CATAPULT
Energy Systems

The future of local area energy planning in the UK

UK Research and Innovation

Foreword

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There is a growing consensus that local action on how we use energy will play a necessary role in getting to Net Zero. Local Area Energy Planning is pivotal in delivering this efficiently, fairly and economically, enabling local stakeholders to identify pathways to decarbonisation.

It needs to be done in a coherent and consistent way, with clear definition, method and guidelines and using robust models and tools. Local authorities should lead but need support in producing plans and delivering actions. A co-ordinated approach offers investors and infrastructure operators comparability, and allows action taken at the local level to inform the Government's view of national progress.

Contents

Acronyms and Initialisms

BAU
Business As Usual

BEIS
Department for Business, Energy & Industrial Strategy

CA
Combined authority

CAPEX
Capital Expenditure

CCC
Climate Change Committee

CHP
Combined Heat and Power

CIL
Community Infrastructure Levy

CNCA
Carbon Neutral Cities Alliance

CO_2/CO_2e
Carbon dioxide/Carbon dioxide equivalent

CSE
Centre for Sustainable Energy

DCLG
Department for Communities and Local Government

DEC
Display Energy Certificates

DECC
Department of Energy and Climate Change (absorbed into BEIS)

DEM
Decentralised Energy Masterplanning

DFES
Distribution Future Energy Scenarios

DLUHC
Department for Levelling Up, Housing and Communities (previously MHCLG and DCLG)

DNO
Distribution Network Operator

ENA
Energy Networks Association

EPN
EnergyPath Networks

ETI
Energy Technologies Institute

EV
Electric Vehicle

ESC
Energy Systems Catapult

FES
Future Energy Scenarios

GB
Great Britain

GHG
Greenhouse Gas(es)

GDNO
Gas Distribution Network Operator

GMCA
Greater Manchester combined authority

GSP
Grid Supply Point

GVA
Gross Value Added

HMT
Her Majesty's Treasury

ID
Identification Number

LA
Local Authority

$LACO_2$
Local Authority Carbon Dioxide

LAEP
Local Area Energy Plan(ning)

LEP
Local Enterprise Partnership

LGA
Local Government Association

LHEES
Local Heat and Energy Efficiency Strategies

LSOA
Lower-level Super Output Area

LULUCF
Land-Use, Land-Use Change and Forestry

MSOA
Middle-level Super Output Area

NAO
National Audit Office

NIB
National Infrastructure Bank

NPF
National Planning Framework

NPPF
National Planning Policy Framework

NREL
National Renewable Energy Laboratory

NYC
New York City

NZAP
Net Zero Area Plan

Ofgem
Office for Gas and Electricity Markets

PPG
Planning Policy Guidance

PPW
Planning Policy Wales

PSDS
Public Sector Decarbonisation Scheme

QA
Quality Assurance

RTPI
Royal Town Planning Institute

SCATTER
Setting City Area Targets and Trajectories for Emissions Reduction

SHMA
Strategic Housing Market Assessments

SiCEDS
Stakeholder Interactive City Energy Simulator

SME
Small- and Medium-sized Enterprises

SPEN
Scottish Power Energy Networks

SPP
Scottish Planning Policy

SSEN
Scottish and Southern Energy Networks

SSH
Smart Systems and Heat

UK
United Kingdom of Great Britain and Northern Ireland

UKPN
UK Power Networks

USA
United States of America

WIP
Work In Progress

WPD
Western Power Distribution

WWU
Wales and West Utilities

Executive Summary

There is a growing consensus, locally, nationally and internationally, that the threats posed by climate change should now be treated as an emergency.

Accordingly, close to 300 local authorities and eight combined authorities have declared a climate emergency. Some have expressed the intention to have their local communities guide and influence the approach they take to reach this target; however, few are clear on how they will make the transition to net zero happen. This has led to an increased level of interest and focus in local area energy planning (LAEP) that has created an active landscape of programmes, projects and initiatives using a variety of models and tools to support the process.

There is a need to understand this landscape so that LAEP can be deployed in the most effective and efficient way. This report:

- Offers a clear definition of what LAEP is (and isn't), making comparisons with alternative approaches to energy planning and providing an understanding of what the market believes it to be.
- Explores current energy planning activities and the context in which LAEP is undertaken, assessing plans that have been made and the products and tools that are used, and making comparisons with approaches from overseas.
- Identifies barriers and challenges that are faced by those involved in producing plans, such as gaps or areas for potential improvement, and the future support required to deliver effective energy planning across the UK.
- Explains the potential benefits of developing a common method, allowing projects to be bundled and finance to be facilitated. Shows the value of guidelines and templates for conducting consistent, best practice LAEP that can support scaling and replication.
- Helps identify approaches to avoiding the risk of the "postcode lottery"[1] when it comes to local energy transition and considers relevant aspects of broader policy and spatial planning.

The project is part of a broader programme of work including strategic and economic analysis of local energy transition as well as the deployment of LAEP and the development of methodology.

[1] The term "Postcode lottery" is used in two ways; to describe funding being distributed unevenly between areas; and outcomes from the energy transition for businesses and residents in an area being different when compared to other areas.

Approach

The project utilised interviews with the market[2] and desktop research to meet its objectives. ESC identified six groups for inclusion in market interviews. These groups are known to have an interest and active role in LAEP. The six groups are:

- Local authorities, Local Enterprise Partnerships, Energy Hubs
- Electricity Distribution Network Operators (DNO)
- Gas Distribution Network Operators (GDNO)
- Delivery consultants
- Central government departments and national organisations
- Academics

A total of 40 interviews were carried out across the six groups. Interviews were semi-structured and took a solely qualitative approach. A topic guide for each stakeholder group was developed, comprising key headline areas and questions, and follow-up prompts.

The desktop research was undertaken in several phases; to help define and understand what LAEP is, alternative approaches to energy planning were assessed; to help understand the scale of energy planning activity underway in the UK, a systematic assessment of every local authority was undertaken; to help understand the future of LAEP, the need for a common method was identified and potential integration with other policy was identified.

Defining Local Area Energy Planning

The market interviewees identified uncertainty[3] over what LAEP is, what it isn't, what should be included in the scope of a plan, and how a plan should be procured and produced. A formalised definition that addresses these uncertainties can help those involved in LAEP. Despite LAEP aspiring to be a comprehensive approach, market interviewees identified elements that were felt could be included in plans that are currently omitted, such as land use and agriculture. Market interviewees recognised some elements of LAEP as being particularly important, such as taking a whole systems approach to tackle all energy vectors and identifying near terms actions and projects that can be deployed immediately to reduce emissions.

The market interviewees felt that LAEP should be led by a local government organisation, as they are trusted and impartial and have access to certain types of information and data that other organisations don't. However, there was some uncertainty at which level of local government LAEP should be delivered at, with some highlighting that unitary or combined authorities may be better placed than district authorities as they cover a larger geographical scale and have more access to resources.

This project has developed a tiered approach to allow authorities to see where their current plans sit as compared to a LAEP and the variation between them described in terms of scope and actions.

[2] The 'market' refers to a broad set of stakeholders who were interviewed for the project. These stakeholders are involved in LAEP in some way (e.g., local authorities, DNOs, government, delivery contractors). Further details of the market and who was involved in the interviews are described in Appendix 1.

[3] It should be noted that the interviewees are all known to ESC, and the assumption is that they are already aware of LAEP; a wider market assessment, that included interviewees not known to ESC is likely to be less knowledgeable about LAEP

Scale of energy planning underway in the UK

The level of LAEP activity undertaken to date is low but is growing. Just three local authorities have a completed plan that they can work from, although this will soon increase to fifteen. A very large number of plans (250+) have been made that did not meet the criteria[4] to be categorised as a LAEP, although do cover a geographically comparable sized area. A subset of the most detailed plans was assessed against nine criteria to understand differences to LAEP. Of the twelve plans that scored the highest against the criteria, nine were at the geographical scale of a county council, LEP, or combined authority.

The market interviewees felt that plans took a long time to put together, were costly to produce and local authorities felt that they were under-resourced to deliver them. They highlighted the need for a common approach and language, to make planning more useful to stakeholders. A review of models and tools identified that no single tool is currently available that can sufficiently model the energy system, in a way that was simple enough to use, and that was available without significant costs. Assessment of plans developed overseas identified insights that could be incorporated into LAEP; highlights include strong stakeholder buy-in, clearly defined roles and responsibilities, measurable actions and consideration of other factors such as resilience.

Finally, interviewees gave their thoughts on delivering the actions that plans had identified, focussing on the funding required for interventions and the shortage of appropriately skilled personnel in the construction industry to deliver the low carbon measures.

The Future of Local Area Energy Planning

Interviewees valued the benefits that LAEP brings. They acknowledged LAEPs as providing a practical roadmap that identifies what actions need to be taken, by who, where, when and how much they will cost. They cited the benefit of robust analysis undertaken for a LAEP that is used to inform decisions, secure stakeholder agreement, and de-risk external investment. The market identified the benefits that a common method and consistent approach to LAEP can bring, particularly in collection and analysis of data, modelling of pathways and scenarios and assumptions being consistently developed and applied. Further, they recognised the importance of having a consistent approach to LAEP outputs, both in terms of how they are structured and what they contain.

The market identified efficiencies of a common method and consistent approach to LAEP, for example stakeholders only need to be familiar with one approach, avoiding duplication of efforts across the sector as multiple inconsistent approaches are developed simultaneously, and for reducing the cost of consultancy work. They also identified the benefit of being able to knit plans together from across multiple areas if all of them have followed a consistent method and approach, and the benefits that this brings in terms of preventing contradictions and discrepancies. Interviewees requested guidance, tools and standardised templates, to help with procuring for a LAEP and ensuring outputs are as required.

[4] Detail on the criteria used in the assessment is described in Chapter 3

Desktop research further assessed the need for a common method and consistent approach, citing the transparency that it gives to investors to support their decision making when assessing potential investments, and the robust evidence it could provide in support of applications to funds such as NIB and CIL. Examples were provided of how a common method could facilitate providing consistent insights and information to central Government, allowing a national 'summing-up' of local action.

Interviewees reported being aware of the Ofgem LAEP method but expressed reservations about the scale and complexity of it when asked about using it. They highlighted concerns around costs and timescales, reporting that the complexity of the work meant it took a long time to complete, and was also therefore costly to produce. Interviewees also reported being uncertain about what they would get at the end of following the method, as it doesn't provide examples of best practice or what a plan 'done well' will look like.

Finally, the integration of LAEP with other types of planning policy such as NPPF and PPG was discussed and illustrated. An example of LAEP being integrated with planning policy is currently being enacted by the Welsh Government. This integration is linked to the two pilots of LAEP that are currently being undertaken in Newport and Conwy.

Recommendations

Recommendation 1

Endorse the definition of LAEP proposed by this report

A definition of LAEP is developed in this report. The definition should be adopted and endorsed by central Government to provide clarity to stakeholders who are involved in the transition of local areas to net zero. The endorsement of the definition should be a collaborative effort, that involves the appropriate government departments (such as HM Treasury, BEIS, and DLUHC, devolved governments), representatives of local government (such as LGA), industry (Ofgem, ENA, National Grid) as well as other interested bodies that have experience in this area (such as Innovate UK, ESC, CSE, Regen).

Local Area Energy Planning Definition

- LAEP is a data driven and whole energy system, evidence-based approach that is led by local government developed collaboratively with defined stakeholders. It sets out to identify the most effective route for the local area to contribute towards meeting the national net zero target, as well as meeting its local net zero target.
- LAEP results in a fully costed and spatial plan that identifies the change needed to the local energy system and built environment, detailing 'what, where and when and by whom'. LAEP sets out the total costs, changes in energy use and emissions, and sets these out over incremental time periods to meet the 2030 target of a 68% reduction in emissions, and the 2035 target of a 78% reduction in emissions, and net zero by 2050.

- LAEP provides the level of detail for an area that is equivalent to an outline design or master plan; additional detailed design work is required for identified projects to progress to implementation.
- LAEP defines a long-term vision for an area but should be updated approximately every 3–5 years (or when significant technological, policy or local changes occur) to ensure the long-term vision remains relevant.
- LAEP identifies near-term actions and projects, providing stakeholders with a basis for taking forward activity and prioritising investments and action.
- LAEP scope addresses electricity, heat, and gas networks, future potential for hydrogen, the built environment (industrial, domestic and commercial) its fabric and systems, flexibility, energy generation and storage, and providing energy to decarbonised transport e.g. electricity to electric vehicles and charging infrastructure.
- Actions to be addressed when developing the plan include: stakeholder engagement and a social process that considers both technical and nontechnical evaluation, using robust cost inputs and standardised assumptions and data sets, multiple future scenarios/ pathways, whole system approach, spatial analysis (including zoning and data granularity), temporal analysis, network infrastructure impacts, and developing the plan through a credible and sustained approach to governance and delivery.

Recommendation 2

Endorse LAEP activity being led by local government

This recommendation is for LAEP activity to be led by local government, and it should be endorsed by central and devolved governments and Ofgem in order to provide clarity of roles and responsibilities to stakeholders. There is currently no clear obligation for local government to undertake a mandated form of LAEP, but consensus evidenced by this project was for locally led activity (see section 2.5.4). It was recognised that local government is impartial and provides democratic accountability to lead on the plan-making process. LAEP being led by local government presents an opportunity to align with other local government policy, such as planning, transport, environment, health, energy, climate change, housing, regeneration and economic development.

The geographical scale at which LAEP is carried out needs to be considered: findings indicated that plans covering a larger area led by combined authorities, County Councils or LEPs tend to be more comprehensive and may also be more likely to identify a wider portfolio of investable projects.

Local government organisations should collaborate to both define LAEP areas and identify the lead organisation, so that a LAEP best reflects existing local preferences, working arrangements and capacity to lead/resource.

Recommendation 3

Develop a method, guidelines and templates to assist in the coherent production of plans and establish roles and responsibilities

The need for a common method to govern the production of LAEPs was identified by the market. The absence of a method, guidelines and a consistent approach was identified as hampering progress on many fronts; from not being able to understand what LAEP is, how to do it, what it should involve, who should be involved and what responsibilities they should have; to what it looks like when it is finished, to broader concerns such as neighbouring areas having conflicting plans, and central Government not being able to understand progress towards net zero.

As with Recommendation 1, developing the method should be a collaborative effort that involves the appropriate government departments (such as HM Treasury, BEIS, and DLUHC, devolved governments), representatives of local government (such as LGA), industry (Ofgem, ENA, energy network operators, delivery organisations and investors) as well as other interested bodies that have experience in this area (such as Innovate UK, ESC, CSE) and others drawn from the community of relevant stakeholders.

Recommendation 4

Provide innovation funding to drive LAEP tool development

An assessment of available models and tools identified that no single tool is sufficiently developed to produce all aspects of a LAEP, without significant computing power and user training, and is publicly available. Innovation funding should be provided to support tool development, with organisations considering how to best utilise, manipulate and assess data, visualise outputs and identify project and investment opportunities, whilst also focusing on how to make the plan making process more efficient and accessible. New tools should align with the proposed LAEP method.

Funding may involve the appropriate government departments (such as HM Treasury, BEIS, and DLUHC, devolved governments), representatives of local government (such as LGA), industry (Ofgem, ENA, National Grid) as well as other interested bodies that have expertise in this area (such as Innovate UK, ESC, CSE, Regen).

[5] A comparison is with the Building Research Establishment (BRE), who looks after non-domestic (BREEAM) and domestic (SAP) building standards and assessment, provide software, training and support.

[6] Research into a National-Local Net Zero Delivery Framework, UK100, October 2021

[7] Net Zero Strategy: Build Back Greener, HM Government, October 2021

[8] The term "Postcode lottery" is used in two ways; to describe funding being distributed unevenly between areas; and outcomes from the energy transition for businesses and residents in an area being different when compared to other areas.

Recommendation 5

Establish a governance arrangement with key national stakeholders. Appoint a technical assistance facility to oversee the rollout of consistent LAEPs that supports net zero and the levelling up agenda

Key national stakeholders (e.g. central and devolved governments and Ofgem) should form a national governance arrangement to oversee and steer the delivery of LAEP, to align LAEP with national policy objectives, and to consider interaction with the national energy system. A created or appointed organisation could then oversee the development, technical delivery and rollout of LAEPs, acting as an agency (on behalf of the governance arrangement) to develop the aforementioned methods. They could support the specification of models and tools for delivery of LAEPs, include interaction of LAEP with energy network planning, as well as providing a sounding board for local authorities undertaking the process of LAEP, quality assuring their processes and outputs, and working with central Government to bridge between local and national [5].

The lifetime of the facility is long-term; to remain relevant, LAEPs need to be refreshed periodically, and so the role for the facility will continue to at least 2050. Further, the facility should recognise that timelines for producing and refreshing LAEPs may need to align with other activities (e.g. annual public sector budgets, election cycles, Ofgem price control periods). Although as described here the focus is the facility assisting in the delivery of LAEPs, the remit of such a facility will be broader and encompass other elements of local net zero delivery and actions. The above is in line with recommendations made by UK100 [6] for a Net Zero Delivery Board and Net Zero Delivery Unit, and BEIS's Net Zero Strategy that proposes establishing a Local Net Zero Forum [7].

Recommendation 6

Prioritise resource to produce LAEPs and develop a Net Zero Delivery Framework to enable local energy transition activity

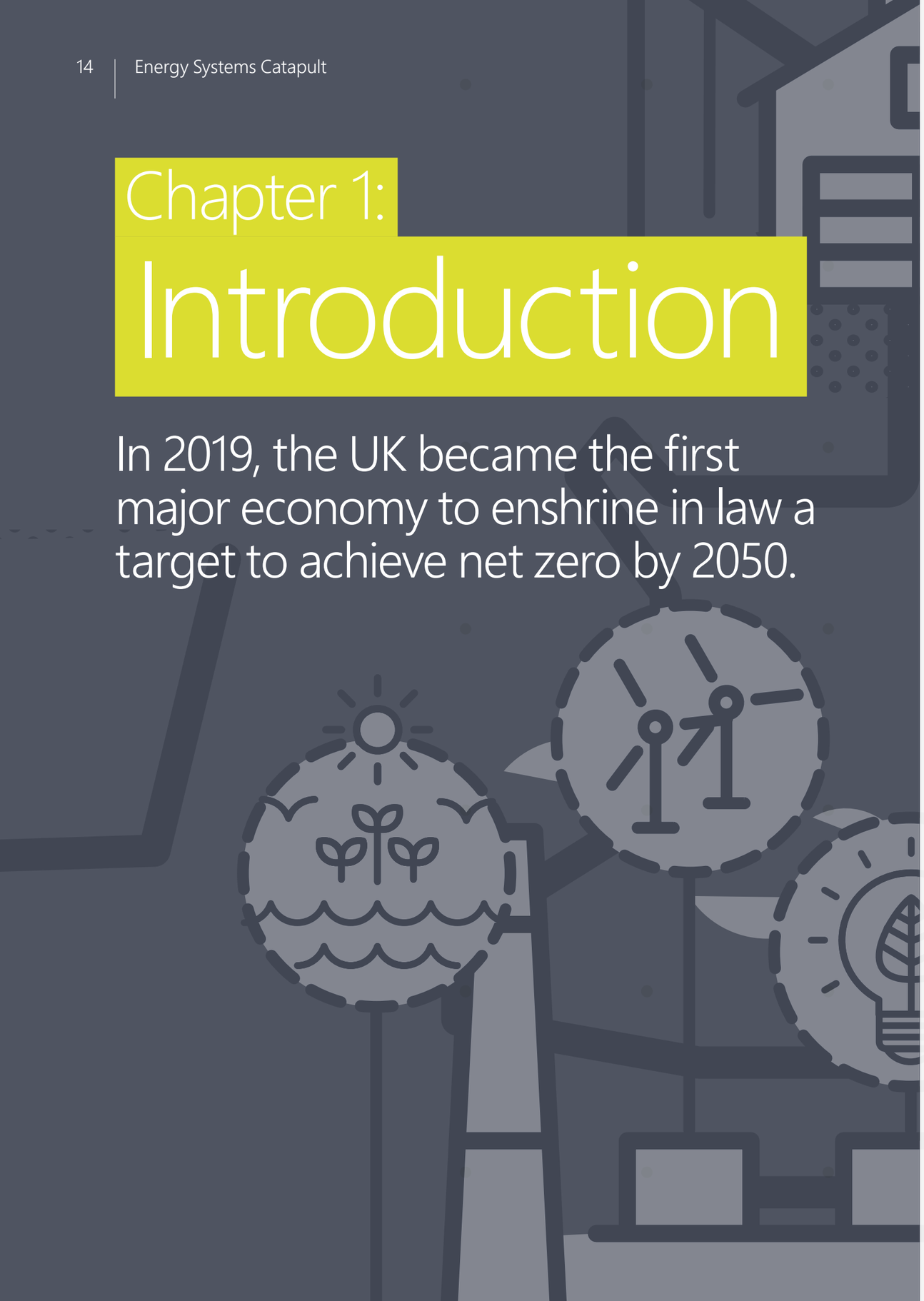
LAEP delivers the desired coordinated approach to planning for net zero in local areas however there are several blockers to roll out across the country, one of which is funding. Local authorities do not typically have resources — people and money — to undertake producing LAEPs and delivering the actions that they identify. A structured mechanism needs to be developed that provides dedicated funding for the production and ongoing upkeep of LAEPs, with the proposed governance arrangement and technical assistance facility overseeing their development and implementation. Beyond production of LAEPs, a structured mechanism with the objective of funding and implementing projects identified by LAEP is also required.

It should be recognised, also, that LAEPs are long-term strategic documents that need to be kept up-to-date and require continued engagement with stakeholders to remain relevant and take account of any recent changes. Such a model would help avoid the postcode lottery [8] of energy planning and action. This could look to establish a blended funding mechanism that seeks funding from energy network innovation funding, local area funding, investor or consumer funding, UK innovation funding and central/devolved government.

Funding may involve the appropriate government departments (such as HM Treasury, BEIS, DLUHC and devolved governments), representatives of local government (such as LGA), industry (Ofgem, ENA, National Grid) as well as other interested bodies that have experience in this area (such as Innovate UK, ESC, CSE, Regen).

Chapter 1: Introduction

In 2019, the UK became the first major economy to enshrine in law a target to achieve net zero by 2050.



In addition, close to 300 local authorities and eight combined authorities have declared a climate emergency, representing some three-quarters of the total number. Many have set 2030 as the target for achieving net zero. Some have expressed the intention to have their local communities guide and influence the approach they take to reach this target; however, few are clear on how they will make the transition to net zero happen. In 2021, the UK amended the law to target emissions reductions of 78% by 2035, essentially bringing the targets in the 2008 Energy Act forward by fifteen years.

The UK Government has also stated its commitment to delivering economic and societal benefits as part of its recovery from the COVID-19 pandemic and 'levelling-up' agendas. This highlights the need to consider net zero interventions in the context of the specific requirements of each local area.

Fundamental change is needed if these commitments are to be delivered. The UK will only be successful if the many parties involved — government at all levels, regulators, innovators, industry, investors and citizens — are engaged, empowered and equipped to make appropriately informed decisions in a timely manner.

Local area action informed and enabled by Local Area Energy Planning (LAEP) will play an important and necessary role in getting to net zero and doing so in a way which satisfies broader Government goals.

There are many parties now conducting LAEP type work of varying substance and content, effectively creating a market for preparing local area energy plans. This has resulted in significant comparability challenges and an inability to ensure the sum of the local parts equals a whole regional or national picture. As a result, the clarity of the value of such planning can be obscured.

1.1 Project objectives

This project provides evidence to Innovate UK, HM Treasury and other Government departments to inform the future of LAEP and how it can assist meeting net zero. An increased level of interest and focus in LAEP has created an active landscape of programmes, projects and initiatives which may not always be aligned in approach and may not connect action with outcomes. There are also a variety of products and tools emerging to support the process. There is a need to understand this landscape so that LAEP can be deployed in the most effective and efficient way.

The project:

- Offers a clear definition of what LAEP is (and isn't), making comparisons with alternative approaches to energy planning and providing an understanding of what the market[9] believes it to be.
- Explores current energy planning activities and the context in which LAEP is undertaken, assesses plans that have been made and the products and tools that are used, and makes comparisons with approaches from overseas.
- Identifies barriers and challenges that are faced by those involved in producing plans, gaps or areas for potential improvement, and the future support required to deliver energy planning across the country.
- Explains the potential benefits of developing a common method, including for example, allowing projects to be bundled and finance to be facilitated. It shows the value of guidelines and templates for conducting consistent, best practice LAEP that can support scaling and replication
- Helps identify approaches to avoiding the risk of the "postcode lottery"[10] when it comes to local energy transition, and considers relevant aspects of broader policy and spatial planning
- Makes recommendations on how to achieve community, local and national outcomes that could not be achieved without local action.

[9] The 'market' refers to a broad set of stakeholders who were interviewed for the project. These stakeholders are involved in LAEP in some way (e.g., local authorities, DNOs, government, delivery contractors). Further details of the market and who was involved in the interviews are described in Appendix 1.

[10] The term "Postcode lottery" is used in two ways; to describe funding being distributed unevenly between areas; and outcomes from the energy transition for businesses and residents in an area being different when compared to other areas.

1.2 Approach

The project utilised interviews with the market and desktop research to meet its objectives. ESC identified six groups for inclusion in market interviews. These groups are known to have an interest and active role in LAEP. The six groups are:

- Local authorities, LEPs, Energy Hubs
- Electricity Distribution Network Operators (DNO)
- Gas Distribution Network Operators (GDNO)
- Delivery consultants
- Central government departments and national organisations
- Academics.

A total of 40 interviews were carried out across the six groups. Interviews were semi-structured and took a solely qualitative approach. A topic guide for each group was developed, comprising key headline areas and questions, and follow-up prompts.

The desktop research was undertaken in several phases; to help define and understand what LAEP is, alternative approaches to energy planning were assessed; to help understand the scale of energy planning activity underway in the UK, a systematic assessment of every local authority was undertaken; to help understand the future of LAEP, the need for a common method was identified and potential integration with other policy was discussed.

1.3 Report structure

The evidence gathered in this landscape review is broadly separated into four key chapters:

- Chapter 2 sets the scene for understanding LAEP, providing an overview of its historical development, a definition and comparison of alternative approaches to energy planning, and an understanding of what the market thinks it to be.
- Chapter 3 baselines the level of LAEP activity underway to date in the UK, systematically assessing progress made by every local authority, assessing the products and tools that are used, making comparisons with overseas approaches, and understanding market perspectives on progress, barriers and challenges to date; the chapter concludes with the development of a tiered approach to categorising activities.
- Chapter 4 looks to the future for LAEP, explaining the benefits from following a common method and guidelines, and using templates and toolkits in the process, exploring market views on taking a consistent and structured approach, and considers integration with other planning policies; the chapter concludes with an understanding of market views on the type of support required in the future.
- Chapter 5 concludes by making recommendations on how LAEP can be deployed in an effective and efficient way to deliver both local and national outcomes, as well as benefit communities.

Chapter 2: Defining Local Area Energy Planning

The intention of this chapter is to define LAEP. This definition considers the historical context of LAEP, the development of a method for governing the undertaking of LAEP, how LAEP compares to other approaches to energy planning and the market perspectives on LAEP, what should be included in the scope of an LAEP, who should lead and be involved in their production.

2.1 History of Local Area Energy Planning

The concept of LAEP has been developed over a number of years by ESC (see appendix 1 for history) and other organisations. The UK Government's commitment to net zero is significant; it means decarbonisation must now reach all corners of the UK. LAEP is seen as a key component to facilitating the journey to net zero, and various organisations have expressed their commitment both to the need to take a whole energy system-based approach, and the role of local in the energy transition.

Examples of LAEP and local government initiatives include:

- Welsh Government publishing their guidance document 'Planning Policy Wales', which states *"To assist in the achievement of energy and decarbonisation targets, local and regional authorities must take an active, leadership approach at the local and/or regional level by setting out their vision for decarbonisation and energy for their areas. The Welsh Government recommends a whole systems approach is taken when developing plans for a low carbon energy system. We are exploring the use of LAEP, which aims to inform, shape and enable key aspects of the transition to a low carbon energy system"*[11] (February, 2021)
- The Net Zero Infrastructure Industry Coalition publishing a report, 'A place-based approach to net zero', concluding that *"Achievement of the net zero goal will require extensive collaboration between central and local government, as well as with the private sector"*[12] (March, 2021)
- The Royal Town Planning Institute publishing a report, 'Place-based approaches to climate change', this advocates for a place-based and holistic approach and collaborative working across departments in local authorities, whilst recognising a resourcing and skills gap[13] (March, 2021)
- Citizens Advice publishing a report, 'Look before you LAEP',[14] calling for an end to the postcode lottery of Local Area Energy Plans (May, 2021).

LAEP activity is currently underway across the country; each of Greater Manchester's ten borough councils is working to produce a LAEP as part of the Greater Manchester Local Energy Market project[15]. The Welsh Government has commissioned two LAEP pilots, in Newport and Conwy, that follow the Ofgem method (see below). Further details of the level of LAEP activity underway in the UK is described in chapter 3.

2.2 Local Area Energy Planning: The Method

In July 2020, Ofgem published Local Area Energy Planning: The Method,[16] a report that was co-authored by ESC and Centre for Sustainable Energy (CSE). It describes *"the purpose and value of local area energy planning (LAEP). It identifies four critical elements of LAEP and sets out quality criteria for each element which together define what LAEP 'done well' involves."* The report was commissioned by Ofgem and has benefitted from the input of a Steering Group including the Department for Business Energy and Industrial Strategy (BEIS), the Committee on Climate Change, the Scottish Government, the Welsh Government and Innovate UK.

The method is based around the following four key elements:

- The use of robust technical evidence produced using analytical techniques which consider the whole energy system and make consistent use of available data, and whose strengths and weaknesses are well understood.
- A comprehensive assessment of wider non-technical factors which need to be understood and addressed to secure change.
- A well designed and engaging social process that involves appropriate stakeholders effectively, uses the technical evidence appropriately, and manages vested interests effectively, thus ensuring the resulting plan is an informed and legitimate representation of local intent in relation to energy system decarbonisation.
- A credible and sustained approach to governance and delivery.

The method provides guidance on how each of these four elements can be done well, through a checklist approach, as well as outlining key issues to consider and highlighting techniques that could be applied to aid delivery of a LAEP. The method provides a strong basis to introduce the reader to components of a LAEP, as well as providing high-level guidance. However, it is a framework rather than a more definitive 'how-to' guide and therefore requires user judgement and interpretation.

[11] https://gov.wales/planning-policy-wales

[12] https://www.mottmac.com/download/file?id=39870&isPreview=True

[13] https://www.rtpi.org.uk/research/2021/march/place-based-approaches-to-climate-change/

[14] https://www.citizensadvice.org.uk/Global/CitizensAdvice/Energy/Local%20Energy%20Report.pdf

[15] https://www.greatermanchester-ca.gov.uk/what-we-do/environment/energy-supply/

[16] https://es.catapult.org.uk/reports/local-area-energy-planning-the-method/

2.3 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 least cost preferred 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.

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 buildings)[17] 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 CO_2 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.

2.4 Similarities with other approaches to energy planning

LAEP shares similarities with other methods and approaches to energy planning. Some of these have been developed since LAEP, whilst others existed prior to LAEP. A brief overview of relevant energy planning methods and approaches is provided here, alongside a clear assessment of where there are similarities and differences.

2.4.1 Local Heat and Energy Efficiency Strategies (LHEES)

The concept of LHEES was introduced in 2016 by the Scottish Government[18] and has been piloted as part of the Energy Efficient Scotland programme. LHEES aim to establish area-based plans and priorities for systematically improving the energy efficiency of buildings, and decarbonising heat.

[17] The be clear; built environment industrial energy use includes energy used in industrial processes

[18] https://www.gov.scot/publications/consultation-heat-energy-efficiency-strategies-regulation-district-heating/

The Scottish Government have suggested that LHEES adopts a local authority area-wide approach and covers a long-term period (15–20 years). In line with the goals of Energy Efficient Scotland, LHEES should reflect and support local and national policies, frameworks, strategies and targets, and identify opportunities for energy efficiency improvements and heat decarbonisation. The Scottish Government has outlined LHEES as including the following stages:

- **Stage 1**: Assess existing local and national strategies and data availability.
- **Stage 2**: Conduct an authority-wide assessment of existing building stock's energy performance and heat supply.
- **Stage 3**: Conduct an authority-wide setting of aggregate targets for heat demand reduction and decarbonisation of buildings.
- **Stage 4**: Conduct a socio-economic assessment of potential energy efficiency and heat decarbonisation solutions.
- **Stage 5**: Select areas/undertake prioritisation of opportunities for energy efficiency and/or heat decarbonisation, leading to the designation of zones.
- **Stage 6**: Cost and phase delivery programmes.

Between 2017 and 2019, twelve local authorities participated in the first round of pilots,[19] with eleven further local authorities participating in the second round of pilots from 2018 to 2020.[20] The aims of the pilots were to test and develop methods for creating an LHEES, identify relevant sources of data (and any data gaps), and gain a fuller understanding of the resources and capabilities required to deliver an LHEES. All local authorities in Scotland now have an LHEES, with Phase 3[21] of the pilot completed in October 2021.

2.4.1.1 Similarities and differences to LAEP

There are a number of similarities between LHEES and LAEP:

- plans include estimated costs.
- plans include a spatial element, whereby zones are designated and prioritised for specific interventions.
- plans are intended to be delivered in phases that are linked to intermediate carbon budgets and emissions reductions targets.
- consideration of more than one pathway.
- socio-economic assessment.

Whilst LHEES has similarities with LAEP, there are also notable differences:

- LHEES does not take a 'whole systems' approach or all include all energy vectors, instead focussing solely on buildings and primarily focussing on the decarbonisation of heat (but also including other energy efficiency measures such as lighting upgrades).
- Further, the LHEES pilots often chose to cover a subset of buildings (i.e. public sector buildings, local authority and social housing, SME buildings, privately owned, privately rented), instead of providing a plan for an entire area's built environment and energy system.[22]
- Stakeholder engagement was minimal, typically involving only local authority officers and elected members.
- Network operators were not involved in the planning.

[19] https://www.gov.scot/publications/local-heat-energy-efficiency-strategies-phase-1-pilots-social-evaluation/

[20] https://www.gov.scot/publications/local-heat-energy-efficiency-strategies-lhees-phase-2-pilots-evaluation/

[21] https://www.gov.scot/publications/lhees-phase-3-pilot-evaluation/

[22] It should be noted that this was the intention of the LHEES pilots; future roll-out of the LHEES approach may cover a broader range of sectors and vectors.

2.4.2 Distribution Future Energy Scenarios (DFES)

Distribution Future Energy Scenarios (DFES) are used for planning by Distribution Network Operators (DNOs) and Gas Distribution Network Operators (GDNOs). Different approaches have been taken in the creation of the DFES, two of which are described below.

The DFES approach has been adopted as business as usual by Western Power Distribution (WPD), Scottish and Southern Electricity Networks (SSEN), UK Power Networks (UKPN) (who are now using a similar approach with Element Energy), Scottish Power Energy Networks (SPEN) and Wales and West Utilities (WWU). Having completed separate DFES analyses for each of the electricity and gas networks, the Net Zero South Wales[23] DFES project is now completing a single integrated DFES for both gas and electricity networks. Some DNOs are producing DFES analyses on an annual basis, to allow greater alignment and feedback to the National Grid's Future Energy Scenarios (FES) that is also updated annually. National Grid's FES represent a range of different, credible ways in which the energy systems will be decarbonised by 2050.[24]

[23] https://www.regen.co.uk/project/net-zero-south-wales/

[24] https://www.nationalgrideso.com/future-energy/future-energy-scenarios

[25] https://www.westernpower.co.uk/distribution-future-energy-scenarios-application

[26] https://www.regen.co.uk/area/distribution-future-energy-scenarios/

[27] https://www.regen.co.uk/wp-content/uploads/Methodology-for-web.jpg

[28] https://innovation.ukpowernetworks.co.uk/2021/01/11/distribution-future-energy-scenarios-2021/

2.4.2.1 Regen, DFES

First developed with WPD[25] in 2015, Regen's DFES provides a detailed and bottom-up projection of how National Grid's FES apply across a DNO or GDNO area.[26] The DFES determines a baseline view of the area and incorporates a known pipeline of future network load before applying different scenario projections; both baseline and pipeline analyses make extensive use of local and regional data.[27] Future local projections against FES scenarios are made using evidence from, for example, local stakeholder engagement and third-party data on socio-economic factors. DFES therefore supports network operators with long term strategy and network planning processes, at a localised level, allowing them to gain an understanding of the future energy requirements for different technologies, where and when they are likely to be deployed and identifying future constraints on the network to enable assessment of appropriate network solutions.

2.4.2.2 Element Energy, DFES

Element Energy produced DFES to illustrate energy futures with different levels of decentralisation, decarbonisation and digitalisation. Element Energy has used this approach to describe the evolution of demand and generation across a number of UK DNO's licence areas out to 2050. These scenarios are constructed from a series of key drivers, which are thought to have significant impacts on energy demand and supply, e.g. number of electric vehicles, low carbon heating technology choices, installation of distributed generation and so on.[28]

For the majority of the drivers of demand and generation considered in the modelling framework, a bottom-up approach that is regionally and technology-specific is used. Generally, the scenario framework used for the development of DFES is consistent with the overarching views of the future considered in the National Grid FES, but there are some significant differences in the regionally specific views of low carbon technology uptake.

2.4.2.3 Similarities and Differences to LAEP

Whilst DFES covers a similar scope to LAEP, the primary audience for the work is commercial organisations (i.e., network operators) rather than a local authority, stakeholder engagement is narrower in focus, and public consultation is omitted. Interventions arising from a DFES are targeted at upgrading network infrastructure, identifying where changes (i.e., network reinforcements) may be required, with the primary aim of maintaining network infrastructure.[29]

2.4.3 Decentralised Energy Masterplanning (DEM): A manual for local authorities

The Association of Decentralised Energy (ADE) member Arup worked with several London Boroughs under the Department of Energy and Climate Change (DECC) funded Local Carbon Frameworks Programme to develop a toolkit for local authorities undertaking decentralised energy masterplanning. The toolkit is designed to help local authorities and other stakeholders identify specific areas that will deliver the best returns from installing a heat network. The toolkit consists of a manual and accompanying Excel spreadsheet tool which allows assessment of potential schemes at a pre-feasibility level, estimating economic and environmental performance.

[29] More recent Ofgem requirements have asked network operators to take a whole energy system approach to planning and integration, with increased requirements for stakeholder engagement and working with local authorities. See: https://www.ofgem.gov.uk/sites/default/files/docs/2020/12/ed2_ssmd_overview.pdf ; https://www.ofgem.gov.uk/publications/riio-ed2-business-plan-guidance; https://www.ofgem.gov.uk/publications/riio-ed2-enhanced-stakeholder-engagement-guidance-version-2

The primary focus of decentralised energy masterplanning is on combined heat and power (CHP) systems and waste heat connected to district heat networks. The guidance provides advice on connecting heat networks primarily to local authority operated non-domestic buildings, but also to other public sector non-domestic buildings.

2.4.3.1 Similarities and Differences to LAEP

There are a small number of similarities between DEM and LAEP:

- The approach to planning is data driven, understanding and analysing energy demand of different buildings and planning the deployment of heat networks spatially.
- The plan considers costs and revenues that may be derived from the network

Whilst DEM has similarities with LAEP, there are also notable differences:

- DEM is limited in scope and considers only a CHP plant connected to a district heat network; it therefore does not take into account a 'whole systems' perspective by including, for example, considering if other energy vectors and networks would be a better value means of providing heat to an area, as well as generation, supply and demand, other buildings not connected to the network, nor transport.
- DEM does not include network involvement.
- DEM is not driven by meeting emissions reductions targets and does not set future targets to be met.
- DEM does not consider pathways nor scenarios.
- Stakeholder engagement within DEM is primarily focussed on building a core team of local authority officers, although other public sector organisations are suggested as members of a steering group.
- The focus of the network is connecting to non-domestic buildings, and in particular local authority owned non-domestic buildings.

2.5 What does the market think that Local Area Energy Planning is?

Interviews conducted under this project covered market perspectives on LAEP, covering how interviewees would define LAEP including, what should be in and out of scope. Further, interviewees were asked about who should lead LAEP work, and how wider stakeholders should be involved in the process of making plans.

2.5.1 Defining LAEP

Whilst the majority of interviewees felt there was not currently an agreed definition of LAEP, when they shared their views on what they thought LAEP was, there was actually consensus across all groups that there are two main elements to LAEP:

- Using data, analysis, and modelling to decide upon an overarching strategy and approaches to getting to net zero. Many respondents emphasised the need for the strategy to be based on robust evidence.
- Breaking that strategy down into detailed actions and / or projects to map how net zero will be achieved, understanding what needs to be done, by who, when and where. The terms "action plan" and "road-map" were often used. A plan that contains both long-term goals with shorter-term milestones.

"LAEP is a way for a local area to understand how the energy landscape needs to change in the local area, primarily focused on heat sources, to understand what the infrastructure options could be and how the different energy vectors need to be applied so that you do the right investment at the right time to enable decarbonisation, as well as clear planned-out pathways to make investment decisions and make those changes."

"It's providing that spatial context, taking a holistic view of all of the different elements required in getting to net zero and bringing it all together into one strategy. What LAEP does that other strategies don't is inform where you do projects e.g. where does it make sense to have district heating networks?"

"A LAEP should tell you the energy mix that will be required to meet the net zero target long-term and importantly also have short term milestones along the way to match up with climate policy nationally, and it needs to confront the need to decarbonise heat and transport, and it needs to give people the tools to recognise that power will be decarbonised on a timeline. You need strategic documents in place that are well evidenced and bought into by local government, recognised by planners, and integrated into wider planning around transport infrastructure."

"My understanding is that LAEP is the bridge between your baseline evidence and telling you what you need to do, where and when."

2.5.2 LAEP scope

The majority of interviewees suggested that ideally the scope should be as wide or broad as possible, often describing the approach as "holistic" or "whole systems". They were specifically prompted on whether they thought the following areas should be included within the scope of LAEP:

- local generation opportunities for low/zero carbon heat and power;
- distribution networks for electricity, gas and heat;
- use of distributed hydrogen where regional/national contexts suggest it may be an option;
- heat demand in buildings (domestic and non-domestic), and the opportunities for managing and meeting demand (including retrofitting homes);
- expected demand for EV charging, and its impacts on electricity distribution systems.

The majority agreed that LAEP should ideally consider and include all of the above, although some mentioned that in practice there could be exceptions or limitations. For example, some stated that due to the timescales in which they plan to achieve net zero, they would be unable to wait for a decision by central government on deployment of hydrogen and large-scale carbon capture technology, and as a result have excluded them from their LAEP scope (recognising that they may reintegrate it in future plans).

In addition to those aspects prompted in the discussions, a small number of respondents (from local authorities, LEPs and Energy Hubs) mentioned that they were considering including a broader scope in their plans. Interviewees referenced the construction supply chain, farming, tree-planting and agriculture, encouraging active travel, and air travel, when discussing taking a 'holistic' or 'whole-systems' approach.

2.5.3 Pathways

Interviewees were asked about considerations for future pathways or scenarios in their planning. Most said that they were too early in the process of considering their LAEP to say firmly, but expected their plans to:

- Focus on identifying the **lowest cost options** for achieving net zero and acknowledged that this may rule out some technologies or changes to infrastructure.
- Focus on what could be achieved **by certain dates** e.g., what options could be considered if they wanted to achieve net zero by 2030, and what options might be available if they extended the target date to 2040.
- Select solutions that **fitted best with their area** e.g., if geographically the area lent itself to solar PV, or wind generation.

"Hydrogen is not something the LAs are focused on. We have an aspiration to be carbon neutral by 2030 and don't really see a huge place for hydrogen in that, given the current expected timescales for it."

2.5.4 Who should lead LAEP activity?

Interviewees were asked for their views on who they felt should lead LAEP. Many reflected on LAEP activity that was already in progress and referenced who is currently leading that activity. There was a recognition of the potential benefits and limitations of different organisations leading LAEP.

Local authorities

The prevalent view across all interviewee groups was that local authorities are best placed to lead LAEP activity, with interviewees citing one or more of the following reasons:

- They are **impartial and technology neutral** i.e., no strong vested interest in a particular solution
- They were generally felt to be more **trusted** by the general public i.e., compared to utilities
- They have the **most control** over many areas central to LAEP i.e., transport, planning, buildings and construction
- Many have made a political declaration, such as a climate emergency and set a target date to achieve net zero, and are therefore seen as **motivated to drive LAEP**
- They already hold a lot of useful data on a local area, meaning **more efficient data collation and analysis**.

> *"There is a cross-boundary regional coordination issue here that could be more collaborative; maybe that's where (a more regional) model of coordinating across the various authorities helps solve this sort of dislocation that you may get on the edges."*

Combined authorities — a regional approach

Some interviewees across the whole sample noted that combined authorities are well placed to lead LAEP as they tend to have greater resources and expertise compared to local authorities.

> *"The fact that we are a Combined Authority probably helps with leading that — in terms of hierarchy. Somebody needs to take the lead."*

Some interviewees across the whole sample noted the additional benefit of wider geographic coverage in instances when combined authorities lead. Those that referenced combined authorities tended to either be involved in a LAEP where the combined authority is leading or were aware of examples of plans being led by a combined authority (e.g., Greater Manchester and Yorkshire).

Likewise, some interviewees across the whole sample noted the potential benefits of producing plans at a regional level, or dis-benefits from not taking a regional approach:

- A lot of the energy infrastructure, (e.g., DNO and GDNO infrastructure) will cross political boundaries; projects and solutions may be better aligned to infrastructure rather than political boundaries;
- Inefficiencies and barriers may be encountered if neighbouring authorities take different approaches (e.g. hydrogen vs electrification);
- There could be efficiencies in taking a regional approach; in terms of reduced costs, better investments, more efficient data collection and management, and better stakeholder engagement.

There was discussion of neighbouring local authorities working together on a joint LAEP, acknowledging some of the potential benefits (listed above) that could be gained from doing so.

> *"From our perspective it would be great to have a (two counties) LAEP, and the public sector partners have an interest in that as well — we are working with the two local authority groups to see if we can come up with a consistent output."*

One DNO also suggested that the energy planning work they undertake tends to be at a regional level.

> *"To inform our plans, we model a number of future energy pathways... scenarios of different things that may happen in the future. Our scenarios are built on National Grid's Future Energy Scenarios which look at different pathways for energy demand changes and energy behaviour trends, uptake of low carbon technologies, and so on so forth, for the whole of the UK. We take a regionalized view on that in our Distribution Future Energy Scenarios, knowing our infrastructure and some of the plans that might be happening."*

One respondent suggested LAEP should be conducted on a more local basis, to take into account the differences in energy supply and demand and infrastructure that will vary from substation to substation.

DNOs and GDNOs

The majority of interviewees across the whole sample acknowledged the importance of involving DNOs and GDNOs in the LAEP process, due to the essential data and information they hold regarding grid capacity and constraints and because they will be responsible for some of the actions resulting from plans. However, it was felt — by all groups including the DNOs and GDNOs themselves — that they would probably not be as well placed as local authorities to lead LAEP, as they are not seen as impartial, nor do they have control over other local issues such as transport and planning.

> *"We don't believe networks can lead on that because we (a DNO) have a narrower expertise. Local government, on the other hand, has a democratic mandate, and they can lay down the plans in their region."*

The DNOs and GDNOs are proactively undertaking their own energy and infrastructure planning activity (e.g., data analysis and modelling pathways) and most have tried to contact local authorities in their area about their future energy and infrastructure requirements. They have worked with local authorities that are advanced in their energy planning, and others that are just getting started. Both felt that some local authorities do not have the skills and capacity to undertake LAEP, which may be a barrier to a local authority led LAEP approach.

> *"The picture is really varied and we have some local governments which are well ahead, they have analytical capabilities in-house or who have employed consultants to develop pathways, and then there are a few who don't have one — or more than one — person who would be working on this subject."*

2.5.5 Stakeholder engagement

Regardless of views on who should lead the planning process, interviewees were asked for their views on which stakeholders they thought should be engaged in the planning. They acknowledged the value of stakeholder engagement across a range of areas:

- Access to data and information that is essential in producing the plans
- Ensuring buy-in to the plans and the resulting projects that are delivered
- Alignment of strategies with other areas, such as transport and economic growth.

It should be noted that interviewees didn't necessarily provide an exhaustive list of all the stakeholders that they would engage, nor go into detail about the extent to which a certain stakeholder should be involved. However, there was broad agreement that **local authority departments** such as energy/low carbon, planning and transport, **combined authorities, LEPs, Energy Hubs** and **DNOs** should be fully engaged in the planning.

Most also recommended engaging with:

- **GDNOs**: although some expressed reservations about them prioritising hydrogen.
- **Consumers/The general public**: with most stakeholders acknowledging that decarbonising heat and transport will require public consent (for major works) and substantial shifts in behaviour, as well as the need to integrate any community renewable schemes in the area. Some suggested that the general public could be engaged through local community groups if they exist.
- **Business**: especially any large industrial organisations in the area or region for whom specific decarbonisation actions would be key to the area as a whole achieving net zero. They suggested both individual businesses and broader sector organisations, such as the Chambers of Commerce.

Less frequently suggested was including large landowners and developers, housing associations, utilities, transport providers, universities, hospital trusts, transport providers, and experts/consultants in relevant fields. Some suggested that there are examples whereby a good stakeholder engagement set-up is already in place, with a core group involved regularly, and other stakeholders involved as and when required.

Most respondents referred to challenges they have experienced already with stakeholder engagement:

- When to engage stakeholders, and how this differs by type of stakeholder.
- How best to engage stakeholders.
- Asking already busy people to input into complex planning activity, when they may not have sufficient time to do so
- Finding the most appropriate contact within an organisation to liaise with.

2.6 A tiered approach to meeting net zero at the local level

Planning to meet net zero may best be understood by local authorities if it can be seen in the context of other decarbonisation activity. Many local authorities have taken action on tackling climate change, improving energy efficiency in their area or complying with environmental legislation, but an understanding of how this activity dovetails with LAEP or whether the authority is 'net zero ready' isn't immediately obvious. This project develops a tiered approach to meeting net zero at the local level, that is informed by market interviews and a systematic assessment of energy planning activity underway in the UK (see section 3.1). To differentiate between the tiers, they vary according to two elements. Firstly, a tier's scope (i.e., sources of emissions), that follows the approach developed to categorise local authority level emissions in an annually published national database.

Secondly, a tier's actions, following the type of activities that LAEP should involve according to the Ofgem method.

It allows local authorities to see where their current plans sit — in comparison to a LAEP — and what they need to focus on in order to improve their plan. Since the introduction of a net zero target by the UK government in June 2019, there has been a recognised need by some to include emissions of all types rather than those simply from energy, as noted by market interviewees (who pointed to the inclusion of land use, for example). Accordingly, a tier has been added above LAEP which focusses on Net Zero Area Planning (NZAP) with the aim of planning to reach net zero across the local (authority) area by tackling a broader scope of emission sources. The tiers are shown in Table 1.

Table 1: Tiered approach to categorising plans

Tier	Description
1	Net Zero Area Plan (NZAP)
2	Local Area Energy Planning
3A	High-Detail Energy Strategy/ Climate Emergency Plan
3B	High-Level Energy Strategy/ Climate Emergency Plan
4A	Local Authority Plan to Decarbonise Own Estate
4B	Climate Emergency Declaration

2.6.1 Scope: sources of emissions

The scope of what should be included within each tier has been defined based on the Local Authority CO_2 ($LACO_2$)[30] database which is published annually by the Department for Business, Energy and Industrial Strategy (BEIS) and developed by Ricardo Energy & Environment. Although this database is not exhaustive, and has a number of methodological assumptions, it is the clearest and most thorough database currently published which would allow a local authority to track their CO_2 emissions over time and note their progress towards any locally agreed emissions targets.

Within the $LACO_2$ database, national carbon dioxide emissions (accounting for around 80% of greenhouse gas emissions) are attributed to each local authority area on an "end user basis", meaning the emissions are allocated to where the consumption takes place rather than where the production happens. This seems appropriate for LAEP as local authorities tend not to have influence over the decision of large emitters (e.g., power stations), but have at least some influence over consumers of their products e.g. electricity. The direct decarbonisation of these large emitters will likely be done via national government regulation. The emissions from industry are assigned to where the production takes place meaning emissions from the production of goods which are exported will be included, and emissions from the production of goods which are imported are excluded.

The $LACO_2$ database breaks emissions down into six classifications: Industry, Commercial, Public Sector, Domestic, Transport and LULUCF (Land-Use, Land-Use Change, and Forestry). A summary of how these classifications are made up, and therefore how emissions are apportioned, is provided in the 'UK Local and Regional CO_2 Emissions Technical Report'.[31]

[30] UK Local Authority Carbon Dioxide Emissions Estimates 2019 (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/996056/2005-19-local-authority-co2-emissions-statistical-release.pdf) Accessed: 01/10/2021

[31] UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2019 (https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2019) Accessed 13/10/2021

2.6.2 Actions

The actions within a plan described in this section is based on the 'Local Area Energy Planning — The Method' report published by ESC and CSE (Ofgem Method).[32] The main areas of consideration are: stakeholder engagement, costing of a plan, producing a set of future pathways, optimisation, spatial and temporal analysis, network infrastructure impacts, and a whole-system approach. A description of each of these actions is included here, based upon Ofgem method definitions.

2.6.2.1 Significant engagement with stakeholders

Any plan needs to involve a wide range of local stakeholders to ensure its output has been shaped by and reflects informed local perspectives and their shared priorities. This requires an effectively designed and delivered social process which:

- engages stakeholders from the public, private, and charitable sectors, and the general public to provoke an evidence-based debate
- enables and builds a shared understanding
- informs, shapes and reveals options, trade-offs, preferences, and priorities
- helps foster consent for the nature and scale of changes needed and the actions required (and from whom) to deliver them
- works within the democratically accountable processes within the area.

A range of public sector stakeholders including local and regional/county councils, combined authorities, LEPs, and BEIS Energy Hubs are likely to have an interest in the development of the plan and as such should be engaged. Wider public sector groups (e.g. universities, hospital trusts, TfL, TfGM, Northern Powerhouse) should also be engaged where appropriate. Typical job roles to involve are:

- Climate/Energy/Environment Officers
- Transport Officers
- Planning Officers
- Housing/Infrastructure Officers

In the private sector, DNOs, GDNOs and heat network operators are key to the process as gatekeepers of data and infrastructural information required to create the plan. These organisations are also likely to be key delivery partners once the plan is complete. Local SMEs, EV charge point operators, housing and commercial developers, major industrial users, chambers of commerce, and many others will also have a role by providing data/information about their organisational plans and potential future investments. Trades and supply chains (e.g., heat pump manufacturers) may also provide useful context and limitations to what can be delivered and within what timescales.

Community-led organisations and charities can offer a different angle, often having a more consumer or community-focussed approach which considers fuel poverty agendas, health impacts and social mobility.

[32] Adapted from 'LAEP – The Method' (https://esc-non-prod.s3.eu-west-2.amazonaws.com/2020/08/LAEP-method-final-review-30-July-2020.pdf) Accessed: 05/10/2021

Public surveys, focus groups, citizen panels and engagement via digital platforms and forums, allied with appropriate information and evidence (such as maps and 'what if' tools), can reveal local attitudes to the changes being considered. The resulting insights can help to inform the nature and scale of the opportunities and challenges for public engagement and the action they would be expected to undertake. It should also be noted that the involvement of the public in such processes can often lead to greater interest and willingness to act and consent for others to make appropriate decisions which drive change.

The goal of the stakeholder engagement should be the plan's adoption by the authorities within the area and the endorsement of wider stakeholders to increase the likelihood of implementation and delivery by providing a sense of ownership.

2.6.2.2 Robustly costed

The capital cost of reaching net zero will be large and, likely, far beyond the investments of a single funder including national government. In addition to significant national government funding, investments will need to be sought from private investors for future returns (e.g. investment in a solar farm to gain income from the sale of electricity into the network, or investment in battery storage to gain from the flexibility markets), and individual/commercial purchasing (e.g. purchasing an electric vehicle or investing in energy efficiency measures).

Within the production of a plan, capital costs of each pathway should be considered using good quality cost data. The costs should also be discounted — using the HMT Green Book method [33] — and calculated on an annual basis between the start date and 2050. All assumptions should be clearly described, for example, if it has been assumed that the cost of a domestic heat pump installation falls 50% over the period to 2050.

For comparison, it is essential that a business as usual (BAU) case is considered which assumes that all UK legislated targets are met (e.g. a 78% CO_2 reduction is achieved in 2035 compared to 1990 levels and net zero is met by 2050). All pathway costs should be compared to this baseline rather than a 'do nothing' pathway.

Operating and maintenance costs should also be considered where relevant and data are available. This is particularly important when considering the cost implications of decarbonisation on the consumer.

2.6.2.3 Multiple future scenarios/pathways

Scenario modelling involves the user describing a set of decisions about the system, with the model calculating the impacts of those decisions on some quantities of interest — e.g. carbon and air quality emissions, total cost, final demand, etc. If scenario modelling is the only approach used, then the choice of scenarios is critical. There is a risk of bias, and the analysis will be constrained to the set of scenarios that can be imagined by the participants. This does, however, allow for a local area to concentrate on creating a pathway which includes a mix of technologies that may be deemed politically or economically advantageous, or scenarios/pathways which have been developed as part of other work.

[33] https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

2.6.2.4 Optimised pathway

Optimisation models are used to find the set of choices which absolutely maximises or minimises a quantity of interest (referred to as the objective), subject to some rules about what sets of choices are allowable (referred to as constraints). Typically, the lowest cost pathway to net zero by the agreed date is the aim of the optimisation, however, authorities in a local area may wish to ensure that the decarbonisation pathway has the lowest impact on consumer bills, or the greatest benefit in terms of air quality, etc. These pathways are equally valid. The focus of the optimisation must be fully bought into by the stakeholders in the local area, led by the authorities and their elected members.

2.6.2.5 Spatial analysis

Within LAEP, spatial analysis allows large amounts of data to be interrogated and ultimately shown visually in a way that is easily digestible to a layperson. There are a number of techniques used and ways in which the data can be visualised to analyse the underlying complexity, but the outputs should be simple and clean to allow policy decisions to be made.

The spatial analysis will include the creation of zones whether defined at the outset based on energy networks or political/ administrative boundaries, for example, or within the process allowing the model(s) to create zones based on similarity of housing stock or infrastructure need, for example.

2.6.2.6 Temporal analysis

Temporal analysis within LAEP is understanding the changes that could occur to the energy system, political landscape, or assumptions about these over a period of time. The end point for the analysis in LAEP is typically 2050 due to that being the legislated date for reaching net zero within the UK as a whole; however, other targets (e.g. net zero in Scotland by 2045) exist and need to be considered within the LAEP process. Equally, although not written into legislation, local targets for reaching net zero should also be considered en route to 2050, and not be seen as an end point.

LAEP should also give consideration to related targets, including but not limited to:

- Ban on fossil fuelled heating in new builds by 2025
- Ban on the sale of fossil fuelled cars and vans in 2030
- Net zero power system by 2035.

Temporal considerations should also be given to energy demands, installation rates, supply chain readiness, consumer appetite, etc.

> *"Spatial analysis is how we understand our world — mapping where things are, how they relate, what it all means, and what actions to take."*

2.6.2.7 Network infrastructure impacts

Network operators — electricity, gas and heat — will have a significant part to play in both the planning and delivery of a net zero local energy system. Decisions made at a local level about the deployment of generation technologies, the roll-out of flexibility and storage, and the consumption levels compared to capacity, will impact on those networks. It is important that a whole-system planning process takes place to ensure that the interactions between vectors are adequately captured and that subsequent network upgrades are made only once, rather than being upgraded multiple times before 2050. This will help to maintain the reliability of the networks and keep costs down for consumers within the area and beyond (since the network boundaries and local administrative boundaries are often not the same).

2.6.2.8 Whole-systems approach

A whole-systems approach captures the complexity and interdependencies within a system and the relationships between vectors, sectors, supply, generation, and demand. For example, in the energy system, the installation of heat pumps in on-gas dwellings has a number of effects:

- Increased efficiency and lower carbon emissions from the dwellings
- Increased electrical usage
- Removal of fossil gas requirement

In turn, the knock-on effects are:

- Increased demand for energy efficiency measures and heating systems
- Increased power draw through the feeders and substations
- Reduced headroom on these assets which could limit EV charge point roll-out or H_2 production via electrolysis
- Potential for stranded gas distribution assets and costs for removal passed on to remaining gas consumers
- Increased demand on limited installation/ design skill sets and supply chains.

A whole-systems approach is the antithesis of a siloed approach where, returning to the example above, the electrification of domestic heating has no impact on the ability to roll-out EV charging infrastructure. This allows costs to reinforce the electrical network to be more accurately estimated and reduces the risk of decisions being made within a local area which could have unforeseen consequences.

2.6.3 Tier Descriptions

In this section each of the tiers will be described and a table presented showing what is currently included (✓), partially included (o), or excluded (×). To re-iterate; these categorisations and associated descriptions are based upon market interviews and a systematic assessment of energy planning underway in the UK; they use the $LACO_2$ database to define emissions scope, and Ofgem method to describe actions.

2.6.3.1 Tier 4B

Climate Emergency Declaration

A 'Climate Emergency Declaration' for a local area is a formal statement by elected members of an authority noting the need/ urgency to reduce emissions from their current levels. Since late-2018 there have been hundreds of such climate emergency declarations in the UK by parish, local and regional authorities. The declaration is usually accompanied, or shortly followed, by the setting of a date by which the authority itself, or the local area as a whole, will reach an agreed level of decarbonisation. Being a political declaration, rather than a plan, there is no defined minimum scope of emissions sources and actions that are typically undertaken.

2.6.3.2 Tier 4A

Authority Plan to Decarbonise Own Estate

Authorities typically commence decarbonisation efforts by looking inward and assessing their own property and operations to understand how and when they can be tackled. This typically requires reviewing display energy certificates (DECs) across their property portfolio and identifying energy efficiency measures that could be carried out alongside regular maintenance schedules or considering a gradual replacement of fossil fuelled fleets with zero carbon fleets. These actions may be fully costed within the plan and identify when the investment will take place in line with, for example, leasing arrangements. Internal stakeholders such as the estates/facilities team are likely to be consulted where appropriate, and external stakeholders consulted at the delivery stage e.g. DNO permissions to install EV charging infrastructure.

An extension of this tier is to consider the impact of the authority's operations and could include the divestment of pensions from fossil fuels, employee travel (to/from work and for business), sustainable procurement, and their waste operations.

2.6.3.3 Tier 3B & 3A

High-Level and High-Detail Energy Strategy/Climate Emergency Plan

Many local authorities have considered how they can use their position to enable the decarbonisation of the local area beyond the elements they have under their direct control. This could be seen as a baselining exercise with future aspirations.

Some of the information included in a high-level energy strategy or climate emergency plan is typically:

- Total electrical generation and identification of low carbon generation
- Identification of current heat networks
- Sectoral split of energy use and/or emissions
- Analysis of EPCs and housing data
- Identification of current electric vehicle charging infrastructure

Depending upon the data held by the authority and their powers these data could be supplemented with owned housing stock or public transport information.

Where resource and funding have allowed, authorities have taken a more sophisticated approach to the development of an energy strategy or climate emergency plan. Although the scope of a high-detail plan is typically the same as a high-level plan, more detailed analysis is carried out built upon the engagement of external stakeholders. Stakeholders involved in this process often include:[34]

- Regional bodies such as combined authorities and local enterprise partnerships (LEPs) (England), regional economic partnerships (Scotland), and statutory joint committees (Wales)
- Wider public sector organisations (e.g. universities, healthcare)
- Gas, electricity, heat network, and EV charge point operators
- Social housing providers
- Community organisations
- Local Energy Hubs.

Plans sometimes involve external stakeholders, allowing for local knowledge and insights to be collected resulting in greater buy-in and ownership of the plan. Stakeholder events typically focus on data availability and future projects which can be utilised in the development of the plan and the pathway towards the net zero target.

[34] See 'Local Area Energy Planning — The Method' (section 2.2) for a full list.
[35] Good examples can be found at https://pcancities.org.uk/climate-commissions
[36] https://scattercities.com

Engagement with the wider public is less frequent, and sometimes only happens upon establishment of a Citizens' Assembly.[35]

It is likely that only a single pathway is described however this pathway will likely have interim targets based on emissions or deployment of technologies. For many authorities, the SCATTER tool[36] has been used to set an endpoint with the interim target date(s) being established by consultants taking into account the data and feedback from stakeholders. The cost of this pathway may have been estimated, but the Authority won't know whether this is the most cost-effective approach. Spatial analysis in a high-detail energy plan is based on where stakeholders are currently delivering or planning projects and have identified these through previous engagement. These projects won't be sufficient to reach net zero and are likely formed around availability of funding.

2.6.3.4 Tier 2

Local Area Energy Planning (LAEP)

Tier 2 is developed to reflect those areas that have stipulated that their plans follow the Ofgem method for LAEP 'done well'.

LAEP, as the name suggests, focusses on the energy system which accounts for a significant proportion of a local area's emissions. The scope considers electricity, heat, the gas network, hydrogen, the built environment and its fabric and systems (industrial, domestic and commercial), generation, storage, energy networks and the providing energy to decarbonised transport e.g. electricity to electric vehicles and charging infrastructure (based on the outcomes of transport plans).

For the purposes of this approach the 'Local Area Energy Planning — The Method' document developed by ESC and CSE for Ofgem has been used as a basis for the actions.

A LAEP is seen by the market as a quality product because of its methodological rigor, with stakeholder engagement at its core. The internal and external stakeholders are included in the process throughout, helping to scope and develop the plan, submit data and shape the scenarios/pathways. Once the pathways have been developed, stakeholders can comment on their suitability based on their experience of the local area. Finally, the stakeholders are invited to comment on the plan with the aim of endorsing and taking ownership for delivery of certain aspects based on their expertise and abilities.

The scenarios produced with the stakeholders are prioritised or optimised in some way based on criteria set by the authority. For example, if a low-cost path to net zero is the goal then the scenarios are prioritised or optimised on that basis. For this to happen, a robust socio-economic analysis is carried out to establish the capital expenditure within each zone and over time to allow the authority to understand where and when the investment will be required.

To produce these insights, spatial and temporal analysis is carried out at an appropriate level of granularity. For example, spatially some data is provided at the household level and whilst this can be used within the analysis, re-aggregating to an LSOA level may allow more insights to be drawn and commonalities found. Temporally, local and regional authorities typically work on funding cycles and therefore estimating the costs on a 3-5 year time frame is most suitable.

The funding is based on the expected (or required) development within each zone of the local area. A LAEP should aim to identify decarbonisation projects in the short-, medium-, and long-term and highlighted in a way that allows them to be considered for investment (e.g. an 'investible propositions portfolio') or highlighted for further feasibility assessment.

2.6.3.5 Tier 1

Net Zero Area Planning (NZAP)

Feedback from some market interviewees made it clear that some important aspects are missing from the current Ofgem method of LAEP that would allow a local area to fully plan for net zero. This has led to the identification of an additional tier that is beyond LAEP, and that includes a broader scope of emissions sources; tier 1 describes a Net Zero Area Plan (NZAP). Further work is required to determine if there is cross sector support for expanding the scope of LAEP to a NZAP. No authorities were found to have such a plan. The description of what a NZAP might entail is based upon expectations, rather than findings from assessing existing plans.

Most critically, a NZAP should be holistic from an emissions perspective, rather than an energy perspective. Is should allow authorities to understand how actions to implement plans helps net zero ambitions to be realised without having to separately consider emissions from, for example, LULUCF and waste. It is not expected that shipping, aviation, military transport, exports, and large emitters (such as large-scale power generation) that have been considered out of scope as part of other tiers are included in a NZAP, as these are considered to be 'national-level decarbonisation challenges'.[37] Emissions from waste disposal should be included as part of the NZAP as it is typically within the remit of the authority.

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A number of additional aspects could also be included in the plan:

- the skills requirement to deliver the scale of change required
- the number of jobs gained/lost in each sector
- the impact on the supply chain including installers and materials
- the economic value (GVA)
- impact on business/industry and where opportunities exist in the market
- climate adaption assessment and planning.

Although additional functionality and capability may be required to carry out an NZAP process, the actions may remain the same as those for LAEP i.e. an NZAP may still require a spatial analysis of multiple scenarios to be carried out, fully-costed and optimised to produce a stakeholder-backed and investable plan to reach net zero. Equally, impacts on the networks and other supporting infrastructure may be considered. Additional actions, beyond those undertaken as part of a LAEP, may be required to deliver a NZAP. The process for delivering a NZAP would also need to be aligned with other existing work.

[37] These are referred to as 'national-level decarbonisation challenges' because the responsibility of tackling these emissions sources will sit outside of the remit of a local authority and be led by central government. It is expected that local authorities will be involved in this process, and are ideally placed to suggest opportunities

2.7 Conclusion

The market interviewees identified that the Ofgem method is not widely understood or regarded as sufficiently clear to enable LAEP to be carried out, and highlighted ambiguity around what should be included in the scope of a plan, and the actions that planning activity should include. A desktop review of alternative approaches to energy planning identified several, but none were found to be as comprehensive as LAEP in terms of their scope and methods. Despite LAEP being the most comprehensive approach, market interviews identified elements that were felt could be included in plans that are currently omitted, such as agriculture and air-travel.

A definition of LAEP is developed as part of this project, and Recommendation 1 in Chapter 5 is for it to be endorsed. The LAEP definition is as follows:

- LAEP is a data driven and whole energy system, evidence-based approach that is led by local government developed collaboratively with defined stakeholders. It sets out to identify the most effective route for the local area to contribute towards meeting the national net zero target, as well as meeting its local net zero target.
- LAEP results in a fully costed and spatial plan that identifies the change needed to the local energy system and built environment, detailing 'what, where and when and by whom'. LAEP sets out the total costs, changes in energy use and emissions, and sets these out over incremental time periods to meet the 2030 target of a 68% reduction in emissions, and the 2035 target of a 78% reduction in emissions, and net zero by 2050.
- LAEP provides the level of detail for an area that is equivalent to an outline design or master plan; additional detailed design work is required for identified projects to progress to implementation.
- LAEP defines a long-term vision for an area but should be updated approximately every 3–5 years (or when significant technological, policy or local changes occur) to ensure the long-term vision remains relevant.
- LAEP identifies near-term actions and projects, providing stakeholders with a basis for taking forward activity and prioritising investments and action.
- LAEP scope addresses electricity, heat, and gas networks, future potential for hydrogen, the built environment (industrial, domestic and commercial) its fabric and systems, flexibility, energy generation and storage, and providing energy to decarbonised transport e.g. electricity to electric vehicles and charging infrastructure.
- Actions to be addressed when developing the plan include: stakeholder engagement and a social process that considers both technical and non-technical evaluation, using robust cost inputs and standardised assumptions and data sets, multiple future scenarios/ pathways, whole system approach, spatial analysis (including zoning and data granularity), temporal analysis, network infrastructure impacts, and developing the plan through a credible and sustained approach to governance and delivery.

Market interviews recognised some elements of LAEP as being particularly important, such as taking a whole systems approach to tackle all energy vectors and identifying near terms actions and projects that can be deployed immediately to reduce emissions.

The market felt that LAEP should be led by local authorities, as they are trusted and impartial and have access to certain types of information and data that other organisations don't. However, there was some uncertainty at which level of local government LAEP should be delivered at, with some highlighting that unitary or combined authorities may be better placed than district authorities as they cover a larger geographical scale and have more access to resources. The following chapter explores the current level of energy planning activity of local authorities across the UK, and how certain types of authority are making more progress than others. The need to consider leadership and the geographical scale that LAEPs are produced at is described in Recommendation 2 in Chapter 5.

The definition of LAEP is best understood by authorities where it can be seen in the context of other decarbonisation activity. In order to do this, a tiered approach has been developed to allow authorities to see where their current plans sit as compared to a LAEP and the variation between them described in terms of scope and actions. Consideration should be taken to investigate the integration of emissions beyond the energy system into planning to create 'Net Zero Area Plans'. A summary of the scope and actions included in each tier is given in Table 2 and Table 3.

The scope of LAEP does not include shipping and aviation, exports, military transport, 'large' power generation, and oil refineries. These 'national-level decarbonisation challenges' should be managed by central Government.

Table 2: Actions within each tier

Actions	4B	4A	3B	3A	2	1
Stakeholder Engagement	×	○	✓	✓	✓	✓
Robustly Costed	×	✓	○	○	✓	✓
Multiple Future Scenarios/Pathways	×	×	×	×	✓	✓
Optimised Pathway	×	×	×	×	✓	✓
Spatial Analysis	×	×	✓	✓	✓	✓
Temporal Analysis	×	✓	✓	✓	✓	✓
Network Infrastructure Impacts	×	×	✓	✓	✓	✓
Whole-Systems Approach	×	×	×	×	✓	✓

Table 3: Scope within each tier

Scope		4B	4A	3B	3A	2	1
Generation	Traditional Electricity	×	×	○	✓	✓	✓
	Low Carbon Electricity	×	○	○	✓	✓	✓
Storage	Electrical	×	×	×	✓	✓	✓
	Thermal	×	×	×	✓	✓	✓
	Other	×	×	×	×	○	✓
Industry	Electricity	×	×	○	○	✓	✓
	Gas	×	×	○	○	✓	✓
	'Other Fuels'	×	×	○	○	✓	✓
	Large Installations	×	×	×	×	○	✓
	Agriculture	×	×	×	×	○	✓
Commercial	Electricity	×	×	○	○	✓	✓
	Gas	×	×	○	○	✓	✓
	'Other Fuels'	×	×	○	○	✓	✓
Public Sector	Electricity	×	✓	✓	✓	✓	✓
	Gas	×	✓	✓	✓	✓	✓
	'Other Fuels'	×	✓	✓	✓	✓	✓
Domestic	Electricity	×	×	○	○	✓	✓
	Gas	×	×	○	○	✓	✓
	'Other Fuels'	×	×	○	○	✓	✓
Road Transport	'A' Roads	×	×	×	×	○	✓
	Minor Roads	×	×	×	×	○	✓
	Other	×	×	○	○	○	✓
LULUCF	Forest Land	×	×	×	○	×	✓
	Cropland	×	×	×	×	×	✓
	Grassland	×	×	×	×	×	✓
	Wetlands	×	×	×	×	×	✓
	Settlements	×	×	×	×	×	✓
	Harvested Wood Production	×	×	×	×	×	✓
Other	Domestic Shipping	×	×	×	×	×	×
	Domestic Aviation	×	×	×	×	×	×
	Military Transport	×	×	×	×	×	×
	Exports	×	×	×	×	×	×
	International Shipping	×	×	×	×	×	×
	International Aviation	×	×	×	×	×	×
	Waste	×	○	×	×	×	✓

Chapter 3: Scale of energy planning underway in the UK

The intention of this chapter is to provide an assessment of the level of energy planning activity undertaken to date, and the models and tools that are used. This will give an understanding as to the coherence of activity and indicate the 'step up' in activity required to roll out LAEP. Although primarily focussed on the UK, the chapter also draws insights gained from reviewing energy planning in other countries.

A desktop study identifies the level of energy planning undertaken by every UK local authority and LEP to date, categorising their progress and making high-level assessments as to the level of detail each has covered. A more in-depth assessment of plans identified as not quite a LAEP, but that do cover the same geographical region is carried out. The models and tools that are available and used by local authorities in energy planning are also assessed on both a technical and usability basis, to provide an understanding of their strengths and weaknesses.

Market interviews provide insight on activities to date, identifying what is working well, and what barriers and challenges are being faced in both the production of the plans and the delivery of the actions that a plan identifies.

3.1 Baseline of energy planning in the UK

This project has baselined the level of energy planning activity underway to date in the UK. Without an understanding of the baseline, it is uncertain how much of a 'step-up' a programme to roll-out LAEP would be. Local authorities will more likely adopt LAEP, face fewer uncertainties and have more confidence in undertaking a LAEP if they have already undertaken energy planning activities historically. A desktop study assessed the level of energy planning underway, searching for evidence from publicly available sources. Details of the method are provided in Appendix 2.

3.1.1 Results

The systematic assessment of energy planning resulted in a database with 376 entries. The categorisation of plans informed the tiered approach to defining LAEP that was described in 2.6. A count of the categorisation of the plans is shown in Table 4.

Table 4: Categorisation of energy planning activity underway to date

Categorisation	Count
Local Area Energy Plan	15
Regional or Local Energy Strategy Climate Action Plan Climate Emergency Declaration Energy Masterplan Net Zero Masterplan	262
Local authority plan to decarbonise its own estate	55
Projects (No Plan)	5
Other	39

The 15 plans that are classified as 'LAEP', include two pilot projects from SSH (Bridgend and Newcastle), 10 boroughs of GMCA, and as well as two being delivered by Welsh Government (Conwy, Newport) and one other underway currently (Glasgow). Bridgend and Newcastle were completed before the Ofgem Method had been developed; the remaining 13 LAEPs are currently underway and are all following the Ofgem method.

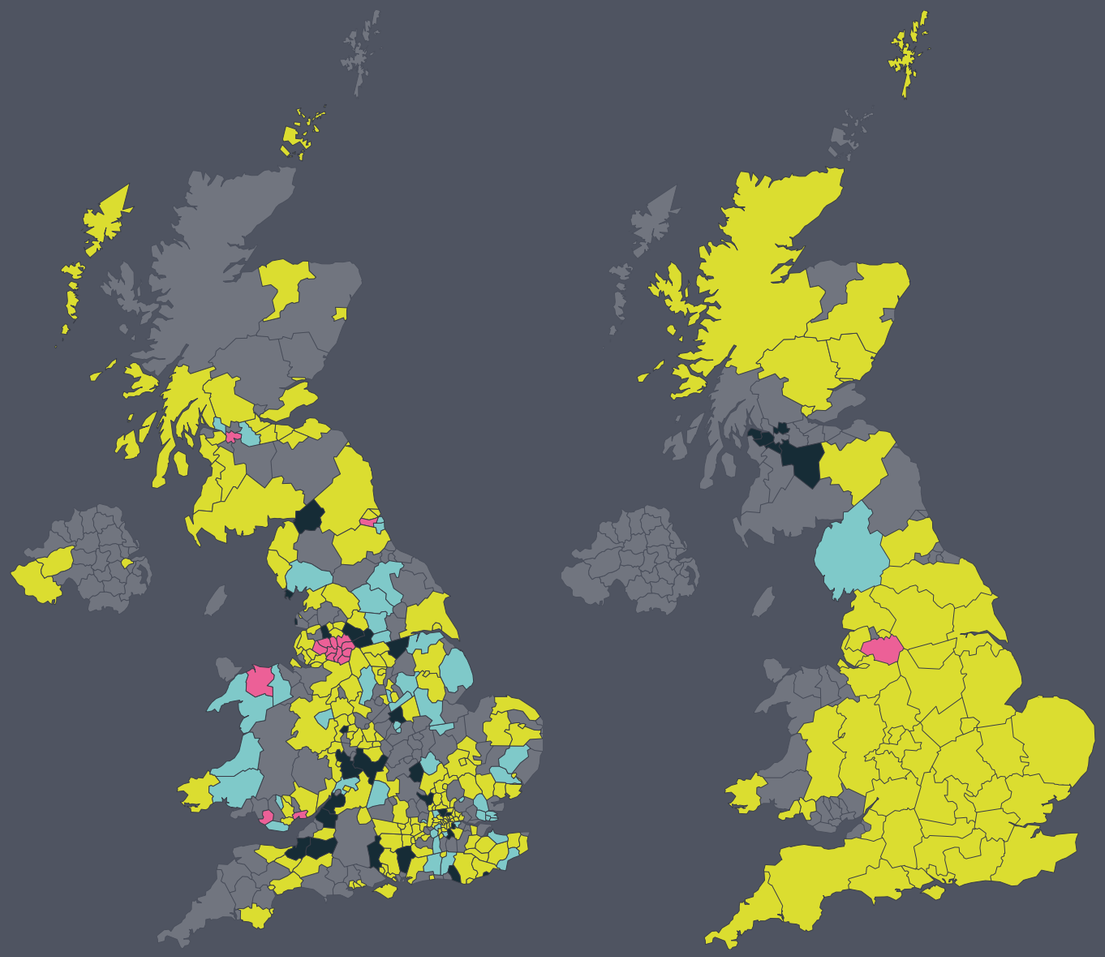
Of the 262 energy plans that are not LAEP, 88 are classed as detailed plans, 160 are high level plans, 12 are very high level, and the remainder are underway, so it hasn't been possible to assess their level of detail. The 88 detailed plans are further assessed in 3.2. The remaining 99 database entries aren't energy plans that cover a local area, and so are not described here. The categorisation of the plans is illustrated in Figure 1. The map on the left has plans made by local authorities excluding county councils. The map on the rights shows county councils, LEPs, and combined authorities.

Finally, the types of authorities that have been making energy plans is shown in Table 5.

Table 5: Types of authorities making energy plans

Categorisation	No. of plans
Combined authority	5
County council	35
Region or Group of areas [39]	14
Local authority [40]	292
LEP	14
Other [41]	12

Figure 1: Map of the UK with local authority areas coloured according to their categorisation (L), with county council, combined authority or LEP coloured according to their categorisation (R) [38]



Categorisation*	Count
Local Area Energy Plan	15
Regional or Local Energy Strategy / Climate Action Plan Climate Emergency Declaration / Energy Masterplan Net Zero Masterplan	262
Local Authority plan to decarbonise its own estate	55
Projects (No Plan)	5
Other	39

*Areas are categorised according to their 'highest' level of plan in instances where more than one plan has been identified for an area. As such 'lower' categorisations will not appear in the maps.

3.2 Assessment of plans

As noted in 3.1.1, 88 plans were categorised as being detailed energy plans, but did not meet criteria to be categorised as LAEP. For these plans, the assumption is that a 'step-up' to LAEP will require much less than if no plan currently exists, or if the existing plan is insufficiently detailed. For these plans, some of the groundwork is already done; some of the considerations may have already been made, political will and resources may already be in place, and engagement of stakeholders may already be underway. To further understand these plans and how they differ from what would be categorised as LAEP, as well as what steps would be required to make them a LAEP, these 88 plans were taken forward for a more detailed assessment. Details of the method are provided in Appendix 3.

3.2.1 Results

Of the 88 plans that were identified, 81 were assessed in more detail. The remaining seven could not be assessed because they are in the process of being produced or form part of a guidance framework for a regional programme of LAEP.

The plans were categorised as 'good', 'better', 'best' according to their total score, against criteria based on the LAEP Ofgem methodology (see Table 6, and see appendix 3 for full approach to assessment). To re-iterate an earlier point; it is not to say that these are not 'good' energy plans, but to say that they do not sufficiently meet Ofgem criteria for LAEP 'done well'.

Table 6: Categorisation of assessed plans

Category (Score)	No. of plans
Best (14–16)	12
Better (11–13)	24
Good (8–10)	32
Other (5–7)	13

Many, if not all of these plans, wouldn't have set out to meet these criteria.

A map of the UK showing the categorisation of the 81 plans is shown in Figure 2. Areas categorised as 'best' are coloured pink, 'better' are coloured yellow, 'good' are coloured teal, with 'other' coloured black. Some areas overlap; for example, the plan for the GLA covers all of London, but some London Boroughs (such as Merton and Islington) have their own plans. Because these are at different geographical scales, these are overlaid in one map.

Details of the 12 plans that are categorised as being 'best' is shown in Table 7. For almost all of these, the geographical scale is larger than a single local authority; only three are at the level of a single local authority, although two of these three cover large urban centres (Cities of Bristol and Newcastle).

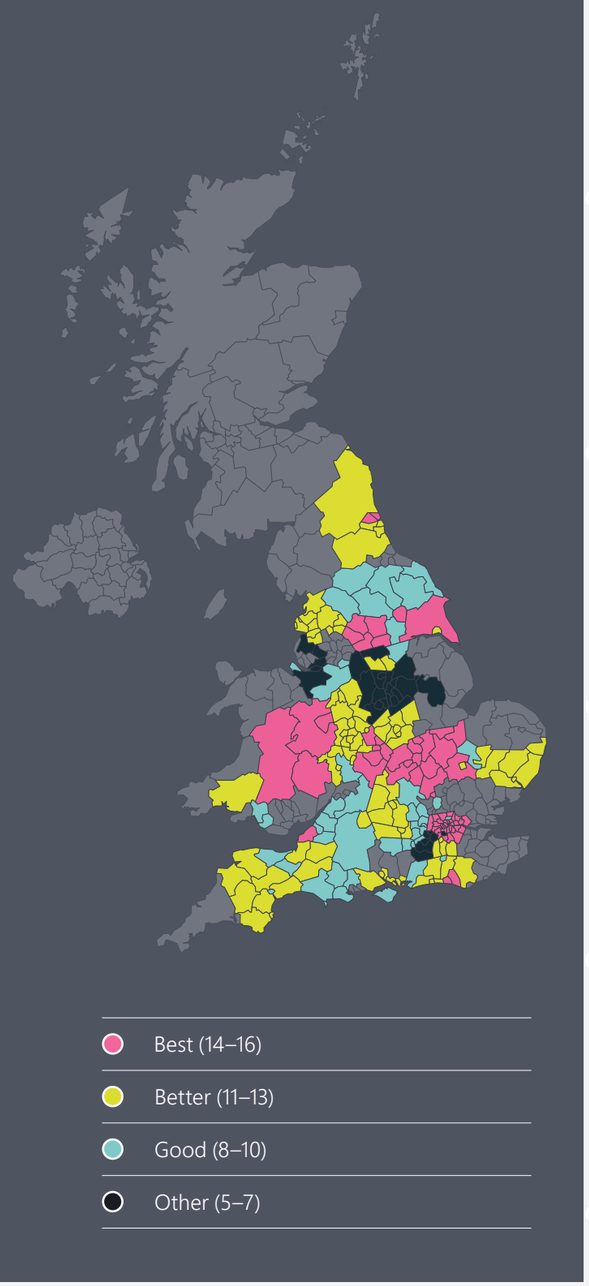
[38] Local authorities in Scotland, Wales and Northern Ireland are single tier authorities

[39] Groups are typically made up of multiple counties, multiple local authorities, or multiple LEPs

[40] This includes district councils, London and metropolitan boroughs, and unitary authorities.

[41] This includes devolved administrations, and areas smaller than a local authority.

Figure 2: Map of the UK showing scores for assessed plans



This indicates that the breadth and quality of plans being led by authorities covering a wider area, such as a combined authority, is high. Several reasons may explain why these plans are better; larger authorities may have better access to resources, capacity and capability, allowing for more time to spend co-ordinating and leading energy planning; further, both are well positioned to carry out the co-ordinator role across multiple areas ensuring each individual area has their say in the wider plan; and LEPs are well placed to undertake this role, as often they sit within larger authorities.

Market interviewees noted that the lead role for LAEP may be best placed at county or combined authority level (see 2.5.4). Energy planning that involves multiple areas and crosses boundaries may indicate a leading role for regional authorities but may also bring benefits from an investment perspective; identifying larger projects and aggregating a portfolio of identified projects may attract private sector infrastructure investors who typically would not consider opportunities below £50m.

Further details of how each of these 12 plans met the criteria is shown in Table 8. Green indicates meeting all elements of a criterion (score 2), with orange indicating some elements of a criterion were not met (score 1), and red indicating all elements of a criterion were not met (score 0). It is noted that taking a whole systems approach to energy planning is rarely undertaken (only two plans score 2), whereas inclusion and coverage of all the energy vectors in an area is (all plans score 2).

Likewise, providing an analysis of the impact on energy networks, providing outputs that allow choices between multiple scenarios and pathways, engaging stakeholders in the planning, and providing an analysis of change over time to meet carbon budgets is frequently included in these plans.

Whereas providing a spatial analysis showing where technologies could and should be deployed, and costs for their deployment and for meeting the plan is less frequently included in these plans. This is interesting given that when asked about the definition of LAEP, interviewees noted the spatial analysis as being necessary, highly valuable and something that is notably missing from other energy planning beyond adopters of LAEP (see 2.5.1). The Net Zero Newcastle plan is notable in that its scope is beyond just considering energy issues and includes waste and tree planting in the five-year carbon budgets.

Table 7: Details of the 12 plans that were categorised as 'best'

ID	Name of plan	Authority type
30.23	Humber Local Energy Strategy	LEP
11	London's Climate Action Plan: WP3 Zero Carbon Energy Systems	GLA
78	Greater Brighton Energy Plan	Region
30.12	Energy Strategy for the Marches Local Enterprise Partnership	LEP
30.14	A Regional Energy Strategy for the West Midlands	Three LEPs and CA
30.21	Towards a zero-carbon Leeds City Region: Energy Delivery Plan	LEP and CA
271	North Tyneside Climate Emergency Action Plan	Metropolitan Borough Council
30.4	Local Energy East Strategy	Three LEPs
30.11	South East Midlands Energy Strategy	LEP
121	City Leap	Unitary Authority
90	Mid Wales Energy Strategy	Group of areas
141	Net Zero Newcastle	Metropolitan Borough Council

Table 8: The 'best' 12 plans and how they scored against the criteria

ID	Whole Systems	Stake-holders	Energy Vectors	Networks	Spatial analysis	Change over time	Costs	Outputs	Impact
30.23									
11									
78									
30.12									
30.14									
30.21									
271									
30.4									
30.11									
121									
90									
141									

3.3 Market perspectives on energy planning activities to date

Market interviewees were asked about energy planning activities underway to date, in order to provide context and qualitative information to complement the desktop-based study. Whilst the desktop study has provided a detailed snapshot of activity undertaken to date, what it hasn't provided is any explanation or justification for this level of activity; what is preventing more activity? What has encouraged those that have made plans to do so? What barriers and challenges were faced in the process of making plans? Interviews have captured these data, allowing for these questions to be addressed.

3.3.1 What LAEP activity is being undertaken?

A summary of activities reported by each group is provided here.

Local authorities, LEPs and Energy Hubs

Activity reported by each interviewee is at different stages of the energy planning process; for example, some local authority interviewees are actively involved in producing a LAEP, some are gathering evidence and collecting data in support of and preparation for producing a LAEP, or applying for funding to produce a LAEP; others are busy delivering the projects and impact that a LAEP had previously identified.

Interviewees reported:

- Gathering, analysing and modelling data, producing 'Local Energy Asset Representations'.
- Using nationally available tools and those developed by consultants.
- Setting an overall strategy in consultation with other stakeholders
- Applying for grant funding (e.g. PSDS) to undertake decarbonisation plans and for capital investment to improve the energy efficiency of buildings and decarbonise them.
- Engaging with neighbouring local authorities regarding the possibility of working jointly on a LAEP, to cover a wider geographic area.
- Setting up and coordinating stakeholder partnerships to inform and shape a LAEP.
- Progressing adjustments to local transport and planning policies to align with net zero ambitions and LAEP pathways.

DNOs and GDNOs

Interviewees reported:

- Enabling the decarbonisation plans of other stakeholders — e.g. the local authority, or businesses — in a timely and effective manner, through planning changes to the energy infrastructure that will be required in local areas.
- Planning for the introduction of hydrogen. In some cases, they are starting the installation of new piping.

DNOs say they are predominantly reactive to local authorities and their needs, with one specifically commenting:

> *"We are informed by what any given stakeholder would like to do, and we need to take that into account and plan for it."*

However, others are proactively seeking to engage with local authorities, and some have developed tools to produce pathways to net zero.

GDNOs are generally less engaged in LAEP activity at present. They recognise that they aren't the most appropriate organisation to lead LAEP activity, and will either await requests from local authorities or other organisations, or wait for their role in LAEP to be further defined by Government:

> *"We are bound by the national policy landscape with regard to what happens about natural gas and when that's phased out."*

Consultants and academics

Consultants and academics talked about two main areas of involvement relating to LAEP:

- Being commissioned by local authorities, undertaking data analysis and modelling, either using their own tool or nationally recognised tools available publicly, to inform decisions on pathways to net zero. Academic institutions are also involved in bidding for research funding to conduct similar work
- Conducting research more broadly around the topic of LAEP (e.g. decision making in infrastructure planning, energy demand and energy supply), the findings of which could be considered in/useful for LAEP.

Central Government and national organisations

The involvement of central government departments and national organisations is more varied, as is to be expected given the varying roles in this group. Examples given by interviewees include:

- The Town and Country Planning Association (TCPA) are advising local authorities how they should be setting their net zero targets, and how they could achieve them. This involves advocating that LAEP should be a local authority document and referenced within planning policy. TCPA signpost local authorities to ESC guidance if they need support.
- Welsh Government have an aspiration for LAEPs to cover all parts of Wales to produce an aggregated picture of the future energy system in Wales. They are currently supporting two pilot projects in Newport and Conwy that will follow the Ofgem method, where consultants have been procured to conduct technical analysis and lead stakeholder engagement. The projects are due to complete in early 2022 and learnings will be used to inform the future support that is offered to the rest of Wales.
- As part of Local Heat and Energy Efficiency Strategies (LHEES), Scottish Government have developed a toolkit which looks at the heat supply, energy efficiency and heat networks for domestic and non-domestic buildings and have worked closely with the 32 local authorities in Scotland to help them develop their own strategy.

3.3.2 What is working well?

Interviewees (except the central government and national organisations group) were asked for their views on what they felt was working well with regards to delivering LAEP. They often struggled to think of anything specific, instead reflecting on the general progress made relating to net zero or energy planning:

- Some expressed the view that the large number of local authorities that have set a net zero target and had some sort of strategy (whether broad or detailed) was positive and is a driver for LAEP progress.
- Some thought that there had been quite a lot of LAEP type work commissioned to consultants, to capture data, and model scenarios / energy pathways.
- Some mentioned that there is a small number of examples in the UK where LAEP activity is more advanced (such as Greater Manchester and Bridgend) and are looking to these examples to follow.

> *"I gather from others we would need between £100k and £200k. For me to make the case to senior management to spend over £100k and delay the work to not get the results for over a year, I didn't feel the argument stacked up enough. Or, if I could have said to senior management if we spend this £100k, then it would guarantee private sector investment, or central government funding, but that certainty isn't there."*

3.3.3 What challenges are faced?

Local authorities, LEPs, Energy Hubs, DNOs and GDNOs were asked what they felt was working less well, and to describe any challenges or barriers they had faced in delivering energy planning activity. The main themes arising are summarised below, by group.

Local authorities, LEPs and Energy Hubs

Not having a clear, agreed definition of LAEP can mean spending time trying to understand what it is and making decisions around its scope. There was a general sense that — because of LAEPs complexity — many do not know where to start.

The cost to develop a LAEP, with many local authorities reporting that consultants have suggested costs may be between £100k–£200k to develop a LAEP. If individuals have found it hard to articulate the added value of the process, securing this funding is a difficult sell.

The cross-sector nature of net zero means that it is difficult to understand and define who 'owns' it. Many interviewees explained that net zero spans different organisations, and different national and local government departments. Whilst they agreed that everyone has a part to play, they found it difficult to know who should set direction and leadership, and who is making sure that "all the pieces of LAEP fit together and nothing falls through the gaps." They did not go into detail about the factors that influence good energy planning leadership, but one respondent suggested that there would be value in a third-party organisation leading the process of developing LAEP.

Limited skills and capacity within local authorities, for stakeholder engagement and coordination, data analysis, and commissioning (i.e. writing a brief to procure LAEP data modelling and analysis work, assessing tenders and then overseeing and quality assuring the resulting work).

The availability of data and how to access it; understanding who has what data, the quality of the data and where the gaps are. Some also said that they lacked access to real-time data and that relying on "data snapshots" meant that they could not be as agile in spotting opportunities to update plans as they would like. Some also mentioned that data protection had been an issue, delaying access to data (especially at a granular level).

Engagement with the general public being somewhat limited. Some suggested that it was difficult to know at what stage consumer engagement should happen in the process, or the best way to go about it; *"Nobody is warming up consumers to what we're doing and why."*

Some expressed concern that **LAEP could come into conflict with other local authority obligations**, such as tackling fuel poverty, and therefore choosing pathways and actions required careful balancing.

Two local authority respondents raised region-specific challenges, including:

- Difficulty engaging with the DNO operating in the area, claiming there wasn't anyone within the DNO responsible for discussions relating to LAEP. This authority has committed to achieve net zero by 2030 and is proceeding without significant involvement from the DNO.
- How to deal with national infrastructure located in the local area; who is responsible for decarbonising that infrastructure? To what extent can the benefits from that (i.e., renewable energy generation) stay with the local area.

DNOs

Whilst DNOs suggested that there is significant work happening in their areas, particularly in terms of strategy development and identifying pathways, very few have what they believe to be a LAEP.

A claim that in some local authorities there isn't a dedicated person or role responsible for LAEP, making engagement difficult.

Engaging different and multiple local authority departments (e.g. housing, transport, planning etc.), that may traditionally have worked in silos, and can sit at different levels of the local authority hierarchy, making it difficult to agree pathways or actions.

In some cases, the data analysis and planning by local authorities isn't relevant to the DNOs and it requires conversion, outputs need to be in a common language that is useful to all stakeholders. There was a suggestion that better engagement at the outset about requirements for data analysis for all parties could make the process more efficient and effective.

Two DNOs reported trying to recruit new staff who will have a specific role in LAEP but are finding it difficult to find candidates with the skills needed, such as sufficient technical knowledge and the ability to engage with various stakeholder groups.

GDNOs

A lack of a common LAEP template or a consistent approach to data capture and analysis means that it is difficult to compare plans, understand which (if any) were particularly good or bad, and how various LAEPs fit together as a whole.

It has been difficult for the GDNO to see where certain figures from data analysis are derived; this, and unclear definitions and terminology are resulting in a lack of confidence in the plans produced.

> *"If there was some kind of common template and no matter how you do your plan this is the way you need to present your data in the end, then again we could be comparing them and we could be aggregating them together and say, well if all of these things happen, what does that look like for the UK?"*

> *"I started looking at one report, and it looked good, there was a lot of data there, but when I started putting it in our spreadsheets, I couldn't match it up."*

3.4 LAEP Models and Tools

A review of existing models and tools in the local energy planning space was conducted to understand the extent to which they could meet the needs of a LAEP approach, or where gaps may exist between existing tool capabilities and what might be needed. An initial model review was also undertaken as part of the previous project to develop the Ofgem method, and this builds on that, providing more detail and additional review criteria, updates on models, and a larger number considered in detail. This review considers both models and tools.

The model or tool used in the production of the plan is referenced for 93 database entries. The plans made by ESC have used Energy Path Networks, 21 plans have used SCATTER, 10 have used DFES/Future Energy Scenarios data, and 10 have used the Tyndall Carbon Budget Tool. For the remainder of the database entries (where a model is noted), each entry appears only once and the model or tool is often bespoke, often provided by the delivery contractor specifically for the plan and is not publicly available for re-use. For 281 database entries, the model or tool used in the production of the plan is not noted. For some, this will be because a model or tool was not used (for example, a plan to decarbonise local authority buildings may need nothing more than Excel), whereas for others, this will be because the authority has not published what they used.

3.4.1 Criteria used in analysis

Eight models or tools were selected and reviewed against a set of criteria. These criteria were designed to cover key attributes, both in their technical scope and method and also on factors such as ease of use, licensing, and documentation affecting how easily they could be applied. They include the elements of modelling currently considered to be part of a LAEP approach, based on the Ofgem method. The criteria used for the assessment are described in Appendix 5.

The model and tool evaluations against the criteria were undertaken on the basis of published reports and publicly available information about them; some criteria may have been evaluated differently if more information was available. Although best efforts have been made to find information, some may have been missed. Models are developed over time and customised to the needs of particular projects, so the evaluation may only hold correct for the specific version considered. Where possible the version and date of release has been noted. The detailed evaluation of each model and tool is in Appendix 5, along with a link to each. Included here is a short summary of each.

3.4.2 Summary of each of the tools and models

SiCEDS: is successful in being a tool usable by a wide variety of stakeholders through a clear web interface. It lacks the level of spatial and temporal detail that is required for LAEP, and no evidence is found that it has been applied or updated since its initial project. It however provides an example of how an interface that lets stakeholders easily test different scenarios has value.

Pathfinder: provides a whole energy system optimisation approach, but without some of the spatial and temporal detail that is required for LAEP. Its spreadsheet-based interface allows transparency of data and non-expert use but provides a limit on the complexity that can be modelled. It is not currently available to a wide variety of users, and although multi vector is likely to have been developed with a greater focus on the gas sector compared to others.

DFES — Regen: The DFES approach is DNO focused and is consequently very different to local authority needs. However, it contains reasonable spatial and temporal detail, and can consider a wide slice of the energy system. The Regen approach seems to have wide take-up by DNOs.

DFES — Element Energy: The DFES approach is DNO focused and is consequently very different to local authority needs. However, it contains reasonable spatial and temporal detail, and can consider a wide slice of the energy system.

Thermos: Provides very spatially detailed design and optimisation of heat networks but does not currently have the full energy system scope required for LAEP. It does provide an easy to use interface for non-expert users and may have a potential role as a tool to allow more detailed assessment of heat network opportunities identified by another whole system tool. The reciprocal licence term may limit commercial use of the tool, as any development of it undertaken by a user has to be shared with all others.

EnergyPath Networks: Is well aligned to the scope, scale and level of detail required by LAEP, with the detailed spatial scale and representation of time. However, it is not available for use outside of its owning organisation and requires significant modelling experience and access to dedicated computing resources, meaning it may not be suitable for widespread deployment without further modification.

SCATTER/Tyndall: Is an easy to use, web-based tool that allows non expert users to understand the carbon emissions from their local area. The pathways for carbon reduction are not suitable for LAEP, with no spatial element and only pre-defined interventions at pre-defined levels possible. The Carbon budget reporting tool provides simple reports on current emissions, but only generic advice for how they could be reduced.

Calliope: An open and flexible model framework that can be used for optimisation. A distinction should be drawn between the model framework and the setup of the model for a specific scale and type of modelling, work would be required to parameterise the model with local technologies and representations of local demand in order to be used for local scale modelling. It is unclear without testing what level of spatial detail could be solved at the local authority scale, and this would also depend on the commercial solver used. It is not suitable for non-modelling expert users.

3.4.3 Summary of model and tool review

No single model or tool has been identified to meet all the requirements of LAEP and be ready to deploy at scale in a consistent and rapid programme to roll out LAEP. There are three key criteria required of the tools considered:

- Outputs simulations in sufficient temporal and spatial detail, with a wide enough energy system scope
- Can be used relatively easily by a third-party, without the need for significant training and without access to significant computing power
- Is available for a wide variety of organisations to use in a cost-effective way through licenses or other mechanisms.

None meet all these criteria, and the criteria may actually be mutually exclusive; providing sufficient detail is very challenging, especially if it is to be presented and modelled in a way that is accessible to third-party users without significant training and high computing power. The level of investment required in a tool to meet both of the first two criteria then makes it less likely that criterion three will be met, as the tool owner seeks to recover the investment they made.

Many of the models and tools considered do offer particular elements of the LAEP process well: SCATTER to set initial carbon budgets, Thermos to assess heat network opportunities, Energy Path Networks for underlying whole system modelling. An approach that combines multiple models and tools hasn't been tested, and so it is uncertain if it could work in practice; this may require either directly sharing data from existing tools or developing a new tool that builds on the strengths and learning that each has developed.

3.5 Energy planning overseas

The project looked at examples of energy planning activity overseas, in order to explore how other cities, regions and countries are approaching it. The intention was to learn lessons and broaden the scope and method for energy planning in the UK. Details of the method are provided in Appendix 4. Twenty-four plans were assessed and added to the baseline database, with 15 of these assessed further against the same nine criteria that UK plans were assessed against.[42] A subset of these 15 is described here, presented as case studies to describe how each of these plans include an element of energy planning that is done notably well, or include something that plans produced in the UK typically do not.

3.5.1 Energy Evolution: Ottawa's Community Energy Transition Strategy (2021) [43]

Ottawa, Canada

Ottawa municipality worked with Sustainability Solutions Group using a custom-built energy, emissions and finance model called CityInSight to produce their plan Energy Evolution: Ottawa's Community Energy Transition. The plan focussed on the communities in Ottawa, and as such deployed a strong stakeholder engagement strategy. Modelling and development of future scenarios was notably detailed and resulted in identification of several projects, each of which is costed.

CityInSight produced 14 pathways in different sectors (developed in conjunction with city departments and experts), and the pathways modelled together to identify 'feedback' between them. From this, the ideal 100% reduction scenario was identified. Almost 200 representatives of over 90 public and private organisations were consulted as part of the pathway development. The solar potential and Demand-Side Management and energy storage pathways were based on detailed technical background papers, including detailed analysis into capex, O&M, energy and carbon price savings, revenue from generation and net cost.[44] Thirty-two actions were modelled in the 100% scenario. Modelling assumptions and parameters were developed for each action. Each action was modelled using CityInSight in two steps: assumptions for each of the actions were modelled to quantify the emissions reduction impact against the Business-as-Planned (BAP) scenario; then the 100% scenario was developed.

[42] See Appendix 3

[43] https://ottawa.ca/en/living-ottawa/environment-conservation-and-climate/climate-change-and-energy/energy-evolution

[44] https://documents.ottawa.ca/sites/documents/files/energy_pathway_phase1_en.PDF and https://documents.ottawa.ca/sites/documents/files/energy_pathway_phase2_en.PDF

Interestingly, actions were sequenced before the feedback modelled, to make sure that consumption reduction and efficiency maximisation came before deployment of renewable energy.[45] Costs also influenced the rate of uptake of the actions identified in the model.[46] Outputs include zonal analysis that is publicly available through a dashboard.[47]

A strong output from the modelling process is the projects that are identified. These are identified by sub-sector, aggregated over the whole city and estimate are made of the CAPEX cost, net return on investment by 2050, and by end of asset life. Sources of funding and delivery agents are suggested for each project. For projects that need to be delivered in the next 20 years, further **analysis is provided that provides costings, financing tools, timescales, anticipated benefits, risks and stakeholder responsibilities for each individual project**.[48]

[45] https://documents.ottawa.ca/sites/documents/files/energyevolution_technical_en.pdf

[46] https://documents.ottawa.ca/sites/documents/files/energy_evolution_strategy_en.pdf

[47] http://cityinsight-interface.ssg.coop/ottawa-emissions

[48] https://documents.ottawa.ca/sites/documents/files/energy_evolution_appendix_f_en.pdf

3.5.2 1.5°C: Aligning New York City with the Paris Climate Agreement (2017) [49]

OneNYC, New York City, USA

This plan sets out a comprehensive, science-based plan to reach 80% emissions reductions by 2050. It is based on analysis carried out by BURO Happold called "New York City's Roadmap to 80x50", or 80x50 for short. The 80x50 study identified actions with the greatest potential for GHG reductions across the sectors of energy, transport, buildings and waste. These were taken by the City and prioritised further on **risk reduction achieved through adaptation and resiliency**, as well as additional benefits such as job creation, equity and health.

OneNYC [51] was a follow-up to the plan and contains detailed policy measures. The "OneNYC Vision" is used to **query the societal benefits of the technological actions**. These provoking questions fall under the categories of; growth, equity, sustainability, and resiliency and contain sub-categories that dig-deep into the potential benefits of any measure. These sit alongside greenhouse gas abatement assessments, with the purpose being to **better reflect the human nature of decisions and the issues faced by local authorities**, as opposed to a purely techno-economic analysis. The questions were formulated and developed through stakeholder outreach alongside the technical roadmap to 80 x 50. A second point of interest is how the City has delegated responsibility and accountability to departments to carry out actions from the plan, effectively making them measurable deliverables.

[49] https://www1.nyc.gov/site/sustainability/codes/1.5-climate-action-plan.page

[50] https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/New%20York%20City's%20Roadmap%20to%2080%20x%2050_Final.pdf

[51] http://onenyc.cityofnewyork.us/

3.5.3 First revision of the Hamburg Climate Plan

Hamburg, Germany [52]

Hamburg's Climate Plan update is based on scenarios calculated by the Wuppertal Institute [53] in 2017 which in turn is informed by work from the Öko-Institut.[54] Being a 'Climate Plan' rather than an energy plan means that it is quite different to LAEP. However, it is formidable in terms of its scope, impact, and pragmatism.

A huge range of stakeholders have been actively engaged including utilities, Chambers of Commerce and Crafts and Trades, environmental and civil associations, churches and public sector. Back in 2007 as part of an earlier version of the Climate Plan, 11 Hamburg-based large industry firms signed a pledge to reduce emissions by 25%. By 2012 they had reduced emissions by 333,000 tonnes CO_2.[55]

These firms included Arcelor Mittal, Lufthansa, Vattenfall and others. Hamburg has recognised that a green economy is necessary to remain globally competitive; 16 public enterprises have also signed climate partner agreement with the Senate, sending a strong message to the private sector. The Senate continues to rely on voluntary agreements with the private sector and recognises that SMEs are often harder to reach and lack resources to carry out decarbonisation measures. The revision to the plan recommends additional advisory and funding to be made available to this sector but does not elaborate in this document. The City has developed and trademarked the #moinzukunft ("hello future") logo and uses it to mark all climate protection activities. This is part of the awareness campaign to bring citizens into accepting the plan.[56]

At the end of 2020 Hamburg's climate act was passed into law. This makes the City and any entities it controls responsible for limiting global warming. It mandates for example the phase out of lignite or coal for energy generation or for use in urban heat networks.[57] It is worth remembering that in Germany most energy suppliers are municipal. Interestingly, one action that the City took in response to its plan was to buy a 25% stake in the networks, which was then increased to 100% in 2016 following support from citizens. It has also set up its own operating company in order to be able to develop innovative services in the renewables sector.[58]

52 https://www.hamburg.de/contentblob/9051304/754a498fcf4e4bbf9516e1f9a99e2bfe/data/d-21-2521-hamburg-climate-plan.pdf

53 https://wupperinst.org/

54 https://www.oeko.de/aktuelles/2016/klimaschutz-in-deutschland-bis-2050/

55 https://www.hamburg.de/contentblob/4028914/6bdf8a2548ec96c97aa0b0976b05c5d9/data/booklet-englisch).pdf

56 https://moinzukunft.hamburg/was-ist-moinzukunft/

57 https://carbonneutralcities.org/hamburg/

58 https://www.hamburg.de/contentblob/4028914/6bdf8a2548ec96c97aa0b0976b05c5d9/data/booklet-englisch).pdf

As an investor, the City also recognises the need to avoid and divest fossil fuel investments to contribute to climate impact but also to reduce investment risk. The Senate will now review and prepare investment policies geared to a sustainable investment strategy both for its own activities in the financial market and for holdings in public companies.[59–60]

By the end of 2020, the Senate aimed to have climate managers in all districts involved in setting up and implementing climate change mitigation plans.[61] By the end of 2021 the aim is to have an energy efficiency management plan in each neighbourhood. Within the state budgetary regulation there is already a stipulation that all spending must be cost effective and this is being used to prioritise retrofit measures to public building stock.

There is recognition that the plan needs to take a holistic, comprehensive approach. This includes sector coupling across mobility, buildings and energy. The four main 'transformation paths' developed by the Wuppertal Institute have adjustable levers so the feedback between them is taken into account. A comprehensive plan also means checking for synergies and conflicts with the plan's other aims of increasing resilience and adaptation.[62]

Flexibility, self-consumption and demand-side management are all recognised in the plan as being important. The City lobbies Federal Government to make regulatory changes (for example removing double-charging of electricity storage assets) and makes the case that currently the regulatory environment is not conducive to flexibility business models.[63]

Further sources of interest are available on the Climate Protection Law,[64] the transformation paths [65] for heat including building efficiency, mobility, business and climate adaptation and citizen engagement.[66]

3.5.4 Overseas plans: summary of findings

The overseas plans reviewed here (and those that were reviewed and are described in Appendix 4) share commonalities and differences. The way that costs are estimated and dealt with in plans often varies; the OneNYC plan provided a strong case for investment through clear project identification alongside associated CAPEX, net return on investment, and project lifetime. These are all elements that support business and investment cases and help to attract varying investment sources including private sector. Potential sources of funding and delivery agents are also suggested for each project.

59 https://www.hamburg.de/contentblob/13899086/749a6e50662c96eee81d370f1b0cb631/data/d-first-revision-hamburg-climate-plan.pdf

60 https://www.hamburg.de/klimaplan/13255444/stadt-als-vorbild/

61 https://www.hamburg.de/contentblob/13899086/749a6e50662c96eee81d370f1b0cb631/data/d-first-revision-hamburg-climate-plan.pdf

62 https://www.hamburg.de/klimaplan/13254982/vier-transformationspfade/

63 https://www.hamburg.de/contentblob/13899086/749a6e50662c96eee81d370f1b0cb631/data/d-first-revision-hamburg-climate-plan.pdf

64 https://www.hafen-hamburg.de/en/press/news/new-climate-plan-and-climate-protection-law-for-hamburg-senate-adopts-concrete-measures-for-the-next-10-years-and-sets-new-c-365/

65 https://www.hamburg.de/klimaplan/

66 https://www.hamburg.de/klimaplan/13255446/klimafreundliche-gesellschaft/

'Benefits' beyond carbon abatement are evaluated by many cities such as increased resilience and adaptation, protecting the vulnerable and increasing equality. These elements also support business and investment cases as well as building the case for wider public citizen buy in.

Measurable action and clearly defining roles and responsibilities of key stakeholders were also elements that should be considered as key learnings to take forward into UK LAEP best practise. Delegated responsibility and accountability to departments allowed for measurable action within the OneNYC plan. Defined roles and responsibilities of stakeholders making it clear who owns what action, data or engagement also promotes ownership and action.

The most effective plan for stakeholder engagement we reviewed was the Hamburg Climate Plan that takes an extremely pragmatic and hands-on approach to decarbonisation. The City has really used its position as lead investor to develop relationships with public and private sector and have put forward a large number of measurable projects. They own some city entities so they have control. For each project the plan outlines, stakeholders / project leads have been identified, emissions reductions quantified, timelines indicated and KPIs suggested. As a result, Hamburg has managed to increase economic growth whilst reducing emissions even with a very large industrial base.

> *"The LAEPs should essentially be an investment portfolio; once we've got the evidence and local plans reflecting that, organisations should want to invest in renewables."*

3.6 Market views on delivering actions identified in Local Area Energy Plans

This section describes market views on delivering and implementing the plans that they developed.

Funding delivery of plans

The majority of Local Authority, LEP and Energy Hub respondents were not certain how the actions within their plan will be funded. Expected routes identified included:

- Almost all recognised that **private investment** will be essential; both individual businesses investing in their own premises and activities and using investment from finance providers. Whilst some respondents felt confident that their plans would provide the information needed to encourage and secure private investment, others were less confident about how to make this happen

> *"We need to get better at leveraging private investment by taking a portfolio approach to projects. And thinking about how we get some expertise to help us with that in terms of packaging projects — what that means contractually, different kinds of approaches in terms of joint ventures, and legal structures to put in place."*

- There is an expectation amongst most that **central government** will provide some of the investment needed e.g., funding for consumers to invest in the energy efficiency of their homes. It was suggested that an evidenced and costed LAEP should help secure the funding required to deliver a plan, but with some expressing concern that national funding has not always been helpful to LAEP. Concern was expressed around the way annual budgets work for local authorities, and how they prevent long-term planning, and therefore force a more piecemeal approach to energy planning on a project-by-project basis. Another commented that funding pots tend to have what they perceive to be unrealistic timescales for applying for and spending the money, effectively preventing some local authorities from obtaining it.
- Some **local authorities** expect to contribute from their own funds, but the scale and direction of this is unclear. One respondent said that they may have access to some budget through devolved powers agreements.
- Some suggested that householders will need to invest in their own homes.

> *"Part of it is trying to create a value proposition that means the customer wants it, which then encourages private investment into those projects."*

> *"How do we change the infrastructure and also how do we make it affordable? How do we encourage private householders, enable them to pay for the changes that they will need to make?"*

What are the skill requirements to deliver the plan?

Interviewees felt there were two main types of skills gaps to delivering actions in LAEPs:

- Skills and knowledge within local authorities to procure contractors to install measures such as heat pumps, to assess tenders, and quality assure the installations.
- Well-documented skills shortages in the construction industry to deliver the types of measure and projects recommended in LAEP plans.

> *"The skills and capacity of the installation supply chain to actually make this stuff happen at the scale required isn't there. We have working relationships with a number of local installers, but if for example we look at the numbers of heat pumps required to meet a 2030 decarbonisation target, we don't see the installer base is there to achieve that."*

Other barriers to delivering plans

- Roles and responsibilities in delivering LAEP projects/actions are not well understood at present.
- Recognition that net zero ambitions are reliant on big shifts in individual behaviour — how people use energy in their homes, which mode of transport they choose — that will be difficult to achieve.
- The validity of LAEPs being affected by external factors such as national policy shifts and technological advances. As an example, some respondents acknowledged that they were developing their LAEP without knowing about national level hydrogen strategies. Respondents talked about the need to review their plans annually, and a more formal refresh at least every five years.
- Reticence within LAs to drive actions due to perceived risk and long-term liabilities i.e. would there be sufficient customers for a heat network to be commercially viable, or will the authority need to subsidise it? What happens if there are faults with the technologies installed in people's homes and the installer goes out of business; will the local authority need to foot the bill?
- A concern that LAEPs set out goals and actions without a sufficiently granular breakdown of how to get there i.e. very detailed step-by-step process to follow.

3.7 Conclusion

The level of LAEP activity undertaken to date is low but is growing. Just three areas have a completed plan that they can work from, although this will increase significantly (to 15) once those plans that are currently in production are completed. A very large number of plans (250+) have been made that are not LAEPs. These plans are typically labelled as 'Climate Action Plans', 'Local Energy Strategy', 'Energy Masterplans', 'Net Zero Masterplan', and, generally speaking, set out to decarbonise a local area and/or its energy system. Comparing this to the tiered approach considered in Section 2.6, the vast majority of these plans would come within the 'high-level energy plan' tier (3B) or 'high-detail energy plan' (3A).

However, none of these plans met the criteria to be categorised as a LAEP. A subset of the most detailed plans was assessed; of the twelve plans that scored the highest against the criteria, nine were at the geographical scale of a county council, LEP, or combined authority, indicating that working across boundaries could allow for the creation of better plans. This was perhaps through a greater understanding of the issues from more parties being involved, access to greater resources that were used more efficiently, or having greater capacity to deliver. This aligns with market insights highlighted in Chapter 2 that interviewees believe LAEP may be best led by combined authorities, where they exist, that cover a wider area.

Whilst the level of activity underway already is a good sign, the variety of approaches to energy planning is a concern. Uncoordinated and inconsistent planning will lead to uncoordinated and inconsistent interventions that may pull the energy system and decarbonisations efforts in opposite directions, giving the impression that progress is being made and hiding the inefficiencies that such an approach causes. Interviewees recognised that activity to date is varied; they identified challenges and barriers such as costs and resources, and a lack of a common method and examples of LAEP to draw from, all of which are exacerbated by the variety in approaches. The need to consider funding production of LAEP is described in Recommendation 6 in Chapter 5.

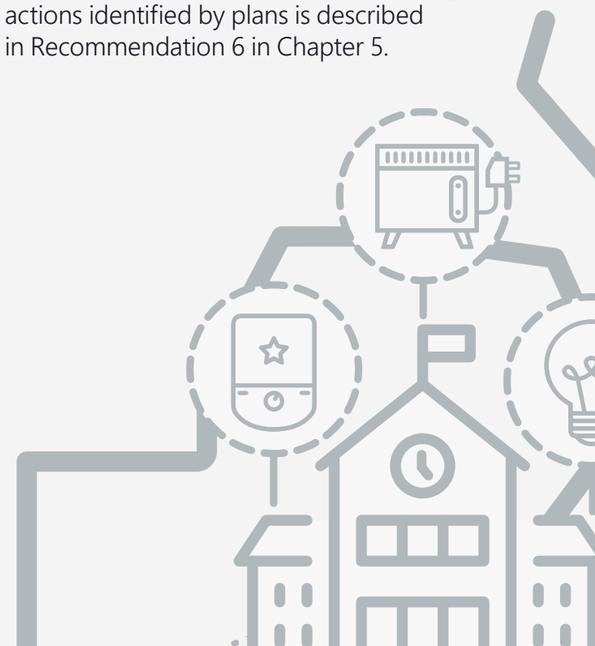
The market interviewees felt that plans took a long time to put together, were costly to produce and local authorities felt as if they were under-resourced to deliver them. This underlines the need to make plans more streamlined and produced more efficiently, and points towards the benefits that could be realised by following a common method, with guidelines and templates. As well, interviewees identified that they needed help throughout the process of making a plan, from guidance on what to procure and specify when appointing delivery contractors, to what to expect from plans in terms of outputs and actions. DNOs and GDNOs also highlighted the need for a common approach and language, to make planning more useful to stakeholders. The lack of method and guidance was also felt by interviewees to create ambiguity around roles and responsibilities in developing plans.

As well as guidance on producing plans, a body acting in an advisory capacity could eliminate these challenges, whilst also overseeing the process and productions of plans and ensuring value for money, these are addressed in recommendations 3 and 5. Whilst the Energy hubs were not mentioned directly in the market interviews, the energy hubs may be well placed to co-ordinate activity at a regional / multi-county level, and could support planning activity, provide technical guidance and assist in the delivery of interventions identified in a plan.

A review of models and tools identified that no single tool is currently available that can sufficiently model the energy system, in a way that was simple enough for third parties to use without significant training and computing power, and that was available widely without significant costs for licences and access. Upgrading models and tools in order to deliver against a common method or standard may result in them being able to sufficiently model the energy system and standardise to some extent the training that is required to operate the model or tool. However, it may exacerbate requirements for significant computing power, and more capable models may come at a higher cost. The need for a model or tool is described in Recommendation 4 in Chapter 5.

Plans from overseas identified areas that LAEP could learn from; highlights include strong stakeholder buy-in, clearly defined roles and responsibilities, and consideration of other factors such as resilience. Some plans made a stronger link between clearly defined projects or interventions and the investment that they required that then supported economic growth. Identifying actions that progress could be measured against was also noted. If this was adopted into best practice for producing UK LAEPs, it could be done in such a way to also address concerns around roles and responsibilities, linking measurable actions to specific roles, and assigning responsibility.

Finally, interviewees gave their thoughts on delivering the actions that plans had identified, focussing on the funding required for interventions and the shortage of appropriately skilled personnel in the construction industry. With regards to funding, interviewees noted private investments, central Government investment, householder investment as well as contributions from local authorities. However, these were always put forward as ideas on where funds may come from, and the overarching finding was uncertainty. The need to consider funding actions identified by plans is described in Recommendation 6 in Chapter 5.



Chapter 4: The future of LAEP in the UK

This chapter sets out the future of LAEP in the UK, taking insights from interviews with the market and assessing how common methods, guidelines and templates could be used to support future work. Aspects of the existing policy landscape are assessed in order to inform how they could be adapted to support the vision and definition of LAEP that is in focus in this report.

4.1 Market views on the value and benefits of LAEP

Interviewees were asked for their views on the value and the benefits of LAEP, especially over and above work already happening e.g., declaring a climate emergency. On the whole, they felt that there is value in LAEP. The following benefits were frequently cited by respondents across all groups:

- LAEP providing a practical roadmap as to how net zero can be achieved in a local area. Net zero ambitions have sometimes seemingly been set without a full understanding of whether and how they can be achieved. LAEP helps to overcome that by setting out what actions need to be taken, by who, where, when and how much it will cost.
- It enables all parties (e.g. DNOs, GDNOs, planners, developers, etc.) to make informed decisions as the product of robust analysis, and secure stakeholder agreement. As a result, LAEP should encourage external investment through de-risking investment, providing reassurance that the project is feasible/viable and has the backing of local partners.
- LAEP should help to achieve efficiencies by making it easier/quicker to approve plans that link directly to the LAEP, and similarly discouraging investment in plans that do not fully align with the LAEP.

> *"Enabling different construction works planned for the same area to be identified and implemented concurrently / in a joined-up way (reducing disruption and costs)."*

> *"In a planning application, if a developer submits X,Y, Z not in line with a LAEP it's just really helpful to be able to say 'no'; you can't do that because of this, and be able to point them to that document or plan or also then say if you do this to bring it in line with that then you know it might be a different story... actually having something written down and as hard policy of the local authority is just a very powerful tool for people in their day-to-day jobs."*

> *"The benefit is avoidance of chaos; piecemeal action that is uncoordinated is going to be wasteful of resources, inefficient, and probably have unintended consequences. Coordinated, strategic planning, with appropriate levels of feedback and monitoring and adjustment to plans as they are implemented is the only sensible way of achieving a target efficiently and effectively."*

- LAEP increases the chances of securing funding to help deliver projects. For example, one local authority explained that they have so far been able to apply for over £100million in funding (from sources such as Innovate UK, PSDS, and the Green Homes Grant) as they were able to reference the data analysis and modelling work that had been conducted as part of LAEP in their application.
- LAEP could encourage economic growth, examples include:
  - The long-term plan providing confidence to the construction industry to invest in workforce skills to deliver the measures set out in the LAEP
  - Encouraging businesses within the supply chain to set up in/move to their area e.g. a heat pump manufacturer relocating to the UK.
- LAEP helps to align other local authority policies, such as the local plan.

> *"I think it also aligns all the different elements of what local authorities do, because local energy planning is not just about one department in a local authority. It's all very well one department doing loads of stuff if another one is just ignoring the problem completely. But this way you're kind of aligning all of the ambitions across the local authority, which is really important, I think for just getting buy-in and kind of making people want to do it. And actually having enough of an impact."*

Some interviewees, whilst acknowledging the value of LAEP, expressed the following reservations:

- LAEPs are only as good as the data they are based on, and plans could quickly become obsolete as technology moves on.
- LAEP shouldn't prevent or stall projects that are broadly the 'right thing to do', even if it hasn't been proven or endorsed within the LAEP process.

4.2 Market views on adopting a consistent approach to Local Area Energy Planning

The majority of interviewees across all groups recognised the potential benefits of a consistent approach to LAEP in terms of:

- What data is gathered, and how it is analysed and modelled, including consistent assumptions being inputted into the model.
- The outputs that are produced in terms of the structure and content.

Interviewees suggested that a consistent approach to LAEP would further enhance the benefits and value of LAEP, and referred to:

Efficiencies

- All stakeholders will only need to be familiar with one approach and can therefore understand and interpret LAEPs for different areas more easily.
- Reducing duplication of effort i.e. no 'reinventing the wheel' when developing tools and outputs.
- Reducing the cost of consultancy work, in similar specifications and methods reducing such development work, and the more consistent/better understood approach opening work to more consultants, which could make the tendering process more competitive.

> *"You hope you get economies of scale; if you've got a tool that presents the data in the same format on the map, stakeholders don't have to develop things from scratch and reinvent the wheel, in terms of converting those numbers to impact on the electricity network."*

> *"We need to avoid, where possible, the spending of public money on things that have been done before and could have been got either free or more cheaply."*

Greater certainty that all of the plans, within their region for example, will "knit" together coherently and that there won't be any contradictions, e.g. due to different local authorities using different assumptions in their data modelling.

> *"It would be good to think that if all ten authorities in our region had their LAEPs produced, we could put all those together and we have a pretty good regional plan. If we've all used slightly different methods, slightly different models, different consultancies, then there's likely to be discrepancies."*

> *"Consistency enables aggregation and ability to compare the relative benefits of things to guide our investment and our policy priorities. Using different assumptions, it's quite difficult to work out where you would get the best value."*

Greater confidence in the outcomes produced because (presumably) everyone is following a best practice method. This should subsequently instil greater confidence in decision makers and financial investors.

Whilst acknowledging the potential benefits of a consistent LAEP approach, some (across all groups) also expressed one or more of the following reservations:

- A consistent approach should still consider and accommodate local differences.
- A consistent 'best practice' approach could be prohibitively comprehensive, with not all areas having the resource to pay for it. Some respondents said there would need to be financial support if all areas were going to follow the same approach.
- One respondent questioned whether everyone following the same approach could stifle innovation or embed errors.
- If everyone were to be made to follow the same approach, what would happen to LAEP activity that is already underway and didn't follow this approach. Would it have to be repeated? Would it be ineligible for Government support/funding?

Interviewees were asked what support would be useful in developing, implementing and refreshing LAEPs, and in particular whether they would value standardised guidance, tools or toolkits.

Often unprompted, most respondents suggested that guidance, tools and toolkits would be useful in demystifying certain aspects of LAEP and ensuring a more consistent approach.

> *"We need to define a consistent specification for a Plan — What is it? What does it look like? What should the outputs be? Over what time scale? How do you determine the area for a plan? As part of that, standardised templates would be useful."*

> *"Tool kits that can help you make the right decisions and avoid making bad decisions have to be helpful."*

4.3 Value of common methods, guidelines and templates

Section 4.2 set out market perspectives on the need for a common method, guidelines and templates in order to support production of LAEPs. LAEP involves a range of stakeholders across central and local government, industry, and other interest groups, each with their own objectives relating to commercial, regulatory, social and net zero drivers. The process is complex and has many moving parts, some of which are highly technical, others of which involve co-ordination across large geographical areas. Consistency in the production of LAEPs is therefore required to avoid inconsistent results, delayed plan development and, as far as is possible, the inevitable complexity of net zero delivery. A number of benefits and examples of developing a common approach are suggested in this section.

4.3.1 Offers consistent insight and representation from local to national

A common method applied to LAEP gives national policy makers a consistent insight on what those responsible for local policy and planning decisions are going to do, and how and when they are going to do it. This provides national policy makers robust evidence of the approach taken, helps to avoid the inefficient use of resources, and creates a more focused evidence base minimising time required for their production.

This mirrors the approach followed for the development of Local Plans, which are produced against a well-established framework of legal provision, national policy, and require adequate and proportionate evidence to support their development.[67] The preparation of plans typically follows common stages to help guide local authorities through the process; the complexity associated with gathering evidence and following these stages has also led to the creation of common methods for more contentious policy areas.

For example, Strategic Housing Market Assessments (SHMA) were found to be problematic due to the omission of pre-set housing market area boundaries and no definitive guidance on the way in which to prepare the assessments.[68] This led to local authorities objecting on how to conduct SHMA and using different assumptions and methods, creating inconsistent results and delaying the publication of local plans. As a result, a standard method was developed and is used by local authorities to make their plans and by Government[69] for assessing housing needs and to identify the number of homes being planned for. The approach benefits both Government and local planning authorities by monitoring local projections against national policy objectives and simplifying how local authorities calculate housing need respectively, leading to increased efficiency in plan-making. LAEP could benefit in a similar way; uncoordinated planning, using different assumptions, data and methods delaying development and hindering Government efforts to monitor national progress by assessing local progress.

[67] https://www.dartmoor.gov.uk/__data/assets/pdf_file/0014/330026/PAS_Evidence-for-Plan-Making_1.0.pdf

[68] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/508345/Local-plans-report-to-governement.pdf

[69] https://www.gov.uk/guidance/housing-and-economic-development-needs-assessments (this applies to England only; planning policy is a devolved matter)

Similarly, a common method ensures transparency through appropriate representation across different political, regulatory, commercial and local stakeholders, but helps to avoid the risk of closely related interest groups serving their own interests. Representation across various bodies is already a prerequisite for the preparation of local plans as part of the Town and Country Planning Regulations[70] and although this ensures all stakeholders can contribute and collaborate, the subjective nature of local plan development often requires independent examination into the 'soundness' of evidence. Adopting an independent examination or assurance process for LAEP could also ensure the method is adhered including the consultation and provision for stakeholder representation and views.

A common method will allow for a set of minimum standards and codes of practice to be developed and to enforce compliance with them, helping to avoid a scenario whereby multiple LAEPs are developed by multiple providers with varying methods, leading to uncertainty and inconsistent outputs. For example, the data gathered, analysed and used to develop LAEPs could vary in accuracy, completeness and credibility, unless a common method for recording the reliability of data is enforced.

Enforcing a common method allows central policy makers to take up a position of system stewardship, creating more capacity for monitoring and incorporating local perspectives into national net zero goals and ensuring that local supports national. The role of system stewardship does not preclude Government from setting the direction of travel through high-level policy but avoids trying to tackle local level complexities at a national level, relying instead on local system actors to find the optimal solutions that are identified from executing a common method.

Similarly, a previous Renewable and Low Carbon Energy Capacity Method was also developed by DECC in 2010[71] to help support LAs to undertake assessments of the opportunity and impact of developing regional renewable energy technologies in a consistent way. A key objective and benefit to the method was the resulting evidence base used to support regional energy strategies and Government policy. Although originally developed in 2010, there are recent examples of the method being refined and employed to support action on climate emergencies.[72]

[70] https://www.legislation.gov.uk/uksi/2012/767/made

[71] Renewable and Low-carbon Energy Capacity Method for the English Regions 2010

[72] Test Valley Renewable and Low Carbon Energy Study, 2020

4.3.2 Supports central Government co-ordination of net zero

Co-ordination of the inter-dependant relationship between vectors and networks will require better integration across Government departments and with regional hubs. A common LAEP method, coupled with guides and templates, could foster a whole Government approach to net zero.

Objectives developed by Government departments can be developed in isolation of one another, without consideration for the effect that meeting the objective has on meeting other Government objectives. For example, how would one central Government department that wanted to introduce obligations on local authorities with respect to electric vehicle charging ensure that these duties aligned with other policy areas such as low carbon housing development whilst also considering the effects on national infrastructure, without a common method that recognises and advises on how they should be dealt with?

The challenge and cost of net zero co-ordination and delivery requires adapting existing infrastructure as well as building new infrastructure. It therefore requires coordination of multiple activities, that are best managed if delivered against a consistent approach that considers individual, local, and regional needs, as well as national. Regulation 18 of the current Local Planning Regulations [73] (England) requires local authorities to notify statutory bodies of their intentions for a Local Plan before eventual submission to the Secretary of State (DLUHC). The production of a LAEP or net zero plan is of relevance to multiple Government departments and may provide benefits to them if they were notified in the same way. If such a notification to central government was paired with an unstandardised approach, the review by multiple government departments (with potentially competing objectives) is time consuming, unhelpful and ambiguous, and leads to uncertainty as to whether the plan meets all its desired objectives.

A common method that improves cross-Government understanding of the requirements of net zero and LAEP may improve decision-making and improve cross-Government communication and could form part of a systems approach to net zero. This may assist existing efforts to evaluate the progress of policy and help advance towards common policy goals (e.g., Environmental Audit Committee net zero workstream).[74] Equally, Government's new Evaluation Taskforce,[75] established to ensure robust and rigorous evaluation of policy, will benefit from a common method from which to develop evaluation criteria, and by having consistency in the plans assessed. The importance of progress and reporting to better clarify the role of local authorities in net zero delivery has also been identified by the National Audit Office.[76]

[73] Town and Country Planning (Local Planning) (England) Regulations 2012

[74] https://committees.parliament.uk/committee/62/environmental-audit-committee/news/156158/committee-to-monitor-net-zero-plans-across-government-departments-in-run-up-to-cop26/

[75] https://civilservice.blog.gov.uk/2021/08/09/dont-stagnate-evaluate-to-innovate/

[76] https://www.nao.org.uk/wp-content/uploads/2021/07/Local-government-and-net-zero-in-England-Summary.pdf

In the context of LAEP and net zero, central Government tracking and reporting on progress at the local level will be extremely challenging if based on inconsistent approaches to planning, set against criteria that are relevant only to individual departments. A common method addresses creates a clear sight of local net zero plans; and if combined with the provision of guidelines and templates would allow local authorities to report to central Government in a standardised format, simplifying the evaluation process and encouraging cross department co-ordination (see 4.3.4 for a discussion of guides and templates).

4.3.3 Supports scaling and replication

Guides and templates can also be used to measure performance of LAEP with a reduced cost and therefore reduced resources for data collection, processing and auditing through standardisation. The development of these standards has been recommended by the NAO to make it easier and quicker to report on progress.[77]

Providing guidelines and templates within a supporting framework helps with both the production of plans and monitoring of progress by setting transparent and focused requirements, whilst also helping to promote best practice and reduce the time required for auditing and revisions. Framework principles reduce the amount of monitoring resource required at a national level by outlining and enforcing pre-determined evaluation criteria e.g., potential risks and strategic priorities. Net zero monitoring processes are not currently enforced by UK Government.[78]

Guides and templates will support the delivery of LAEP best practice if designed to supplement established planning processes and technical guidance and could also encourage greater co-ordination and integration of activities between stakeholders. For example, if energy and spatial planning were conducted by two different departments in a local authority, appropriate guidance could ensure the two departments engaged each other before publication and submission plans that may otherwise have contradicted one another. Central Government currently provides development guidance for producing Local Plans in order to speed up plan adoption.

Developing templates will encourage clear and consistent data on net zero to be reported back to Government to help decision makers keep track of progress and identify issues. LAEP guides and templates should be considered as a means to implementation by addressing specific blockers to net zero e.g., limited local authority resources, lack of skills to deliver high quality and robust plans, challenge of demonstrating value for money, and clarity over responsibilities. Similar tools and processes have been used in other sectors to enforce a framework of principles matched to specific planning and development issues.

[77] https://www.nao.org.uk/wp-content/uploads/2020/12/Achieving-net-zero.pdf

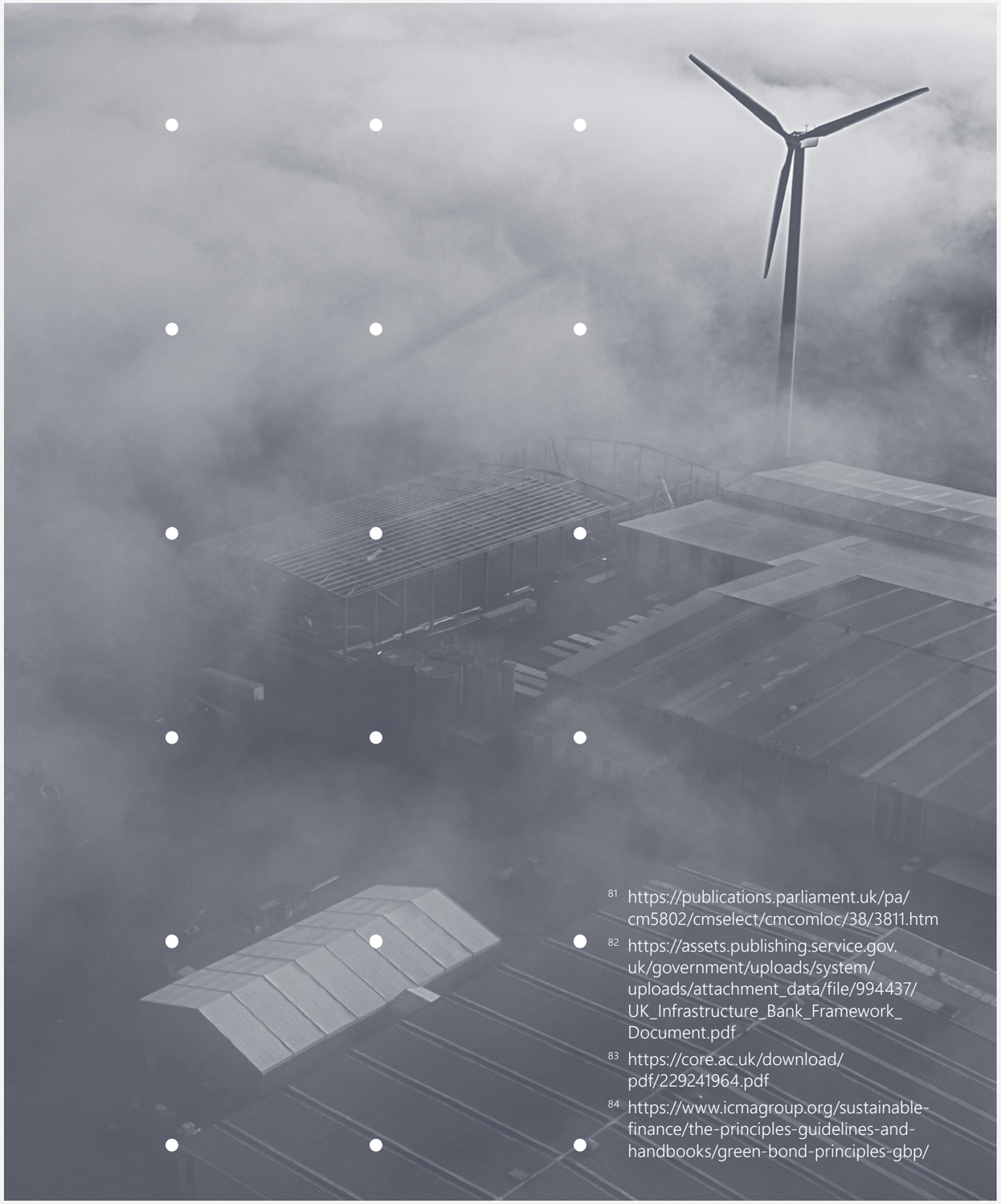
[78] https://www.nao.org.uk/wp-content/uploads/2020/12/Achieving-net-zero.pdf

4.3.4 Provides transparent evidence base for investor decision making

A common method reduces the time required by investors to evaluate, review, and audit net zero opportunities. The assessment and identification of a portfolio of projects for investment will be driven by the needs of diverse stakeholders, a common method provides the basis for a more robust evidence base for investment decision making.

It is estimated that 50% of the £40bn annual investment requirement to reach net zero remains out of reach due to the high costs of capital [79] associated with low technology maturity (e.g., low carbon heating and electric vehicle charging), coupled with a lack of effective market mechanisms and signals for attracting investment. LAEP has the potential to inform, shape and enable the signals for net zero investment, and the method with which LAEPs are conducted will underpin the evidence base for such investments. A common approach to LAEP could help to address some of the risk classifications associated with infrastructure investments (i.e., political, regulatory and technical) and increase investor confidence by demonstrating a consistent and robust basis for project identification, pricing, governance, and stakeholder buy in.

A recent report highlighted the finance and investment outlook for local authorities and net zero planning,[80] noting a need for a nationally supported planning process.



A common method may also better equip investors who are assessing projects identified by local area plans and may open opportunities to combine portfolios and explore hybrid approaches with the UK's National Infrastructure Bank and other existing infrastructure levies such as the Community Infrastructure Levy (CIL), that was valued at £7bn in 2018-19.[81] The Government's new lending facility has outlined the prioritisation of investments which support net zero and where an under supply of private capital exists.[82] A common method will help to address the considerable effort required for analysing and planning projects of this nature,[83] ensuring funds are allocated to support the Bank's key focus areas of meeting net zero emission targets and supporting regional economic growth. Over time, a common LAEP method will be something the NIB comes to recognise in applications made to it.

Similarly, aligning a LAEP method with the common framework and standards being developed to support the roll out of Green Bonds for infrastructure investment would be beneficial. The second component of the Green Bond Principles [84] encourages providers to follow a common process for project evaluation and reporting, and a common method for LAEP would allow bond issuers to compare project opportunities against each other like for like, without having to consider and factor in the variables associated with inconsistent planning methods. The Green Finance Institute has recently launched 'Local Climate Bonds', allowing local authorities to raise capital to fund decarbonisation measures. These bonds provide citizens with a low-risk fixed return investment, comparable to other government bonds, may provide a cheaper alternative to green bonds, and not require a common method to be followed.

79 https://www.pwc.co.uk/issues/real-assets/infrastructure-investment-in-net-zero.html

80 https://es.catapult.org.uk/report/enabling-smart-local-energy-systems-finance-and-investment/

81 https://publications.parliament.uk/pa/cm5802/cmselect/cmcomloc/38/3811.htm

82 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994437/UK_Infrastructure_Bank_Framework_Document.pdf

83 https://core.ac.uk/download/pdf/229241964.pdf

84 https://www.icmagroup.org/sustainable-finance/the-principles-guidelines-and-handbooks/green-bond-principles-gbp/

4.3.5 Market views on Ofgem's method

Awareness

Interviewees were asked if they were aware of Ofgem's LAEP method, and the majority reported they were aware of it. Awareness and familiarity with the method was highest amongst respondents in the local authority, DNO, GDNO and delivery consultant groups interviewed. Some respondents in these groups said that they had only looked at it briefly or hadn't looked at it in detail for a while, and some needed clarification that they were referring to the correct document. The academics interviewed and some of the respondents in the central government and national organisation groups were not aware of the method.

Views on the method

Interviewees who were aware of the method were asked for their views on it; what they thought it did well and what could be improved. They were very positive about it, commenting that it is "very comprehensive", and most interviewees described it as a "best-practice guide" or "recipe book" for LAEP. Some went on to say that they would trust the document due to the reputation of the organisations involved.

> *"It doesn't provide you with a precise method for LAEP, but it describes different ways you could go about it. There's still uncertainty of what success looks like at the end."*

Across all groups, most expressed one or more reservations about the method:

- The scale and complexity of the work required;
  - Some things within the method, particularly around the technical analysis, are felt to be beyond the technical knowledge and capacity of some of the target audience e.g. council officers, and therefore external expertise will be needed to deliver it.
  - Some local authorities have been told by consultants that to follow the method could cost £100k–£200k per local area, a sum that will be challenging to secure in budget allocations. Another local authority reported that they were using the method as completely as possible, but their budget wouldn't stretch to cover all of the requirements and guidance set out:

> *"Some corners will be shaved…. The impact is that some of the numbers that come out aren't quite as accurate as they could be if we spent more money."*

  - Concern that producing a LAEP could take too long and stall net zero activity.

> *"My take on this, and feedback from some local authorities, is that it is a very good document, a very good framework and comprehensive. But then that's also the downside — it's too comprehensive and then the LAs feel like it's difficult to build a plan that will tick all of those boxes."*

- The document doesn't set out recommended roles and responsibilities for each type of stakeholder.
- It doesn't show what the end result should look like, or what success looks like; it was felt an example of a completed LAEP, a "blueprint" for LAEP would be more useful.

Use of the method

Interviewees were either following — or certainly drawing upon — the method. Examples included:

- Some local authorities were in the process of procuring consultants to conduct LAEP activity and have recently used the method to inform their specifications.
- All of the DNOs are either using it and/or advocating for the method to be followed in LAEP work undertaken within their areas.
- One consultant said they check that the work they are doing, and the tools they have developed, aligns with the Ofgem guidance.
- The Welsh Government pilot projects are following the guidance.

The majority of interviewees were unaware of any other guidance or methods concerning LAEP or other energy planning. The only ones cited were:

- The Decentralised Energy Masterplanning manual for local authorities
- Industrial Clusters and Innovate UK work looking at local areas
- Local Heat and Energy Efficiency Strategies (LHEES) by Scottish Government.

4.4 Market views on future support for Local Area Energy Planning

Interviewees were asked what support they would find most valuable in the future to assist their LAEP activities. They suggested that they would find the following useful:

- Greater clarity — in particular from central government — on certain aspects:
  - Agreeing and promoting an agreed 'best practice' method
  - Defining the roles and responsibilities of stakeholders, and addressing accountability issues — who is overseeing LAEP activity? Who is making sure that nothing is falling through the gaps? Who is overseeing where there might be conflicts of interest? Who is doing QA to make sure that LAEP activity is robust?
  - Setting out how the development and delivery of LAEPs could and should be funded
  - Making a decision on the use of hydrogen
- Help and support for local authorities to develop LAEPs:
  - Providing or sharing examples of what LAEP "done well" looks like, and facilitating local authorities that are more advanced in the development of their LAEPs to support other local authorities that are further behind
  - Help from ESC or other consultants to better understand LAEP guidance and the Ofgem method
  - Accredited training for local authority staff to increase knowledge, skills and expertise to commission LAEP work and manage delivery of the LAEP process.
  - By supporting them to understand what types of data are required in plans and how they can be used.

A more consistent approach to data access and availability to improve understanding of where there are differences in data and outcomes, and why that might be. Some suggested that a central data repository would be valuable.

An education piece around the benefits of taking a whole systems approach, as some respondents suggest that in particular there are gaps in awareness and understanding amongst elected members.

> *"There are some hearts and minds that still need convincing, in our local politics. It's an education piece, it's about understanding the challenge and how we can fix it."*

> *"If we don't involve everybody in this to understand what is driving this and the need for this, then we're not going to get public acceptance to deliver these plans e.g. political support of elected members is hugely important."*

4.5 Avoiding the 'postcode lottery'

LAEP delivered in an uncoordinated way, without common methods and guidelines may result in the creation of a 'postcode lottery'. A postcode lottery, in this sense, is created in one (or both) of two ways:

- A local authority accesses funding to produce a LAEP; the pot of funding is limited, and other local authorities cannot produce a LAEP without it. The authority with a LAEP goes on to access further funding to deliver the interventions in the LAEP. Residents in the area without a LAEP are left behind on the route to decarbonisation.
- A LAEP is produced that identifies and proposes different technology solutions for each zone within a local area; each area having a different technology solution results in different experiences for those in each zone. Different experiences associated with differing technology solutions can mean higher energy bills, less comfort, more issues with servicing and maintenance, more disruption, and so forth.

Establishing a statutory duty on local authorities to have a LAEP, providing the associated funding to produce it and deliver the interventions is crucial to help avoid the first type of postcode lottery. This is considered in recommendation 6 in Chapter 5. The funding to do this should consider the Levelling Up agenda and incorporate the tackling of other issues that are also related to postcode, such as creating jobs and growth. The levelling up and the net zero agenda may work in unison here; identifying cost-effective decarbonisation measures in priority places within the levelling up agenda, to both tackle net zero aspirations and enabling jobs and growth.

The second type of postcode lottery should be a consideration when a common method for LAEP is developed. However, such a consideration is challenging; a fundamental feature of LAEP is that it doesn't enforce one system and technology choice on the nation that disregards local conditions. It purposefully looks to deploy the best technology mix for a zone, based upon the characteristics of the zone. Inherently this leads to different technologies being deployed in different zones and leads to differences in the lived experiences for those in each zone. If differences are therefore inherent, the challenge becomes how to minimise the effect of them. This is where policy, either local or national, may need to be introduced. There is potential to mitigate the impacts on customers with regards to their service experience or costs incurred by introducing a range of policy and regulatory mechanisms. These could include targeted mechanisms such as universal or minimum service standards, approaches to fairly recovering shared networks costs, price-cap type policies, and measures targeted to assist vulnerable groups in areas where the cost of the energy transition is disproportionately higher.

4.6 How does LAEP fit within broader planning and spatial policy?

This section identifies how LAEP could sit within the existing planning policy framework, if it was amended to support it, and provides examples of other initiatives that have been adopted into broader planning policy. This includes a recent proposal to place a duty on local authorities in Wales to produce a LAEP, that is integrated in their planning policy.

4.6.1 The National Planning Policy Framework

The National Planning Policy Framework (NPPF) sets out land use and planning policy in England. It provides a framework for producing Local Plans for housing and other developments and describes how government expects plans to be applied. It stipulates that local authorities prepare Local Plans for their area that contribute to sustainable development.

The NPPF is accompanied by guidance — Planning Practice Guidance (PPG) — which sets out what should be included in Local Plans, design and neighbourhood planning concerns and the 'Duty to Cooperate'. The PPG includes advice on climate change mitigation and advises how local plans can be used to encourage deployment of renewable and low carbon energy technologies and provide opportunities for decentralised energy and heating. The guidance encourages engagement and collaboration with local stakeholders to drive Local Plans, and to ensure characteristics of each local area are appropriately considered

LAEPs do not yet have a formal or statutory basis but could if integrated with other planning policy. The ideal scenario would be to see a much deeper and solidified integration of LAEP within planning policy across the UK. This could be a method to encourage a whole systems approach to local decarbonisation, promoting an approach to planning which could help guide local infrastructure investment. However, energy planning and spatial planning are not integrated currently, and whilst the National Planning Policy Framework allows local authorities the freedom to go beyond the national standards towards lower carbon buildings, they often face counter challenges to other objectives such as housing targets.

Rather than a fully integrated scenario whereby LAEP is incorporated in planning policy, it is more likely that LAEP would have to align with what is already contained within the current framework of the NPPF, although this is not specified at present and therefore different approaches to this exist throughout the UK. LAEPs could provide the benefit of coordinating (or mandating) responsibilities in a much more valuable and consistent way.

Planning Policy Guidance (England): renewable and low carbon energy

The Planning Policy Guidance states that "planning has an important role in the delivery of new renewable and low carbon energy infrastructure in locations where the local environmental impact is acceptable."

The document specifically relating to renewable and low carbon energy identifies how decentralised energy can provide opportunities for and encourage energy development independent of other obligations such as building regulations. It proposes the planning framework has an important contribution to make in energy through its ability to identify opportunities, for example by "getting the right land uses in the right place [which] can underpin the success of a district heating scheme," and suggesting that "planning can influence opportunities for recovering and using waste heat from industrial installations."[85]

The PPG recognises that each area has its own challenges and opportunities for mitigating carbon emissions. Information on local heat demand is used to assist developers in their strategic planning, including explicitly citing heat maps as a tool by which to identify the potential for combined heat and power and district heating and cooling. This could provide an evidential basis on which to integrate LAEP into planning policy. The role of place in decarbonisation is recognised in the UK government's current consultation (October, 2021) that proposes identifying and designating heat network zones.[86]

Scotland: National Planning Policy

Scottish planning policy is set out by the National Planning Framework 3 (NPF3) and the Scottish Planning Policy (SPP) and quantify the extent to which heating and cooling comprise total energy demand. Across these documents, there is a suggestion that the planning system could — and should — support the transformational change to a low carbon economy in line with national targets.

Heat is a considerable focus in these publications, and it makes suggestions for how planning can be used to assist delivery of decarbonised heat. The documentation explicitly posits that the planning system should help to reduce emissions and energy use in new buildings and from new infrastructure by "enabling development at appropriate locations that contributes to energy efficiency, heat recovery and sufficient energy supply and storage."[87]

The SPP is proactive in identifying the specific roles that Development Plans could play in supporting district heat network development and decentralised low carbon energy systems, stating that such Development Plans "should support the development of heat networks in as many locations as possible, even where they are initially reliant on carbon-based fuels, if there is potential to convert them to run renewable or low carbon sources of heat in the future."[88]

[85] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/225689/Planning_Practice_Guidance_for_Renewable_and_Low_Carbon_Energy.pdf

[86] https://www.gov.uk/government/consultations/proposals-for-heat-network-zoning

[87] https://www.gov.scot/publications/scottish-planning-policy/documents/

[88] https://www.gov.scot/publications/scottish-planning-policy/documents/

4.6.2 Examples of integration and alignment

Future Wales and PPW

Welsh Government has recently proposed legislative change that places a duty on local authorities to prepare LAEPs. Land use and planning for Wales is centred around the Planning Policy Wales (PPW) document, which sets out what local planning authorities must consider when preparing development plans. Earlier this year, 'Future Wales – the National Plan 2040' was published, providing a national spatial development plan setting out focus areas for Welsh planning policy over the next 20 years to address national priorities. Together, these two documents comprise the key strategic planning priorities for local authorities in Wales, with a focus on how the planning framework can play a role in responding to the climate emergency.

In addressing LAEP, the Future Wales report states that, "The Welsh Government will support regional and local energy planning to identify opportunities for all types of renewable projects LAEPs will identify the preferred combination of technological and system changes needed to the local energy system, to decarbonise heat and local transport and realise opportunities for local renewable energy production." [89]

There is an understanding in the Future Wales report that a multi vector (i.e., 'whole systems') approach can vastly benefit local areas with adoption of flexibility assets for instance, to "fully exploit the inter-relationships and synergies between the power, heat and transport sectors." [90]

Integrating existing LA powers

As highlighted by the RTPI in their report 'Place-Based Approaches to Climate Change ,' many local authorities do not have the expertise to deliver the scale of action required to address climate change. The recently released Net Zero Strategy from central Government details 'Local Climate Action', supporting decarbonisation and regeneration in local areas and communities. The RTPI also suggests that local authorities can use their existing policies and better enable cross-departmental working.

The Glasgow City Council Climate Emergency Implementation Plan is an example whereby the authority's planning and sustainability teams came together to integrate plans for managing environment health, energy, planning, housing regeneration, economy, property management and transport to ensure climate mitigation activities are delivered in a coordinated manner, maximising local outcomes.[92]

[89] https://gov.wales/future-wales-national-plan-2040

[90] https://gov.wales/future-wales-national-plan-2040

[91] https://www.rtpi.org.uk/research/2021/march/place-based-approaches-to-climate-change/

[92] https://www.glasgow.gov.uk/CHttpHandler.ashx?id=50623&p=0

Merton Rule

The Merton Rule (introduced by the London Borough of Merton) required new major developments to generate at least 10% of their energy needs from on-site renewables and to achieve energy efficiency standards higher than Building Regulations stipulated. Consequently, Merton was the first local authority to formalise the Government's renewable energy targets in a Local Plan; [93] although the rule wasn't formally mandated, Merton's planning policy explicitly demanded climate action in that area.

London Plan and Carbon Offset funds

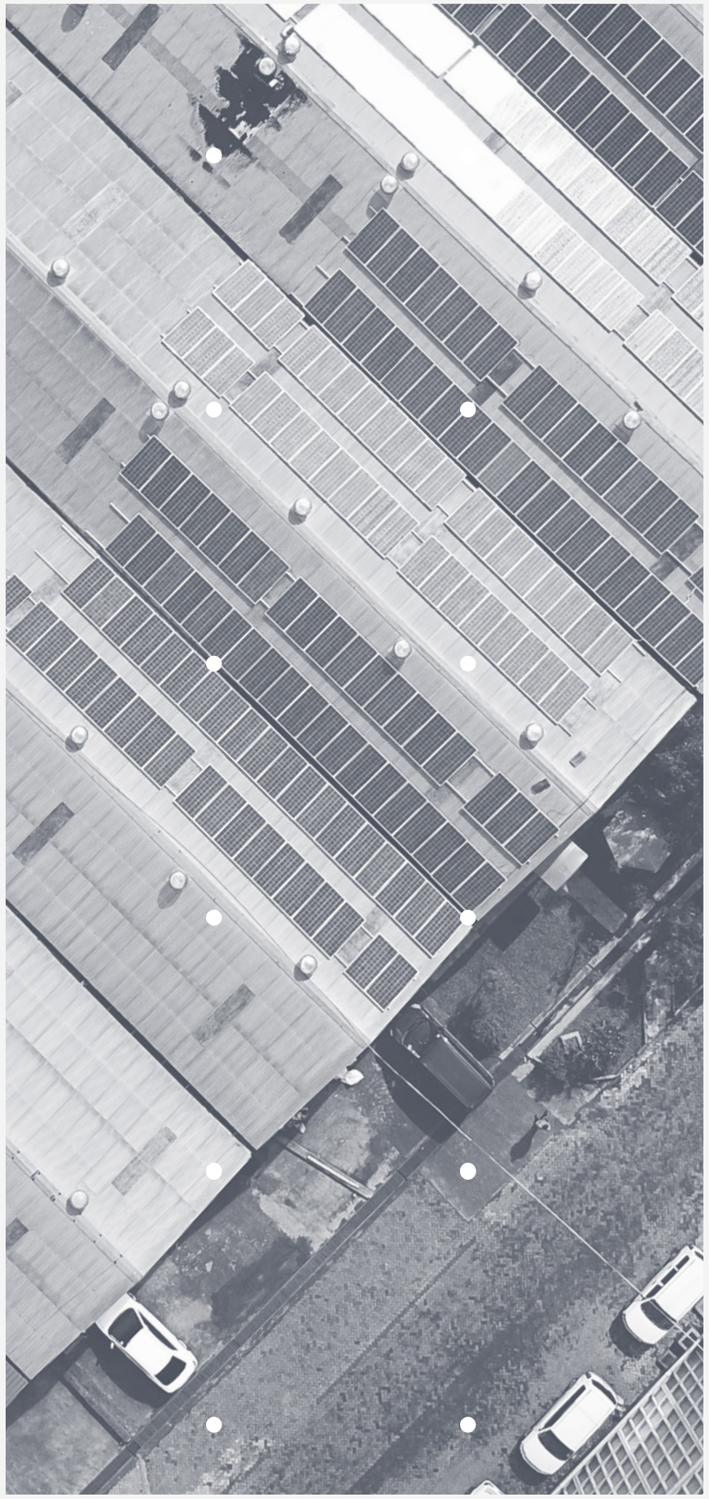
The planning system in London is centred around the Mayor's 'London Plan' which determines the requirements for new developments to assist meeting net zero targets. When on-site carbon savings are maximised by a development, any remaining shortfall in emissions reduction (against the minimum of a 35% carbon reduction beyond Building Regulations) can be offset by developers through a cash-in-lieu contribution to a local authority's carbon offset fund. These carbon offset funds can then be used as a source of funding for local authorities for low carbon infrastructure developments in their respective areas.

[93] Other local authorities subsequently did the same

4.7 Conclusion

Interviewees valued the benefits that LAEPs bring, noting they are a practical roadmap that identifies what actions need to be taken, by who, where, when and how much they will cost. They cited the benefit of robust analysis undertaken for a LAEP that is used to inform decisions and secure stakeholder agreement, and de-risk external investment. They went on to describe how LAEPs have been used to support applications for grant funding to deliver the projects that it identified, suggested that LAEP can deliver economic growth by providing signals to the supply chain, and enabled employers to invest in the training and up-skilling of their workforce who could point to delivering a pipeline of projects.

The market identified the benefits that a common method and consistent approach to LAEP can bring, particularly when it came to collection and analysis of data, modelling of pathways and scenarios and assumptions being consistently developed and applied. Further, they recognised the importance of having a consistent approach to LAEP outputs, both in terms of how they are structured and what they contain.



There is a strong need for a common method and consistent approach to LAEP, and for guidelines and templates to be developed and used to support producing a LAEP. The market identified the efficiencies that this would bring, for stakeholders who only need to become familiar with one approach, for avoiding duplication of efforts across the sector as multiple inconsistent approaches are developed simultaneously, and therefore reducing the cost of consultancy work. They also identified the benefit of being able to knit plans together from across multiple areas if all of them have followed a consistent method and approach, and the benefits that this brings in terms of preventing contradictions and discrepancies.

Interviewees requested guidance, tools and toolkits and standardised templates, to help them understand what a LAEP is, to help them ensure a consistent approach is delivered, and to help them make decisions. The need for a common method, guidelines and templates is described in Recommendation 3 in Chapter 5.

Desktop research further assessed the need for a common method and consistent approach, citing the transparency that it gives to investors to support their decision making when assessing potential investments, and the robust evidence it could provide in support of applications to funds such as NIB and CIL. Examples were provided of how a common method could facilitate providing consistent insights and information to central Government, allowing a national 'summing-up' of local action.

Further, the benefits a common method could deliver in terms of coordinating central Government objectives that sit across multiple departments, and that can be contradictory, was described. Examples of how guidance and templates could assist with reporting, both locally and nationally, were described, and links to how they could support scaling and replication were discussed.

Interviewees reported being aware of the Ofgem method but expressed reservations about the scale and complexity of it when asked about using it. They reported that the method was technically challenging, and that the skills required to deliver a plan against the method were above the capabilities of local authority officers. They highlighted concerns around costs and timescales, reporting that the complexity of the work meant it took a long time to complete, and was also therefore costly to produce. Interviewees also reported being uncertain about what they would get at the end of following the method, as it doesn't provide examples of best practice or what a plan 'done well' will look like.

Finally, the integration of LAEP with other types of planning policy such as NPPF and PPG was discussed and illustrated. An example of LAEP being integrated with planning policy is currently being enacted by the Welsh Government. This integration is linked to the two pilots of LAEP that are currently being undertaken in Newport and Conwy.

Chapter 5: What are the recommendations?

In under three decades, the UK must almost eradicate all sources of greenhouse gas emissions to meet its net zero target.

Progress in the last decade has exceeded targets, however future carbon budgets and the net zero target will require more difficult choices, some of which will be best made at the local level, and informed and delivered by local organisations. LAEP can assist local areas to meet net zero, but its success in doing so depends on how it evolves.

This chapter makes six recommendations for the future of LAEP in the UK. The recommendations seek to efficiently and effectively deliver net zero at the local level through LAEP and maximise the benefits that LAEP could deliver in the transition to net zero. These six recommendations are the result of the evidence identified and described in this report. Exactly how these recommendations are enacted will depend upon who takes responsibility for them, but they should be considered as a coherent set that are dependent upon one another. Delivery of a subset of the recommendations will leave gaps that will hinder LAEP facilitating the delivery of net zero at community, local and national level.

Recommendation 1

Endorse the definition of LAEP proposed by this report

In under three decades, the UK must almost eradicate all sources of greenhouse gas emissions to meet its net zero target. Progress in the last decade has exceeded targets, however future carbon budgets and the net zero target will require more difficult choices, some of which will be best made at the local level, and informed and delivered by local organisations. LAEP can assist local areas to meet net zero, but its success in doing so depends on how it evolves.

This chapter makes six recommendations for the future of LAEP in the UK. The recommendations seek to efficiently and effectively deliver net zero at the local level through LAEP and maximise the benefits that LAEP could deliver in the transition to net zero. These six recommendations are the result of the evidence identified and described in this report. Exactly how these recommendations are enacted will depend upon who takes responsibility for them, but they should be considered as a coherent set that are dependent upon one another. Delivery of a subset of the recommendations will leave gaps that will hinder LAEP facilitating the delivery of net zero at community, local and national level.

Local Area Energy Planning Definition

- LAEP is a data driven and whole energy system, evidence-based approach that is led by local government developed collaboratively with defined stakeholders. It sets out to identify the most effective route for the local area to contribute towards meeting the national net zero target, as well as meeting its local net zero target.
- LAEP results in a fully costed and spatial plan that identifies the change needed to the local energy system and built environment, detailing 'what, where and when and by whom'. LAEP sets out the total costs, changes in energy use and emissions, and sets these out over incremental time periods to meet the 2030 target of a 68% reduction in emissions, and the 2035 target of a 78% reduction in emissions, and net zero by 2050.
- LAEP provides the level of detail for an area that is equivalent to an outline design or master plan; additional detailed design work is required for identified projects to progress to implementation.
- LAEP defines a long-term vision for an area but should be updated approximately every 3–5 years (or when significant technological, policy or local changes occur) to ensure the long-term vision remains relevant.
- LAEP identifies near-term actions and projects, providing stakeholders with a basis for taking forward activity and prioritising investments and action.
- LAEP scope addresses electricity, heat, and gas networks, future potential for hydrogen, the built environment (industrial, domestic and commercial) its fabric and systems, flexibility, energy generation and storage, and providing energy to decarbonised transport e.g. electricity to electric vehicles and charging infrastructure.
- Actions to be addressed when developing the plan include: stakeholder engagement and a social process that considers both technical and non-technical evaluation, using robust cost inputs and standardised assumptions and data sets, multiple future scenarios/ pathways, whole system approach, spatial analysis (including zoning and data granularity), temporal analysis, network infrastructure impacts, and developing the plan through a credible and sustained approach to governance and delivery.

Recommendation 2

Endorse LAEP activity being led by local government

There is currently no clear obligation for local government to undertake a mandated form of LAEP, but consensus evidenced by this project was for locally led activity (see section 2.5.4). It was recognised that local government is impartial and provides democratic accountability to lead on the plan-making process. It is ideally placed to deliver and oversee the benefits and impact that the transition to net zero will have on their local area and that support the levelling up agenda. LAEP being led by local government presents an opportunity to align with other local government policy, such as planning, transport, environment, health, energy, climate change, housing, regeneration and economic development..

Endorsing local government to lead LAEP will need to consider:

- The deadline for an area to produce a LAEP must be soon (i.e., before 2025) if significant changes to infrastructure, the built environment and energy system are to be planned and implemented in time to contribute towards meeting net zero. The geographical scale of the area (or the political boundaries) a LAEP is produced at determines how many LAEPs need to be produced across the UK; the ability of the supply chain to deliver plans affects how soon all areas can have a plan, and when this is achievable by.
- A plan that covers an area too small may not gain the interest of key actors, such as network operators and investors, both in supporting the plan-making process and delivering the actions. Conversely, an area too large may not be able to sufficiently consider factors that make LAEP unique.

Based on these considerations, it is recommended that the geographical scale at which LAEP is undertaken, and the organisation that leads LEAP for each area, is identified. This identification should include collaboration with regional stakeholders, to ensure that a LAEP best reflects existing local preferences, working arrangements and capacity to lead/resource. Smaller or sparsely populated areas may need to work together to combine resources for a LAEP and recognising that larger areas have historically produced better, more detailed plans (see section 3.2).

Recommendation 5 suggests a proposed governance arrangement that can support identification of a leading organisation for an area, and support coordination where areas work collaboratively.

Recommendation 3

Develop a method, guidelines and templates to assist in the coherent production of plans and establish roles and responsibilities

The market interviewees identified a clear need for a common LAEP method, guidelines and templates (see section 4.2). Without them, local authorities do not know what they are producing, how they should do it, and what they should include. A method, with accompanying guidelines and templates will enable production of LAEPs in a standardised and consistent way. If all future plans are produced following common standards, outputs across multiple plans and areas are comparable and summable, allowing for easy reporting and assessment by both investors, central Government, innovators and other key stakeholders.

The assessment and base lining of energy planning activities in this report highlighted significant variety in scope, objectives and outcomes (see section 3.1). The benefits of following a common method were detailed through examples in section 4.3.

As with Recommendation 1, developing the method should be a collaborative effort that involves the appropriate government departments (such as HM Treasury, BEIS, and DLUHC), representatives of local government (such as LGA), industry (Ofgem, ENA, energy network operators, delivery organisations and investors) as well as other interested bodies that have experience in this area (such as Innovate UK, ESC, CSE) and others drawn from the community of relevant stakeholders.

The process of developing a common method, with accompanying guidance and templates, needs to be carefully considered; on one hand, an end-to-end process is required, that holds the hand of the plan producer all the way through, and adheres them to meeting pre-determined and specific aims. However, this should be balanced with giving enough scope for innovation to improve the process, tools and plan outputs, and to recognise that each area is different. The emphasis here is on recognising that a method, however prescriptive, needs to cover the end-to-end process, and clearly set out scope, objectives, roles and responsibilities. It also needs to provide guidance on how to integrate existing energy planning work to prevent authorities starting again. A method, guidelines, and templates will also support resource constrained local authorities (as identified in section 3.3), by creating a more efficient, measurable process with a clear view on what outputs should look like.

The method should also identify the required stakeholders and their roles and responsibilities, detailing when and how each stakeholder should be involved in the process of planning. Development of the method should also draw on best practise identified from overseas approaches as noted in the report (3.5.4).

Recommendation 4

Provide innovation funding to drive LAEP tool development

The assessment of available models and tools identified that no single tool is both publicly available and sufficiently developed to produce all aspects of a LAEP, without significant computing power and user training (see section 3.4). This recommendation addresses this gap and is heavily linked with Recommendation 3; any model or tool used for LAEP must be able to meet the requirements of the method.

The proposed method (Recommendation 3) will provide a common standard to which a LAEP should be produced; an opportunity therefore exists to align development of models or tools to produce LAEP simulations and outputs that also meet the requirements of the method. Innovation funding could be provided to support development, with organisations considering how to best utilise, manipulate and assess data, visualise outputs and identify project and investment opportunities (building on aspects of the Modernising Energy Data programme).[94] Over time it is expected that further innovation of tools will improve efficiency and outcomes of the plan making process, increase efficiency and accessibility.

Funding may involve the appropriate government departments (such as HM Treasury, BEIS, and DLUHC), representatives of local government (such as LGA), industry (Ofgem, ENA, National Grid) as well as other interested bodies that have experience in this area (such as Innovate UK, ESC, CSE, Regen).

[94] https://www.gov.uk/government/groups/modernising-energy-data

Recommendation 5

Establish a governance arrangement with key national stakeholders. Appoint a technical assistance facility to oversee the rollout of consistent LAEPs that supports net zero and the levelling up agenda

This report has established a requirement for a clear governance arrangement to oversee and steer the delivery of LAEP.[95] Also required is an organisation to oversee the implementation of LAEP across the UK to develop the aforementioned methods. Outline responsibilities for the two entities:

Governance Arrangement

- Key national stakeholders (for example, central government, Ofgem and devolved government) should form a national governance arrangement
- Responsibility to steer and support the national and local transition to net zero, ensuring value for money (in investment directed at the energy system and net zero)
- Overseeing LAEP guidance so that it aligns with national energy planning objectives and policy
- Encouraging regional coordination and participation of stakeholders such as the energy network operators
- Ensuring an equitable distribution of activity and support and maximisation of investment opportunities identified in LAEPs in order to support the levelling up agenda.

[95] A comparison is with the Building Research Establishment (BRE), who looks after non-domestic (BREEAM) and domestic (SAP) building standards and assessment, provide software, training and support.

Technical Assistance Facility

- Appointed on behalf of the governance arrangement to act as an agency to oversee the technical delivery of LAEP
- Develops and upholds method, guidance and templates for the delivery of consistent, whole energy system based, LAEP; providing clarity and structure to the local areas who are carrying out a wide range of uncoordinated energy and net zero based activity
- Conducts quality assurance of LAEP outputs and process ensuring they meet the method
- Supports the specification of models and tools for LAEP
- Provides support to local government overseeing the delivery of LAEPs (e.g. in a technical advisor role) helping to alleviate some of the capability issues through guidance and advice
- Provides training and support so that there is suitably qualified resource to produce LAEPs; aiding capacity building where required
- Ensuring the method is adhered to so that the LAEPs can be "stitched" together to ensure alignment and reconciliation with the national plan
- Working with central government to bridge the local to national net zero planning and actions.

This recommendation aligns with those made by UK100[96] for a Net Zero Delivery Board and Net Zero Delivery Unit, and BEIS's Net Zero Strategy that proposes establishing a Local Net Zero Forum.[97] Further, several reports have highlighted the uncertain role that local authorities have in achieving net zero, and a technical assistance facility would provide a clarity.[98]

The lifetime of the facility is long-term; to remain relevant, LAEPs need to be refreshed periodically, and so the role for the facility will continue to at least 2050. Further, the facility should recognise that timelines for producing and refreshing LAEPs may need to align with other activities (e.g., annual public sector budgets, election cycles, Ofgem price control periods).

The role of Energy Hubs should be considered when creating or appointing the technical assistance facility. Energy hubs may be well placed to work with the technical assistance facility, co-ordinating activity at a regional/multi-county level, and could support planning activity, provide technical guidance and assist in the delivery of interventions identified in a plan. Although as described here the focus is the facility assisting in the delivery of LAEPs, the remit of such a facility will be broader and encompass other elements of local net zero delivery and actions.

[96] Research into a National-Local Net Zero Delivery Framework, UK100, October 2021

[97] Net Zero Strategy: Build Back Greener, HM Government, October 2021

[98] See: NAO (July 2021) https://www.nao.org.uk/report/local-government-and-net-zero-in-england/ and https://www.theccc.org.uk/publication/local-authorities-and-the-sixth-carbon-budget/ and https://www.regen.co.uk/publications/local-energy-leadership-to-transform-our-energy-system/

Recommendation 6

Prioritise resource to produce LAEPs and develop a Net Zero Delivery Framework to enable local energy transition activity

Market interviews identified that funding production of LAEPs was a challenge (see section 3.3.3) and further that funding delivery of the actions identified by a LAEP was also a challenge (see section 3.6). Local authorities do not typically have resources — people and money — to undertake producing LAEPs and delivering the actions that they identify. Grant funding often used to fund decarbonisation, such as the PSDS, typically requires fast applications and rapid deployment of measures, rewarding those who can mobilise resources and projects quickly, and not rewarding those who take a more strategic, long-term approach.

In the short-term, local areas and other key stakeholders should prioritise production of LAEPs, reallocating resources assigned to other energy planning approaches and energy, climate change and net zero activity where appropriate and possible. Local government organisations should work with other stakeholders, such as devolved government, combined authorities, LEPs, local energy hubs, and energy network operators to identify opportunities to fund production of LAEPs.

Moving forward a more structured funding mechanism could be developed that provides dedicated funding for the ongoing production and upkeep of LAEPs, with the proposed governance arrangement and technical assistance facility overseeing its development and implementation. Such a model would help avoid the postcode lottery of energy planning and action, preventing areas from being left behind.

A blended funding mechanism could be established that secures funding from, for example, energy network innovation funding, local area match funding, UK innovation funding and central/devolved governments. Funding each local authority in the region of £100-200k to produce a plan may require a total budget of £40-80m; a small proportion of the £50 billion that the CCC is estimating [99] the UK needs to invest each year to get to net zero; this cost should be compared to other statutory obligations that authorities undertake, and the benefit that meeting those statutory obligations creates.

A more structured funding mechanism for producing LAEPs can be integrated with a wider framework that has the objective of facilitating and supporting local energy transition implementation, projects and activities identified in LAEPs. A LAEP can identify many £billions of investments in the energy system per local area over the coming decades. The framework should consider how best to raise project investment by considering the role of different actors, the local area, the region and public and private finance; it should work with respective organisations, including the UK Infrastructure Bank and government units that support energy and net zero deployment (e.g., in local energy and heat networks), to determine the optimum way to support, package and structure delivery. The framework should also consider the appropriate scale of investments and look to combine projects and investment packages across multiple LAEP areas within a region if necessary. Such a framework should also look to consider other enabling action required to ensure the delivery of LAEP actions such as capacity and skills within the supply chain.

Funding may involve the appropriate government departments (such as HM Treasury, BEIS, and DLUHC, devolved governments), representatives of local government (such as LGA), industry (Ofgem, ENA, National Grid) as well as other interested bodies that have experience in this area (such as Innovate UK, ESC, CSE, Regen).

[99] https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf

Appendix 1: History of LAEP and stakeholder interviews method

History of LAEP

ESC work on LAEP originated from the Energy Technologies Institute's (ETI) Smart Systems and Heat (SSH1) programme (2014-2017). As delivery partner to the SSH programme, Energy Systems Catapult, through extensive sector engagement, developed the initial concept of LAEP, alongside a whole energy system-based optimisation tool, EnergyPath Networks (EPN). SSH piloted LAEP in three areas; Bury, Bridgend, and Newcastle. The key principles governing the LAEP approach were:

- A data driven and evidence-based approach that understands local options to decarbonise; explores credible options and pathways out to 2050, to identify an agreed, cost-effective plan to decarbonise a local area
- Based on a technology agnostic, whole energy system approach, that considers electricity, heat, the gas network, hydrogen, the built environment (including fabric and systems), generation, storage, energy networks and the electrification of transport.
- Whole energy system meaning that all combinations of options are considered as a whole, including their interaction and impact across the system, to identify and fit-together the best combination of options, to decarbonise an area for best value
- Incorporating a detailed representation of a local area and its energy system, considering an area as a number of zones, resulting in a spatial plan (similar to a 'master plan'), setting out total cost, energy and emissions (broken down into components), that identifies the 'what, where and when' to decarbonise the local area, identifies near-term priorities, actions and activities and sets out a long-term vision
- Based on a collaborative process of structured engagement, that is local government led, working with key local stakeholders, including energy network operators
- Focusing on a local area, that considers existing local government structures and where the scale is sufficiently small to be regarded as local, but large enough to warrant interest from key stakeholders.

Since 2018, ESC has worked with the wider sector to advocate the need for LAEP, continuing to develop the concept, producing insights, recommendations and guidance. In December 2018, ESC published Local Area Energy Planning: Supporting clean growth and low carbon transition.[100]

Stakeholder interviews method

Energy Systems Catapult (ESC) identified six groups of stakeholders for inclusion in interviews. These groups are known to have an interest and active role in LAEP. The six groups are:

- Local authorities, LEPs, Energy Hubs
- Electricity Distribution Network Operators (DNO)
- Gas Distribution Network Operators (GDNO)
- Delivery consultants
- Central government departments and national organisations
- Academics.

[100] https://es.catapult.org.uk/reports/local-area-energy-planning/

ESC compiled a database of organisations and contacts against each stakeholder group, comprised of individuals ESC had liaised with regarding LAEP in the past. All contacts were sent an email from ESC explaining the purpose of the work and encouraging participation. Some recipients responded proactively to arrange a mutually convenient time for the interview; others were recruited via a follow up contact. In general, the contacts within the database were keen to participate in the interviews. Interviewee recruitment was guided by meeting approximate quotas for each stakeholder group. The details of the stakeholder database, quotas, and number of interviews achieved per group is summarised in Table 9.

The majority of the interviews were conducted via Teams, with two conducted by telephone (the respondents specifically requested this). The majority of interviews were around 60 minutes in length. If an interviewee had limited time, the discussion focused on priority questions, and aimed to finish within 30–40 minutes.

Interviews were semi-structured and took a solely qualitative approach. A topic guide for each stakeholder group was developed, comprising key headline areas and questions, and follow-up prompts. Each topic guide followed a similar structure and covered the same topics, but questions were tailored to each stakeholder group. The interviewees held varying positions in their organisations. Table 10 summarises the roles and responsibilities of interviewees from each stakeholder group.

Table 9: Details of stakeholder groups and interviews targeted and achieved

Categorisation	Number of organisations in database	Target number of interviews	Number of interviews conducted
Local authorities, LEPs and Energy Hubs	26	14–16	15
Electricity Distribution Network Operators	6	2–3 (minimum)	5
Gas Distribution Network Operators	5	2–3 (minimum)	3
Delivery consultants	14	6–7	4
Central Government departments and national organisations	17	4–5	10
Academics	13	3–4	3
Total	**81**	**40**	**40**

Terminology

When discussing findings that resulted from interviews, specific terms are used to indicate the prevalence of views, as opposed to reporting precise numbers or proportions (see Table 11).

These terms, proportions and numbers are used for both reporting on the whole sample (n = 40), or proportions and numbers in each interviewee group.

Table 10: Roles and responsibilities of interviewees

Stakeholder group	Type of respondent (e.g. typical job role)
Local authorities, LEPs and Energy Hubs	Typically, a specialist from within the energy/sustainability team, e.g. head of low carbon, climate change manager, decarbonisation programme manager
Electricity Distribution Network Operators	Various; including leading the DNOs business planning, leading on the network strategy, project management, technical analysis, stakeholder engagement and policy development
Gas Distribution Network Operators	Various; including managing the control centre, developing the policy regulatory market frameworks for net zero, and stakeholder engagement
Delivery consultants	Respondents were typically involved in helping organisations with the technical analysis needed for LAEPs; some have developed their own tools and models
Central Government departments and national organisations	Respondents were involved in strategy and policy development relating to energy, or associated areas related to LAEP. Some are involved in activities to support local authorities reach net zero
Academics	Involved in research directly or indirectly associated with energy planning. Some provide consultancy to organisations, particularly technical analysis, and some have developed their own tools and models that could be used as part of the LAEP process

Table 11: Terminology used when describing findings that resulted from stakeholder interviews

Term used in the report	Approximate proportion/number of respondents
Most/The majority	Over 50%
Some	50% or fewer
A few/Small number	3–5 respondents
A couple	Two respondents
One	One respondent

Appendix 2: Baselining energy planning activity: method

The first task of the desktop study was to create a database to keep records of the evidence that was found. The purpose of the database was to primarily keep administrative reference details of any energy plan identified, but also to record details of high-level assessments of the plans. This baseline database serves as a snapshot of energy planning as of summer 2021 but can of course be maintained and updated.

The database had the following field headings. Two field headings are in italics; for these, the researcher was required to make a high-level assessment of the plan, whereas for the other fields the researcher was simply required to find and copy administrative details.

- ID
- Type (Programme or Project)
- Name of plan
- Geographical area covered
- Categorisation, either:
  - LAEP
  - Regional or Local Energy Strategy
    Climate Action Plan
    Climate Emergency Declaration
    Energy Masterplan
    Net Zero Masterplan
  - Local Authority plan to decarbonise its own estate
  - Projects (without a plan)
  - Other (e.g. background or evidence papers, technical papers, studies)
- Level of detail
  - Detailed
  - High-level
  - Very high-level
- Name of product or tool used
- Years plan covers
- Method plan follows
- Local authority type
  - Combined authority
  - County council
  - District council
  - Metropolitan borough
  - London borough
  - Unitary authority
- Name of lead client (if different from local authority)
- Name of lead consultant
- Name(s) of other delivery partners and stakeholders
- Date published
- Link to source
- OS area code.

To identify evidence of energy planning, the method followed these steps:

- Access local authority website
- Search for specific terms, including:
  - energy
  - net zero
  - carbon neutral
  - climate
  - sustainability
  - environment
- If the local authority website returned no results, Google was used to search for the same terms alongside the name of the local authority
- View the webpages, documents, and any other relevant resources that appeared in the search results
- Copy administrative reference details of relevant plans into database
- Make high-level assessments of the plans identified

All councils in England, Wales, Scotland and Northern Ireland were included in the systematic searching. Also included were all Local Enterprise Partnerships.

The copying of administrative reference details into the reference guide was a straightforward task, with the only difficulty faced being the lack of publicly available information to complete all database fields for all plans. Where blanks do exist for administrative data, it is uncertain as to why they exist without further research. For example, for some plans the name of the lead consultant is not available; it is uncertain as to whether this is because a consultant was not used, or whether their details are simply omitted from the publication of the plan.

The making of high-level assessments of the plan was undertaken by a single researcher to maintain a consistent approach to all plans. Their approach to making assessments was to assess the title, contents page and executive summary of a plan, assess any graphs, tables or maps, and to search for specific terms within the plan. In some instances, the production of the plan was underway and so the final plan is not what has been assessed, but other documents and sources that describe what the plan will include was instead assessed. Search terms included:

- Cost or '£'
- Electricity, heat, gas, transport
- Network operator
- Whole systems
- Stakeholder
- Carbon emissions, carbon budget.

Plans were categorised as LAEP if they covered a politically defined geographical area, took a whole systems approach that considered and included all sectors, energy vectors and stakeholders, and considered the effects of the plan on the network operators.

The plan needed to provide outputs that included where technologies were best deployed, immediate 'no regret' options, costs, and change over time to meet carbon budgets. These criteria are drawn from the Ofgem LAEP 'done well' criteria; all of the Ofgem 'done well' criteria need to be met for the plan to be categorised as a LAEP.[101]

In instances whereby one or more criteria are not met, the plan is categorised as the next category down. This category contained various types of plans, that are referred to as being regional or local energy plans or strategies, climate action plans or emergency declarations, energy or net zero masterplans. These plans often covered a politically defined geographical area but didn't take a whole systems approach that included all of the sectors and energy vectors, or omitted consideration of the effect of the plan on the networks. Outputs produced in these types of plans were often not as detailed as they are in a LAEP; costs are aggregated or not estimated, technology deployment is not considered spatially, and change over time to meet budgets is not always considered. This is not to criticise these plans; they will have met the criteria that were defined at the outset of making the plans, and those intentions were likely not to produce a LAEP.

Outside of these two primary categories, a number of local authorities and LEPs had made other types of progress with regards to energy planning. Some had made plans to decarbonise their own estate of buildings and fleet of vehicles, some had produced or commissioned background or evidence papers, or technical papers and studies, that provided an assessment of the issues needed to be considered, whereas others had set about undertaking individual projects.

[101] The criteria align with the nine criteria described in Appendix

Appendix 3
Assessing UK plans: method

To assess these plans, nine criteria were developed. These nine criteria were informed by the criteria in the Ofgem method for LAEP 'done well'. The nine criteria, and a description of what the researcher looked during their assessment is shown in Table 12.

Against each of the criteria, the researcher entered a 'score' from 0–2 depending upon their assessment of a plan (see Table 13). Where it was not possible to score the plan against a criterion, the researcher made a note as to whether this was because the criterion was not applicable to the plan, or because there was insufficient evidence to score the plan against the criterion. Again, to ensure consistency, a single researcher assessed all of the plans., and their work was checked. The scoring descriptions are bespoke for each criterion, however they can broadly be summarised in Table 13.

In addition to scoring the plans against the nine criteria, the researcher made a note of any particularly distinguishing features of each plan, comments to explain the scores, or note the progress of production of the plan (as some plans were in the progress of being developed, and scores reflect the evidence available at the time of assessment). Scores are summed, with a maximum score of 18 points available.

Table 12: Assessment criteria and their descriptions

Criterion	Description
Whole systems	Can the plan be considered a 'whole systems' plan? For this it would need to cover all relevant energy vectors and both generation and consumption, include network impacts and upgrade costs, and identify cost optimised scenarios.
Stakeholder	Does the plan incorporate a wide range of stakeholder views in a way that empowers local authorities to deliver decarbonisation?
Energy vectors	Does the plan cover decarbonisation of relevant energy vectors, such as electricity, gas, heat, and transport systems? (some energy vectors may not be present in an area - i.e., off gas grid areas, or those without heat networks)
Networks	Does the plan consider how its implementation will impact relevant energy networks and the interactions between them, such as electricity, gas, and heat networks? (again, some networks may not be present, but this should be explicitly mentioned)
Spatial analysis	Does the plan identify which technologies should be deployed in which zones (or sub-areas) in the area? (this may include technologies that use energy and those that produce energy)
Change over time	Does the plan set carbon budgets which reduce over time? (these should start immediately, and cover the period until net zero is reached)
Costs	Does the plan include detailed costings? (these costings should include the impact of the plan on capital expenditure and resulting impact on energy bills)
Outputs	Does the plan identify more than one scenario or pathway that would allow the authority to reach net zero, depending on how it prioritised actions? (i.e. competing pathways may include or omit hydrogen depending on national progress; or suggest deep fast emissions reductions, or slow steady emissions reductions)
Impacts	Has the plan led to actions being taken to decarbonise the local area? (projects and policies may be identified in the plan, or may have been identified subsequently and be detailed on other webpages)

Table 13: Scoring criteria

The plan meets all elements of the criterion	The plan meets some elements of the criterion	The plan does not meet any elements of the criterion
2	1	0

Appendix 4
Assessing overseas plans: method

The overseas plans were collected in the same database as for the baselining of UK activity task. Searching for plans included looking at several groups, including:

- C40 Cities
- Carbon Neutral Cities Alliance (CNCA)
- National Laboratory for Renewable Energy (NREL)
- State of Green and many others.

To complement the plans found from these sources, internet searches were also used. Contact was also made with science and innovation staff in embassies to ask them for local knowledge. Previous ESC work was also reviewed. Although plans were looked at from every continent and from countries where English is not a first language, the majority were from cities in northern Europe and North America.

Plans were selected for review if they met all of the following criteria:

- needed to be for an entire jurisdiction. Several plans were discarded from the review as they focussed on regeneration of a particular area of a city, or on a brownfield site for example.
- needed to make plans for existing cities, rather design new cities. Several plans were discarded from the review, particularly in developing nations, that designed new 'eco' cities or towns.
- plans needed to be either a LAEP, a climate action plan, energy masterplan, a local decarbonisation strategy, or similar.

Plans that were viewed as being sufficiently detailed were also assessed against the nine criteria in the assessment database. A total of 24 plans were assessed and are included in the baselining database. Of these, 15 were assessed against the same nine criteria as UK plans. Details of these 15 plans is shown in Table 14.

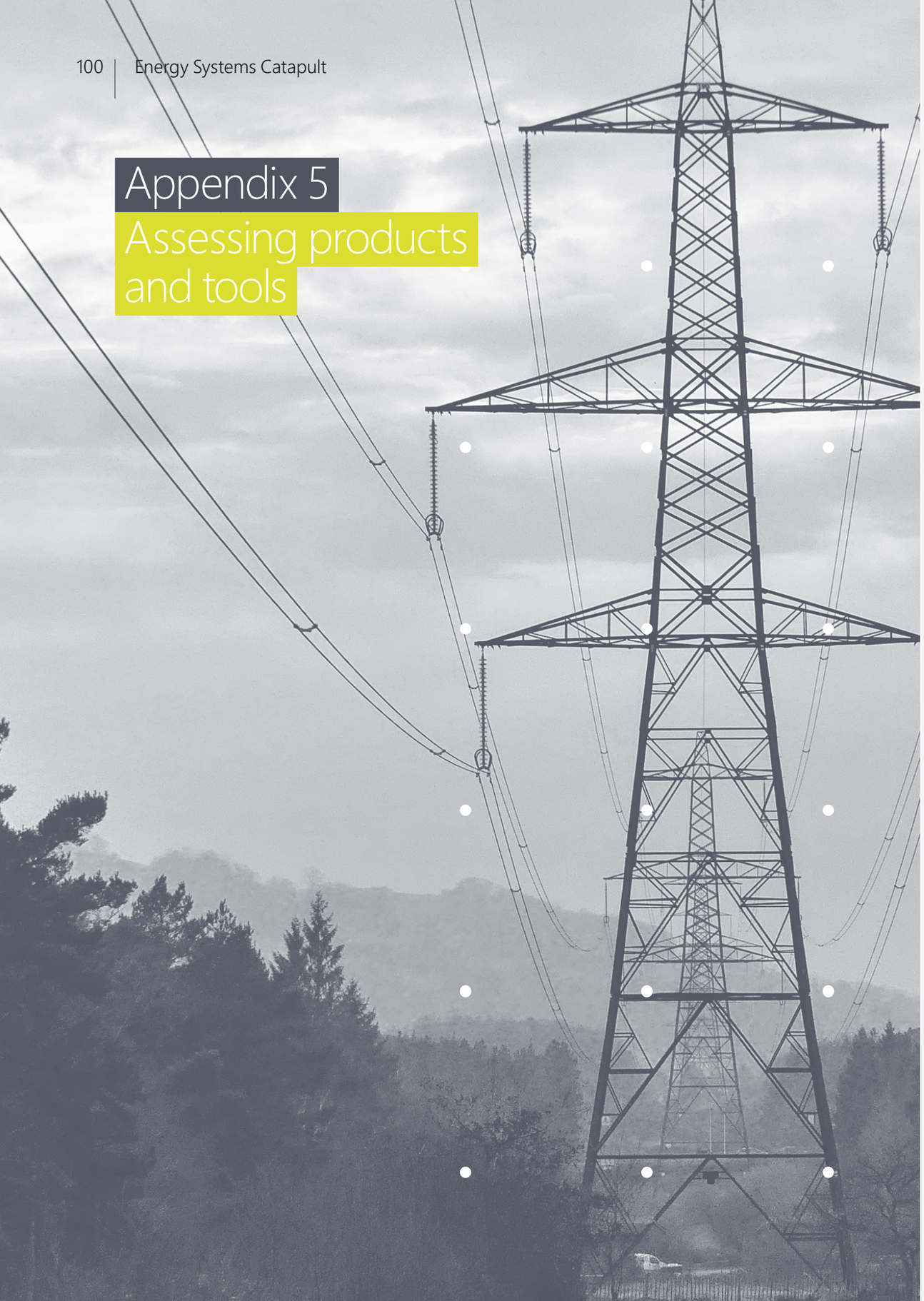
Table 15 shows the result of the assessment of overseas plans against the nine criteria. Green indicates meeting all elements of a criterion (score 2), with orange indicating some elements of a criterion were not met (score 1), and red indicating all elements of a criterion were not met (score 0). Purple indicates the criterion is not applicable / or an assessment against it was impossible. Fewer than half the plans included consideration of network impacts or include spatial analysis; around two-thirds of them included consideration of costs, and whole systems analysis. Most considered change over time, outputs, impact, included stakeholder engagement, and almost all considered all energy vectors.

Table 14: Details of 15 overseas plans that were assessed

ID	Name of plan	Location
1017	The Rotterdam Energy Approach & Planning	Rotterdam
1019	The Carbon-neutral Helsinki 2035 Action Plan	Helsinki
1020	Climate and Energy Strategy for Oslo	Oslo
1021	Hoja de ruta hacia la neutralidad climática en 2050 (Madrid)	Madrid
1023	CPH 2025 Climate Plan : Roadmap 2017-2020	Copenhagen
1024	1.5°C: Aligning New York City with the Paris Climate Agreement/ New York City's Roadmap to 80 x 50	New York
1026	Energy Evolution: Ottawa's Community Energy Transition Strategy	Ottawa
1028	City of Victoria Climate Leadership Plan	Victoria
1029	City of Vancouver Climate Emergency Action Plan	Vancouver
1030	Clean Energy DC: The District of Columbia Climate and Energy Action Plan	Columbia
1031	Powering Our Future: A Clean Energy Vision for Philadelphia	Philadelphia
1033	LA100: The Los Angeles 100% Renewable Energy Study	Los Angeles
1035	Climate Smart San Jose: A People-Centred Plan for a Low-Carbon City	San Jose
1036	Cleveland's Clean and Equitable Energy Future	Cleveland
1037	Auckland's Energy Resilience and Low Carbon Action Plan	Auckland

Table 15: Assessment of overseas plans

ID	Whole Systems	Stake-holders	Energy Vectors	Networks	Spatial analysis	Change over time	Costs	Outputs	Impact
1017									
1019									
1020									
1021									
1023									
1024									
1026									
1028									
1029									
1030									
1031									
1033									
1035									
1036									
1037									



Appendix 5
Assessing products and tools

The following criteria were considered for each tool:

Criteria	Description
Owning Organisation	The main organisation identified as responsible for the tool
Link	A weblink to the main source of information on the tool
Description	A brief description of the tool and its purpose. In many cases this has been provided previously by the tool owner
Model availability	How available the model or tool is for third party use, including consideration of access to the tool, any underlying source code and any licence restrictions
Documentation availability	To what extent documentation of the model is available publicly, considering both documentation for use and any further that explains modelling assumptions, underlying calculations and similar
Transparency of input data	How available the input data is for external scrutiny
Model Version	Has the model been released as a production version, or is it still in development? Is it receiving regular updates?
Target user	An indication of the level of modelling expertise required to use the tool. It is expected that all the tools will need a degree of energy knowledge to correctly setup and interpret results, but this considers whether it needs to be operated by someone with modelling expertise (which is more likely to be someone external to a local authority)
Type of model	A high level view of the type of analysis that the tool undertakes e.g. optimisation, scenario testing, simulation modelling
Spatial scope of modelling	What is the spatial scale the model is designed for e.g. national, regional, city, building
Energy System scope	What elements of the energy system are in scope for the tool
Level of detail	The level of energy system detail available in the tool, for example network components or individual buildings
Consideration of time	How time is represented in the tool, does it just present a start and end point or does it show change over intermediate time periods
Representation of uncertainty	To what extent future uncertainty can be represented in the tool, either with built in approaches such as Monte Carlo or the ability to modify input data
Potential to integrate with other tools	Opportunities to couple to other models, if the tool is not used for the complete LAEP process could it pass data to or receive data from other tools covering other elements
Existing quality assurance, validation and verification	The extent to which the tool has been tested or validated against other data, or been subject to an external review

Stakeholder Interactive City Energy Demand Simulator (SiCEDS)	
Owner(s)	• University College London and Energy Saving Trust
Link	• energysavingtrust.org.uk/sites/default/files/reports/Siceds-Information-Package-052017.pdf • gtr.ukri.org/projects?ref=972198 • eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/4-mobility-transport-and-smart-and-sustainable-cities/developing-a-city-energy-modelling-tool-and-approach/
Description	• An online scenario modelling tool that allows users to understand the impacts of policy scenarios across demand, local generation, emissions, air pollution and health, costs, fuel poverty, electricity demand • It uses Home Analytics data as well as other data as inputs to represent; energy efficiency of buildings, heat sources, district heating penetration, local renewable generation, new build volumes and efficiency and transport technology and mode
Model availability	• Medium — Not freely available but may be available in a commercial arrangement on request from the Energy Savings Trust
Documentation availability	• Low — Basic information about model inputs and outputs available
Transparency of input data	• Not published. Without model access it is not clear how transparent it is to a user of the tool, but users are able to setup scenarios by changing inputs, so their must be some visibility
Model Version	• Production used for live projects. Cannot find evidence of tool updates later than 2017
Target user	• Target user described as a 'city stakeholder', so not expected to be a modelling expert. Tool interaction is through a web interface
Type of model	• 'What if' scenario modelling
Spatial scope of modelling	• Dwelling level data, MSOA for non-domestic data, city wide for transport
Energy System scope	• Domestic and non-domestic (non-domestic is mainly service sector buildings), district heat, renewables, transport
Level of detail	• The outputs can be visualised at Medium Super Output Area (MSOA), Lower Super Output Area (LSOA) and 1km grid square resolution
Consideration of time	• Unclear, but provides 'time series' visualisations
Representation of uncertainty	• Inputs can be varied to represent different scenarios
Potential to integrate with other tools	• Unclear
Existing quality assurance, validation and verification	• Worked with Birmingham and Exeter City authorities as lead cities and followed a feasibility study to ensure stakeholder needs were met

Pathfinder	
Owner(s)	• Wales and West Utilities
Link	• wwutilities.co.uk/about-us/our-company/publications/the-future-of-energy-research/ • wwutilities.co.uk/media/3857/2050-energy-pathfinder-an-integrated-energy-system-simulator.pdf
Description	• The 2050 Energy Pathfinder has been built to assess how different future energy mixes would work in practice . It is a simulation tool which runs hourly throughout the year to model the carbon emissions, cost to customers, reliability impact due to energy imbalances, annual cumulative imbalance and interconnection requirements associated with a scenario • The input data includes data on supply sources, demand, scalability, flexibility services, storage and costs. The tool is able to analyse at house, town, county or country level and considers heat, power and transport
Model availability	• Medium — Available to some organisations on request from WWU. Expected licence terms not published
Documentation availability	• Medium — some information on model structure and types of inputs and outputs available
Transparency of input data	• Not published but understood to be transparent to model users through spreadsheet interface
Model Version	• Production
Target user	• Local stakeholders capable of using a relatively complex spreadsheet
Type of model	• What-if scenario modelling
Spatial scope of modelling	• Up to country level
Energy System scope	• Power, heat and transport. Gas, electricity and storage
Level of detail	• From house level upwards, if data is available. Not believed to be explicitly spatial
Consideration of time	• Simulated hourly intervals across a year for model operation. Unclear from published information how it interacts with planning timescales i.e. change year on year
Representation of uncertainty	• Believed to be possible through the parameterisation of different scenarios
Potential to integrate with other tools	• Unknown, but use of spreadsheet format suggests would be relatively straightforward to integrate inputs or outputs with other tools
Existing quality assurance, validation and verification	• The balancing approach and algorithms were put together by WWU. Delta-EE validated the model and default parameters and provided feedback for improvement • Progressive Energy performed some validation as part of the Green City Vision project where Pathfinder was used. They also advised on additional functionality that they wanted for the project

Distributed Future Energy Scenarios — DFES Regen	
Owner(s)	• Regen
Link	• regen.co.uk/area/distribution-future-energy-scenarios/
Description	• Distribution Future Energy Scenarios (DFES) provide granular scenario projections for the growth (or reduction) of generation, demand and storage technologies which are expected to connect to the GB electricity distribution networks • Regen has pioneered the Distributed Future Energy Scenarios (DFES) approach, an analysis-based method that directly supports electricity and gas networks with long term strategy and network planning processes, at a localised level
Model availability	• Low — Has been used in a variety of areas but approach retained by Regen
Documentation availability	• Medium — Reports published for a variety of projects and areas contain relatively detailed information about the approach
Transparency of input data	• Medium — Published reports show input assumptions for areas
Model Version	• Production, used on regular basis with DNO's and updated each year
Target user	• DNO in conjunction with consultant. Believed that some modelling expertise currently required to undertake the process
Type of model	• Integrated toolset/modules brought together into a GIS system and single database rather than a single model
Spatial scope of modelling	• Used at local authority scale then combined together to cover supply areas of DNO's
Energy System scope	• Up to 50 technology categories across the power, built environment, transport, and heat sectors that interact with the electricity and gas distribution network
Level of detail	• Electricity Supply Areas supplied by primary or secondary substations for domestic technologies. Some more recent projects have started to add street level analysis, but this does not yet appear to be part of the standard approach
Consideration of time	• Shows trajectories and change over time on annual basis to 2050
Representation of uncertainty	• Different scenarios can be tested, based on the different FES scenarios
Potential to integrate with other tools	• Unclear, outputs believed to be spreadsheet based which could allow integration with other tools
Existing quality assurance, validation and verification	• Worked with a variety of network operators to improve and update t he DFES method and outputs • Undertook comparisons with previous rounds of DFES assessment and used other available projections. The DFES process reconciles with National Grid FES overall GB and the regional GSP analysis

Distributed Future Energy Scenarios — DFES Element Energy	
Owner(s)	• Element Energy
Link	• element-energy.co.uk/2020/02/northern-powergrid-publishes-distribution-future-energy-scenarios
Description	• Element Energy produced Distribution Future Energy Scenarios (DFES) to illustrate energy futures with different levels of decentralisation, decarbonisation and digitalisation. Element Energy has used this approach to describe the evolution of demand and generation across a number of UK DNO's licence areas out to 2050 • These scenarios are constructed from a series of key drivers, which are thought to have significant impacts on energy demand and supply, e.g. number of electric vehicles, low carbon heating technology choices, installation of distributed generation
Model availability	• Low – Has been used in a couple of areas but approach retained by Element Energy
Documentation availability	• Low/medium — Some information on method in published reports but limited
Transparency of input data	• Unclear. UKPN DFES report shows assumptions used, but full input data not available
Model Version	• Production, used for multiple DFES
Target user	• DNO in conjunction with consultant. Some modelling expertise required to use
Type of model	• Scenario modelling with stakeholder engagement
Spatial scope of modelling	• DNO supply area level
Energy System scope	• Domestic, non-domestic and commercial buildings. Building fabric changes, distributed generation, electric vehicles, air conditioning, ground and air source heat pumps, district heat, hydrogen for heating, solar PV, battery storage and flexibility
Level of detail	• Some data at LSOA level
Consideration of time	• Shows annual change over time
Representation of uncertainty	• Tests different FES scenarios
Potential to integrate with other tools	• Unclear
Existing quality assurance, validation and verification	• Validated by comparison of forecast to actual deployment by DNOs and others (e.g. CCC) over several years • For the current DFES work the models will be validated against historical data (i.e. we demonstrate how accurately they are able to predict historic uptake curves) • In terms of quality assurance, the models are all subject to stringent internal QA processes, but have also been user tested extensively by clients and in some cases have been subject to formal peer review

Thermos	
Owner(s)	• Centre for Sustainable Energy
Link	• thermos-project.eu
Description	• A web application for pre-feasibility optimisation of heat network designs. Given a map showing a set of building demands and potential network routes, THERMOS uses a mixed-integer linear program to identify the subset of buildings, and the routing options, which maximise the net present value of the resulting network • The output from THERMOS is a sized and costed optimal network layout, specifying all pipe routes and connected buildings. Additional features include the ability to include decisions about insulation and individual building heating systems in the optimisation process
Model availability	• Medium to High — previous model version is open source and available to be self-hosted. Released under a Reciprocal Public License which requires any changes, updates or new functionality made by a user to be published as open source. The updated, centrally hosted version is not open source. This has a free version with limits on the model complexity and number of iterations, and an option to pay a licence fee to reduce or remove the limits
Documentation availability	• High — A large variety, case studies and training material is publicly available • However, some sections, such as the description of the demand estimation approach are yet to be released
Transparency of input data	• Not published, but generally believed to be transparent to user • Demand estimation method for buildings may be less transparent
Model Version	• Production. Version 8 (03/2021) is open source but receives no further updates. Updates since are closed source; commercial product available through a software as a service approach
Target user	• No specific model expertise required to use closed source hosted version, but a moderate to sophisticated understanding of thermal networks is requested. The open source version would require technical knowledge to be able to install and self-host
Type of model	• Decision optimisation
Spatial scope of modelling	• Areas of a city
Energy System scope	• Heating and cooling networks for domestic and non-domestic buildings
Level of detail	• Building level upwards. If area is particularly large, then buildings may needed to be grouped together to allow the optimisation to complete in a timely manner
Consideration of time	• Only represents peak and annual averages, no representation of change over time
Representation of uncertainty	• Different scenarios can be tested by changing input data
Potential to integrate with other tools	• Unclear

EnergyPath Networks	
Owner(s)	• Energy Systems Catapult
Link	• es.catapult.org.uk/capabilities/modelling/local-energy-system-modelling/
Description	• EnergyPath Networks (EPN) is a modelling tool used to design cost-effective local energy systems for areas within the UK. It is designed to model areas that are local authority scale. At its core is an optimisation engine which trades off options for transitioning heating systems, building fabric, networks and local generation assets to meet a set carbon target in a least cost way. Before reaching the optimiser, there are a number of other processes that are carried out to represent the area and the options that are sensible for the optimiser to consider. For example, EnergyPath Networks has a routing algorithm which can determine current electricity network layouts using only substation location and capacity data from the network operator and has a dynamic demand modelling to determine daily demand profiles for domestic buildings throughout the year
Model availability	• Low — used in a wide range of projects, but the model is not currently available to external users
Documentation availability	• Low — some publicly available project reports have details of the method, but there is no overall public documentation
Transparency of input data	• Low — data available in input databases for expert model users, but not externally available
Model Version	• Currently version 3. Has received ongoing development to improve functionality and reflect latest technologies
Target user	• Expert modeller with access to moderately high computing power
Type of model	• Optimisation of pathways
Spatial scope of modelling	• Local Authority
Energy System scope	• Domestic and non-domestic buildings. Heating systems and building fabric changes. District heat, repurposing gas to hydrogen and electricity network reinforcement options considered
Level of detail	• Uses input data at individual building level and results can be represented at that level, although imperfect input data means that postcode level is a more reliable maximum level of output. Network results generally at HV substation level
Consideration of time	• Includes detailed representation of typical operational timeslices throughout a year, and a representation of change over time through user defined groupings of years
Representation of uncertainty	• Can be tested through easy parametrisation different scenarios • Also has built in monte carlo function for testing uncertainty in technology data
Potential to integrate with other tools	• Integrates with a number of third party models as part of its process (e.g. EnergyPlus, Sincal). Input and output data stored in SQL databases so could integrate with other tools capable of interacting with those.

SCATTER and Tyndall Carbon Budget tool	
Owner(s)	• Anthesis and Tyndall Centre
Link	• scattercities.com • carbonbudget.manchester.ac.uk
Description	• SCATTER is designed to calculate greenhouse gas inventories with carbon reporting and model carbon reduction pathway — allowing a local authority to identify emission sources and where to focus attempts to reduce. It can model carbon reduction pathways to 2050 based on choosing fixed levels of implementation of different interventions • The Tyndall centre carbon budget reporting tool was initially created as part of the same project and focusing on providing automate local authority level reports on carbon emissions
Model availability	• Medium — SCATTER freely available to government employees (local and national, based on .gov email address) but no access possible for any other organisations
Documentation availability	• Low — limited details available publicly. Potentially more available to those with a .gov email address, but this could not be confirmed
Transparency of input data	• Low — not published and based on fixed national data, not possible to replace with specific locally provided datasets
Model Version	• Production, used with a variety of local authorities
Target user	• Local authority user — not modelling expert
Type of model	• What-If
Spatial scope of modelling	• Local authority
Energy System scope	• Whole system linked to emissions sources
Level of detail	• Limited to results for the whole local authority, no further spatial detail
Consideration of time	• Shows a pathway changing over time
Representation of uncertainty	• Not believed to be integrated. Different pathways could be chosen and the effects compared
Potential to integrate with other tools	• Low — closed web-based system
Existing quality assurance, validation and verification	• Unclear

Calliope	
Owner(s)	• Original version produced by ETH Zurich and University of Cambridge • Now open source and contributed to by a wide community
Link	• https://www.callio.pe/ • Pfenninger et al., (2018). Calliope: a multi-scale energy systems modelling framework. Journal of Open Source Software, 3(29), 825, https://doi.org/10.21105/joss.00825
Description	• A python framework for energy system optimisation, designed to address questions around the transition to renewable energy • It is specifically designed to be suitable to analyse energy systems with high shares of variable generation, allowing arbitrary spatial and temporal resolutions • It aims to be easily modifiable and auditable, and simple to deploy to high performance computing clusters for the calculation of large numbers of model runs
Model availability	• Very high — free and open source. More complex problems are likely to require the use of a commercial solver, which will have an associated licence fee
Documentation availability	• High — detailed information available about the model approach
Transparency of input data	• High — data openly accessible within model
Model Version	• Production, frequent updates through open source community
Target user	• Modelling expertise required to configure and operate tool
Type of model	• Optimisation modelling
Spatial scope of modelling	• Depends how framework is used, examples of use ranging from neighbourhood to European level
Energy System scope	• Depends on the technologies the user decides to represent in the framework but geared towards representing generation and generic demand
Level of detail	• Depends how framework is used. Demand is linked to coordinates, these could potentially represent single buildings if the model was small, but more commonly seem to be used to represent groups of buildings or administrative regions
Consideration of time	• Detailed and flexible representation of time, both operational and time series of change
Representation of uncertainty	• Designed to allow parameterisation of multiple scenarios to allow uncertainty to be tested
Potential to integrate with other tools	• High given open code and open and data stored in easily readable text files
Existing quality assurance, validation and verification	• Open nature means community verify and validate model code • Used in over 20 peer reviewed publications

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