

Building a governance framework for coordinated Local Area Energy Planning

CATAPULT
Energy Systems



UK Research
and Innovation



Contents

1. Executive summary	4	5. What could be the value of coordinating Local Area Energy Planning?	24
2. Introduction	10	5.1 Summary of coordinated LAEP value to key stakeholders across local, regional and national scales	26
3. What is Local Area Energy Planning?	12	6. How can coordinated Local Area Energy Planning be delivered?	30
4. Who are the key stakeholders involved in Local Area Energy Planning?	13	6.1 Strategic Policy Coordination	31
4.1 Heating supply chain require evidence of demand to allocate resource efficiently	13	6.2 Policy Instrument Coordination	32
4.2 ESCOS are looking for strategic net zero opportunities at scale	15	6.3 Organisational coordination	33
4.3 Future proof decisions about bus fleet decarbonisation depend on local and regional infrastructure plans	16	6.4 Rule based coordination	34
4.4 Regional system stakeholders need a consistent evidence base to inform net zero infrastructure development	17	6.5 Summary	37
4.5 National Stakeholders are unable to articulate the implications of decisions being made locally	18	7. What actions need to be taken to enable coordination?	38
4.6 Various shapes and sizes of investment will be required	20	8. Acronyms	42
4.7 Common themes and challenges	20	9. References	43
4.8 Summary	21		

1. Executive summary

Energy Systems Catapult’s ‘Building a Governance Framework for Local Area Energy Planning’ used a combination of stakeholder interviews, market research and whole system modelling to explore how coordinated local area energy planning could deliver significant financial benefits on the road to net zero. It also explored in detail the future policy, regulatory and governance reform that is needed to deliver it.

A Local Area Energy Plan (LAEP) sets out the change required to transition an area’s energy system to net zero in a given timeframe. This is achieved by exploring potential pathways that consider a range of technologies and scenarios, and when combined with stakeholder engagement leads to the identification of the preferred cost-effective pathway to achieving an area’s net zero goal.

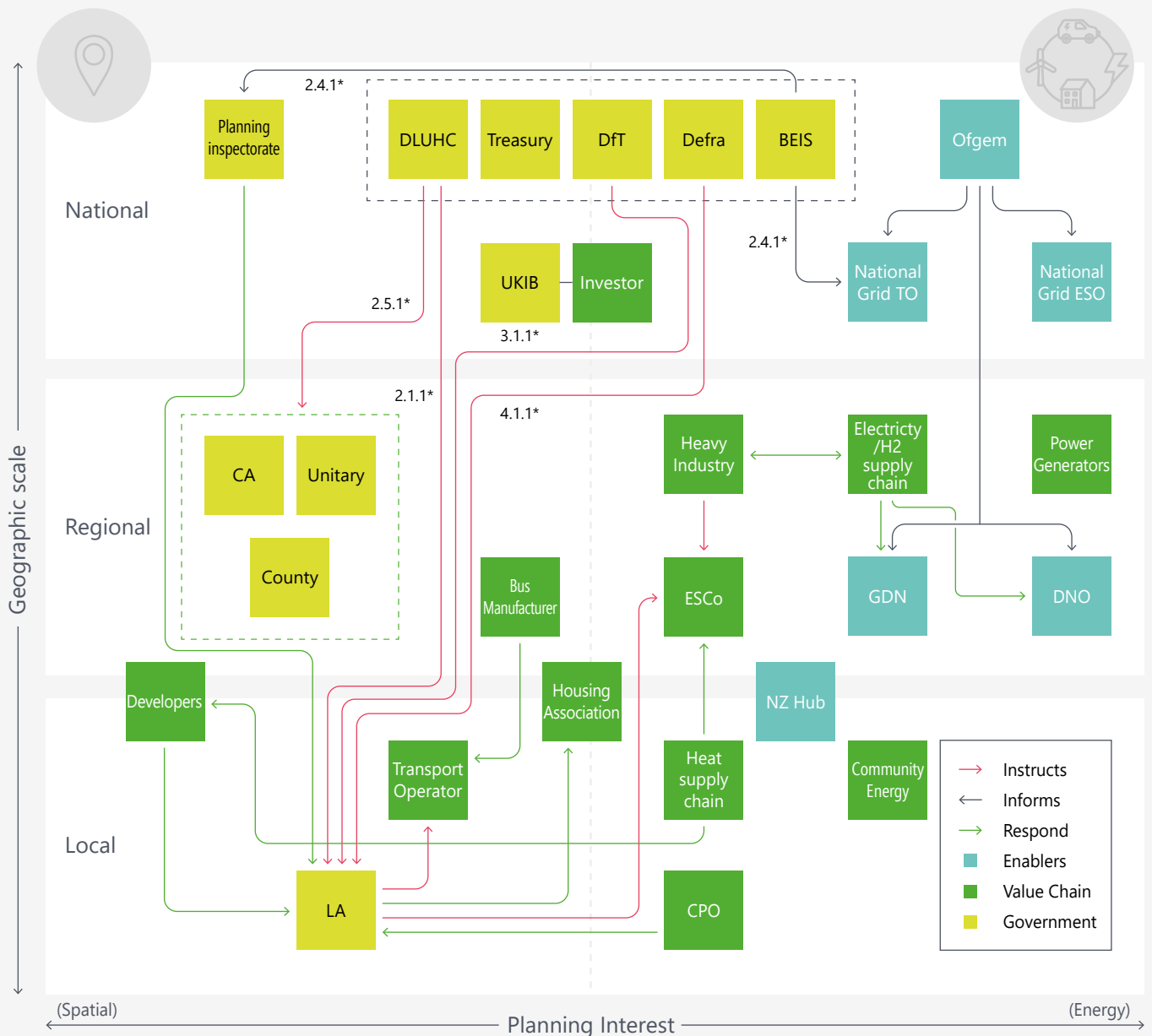


Figure 1: highlighting the complexity of decision making in the net zero value chain

*See table 4 on page 40

As the UK moves towards decarbonisation, the level of interaction between local interventions and sectors will increase – home heating will rely more on electrification, electric vehicles will require charging, public fleets may require hydrogen fuel cells and industrial clusters may need hydrogen with carbon capture and storage.

Exploring the comprehensive interactions between stakeholders, private and public, across local, regional and national scales revealed the contradictory and divergent plans, objectives, incentives and decisions across spatial and energy planning frameworks as outlined in Figure 1.

Currently, the decisions made by these stakeholders are often made in isolation and lack coordination with the wider energy system. Installers, housing associations, energy services companies and others agreed that coordinated LAEPs would help them to make more informed and strategic decisions. These stakeholders also revealed they are often responding to conflicting signals, both locally and nationally, which deter them from making longer-term investments. Similarly, opportunities to achieve economies of scale are hampered by the lack of cross boundary strategic planning.

These local opportunities and decisions are becoming increasingly reliant on the enabling physical infrastructure, which will require expansion, adaption and/or decommissioning. The current national level forecasts, transposed down to a regional level, used to inform these energy planning decisions struggle to articulate the implications of decisions being made at the local level. They are also based on competing technologies between regulated utilities who ultimately have legal duties and commercial objectives to satisfy.

The lack of coordination between local and regional frameworks (spatial and energy) was highlighted as a key issue. As a result, local level decisions are made without consideration of the existing and future network infrastructure (and vice versa), neighbouring authorities are missing opportunities to coordinate on potential cross boundary net zero opportunities and local policies are subject to the constraints imposed by the regulated network operators in certain areas.

In addition, some of the nationally significant infrastructure decisions required for net zero will be made outside of the frameworks mentioned, by the Secretary of State. These decisions are guided by National Policy Statements. Although legislative provisions within the Planning Act exist to ensure decisions have regard to local impacts, the statements themselves are not planned with a local context. This raises the level of uncertainty over future strategic infrastructure investments.

Aggregating LAEPs up to a regional level could help to address this uncertainty and coordinate whole system network planning through providing important contextual information with a granularity otherwise lost at national level. This will however rely on more than the incremental economic drivers currently used for network options assessments and network asset management.

The benefits of a planned and coordinated approach are likely to be significant. ESC's whole system models have been used to explore the impact of local planning and coordination on the choices available and decisions made by the stakeholders discussed.

The modelling analysis reveals:

- without local planning and coordination to manage a higher energy demand, the power system could end up increasing by almost 40% in capacity terms and require increased compensatory investments in production, storage transmission and distribution to help balance supply and demand.

- LAEP can proceed now without causing significant costs to the wider system. The compensatory costs associated with uncoordinated LAEP only begin to be realised when a critical mass of LAEP (over 90 – or 25% of districts) are implemented in an uncoordinated way. These costs range from national infrastructure to investment in buildings, transport and decentralised power. Appropriate coordination measures will eventually be required and could deliver significant benefits and cost savings. Coordinated LAEP is likely to deliver substantial whole system cost savings, in the order of 1% GDP, relative to an organic, unplanned approach.
- the total energy system discounted cost saving from this approach could total £252bn between 2025 and 2050.

A consistent local evidence base, established through LAEPs, is the starting point for coordinating local, regional and national decisions but will require new processes and governance. A range of coordinating mechanisms are required for both for the creation and implementation of LAEP which ultimately seek to:

- better align spatial and energy planning frameworks.
- incentivise coordinated action across local authority boundaries
- address key tensions between local level ambition and regional regulatory price control
- enable aggregation of LAEPs to a scale which can inform strategic infrastructure investment and policy

The success of coordinated LAEP starts with the creation of high quality LAEPs as a material consideration at the local level. This will require resources within LAs supported by a technical assurance facility and reporting process, to support decision making on current policy priorities across heating, transport and industrial decarbonisation.

As illustrated in Figure 2 there is a clear need to join up energy and spatial planning responsibilities.

A statutory enhanced partnership (SEP) is a mechanism used to formalise the relationship between local authorities and private sector operators. SEPs have been used predominantly in the transport sector to support the successful delivery of national Government initiatives by setting out clear and specific service level plans and outcomes, however this type of arrangement could be used with respect to local authorities and network companies. DNOs have been engaging proactively with LA's through the Energy Networks Association's (ENA) Open Networks forum, and whilst there are requirements for DNOs to engage on capacity, there are no formal requirements for DNO/GDNs to engage with LAs on future energy planning, running the risk of misaligned strategies. We envision a place for SEPs to deliver on 3 key targets, namely – transparency, risk, and investment.

Incentivising the aggregation of LAEPs through existing regulatory measures and formal partnerships could help create a mutual understanding of the investments and risk mitigation measures required. Going forward, these partnerships should be complemented by the development of whole system asset management decision making frameworks, informed by LAEP.

High quality LAEPs aggregated to regional levels can then act as an evidence base to inform regional whole systems energy planning and cluster decarbonisation.

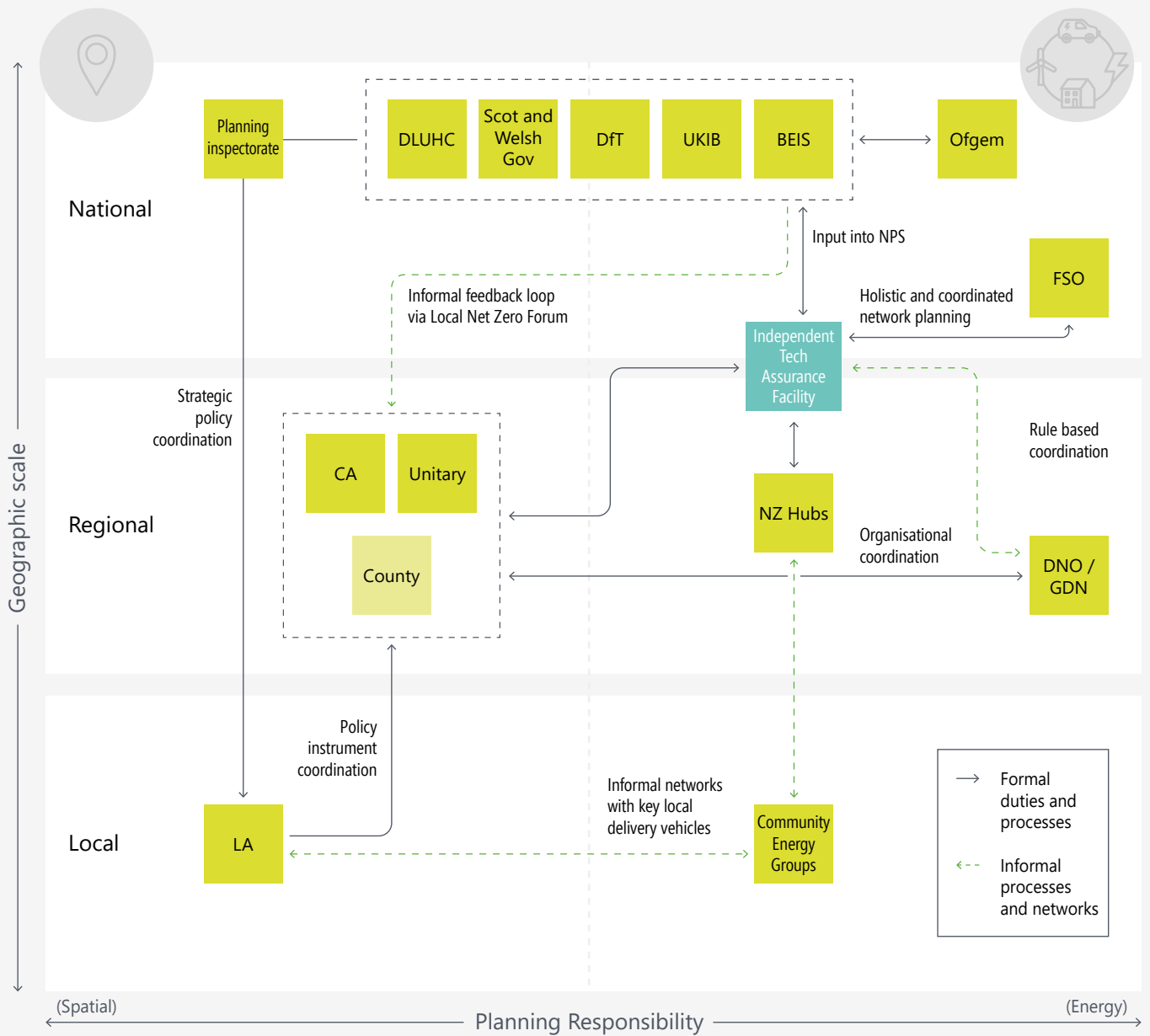
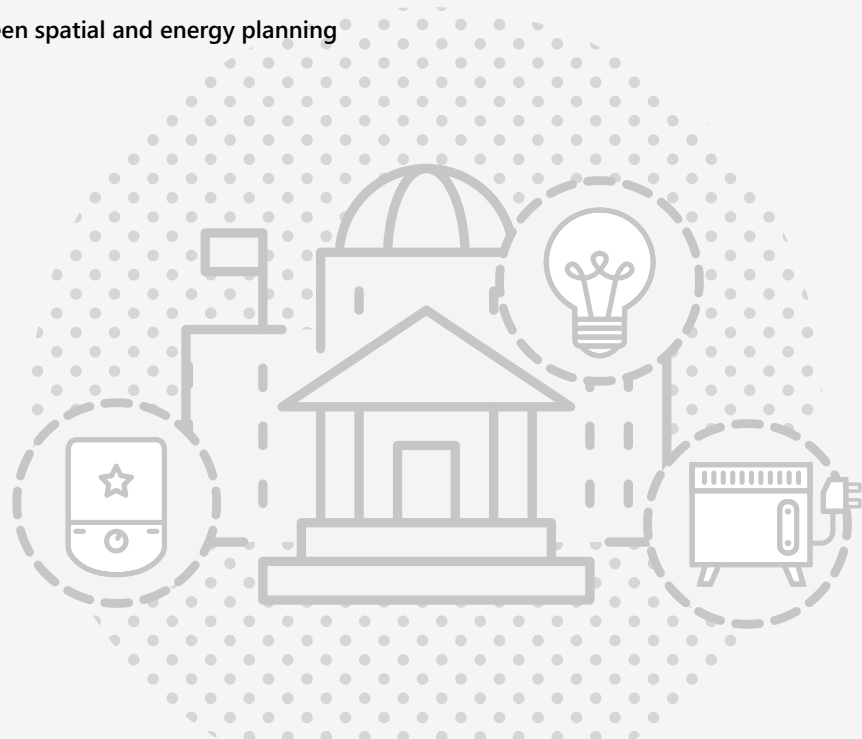


Figure 2: illustration of governance framework between spatial and energy planning



Actions

1) Enable local authorities to support with strategic policy coordination by rolling out LAEP

- ▶ Our analysis has shown that planned local decarbonisation is likely to be lower cost than an organic, unplanned approach, perhaps by as much as £252bn by 2050.
- ▶ Coordination will be required eventually, but only once there is a critical mass of over 90 district level LAEPs being implemented.
- ▶ The evidence from a robust set of LAEPs can support national policy decisions across heating, transport and industry now to ensure cost savings in the future.

2) Planning frameworks will need to do more to support net zero

- ▶ The NPPF is a fundamental framework which supports key and sensitive policy areas. Net Zero will require bold changes to existing processes
- ▶ Introducing a statutory duty and acknowledging LAEP within the NPPF is required to ensure decisions within existing frameworks are coordinated.
 - This should be backed by funding and support for LAs to deliver LAEPs
- ▶ The modelling from this work highlights that coordination between spatial and energy planning could deliver significant benefits

3) Provide multidisciplinary resources into LAs to support with LAEP

- ▶ BEIS' recent heat network zoning consultation impact assessment indicated the provision of 510 FTE zoning coordinators, and DfT's EV infrastructure strategy has included up to £50m to fund the resources needed in local authorities.
- ▶ Support should be expanded/ coordinated to support the deployment of multidisciplinary resources within local authorities.
 - This could for instance take the form of new posts within LAs to liaise with network operators, deliver low carbon generation and introduce dedicated teams to lead retrofit/EE/heat pump rollout programmes
- ▶ LA's are under significant resource constraints. As such, this should be complemented by appropriate incentives e.g. funding allocation for forming joint LAEP decision making groups/committees to make best use of resources available.

4) LAEPs should be an essential piece of evidence in the RIIO process

- ▶ The regulatory framework will need to be robust in the face of inevitable uncertainties as well as potential vested interests.
- ▶ Ofgem should shape and lead a robust process in collaboration with network companies to build upon coherent strategic decisions across their networks based on LAEPs, and do this in a way that delivers maximum value for the wider energy system transition.
- ▶ New processes to coordinate across the whole system will be required to ensure decisions are made based on comparisons between low carbon gas, other vectors and full system value

5) Independent coordination at the regional level required to ensure lowest cost of net zero delivered

- ▶ In the short-term, independent technical assurance is required to support with the creation of high quality LAEPs. A foundation of robust LAEPs is necessary for regional coordination across heat, transport and industry.
- ▶ In the medium term, coordination will require greater steer and influence from a sub-national level, coupled with the functions and responsibilities outlined in this report to enable coordinated network planning across regions.
- ▶ A decision on this function is required from BEIS and Ofgem, to clarify who will be responsible for understanding how LAEPs fit together across regions
- ▶ Processes such as those contained within the Localism Act can set a precedent for enabling LAEP to feed into national decisions on net zero infrastructure planning.

6) Expand the role of net zero hubs to support with LAEP project development and investment

- ▶ Informal frameworks which facilitate lessons learnt between local and national levels are required and the local net zero forum should harness the knowledge acquired through Net Zero Hub activities
- ▶ Net Zero Hubs also have experience of project delivery and should have their role expanded to support LAs work/connect with community energy groups to serve local areas, with tailored local delivery vehicles and offers.
- ▶ This will certainly need greater allocation from revenue funding budgets, and additional support for Net Zero Hubs to build and coordinate project portfolios

7) Ofgem to commission further evaluation of statutory enhanced partnerships for delivering coordination

- ▶ RII02 business plans highlight commitment from network companies, but this needs to be consistent across all regions to ensure fair distribution of resources and support
- ▶ Better and more consistent coordination between local authorities and network companies is required, and statutory enhanced partnerships have been highlighted as a potential supporting mechanism
- ▶ However, it remains unclear whether this should be statutory. Further evaluation is required to confirm.



2. Introduction

Many of the decisions and investments required to deliver net zero - in the built environment, in new infrastructure and in transport systems - have a strong local dimension. Local leadership is therefore critical. Progressive local authorities have already been delivering projects and initiatives linked to net zero, including developing Local Area Energy Plans (LAEP) to build an evidence-based understanding of what needs to be done to deliver net zero at a local level. In parallel, there are also ongoing discussions on how the existing powers that local authorities possess can be leveraged to support a quicker energy system transition. This has led to proposals for new frameworks for local leadership and coordination of net zero investment and actions (UK100, 2021) based on establishing statutory, and in some cases contractual, mechanisms between local and national policy makers.

Energy Systems Catapult's work to develop and test the concept of LAEP suggests strongly that Local Authorities are well placed to take on a greater leadership responsibility for net zero planning. They have existing roles and responsibilities in domains (e.g. the planning system in relation to the built environment) that are key for net zero. Crucially, local authorities also have democratic accountability, and links to community stakeholders (ESC, 2021). However, a key remaining challenge is the development of a coherent and nationally agreed methodology for preparing LAEPs so that varied plans, declarations and emergencies can be converted into coherent regional and national plans and ultimately actionable delivery programmes (Gudde, Oakes, & Cochrane, 2021).

Reaching a conclusion on the exact requirements of local authorities is challenging when considering the devolved governments of Scotland, Wales and Northern Ireland's responsibilities for local government, their varying composition, existing statutory duties and capacity (Kuzemko & Britton, 2020). Local authorities are under considerable resource constraints and any new statutory duties to deliver LAEP would require adequate funding and resources (LGA, 2021). However, this is difficult to justify without a clear understanding of the potential impact of local transitions on supply chains and the prevailing energy system (Cowell, 2017). The implications of a locally driven unplanned transition on the national system are not clear, nor are the impacts of a locally planned system without a level of regional or national coordination.

Net zero is forecast to require £40bn (PWC, 2020) of annual investment across power grid, buildings, industry, transport and digital up to 2030. Much of this investment will be delivered by private sector actors (e.g. regulated network companies, building owners, transport providers etc). Clear and agreed co-benefits must be understood and realised through both formal and informal relationships between local authorities, communities, supply chains and energy system stakeholders, and will be essential to ensuring more investment is channelled into and informed by LAEP.

Plans are generally used to introduce a degree of coordination into decision making by a range of bodies (public and private sector) operating in markets and/or regulated environments. They are used to shape and influence individual decisions that remain the responsibility of a range of different actors. LAEPs provide an evidence-based approach to assessing choices and building coherent net zero strategies.



LAEP will require an appropriate 'governance framework' for their use and implementation – that is the set of powers, duties, guidance and processes through which the plans actually impact on and influence a myriad of decisions made by the full range of relevant actors on an ongoing basis.

This report aims to build on previous insights by considering the objectives of multiple key stakeholders required for LAEP, and whether LAEP can support with the delivery of these objectives. The objectives of these stakeholders are guided by various duties, planning responsibilities and market incentives. A delivery framework for how LAEP could be integrated and coordinated within these frameworks is provided, along with a modelling exercise to explore the value in doing so.

3. What is Local Area Energy Planning?

A LAEP sets out the change required to transition an area's energy system to net zero in a given timeframe. This is achieved by exploring potential pathways that considers a range of technologies and scenarios, and when combined with stakeholder engagement leads to the identification of the preferred cost-effective pathway to achieving an area's net zero goal. A LAEP identifies low regret near-term projects and activity to begin the area's net zero transition, followed by a long-term view of how the area could decarbonise.

The scope of the LAEP covers the current energy consumption as well as the projected consumption in a defined area to 2050, primarily focussing on the area's built-environment (all categories of domestic, non-domestic, commercial and industrial buildings¹⁷) and some aspects of energy used for transportation. The Ofgem method summarises this by stating that the LAEP assesses *"what is the preferred combination of technological and system changes we can make to the local energy system, to decarbonise heat and local transport and realise opportunities for local renewable energy production?"*.

A LAEP, therefore, does not currently provide for all sources of CO₂ emissions for an area; it excludes emissions sources such as aviation and shipping, agriculture and land-use.

A LAEP provides a level of detail comparable to an urban masterplan. It provides a proposed future layout for an area rather than providing a detailed schematic that sets out how each part of the area would be designed and built. More detailed work would be required to deliver specific elements of a LAEP. As an example, a LAEP identifies a zone that is best suited to a district heat network by assessing the types of buildings in the zone, their characteristics, and density; however, to deliver the district heat network it would require a full feasibility assessment by an appropriately qualified installation/design company.



4. Who are the key stakeholders involved in Local Area Energy Planning?

The stakeholder landscape for LAEP is complex, with both the public and private sector required for delivery and implementation. The focus for this report is on stakeholders identified in Government net zero policies (current and planned).

These stakeholders operate across local, regional and national scales, as shown in Figure 3. Through a series of nine interviews we engaged with local and central government experts, policy thinktanks and network

stakeholders, supplemented by desk-based market research, industry 1-2-1's and a final workshop, compiling an understanding of the variety of, often divergent, objectives across stakeholders.

Whilst these conflicting objectives can act as blockers to net zero action, the process of drawing up LAEPs and then using them to guide actions and individual investment decisions can help to achieve greater alignment to create net zero opportunities and deliver investment. The five examples below illustrate some of the blockers and opportunities that we have identified through this research.

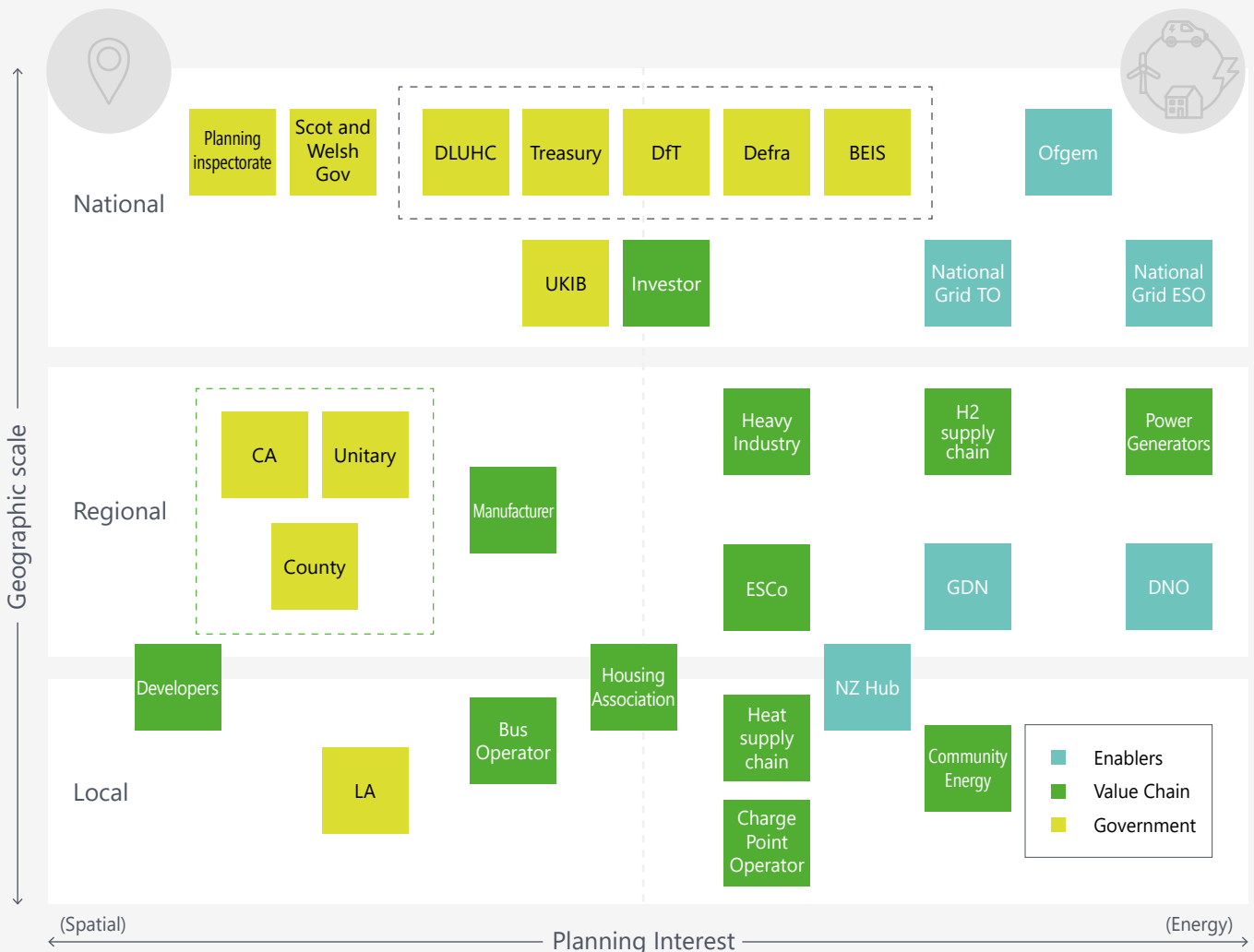


Figure 3: Key LAEP stakeholders

4.1 Heating supply chain require evidence of demand to allocate resource efficiently



Heat supply chain

Installers of heating solutions are often micro and SME businesses who find it difficult to justify investing in capacity given the changing policy environment. Attempts to stimulate local supply

chains with technology funding often creates short-term boosts to markets which ultimately marginalise, through eligibility requirements, the key micro businesses required to meet demand in hard-to-treat sectors. The evolving nature of support programmes such as the Energy Company Obligation (ECO) lead to a lack of certainty and demand. The low carbon heating market is fragmented and dysfunctional, typically operating on a 3-year planning horizon making it difficult for firms to forecast in the long term.

More established supply chains provide heating and building retrofit services/solutions within social housing. The social housing sector regulatory frameworks and Decent Homes standards drive long-term planned investment programmes, resulting in competition between main and sub-contractors. In some cases, 20-year contracts to deliver over £1bn of housing investment across 67,000 properties have been signed (LABM, 2019)¹.

However, feedback suggests that organisational targets are often based on signals from national policy. These targets may not align with 'whole systems' thinking at a local level. Therefore, landlords are potentially investing in solutions which aren't aligned with wider energy system decarbonisation objectives. For example, the Minimum Energy Efficiency Standard (MEES) regulations mandate that private rented homes must meet EPC Band E before they are let – which could be achieved through the

cheapest option (i.e. - solar PV) rather than optimal system wide solution (where energy efficiency measures may be more appropriate). Although these regulations are set to tighten², currently c.3m homes are EPC D or below. Any interventions to improve building energy performance must take into consideration local nuances and geographic context when defining retrofit strategies. Area-based approaches to determining investment decisions were cited by housing associations during our research as a way of helping to inform investment decisions and long-term planning, sending clear signals and opportunities for the supply chain.

Supply chain development and coordination of technology deployment are highlighted as key enablers to realising the economic benefit (PWC, 2022)³ of place based approaches to net zero. However, existing policy is creating uncertainty as to where to invest resources – for instance, heat pumps and hydrogen boilers. Decisions on pathways for decarbonisation of heat are required at national and local levels to provide clearer evidence of demand across regions. Alongside targeted technology incentives this will give organisations stronger grounding on which to build partnerships and make informed investments. These incentives need to be aligned with the system needs to ensure appropriate technologies are deployed in suitable locations; coordinated LAEP can help solidify this.

¹ <https://labmonline.co.uk/news/clarion-housing-group-signs-contracts-to-deliver-20-years-of-investment-in-our-homes/>

² <https://www.gov.uk/government/consultations/improving-the-energy-performance-of-privately-rented-homes>

³ PWC, Accelerating Net Delivery – unlocking the benefits of climate action in UK city-regions, 2022

4.2 ESCOs are looking for strategic net zero opportunities at scale



Heat networks and the energy service companies (ESCOs or other similar models) that run them have experienced progress over the last decade, supported through BEIS' Heat Network Investment

Project, £288m from the subsequent Green Heat Networks Fund and supporting legislation.

Local authorities can set local development plans, orders and conditions which require the development of and connection to heat networks, enabled through the Planning and Compulsory Purchase Act and the Town and Country Planning Act.

However, explicit requirements for these heat networks to be low or zero carbon is missing from the legislative framework which often results in connections to high carbon heat sources. Additionally, contracts for large district networks can run for over 20 years, presenting carbon lock-in risk. Using alternative sources such as waste heat, coupled with strategic planning between local authorities to reduce the cost of low carbon heat networks are potential routes to solving this (National Grid, 2021)⁴.

Our research revealed the piecemeal nature of local planning disincentivises strategic supply chain planning and restricts their ability to capture the cost savings created through economies of scale. As scale increases, so too does the level of complexity regarding local governance and priorities. The history of duties to cooperate within spatial planning highlights the challenge of working across administrative boundaries, but collaboration agreements between councils and utilities in support of local broadband and strategic water plans respectively, shows it is possible with the right incentives. LAEPs can be used to identify potential whole system net zero opportunities

/ projects where strategic coordination across local authorities or interest groups could unlock investible district heating schemes and maximise growth opportunities.

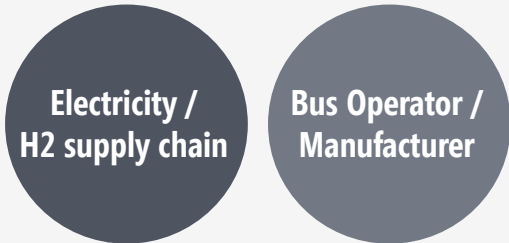
Duty to Cooperate - the duty to co-operate was introduced in England by the 2011 Localism Act as a strategic planning mechanism, and as a way of ensuring regional spatial strategies in Scotland. The duty requires councils to engage continuously and constructively with neighbouring authorities on strategic cross-border issues

Local Broadband Plans - Local and regional plans were encouraged and delivered through incentives which maximised the use of additional funding sources and achieved scale through demand registration/stimulation, helping to reduce transaction and procurement costs.

Strategic Water Plans - the National Framework for Water Resources now requires collaboration across boundaries to develop regional plans which feed into statutory Water Resource Management Plans to help inform investment needs across England and Wales.

⁴ <https://www.edie.net/news/6/National-Grid-and-SSE-plan-to-redirect-waste-heat-to-homes/>

4.3 Future proof decisions about bus fleet decarbonisation depend on local and regional infrastructure plans



Local level policies and initiatives to decarbonise public bus fleets are driven through air quality duties and DfT’s Zero Emission Bus Regional Area (ZEBRA) scheme. ZEBRA provides grant funding to support LAs in shifting their respective fleets to cleaner fuels and for grid infrastructure upgrades. Interestingly, our

findings indicate that neighbouring authorities are pursuing this transition using different energy vectors (based on the nature of routes being operated, existing statutory duties and the cost of grid infrastructure upgrades). As a result, bus manufacturers now have both electric *and* hydrogen research programmes active, resulting in mixed signals being sent to market (see Fig. 4).

In the absence of clear, legal carbon mandates, our research found instances where air quality targets were driving some councils to convert their public buses to run on hydrogen sourced from suppliers outside of their area using diesel lorries to import their fuel.

Specialist manufacturers of low weight, short wheelbase buses consider battery technology to be the leading technology for their fleets, albeit there are examples of councils applying

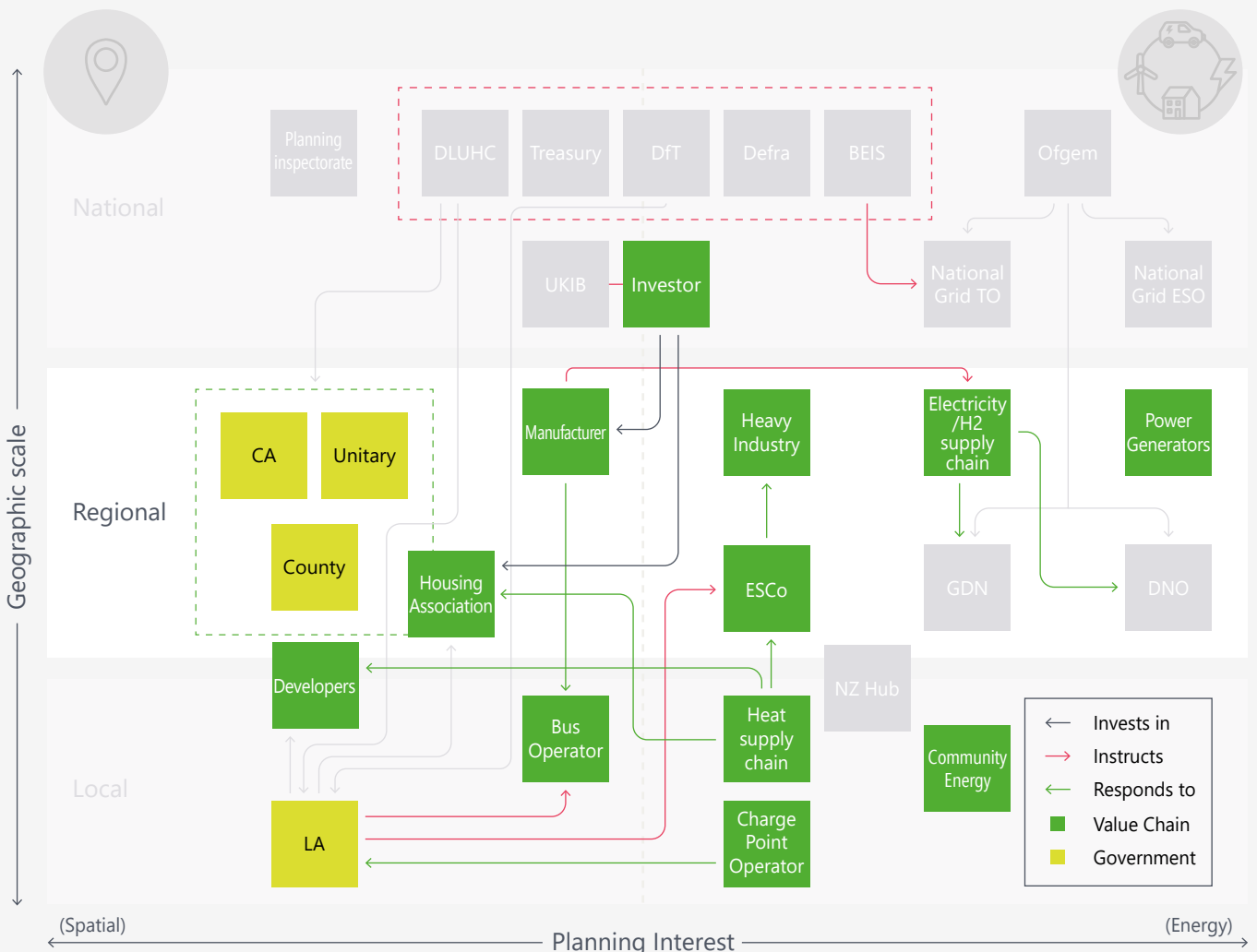


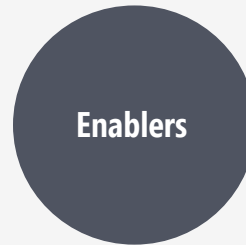
Figure 4: Lack of regional coordination creates mixed signals for supply chains

for funding for battery-electric double-decker vehicles. Some larger vehicle manufactures are opting for H2 fuel cells, which ultimately requires the availability of low carbon hydrogen production.

High carbon methods such as steam methane reforming (SMR) account for over 90% of H2 production in the UK⁵, and therefore carbon capture and storage is needed. For areas where the demand for hydrogen is more concentrated (e.g. the Humber), the business case is likely to be stronger. However, where suitable hydrogen development and applications are spread across multiple sites and areas, the strategic decision to adopt H2 becomes more challenging. This is partly due to the dependency on the infrastructure required for the transportation and storage of the captured carbon. Once this infrastructure exceeds 10 miles in length, it is considered a nationally significant infrastructure project (NSIP) (BEIS, 2021) and requires a development consent order (DCO) from Secretary of State.

The National Planning and Policy Framework (NPPF) does not address NSIPs. This creates a risk of the business cases for these decisions within the value chain being made in isolation based on wide ranging assumptions around future grid upgrades, connection costs (EY, 2020) and without consideration of local policy priorities. A robust evidence base to inform these strategic decisions is currently missing, but could be filled through LAEP development that is coordinated at a regional scale – and with plans for industrial cluster development (e.g. in relation to hydrogen and CCUS infrastructure availability).

4.4 Regional system stakeholders need a consistent evidence base to inform net zero infrastructure development



The current regulatory system leaves energy infrastructure planning primarily to the transmission owners and regional network operators, overseen and guided by Ofgem and RIIO price controls, respectively. The main objectives of these stakeholders are to plan and develop the infrastructure required for the system and support the energy transition by considering the network requirements for net zero. Investment decisions are based on future energy scenarios, which consider national level policies and forecasts rather than locally driven energy system plans that deliver local decarbonisation targets.

Existing policies on how network upgrade costs are recovered are a case in point. The first stakeholder to install new technologies may be required to disproportionately bear the costs of any required network upgrades thus stalling confidence. Local planners, developers and service companies are having to contend with this particularly challenging aspect of network investment.

Alternative solutions to capital investment are incentivised through the RIIO framework but their suitability is dependent on and subject to the variation in heating, transport and industry loads across regions. The uncertainty around technology choices (in part caused by the commercial conflict of interest between gas and electricity network operators) at the local and regional level, coupled with the growing interaction of energy vectors will make cost-effective delivery of future infrastructure and solutions more challenging (Strbac, 2016).

⁵ <https://www.statista.com/statistics/457795/uk-hydrogen-production-share-by-method/>

Regional stakeholder whole system planning information will support better coordination of national network planning, rather than incremental economic drivers alone. An efficient trade-off between regional network companies and their competing technology is unlikely to be delivered by regulatory scrutiny of expenditure plans within separate price control processes. It will be important to create and use robust place-based whole system evidence to inform decision making on energy network investments.

Formal partnerships and data sharing between local authorities and regulated energy network companies could help. Currently there are no specific obligated interaction requirements with any authorities for heat, transport, local planning etc, aside from the specific licence obligations to reflect end customers' needs in GDN/DNO forecast data and plans.

4.5 National Stakeholders are unable to articulate the implications of decisions being made locally



The Government's recent Net Zero Strategy (HM Government, 2021) points towards sub-national and local levels to support with decisions on energy infrastructure, distribution network

upgrades, how best to use local conditions to determine suitability of heat sources and the pace of infrastructure upgrades. However, it is ultimately national policy and legislation which drives a wide range of planning functions, powers and duties which link to key net zero infrastructure, including housing (new build and retrofit), transport, energy networks and energy generation – see Figure 5 and Table 4.

National policy statements (NPS) set by BEIS outline the nationally significant infrastructure projects (NSIPs) required for net zero, as per the requirements of the Planning Act 2008. NPS are used as a material consideration within the Town and Country Planning Act and set out policy for various infrastructure development, including Overarching Energy, Fossil Fuels, Renewable Energy, O&G Supply and Storage, Electricity Networks and Nuclear Power. Draft revisions are made to NPS to ensure current regulatory and policy priorities are acknowledged, based on up-to-date analysis, and understanding of energy infrastructure and technologies.

The ultimate decision on NPS development consent is made by the Secretary of State, but the Localism Act 2011 allows local authorities to submit local impact reports (LIR) during the examination of NSIP, where the proposals are at odds with local policy. Section 93 of the Local Government Act also allows relevant local authorities to claim costs for appraising these larger infrastructure projects, and joint LIR submissions between local authorities are allowed. Aside from this there is no clear ability for local level stakeholders to inform national net zero decisions, even though there are a wide range of projects being delivered at a local level.



This will become increasingly important as decisions over where to locate and how best to adapt infrastructure in support of net zero become increasingly reliant upon the interaction between different vectors at a local level. Processes such as those contained within the Localism Act can set a precedent for enabling local level input into national decisions on net zero planning through LAEPs.

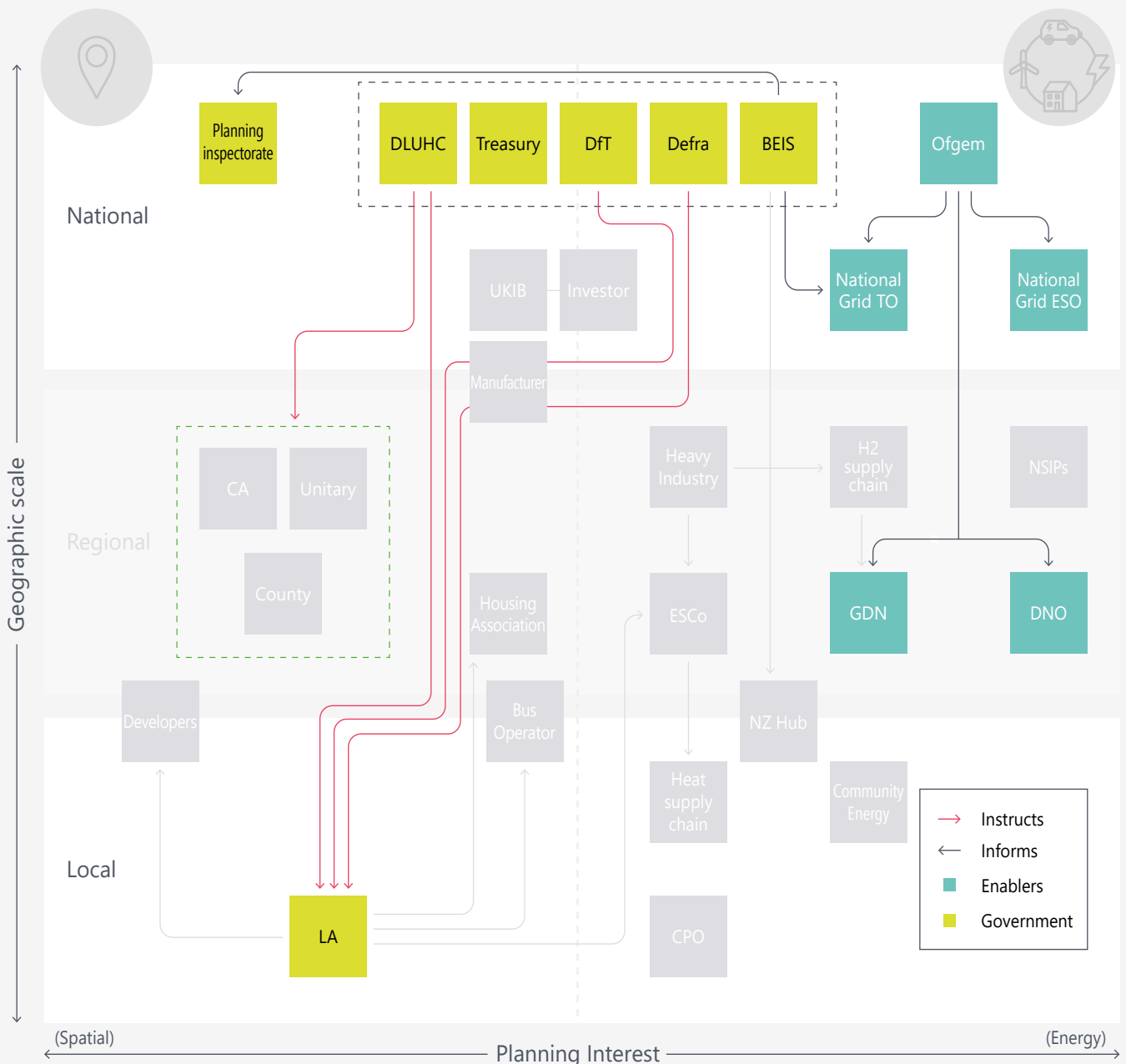


Figure 5: National net zero policy statements do not align to local plans

4.6 Various shapes and sizes of investment will be required



Investors

The type of investor required to support the scale of capital mentioned in the introduction will vary as will the investment product. Local, retail, institutional and infrastructure investors

are required but will need to see evidence of three key criteria: appropriate scale, secure revenue streams and acceptable risk levels. Satisfying these criteria could lead to further investment in the UK supply chain, such as the £40m acquisition of Liverpool based Arcola by Canadian Manufacturer Ballard.

New and innovative community bonds are being explored at a local level; however, these alone will not be able to deliver the scale of investment required. There are examples of £300m 30-year sustainability bonds in the social housing sector, driven by social purpose and low risk revenue streams. Meter asset providers (MAP) have access to competitive pension fund finance and use leasing to develop low risk business models for smart meter roll out. These investors appear willing to support with in-home low carbon technology but need further assurances over delivery risk management.

The renewable energy investors/developers ESC engaged with stated that most solar PV projects are completed at 49.99MWac (~£100m) purely because this is the largest you can develop without having to go through the NSIP process (which takes longer compared to the local planning system). Investor feedback suggests this scale is too small and therefore portfolio and development platforms are being sought to achieve preferred values. Similarly, there are also concerns over other NSIP such as CCS (as discussed in section 3.3) due to technology risk but also the long-term viability of the gas grid. Longer term planning is required to mitigate these risks.

Individual LAEPs will help to guide and inform investment decisions at the local level but when coordinated will provide more appealing scale and evidence to attract lower cost capital from major infrastructure investors. Funds which combine public and private asset classes together to produce a diversified profile are considered a tangible way to lower risk and increase confidence across a portfolio (HSBC, 2019).

Investors will ultimately be guided by market forces to help shape investment decisions. For example, housing developers will still respond to housing market forces, network companies will still choose to design their infrastructure assets taking account of forecasted increases in demand and renewable energy developers will locate where a connection is available and economical.

4.7 Common themes and challenges

The complexity of and interactions (although not exhaustive) between the key stakeholders⁶ discussed in sections 3.1 – 3.6 are illustrated Figure 6 (numerical labels refer to table 4). In addition to the previous 5 examples and through wider stakeholder engagement, common themes and challenges emerged with regard to local net zero action - these are summarised below and considered in our recommendations.

⁶ Please note – the interactions between Net Zero Hubs and Community Energy Groups have not been illustrated. They are key stakeholders but given their comprehensive connection to all stakeholders it is not possible to illustrate this clearly.



Processes lack flexibility

The importance of building a net zero delivery framework that can be updated to iterate local feedback is widely discussed across a range of sources, including the CCC's 6th Carbon Budget report. Incorporating local experience and recognising diversity between areas could support with national policy decisions. Lessons learned should be shared between LAs and insights used to make changes to future process.



Lack of Coordination causes strategy misalignment

LAs need support, provision of resources, and a single 'go-to' source of information to make it easier for them to deliver coordinated LAEP. Fragmentation of policy, incentives and data create tensions within planning and can result in conflicting strategies.



long-term Financing is required

Short-term grant funding opportunities fail to provide enough certainty for the scale of planning needed to deliver low carbon solutions efficiently, and often prevent coordination of different financial incentives. Private investment is needed to fund at sufficient scale, and further support needed to fill knowledge and skills gaps.



Sharing of Expertise for Net zero at the local level

A lack of expertise within LAs is recognised along with a need for multidisciplinary support. The extent to which skills need to be developed varies, but there is agreement that new support should build on existing capabilities such as the Carbon Literacy toolkit for LAs. There is particular focus on improving the use of data through sharing and improving expertise available at a local level.



Fairness

Recovering the cost of decarbonisation must be fair to the consumer and avoid harming the most vulnerable. Policy should be assessed through mechanisms such as the fair funding review to ensure it does not negatively impact disadvantaged groups. Authorities should play a key role in targeting incentives to benefit those most in need e.g. fuel poor, as regional differences can be difficult to reconcile with a national net zero strategy.

4.8 Summary

Decisions in local heating and transport supply chains are being made in isolation from each other and the wider energy system. Attempts to plan and scale opportunities can be hampered due to a lack of cross boundary cooperation, and in some cases contradictory decision making. This sends mixed signals to supply chains and regional network operators. As the interaction between energy vectors increases, these decisions will need to be coordinated to ensure delivery of strategic and optimal network investments for net zero.

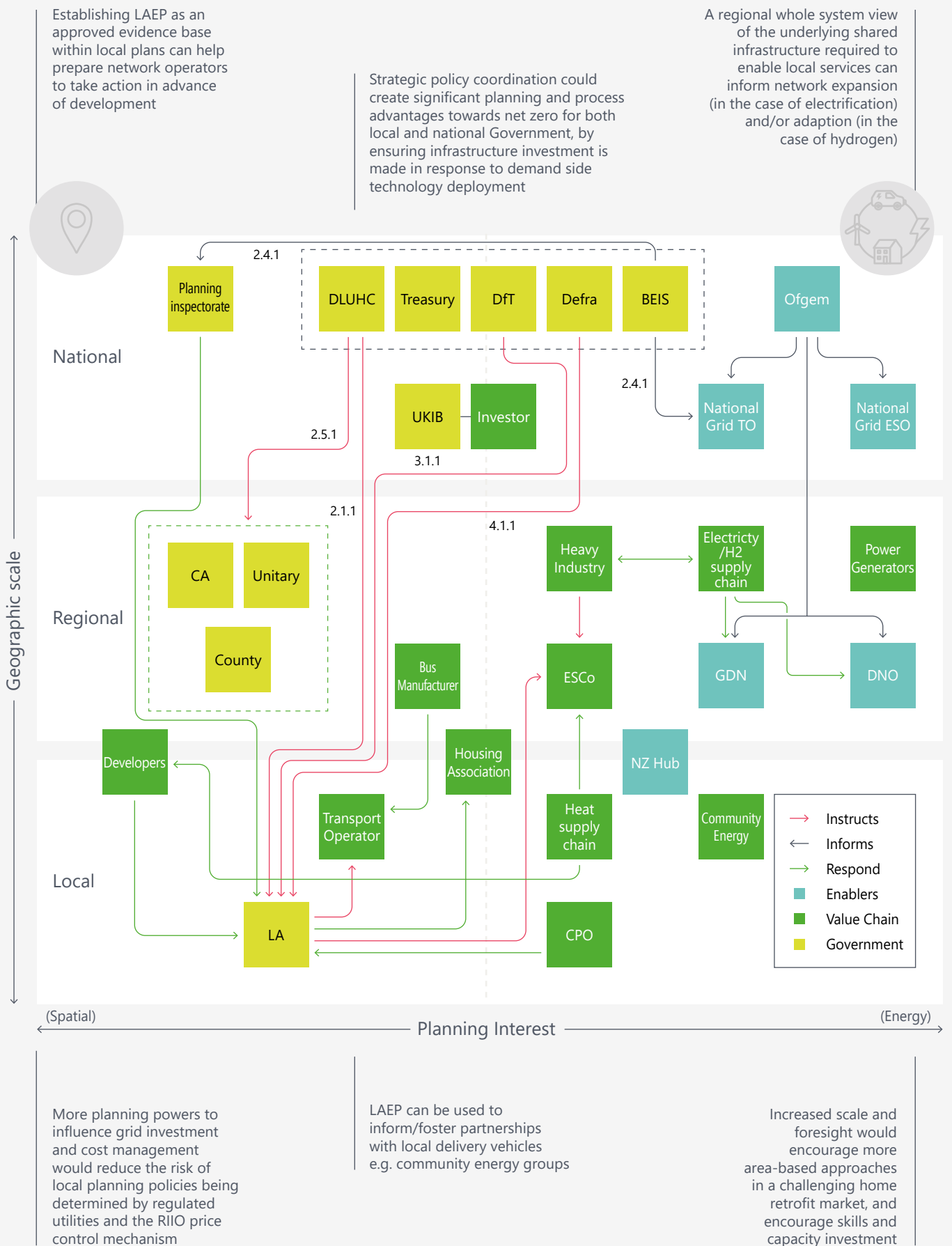


Figure 6: the complexity of decision making in the net zero value chain

With the previously highlighted challenges in mind, it is important to distinguish between voluntary action (from individuals or organisations) and holistic sectoral movement (i.e. – encouraged through regulation) – see Figure 7. Individual, climate-conscious organisations for example may seek to rework

business plans or perhaps introduce more sustainable operations. However, unless addressed from a whole systems perspective through regulatory frameworks it may prove difficult to move entire areas and industries forward and build supply chains while managing system costs.




	Supply chain development 	Formal partnerships 	Skills and levelling up 
Problem	<ul style="list-style-type: none"> Rigid, technology specific policies without long-term drivers or underlying regulation do not address market barriers, such as hidden costs and poor relationships between users and supply chain 	<ul style="list-style-type: none"> UK public transport sector is largely deregulated and managed by private and municipal operators, but the hugely diverse bus industry has been in long term decline 	<ul style="list-style-type: none"> Net Zero will require re-training for up to 3.2 million carbon-intensive industry workers, and regional high-carbon manufacturing bases are often located in clusters of some of the most challenging areas in the UK
Requirement	<ul style="list-style-type: none"> Policies which focus on more than marginal financial incentives and consider wider impacts on supply chains and end users are required 	<ul style="list-style-type: none"> New levers and powers to ensure the future of local transport provision is coordinated at the local level, to produce better outcomes for local areas and end users, due to significant cost savings. 	<ul style="list-style-type: none"> Under the right conditions with policy drivers and a push for more locally sourced ambition, regional growth can occur at scale and mitigate the risk of surplus labour capacity in carbon intensive industries. However, attempts to stimulate labour markets may limit the choice of potential stakeholders
Example	<ul style="list-style-type: none"> Norwich City Council is a good example of a local authority taking voluntary action where the planning framework allows, demonstrating how place based initiatives can develop long-term supply chain skills 	<ul style="list-style-type: none"> New statutory enhanced partnerships are also now required as part of local bus services act and require LAs to build strong relationships with bus operators across a region, helping to integrate strategic policies with local and transport plans, encouraging holistic sectoral movement. 	<ul style="list-style-type: none"> Analysis shows supply chains react to local content regulations (LCR) and policy drivers depending on the formal governance arrangements. For example, the UK plans to increase offshore wind local content regulations to 60%.
LAEP link	<ul style="list-style-type: none"> Planned framework and conditions for Passivhaus homes justified training construction workers in new standards and led to the establishment of the Fabric First Institute. Heating/building supply chains tend to be local rather than national and require area-based approaches that signal a sustained demand 	<ul style="list-style-type: none"> There are lessons here which may be applicable elsewhere in the low carbon energy system. As it stands, local authorities do not have any formal relationships with iDNOs, DNOs or GDNs on future energy planning, but with new powers could potentially inform and support their investment 	<ul style="list-style-type: none"> In the presence of LCRs, subsidies or tax incentives can be used to offset any distributional impacts. This is important in the context of LAEP where areas proceeding with net zero have the potential to create and distribute additional system costs on areas where progress is slower.

Figure 7: how regulatory initiatives and measures have delivered on local and national priorities

5. What could be the value of coordinating Local Area Energy Planning?

The previous sections highlight that coordinating LAEP could help to align stakeholder objectives in the supply chain. However, coordinated LAEP is likely to have broader system benefits.

ESC's whole system models have been used to explore the impact of planning and coordination on the choices available and decisions made by stakeholders. These looked at scenarios which illustrate three cases which, in their own way, are rather extreme representations of how the energy system could be designed over the next three decades (Figure 8). None of these three scenarios constitutes a forecast, but rather a starting point for assessment of how parts of the energy system could be steered and the impact of doing so.

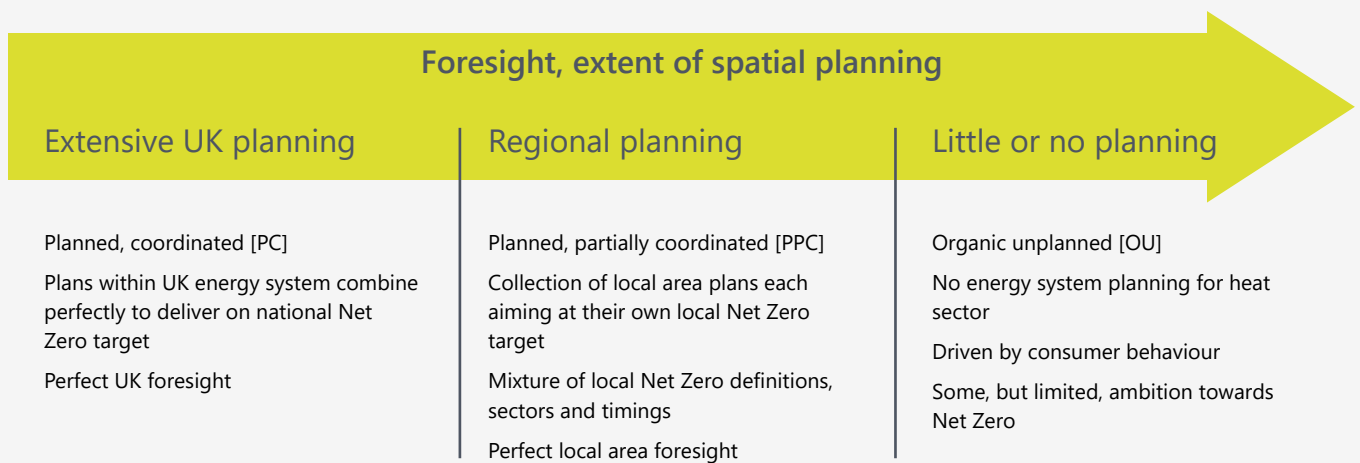


Figure 8: summary of scenarios used within modelling exercise

All the scenarios focused on the decarbonisation of heat in buildings. In all scenarios other aspects of the national energy system were assumed to be nationally planned and coordinated. The Planned, Coordinated scenario represents perfect local and national planning with a system architect that can coordinate across areas to achieve all goals at optimum price and cost. The Planned, Partially Coordinated scenario represents some local areas performing local area energy planning in isolation whilst other areas follow a coordinated approach equivalent to the Planned, Coordinated scenario.

The Planned, Partially Coordinated scenario has been explored with different numbers of local areas following their own, isolated planning processes. The Organic Unplanned scenario is a 'do minimum' alternative. It assumes that no-one is planning effectively for net zero heat at a local level such that a significant proportion of consumers retain incumbent systems that have the lowest replacement and operational costs.

Our analysis, as illustrated in Figure 9, indicates the following:

Without any form of LAEP or coordination, it will be incredibly costly to reach net zero, with very expensive mitigation actions unable to achieve net zero emissions. The residual emissions in this case total roughly 36 MtCO₂e, equivalent to delivery of approximately 95% emissions reduction. Without evidence or guidance to support, local level decisions on heating are largely driven by choices which prioritise capital cost and lead to a more diverse mixture of technologies, including carbon emitting thermal system and various electric heating systems. As a result of these adaptations, the power system could end up increasing by almost 40% in capacity terms⁷.

Coordinated LAEP is likely to deliver substantial whole system cost savings, in the order of 1% GDP in 2050. This is achieved through a reduced need for compensatory investments in additional plant and associated network investment to support with system balancing, to accommodate peak loads from heating and transport. Enabling local and regional authorities to inform key decisions associated with these sectors will allow for mitigation of regional variation across technologies.

To compensate for imperfect coordination between LAEPs, additional technology investments are needed. This becomes notably more costly when more than 25% LAEPs are implemented, equivalent to 91 districts. When considering the 10 current LAEPs in place, this highlights progress on delivering plans can be accommodated with little impact on overall system costs. Therefore, although a coordination process will be required eventually, in the short-term LAEP progress can continue without incurring significant system costs.

This provides an opportunity to ramp up LAEP delivery and share the experience and knowledge through adaptive and informal frameworks which gradually coordinate local planning processes with more significant infrastructure decisions. The governance arrangements for this are suggested in section 5.

Without coordination after 50% implementation, additional investment is likely to be required on infrastructure outside of local boundaries or indeed, outside of the area of influence that LAs have. In particular, investment into flexibility and capacity to ensure security of supply. The key observation at this stage is the absence of coordinated planning across boundaries necessitates a system-wide response to ensure secure energy supply.

Achieving net zero through a fully planned and coordinated approach inevitably requires regional distribution of some key assets – in particular, consented offshore wind sites, gas and hydrogen storage facilities, permitted nuclear power station sites and CO₂ storage destinations – meaning that technologies are distributed heterogeneously across the country. Whilst LAEPs will in general account for infrastructure connected to low voltage and pressure networks, coordinated LAEP can feed into the NSIP process to inform this regional decision making.

⁷ 40% represents the difference between the size of the 2050 capacity stacks for the Planned Coordinated (PC) and Organic Unplanned (OU) scenarios

5.1 Summary of coordinated LAEP value to key stakeholders across local, regional and national scales

Table 1: summary of coordinated LAEP value across scales and sectors

Scale	Decisions	Direction of travel	Coordinated LAEP value	Risks of not coordinating LAEP
Local	Consumer choice	The current high costs of low carbon technology relative to high carbon results in a lack of demand	Local planning strategies and coordination could lead to an adaptation of energy consumer behaviour. A greater level of interaction between local planners and communities could influence the decisions of individuals leading to multiplier effects (Economics, 2021)	Decisions to either retain gas boilers or select lowest capital cost options risk limiting the regional optimisation of heating solutions.
Local	Heat networks	BEIS planning new heat network zoning policy to enforce the deployment of local heat networks, supported by 510 FTE zoning coordinators within local authorities (BEIS, 2021)	LAEP can consider a whole system approach and provide robust and consistent evidence base for heat network, retrofit and EV charger zones (not necessarily enforced). The wide-ranging options on housing retrofit would be informed by local zones which indicate the most cost-effective whole system solutions, potentially through adaption of local planning policy	Failure to identify/connect critical mass of demand, locate network close to waste heat source, and/or anchor due to cross boundary issues
Local	Housing retrofit	Investment decision informed by national policy EPC targets and overseen by building regulations and sector specific standards		Location and utilisation of storage assets – behind-the-meter heat storage, direct electricity storage systems – fails to support with balancing of supply and demand
Local	EV charging	Local authorities may have a role in ensuring required charging infrastructure/stations in place (DfT, 2022)	Coordinated LAEP will ensure regional demand for EV charging is communicated to supply chains and investors to help encourage capacity building in an evolving technological landscape	Without planning and coordination of EV charging, CPOs migrate to dense urban areas and neglect other areas. Therefore, a risk that: 1) people hold onto ICE vehicles, 2) increased loads on localised distribution system unable to support the needs of fleet electrification 3) more challenging to diversify/smooth load profile

Scale	Decisions	Direction of travel	Coordinated LAEP value	Risks of not coordinating LAEP
Regional	Network investment	Network investment informed through RII02 price controls	<p>LAEP provides a common understanding to inform regional utility investment, highlight opportunities for collaboration and investment in hard-to-treat sectors.</p> <p>Investment options identified by coordinated LAEPs can provide a higher level of evidence and support to local industrial strategies, decisions, and consents.</p> <p>Intelligent coordination between industrial clusters and regional heat decarbonisation could enable a cluster approach to decarbonisation and ensure decision across boundaries are optimised.</p>	<p>Without planning and coordination the uncertainty of distribution expansion could reach 25 GW (even with availability of smart solutions). This is roughly equivalent to an addition of 1 kW to diversified peak demand per dwelling</p> <p>This also has implications for conversion of the gas network to hydrogen. Areas that do not switch may prevent neighbouring areas from switching depending on the locations at which hydrogen is introduced into the network.</p> <p>Processes to enable comparison of low carbon gas vs other vectors do not materialise and therefore ignore whole system costs</p>
Regional	Industrial Clusters	Local Industrial Strategies have been instrumental in delivering greater levels of coordination, including joining local economic policies with national funding priorities	<p>Coordinated LAEP can potentially inform NPS/ NSIP by addressing the increased uncertainty of future network development caused by growing interaction between multi vector solutions at local and regional levels.</p>	<p>As discussed, industry provides suitable opportunities for hydrogen production. However, lack of coordination between industry and heat decarbonisation could result in additional costs by 2050. The upper limit of this could be £5bn.</p> <p>Failure to spread/apportion H2 development costs across a wide base leads to poor investment signals</p>
National	National Policy Statements	Hydrogen and CO2 networks are not covered specifically but EN-1 has effect in relation to them, thus intending that decisions on such projects will be taken under the Planning Act 2008.		<p>Failure to acknowledge local context in support of national policy objectives because of not having a regional overview of progress/planning.</p> <p>Inefficient choice of infrastructure and energy carriers due to price / tariff distortion</p>

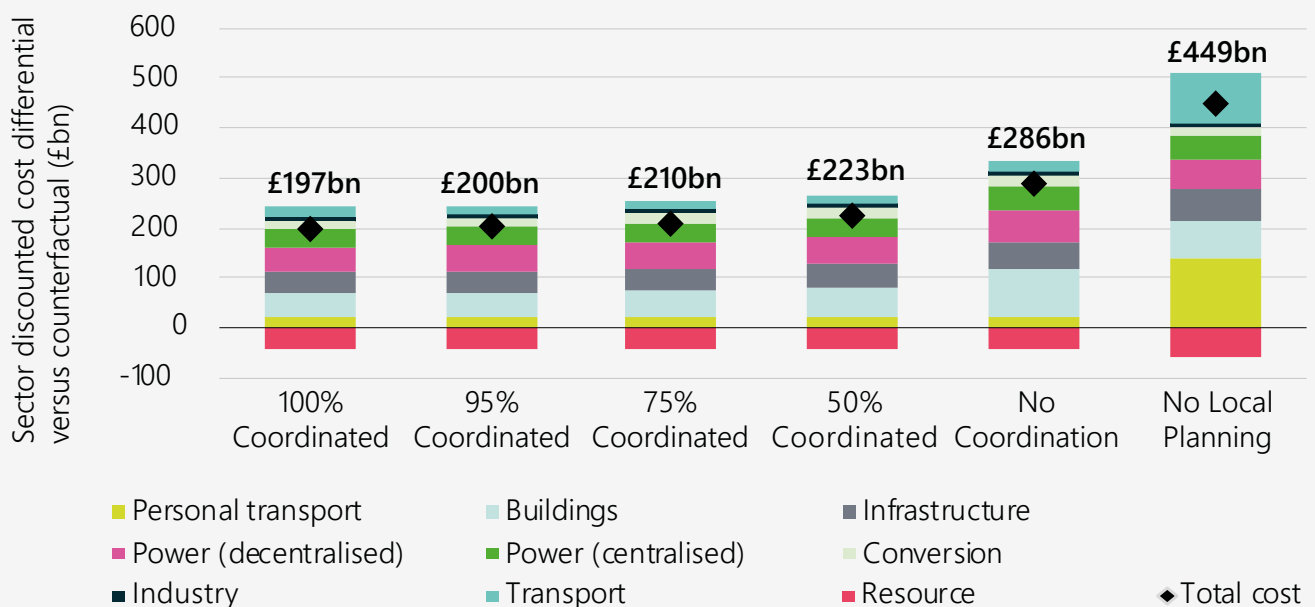


Figure 9: Total and sectoral cost of abatement for each modelled scenario

The 100% coordinated scenario represents all local plans being perfectly coordinated. The percentage figures represent the proportion of local plans that are coordinated with national goals. For example, in the case of 75% Coordinated $\frac{1}{4}$ of local areas have local energy plans that are not coordinated with national or regional plans. As local plans become less and less coordinated more action is required at a national level to achieve net zero and overall system costs rise.

The abatement costs presented represent the difference between the total energy system cost for each scenario (including all years between 2025 and 2050) and a counterfactual scenario absent any emissions targets. Future costs are discounted to 2015. The sectors where local and regional authorities can or will be able to influence some key actions associated with decarbonisation have been highlighted.

The fully planned and coordinated scenario equates to an estimated discounted abatement cost of £197bn between 2025 – 2050. This is a saving of £252bn compared to an unplanned and uncoordinated approach⁸.

Even without coordination, the cost premiums to deliver the various levels of planning are, in all cases, considerably lower than those presented within the organic, unplanned scenario. When considering these savings against the forecasted cost of £70m⁹ for establishing LAEP across the UK, the value becomes clear.

Realising the full benefits of coordinated LAEP will require policies and mechanisms which drive co-ordination at local, regional and national levels.



⁸ Within this modelling carried out for this study, the system cost of the organic and unplanned scenario is notably high. As this scenario aims for Net Zero emissions but is unable to achieve this due to the quantity of emissions in the heat sector that cannot be offset, other sectors take extensive action to compensate by eliminating all emissions **irrespective of the cost-effectiveness of such steps**. These actions include: an earlier and more extensive rollout of zero-emission road vehicles and charging infrastructure, higher capacities of electricity generation and associated networks, and ambitious interventions in the aviation sector to increase fleet efficiency. It should be noted that the modelling approach adopted in this study assumes that energy service demands are fixed and inelastic: consumers are not permitted to forgo an energy service if the implied cost is high. In reality, if the price of a service is uplifted sufficiently, consumers may respond leading to a reduction in energy service demand and a reduction in system costs. The cost premium of the organic, unplanned scenario should therefore be interpreted as an upper limit, illustrating the scale of the potential costs should decarbonisation through planning within the heat sector not be realised.

⁹ ESC internal calculation based on developing plans across 210 areas with technical support for data analysis, energy system modelling and development of local plans alongside extensive community engagement

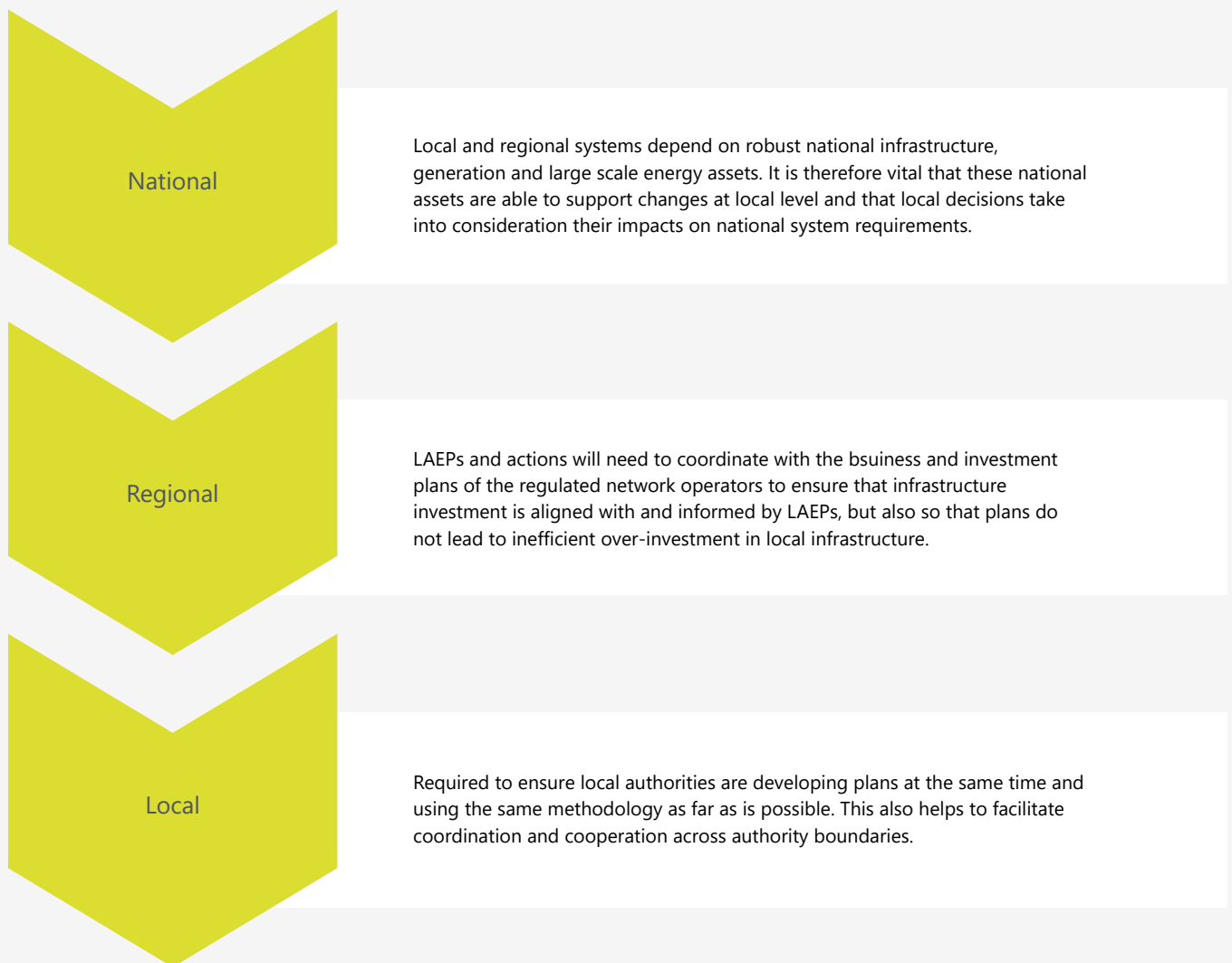


Figure 10: definition of coordinated LAEP requirements across spatial scales



6. How can coordinated Local Area Energy Planning be delivered?

If implemented well, coordinated LAEP could overcome the challenges outlined in section 3 and help to realise the value identified in section 4, justifying the case for locally-driven net zero strategies at scale throughout the UK.

The precise mechanism through which a LAEP should inform decisions of the stakeholders mentioned in this report, will of course depend on the existing legal and governance framework for those decisions, such as; development control in relation to the built environment; energy network regulation processes; and the license duties of network companies in relation to new energy infrastructure.

The governance framework will need two elements:

- the governance of the **creation** (and regular review/revision) of LAEPs (i.e. their scope, content, methodology, relevant considerations that must be taken into account, the body responsible, the funding framework, rights of appeal/challenge etc)
- the governance of the **implementation** of LAEPs - the framework of law, regulations and guidance through which LAEPs exert influence on decisions made by LAs, developers, network companies, housing providers, local development agencies etc

These two elements of the governance framework will need to be complemented by informal networks across different spatial scales to facilitate sharing of learnings, knowledge and expertise.

The following section outlines 4 key coordination mechanisms required which could help to establish coordinated LAEP, as summarised in table 2 below.

Table 2: summary of key coordination mechanisms

Stage	What?	Why?	How?
LAEP creation	Strategic policy coordination	The cross-cutting nature of net zero objectives at local and national level must be coordinated and considered against cross department policy priorities	Develop guidance to enable a common approach to LAEP Existing frameworks recognise this guidance and LAEPs as a material consideration
LAEP creation	Policy instrument coordination	Deal based mechanisms including grants, training, loans and incentives are required to support and share resources/learnings	Develop incentives aligned to national policy priorities which target funding allocations and incentivise cooperation in support of LAEP coordination
LAEP implementation	Organisational coordination	A range of organisations are required to support with the implementation of LAEP	Enable formal and informal partnerships to facilitate consistent collaboration and coordination between regional authorities, networks and key stakeholders
LAEP implementation	Rule based coordination	Required to align local and regional policies (based on LAEPs) and integrate with network investment policies	Ofgem to shape and lead a robust process to drive network companies to make coherent strategic decisions Technical assurance facility to deliver high quality LAEP and reporting

6.1 Strategic Policy Coordination

Local authorities have clear responsibilities and duties in relation to decision making in some (but not all) of the key domains for delivering net zero. For example, spatial planning and development control, waste management, highways and transport. As we move toward decarbonisation the interactions between these duties and key net zero services, such as heat network zones, EV charging, public fleet decarbonisation and social housing retrofit will increase. This will require a common frame of reference across government departments, with a consistent evidence base to support local authorities to plan, make decisions and report against.

6.1.1 National Planning and Policy Framework (NPPF)

Our recommendation is that LAEPs be established in the NPPF as a recognised evidence base and material consideration to ensure the interventions required for achieving net zero are delivered by the planning system. Implementing LAEPs will require coordination of decisions made by planning authorities, achieved through expanding the strategic priorities outlined in the Town and Country Planning regulations to consider LAEP.

As discussed in section 3, the success of local net zero action will be dependent on the enabling physical infrastructure. One of the main blockers to realising the strategic coordination required to support local progress towards net zero is the disconnect between spatial and energy planning - they are ultimately part of two separate legal/institutional frameworks.-

However, there are some subtle links. For example, the Town and Country Planning (General Permitted Development) (England) Order 2015, Class G electricity undertakings enables electricity network companies to undertake certain works without going through the planning system. Similarly, the Order also allows a range of microgeneration measures the same privilege, while LAs do have the powers to create permitted development exemptions.

Developing a robust set of LAEPs across LAs now can be used to target low regret, quick win activities at the micro/building level, whilst also identifying insights, priorities and longer-term opportunities for whole system planning in the future. We recommend that:

- a statutory duty should be established on local planning authorities to enable them to take a strategic approach to net zero
- this should feed into the existing statutory process of local development planning and be considered within local strategy documents, plans and exemptions¹⁰.
- future design and allocation of grant funding is based on priorities emerging from LAEPs in place of ad hoc bidding by local authorities to access competitive funds.

6.1.2 Informal governance, learning and reporting

Establishing coordinated LAEPs across the UK will take time and it is therefore important to harness the knowledge and learnings which emerge from current early adopters. (e.g. GMCA, Welsh Government). These learnings should be harnessed and shared via existing local networks between authorities (e.g. Net Zero Hubs) but also the national level via the Local Net Zero Forum (LNZF). Net Zero Hubs will play a vital role in building portfolios of projects at the local level and also identifying opportunities to coordinate projects across their regional coverage.

¹⁰ Please note – this is not an immediate recommendation for LAEP to overrule existing permitted development statutory undertakings, but highlights how LAEP could inform spatial decisions on technology and infrastructure in the future

6.2 Policy Instrument Coordination

There are particular instruments which could be used to ensure coordination of LAEP, as summarised in Table 3.

Government funding, grants and resources such as the public sector decarbonisation fund, ZEBRA, EV infrastructure strategy should be coordinated to support the implementation of net zero action identified through the creation of LAEPs at a local level, and coordination at a regional/strategic level. The criteria for allocation of funding can also be structured to incentivise partnerships across boundaries, ensure opportunities for strategic projects are identified and create more attractive investment opportunities to crowd in private investment.

The mechanisms to facilitate this could be achieved through the Planning (Scotland) Act 2019 which establishes a duty on planning authorities to develop regional spatial strategies, and Corporate Joint Committees (Wales) regulations which aim to foster regional cooperation between local authorities.

Due to the abolishment of regional planning in 2010 this layer of strategic planning and governance no longer exists in England. However, the growing number of regional unitary restructures and combined authority devolution deals coupled with new functions and responsibilities¹¹ makes them an appropriate set of stakeholders responsible for leading regional LAEP coordination.

For areas where combined or unitary authorities do not exist, then joint district, borough and county committees could be created to support appropriate regional coordination of LAEPs and mechanisms to implement them. County councils have strategic planning functions which advise on local planning matters, and existing statutory mechanisms could be used to formalise cooperation and decision making where appropriate – see table 3.

Establishing lead authorities for strategic planning at this scale has led to success in the water industry, where unitary and county level Lead Local Flood Authorities (LLFAs) have been established. The LLFAs are responsible for interfacing with the Environment Agency and have also been granted greater planning approval powers within the NPPF, in collaboration with LPAs.

However, sub-national powers and functions must reserve local influence and be accompanied by regional governance which is able to oversee, understand and articulate the impacts on the wider energy system. Organisational (LA, DNO/GDN, National Grid) coordination is also required. Ofgem could incentivise or require energy network providers to interface with regional LAEP coordination structures.



¹¹ The Government's Levelling Up white paper includes provisions for "opportunities to adopt innovative local proposals to deliver action on climate change and the UK's Net Zero targets"

Table 3: examples of existing instruments which can be used to deliver regional coordination

Instrument	Notes
Duties to cooperate	Duties to cooperate may be used to achieve strategic outcomes but require clear guidance
Formal (statutory) coordination of decision making	Local Authorities (Arrangements for the Discharge of functions) (England) Regulations 2012 section 29 and Joint decision-making Committees (Section 29 PCPA 2004) can be used by one or more LPA(s) in agreement with one or more county council(s) to put in place a formal decision-making committee.
Funding allocation criteria	Central Government can incentivise strategic collaboration in support of national policy objectives by making allocations through criteria which delivers relevant projects and initiatives

Drainage Strategy and Sustainable Drainage Systems (SuDS)

Primary legislation in relation to water management is set through the Water Act 1991 and is regulated by Ofwat. A set of secondary legislation amended firm up the role of local authorities, including introducing responsibilities around sustainable drainage and risk management.

6.3 Organisational coordination

Spatial planning responsibilities and functions are organised through the planning system, while energy infrastructure planning is largely a matter for the network companies operating within the sectoral regimes set up by the relevant legislation (Gas Act 1986, Electricity Act 1989), and Ofgem's more detailed licensing and regulatory processes. In the future, LAEPs can play a key role in shaping the energy transition by aligning spatial and energy planning at local and regional levels.

We recommend that the evidence and analysis assembled through the development of LAEPs should be a formal consideration that regulated network companies are required (and incentivised) to take account of in their network infrastructure investment planning and decision making. There are a range of mechanisms which Ofgem can use to achieve this, through business planning guidance, licence conditions and the structuring of RIIO incentive and re-opener mechanisms. ESC has outlined proposals for how this could be achieved¹².

Network planning may require mechanisms which obligate or incentivise operators to look further into the future and consider high risk anticipatory mechanisms backed by a robust evidence base to support long term investment. However, once developed, these assets are typically irreversible investments, and therefore network companies are faced with a dilemma when investing ahead of time due to the risk of stranded assets.

We recommend that, subject to the creation of a regional level strategic lead for LAEP, local authorities should be granted the powers to enter into more formal partnerships with their regional network operators through statutory enhanced partnerships.

6.3.1 Statutory Enhanced Partnerships

A statutory enhanced partnership (SEP) is a mechanism used to formalise the relationship between local authorities and private sector operators. SEPs have been used predominantly in the transport sector to support the successful delivery of national Government strategies by setting out clear and specific service level plans and outcomes.

¹² <https://es.catapult.org.uk/policy-brief/six-steps-to-zero-carbon-buildings-step-3/>

The SEPs would be established to deliver on 3 key targets:

- 1. Improved transparency** – as a way to exchange views, data and knowledge between the network operator and the lead county / regional authority.

While LAs may be ultimately responsible for producing a LAEP, they do not control decision making over all the investments or actions that may be proposed/recommended within a LAEP. DNOs have been engaging proactively with LA's through the Energy Networks Association's (ENA) Open Networks forum, and whilst there are requirements for DNOs to engage on current capacity, there are no formal requirements for DNO/GDNs to engage with LAs on future energy planning, running the risk of misaligned plans and strategies. Under a SEP there would be a transparent sharing of LAEPs with agreed project credibility thresholds to give confidence to energy network companies of projects and near-term interventions going ahead.

- 2. Risk management** – to mitigate, or at least share, a mutual understanding of potential costs/benefits, complexities and delays.

Private and public organisations view risk differently. Network operators are concerned with maximising marginal commercial gains within the RIIO price control, while local authorities aim to maximise the value of local services for the public interest. As with any public-private partnership there are tensions between objectives. Network companies do not have full certainty around what exactly is likely to impact their network, or the requirement to invest ahead of need, and LAs don't have the ability to understand the impact of their developments on networks. LAEP built on the foundation of a SEP could help both parties manage risks arising from these tensions.

- 3. Investment** – to provide assurances over the timing, direction and execution of investments

A formal link between network companies and local authorities around the analysis and planning of investment needs arising from LAEPs should enable better coordination of area-based investment and phasing to develop in the future.

The SEP would set / agree shared aims between a county / regional authority (see section 5.2) and network companies, enabling the authority to impose some service standards/requirements on the network companies. This would ensure that investments in infrastructure and investments in services/projects are coordinated. The UKIB can play a critical role here through provision of guarantees and bridging loans to align LA projects and budgets with network company business plans.

This would also act as an accountability mechanism to ensure that both parties are fully committed to delivering their investment plans. Net Zero Hubs will be essential to supporting LAs with project development, investment and delivery.

6.4 Rule based coordination

The rules and regulations around network asset investment management and decision making will need to be expanded to cover whole system views and benefits. Currently, there are a competing set of requirements and measures of value (risk, cost, service etc) across national, regional and local stakeholders. For example, the value of enabling net zero energy infrastructure to a local authority needs to be considered against regional network engineering and asset health aspects, which needs to be considered against the economic and security of supply values of the system.

6.4.1 Asset management framework

Delivering net zero is likely to require a greater use of anticipatory investment in energy network infrastructure to ensure that network capacity is available to meet the demands arising from the uptake of low carbon technologies, particularly heat pumps and EVs. Ofgem has to meet its statutory duties in its approach to regulating networks, and historically has emphasised customer interest in terms of cost efficiency. However, Ofgem's primary duties are broadly framed in the 2020 Decarbonisation Action Plan which gives a strong indication that the regulator views decarbonisation at lowest cost as one of its three core priorities.

Our modelling has indicated that coordinated LAEP is required to achieve the lowest cost net zero energy system – as noted in section 4.

Our view is that well evidenced and structured LAEPs developed according to nationally agreed guidance could be a key tool for Ofgem to use in its approach to regulating the network investment activities of monopoly energy network providers. LAEPs can provide a whole system analysis of net zero action phasing and associated demands on network infrastructure. Once a strong set of LAEPs has been developed, then Ofgem can require or incentivise network companies to take account of the evidence around demand and phasing of infrastructure investment. Crucially LAEPs provide a mechanism for bottom-up whole system analysis and optimisation to inform energy network infrastructure planning.

Existing investment decision frameworks such as common network asset indices methodology (CNAIM) and network asset risk metric handbook (NARM) are largely based on engineering metrics, such as asset health and probability of failure. Network regulatory business plans and business planning processes, as part of future regulatory cycles (RIIO3+), will need to bring LAEP into the needs case to support with more whole system level value measurements, with appropriate prioritisation/weightings. LAEPs will allow for LAs to state their value items to enable consideration against network operators' values, such as return on investment and cost benefit analysis, and encourage coordinated network planning across regions.

Developing a whole system value framework, influenced by existing asset management frameworks could contribute to this by establishing common values across different stakeholders and geographical granularities. Ofgem would need to drive the requirement for this to be considered. This framework would need to move away from network risk to whole system value as a basis. A common set of values will also allow for the optimisation of decisions linked to Government policy priorities - e.g. safety, speed of transition to net zero, facilitation of regional heating, investments linked to industrial clusters, economic viability, socio-economic benefits etc.



The strategic planning and investment asset management activities will ultimately need to be lifted to a system level and enable optimisation of value at local, regional and national levels. More granular demand analysis and system value agreements will be needed to optimise the transition. For these additional and common values to be considered, network operators will require a consistent and robust evidence base from local authorities on which to base investment decisions.

6.4.2 independent technical assurance

Short-term (up to 2026/28)

The governance arrangements for LAEP creation may need to change as the energy transition progresses. Creating formal feedback loops will allow for the governance framework to adapt over time as the wider energy system transition unfolds.

As the modelling analysis highlights, LAEP can deliver significant benefits now prior to the need for coordination with the wider system. This will identify short-term opportunities for heat, transport and industry decarbonisation aligned to existing heat network zoning, EV charging and industrial decarbonisation policy.

Local level coordination of heat and transport decarbonisation with industrial decarbonisation decisions could unlock significant benefits. This bottom-up approach to decarbonisation will however still require technical and quality assurance / governance to ensure the regional diversity in grid infrastructure, resource demand and technology investment are accurately considered. This initial action and progress should be supported and overseen by an independent technical assurance facility to ensure high quality standards of LAEP and a common methodology are employed. This independent function could also support with potential dispute resolution by verifying the data sources and standards. Establishing a set of robust and high quality LAEPs now will support wider regional coordination in the future.

Medium-term (2028 onwards)¹³

Prior to the scale of LAEP implementation causing compensatory costs elsewhere in the system (as outlined in the modelling), the role of the technical assurance facility could either be expanded or considered as part of FSO proposals (BEIS, 2021). This facility would consider and identify the key strategic challenges arising from regional diversity once LAEPs start to be aggregated e.g. how to avoid inefficient delivery of infrastructure. This coordinating role would be responsible for recognising the potential implications of certain areas progressing organically, ensuring the full system value and co-benefits of LAEP coordination can be realised. This would include guidance, standards and potentially rules, with Government support, being employed during the creation or refresh of plans e.g. by indicating vectors for specific regions or sectors.

The role of the technical assurance facility should also be to drive planned and coordinated action by monitoring the pace and scale of plan development, implementation and consideration of infrastructure upgrades across regions (noting the influence / interests of incumbent actors). Ultimately, the unit should facilitate a process of high quality LAEP synthesis and support local to national reconciliation e.g. reporting information to BEIS, Ofgem, Planning Inspectorate to help inform energy network and NSIP decisions. It is recognised that this will need to be an iterative process and align with and inform requirements in the RIIO price control.

Building a regional view of LAEPs could then allow for a process whereby local level context is used to inform NPS to help policy makers with challenging questions over uncertain infrastructure decisions e.g. industry, hydrogen, CCS etc. Coordinating these processes across the spatial scales discussed in this report could create an important synergy between strategic infrastructure planning, enabling industry and cluster decarbonisation.

¹³ 2028 represents the end of the current network price control period (2021-2028) (RIIO-2)

6.5 Summary

4 key coordinating mechanisms are required for the creation and implementation of LAEP – as summarised in table 2.

The success of coordinated LAEP starts with the creation of high quality LAEPs as a material consideration at the local level. This will require resources within LAs supported by a technical assurance facility and reporting process, to support decision making on current policy priorities across heating, transport and industrial decarbonisation.

Incentivising the aggregation of LAEPs through existing regulatory measures and formal partnerships could help create a mutual understanding of the investments and risk mitigation measures required. Going forward, these partnerships should be complemented by the development of whole system asset management decision making frameworks, informed by LAEP.

High quality LAEPs aggregated to regional levels can then act as an evidence base to inform regional whole systems energy planning and cluster decarbonisation.

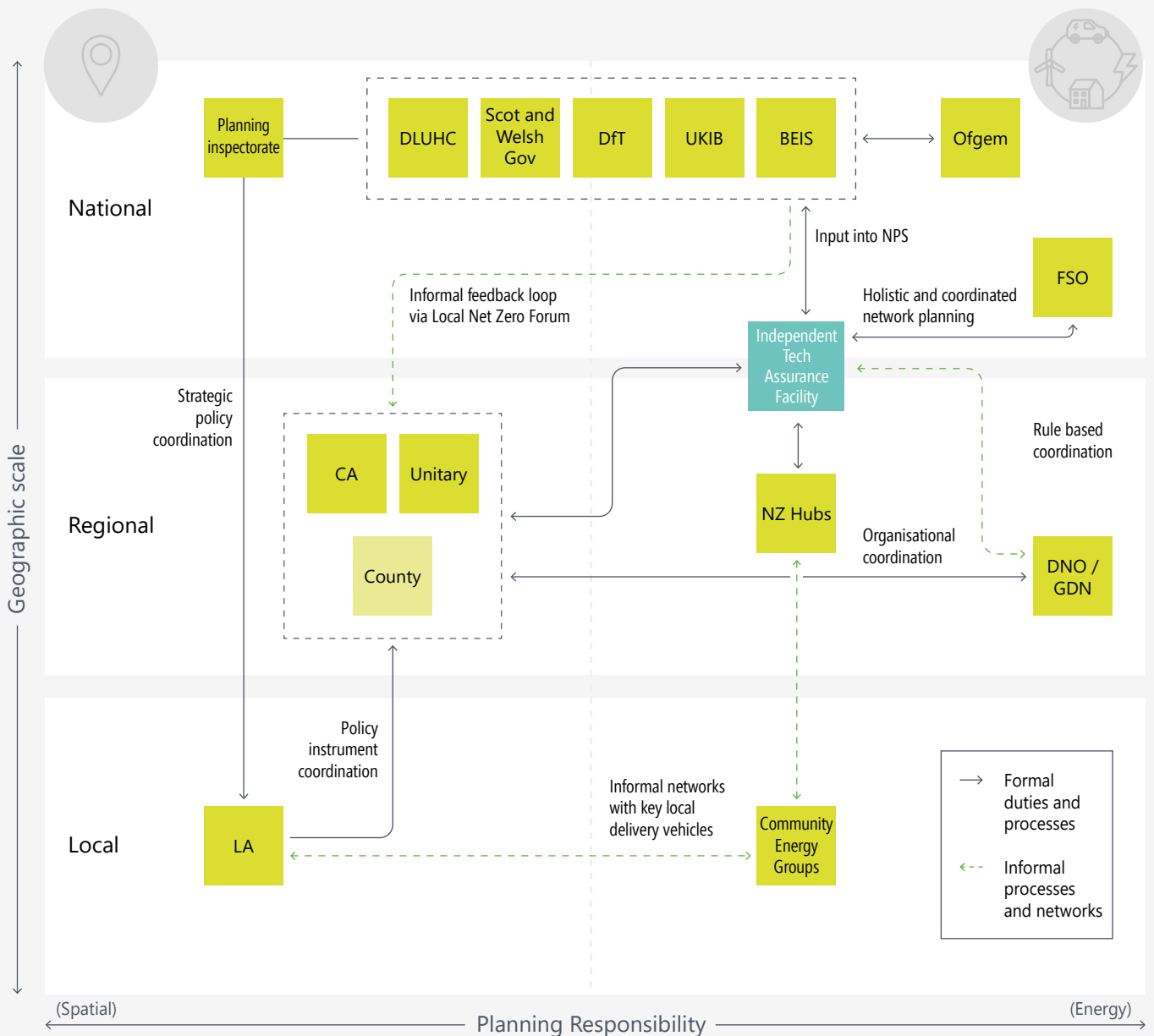


Figure 11: illustration of governance framework between spatial and energy planning

Actions

7. What actions need to be taken to enable coordination?

1) Enable local authorities to support with strategic policy coordination by rolling out LAEP

- ▶ Our analysis has shown that planned local decarbonisation is likely to be lower cost than an organic, unplanned approach, by as much as £252bn by 2050.
- ▶ Coordination will be required eventually, although we can take time to get it right, as the implications of not coordinating are likely not to materialise until a critical mass of 25% or over 90 district level LAEPs being implemented.
- ▶ The evidence from a robust set of LAEPs can support national policy decisions across heating, transport and industry now to ensure cost savings in the future.

2) Planning frameworks will need to do more to support net zero

- ▶ The NPPF is a fundamental framework which supports key and sensitive policy areas. Net Zero will require bold changes to existing processes
- ▶ Introducing a statutory duty and acknowledging LAEP within the NPPF is required to ensure decisions within existing frameworks are coordinated.
 - This should be backed by funding and support for LAs to deliver LAEPs
- ▶ The modelling from this work highlights that coordination between spatial and energy planning could deliver significant benefits.

3) Provide multidisciplinary resources into LAs to support with LAEP

- ▶ BEIS' recent heat network zoning consultation impact assessment indicated the provision of 510 FTE zoning coordinators, and DfT's EV infrastructure strategy has included up to £50m to fund the resources needed in local authorities.
- ▶ Support should be expanded/ coordinated to support the deployment of multidisciplinary resources within local authorities.

This could for instance take the form of new posts within LAs to liaise with network operators, deliver low carbon generation and introduce dedicated teams to lead retrofit/EE/heat pump rollout programmes
- ▶ LA's are under significant resource constraints. As such, this should be complemented by appropriate incentives e.g. funding allocation for forming joint LAEP decision making groups/committees to make best use of resources available.

4) LAEPs should be an essential piece of evidence in the RIIO process

- ▶ The regulatory framework will need to be robust in the face of inevitable uncertainties as well as potential vested interests.
- ▶ Ofgem should shape and lead a robust process in collaboration with network companies to build upon coherent strategic decisions across their networks based on LAEPs, and do this in a way that delivers maximum value for the wider energy system transition.
- ▶ New processes to coordinate across the whole system will be required to ensure decisions are made based on comparisons between low carbon gas, other vectors and full system value

5) Independent coordination at the regional level required to ensure lowest cost of net zero delivered

- ▶ In the short-term, independent technical and quality assurance is required, through a technical assistance facility, to support with the creation and reporting of robust LAEPs.
- ▶ In the medium term, coordination will require greater steer and influence from a regional level, coupled with the functions and responsibilities outlined in this report to support coordination across regions and nationally.
- ▶ A decision on this function is required from BEIS and Ofgem, to clarify who will be responsible for understanding how LAEPs fit together across regions
 - Processes such as those contained within the Localism and Planning Acts can set a precedent for enabling LAEP to feed into national decisions on net zero infrastructure planning.

6) Expand the role of net zero hubs to support with LAEP project development and investment

- ▶ Informal frameworks which facilitate lessons learnt between local and national levels are required and the local net zero forum should harness the knowledge acquired through Net Zero Hub activities
- ▶ Net Zero Hubs also have experience of project delivery and should have their role expanded to support LAs work/connect with community energy groups to serve local areas, with tailored local delivery vehicles and offers.
 - This will certainly need greater allocation from revenue funding budgets, and additional support for Net Zero Hubs to build and coordinate project portfolios

7) Ofgem to commission further evaluation of statutory enhanced partnerships for delivering coordination

- ▶ RII02 business plans highlight commitment from network companies, but this needs to be consistent across all regions to ensure fair distribution of resources and support
- ▶ Better and more consistent coordination between local authorities and network companies is required, and statutory enhanced partnerships have been highlighted as a potential supporting mechanism
 - However, it remains unclear whether this should be statutory. Further evaluation is required to confirm.

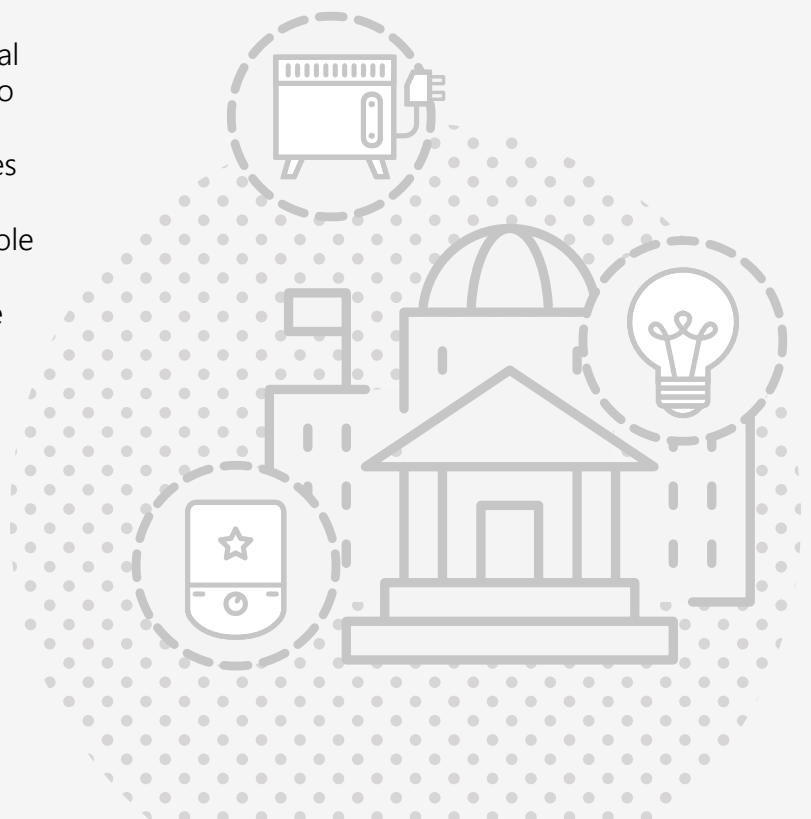


Table 4: Summary of legislation and duties discussed in this report

Department	BEIS	DLUHC	DfT	Defra	Ofgem
	<p>1.1 Climate Change Act</p> <p>1.2 Energy Act</p>	<p>2.1 Town and Country Planning Act</p> <p>2.2 Planning and Compulsory Purchase Act</p> <p>2.3 Local Government Act</p> <p>2.4 Planning Act</p> <p>2.5 (Cities and Local Government Devolution Act 2016) Levelling Up and Regeneration Bill</p>	<p>3.1 Local Transport Act</p> <p>3.2 Transport Act</p> <p>3.2 Automated and Electric Vehicle Act</p>	<p>4.1 Environment Act</p> <p>4.2 Air Quality Act</p>	<p>5.1 Gas Act – license conditions for gas network companies</p> <p>5.2 Electricity Act –license conditions for electricity network companies</p>
<p>Relevant plans, statement and/or provisions</p>	<p>2.4.1 National Policy statement (NPS) form a framework for decision making which can support the infrastructure required for the transition to net zero</p>	<p>2.1.1 NPPF requires review/update of local plans every 5 years</p> <p>2.1.2 In preparing a local development document the local planning authority must have regard to— national policies and advice contained in guidance issued by the Secretary of State</p> <p>2.1.3 Sets exemptions for permitted development rights for specific assets (e.g., underground district heating pipework)</p> <p>2.1.4 Town and Country Planning Order – Article 4 Direction, gives LA the power to remove certain permitted development rights.</p> <p>2.3.1 Section 93 of LGA allows LA to claim costs for appraising larger infrastructure projects</p> <p>2.5.1 Provision for Devolution framework in Levelling Up white paper. Local devolution is the mechanism which has enabled elected Mayors to take forward low carbon measures in strategic plans (legal duty)</p>	<p>3.1.1 Local transport authorities required to develop transport plans and policies on how to implement</p> <p>3.1.2 Local authority transport plans may need to set out ‘how quantifiable carbon reductions will be achieved’ and that funding will be ‘dependent on those plans being robust, ambitious and achievable’.</p> <p>3.2.1 Section 108 of Transport Act allows for statutory enhanced partnership between local authority and private operators, (a)an enhanced partnership (link) plan in relation to the whole or part of their area, or combined area, and (b)one or more enhanced partnership schemes relating to the whole or part of the area to which the plan relates.</p>	<p>4.1.1 Environment Bill amendments aim to strengthen the local air quality management (LAQM) framework to enable greater cooperation at local level and broaden the range of organisations that play a role in improving local air quality.</p> <p>4.2.1 Places legal duties on local authorities to check air quality in their areas against objectives for seven air pollutants set out in the in The Air Quality (England) Regulations 2000 and The Air Quality (England) (Amendment) Regulations 2002.</p>	<p>Principal Objective: to protect the interests of existing and future electricity consumers in relation to electricity conveyed by distribution systems or transmission systems, and future and existing gas consumers in relation to gas conveyed through pipes</p>

Department	BEIS	DLUHC	Dft	Defra	Ofgem
LAEP link	<p>1.2.1 Ofgem is required under section 132 of the Energy Act 2013 to have regard to any strategic priorities set out by Secretary of State (BEIS)</p> <p>2.4.2 NPS review process is undertaken by DLUHC and the planning policy framework supports the infrastructure required for the transition to net zero</p>	<p>2.1.1.1 Local planning authorities must identify their strategic priorities and have policies to address. Town and Country planning regulations set out specific matters to which the local planning authority must have regard.</p> <p>2.2.2.1 *Development plan documents must include policies designed to secure that the development and use of land in the local planning authority's area contribute to the mitigation of, and adaptation to, climate change</p>		<p>4.2.1.1 NPPF states planning policies and decisions should contribute towards compliance with relevant air quality limit values</p>	<p>2.1.3.1 General Permitted Development Order Class G electricity undertakings</p>



8. Acronyms

LA – Local Authority

DCO – Development Consent Order

NPS – National Policy Statement

NSIP – National Significant Infrastructure Project

DfT – Department for Transport

BEIS – Department for Business, Energy and Industrial Strategy

NPPF – National Planning and Policy Framework

LIR – Local Impact Reports

LAEP – Local Area Energy Planning

CCS – Carbon Capture and Storage

UKIB – UK Infrastructure Bank

DLUHC - Department for Levelling Up, Housing and Communities

LLFA - Lead Local Flood Authorities

Ofgem – Office for Gas and Electricity Markets

Ofwat - Water Services Regulation Authority

CNAIM - common network asset indices methodology

NARM - network asset risk metric handbook

FSO – Future System Operator

TO – Transmission Owner

DNO – Distribution Network Operator

GDN – Gas Distribution Network

RIIO – Revenue = Incentives, Innovation, Outputs

SEP – Statutory Enhanced Partnership

EV – Electric Vehicle

SMR – Steam Methane Reforming



9. References

- BEIS. (2021). *Draft National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4)*.
- BEIS. (2021). *Energy Future System Operator Consultation*.
- BEIS. (2021). *Heat Network Zoning Consultation Impact Assessment*.
- Cowell, R. (2017). Sub-national government and pathways to sustainable energy. *Environment and Planning C: Politics and Space*.
- DfT. (2022). *Government response to the CMA's Electric vehicle charging market study*.
- Economics, F. (2021). *Net Zero begins at home: modelling low-carbon heating uptake*.
- ESC. (2021). *The future of Local Area Energy Planning in the UK*.
- EY. (2020). *Low Carbon Investment - Scottish Bus Electrification commercial and economic content*.
- Gudde, P., Oakes, J., & Cochrane, P. (2021). The role of UK local government in delivering on net zero carbon commitments: You've declared a Climate Emergency, so what's the plan? *Energy Policy*.
- HM Government. (2021). *Net Zero Strategy: build back greener*.
- HSBC. (2019). *Mobilising Capital: Blending finance to deliver the low carbon transition*.
- Kuzemko, C., & Britton, J. (2020). Policy, politics and materiality across scales: A framework for understanding local government sustainable energy capacity applied in England. *Energy Research & Social Science*.
- LABM. (2019). Retrieved from <https://labmonline.co.uk/news/clarion-housing-group-signs-contracts-to-deliver-20-years-of-investment-in-our-homes/>: www.labmonline.co.uk
- LGA. (2021). Retrieved from <https://www.local.gov.uk/publications/scoping-role-local-authorities-EV>: www.local.gov.uk
- National Grid. (2021). Retrieved from <https://www.nationalgrid.com/industry-collaboration-turn-power-grid-transformers-heat-network-boilers-can-save-millions-tonnes>: www.nationalgrid.com
- PWC. (2020). Retrieved from <https://www.pwc.co.uk/assets/document/Unlocking-capital-for-net-zero-PwC-Nov-2020.pdf>: www.pwc.com
- PWC. (2022). *Accelerating Net Zero Delivery - unlocking the benefits of climate action in UK city regions*. Retrieved from <https://www.ukri.org/publications/accelerating-net-zero-delivery/>.
- Strbac, G. (2016). *Delivering future proof energy infrastructure*.
- UK100. (2021). *Research into a National - Local Net Zero Delivery Framework*.

Licence/Disclaimer

Energy Systems Catapult (ESC) Limited Licence for Guidance on creating a local area energy plan.

ESC is making this report available under the following conditions. This is intended to make the Information contained in this report available on a similar basis as under the Open Government Licence, but it is not Crown Copyright: it is owned by ESC. Under such licence, ESC is able to make the Information available under the terms of this licence. You are encouraged to Use and re-Use the Information that is available under this ESC licence freely and flexibly, with only a few conditions.

Using information under this ESC licence

Use by You of the Information indicates your acceptance of the terms and conditions below. ESC grants You a licence to Use the Information subject to the conditions below.

You are free to:

- copy, publish, distribute and transmit the Information;
- adapt the Information;

exploit the Information commercially and non-commercially, for example, by combining it with other information, or by including it in your own product or application.

You must, where You do any of the above:

- acknowledge the source of the Information by including the following acknowledgement:
- "Information taken from Guidance on creating a local area energy plan, by Energy Systems Catapult";
- provide a copy of or a link to this licence;
- state that the Information contains copyright information licensed under this ESC Licence.

acquire and maintain all necessary licences from any third party needed to Use the Information.

These are important conditions of this licence and if You fail to comply with them the rights granted to You under this licence, or any similar licence granted by ESC, will end automatically.

Exemptions

- This licence only covers the Information and does not cover:
- personal data in the Information;
- trademarks of ESC; and

any other intellectual property rights, including patents, trademarks, and design rights.

Non-endorsement

This licence does not grant You any right to Use the Information in a way that suggests any official status or that ESC endorses You or your Use of the Information.

Non-warranty and liability

The Information is made available for Use without charge. In downloading the Information, You accept the basis on which ESC makes it available. The Information is licensed 'as is' and ESC excludes all representations, warranties, obligations and liabilities in relation to the Information to the maximum extent permitted by law.

ESC is not liable for any errors or omissions in the Information and shall not be liable for any loss, injury or damage of any kind caused by its Use. This exclusion of liability includes, but is not

limited to, any direct, indirect, special, incidental, consequential, punitive, or exemplary damages in each case such as loss of revenue, data, anticipated profits, and lost business. ESC does not guarantee the continued supply of the Information.

Governing law

This licence and any dispute or claim arising out of or in connection with it (including any noncontractual claims or disputes) shall be governed by and construed in accordance with the laws of England and Wales and the parties irrevocably submit to the non-exclusive jurisdiction of the English courts.

Definitions

In this licence, the terms below have the following meanings: 'Information' means information protected by copyright or by database right (for example, literary and artistic works, content, data and source code) offered for Use under the terms of this licence. 'ESC' means Energy Systems Catapult Limited, a company incorporated and registered in England and Wales with company number 8705784 whose registered office is at Cannon House, 7th Floor, The Priory Queensway, Birmingham, B4 6BS. 'Use' means doing any act which is restricted by copyright or database right, whether in the original medium or in any other medium, and includes without limitation distributing, copying, adapting, modifying as may be technically necessary to use it in a different mode or format. 'You' means the natural or legal person, or body of persons corporate or incorporate, acquiring rights under this licence.



This area contains a series of horizontal lines, spaced evenly, providing a template for writing or drawing. It occupies the majority of the page below the header.

Energy Systems Catapult

7th Floor, Cannon House
18 Priory Queensway
Birmingham B4 6BS

Telephone +44 (0)121 203 3700

Email info@es.catapult.org.uk

es.catapult.org.uk

© 2022 Energy Systems Catapult



UK Research
and Innovation