire is an example of a potential EIZ driven by a small number of stakeholders - essentially JLR and Coventry City Council - with a tightly defined agenda: to satisfy strong electricity demand growth and develop infrastructure to support connected autonomous vehicles (CAVs). An EIZ could therefore be used as an effective mechanism to ensure innovation and carbon reduction are effectively built into development plans, and these are properly scrutinized and integrated into local infrastructure.



Figure 28 Proposed Coventry and Warwickshire EIZ

Coventry and Warwickshire EIZ covers Whitley, Baginton and wide area around Coventry airport, incorporating land in both Coventry and Warwickshire. This area is well served by transport networks, and significant growth is planned through developments such the £250 million Coventry and Warwickshire Gateway scheme, and the £500 million development of Whitley South – a 60 acre engineering technology hub next to Jaguar Land Rover’s global headquarters.

There is little spare capacity in the local electricity network, yet demand is forecast to rise significantly over the next decade. Coventry Central and Coventry and Warwickshire are reaching the limits their circuits can supply, requiring major reinforcement works to raise capacity. The city council has investigated options including a new 132 kV bulk supply point to the south of Coventry and a new super-grid transformer, which would involve significant capital expenditure. Current regulations do allow capacity to be built ahead of demand, but this requires someone to bear the risk, and if no entity is willing to, then it could hold up development.

Other areas of planned expansion in Coventry and Warwickshire are Gaydon and Ansty. Jaguar Land Rover and Aston Martin have plants at Gaydon, which suffers grid constraints that would limit the growth plans of these and other companies. Ansty has shown considerable growth in recent years and

has potential for large development in the future. Both sites need to ensure adequate power supply to enable future development.

Like UK Central Hub, these areas of economic growth and grid constraints need to develop timely and cost effective clean energy solutions, which an EIZ could facilitate.

Appendix III – Strategy consultation and approval process

This strategy is being published in March 2018.

Feedback and comments are welcome and encouraged and should be sent to:

enquiries@energycapital.org.uk

The deadline for receipt of comments is **5pm on Monday 21 May 2018**

Subject to capacity and the level of feedback, the aim will be to publish a response to comments received in June.

The strategy will be formally submitted to all three LEP Boards and the WMCA at meetings from June onwards for adoption.

Appendix IV – Attendees at the stakeholder engagement event

A stakeholder engagement event was held on Tuesday 6 March 2018 at the Energy Systems Catapult in Birmingham. The event was open and widely publicised and every local authority in the region was invited directly, along with neighbouring LEPs, all existing Energy Capital partners, regional universities and members of relevant regional networks.

The following organisations attended and contributed, and their feedback helped shape this report.

Act on Energy
AECOM
Aston University
BEIS
Birmingham City Council
Cadent
City of Wolverhampton Council
Climate KIC
Coventry City Council
Daikin Air Conditioning UK Ltd
Dudley MBC
E.ON UK
Ecuity
EEF Ltd
Energy Systems Catapult
EnergyHarmonics Ltd
Engie UK
Greater Birmingham and Solihull Local Enterprise Partnership
International Synergies Ltd
Lichfield District Council
Manufacturing Technology Centre
MEBC
Midlands Engine
Orsted
Sandwell MBC
Severn Trent
Solihull Council
Solihull MBC
Sustainability West Midlands
Tyseley Energy Park
University of Birmingham
Birmingham Energy Institute
University of Warwick
University of Warwick
WPD

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- ^{xv} This data is sourced from BEIS, DECC, the Digest of UK Energy Statistics, The Office of National Statistics and OFGEM. GVA figures are from a SIC code analysis by Charlie Hopkirk for BCLEP.
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https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/533056/Fuel_poverty_Sub-regional_report_2016.pdf
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https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/533056/Fuel_poverty_Sub-regional_report_2016.pdf
- ^{xl} <https://www.westernpower.co.uk/docs/About-us/Our-business/Our-network/Strategic-network-investment/West-Midlands/West-Midlands-scenarios-accompanying-report.aspx>. Note that this report covers the West Midlands as defined by WPD, which excludes Coventry and includes large parts of the Marches and areas to the South West which have never been in any government definition of the West Midlands, such as Gloucestershire. However, having said this the net effect in terms of gross housing investment figures and associated demand (for example) is negligible, as the total planned new housing is around 200,000 homes for either geographical definition. In other words, the net economic activity covered by the report is very similar, and the major economic hubs of Birmingham, the Black Country and UK Central and Solihull are common to both regional definitions.
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